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First Nations and Inuit Health Branch Pediatric Clinical Practice Guidelines for Nurses in Primary Care

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First Nations and Inuit Health Branch
Pediatric Clinical Practice Guidelines
for Nurses in Primary Care

Contents

Introduction

These revised *First Nations and Inuit Health Branch Pediatric Clinical Practice Guidelines for Nurses in Primary Care* review the diagnosis and management of the most common medical problems seen in children in northern communities and in Canadian Aboriginal children.

The guidelines are subdivided into two parts. Part I, comprising chapters 1–7, contains general information about topics pertinent to pediatric care (e.g., physical assessment) and to pediatric procedures (e.g., intraosseous infusion). Part II, comprising chapters 8–20, contains specific guidelines. Each of these chapters includes information about the assessment of the body system in question (history and physical examination), along with clinical practice guidelines on common disease entities and emergency situations seen in that system.

The reviewers have attempted to update the material using an evidence-based approach.

The Nurses' Drug Classification System has been incorporated into the drug treatments outlined in the text:

A class drugs are those that a nurse is authorized to prescribe independently.

B class drugs are drugs that may be prescribed only by a physician.

C class drugs are drugs that a nurse may prescribe for one course of treatment.

D class drugs are drugs that a nurse may administer for one dose only, in an emergency situation; any subsequent doses must be authorized by a physician.

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Preface

These *First Nations and Inuit Health Branch Pediatric Clinical Practice Guidelines for Nurses in Primary Care* are intended primarily for use by qualified and licensed nurses working in nursing stations and treatment health centers located in semi-isolated and isolated First Nations and Inuit communities.

It is important to note that while the guidelines contain useful information, they are not intended to constitute a comprehensive, authoritative text of pediatrics, nor are they to be interpreted as such. Consequently, the manual is to be used for reference and educational purposes only and should not be used under any circumstances as a substitute for clinical judgment, independent research or the seeking of appropriate advice from a qualified healthcare professional.

Appropriate medical advice is to be obtained by telephone in cases where the condition of the client is at all serious or in cases where the condition of the client is beyond the scope of practice and expertise of the nurse to manage autonomously.

Although every effort has been made to ensure that the information contained in the guidelines is accurate and reflective of existing healthcare standards, it should be understood that the field of medical science is in constant evolution. Consequently, the reader is encouraged to consult other publications or manuals. In particular, all drug dosages, indications, contraindications and possible side effects should be verified and confirmed by use of the *Compendium of Pharmaceuticals and Specialties* or the manufacturer's drug insert. Furthermore, the reader should have available an up-to-date edition of one of the major standard pediatric texts (e.g., *Current Pediatric Diagnosis and Treatment*) for more detail on conditions appearing in these guidelines, as well as for diseases not covered here.

Finally, it should be noted that the information in the guidelines may have been superseded by a local policy or other guidelines particular to a region or zone or by a common local medical practice. The reader is encouraged to verify as to the existence of these alternative sources of information.

CHAPTER 1 — GUIDELINES FOR PEDIATRIC HEALTH ASSESSMENT

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INTRODUCTION

The clinical assessment of infants and children differs in many ways from that for adults. Because children are growing and developing both physically and mentally, values for parameters such as dietary requirements and prevalence of disease, expected normal laboratory values, and responses to drug therapy will be different from those observed in adults.

HEALTH MAINTENANCE REQUIREMENTS

Well children should have regular health maintenance visits, often done at well-baby clinics. Such visits customarily occur immediately after birth, at 2 weeks of age, at the times when immunizations are indicated (2, 4, 6, 12 and 18 months) and subsequently at 1- or 2-year intervals. At each visit, the child should undergo an appropriate history, physical examination and developmental assessment, and anticipatory guidance should be provided about the following topics:

- Appropriate nutrition
- Safety measures
- Expected developmental and behavioral events

In addition, an assessment should be made of the quality of physical care, nurturing and stimulation that the child is receiving.

The most important components that should be assessed at each time period are given in Table 1-1.

Table 1-1: Components of Well-Child Assessments at Various Ages

Health Parameter	Most Important Ages for Assessment
Height, weight	Every visit, from birth to 16 years of age
Head circumference	Every visit in the first 2 years of life
Growth chart plotting	Every visit
Blood pressure	Once in the first 2 years, once at 4–5 years, during school-age years only if there is a risk or concern about high blood pressure, and every second year during adolescence
Eye assessment	Every visit in the first year of life
Strabismus assessment	Every visit in the first year of life
Visual acuity testing	Initial screening (e.g., Snellen chart) at 3–5 years of age; every 2 years between 6 and 10 years of age, then every 3 years until 18 years of age
Dental assessment	Every visit
Speech assessment	Every visit
Developmental assessment*	Every visit
Sexual development	Every visit
School adjustment	Every visit after child reaches school age
Chemical abuse	Consider during assessments of children >8 years of age
Immunizations	According to schedule: at 2, 4, 6, 12 and 18 months and at 4–6 and 14–16 years
Hemoglobin	Screen at 6–12 months
Safety counseling	Every visit
Nutrition counseling	From birth to 5 years, and for teenagers
Parenting counseling	Every visit

*Formal developmental testing (e.g., DDST) is done only if there is a concern on the part of the parents or caregiver or the healthcare professional.

PEDIATRIC HISTORY

TIPS AND TECHNIQUES

CHILDREN

Children who can communicate verbally should be included as historians, with additional details provided as necessary by parents or caregivers. Questions, explanations and discussions occurring with children present should take into account their level of understanding. Young children may be assisted in providing details of the history by such techniques as having them play roles or draw pictures. The interviewer should gain an understanding of the child's terminology for various body parts.

ADOLESCENTS

Adolescents should be granted privacy and confidentiality.

- Interview the adolescent alone
- Discussions with parents or caregiver should occur separately, with the adolescent's permission

See also chapter 19, "Adolescent Health."

COMPONENTS OF THE PEDIATRIC HISTORY

The pediatric history includes many of the same components as the adult history, but some specific elements are highlighted. The chief complaint, history of present illness, history of past illnesses, allergy and drug history, family history and review of systems are the same as for an adult. In addition, the pediatric history should include the following information:

- Pregnancy and perinatal history
- Immunization history
- Detailed dietary history for the first year of life, including history of vitamin supplements and fluoride use
- Developmental history
- Social history, including questions about any recent separations, deaths, family crises, friends, peer relationships, day-to-day care arrangements, progress in school

PEDIATRIC PHYSICAL EXAMINATION

Clinicians should be aware of the different sizes of body parts in children relative to adults: head relatively larger, limbs relatively smaller and, in small children, ratio of surface area to weight relatively larger.

TECHNIQUE

Much information can be obtained by observing the child's spontaneous activities while the history is being conducted, without touching the child. For this purpose it is useful to have an age-appropriate toy available.

Without touching the child, observe:

- Gait
- Breathing frequency and pattern
- Responses to sound
- Grasp patterns
- Color
- Responses to parental comforting measures

For a young child, parts of the physical examination can be conducted with the child either being held by the parent or caregiver or supported on that person's lap.

Generally, the least stressful parts of the exam should come first, with more intrusive or distressing parts later (e.g., examination of the pharynx with the child restrained). The order of the examination must be varied to suit the situation.

Care should be taken to select appropriate-sized equipment when examining a child (e.g., blood pressure cuff should be two-thirds of the length of the upper arm).

Measurements of length and weight should be part of every health maintenance visit (along with measurement of head circumference in the first 2 years of life). These parameters should be recorded on gender-appropriate growth curves, which should form part of the child's health record.

DEVELOPMENTAL MILESTONES

Assessment of developmental progress should be part of each complete health assessment. Developmental milestones are achieved at different ages in different children; the approximate ages at which developmental milestones occur are presented in Table 1-2. More detailed assessments are indicated when it appears that the child is not progressing normally.

As part of each complete health assessment, attempts should also be made to assess responses to sound and ability to see.

Table 1-2: Approximate Ages for Milestones in the First 2 Years of Life

Milestone	Approximate Age
Social smile	1 month
Sit	7 months
Vocal babble	9 months
Pull to stand	9–10 months
Pincer grasp	12 months
Walks alone	13 months
Three or four words	18 months
Hand preference	18 months
Many words	24 months

PHYSICAL EXAMINATION OF THE NEWBORN

GENERAL

Observe the entire infant at the beginning of the examination, before the assessment of specific organ systems. It is important that the infant be completely undressed and in a warm environment with adequate illumination.

Assess the following:

- Consciousness, alertness, general behavior
- Symmetry of body proportions and body movements (e.g., arms and legs, facial grimace)
- State of nutrition and hydration
- Color
- Any sign of clinical distress (e.g., respiratory)

VITAL SIGNS

Average values of vital signs for newborns:

- Temperature 36.5°C to 37.5°C
- Heart rate 120–160 beats/minute
- Respiratory rate 30–60/minute, up to 80/minute if infant is crying or stimulated
- Systolic blood pressure 50–70 mm Hg

GROWTH MEASUREMENTS

Measure and record length, weight and head circumference. If the infant appears premature or is unusually large or small, assess gestational age *(see Table 1-4, below, this chapter)*.

- Average length at birth 50–52 cm
- Average weight at birth 3500–4400 g
- Average head circumference at birth 33–35 cm

For additional information about growth measurements, see "Well-Child Care," in chapter 3, "Prevention."

SKIN

COLOR

- Pallor associated with low hemoglobin
- Cyanosis associated with hypoxemia
- Plethora associated with polycythemia
- Jaundice associated with elevated bilirubin

LESIONS

- *Milia:* Pinpoint white papules of keratogenous material, usually on nose, cheeks and forehead, which last several weeks
- *Miliaria:* Obstructed eccrine (sweat) ducts appearing as pinpoint vesicles on forehead, scalp and skin folds; usually clear within 1 week
- *Transient neonatal pustular melanosis:* Small vesicopustules, generally present at birth, containing WBCs and no organisms; intact vesicle ruptures to reveal a pigmented macule surrounded by a thin skin ring
- *Erythema toxicum:* Most common newborn rash, consisting of variable, irregular macular patches and lasting a few days
- *Café au lait spots:* Suspect neurofibromatosis if there are many (more than five or six) large spots

HEAD AND NECK

HEAD

Check for:

- Overriding sutures
- Anterior and posterior fontanels (size, consistency)
- Abnormal shape of head (e.g., caput succedaneum, molding, encephaloceles)

Measure head circumference.

EYES: INSPECTION

- Check cornea for cloudiness (sign of congenital cataracts)
- Check conjunctiva for erythema, exudate, orbital edema, subconjunctival hemorrhage, jaundice of sclera
- Check for pupillary size, shape, equality and reactivity to light (PERRL: pupils equal, round, reactive to light), accommodation normal
- Red reflex: hold ophthalmoscope 15–20 cm (6–8 inches) from the eye and use the +10 diopter lens; if normal, the newborn's eye transmits a clear red color back; black dots may represent cataracts; a whitish color may suggest retinoblastoma

EARS: INSPECTION

- Check for asymmetry, irregular shape, setting of ear in relation to corner of eye (low-set ears may suggest underlying congenital problems, such as renal anomalies)
- Look for fleshy appendages, lipomas or skin tags
- Perform otoscopic examination if sepsis is suspected; check canals for discharge and tympanic membranes for color, brightness, bony landmarks and light reflex

NOSE: INSPECTION

- Look for flaring of the alae nasi, which is a sign of increased respiratory effort
- Look for hypertelorism or hypotelorism
- Check for choanal atresia, as manifested by respiratory distress; neonates are obligate nose breathers, so first check to determine if air is coming from nostrils; if not and choanal atresia is suspected, a soft nasogastric tube can be passed through each nostril to check patency

PALATE: INSPECTION AND PALPATION

- Check for defects such as cleft lip and palate

MOUTH: INSPECTION

- Observe size and shape of mouth
- Microstomia: seen in trisomy 18 and 21
- Macrostomia: seen in mucopolysaccharidosis
- "Fish mouth": seen in fetal alcohol syndrome
- Epstein pearls: small white cysts containing keratin, frequently found on either side of the median line of the palate

TONGUE: INSPECTION

- Macroglossia: indicates hypothyroidism or mucopolysaccharidosis

TEETH: INSPECTION

- Natal teeth (usually lower incisors) may be present
- Risk of aspiration if these are attached loosely

CHIN: INSPECTION

- Micrognathia may occur with Pierre Robin syndrome, Treacher Collins syndrome and Hallerman Streiff syndrome

NECK

Inspection

- Symmetry of shape
- Alignment: torticollis is usually secondary to sternocleidomastoid hematoma
- Neck mass (cystic hygroma is the most common type)

Palpation

- Palpate all muscles for lumps and the clavicles for possible fracture
- Lymph nodes cannot usually be palpated at birth; their presence usually indicates congenital infection

RESPIRATORY SYSTEM

INSPECTION

- Cyanosis, central or peripheral (transient bluish color may be seen in extremities if infant is cooling off during the examination)
- Respiratory rate and pattern (e.g., periodic breathing, periods of true apnea)
- Observe chest movement for symmetry and retractions
- Use of accessory muscles, tracheal tug, indrawing of intercostal or subcostal muscles

PALPATION

- Any abnormal masses (palpate gently)
- Breasts may be slightly enlarged secondary to presence of maternal hormones

AUSCULTATION

- Breath sounds
- Inspiratory to expiratory ratio
- Adventitious sounds (e.g., stridor, crackles, wheezes, grunting)

Percussion is of little clinical benefit and should be avoided, especially in low-birth-weight or preterm infants, as it may cause injury (e.g., bruising, contusions).

CARDIOVASCULAR SYSTEM

- Respiratory rate
- Heart rate
- Blood pressure in upper and lower extremities

See normal values in "Vital Signs," above, this chapter.

INSPECTION

- Color: pallor, cyanosis, plethora

PALPATION

- Locate point of maximal impulse (PMI) by positioning one finger on the chest, in the fourth intercostal space medial to the midclavicular line
- Abnormal location of PMI can be a clue to pneumothorax, diaphragmatic hernia, situs inversus viscerum or other thoracic problem
- Capillary refill (<2 seconds is normal)
- Peripheral pulses: note character of pulses (bounding or thready; equality); any decrease in femoral pulses or radial–femoral delay may be a sign of coarctation of the aorta

AUSCULTATION

- Note rate and rhythm
- Note presence of S1 and S2 heart sounds
- Note presence of murmurs (consider murmurs pathologic, as in congenital heart defects, until proven otherwise)

ABDOMEN

INSPECTION

- Shape of abdomen: flat abdomen may signify decreased tone, presence of abdominal contents in chest or abnormalities of the abdominal musculature
- Contour: note any abdominal distension
- Masses
- Visible peristalsis
- Diastasis recti
- Obvious malformations (e.g., bowel contents outside of abdominal cavity [omphalocele]; this abnormality has a membranous covering [unless it has been ruptured during delivery], whereas gastroschisis does not)
- Umbilical cord: count the vessels (there should be one vein and two arteries); note color, any discharge

AUSCULTATION

- Bowel sounds

PALPATION

- Check for any abnormal masses
- Liver and spleen: it may be normal for the liver to be located about 2 cm below the right costal margin; spleen is not usually palpable; if it can be felt, be alert for congenital infection or extramedullary hematopoiesis
- Kidneys: should be about 4.5–5.0 cm vertical length in the full-term newborn
- Techniques for kidney palpation: place one hand with four fingers under the baby's back, then palpate by rolling the thumb over the kidneys; or place the right hand under the left lumbar region and palpate the abdomen with the left hand to palpate the left kidney (do the reverse for the right kidney)
- Hernias: umbilical or inguinal

Percussion usually omitted unless problems such as abdominal distension are noted.

Inspect the anal area for patency and for presence of fistulas or skin tags.

GENITALIA

The genitalia should be carefully assessed, with particular attention to any malformation, abnormalities or sexual ambiguity.

MALE GENITALIA

Inspection

- Glans: color, edema, discharge, bleeding
- Urethral opening: should be located centrally on the glans (in hypospadias, the opening is found on the undersurface of the penis)
- Foreskin (prepuce): usually difficult to retract completely
- Scrotum: in full-term infant, scrotum should have brownish pigmentation and should be fully rugated

Palpation

- Testes: ensure that both testicles are descended into scrotum

FEMALE GENITALIA

Inspection

- Check labia, clitoris, urethral opening and external vaginal vault
- Whitish discharge often present; this is normal, as is a small amount of bleeding, which usually occurs a few days after birth and is secondary to maternal hormone withdrawal
- Hymenal tags, if they occur, are normal

MUSCULOSKELETAL SYSTEM

INSPECTION AND PALPATION

Spine

- Check for scoliosis, kyphosis, lordosis, spinal defects, meningomyelocele

Upper Extremities

- Assess the shoulder girdle for injury and the clavicles for fracture (especially if the delivery was traumatic and in large infants with a history of shoulder dystocia)
- Assess mobility of the shoulder and extension of the elbow
- Inspect palmar creases for assessment of gestational age *(see Table 1-4, below, this chapter)*
- Count the fingers

Lower Extremities

- Assess the feet and ankles for deformity and mobility
- Count the toes
- Examine foot creases for assessment of gestational age *(see Table 1-4, below, this chapter)*
- Examine the hips last, using Ortolani–Barlow maneuver

Technique for Ortolani–Barlow hip examination:

- Place middle fingers over greater trochanters (outer upper legs)
- Position thumbs on medial sides of knees
- Abduct the thigh to 90° by applying lateral pressure with thumb
- Move knee medially and then replace knee in starting position
- If there is a "clunk," the hip may be dislocatable
- If there is a "click," the hip may be subluxable

CENTRAL NERVOUS SYSTEM

- Assess state of alertness
- Check for lethargy or irritability
- Posture: For term infant, normal position is one with hips abducted and partially flexed and with knees flexed; arms are adducted and flexed at the elbow; the fists are often clenched, with fingers covering the thumb
- Assess tone; for example, support the infant with one hand under the chest; the neck extensors should be able to hold the head in line for 3 seconds; there should not be more than 10% head lag when the infant is moved from a supine to a sitting position

REFLEXES

Reflexes are involuntary movements or actions that help to identify normal brain and nerve activity. Some reflexes occur only in specific periods of development. The following are some of the reflexes seen in newborns.

Rooting Reflex

- Present at birth
- Disappears by about 4 months after birth
- Begins when the corner of the baby's mouth is stroked or touched. The baby turns the head and opens the mouth to follow and "root" in the direction of the stroking. This helps the baby to find the breast or bottle to begin feeding.

Sucking Reflex

- Begins about the 32nd week of pregnancy
- Is not fully developed until about 36 weeks
- Disappears by about 4 months after birth
- Premature babies may have weak or immature sucking ability

Moro Reflex

- Present at birth
- Disappears by about 4–5 months after birth
- Often called a startle reflex because it usually occurs when the baby is startled by a loud sound or movement
- In response to the sound, the baby throws back the head, extends the arms and legs, cries, and then pulls the arms and legs back in

Tonic Neck Reflex

- Appears about 2 months after birth
- Disappears by about 6–7 months after birth
- When the baby's head is turned to one side, the arm on that side stretches out and the opposite arm bends up at the elbow
- Often called the fencing position

Palmar Grasp Reflex

- Present at birth
- Disappears by about 2–3 months
- Stroking the palm of a baby's hand causes the baby to close the fingers in a grasp
- Reflex is stronger in premature babies

Stepping, Placing or Dancing Reflex

- Present at birth
- Disappears by 2 months after birth
- When dorsum of foot is placed under a table edge, the infant will step, lifting and placing the foot onto the table surface

Other Reflexes

Reflexes must be symmetric.

- Biceps jerk tests C5 and C6
- Knee jerk tests L2–L4
- Ankle jerk tests S1 and S2
- Landau or truncal incurvation reflex tests T2 through S1
- Anal wink tests S4 and S5

APGAR SCORE

Apgar scoring (Table 1-3) is done at 1 and 5 minutes after birth. If necessary, it is repeated at 10 minutes after birth.

INTERPRETATION

At 1 Minute

<7: depression of nervous system

<4: severe depression of nervous system

At 5 Minutes

>8: no asphyxia

<7: high risk for subsequent dysfunction of central nervous system

5–7: mild asphyxia

3–4: moderate asphyxia

0–2: severe asphyxia

Table 1-3: Determination of Apgar Score*

Feature Evaluated	0 Points	1 Point	2 Points
Heart rate	0	<100 beats/min	>100 beats/min
Respiratory effort	Apnea	Irregular, shallow or gasping breaths	Vigorous, crying
Color	Pale or blue all over	Pale or blue extremities	Pink
Muscle tone	Absent	Weak, passive tone	Active movement
Reflex irritability	Absent	Grimace	Active avoidance

*Sum the scores for each feature. Maximum score = 10, minimum score = 0.

ASSESSMENT OF GESTATIONAL AGE

Gestational age can be assessed on the basis of the newborn's external characteristics (Table 1-4).

Table 1-4: Assessment of Gestational Age

External Characteristic	28 Weeks	32 Weeks	36 Weeks	40 Weeks
Ear cartilage	Pinna soft, remains folded	Pinna harder, but remains folded	Pinna harder, springs back into place when folded	Pinna firm, stands erect from head
Breast tissue	None	None	Nodule 1–2 mm in diameter	Nodule 6–7 mm in diameter
Male genitalia	Testes undescended, scrotal surface smooth	Testes in inguinal canal, a few scrotal rugae	Testes high in scrotum, more scrotal rugae	Testes descended, scrotum pendulous, covered in rugae
Female genitalia	Prominent clitoris with small, widely separated labia	Prominent clitoris; larger, well-separated labia	Clitoris less prominent, labia majora cover labia minora	Clitoris covered by labia majora
Plantar surface of foot	Smooth, no creases	1 or 2 anterior creases	2 or 3 anterior creases	Creases cover the sole

SCREENING TESTS

PHENYLKETONURIA (PKU)

– For newborns tested for PKU in the first 24 hours of life, capillary blood screening test for PKU should be repeated at age 2–7 days

CONGENITAL HYPOTHYROIDISM

– Screening for congenital hypothyroidism (by TSH level in dried capillary blood sample) should be performed in the first 7 days of life

– If the child was born in hospital, verify whether this type of screening was done there

CHAPTER 2 — PEDIATRIC PROCEDURES

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RESTRAINT

GENERAL

If holding the child firmly is not sufficient to keep him or her immobile for a procedure, a wrapping technique can be used. This technique will be needed for many children between 1 and 6 years of age.

PROCEDURE

Use a sheet or blanket to wrap the child as shown in Fig. 2-1. If a limb is required for the procedure (e.g., for IV access), leave it outside the wrapping.

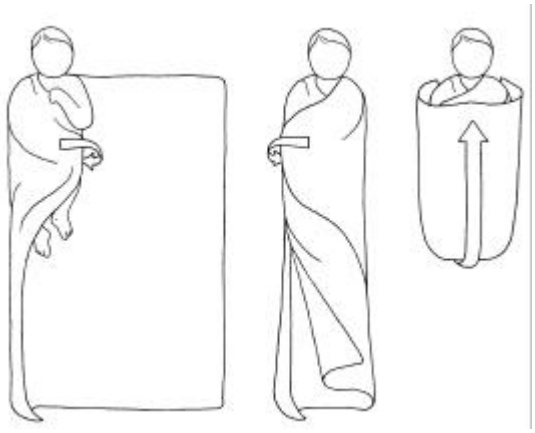

Fig. 2-1: Wrapping Technique to Immobilize a Child for a Procedure

VENIPUNCTURE

GENERAL

For venipuncture, always make your first attempt in the largest, most prominent vein you can find.

It is sometimes easier to feel a vein than to see it.

SITES

PREFERRED (UPPER EXTREMITY)

- Forearm veins (e.g., cephalic, median basilic or median antecubital); these are the best choices in all age groups, but can be difficult to find in chubby babies
- Veins on the dorsum (back) of the hand
- Tributaries of the cephalic and basilic veins, dorsal venous arch

OTHER (LESS WELL KNOWN)

- Saphenous vein, just anterior to medial malleolus (lower extremity)
- Small veins on ventral surface of wrist or larger one on inner aspect of wrist proximal to thumb

PROCEDURE

1. Immobilize child by either holding or wrapping *(see "Restraint," above, this chapter).*
2. Practice universal precautions against contamination with child's body substances (e.g., gloves, possibly goggles, safe disposal of needle).
3. Apply tourniquet proximal to site; rubbing or warming the skin will help to distend the vein.
4. Use a 25- or 23-gauge butterfly needle with syringe attached, bevel up.
5. Stabilize vein by applying traction.
6. Insert needle just far enough to get "flashback" of blood.
7. Apply gentle suction to prevent the vein from collapsing.
8. If flow is very slow, try "pumping," by squeezing the limb above the site of the puncture.

INTRAVENOUS ACCESS

VASCULAR SITES

BEST SITES, IN ORDER

- Dorsum of hand
- Feet
- Saphenous vein
- Wrist
- Scalp: a good site in infants, as veins are close to the surface and are more easily seen than in the extremities; useful for administration of fluid or medication when the child's condition is stable, but rarely useful during full resuscitation efforts
- Antecubital vein

UPPER EXTREMITY

- Forearm veins (e.g., cephalic, median basilic or median antecubital); these veins can be difficult to find in chubby babies
- Veins on the dorsum (back) of the hand
- Tributaries of the cephalic and basilic veins, dorsal venous arch

LOWER EXTREMITY

- Saphenous vein, just anterior to medial malleolus
- Median marginal vein
- Dorsal venous arch

TYPES OF NEEDLES

OVER-THE-NEEDLE CATHETERS

- Cathilons or IV catheters are the most stable
- 24- or 22-gauge needle is usually used in infants
- Required for volume resuscitation efforts

Advantages

- More comfortable than butterfly needle
- Frequency of infiltration into interstitial space is lower

BUTTERFLY

- Especially useful for scalp veins
- 25- to 23-gauge needles are most commonly used in infants

Advantages

- May be used to obtain blood samples
- Design (i.e., the wings) facilitates insertion because there is a handle to be gripped
- Wings allow the needle to be taped more securely in place

Disadvantages

Butterfly needles tend to be inserted interstitially more frequently and should not be used for primary venous access in volume resuscitation efforts.

PROCEDURE

1. Practice universal precautions against contamination with child's body substances (e.g., gloves, possibly goggles, safe disposal of needle).
2. Assemble necessary equipment.
3. Immobilize the child well, but avoid restraints if at all possible.
4. Always make first attempt in the largest, most prominent vein you can find — take your time to ensure you have identified the best vein.
5. If a scalp vein is chosen, you may have to shave the skin around it.
6. Apply tourniquet, if appropriate.
7. Cleanse the skin.
8. Stabilize the vein.
9. If using a catheter needle, insert it through the skin at an angle of 30° to 45°.
10. Once the needle is through the skin, adjust the angle of the cannula so that it is parallel to the skin, and advance it slowly into the vein far enough to get "flashback" of blood, then go in another millimeter or so to ensure that the plastic catheter is also in the vein before trying to thread it.
11. Remove the tourniquet and attach IV infusion set. Make sure there are no air bubbles in the tubing before connecting it.
12. Run in some IV fluid. If the IV line is patent, tape the needle and catheter securely in place.

These small catheters are fragile. Avoid bending them, and always tape them securely, preferably using an arm board and half a plastic medicine cup to cover the site.

COMPLICATIONS

LOCAL

- Cellulitis
- Phlebitis
- Thrombosis
- Hematoma formation

SYSTEMIC

- Sepsis
- Air embolism
- Catheter fragment embolism
- Pulmonary thromboembolism

INTRAOSSEOUS ACCESS

GENERAL

PURPOSE

- Used to administer IV fluids and medications when attempts at IV access have failed
- For use in emergency situations only

INDICATIONS

Attempt intraosseous access in the following situations in children ≤6 years of age, when venous access cannot be achieved within three attempts or 60–90 seconds, whichever comes first:

- Multisystem trauma with associated shock or severe hypovolemia (or both)
- Severe dehydration associated with vascular collapse or loss of consciousness (or both)
- Unresponsive child in need of immediate drug and fluid resuscitation: burns, status asthmaticus, sepsis, near-drowning, cardiac arrest, anaphylaxis

CONTRAINDICATIONS

- Pelvic fracture
- Fracture in the extremity proximal to or in the bone chosen for the intraosseous access

SITES

PREFERRED

- Anterolateral (flat) surface of the proximal tibia, 1–3 cm (one finger's breadth) below and just medial to the tibial tuberosity

OTHER POSSIBILITY

- Distal tibia, 1–3 cm above the medial malleolus on the surface of the tibia near the ankle (believed by some to be the best site in older children because of the greater thickness of the proximal tibia relative to the distal tibia)

PROCEDURE

1. Practice universal precautions against contamination with child's body substances (e.g., gloves, possibly goggles, safe disposal of needle).
2. Assemble necessary equipment.
3. Immobilize the child well, but avoid restraints if at all possible.
4. Place the child in the supine position and externally rotate the leg to display the medial aspect of the extremity.
5. Identify the landmarks for needle insertion.
6. Cleanse the puncture site.
7. If the child is conscious, use local anesthesia *(see section on local anesthesia in "Suturing," below, this chapter).*
8. Use an intraosseous needle or, in a small child, an 18-gauge butterfly needle.
9. Angle the needle away from the joint. Insert the needle at a 60° angle, 2 cm below the tibial tuberosity, through the skin and subcutaneous tissue.
10. When the needle reaches the bone, exert firm downward pressure, rotating the needle in a clockwise—anticlockwise manner. Be careful not to bend the needle.
11. When the needle reaches the marrow space, the resistance will drop (indicated by a "pop").
12. Attach a 10-mL syringe and aspirate some blood and marrow to determine if the needle is correctly positioned (other indicators of correct positioning: the needle will stand upright by itself, IV fluid flows freely, no signs of subcutaneous infiltration are apparent).
13. Secure needle with tape.
14. Use as you would a regular IV line. For example, fluids can be infused quickly for resuscitation of a child who is in shock.

COMPLICATIONS

– Extravasation
– Tibial fracture
– Osteomyelitis
– Epiphyseal injury
– Lower extremity compartment syndrome
– Obstruction of needle with marrow, bone fragments or tissue

INSERTION OF NASOGASTRIC TUBE

GENERAL

TUBE SIZE

Estimate length of tube needed by extending the tubing from the tip of the child's nose to the ear lobe and then to the xiphoid process.

– Neonates: size 5–8 French
– Young children: size 12–16 French

PROCEDURE

1. Assemble required equipment.
2. Explain procedure to child (if he or she is able to understand) and parents or caregiver.
3. Lubricate tip of tube and slide it into the nostril along the base of the nose, advancing the tube slowly. Some pressure may be needed to enter the nasopharynx. Try to have the child assist by swallowing.
4. Once the tube has been advanced the desired distance, check the position either by aspirating gastric contents or by listening with a stethoscope over the stomach as a small amount of air is instilled into the tube.
5. Tape the tube in place.
6. Attach to drainage bag.

Withdraw the tube if choking or coughing occurs during placement.

SUTURING

USE OF LOCAL ANESTHESIA

GENERAL

– Lidocaine (1%, without epinephrine) is the local anesthetic that should be used
– To avoid systemic toxic effects, instill no more than 4 mg/kg (0.4 mL/kg of a 1% solution without epinephrine)
– Use a 28- or 27-gauge needle (the size found on insulin syringes) and inject slowly

For detailed information on wound management and suturing, see "Skin Wounds," in chapter 9, "The Skin," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CHAPTER 3 — PREVENTION

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DEFINITIONS OF PREVENTION

Prevention consists of activities directed toward decreasing the probability of specific illnesses or dysfunctions in individuals, families and communities. It is the concept of reducing unwanted health outcomes by reducing or eliminating risk factors that might lead to those outcomes.

Prevention has three components: primary, secondary and tertiary prevention.

PRIMARY PREVENTION

Activities aimed at intervention before pathological changes have begun and during the natural history of susceptibility. Immunization is an example of primary prevention.

SECONDARY PREVENTION

Activities aimed at early detection of disease and prompt treatment, to cure disease during its earliest stages or to slow its progression, prevent complications and limit disability when cure is not possible. A screening program is an example of secondary prevention.

TERTIARY PREVENTION

Limiting the effects of disease and disability for people in the earlier stages of illness and providing rehabilitation for people who already have residual damage.

IMMUNIZATION

For a detailed discussion of all issues related to vaccines and immunization, refer to the *Canadian Immunization Guide*, 5th edition (Health Canada 1998). Follow regional or provincial immunization schedules.

INJURIES

DEFINITION

An injury is the result of any type of trauma, whether intentional or unintentional. Injuries are preventable.

In terms of potential years of life lost, injuries are significant contributors to total mortality. They are among the leading causes of death and disability in children of all age groups and the leading cause in children >1 year of age.

COMMONEST TYPES OF INJURIES

INFANTS AND TODDLERS

- Falls
- Near-drowning
- Burns, scalds
- Poisonings

OLDER CHILDREN (8–15 YEARS)

- Injuries related to bicycling and other sports

YOUTH (15–20 YEARS)

- Firearms-related injuries

INJURY PREVENTION STRATEGIES

GENERAL

- Preventing injuries requires effort from the total community
- Preventing injuries requires a detailed history of exposure to potentially injurious activities within the family and at school
- Identifying children and families at risk is a critical step in preventing injuries
- The environment can be modified by construction (e.g., fences around water, safer roads) and by regulations (e.g., requiring seat belts and bicycle helmets)
- A large part of preventing injuries is educating parents and caregivers about potential dangers to children and methods of avoiding injuries; this is an important role for the healthcare worker, particularly nurses (during well-baby clinics and illness visits)

ANTICIPATORY GUIDANCE AND COUNSELING

The parents or caregiver should be educated about the following strategies to minimize the risk of injury.

BIRTH TO 6 MONTHS

- Position child on back or side for sleeping (to prevent SIDS [sudden infant death syndrome])
- Never leave child unattended in bathtub
- Use approved infant car seat (properly restrained) to protect child in vehicle
- Ensure that mattress fits snugly in crib and that it provides good body support (i.e., not made of feathers, not too soft); space between bars should be approved by CSA International (formerly the Canadian Standards Association)
- Because children like to put things in their mouths, keep small, hard objects that could be swallowed out of reach, and avoid toys with small parts that could come off while in the child's mouth

6–12 MONTHS

- Never leave child unattended in bathtub
- Use approved infant car seat in vehicles
- Cover electrical outlets
- Keep electrical cords and plugs out of reach or covered to prevent burns from chewing exposed cords or putting plugs in mouth
- Keep cleaning solutions, solvents and medications out of reach of a crawling infant (i.e., in upper cupboards)
- Avoid use of walkers, which represent a significant cause of injury
- Protect steps and stairways with gates
- Avoid peanuts, peanut butter, seeds and round candies
- Advise older children not to share small food items or objects (e.g., gum, peanuts, pennies) with an infant
- When child is near water, ensure that he or she is wearing a life jacket and is under continual supervision

1–2 YEARS

- Never leave child unattended in bathtub
- Set temperature on hot water tank at 54°C to prevent scalding
- Supervise child while he or she is close to vehicular traffic
- Use approved infant car seat in vehicles
- Turn pot handles away from edge of stove
- Keep poisonous substances locked up or out of reach
- Advise older children not to share small food items or objects (e.g., gum, peanuts, pennies) with an infant
- When child is near water, ensure that he or she is wearing a life jacket and is under continual supervision

2–5 YEARS

- Never leave child unattended in bathtub
- Ensure that child uses a seat belt when in a vehicle
- Ensure that child wears a helmet while bicycling or skateboarding
- Avoid transporting children 2–5 years of age on ATVs and snowmobiles
- Keep matches and lighters out of reach
- Keep poisonous substances locked up or out of reach
- Advise older children not to share small food items or objects (e.g., gum, peanuts, pennies) with a younger child
- When child is near water, ensure that he or she is wearing a life jacket and is under continual supervision

5–10 YEARS

- Ensure that child wears a helmet for bicycle, ATV, snowmobile and skateboard use
- Ensure that child uses a seat belt when in a vehicle
- Teach child how to prevent playground injuries and how to use playground equipment safely
- When child is near water, ensure that he or she is wearing a life jacket and is under continual supervision
- Ensure that child receives instruction about water safety and swimming skills
- Teach child to avoid contact with strangers

10–15 YEARS

- Provide guidance about risk-taking behavior (particularly alcohol and substance abuse)
- Provide guidance about sexual activity, including how to say No to unwanted touching
- Provide instruction about gun safety
- Provide instruction about boating safety
- Ensure that young adolescent uses a seat belt when in a vehicle
- Ensure that young adolescent wears a helmet for bicycle, ATV, snowmobile and skateboard use
- Ensure that young adolescent receives instruction about water safety and swimming skills

15–20 YEARS

- Provide guidance about risk-taking behavior (particularly alcohol and substance abuse)
- Provide guidance about sexual activity, including how to say No to unwanted touching
- Provide instruction about gun safety
- Provide instruction about boating safety
- Ensure that young adult uses a seat belt when in a vehicle
- Ensure that young adult wears a helmet for bicycle, ATV, snowmobile and skateboard use

HOME SAFETY

- Ensure that house is equipped with fire alarms and fire extinguishers
- Establish exit routes, and ensure that all members of the family are aware of them
- Ensure that firearms and ammunition are stored safely
- Ensure that dangerous chemicals are stored safely, particularly if there are small children in the home

WELL-CHILD CARE

WELL-CHILD VISIT

PURPOSES

- Immunization
- Parental support regarding feeding, safety and nurturing of children
- Screening for developmental or physical problems
- Parental education, counseling and anticipatory guidance

COMPONENTS OF WELL-CHILD VISIT

Review the child's health record and the family record, so that you are aware of previous health concerns and can plan what should be done during the current visit.

Review the child's immunization record. Ensure that consent for immunization is on file.

Discuss with the parents or caregiver the child's health and progress:

- Current general health
- Achievement of developmental milestones
- Feeding habits
- Sleeping habits
- Behavior
- Relationships with family members

Perform a physical examination. Observe the following aspects:

- Nutritional status
- Character of cry (in infants <6 months of age)
- Color
- Vision
- Hearing
- Activity level
- Any other aspect, as dictated by concerns raised in the history

In addition, examine:

- Hair, scalp, fontanels
- Eyes, ears, nose, mouth (including dentition), throat
- Lungs, heart
- Abdomen, genitalia
- Limbs, specifically muscle tone, motion, symmetry and hips (for congenital dislocation; in newborn period and at every visit up to 12 months of age)
- Skin
- Growth measurements
- Observe for achievement of major developmental milestones

Remain alert for ocular misalignment, vision disorders, tooth decay, and child abuse or neglect.

GROWTH MEASUREMENT

Measurement of a child's weight, height and head circumference is most important in the health assessment process, because growth is a major characteristic of childhood. Atypical growth patterns can be indicators of pathologic processes.

Correct measuring techniques and accuracy are essential if the measurements are to be useful in evaluating growth. In addition, the measurements must be appropriately recorded on a growth chart and compared to norms for the child's age and to his or her previous growth pattern. If the child's measurements consistently follow the relevant growth curve, the growth pattern is considered normal.

A graph gives an easily understood pictorial display of the child's growth and should alert the observer early to deviations from normal.

Failure to thrive should be suspected if the child's growth curve drops by two or more major percentiles. In this situation, the child is considered at high risk. *See "Failure to Thrive," in chapter 17, "Hematology, Endocrinology, Metabolism and Immunology."*

ABNORMAL GROWTH PROBLEMS

Any child with growth or developmental problems should be referred to a physician.

Weight

- Above-normal weight combined with normal height: consider over-nutrition
- Above-normal weight combined with below-normal height: consider a genetic cause (e.g., Down's syndrome) or endocrine problems (e.g., hypothyroidism, Cushing's disease)
- Below-normal weight combined with normal height and head circumference: consider under-nutrition, failure to thrive, iron deficiency, psychosocial deprivation, hypothyroidism
- Below-normal weight combined with below-normal height and head circumference: consider organic cause (e.g., renal failure, iron deficiency, lead intoxication, immune deficiencies, inborn errors of metabolism, HIV infection)

Height

- Above-normal height combined with normal weight and head size: in 90% of cases, this combination of growth parameters represents a familial tendency; the rate of growth is normal, although the absolute percentile value is greater than normal; may also be caused by excess production of growth hormone, hyperthyroidism or Marfan's syndrome
- Above-normal height, weight and head size: consider a pathologic process (e.g., acromegaly) or a chromosomal disorder (e.g., Klinefelter's syndrome)
- Below-normal height: consider a pathologic process (e.g., deficiency of growth hormone, hypothyroidism, chronic anemia), a chromosomal disorder (e.g., Turner's syndrome) or failure of a major organ system (e.g., GI, renal, pulmonary or cardiovascular)

Head Circumference

Disproportionate Microcephaly

- Head size that is small relative to the child's height and weight is often an indicator of a pathologic process
- Below-normal head size combined with normal weight and height: consider craniosynostosis, prenatal insult (e.g., maternal drug or alcohol abuse), maternal infection, complications during pregnancy or birth, chromosome defects
- Disproportionate microcephaly requires immediate evaluation (at the time of diagnosis)

Disproportionate Macrocephaly

- If the head size is large relative to the child's height and weight, close attention must be given to the physical examination and assessment of developmental status—look for associated physical findings such as a bulging fontanel or split sutures, neurologic abnormalities or delays in reaching developmental milestones
- Above-normal head size combined with normal weight and height: consider primary hydrocephalus, hydrocephalus secondary to associated disease of the central nervous system, primary megalocephaly or megalocephaly secondary to associated disease of the central nervous system or to a metabolic storage disease (e.g., Krabbe's disease)

Evaluation

A three-step approach should be taken in evaluating a child with an abnormal growth curve.

1. Check the growth data for accuracy.
2. If a growth problem is substantiated, assess the child closely for associated symptoms, abnormal findings on physical examination or delays in development.
3. Any abnormality in a child's rate of growth requires further assessment. Consult a physician for advice. Children with suspected growth abnormalities who are otherwise normal should be followed closely to determine their growth rate.

APPROPRIATE SCREENING

The idea of screening for early detection of disease is appealing, but it is valuable only if the following conditions pertain:

- The disease can be diagnosed reliably by a simple, acceptable test
- Effective treatment is available
- The benefits outweigh the costs

The following situations are those in which screening is thought to be useful in child care.

Phenylketonuria (PKU)

- All newborns should be screened for PKU by means of a capillary blood sample before discharge from the hospital
- For any newborn who undergoes this type of screening at less than 24 hours of age, the screening test *must* be repeated between 2 and 7 days of age

Congenital Hypothyroidism

– All newborns should be screened for TSH level by means of a dried capillary blood sample in the first week of life
– If child was born in hospital, verify that this type of screening was done before discharge

Hemoglobin Screening

The prevalence of anemia is high among Aboriginal children 6–24 months of age. In addition to ethnic background, other risk factors for anemia are prematurity and low birth weight, breast-feeding beyond 6 months of age, lack of access to or inability to consume iron-fortified products, diet of cow's milk only in the first year of life and low socioeconomic status.

The Canadian Task Force on Preventive Health Care (formerly Canadian Task Force on the Periodic Health Examination 1994) recommends that screening for hemoglobin level be performed at 6–12 months of age, optimally at 9 months (Table 3-1). Hemoglobin should be monitored more frequently in children in whom anemia has been identified and treatment has begun.

Table 3-1: Normal Hemoglobin Levels in Children

Age	Hemoglobin Level (g/L)
1 month	115–180
2 months	90–135
3–12 months	100–140
1–5 years	110–140
6–14 years	120–160

See "Iron Deficiency Anemia in Infancy," in chapter 17, "Hematology, Endocrinology, Metabolism and Immunology."

Developmental Screening

In monitoring the health of children, developmental assessment is an important function that should not be neglected. Such assessment is done by making inquiries of the parents or caregiver and by clinical observation of the child's achievement of major age-appropriate milestones.

Assess achievement of developmental milestones for all children at every opportunity, or at least at the 2-, 4-, 6-, 12- and 18-month well-child visits and at 4–5 years of age, during pre-school entry assessment.

The earlier developmental delays are detected, the sooner an intervention can be undertaken. Hopefully, early intervention will minimize the long-term impact on the child. It is critical that steps be taken to alleviate developmental problems before the child reaches school age.

The Canadian Task Force on Preventive Health Care (formerly Canadian Task Force on the Periodic Health Examination 1994) recommends that the Denver Developmental Screening Test (DDST) be excluded from the periodic health examination of asymptomatic children.

However, formal developmental testing (e.g., DDST, as well as other testing tools that are available) may be helpful if a concern about developmental delay is either expressed by the parent or caregiver or suspected by the healthcare professional. *(For information on the DDST, see Appendix 3-1, "Developmental Testing," below, this chapter)*

Any child with suspected delay(s) should be referred promptly to a physician for assessment.

Hearing Screening

Hearing impairment is one of the most important causes of speech delay, educational difficulties and behavioral difficulties. Early intervention can help to prevent significant speech and educational delays. Therefore, the most important time to screen is during infancy. Unfortunately, this is also the most difficult time to test a child's hearing.

The parents or caregiver should be asked about the child's hearing ability as part of every well-child visit. In addition, the clinician should observe the child's response(s) to sounds.

Formal hearing screening by such methods as tympanometry or pure-tone audiometry is reserved for high-risk (e.g., repeated ear infections or strong family history) or symptomatic children.

The Canadian Task Force on Preventive Health Care (formerly Canadian Task Force on the Periodic Health Examination 1994) does not recommend routine formal testing of asymptomatic children for hearing impairment in the pre-school years. Furthermore, such testing is of little benefit in asymptomatic older children and adolescents.

Temporary conductive hearing loss secondary to otitis media or serous otitis media with effusion is common in Aboriginal communities and may persist for long periods of time (months). Consultation with a physician is important for management of chronic otitis media with hearing loss.

See Appendix 3-2, this chapter, for details of hearing screening.

Vision Screening

The Canadian Task Force on Preventive Health Care (formerly Canadian Task Force on the Periodic Health Examination 1994) recommends that all well-child visits during the first 2 years of life include an eye examination to check for abnormalities of vision. This examination should include inspection of the eyes for abnormalities and the corneal light reflex test. Infants should also be examined for strabismus (by means of the cover–uncover test) in the first year of life *(see also "Strabismus [Squinting]," in chapter 8, "The Eyes")*.

The Task Force also recommends that initial screening of visual acuity be undertaken in the pre-school period (3–5 years of age). If visual acuity on Snellen charts is 20/30 or less, optometric assessment is advised.

See Appendix 3-3, this chapter, for details of vision screening. For more detail on pediatric eye care, see chapter 8, "The Eyes."

When Screening Does Not Work

Urine

Routine urinalysis is not recommended for asymptomatic children.

Scoliosis

The natural history of scoliosis is not well understood, and treatments have not been well evaluated. The screening test itself is not very sensitive or specific. Any abnormalities in posture, spinal symmetry or curvature identified by the child or the child's parents or caregiver should be referred to a physician for assessment.

Observe the spine in adolescents who present for other reasons.

PRE-SCHOOL ENTRY ASSESSMENT

It is important that all children undergo a detailed pre-school assessment in preparation for starting school. The purpose of the assessment is to ensure readiness for school and to identify and correct any health problems that might interfere with the child's performance in school.

The assessment is generally done at 4–5 years of age, before the child enters kindergarten.

It is best to organize one or more special clinics in the spring of each year to carry out pre-school entry assessments for all children of the appropriate age living in the community. This allows time for any medical, surgical or social referrals to be made before school starts in the fall.

COMPONENTS OF THE PRE-SCHOOL ENTRY ASSESSMENT

It is important that a parent or the main caregiver accompany the child for this visit.

- Review of child's past health history, as well as the family's health history
- Review of present health status

Brief Physical Examination

- Eyes, ears, nose, throat, teeth
- Respiratory system
- Check for cardiac murmurs
- Abdomen
- Genitalia
- Musculoskeletal system

Screening

- Growth: measure height and weight, and plot on growth chart
- Vision: Goodlite illiterate "E" chart or random dot "E" chart
- Hearing
- Speech: gross screening for articulation
- Developmental screening: full DDST if indicated by concerns expressed by the parents or caregiver or by a healthcare professional
- Hemoglobin, urinalysis: should be done selectively for children whose medical history indicates a past or ongoing problem such as anemia or urinary tract infection
- Review of immunization status: obtain appropriate consents and update immunizations according to accepted schedule; refer to regional and provincial schedules and to the *Canadian Immunization Guide*, 5th edition (Health Canada 1998)

Health Counseling for Parents or Caregiver as Necessary

- Offer nutritional counseling
- Recommend provision of intellectual stimulation (e.g., exposure to books and reading)
- Provide anticipatory guidance about developmental milestones
- Provide information about resources available for school-age children (e.g., dental care, audiology, optometry, speech therapy)
- Allow time to discuss the results of the assessment with the parents or caregiver and to let them raise concerns or ask questions
- Initiate referrals to specific healthcare professionals or agencies as required to address any identified health problems (with parental approval and consent)
- Record all information on the child's personal health history and immunization record and in general file as necessary
- Instruct the parents or caregiver to notify the school of any identified health problem that might have implications for the child's school attendance or performance

SPECIFIC ISSUES FOR PREVENTIVE CARE OF ADOLESCENTS

See chapter 19, "Adolescent Health."

APPENDIX 3-1: DEVELOPMENTAL TESTING

DENVER DEVELOPMENTAL SCREENING TEST (DDST)

The DDST manual (Frankenburg et al. 1986), which explains the standardized method of administering and interpreting each test item in the DDST, is available in all nursing stations and health centers. The healthcare provider should read this manual before attempting to administer the test.

The DDST is intended as an assessment tool for counseling and planning. It is *not* an intelligence test; rather, it shows how the child is developing in relation to other children of the same age. Some activities outlined in the DDST will have to be adjusted for cultural relevance.

The DDST takes 15–30 minutes and considers development in four areas:

- Large muscles (arms, legs)
- Small muscles (hands, eyes)
- Words and language
- Ability to care for self and relate to others

If properly trained, the CHR can administer this test to advantage, because language and cultural barriers will be avoided. It may also be advantageous to perform the DDST in the child's home or other familiar surroundings.

The parents or another familiar adult should stay with the child during the test and should answer questions about the child's activities at home.

Calculate the child's age carefully so that the line recording results is drawn accurately. Adjust age line to account for weeks of prematurity.

To determine the highest level of development reached, the test should always include some items that are beyond the child's present development level.

The results are confidential and form part of the child's health record. They should be discussed with the parents or caregiver, and ways in which the parents or caregiver can stimulate the child's development should be explained.

Follow-up, consultation and referral should be carried out as indicated by the results.

APPENDIX 3-2: HEARING SCREENING

Perform gross hearing screening for all children during child health clinics. Gross screening includes questioning the parents or caregiver about the child's hearing ability, observing the response to a sound stimulus (e.g., clapping hands) in a younger child and pure-tone audiometric screening in the older pre-schooler (≥3 years of age) if a concern has been raised about hearing.

INFANTS AND PRE-SCHOOL CHILDREN

Age	Procedure	Method	Normal Response
Newborn to 2 months	Startle response (Moro reflex)	Produce a loud noise near the child's ear (e.g., clap hands or slap table surface)	Child is startled, jumps at the noise, blinks, widens eyes, cries
3–5 months	Ability to track sound stimulus	Produce a noise (e.g., ring bell, call child's name, sing)	Child's eyes shift toward sound; child responds to mother's voice or coos when he or she is engaged
6–8 months	Sound recognition	Produce noise out of child's line of vision (e.g., ring bell, call child's name, sing)	Child turns head in response to sound; responds to name; babbles in response to verbalization
8–12 months	Sound localization	Call child's name or say words from outside child's field of vision	Child localizes to source by turning head or body toward sound; may try to imitate words
12–24 months	Speech development (normal for age)	Engage child in conversation or question parent or caregiver about speech	

TODDLERS AND PRE-SCHOOLERS (3–5 YEARS OF AGE)

PURE-TONE AUDIOMETRY USING PLAY RESPONSE

Procedure

1. Demonstrate method to child: put on ear phones, pretend to hear a sound, say "I hear it" and, at the same time, place a block in a box or a plastic ring on a ring holder.
2. Place ear phones correctly on child.
3. Give a block or ring to the child.
4. Produce a tone at 50 dB and 1000 Hz, and guide child's hand to place block in box or ring on ring holder.
5. After practice, when child seems to understand the procedure and responds correctly, proceed with the screening.
6. Set audiometer at 25 dB and 1000 Hz and present tone in left earphone.
7. If child responds correctly, proceed to test 2000, 4000 and 6000 Hz at 25 dB.
8. Switch to right ear and present 1000, 2000, 4000 and 6000 Hz at 25 dB.
9. Record results on audiography sheet (child should be able to hear all frequencies at 25 dB).
10. Retest, later in the day, frequencies for which response was "doubtful."
11. Children who do not hear all frequencies should be referred for further assessment by a physician.

APPENDIX 3-3: VISION SCREENING

GENERAL PRINCIPLES AND CPS GUIDELINES

Screen all children for vision abnormalities. Screening should include inspection of the eye structures for abnormalities, the corneal light reflex test, the cover–uncover test in the younger infant or child, and visual acuity testing in older children ≥3 years).

The Canadian Paediatric Society has made the following recommendations for vision screening (Community Paediatric Committee, CPS 1998).

NEWBORN TO 3 MONTHS OF AGE

- A complete examination of the skin and external eye structures, as well as the conjunctiva, cornea, iris and pupils, is an integral part of the physical examination of all newborns, infants and children.
- The retina should be inspected (by means of the red reflex) for opacities of the lens (cataracts) and signs of posterior eye disease (retinoblastoma).
- Failure of visualization or abnormalities of the red reflex are indications for referral to an ophthalmologist.
- Corneal light reflex should be tested to detect ocular misalignment.

6–12 MONTHS OF AGE

- Conduct examination as for newborn to 3 months of age.
- Observe ocular alignment to check for strabismus. The corneal light reflex should be central and the cover–uncover test normal.
- Observe fixation and following.

3–5 YEARS OF AGE

- Conduct examination as for newborn to 3 months of age.
- Conduct visual acuity testing.
- Any child with visual acuity less than 20/30 should be referred for optometric assessment.

6–18 YEARS OF AGE

- Visual acuity should be assessed (e.g., by Snellen chart) every 2 years until 10 years of age, then every 3 years until 18 years of age.
- Any child with visual acuity less than 20/30 should be referred for optometric assessment.

SUGGESTED SCREENING TECHNIQUES FOR INFANTS AND PRE-SCHOOL CHILDREN

BIRTH TO 4 MONTHS OF AGE (NEAR-VISUAL ACUITY)

Observe child and ensure that the following occur:

- Regards face (of examiner or mother) in line of vision
- Follows object or light to midline
- Follows object or light past midline
- Follows object or light through 180°
- Grasps rattle when offered
- Reaches toward an object placed in line of vision

3–4 MONTHS OF AGE AND OVER

As for children 1–4 months of age, but add tests for strabismus.

TESTS FOR STRABISMUS (SQUINT)

Procedure for Corneal Light Reflex Test

1. Sit at child's eye level.
2. Hold a light source (penlight) 13 inches (32 cm) away from the child, in front of your own nose.
3. Ask child to focus on the light, if child is old enough to understand and follow the instruction.
4. Observe position of the light reflex of each cornea and of the eyes.

Responses

- *Normal:* both eyes are focused in same position, and the light reflects off the same area of the cornea, usually slightly to the nasal side of the pupil center
- *Abnormal:* eyes are not aligned in position, and the light reflexes are asymmetric, i.e., coming off different areas of the cornea; this may indicate squinting

If response is abnormal for the corneal light reflex test, perform the cover–uncover test to further assess for strabismus.

Procedure for Cover–Uncover Test

Perform this test only if the child is able to cooperate.

1. Cover one eye with an opaque object (a large plastic spoon-shaped cover designed for this purpose may be available; otherwise, improvise).
2. Instruct or try to get the child to fix his or her gaze on a light source (held in front of him or her) with the uncovered eye.
3. Quickly remove the cover from the covered eye, and observe the position of that eye.
4. Repeat steps 1, 2 and 3 for the other eye.

For further explanation, see "Strabismus (Squinting)," in chapter 8, "The Eyes."

Responses

– *Normal:* both eyes are focused in the same position
– *Abnormal:* covered eye will deviate and may swing back into alignment when the cover is removed; in more obvious cases, the eye will remain deviated after the cover is removed or always appears deviated

Referral

Children with abnormal responses on the corneal light reflex test and the cover–uncover test should be seen as soon as possible by a physician. Referral to an ophthalmologist may be necessary.

VISUAL ACUITY TESTING

Visual acuity of 20/30 or less requires referral for further optometric assessment.

3–5 YEARS OF AGE

If the child is able to comprehend instructions, use the Goodlite illiterate "E" chart or the random dot "E" chart. This test is preferably administered in the child's own language.

6–18 YEARS OF AGE

If the child knows the alphabet, use a Snellen chart. Otherwise, use the symbol or "E" charts.

CHAPTER 4 — FLUID MANAGEMENT

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FLUID MANAGEMENT

FLUID REQUIREMENTS IN CHILDREN

GENERAL INFORMATION

Maintenance fluid is the amount of fluid the body needs to replace usual daily losses from the respiratory tract, the skin, and the urinary and GI tracts.

A well child usually drinks more than maintenance requirements. If a child takes in significantly less than maintenance requirements, he or she will gradually become dehydrated.

The requirement for maintenance fluids varies with the weight of the child (Table 4-1). Infants need more fluid per kilogram of body weight than do older children. Various medical conditions will also affect these requirements (Table 4-2).

Table 4-1: Daily Maintenance Fluid Requirements (24-Hour Period)

Calculation
100 mL/kg for the first 10 kg body weight
+ 50 mL/kg for the next 10 kg body weight
+ 20 mL for each kilogram of body weight over 20 kg
Examples
For 10-kg child: 10 kg × 100 mL/kg = 1000 mL
For 15-kg child: (10 kg × 100 mL/kg) + (5 kg × 50 mL/kg) = 1250 mL
For 25-kg child: (10 kg × 100 mL/kg) + (10 kg × 50 mL/kg) + (5 kg × 20 mL/kg) = 1600 mL

Table 4-2: Conditions Modifying Daily Fluid Requirements

Requirement Increased	Requirement Decreased
Fever,* sweating, vomiting or diarrhea	Meningitis
Diabetes	Congestive heart failure
Burns	Renal failure

*Daily maintenance fluids should be increased by 12% for every degree Celsius body temperature above 37.5°C (rectal).

DEHYDRATION IN CHILDREN

DEFINITION

Abnormal decrease in volume of circulating plasma.

CAUSES

- Gastroenteritis (most common cause in childhood)
- Inadequate fluid intake
- Diabetes mellitus
- Burns
- Pyloric stenosis
- GI obstruction

Newborns and young children have a much higher water content than adolescents and adults and are therefore more prone to loss of water, sodium and potassium during illness.

HISTORY

- Fever
- Vomiting
- Diarrhea
- Urine output
- Lethargy
- Irritability

All body systems must be reviewed to ascertain underlying cause.

PHYSICAL FINDINGS

Table 4-3 presents the clinical features of various stages of dehydration.

DIAGNOSTIC TESTS

- Urinalysis to check for ketones
- Blood glucometry to rule out diabetes (if no diarrhea)

MANAGEMENT

Goals of Treatment

- Correct dehydration using oral rehydration therapy (ORT) with or without IV fluids
- Treat shock or impending shock
- Prevent complications (e.g., seizures or edema)

Appropriate Consultation

Consult a physician as soon as possible for any infant or young child with signs of dehydration. If the child has presented with severe signs (e.g., shock), this consultation may have to wait until the child's condition has been stabilized.

Nonpharmacologic Interventions

- Using the criteria presented in Table 4-3, decide if child is mildly, moderately or severely dehydrated.
- Weigh child (without clothes).
- Once you have determined the degree of dehydration, calculate the fluid deficit according to Table 4-4 (using the percent dehydration values shown in the column headings for Table 4-3). When you have calculated the deficit, add maintenance requirements (see Tables 4-1 and 4-2) and rehydrate according to Table 4-5.

Monitoring and Follow-Up

Reassess level of consciousness *(according to pediatric Glasgow coma scale, Table 15-1, in chapter 15, "Central Nervous System")*, vital signs, skin perfusion, skin turgor and urine output frequently.

Referral

Medevac any child with moderate to severe dehydration as soon as possible.

Table 4-4: Calculating Fluid Deficit

Calculation
Fluid deficit (L) = weight (kg) × % dehydration
Example
For an 8-kg child with 10% dehydration: 8 kg x 10% = 0.8 L deficit

Table 4-3: Clinical Features of Dehydration

Feature	Mild Dehydration (<5%)	Moderate Dehydration (5% to 10%)	Severe Dehydration (>10%)
Heart rate	Normal	Slightly increased	Rapid, weak
Systolic blood pressure	Normal	Normal to orthostatic, >10 mm Hg change	Hypotension
Urine output	Decreased	Moderately decreased	Markedly decreased, anuria
Mucous membranes	Slightly dry	Very dry	Parched
Anterior fontanel	Normal	Normal to sunken	Sunken
Tears	Present	Decreased, eyes sunken	Absent, eyes sunken
Skin*	Normal turgor	Decreased turgor	Tenting
Skin perfusion	Normal capillary refill (<2 seconds)	Capillary refill slowed (2–4 seconds); skin cool to touch	Capillary refill markedly delayed (>4 seconds); skin cool, mottled, gray

*Skin condition is less useful in diagnosis of dehydration in children >2 years of age.

Table 4-5: Fluid Resuscitation

Mild Dehydration (<5%)	Moderate Dehydration (5% to 10%)	Severe Dehydration (>10%)
Start ORT: 10 mL/kg for 6–8 hours Reassess at 4-hour intervals From 8 to 24 hours, give ORT *ad libitum* Give fluid frequently, in small amounts Replace deficit over 6–8 hours (add maintenance requirement to deficit) Give extra ORT after each diarrheal stool (e.g., 5–10 mL/kg) Monitor urine output (output should be at least 1 mL/kg body weight per hour) Continue breast-feeding; if child is bottle-fed, early refeeding of child's normal formula (within 6–12 hours) is recommended Full diet should be reinstituted within 24–48 hours, if possible Delay refeeding only if there is severe, protracted vomiting	Attempt ORT as in mild dehydration: 15–20 mL/kg for 6–8 hours Reassess at 4-hour intervals From 8 to 24 hours, give ORT *ad libitum* Give fluid frequently, in small amounts Replace deficit over 6–8 hours (add maintenance requirement to deficit) Give extra ORT after each diarrheal stool (e.g., 5–10 mL/kg) Monitor urine output (output should be at least 1 mL/kg body weight per hour) Continue breast-feeding; if child is bottle-fed, early refeeding of child's normal formula (within 6–12 hours) is recommended Full diet should be reinstituted within 24–48 hours, if possible Delay refeeding only if there is severe, protracted vomiting	Medical emergency NS or Ringer's lactate 20 mL/kg IV over 20 minutes Monitor blood pressure Repeat bolus (to a maximum of three boluses in 1 hour) if signs of shock persist (e.g., tachycardia, decreased systolic blood pressure, poor perfusion, skin gray and mottled) Once response occurs, calculate remaining deficit: replace 50% of the deficit over 8 hours, remainder over next 16 hours (be sure to add maintenance requirements to total IV therapy) Monitor urine output (output should be at least 1 mL/kg body weight per hour) If unable to start an IV line in three attempts (or within 60–90 seconds), establish intraosseous access For intraosseous infusion, *see "Intraosseous Access," in chapter 2, "Pediatric Procedures")*; this technique can save the child's life and is not technically difficult; when line is in place, use as you would a regular IV line

ORT = oral rehydration therapy, NS = normal saline, IV = intravenous.

General Comments about Fluid Management

IV therapy should usually be used only for severe dehydration or intractable vomiting; oral therapy is always safer. However, the oral replacement solution (ORS) may be administered by nasogastric tube if necessary.

Use an ORS such as Pedialyte or Gastrolyte to replace the calculated deficit.

If the child is breast-feeding and is able to nurse, then breast-feeding should be continued for maintenance requirements; supplement with Pedialyte or Gastrolyte to make up the deficit.

Increase the amount of maintenance fluids if there are ongoing fluid losses (e.g., if diarrhea continues).

If a *marked* increase in diarrhea occurs when a bottle-fed child returns to his or her usual cow's milk formula, consult a physician about changing to a soy-based formula (e.g., Prosobee or Isomil). Switch back to regular cow's milk formula within 7–10 days. Do not go back to Pedialyte unless there is a *marked* increase in stools while on soy formula. Some increase in stools does not matter, as long as the child takes in enough to keep up with losses. In other words, treat on the basis of the child's condition, not on the basis of the stools.

If the child is vomiting, he or she will usually tolerate fluids by mouth if given in small amounts (one sip at a time). If child will not suck, try giving sips frequently by spoon. Allow mother and other family members to administer fluid. Increase daily maintenance fluids by 12% for every degree Celsius body temperature above 37.5°C (rectal).

CHAPTER 5 — CHILD ABUSE

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DEFINITIONS

CHILD ABUSE

Any injury intentionally inflicted upon a child by an older person. May involve physical, sexual or emotional abuse or neglect.

PHYSICAL ABUSE

An act or omission by a parent, caregiver or other person that results in injury to a child. Such acts include inflicting blows that cause bruising, striking a child with a fist or instrument, and kicking, throwing or shaking a child. An omission is the failure to prevent an injurious act.

SEXUAL ABUSE

Any exploitation of a child for the sexual gratification of an adult or older person. Sexual abuse is a criminal offense under the Criminal Code of Canada; hence, involvement of the local police force and local child-protection authorities is essential in all investigations of sexual abuse.

EMOTIONAL ABUSE

Acts or omissions by a parent, caregiver or other person that are damaging to a child's physical, intellectual or emotional development. Such acts or omissions may include unwillingness or inability to provide care, control, affection or stimulation, or exposure of the child to family violence.

NEGLECT

Failure of the parents or caregiver to provide for a child's basic physical needs.

SITUATIONS IN WHICH CHILD ABUSE OCCURS

The occurrence of child abuse usually depends on the interplay of three components: a high-risk parent, a high-risk child and a crisis.

High-risk parents tend to have low self-esteem, few supports and difficulty establishing trust. Not all abused children become abusing parents, but many abusing parents were abused as children.

A high-risk child is one who may have special physical needs or who is perceived as undesirable for a variety of reasons (e.g., unwanted, of dubious paternity, irritable).

The crisis is an event, major or minor, within the family that precipitates the abusive event.

HISTORY AND PHYSICAL EXAMINATION

INDICATORS OF POSSIBLE PHYSICAL ABUSE

GENERAL

- Family history of abuse
- Delay in seeking medical attention after an injury
- Inconsistencies in the history
- History incompatible with the presenting problem

SPECIFIC

- Unexplained bruises and welts, especially if on multiple body surfaces or if in a recognizable pattern (e.g., belt marks, fingerprints)
- Injuries at various stages of healing (Table 5-1) and in areas of the body not normally injured during play (e.g., axilla, neck, ear)
- Unexplained burns
- Unexplained fractures
- Any fractures in the first year of life

Table 5-1: Estimating Age of Healing Bruises

Color of Bruise	Days since Injury
Red	0–1
Bluish purple	1–4
Greenish yellow	5–7
Yellowish brown	≥8

Source: *Rudolph's Fundamentals of Pediatrics* (Rudolph and Kamei 1998).

DIFFERENTIAL DIAGNOSIS OF PHYSICAL ABUSE

- Accidental injury (e.g., unrestrained child in motor vehicle collision, bicycle accident)
- Dermatologic condition (e.g., impetigo, contact dermatitis)
- Mongolian spots

INDICATORS OF SEXUAL ABUSE

SPECIFIC

- Bruises or lacerations of genitalia
- Vaginal or penile discharge
- STDs
- Vaginal bleeding
- Pregnancy (if child ≤14 years of age and an adult male was involved)

LESS SPECIFIC

- Difficulty walking
- Pain or itching in genital area
- Behavioral symptoms: sexualized behavior in play, delinquent behavior, self-destructive behavior, runaway behavior
- Depression in a child or adolescent

INDICATORS OF EMOTIONAL ABUSE

- Failure to thrive (in some infants)
- Behavioral disturbances
- Developmental lags

INDICATORS OF NEGLECT

- Unattended medical needs
- Poor hygiene
- Abandonment

MANAGEMENT

Review the regional policy on child abuse.

The steps in managing a case of suspected abuse are outlined in Table 5-2.

Table 5-2: Steps in Managing Suspected Abuse

1. Suspect abuse.
2. Obtain detailed history (interview the child alone, if child's age makes this appropriate). Record dates and times of incidents and names of individuals involved.
3. In cases of sexual assault, consult with a physician by telephone before proceeding with examination and cultures.
4. Notify appropriate authorities (e.g., child and family services, police).
5. Do not send child back to a potentially abusive environment.
6. Consider the possibility that the child's siblings are also being abused.
7. Maintain a helping, non-judgmental approach with the parents or caregiver.

Treat acute injuries locally or evacuate the child to a hospital.

Report the situation to local child-protection authorities immediately. Provide the following information: complete family demographic data, the nature of the abuse and any available family social history.

During the initial assessment, consult the child-protection authorities regarding a location for safe placement of the child. This is a critical part of the management.

Include the following information in the documentation:

- Detailed description of the injury
- Measurements and drawings where appropriate
- Color, size and age of lesions
- Dates, times and names of caregivers interviewed
- Child's behavior
- Details of any explanations provided

LEGAL ASPECTS

The Criminal Code of Canada is penal in nature, intended to punish the perpetrator. Conviction under the Criminal Code requires proof beyond a reasonable doubt, but investigations and appropriate placement may be initiated whenever suspicion of abuse arises. Child-protection legislation has been enacted in all Canadian provinces and territories. The purpose of this legislation has been to determine what is in the best interests of the child. Investigations under these acts are considered civil in nature, with the degree of proof based on a balance of probability.

In Canada, any person who has information about potential abuse or who is concerned that a child needs protection is legally obliged to report the situation to a child-protection agency or the police. Failure to do so is considered an offense punishable by summary conviction. Those who report in good faith are protected from legal action.

Nurses should be familiar with the (1) legislation in their own province or territory and (2) the appropriate child-protection and law enforcement representatives.

CHAPTER 6 — DYSFUNCTIONAL PROBLEMS OF CHILDHOOD

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INTRODUCTION

The topics discussed in this chapter include a variety of physiologic, psychologic and social problems that may interfere with important functions of daily living.

Assessment of these problems requires, above all, establishing a good rapport with the family and the child. Usually, the initial interview is lengthy; this is the session during which trust is established. The history and physical examination vary with the presenting complaint.

COMMON DYSFUNCTIONAL PROBLEMS

LEARNING DISABILITIES

DEFINITION

Inability to process language and its symbols or lack of arithmetic-related skills at a level equal to peer group.

Affected children usually suffer from learning disability in a specific area and are normal in all other areas of development.

CAUSES

Specific learning disabilities are generally thought to be biologic in origin, although the exact mechanisms and biology have not yet been determined.

Major psychiatric disturbances, social deprivation, or loss of vision or hearing can also produce poor learning skills and must be differentiated from specific disabilities.

HISTORY

- Current and past behavior and school performance (look for specific patterns and for hyperactivity, which is often associated with a learning disability)
- Perinatal history (perinatal asphyxia or intrauterine injury may play a role in some cases), prematurity
- Family history (such disorders often run in families)
- Early development: recognition of risk factors such as delayed language development
- Social, environmental, family and social factors, which may aggravate the problem (e.g., constant derision may lead to low self-esteem)
- History of meningitis, head trauma

EXAMINATION

Most aspects of the examination required to define a specific learning disability are performed by a psychologist and education specialists.

Perform a physical examination to rule out the following conditions:

- Hearing and vision problems
- Medical problems
- Fetal alcohol syndrome (FAS)
- Abuse
- Iron deficiency anemia
- Neurologic abnormality

DIFFERENTIAL DIAGNOSIS

- Poor school performance (common)
- Poor motivation (family disorganization)
- Global developmental delay (mental retardation)
- Depression
- Sensory disorders (e.g., hearing loss secondary to otitis media)
- Cerebral palsy

MANAGEMENT

Nonpharmacologic Interventions

- Advocate for the child in the education system
- Support the child's self-esteem
- Support child and parents or caregiver with behavioral strategies in conjunction with psychologic counseling and education
- Arrange for treatment by specialists

Monitoring and Follow-Up

- Follow up two or three times a year with the child and the parents or caregiver to assess progress and provide support
- Liaise annually with the school (with parental consent)

Referral

- Most management of this problem should be done through the education system.
- Refer the child to a physician for evaluation as soon as possible (elective).
- A baseline assessment by a pediatrician is indicated.

FETAL ALCOHOL SYNDROME AND FETAL ALCOHOL EFFECTS

INTRODUCTION

Alcohol is a known teratogen that can cause birth defects by affecting the growth and proper formation of the fetus's body and brain (Olson et al 1992). Exposure to alcohol before birth can lead to long-term developmental disabilities in the form of motor, speech or behavioral problems. The range of disability varies, even for those with a diagnosis of fetal alcohol syndrome (FAS).

There is no definitive information as to the quantity of alcohol that may be safely consumed during pregnancy. Full-blown FAS is more likely to occur if intake of alcohol during pregnancy is heavy or continuous (Olsen 1992), but detrimental effects have also been observed after intermittent or binge drinking. Children born to mothers who consumed on average one or two drinks per day and who may occasionally have consumed up to five or more drinks at a time are at higher risk for learning disabilities and other cognitive and behavioral problems.

Abnormalities related to prenatal exposure to alcohol occur along a continuum. Many terms have been and are still used to describe the severity of these alcohol-related abnormalities.

- *Fetal alcohol syndrome (FAS):* Medical diagnosis referring to a set of alcohol-related disabilities associated with maternal use of alcohol during pregnancy. Recognized in Canada as one of the leading causes of preventable birth defects and developmental delay in children.
- *Fetal alcohol effects (FAE):* Birth defects or developmental abnormalities for which alcohol is being considered one of the possible causes. Used to describe children with prenatal exposure to alcohol, but only some of the characteristics of FAS, including reduced or delayed growth, single birth defects, or developmental learning and behavioral disorders that may not be noticed until months or years after the child's birth.
- *Alcohol-related birth defects (ARBD)*
- *Alcohol-related neurologic disorders (ARND)*

The Canadian Paediatric Society (1997) advises healthcare professionals, including family physicians, pediatricians and others to whom children are referred, to increase their awareness of maternal alcohol use during pregnancy, so as to identify the possible causes of birth defects and other developmental disorders and to identify and prevent risks for subsequent pregnancies.

HIGH-RISK POPULATIONS

Women who drink and have the following characteristics:

- Low socioeconomic status
- Poverty
- Lack of education
- Smoker
- Use of other illicit drugs
- Poor health

Higher prevalence rates have been found in Manitoba and British Columbia Aboriginal populations.

Families with one or more children affected by FAS are at much higher risk of recurrence.

Recent research suggests women who have a college education or are still students, who are unmarried, who smoke and who come from households with an annual income of more than $50,000 are also at risk of having a baby with FAS.

DIAGNOSTIC CRITERIA

Minimum criteria for diagnosis of FAS:

- History of maternal alcohol consumption during pregnancy
- Prenatal or postnatal growth retardation
- Involvement of CNS, such as neurologic abnormalities, developmental delay, behavioral dysfunction, learning disabilities or other intellectual impairments, and skull and brain malformations
- Characteristic facial features: short eye slits (palpebral fissures), thin upper lip, flattened cheek bones and indistinct groove between the upper lip and the nose (such characteristics are not to be confused with the facial features that occur normally in some ethnic groups)

PREVENTION STRATEGIES

Pregnancy presents the healthcare professional with an excellent opportunity to encourage behavioral change, as women are generally receptive to suggestions about controlling their alcohol consumption during pregnancy.

According to the Canadian Paediatric Society (1997), prevention efforts should target women before and during their childbearing years, as well as those who influence such women, including their partners, their families and the community. All efforts should be family-centered and culturally sensitive; should address the pregnant woman, her partner and her family in the context of their community; and should be comprehensive, drawing on all services appropriate to the often-complex social, economic and emotional needs of these women.

The CPS also recommends that healthcare professionals working with members and leaders of communities must be consistent in advising women and their partners that the prudent choice is not to drink alcohol during pregnancy.

Primary Prevention

Become involved in educating women, their partners and the community in general about FAS and the adverse effects of alcohol on a fetus.

Goals of primary prevention:

- Early recognition of women who drink alcohol during pregnancy
- Appropriate counseling to reduce or eliminate alcohol use before conception and during pregnancy
- Early recognition and intervention for any child born with alcohol-related effects

Ask all female clients of childbearing age some basic questions about alcohol consumption:

- Do you use alcohol?
- Has alcohol ever caused a problem for you or your family?
- Do you regularly use any other drugs or substances (e.g., illicit drugs, prescription or OTC drugs)?

Discuss contraceptive methods with women and their partners and enhance access to contraception.

Encourage awareness of and access to community resources for alcohol abuse.

Be aware of, use and offer educational handouts on the effects of alcohol in pregnancy.

Secondary Prevention

According to the Canadian Paediatric Society (1997), healthcare professionals play an essential role in identifying women who drink at levels that pose a risk to the fetus and to themselves. Screening should be implemented to identify women at high risk for heavy alcohol consumption before and during pregnancy. Similarly, healthcare professionals have a responsibility to inform women at risk and to initiate appropriate referrals and supportive interventions.

To identify any woman who is using alcohol during pregnancy, screen all pregnant women with basic questions about their alcohol use *(see "Primary Prevention," above)*. If the woman answers Yes to any of those questions, pose some additional screening questions to assess her level of risk:

- In a typical week, on how many days do you drink?
- On those days, how many drinks do you usually have?

In addition, administer a standard screening test, such as the **T-ACE** questionnaire:

- T for **tolerance:** How many drinks does it take to make you feel high? (score 2 for more than 2 drinks, score 0 for 2 drinks or less)
- A for **annoyance:** Have people annoyed you by criticizing you about your drinking? (score 1 for a Yes response)
- C for **cut down:** Have you felt you should cut down on your drinking? (score 1 for a Yes response)
- E for **eye opener:** Have you ever had a drink first thing in the morning to get rid of a hangover or to steady your nerves? (score 1 for a Yes response)
- Any score ≥2 indicates high risk

For women identified as being at high risk of having a child with FAS, take the following steps:

- Ask such women why they drink
- Counsel pregnant women who are using alcohol about the effects of alcohol on the fetus and their own health
- Counsel pregnant woman on the benefits of stopping or reducing the use of alcohol at any time during the pregnancy
- Provide client with educational materials to facilitate behavioral change
- Follow up closely, and provide support and encouragement

The Canadian Paediatric Society (1997) recommends that healthcare professionals inform women who have occasionally consumed small amounts of alcohol during pregnancy that the risk to the fetus in most situations is likely minimal. They should also explain that the risk is related to the amount of alcohol consumed, body type, nutritional health and other lifestyle characteristics of the expectant mother. If exposure has already occurred, healthcare professionals should inform the mother that stopping consumption of alcohol at any time will benefit both fetus and mother.

Tertiary Prevention

- Strategies should include early diagnosis of the condition and programs designed specifically for children with FAS or FAE and their parents or caregivers
- Refer women who are at high risk to appropriate treatment resources for alcohol abuse
- Identify and treat women and their partners who already have one FAS/FAE child and who plan to have more children

MANAGEMENT

Appropriate Consultation

Consult a physician as soon as possible about any child suspected of suffering the effects of alcohol in utero.

Referral

The care of a child with FAS, FAE, ARBD or ARND requires a coordinated, multidisciplinary, team approach to maximize the child's potential for good quality of life.

There is a small window of opportunity, up to age 10 or 12, to achieve the greatest benefit for a child affected by alcohol in utero. This is the period when the greatest development of fixed neural pathways occurs, and thus when it is easiest to develop alternative coping pathways to work around damaged areas of the brain.

ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

DEFINITION

A cluster of behavioral symptoms:

- Poor attention span
- Impulsiveness
- Hyperactivity

Not all children with the disorder will exhibit all three behaviors. For example, some very quiet children have a poor attention span.

CAUSES

Genetic Syndromes

- Fragile X syndrome
- Phenylketonuria (PKU)
- Gilles de la Tourette syndrome

Intrauterine or Prenatal Damage

- Fetal alcohol exposure
- Intrauterine anoxia

Postnatal Factors

- Prematurity
- Meningitis
- Significant head injuries

May be familial without a specific cause.

In most affected children, there is no obvious contributing cause.

HISTORY

- Prenatal: pregnancy, exposure to drugs or alcohol
- Perinatal: delivery, asphyxia, illnesses
- Family history: ADHD, related behavioral disorders
- Past medical history: illnesses such as meningitis, injuries, hospital admissions
- History of school progress and behavior (talk with teacher)
- Symptoms (see Table 6-1) usually present before child enters school

The diagnosis is usually established by the presence of at least 8 of 14 possible characteristics over a period of at least 6 months (Table 6-1).

Table 6-1. Diagnostic Criteria for Attention Deficit Hyperactivity Disorder

A disturbance of at least 6 months' duration during which at least 8 of the following are present
Often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness)
Has difficulty remaining seated when required to do so
Is easily distracted by extraneous stimuli
Has difficulty awaiting turn in games or group situations
Often blurts out answers to questions before they have been completed
Has difficulty following instructions from others, but not because of oppositional behavior or failure of comprehension (e.g., fails to finish chores)
Has difficulty sustaining attention in tasks or play activities
Often shifts from one uncompleted activity to another
Has difficulty playing quietly
Often talks excessively
Often interrupts or intrudes on others (e.g., butts into other children's games)
Often does not seem to listen to what is being said to him or her
Often loses items necessary for tasks or activities at school or at home (e.g., pencils, toys, books, assignments)
Often engages in physically dangerous activities without considering possible consequences, but not for the purpose of thrill-seeking (e.g., runs into street without looking)
Other characteristics
Onset before the age of 7 years
Does not meet the criteria for a pervasive developmental disorder

Adapted, with permission, from Green, M.; Haggerty, R.J. 1990. *Ambulatory Paediatrics IV*. W.B. Saunders Ltd., Baltimore, MD.

PHYSICAL EXAMINATION

- Complete general examination: look for dysmorphic features of genetic conditions, FAS
- Examine ears and check hearing
- Examine eyes and check vision
- "Soft neurologic signs" often present (e.g., increased reflexes, poor coordination, poor balance)
- Educational evaluation done through the school system

DIFFERENTIAL DIAGNOSIS

- Acting-out behavior disorders
- Reaction to a highly stressful environment
- Deafness
- Pervasive developmental disorder (e.g., autism)

MANAGEMENT

Goals of Treatment

- Improve academic achievement
- Improve attention span
- Control hyperactivity (behavior)

Appropriate management includes the involvement of a multidisciplinary team, of which educational specialists are the mainstay. Many specific methods can be used to overcome the child's weaknesses and take advantage of his or her strengths.

The medical role involves advocacy and sometimes the administration of medication. The school and the parents or caregiver should monitor for desired effects and side effects (e.g., impaired growth or tic).

Nonpharmacologic Interventions

- Support for the family
- Advocacy within the educational system and within the community
- Monitor medication use, dosage, side effects

Client Education

- Explain nature, course and treatment modalities of the disorder
- Stress importance of regular follow-up
- Counsel parents or caregiver about medication: appropriate use, dosage and side effects

Behavioral Strategies

Counsel parents or caregiver about behavioral strategies:

- Decrease environmental stimuli
- Focus on the child's positive traits to increase self-esteem
- Give simple directions
- Make eye contact with the child
- Use "time out" as a disciplinary tactic

Pharmacologic Interventions

Drug of choice:

> methylphenidate (Ritalin) (**B class drug**), starting dose 0.2–0.5 mg/kg daily in two doses, morning and noon; the dose can be increased by 0.15 mg/kg each day

This drug is not recommended for children <6 years of age.

This drug can improve concentration and, in higher doses, reduce hyperactivity. Its use is still controversial, and it should be prescribed only by a physician after full evaluation.

Drug-free periods during school holidays will result in catch-up growth.

CHAPTER 7 — NUTRITION

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NUTRITIONAL PRINCIPLES

GENERAL

For normal growth, a child's nutritional intake must include protein, fat, carbohydrate, water, vitamins, minerals and trace elements in adequate amounts. For many nutrients, deficiency states can occur if intake is inadequate. Similarly, a variety of diseases are associated with excess intake of specified nutrients.

TYPES OF NUTRIENTS

- *Energy* (expressed as kilocalories [kcal]): needed for metabolic functions and growth; available from protein, carbohydrate and fat
- *Protein:* contributes to energy intake and supplies amino acids for tissue growth and replacement
- *Carbohydrates:* provide caloric energy and thus help limit the need for protein and fat
- *Fats:* contribute substantially to energy needs because of high caloric density (9 kcal/g); some essential fatty acids are important for growth of the infant's nervous system
- *Water:* necessary to sustain life and growth
- *Vitamins:* essential cofactors in metabolic processes
- *Minerals:* necessary in small quantities for growth and metabolism; deficiency states are clinically recognized for only a few minerals

INFANT FEEDING PRINCIPLES

GENERAL

Healthy infants obtain nutrition in a pattern that encourages social interaction with parents and caregivers. Thus, infant feeding provides both nutrition for growth and an opportunity for social interaction, both of which are crucial to the infant's well-being. Infants should always be held while being fed in an effort to prevent nursing bottle caries of the teeth.

ADEQUACY OF INTAKE

Adequacy of intake is best determined by observing weight gain. Expected gain is as follows:

- 30 g/day in the first 3 months
- 15–20 g/day in the second 3 months

Six well-soaked diapers and yellowish stool daily are also indicators of adequate nutritional intake.

Average daily energy requirement is 115 kcal/kg during the first year of life, although there is some variation from one child to another. The average caloric content of formulas and breast milk is 20 kcal/oz or 67 kcal/100 mL (1 oz = 30 mL).

FEEDING CHOICES

BREAST-FEEDING

In the first 6 months of life, an infant's requirements for water, energy and major nutrients can best be met by human milk. For this reason, as well as for the emotional benefits to the child and the immunologic benefits in terms of protective effects against infection (especially in populations where refrigeration is lacking or water supplies are suspect), breast milk is considered the best choice for feeding infants.

ADVANTAGES

- Fewer respiratory, GI and otitis media infections
- Ideal food: easily digestible, nutrients well absorbed, less constipation
- Increased contact between mother and baby and, perhaps, added self-esteem for mother
- Economical, portable, affords ease of meeting infant's feeding needs quickly
- May decrease occurrence of allergies in childhood
- Mothers often like it more than bottle-feeding
- More rapid and complete reversion of mother's pelvis and uterus to pre-puerperal state

CONTRAINDICATIONS

- HIV infection or active TB
- Substances of abuse will pass into human milk; *see Table 7-1, below, this chapter, for information about drugs that are passed into milk*

PHYSIOLOGY

- Stimulation of areola causes secretion of oxytocin
- Oxytocin is responsible for let-down reflex, whereby milk is ejected from cells into milk ducts
- Sucking stimulates secretion of prolactin, which in turn triggers milk production
- Milk is therefore created in response to nursing, i.e., nursing increases the supply of milk

TECHNIQUE

- Mother should be in a comfortable position, usually sitting or reclining with baby's head in crook of her arm (side-lying position is often useful following delivery by cesarean section)
- Bring baby to mother (to minimize stress on mother's back)
- Baby's belly and mother's belly should face each other or touch (belly-to-belly position)
- Initiate the rooting reflex by tickling baby's lips with nipple or finger; as baby's mouth opens wide, mother guides her nipple to back of the baby's mouth while pulling the baby closer; this maneuver will ensure that the baby's gums are sucking on the areola, not the nipple
- It is important that the baby be allowed to nurse within the first hour after birth

POSITIONING AND LATCHING ON

Source: Baby & Parent Health Program, Community Health Services, Halton Regional Health Department

Fig. 7-1: Cradle Position for Breast-Feeding

1. Breast-feed in a sitting position, with good back support, as soon as possible.
2. Place a pillow on your lap to bring baby to breast height.
3. Position baby with his or her head resting on your forearm, facing you (belly to belly), with your hand supporting the diaper area.
4. Baby's face should be across from the breast, the mouth across from the nipple and the head tilted slightly back.
5. Place four fingers under breast and thumb on top, well back from nipple and areola.
6. Lightly tickle baby's lower lip with nipple. Have patience.
7. When mouth opens wide (as big as a yawn) quickly point nipple at opening and pull baby onto breast.
8. If baby is positioned correctly, the nose should be resting on top of breast and not buried in breast tissue. Do not press on breast to make "breathing space."
9. If there is pain, take baby away from breast and repeat.
10. Check "latch." Mouth should be big with lips turned back. Chin should be well underneath breast, and nose should be resting on top.
11. Listen for baby swallowing. If baby is feeding well, you will see short bursts of sucking and swallowing with pauses between. The jaw movement goes past the ears, sometimes making the ears wriggle.
12. Let baby feed at first breast until he or she pushes nipple out of mouth; offer a burp and continue on other breast. The baby may not suck for as long on the second breast. Start on that side during the next feeding session.
13. If baby starts wriggling during the feeding, he or she may need to burp. Take the baby off the breast, offer a burp and then latch on again.
14. Each baby is different and each will take a different period of time to feed. If a feeding is taking an hour or more, the baby is probably not latched on properly. Contact someone to watch you nurse and check the latch.

Fig. 7-2: Football Hold for Breast-Feeding

If you have difficulty feeding your baby in the cradle position, try the football hold. This hold can work well in the following situations:

- Cesarean birth
- Small baby
- Mother experiencing more difficulty with one side than the other
- Mother with flat nipples

1. Sit in upright position with good back support.
2. Place one or two pillows at your side.
3. Lie baby on pillows at your side.
4. Support the back of the neck with your hand. This allows the baby's head to tilt back a little.
5. Hold your breast as described for the cradle position.
6. Tickle baby's lower lip. Wait for his or her mouth to open and pull the baby onto the breast.

Fig. 7-3: Alternative Position for Breast-Feeding

1. Sit in upright position with good back support.
2. Place a pillow in front of you.
3. Lie baby across your body facing you.
4. Hold breast with hand on same side (right breast, right hand).
5. Support back of baby's neck and shoulders with other hand.
6. Tickle baby's lower lip. Wait for the baby's mouth to open wide and pull the baby onto the breast.
7. When baby is feeding well, try taking hand from breast and putting it around the baby for support.

MOTHER'S DIET WHILE NURSING

- Adequate caloric and protein intake
- Plenty of fluids
- Prenatal vitamins

SIGNS OF ADEQUATE NURSING

- Breasts become hard before and soft after feeding (noted in the first few weeks after the birth)
- Six or more wet diapers in 24 hours
- Baby satisfied and weight gain appropriate (average 1 oz or 28 g per day in the first few months)
- Growth spurts should be anticipated around 10 days, 6 weeks, 3 months and 4–6 months
- During growth spurts, baby will nurse more often over a period of several days, which will increase milk production to allow for further adequate growth

CLIENT EDUCATION

Antepartum

Promote advantages of breast-feeding early and regularly during the course of the pregnancy.

Postpartum

Counsel women on the following aspects of breast-feeding:

- Technique
- Natural history
- Colostrum present in breast at birth but may not be seen
- If baby is feeding well, he or she will be adequately nourished
- Milk will not come in before third day postpartum
- Frequent nursing (at least 9 times/24 hours) will lead to milk coming in sooner and in greater quantities
- Mother should allow baby to determine duration of each nursing session
- Baby will lose weight over the first few days and may not regain birth weight until 7 days
- Supplemental vitamins are unnecessary unless the baby has very limited exposure to sun (in which case vitamin D should be given); *see "Vitamin and Mineral Supplements," below, this chapter*
- Breast milk alone is adequate for first 6 months
- Solids may be introduced at 4–6 months

Mothers who are planning to return to work should start switching the baby to bottle-feeding about a week ahead of time, for the hours of the day when the mother will be away. This can be done by omitting a breast-feeding session every few days and substituting pumped breast milk or formula, preferably given to the baby by another caregiver. To increase the likelihood that the baby will take a bottle occasionally, introduce bottle-feeding at 3–4 weeks (once breast-feeding has been well established). Give milk by bottle once or twice a week.

Breast Care

- Porous breast shields collect any milk that drips; shields should be changed when wet to prevent skin maceration
- Correct positioning, with nipple and areola well into the infant's mouth, helps prevent nipple soreness and cracked nipples
- For cracked nipples, express some milk, and allow the milk to air dry on the nipples; ensure the infant is latching on correctly
- When one nipple is sore, feedings should be started on the side that is not sore; it may be helpful to change the feeding position (e.g., from sitting to lying) when nipples are sore

POSSIBLE COMPLICATIONS

Plugged Milk Ducts

Mother is well except for sore lumps in one or both breasts, without fever.

Apply moist hot packs to lump(s) before and during nursing. The mother should nurse more frequently on the affected side. Ensure good technique.

Mastitis

Woman has a sore lump in one or both breasts, accompanied by fever or redness of the skin overlying the lump. She may be quite ill. Other possible sources of fever should be ruled out (in particular, endometritis and pyelonephritis).

Apply moist hot packs to the lump(s) before and during nursing. The mother should nurse more frequently on the affected side. Administer antibiotics (e.g., cloxacillin) for *Staphylococcus aureus* (the most common organism) for at least 7 days. The mother should get more rest and use acetaminophen (Tylenol) as necessary. The fever should resolve within 48 hours; otherwise, consider changing the antibiotic. The lump should also resolve. A persistent lump may be an abscess, which must be drained surgically.

Engorgement

Engorgement usually develops just after milk first comes in (day 3 or 4). It is characterized by warm, hard, sore breasts.

To resolve, offer baby more frequent nursing. The mother may have to hand-express a little milk to soften the areola enough to let baby latch on. The baby should be allowed to nurse long enough to empty the breasts. The problem usually resolves within a day or two.

Flat or Inverted Nipples

When stimulated, inverted nipples will retract inward, whereas flat nipples remain flat. Check for either of these conditions during the initial prenatal physical.

Nipple shells (doughnut-shaped inserts) can be worn inside the bra during the last month of pregnancy to gently force the nipple through the center opening of the shell. The baby can nurse successfully even if the shell does not correct the problem before birth. A lactation consultant or a member of the La Leche League may be a good resource in this situation.

PROBLEMS OF LACTATION

Source: Baby & Parent Health Program, Community Health Services, Halton Regional Health Department

Insufficient Lactation

This problem is almost always due to improper feeding techniques, which can be remedied. Occasionally, it is due to problems other than technique.

Signs

- Insufficient weight gain in an infant who is receiving food only by breast-feeding
- Infant may latch on poorly
- Infant may suck inconsistently
- Let-down reflex may be inconsistent
- Some infants appear hungry (indicated by crying soon after feedings), whereas others are content, but gain poorly

Risk Factors

- Mother has previous experience with this problem
- Physical abnormality of the breast
- No breast enlargement during pregnancy
- History of breast surgery

Management

Goal is to preserve breast-feeding, if possible.

- Frequent feeding sessions
- Breast pumping (with an electric pump, if available) after each feeding
- Increase maternal fluid intake
- Ensure mother gets adequate rest
- Offer water to infant in small amounts as necessary after breast-feeding sessions
- Monitor the infant's well-being

If signs of failure to thrive or dehydration appear, consult a lactation specialist and a physician. It may be necessary to give formula supplements after breast-feeding sessions, or a switch to formula feeding may be indicated.

Breast Milk Toxicology

Most maternal medications are secreted in some quantity into breast milk (Table 7-1). The risks of discontinuing the mother's medication must be weighed against the risks to the baby. Sometimes the medication can be replaced, and sometimes the effect on the baby is not sufficient for concern.

Any medication marked with an asterisk in Table 7-1 is an absolute contraindication to breast-feeding

Table 7-1: Drugs and Breast-Feeding

Drug	Excreted in Milk	Possible Effect on Infant and Recommendations
Alcohol	Yes	Infants more susceptible to effects
Ampicillin	Yes	Diarrhea, candidiasis
ASA	Yes	Complications rare
Caffeine	Yes	Jitteriness possible
Carbamazepine	Yes	Decreased weight gain
Cephalexin	No	None
Chlorpromazine	Yes (minimal)	Safe for infant
Codeine	Yes (trace)	Neonatal depression; no effect later in usual doses
Contraceptives	Yes	Uncertain long-term effects
Diazepam	Yes	Drowsiness; may increase jaundice; avoid in infants <1 month of age
Digoxin	Yes (minimal)	Usually none
Erythromycin	Yes	Jaundice; avoid in infants <1 month of age
Isoniazid (INH)*	Yes	May be toxic to infant
Methyldopa	Yes	Galactorrhea
Metronidazole	Yes (high)	Contraindicated in infants <6 months of age
Nitrofurantoin	Yes (trace)	Avoid
Nystatin	No	None
Penicillin	Yes	Usual antibacterial effects
Phenobarbital	Yes	Lethargy
Phenytoin	Yes	Usually none
Prednisone	Yes	Usually no effects
Propranolol	Yes	Hypoglycemia; usually no effects
Propylthiouracil*	Yes	Risk of goiter in infant
Senna	No	None
Sulfisoxazole	Yes	Kernicterus (avoid in infants <1 month of age)
Tetracycline†	Yes	Discoloration of teeth
Theophylline	Yes	Irritability
Thiazide diuretics	Yes	Low risk of dehydration, electrolyte imbalance

*Do not breast-feed.

†Use alternative medication.

FORMULA FEEDING

GENERAL INFORMATION

Commercially prepared formulas closely resemble breast milk in composition, except for the immunologic components. Commercial infant formula that is fortified with iron is now the standard recommendation for all infants who are fed formula from birth. Infants weaned from the breast before 9 months of age should receive an iron-fortified formula. Evaporated milk formulas provide adequate energy and nutrient content and are less expensive, provided they are mixed correctly. They lack an adequate supply of iron and may interfere with absorption of iron from other sources. The composition of whole cow's milk is inappropriate for infants and promotes blood loss from the gut. It should not be used in the first 9 or 10 months of life. Partly skimmed and skimmed milk should never be used in the first year of life, because the lack of fat can be difficult for the kidneys to handle. See Table 7-2 for volume and frequency of formula feeding.

Table 7-2: Approximate Volume and Frequency of Feedings

Age	No. of Bottles per 24 Hours	Intake (mL/Bottle)
1st week	6–10	30–80
1–4 weeks	7 or 8	60–120
1–4 months	4 or 5	210–240
5–9 months	3 or 4	210–240

When refrigeration is lacking, it is suggested that bottles be boiled before formula is prepared.

Where mothers are forced by circumstances to use evaporated milk formula, appropriate mixing is essential (see below), and daily ferrous sulfate supplements (2 mg elemental iron per kilogram body weight) are recommended. For the at-risk infant (e.g., low birth weight and premature infants, extremes of poverty or a history of iron deficiency in siblings), provision from birth of daily supplemental iron through formula or Fer-In-Sol is especially important.

RECIPES FOR FORMULA

Commercial Infant Formulas

- Ready to feed: give as is, without dilution
- Concentrate: mix 1:1 with water
- Powdered: follow instructions; over-dilution of powdered formula can be dangerous

Evaporated Milk

3 oz milk + 5 oz water + 1 tbsp sugar = one 8-oz bottle (30 mL = 1 oz)

After 6 months, use 4 oz milk + 4 oz water (no added sugar)

VITAMIN AND MINERAL SUPPLEMENTS

Children in some First Nations and Inuit communities may require fluoride supplementation, except if the community has high levels of natural fluoride in the water supply. The regional dental officer can provide information on the situation in your community.

Recommended dose of fluoride is as follows (Canadian Paediatric Society 1996):

- 6 months to 2 years: 0.25 mg/day
- 3–4 years: 0.50 mg/day
- >5 years: 1 mg/day

Multiple vitamins are generally not recommended, but Tri-Vi-Sol with fluoride is an adequate preparation for children 0–2 years of age.

It is preferable to give vitamin D (e.g., D-Vi-Sol) separately from fluoride (e.g., Pedi-Dent or Karidium).

Table 7-3 indicates requirement for vitamin D in relation to type of feeding. For infants living in northern communitites, the recommended dose of vitamin D is 800 IU/day.

Table 7-3: Vitamin D Requirements

Type of Feeding	Vitamin D Requirement
Breast	Yes
Commercial formula	No
Evaporated milk	No
Minimal cow's milk with breast milk, juice supplements	Yes

SOLID FOODS

Iron-fortified infant cereal should be added to the diet as a first supplement at age 4–6 months (one grain type at a time). Prepared baby foods, if used, should be added initially in small quantities, one at a time, after cereals have been started. Vegetables or meats should be started before fruits.

NUTRITIONAL DEFICIENCY DISORDERS

Nutritional deficiencies can present clinically as symptoms and signs in multiple body systems. Common body parts and systems affected include the skin, hair, nails, eyes, mouth, neck, and cardiovascular, musculoskeletal and neurologic systems. See Table 7-4 for information on the clinical manifestations of common nutritional deficiencies.

Table 7-4: Physical Signs of Nutritional Deficiency Disorders

System	Sign	Deficiency
General appearance	Reduced weight for height	Calories
Skin and hair	Pallor	Anemias (iron, vitamin B_{12}, vitamin E, folate and copper)
	Edema	Protein, thiamine
	Nasolabial seborrhea	Calories, protein, vitamin B_6
	Dermatitis	Riboflavin, essential fatty acids, biotin
	Photosensitivity dermatitis	Niacin
	Acrodermatitis	Zinc
	Follicular hyperkeratosis (sandpaper-like)	Vitamin A
	Depigmented skin	Calories, protein
	Purpura	Vitamins C, K
	Scrotal or vulval dermatitis	Riboflavin
	Alopecia	Zinc, biotin, protein
	Depigmented, dull hair	Protein, calories, copper
Subcutaneous tissue	Decreased	Calories
Eyes (vision)	Poor adaptation to dark	Vitamins A, E, zinc
	Poor color discrimination	Vitamin A
	Bitot's spots, xerophthalmia, keratomalacia	Vitamin A
	Conjunctive pallor	Nutritional anemias
	Fundal capillary microaneurysms	Vitamin C
Face, mouth, neck	Angular stomatitis	Riboflavin, iron
	Cheilosis	Vitamin B_6, niacin, riboflavin
	Bleeding gums	Vitamins C, K
	Atrophic papillae	Riboflavin, iron, niacin
	Smooth tongue	Iron
	Red tongue (glossitis)	Vitamins B_6, B_{12}, niacin, riboflavin, folate
	Parotid swelling	Protein
	Caries	Fluoride
	Anosmia	Vitamins A, B_{12}, zinc
	Hypogeusia	Vitamin A, zinc
	Goiter	Iodine
Cardiovascular system	Heart failure	Thiamine, selenium, nutritional anemias
Genital	Hypogonadism	Zinc
Skeletal	Costochondral beading	Vitamins D, C
	Subperiosteal hemorrhage	Vitamin C, copper
	Cranial bossing	Vitamin D
	Wide fontanel	Vitamin D
	Epiphyseal enlargement	Vitamin D
	Craniotabes	Vitamin D, calcium
	Tender bones	Vitamin C
	Tender calves	Thiamine, selenium
	Spoon-shaped nails (koilonychia)	Iron
	Transverse nail lines	Protein
Central nervous system	Sensory or motor neuropathy	Thiamine, vitamins E, B_6, B_{12}
	Ataxia, areflexia	Vitamin E
	Ophthalmoplegia	Vitamin E, thiamine
	Tetany	Vitamin D, Ca^{++}, Mg^{++}
	Retardation	Iodine, niacin
	Dementia, delirium	Vitamin E, niacin, thiamine

Source: *Nelson's Essentials of Pediatrics* (Behrman et al 1999).

COMMON NUTRITIONAL PROBLEMS

OBESITY

DEFINITION

An excess in weight of 20% or more relative to the calculated ideal weight for age, sex and height, determined from standard pediatric growth charts. Many Aboriginal children have a high weight-to-height ratio on standard growth charts. Rapid increases in weight-to-height ratios are of concern, as is obesity in older children.

CAUSES

- Most commonly exogenous, due to excessive caloric intake for basal needs and low energy output.
- Genetic influences: Obese children <3 years old without obese parents are at low risk for obesity in adulthood, but among older children, obesity is an increasingly important predictor of adult obesity, regardless of whether the parents are obese. Parental obesity more than doubles the risk of adult obesity among both obese and non-obese children <10 years old.

Risk factors influencing the development of obesity in children:

- Parental overweight
- Overweight at birth
- Physical inactivity
- Irregular snacking
- Poor food choices
- Lack of availability of variety of nutritious foods

HISTORY

- Child's birth weight
- Early feeding history
- Age at onset of obesity
- Dietary history (during the week and on weekends)
- Caloric intake beyond calculated norms for age
- Food preferences, snacks, where are meals eaten and with whom, moods associated with food
- Child and family feeding patterns
- Use of food as reward or part of social function
- Family history of obesity, hypertension, cardiovascular disease, diabetes mellitus, cerebrovascular accident
- Past medical history, including illnesses, surgeries, admissions to hospital
- Physical activity pattern
- Older child: school performance, peer relationships, parental relationships, child's perception of his or her body

PHYSICAL FINDINGS

- Overall appearance
- Blood pressure
- Weight and height (with exogenous obesity, linear growth is usually accelerated; with endocrine or metabolic disorders, linear growth is usually retarded)
- Hypoventilation (may suggest Pickwickian syndrome)
- Fat distribution
- Increased subcutaneous tissue
- Increased triceps skin-fold thickness
- Skin: striae, irritations (intertrigo)
- Stage of sexual maturation
- Presence of orthopedic problems (e.g., scoliosis, genu valgum, slipped femoral epiphyses)
- Other causes of obesity associated with signs relevant to underlying cause (e.g., hirsutism, acne, striae, hypertension, mental deficiency)

To rule out a congenital syndrome, check for hypogonadism, short stature, dysmorphic features, small extremities and mental retardation.

DIFFERENTIAL DIAGNOSIS

- Diabetes mellitus
- Hypothyroidism
- Cushing's disease
- CNS diseases (e.g., meningitis, brain tumors, cerebrovascular accident or head trauma may be associated with onset of obesity due to hyperphagia and decreased activity)
- Genetic or congenital disorders (e.g., Down's syndrome)

COMPLICATIONS

- Accelerated bone growth and skeletal maturation
- Accelerated maturation, with early menarche and decreased final height, often seen in girls
- Hyperinsulinemia
- Decreased levels of growth hormone
- Decreased levels of prolactin in girls
- Decreased levels of testosterone in boys
- Increased rates of amenorrhea and dysfunctional uterine bleeding in girls
- Hyperlipidemia
- Hypertension
- Choledocholithiasis
- Slipped capital femoral epiphyses
- Legge–Calvé–Perthes disease and genu valgum
- Increased respiratory illness in toddlers <2 years old
- Pickwickian syndrome (increased daytime sleepiness and hypoventilation)
- Obstructive sleep apnea
- Psychosocial sequelae (e.g., low self-esteem, abnormal body image, difficulty developing peer relationships, social withdrawal and isolation)
- Adult obesity

With more children becoming overweight, the prevalence of insulin-resistance causing type 2 diabetes in children is rising. The earlier diabetes begins, the earlier in life the complications tend to occur. The development of diabetes in children is a serious public health threat. *See "Diabetes Mellitus in Aboriginal Children," in chapter 17, "Hematology, Endocrinology, Metabolism and Immunology."*

DIAGNOSTIC TESTS

- Random blood glucose by glucometry
- TSH and T_4 levels (if child is of short stature)
- Urinalysis (for glucose)
- Lipid profile (in adolescents)
- Pelvic ultrasonography to rule out polycystic ovaries in adolescent girls with amenorrhea or dysfunctional uterine bleeding (this test must be ordered by a physician)

MANAGEMENT

Goals of Treatment

Change behavior so that more energy is used by the child for growth, activity and metabolic processes than is consumed.

The whole family must be included in the management of this problem.

Appropriate Consultation

- Consult a physician if you suspect an underlying physiologic, metabolic or psychologic disorder as the cause of obesity
- In infants and toddlers, treatment should be cautious; consult a physician before any investigation or treatment is begun

Nonpharmacologic Interventions

Prevention

- Early preventive measures, with emphasis on families in which one or both parents are overweight
- Promotion of prolonged breast-feeding may help decrease the prevalence of obesity in childhood
- Because obese children have a high risk of becoming obese adults, such preventive measures may eventually result in a reduction in the prevalence of cardiovascular diseases and other related diseases
- For obesity due to other causes, underlying disorders must be treated

Older Children with Exogenous Obesity

- Program of decreased caloric intake and increased exercise over a long period
- Reducing television, videotape and video game use may be a promising, population-based approach to prevent childhood obesity

Monitoring and Follow-Up

Follow up monthly to monitor height and weight until optimal weight has been achieved.

NUTRITIONAL RICKETS

DEFINITION

A disorder characterized by failure of growing bone matrix to become mineralized. Under-mineralized bones are less rigid than normal, and bone deformities result.

CAUSES

- Vitamin D deficiency
- Calcium deficiency
- Phosphorus deficiency

Children at Risk

- Small, premature infants
- Breast-fed infants who do not receive vitamin D supplementation
- Children whose diet is lacking in vitamin D or who have insufficient exposure to sunlight
- Children with chronic renal insufficiency
- Children with biliary atresia or chronic liver disease
- Children with inflammatory bowel disease

HISTORY

- Diet containing little vitamin D (breast milk, tea, juices as primary fluid sources)
- Low exposure to sun because of pigmented skin or winter season
- Low vitamin D intake by mother during pregnancy
- Bone pain
- Delayed standing or walking
- Anorexia
- Seizures (due to low calcium)
- Pathologic fractures
- Family history of rickets

PHYSICAL FINDINGS

- Growth slowed (short stature)
- Bossing deformity of the head
- Craniotabes
- Premature fusion of sutures
- Bowing of legs
- Thickening of costochondral junction (rachitic rosary)
- Prominence of wrists and knees
- Muscle weakness
- Awkward gait
- Dental caries
- Hepatic or renal enlargement (only if rickets is related to liver or renal disease)
- Seizures (due to low calcium) may be presenting complaint

DIFFERENTIAL DIAGNOSIS

- Chronic renal insufficiency
- Biliary atresia
- Chronic liver disease
- Inflammatory bowel disease

COMPLICATIONS

- Permanent leg bowing, occasionally requiring corrective surgery
- Contractures of the pelvis may cause difficulty with labor and delivery

DIAGNOSTIC TESTS

Discuss any diagnostic tests with a physician.

- Knee and wrist x-ray, if available (one view only, as rickets is a symmetric condition)
- X-ray will show irregular cortices and bony margins, widened mataphyses, widened growth plates and osteopenia

MANAGEMENT

Nonpharmacologic Interventions

Preventive: encourage vitamin supplementation during pregnancy.

In communities where rickets is common, encourage nutrition education and consider vitamin D supplementation for all children <2 years old.

Pharmacologic Interventions

Prevention: Recommendations of the Canadian Paediatric Society

Source: Indian and Inuit Health Committee, Canadian Paediatric Society (1988; reaffirmed April 2000)

Infants who are entirely breast-fed should be given 400 IU/day of vitamin D. This amount may be increased to 800 IU/day during the winter for children living in the Far North. The administration of 800 IU/day should be limited to children <2 years old, who are at greatest risk for rickets.

Infants who are bottle-fed with formulas made from fortified whole or canned milk have sufficient amounts of vitamin D during the summer but should receive a supplement of 400 IU/day of vitamin D during the winter.

Pregnant women and nursing mothers in the North should take 400 IU/day of vitamin D either as fortified milk or in addition to their vitamin and mineral supplementation, which provides 400 IU/day of vitamin D.

Children >2 years old who do not drink adequate amounts of milk enriched with vitamin D should be given 400 IU/day of vitamin D during the winter. The long days during the summer should provide enough sunlight to produce adequate amounts of endogenous vitamin D.

Treatment

Discuss with a physician the initial vitamin D dose for treating rickets.

vitamin D (D-Vi-Sol) (**A class drug**), 400 units/mL; 5000 to 10 000 units/day for 5 weeks, followed by 400 units/day (curative dose) is a common regimen

Monitoring and Follow-Up

– Blood and urinary calcium levels should be monitored if vitamin D therapy is used
– Discuss frequency of monitoring with a physician

Referral

Refer all cases of suspected rickets to a physician for evaluation as soon as possible.

IRON DEFICIENCY ANEMIA IN INFANCY

See "Iron Deficiency Anemia in Infancy," in chapter 17, "Hematology, Endocrinology, Metabolism and Immunology."

CHAPTER 8 — THE EYES

Table of Contents

For more information on the history and physical examination of the eyes in older children and adolescents, see chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

For many ocular diseases and conditions, clinical presentation and management are the same in adults and children. For information on the following conditions, see chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

- Allergic conjunctivitis
- Hordeolum or stye
- Chalazion
- Corneal abrasion
- Conjunctival, corneal or intraocular foreign bodies
- Acute angle-closure glaucoma
- Chemical burns
- Blunt or lacerating ocular trauma
- Uveitis (iritis)

ASSESSMENT OF THE EYES

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

GENERAL

The following characteristics of each symptom should be elicited and explored:

- Onset (sudden or gradual)
- Chronology
- Current situation (improving or deteriorating)
- Location
- Radiation
- Quality
- Timing (frequency, duration)
- Severity
- Precipitating and aggravating factors
- Relieving factors
- Associated symptoms
- Effects on daily activities
- Previous diagnosis of similar episodes
- Previous treatments
- Efficacy of previous treatments

CARDINAL SYMPTOMS

In addition to the general characteristics outlined above, additional characteristics of specific symptoms should be elicited as follows.

Vision

- Recent changes
- Blurring
- Corrective measures (glasses, contact lenses)

Other Associated Symptoms

- Pain
- Irritation
- Foreign-body sensation
- Photophobia
- Diplopia
- Lacrimation
- Itching
- Discharge
- Ear pain
- Nasal discharge
- Sore throat
- Cough
- Nausea or vomiting

MEDICAL HISTORY (SPECIFIC TO EYES)

- Eye diseases or injuries
- Eye surgery
- Use of corrective eyeglasses or contact lenses
- Concurrent URTI
- Immunocompromise from other illness or medications
- Environmental exposure to eye irritants
- Systemic inflammatory disease (e.g., juvenile rheumatoid arthritis)
- Diabetes me llitus
- Chronic renal disease
- Bleeding disorders
- Allergies (especially seasonal)
- Current medications

PERSONAL AND SOCIAL HISTORY (SPECIFIC TO EYES)

- Concerns reported by parent, caregiver or teacher about child's vision (e.g., squinting, headaches caused by reading)
- Use of protective eyewear for sports and other activities
- Housing and sanitation conditions
- School or daycare exposure to eye infection

PHYSICAL EXAMINATION

EYE

Examine the bony orbit, lids, lacrimal apparatus, conjunctiva, sclera, cornea, iris, pupil, lens and fundi. Note the following:

- Visual acuity (which is decreased in keratitis, uveitis and acute glaucoma)
- Swelling
- Discharge or crusting
- Discoloration (erythema, bruising or hemorrhage)
- Position and alignment of eyes (e.g., strabismus): use corneal light reflex test, cover–uncover test
- Reaction of pupil to light
- Extraocular movements (which are associated with pain in uveitis)
- Visual field (test in older children if there is concern about glaucoma)
- Corneal clarity, abrasions and lacerations
- Lens opacities (cataracts)
- Red reflex (which is abnormal if there is retinal detachment, glaucoma or cataract)
- Hemorrhage or exudate
- Optic disk and retinal vasculature

Palpate the bony orbit, eyebrows, lacrimal apparatus and pre-auricular lymph nodes for tenderness, swelling or masses.

Apply fluorescein stain to test for corneal integrity (if there is a possibility that trauma has occurred).

An ENT examination, including the lymph nodes of the head and neck, should also be performed if there are symptoms of a systemic condition, such as viral URTI.

COMMON PROBLEMS OF THE EYE

RED EYE

DEFINITION

Inflammation in and around the structures of the eye.

CAUSES

There are numerous causes of red eye in children (Table 8-1).

Table 8-1: Features of Various Causes of Red Eye in Children

	Conjunctivitis*			Corneal Injury or Infection	Uveitis (Iritis)	Glaucoma
	Bacterial	Viral	Allergic			
Vision	Normal	Normal	Normal	Reduced or very reduced	Reduced	Very reduced
Pain	–	–	–	+	+	+++
Photophobia	+/–	–	–	+	++	–
Foreign-body sensation	+/–	+/–	–	+	–	–
Itch	+/–	+/–	++	–	–	–
Tearing	+	++	+	++	+	–
Discharge	Mucopurulent	Mucoid	–	–	–	–
Pre-auricular adenopathy	–	+	–	–	–	–
Pupils	Normal	Normal	Normal	Normal or small	Small	Moderately dilated and fixed
Conjunctival hyperemia	Diffuse	Diffuse	Diffuse	Diffuse with ciliary flush	Ciliary flush	Diffuse with ciliary flush
Cornea	Clear	Sometimes faint punctate staining or infiltrates	Clear	Depends on disorder	Clear or lightly cloudy	Cloudy
Intraocular pressure	Normal	Normal	Normal	Normal	Reduced, normal or absent	Increased

Note: +, present (to various degrees); –, absent; +/–, may be present.
*Hyperthyroidism may cause conjunctival injection.

HISTORY

- An accurate history is very important
- History may point to a systemic illness such as juvenile rheumatoid arthritis or the possibility of trauma
- Ask about preceding viral URTI (which would indicate infectious conjunctivitis)
- Ask the child (if of an appropriate age) about visual acuity, pain on movement of the eye and contact with chemical agents or makeup (the last of which might indicate allergic conjunctivitis)
- For newborns, inquire about exposure to silver nitrate or the possibility of maternally acquired infections such as gonorrhea

PHYSICAL FINDINGS

- Assess both eyes for symmetry
- Carefully document any evidence of external trauma
- Assess visual acuity and pupillary reaction, essential for measuring improvement or deterioration
- Examine the anterior segment of the globe with a small penlight, and use a fluorescent stain to assess for corneal abrasion or ulcers
- Assess ocular mobility by checking range of movement

FEATURES OF DANGEROUS RED EYE

The first step is to differentiate major or serious causes of red eye from minor causes. The following danger signs call for urgent consultation and/or referral to a physician.

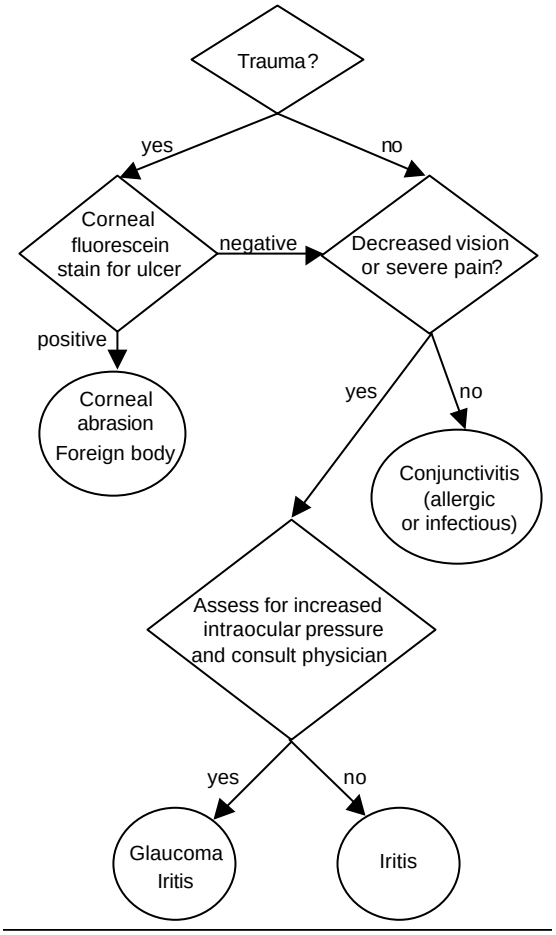
- Severe ocular pain, especially if unilateral
- Photophobia
- Persistent blurring of vision
- Exophthalmos (proptosis)
- Reduction of ocular movements
- Ciliary flush
- Irregular corneal reflection of light
- Corneal epithelial defect or opacity
- Pupil unreactive to direct light
- Worsening of signs after 3 days of pharmacologic treatment for conjunctivitis
- Immunocompromise (e.g., neonate, immunosuppression)

DIFFERENTIAL DIAGNOSIS

See Fig. 8-1.

- Ophthalmia neonatorum
- Conjunctivitis (bacterial, viral or allergic)
- Traumatic injury (e.g., corneal abrasion)
- Foreign body
- Glaucoma
- Uveitis (iritis)
- Periorbital or orbital cellulitis

Fig. 8-1: Differential Diagnosis of Red Eye



MANAGEMENT

Some of the diseases (e.g., ophthalmia neonatorum) associated with red eye are covered in detail elsewhere in this chapter. *See table of contents of the chapter for topic headings.*

Referral

When in doubt about the diagnosis or if there is significant associated ocular trauma or decreased visual acuity, urgent consultation with and referral to a physician is indicated.

For more details about the causes, assessment and management of conditions associated with red eye, see "Red Eye," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CONJUNCTIVITIS

DEFINITION

Inflammation of the conjunctival membrane of the eye. This is one of the most common causes of red eye in children.

CAUSES

Viral or bacterial conjunctivitis is common in children.

The allergic form is more common in adolescents. *See "Conjunctivitis" (allergic type), in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).*

Bacterial Pathogens

- *Chlamydia*
- *Hemophilus influenzae* (non-typable)
- *Neisseria gonorrhoeae*
- *Staphylococcus aureus*
- *Streptococcus pneumoniae*
- In an adolescent, gonococcal or chlamydial infection should be considered if the history is supportive of this diagnosis and the adolescent is sexually active

Viral Pathogens

- Adenovirus
- Enterovirus
- Epstein–Barr virus and herpes zoster virus (less common)
- Measles and rubella viruses

HISTORY

- Eye red and itchy
- Discharge or sticky eye common upon waking in the morning
- Sensation like that of sand in the eye
- Commonly, a viral URTI has preceded the eye infection
- Complicating bacterial infections, such as otitis media, may be evident
- Perform a general assessment if the child appears systemically ill (e.g., fever)

Children with mild viral or superficial bacterial conjunctivitis do not usually have significant systemic symptoms.

PHYSICAL FINDINGS

- Assess both eyes for symmetry
- Carefully document all evidence of external trauma
- Assess visual acuity and pupillary reaction, essential for measuring improvement or deterioration—both should be normal
- Examine the anterior segment of the globe with a small penlight, and use a fluorescent stain to assess for corneal abrasion or ulcers if history or physical findings suggest corneal abrasion
- Assess ocular mobility by checking range of movement
- Check for reddened conjunctiva (unilateral or bilateral)
- Check for discharge (purulent, watery, milky), which is usually present
- Check for white granules (phlyctenules) on the edge of the cornea surrounded by erythema

DIFFERENTIAL DIAGNOSIS

- Infectious conjunctivitis
- Trauma
- Foreign body
- Allergic conjunctivitis
- Keratitis
- Glaucoma
- Uveitis (iritis)
- Periorbital or orbital cellulitis
- Measles -associated conjunctivitis

COMPLICATIONS

- Spread of infection to other eye structures
- Spread of infection to others

DIAGNOSTIC TESTS

- Measure visual acuity if >3 years old
- Swab any drainage for culture and sensitivity

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Rule out more serious infections (e.g., uveitis)
- Prevent complications
- Prevent spread of infection to others

Appropriate Consultation

Consult a physician if any of the following occur:

- Significant associated eye pain
- Any deficit in visual acuity or color vision
- Suspicion of keratoconjunctivitis or other more serious cause of red eye
- Evidence of periorbital cellulitis
- No improvement after 48–72 hours of treatment

Nonpharmacologic Interventions

- Supportive care and good hygiene for both forms of infectious conjunctivitis
- Cleansing of eyelids qid by application of compresses of saline or plain water
- Public health measures that support good hygiene (e.g., frequent hand-washing, use of separate clean face cloth and towels), because the condition is highly contagious

Client Education

- Counsel parents or caregiver about appropriate use of medications (dose, frequency, instillation)
- Advise parents or caregiver to avoid contamination of the tube or bottle of medication with the infecting organisms
- Suggest ways to prevent spread of infection to other household members
- Instruct parents or caregiver (and child, if of a suitable age) about proper hygiene, especially of hands and eyes
- For bacterial form: child may need school or daycare restrictions for 24–48 hours after treatment is initiated
- For viral form: contagious for 48–72 hours, but condition may last for 2 weeks
- For allergic form: recommend that child avoid going outside when pollen count is high and that protective glasses be worn to prevent pollen from entering the eyes
- Do not use a patch for conjunctivitis

Pharmacologic Interventions

Never use steroid or steroid-and-antibiotic combination eye drops, because the infection may progress or a corneal ulcer may rapidly form and cause perforation.

Bacterial Conjunctivitis

Topical antibiotic eye drop:

polymyxin B gramicidin eye drops (Polysporin) (**A class drug**), 2 or 3 drops qid for 5–7 days

An antibiotic eye ointment may be used at bedtime in addition to the antibiotic eye drops prn:

erythromycin 0.5% (Ilotycin) (**A class drug**), hs

These treatments should not be used for gonorrheal or herpetic eye infections, for which consultation is required.

Viral Conjunctivitis

Antibiotics are not helpful and are not indicated.

Normal saline washes often provide excellent symptomatic relief.

Monitoring and Follow-Up

Follow up appropriately in 2 or 3 days, or sooner if symptoms worsen.

Referral

Referral is indicated under the following circumstances:

- The diagnosis is in doubt and significant ocular infections (e.g., uveitis) cannot be ruled out
- There is associated trauma
- Visual acuity is decreased
- There is significant associated ocular pain
- The child's condition deteriorates or the symptoms persist despite treatment
- The condition recurs frequently

ALLERGIC CONJUNCTIVITIS

See "Conjunctivitis" (allergic type), in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

OPHTHALMIA NEONATORUM

DEFINITION

Severe conjunctivitis in newborns (<28 days of age).

This condition must be differentiated from the more common mild conjunctivitis, which has the same causes; *see "Conjunctivitis," above, this chapter.*

CAUSES

- Generally acquired from the maternal genital tract
- Bacterial organisms include *Chlamydia* and *Neisseria gonorrhoeae*
- Chlamydial infection is a very common STD in North America and is thus the more common cause of neonatal conjunctivitis
- Less commonly, *Hemophilus* strains, *Staphylococcus aureus*, *Streptococcus pneumoniae* and other gram-negative organisms may be involved

HISTORY

- Depends on causative organism

Gonorrhea

- Generally presents early (day 3–5 of life)
- Should be considered in any infant who presents with conjunctivitis at less than 2 weeks of age

Chlamydial Infection

- Children present with a history of eye redness and discharge after incubation period of 1–2 weeks
- Should be considered in any child who presents with conjunctivitis in the first 3 months of life and who does not respond to usual topical antibiotics for mild conjunctivitis

PHYSICAL FINDINGS

The child may appear severely ill, but the physical findings are generally limited to the eye examination:

- Edema or erythema of the conjunctiva
- Purulent secretion
- Eyelids may be stuck together secondary to the purulent secretions

DIFFERENTIAL DIAGNOSIS

- Infectious conjunctivitis
- Trauma
- Nasolacrimal duct obstruction (dacryostenosis)

COMPLICATIONS

- Gonorrheal conjunctivitis (also known as GC conjunctivitis) may be fulminant, leading rapidly to extensive orbital infection and possibly blindness
- Systemic infections, including blood, joint and CNS infections, may occur secondary to *N. gonorrhoeae* infection

DIAGNOSTIC TESTS

- Swab drainage for culture and sensitivity, *N. gonorrhoeae* and *Chlamydia*

It is important to rule out chlamydial infection by means of a *Chlamydia* antigen swab.

MANAGEMENT

Goals of Treatment

- Treat infection
- Prevent complications

Appropriate Consultation

Consult a physician immediately, before commencing treatment, especially if you suspect gonorrheal or chlamydial infection.

See also "Conjunctivitis," above, this chapter.

Nonpharmacologic Interventions

- Prevention of perinatally acquired infections through prenatal clinics and screening and through STD control
- Appropriate follow-up of infected mother and her partner

Pharmacologic Interventions

Prevention

Routine prophylaxis with erythromycin ointment (Ilotycin; **A class drug**) for all newborns at birth.

Treatment of *Chlamydia* Infection

erythromycin ethylsuccinate suspension (EES-200) (**A class drug**), 40–50 mg/kg daily, divided qid, PO for 10 days

Topical erythromycin ointment alone is not effective in eliminating nasopharyngeal colonization.

Referral

Refer all suspected cases of gonorrheal ophthalmia to a physician immediately. The child must usually be admitted to hospital for IV administration of antibiotics (e.g., penicillin or cefotaxime) for 7 days.

Refer all cases of *Chlamydia* infection to a physician if there is no improvement after 2 or 3 days of oral treatment.

NASOLACRIMAL DUCT OBSTRUCTION (DACRYOSTENOSIS)

DEFINITION

A congenital disorder of the lacrimal system characterized by blockage of the nasolacrimal duct and resulting in excessive tearing and mucopurulent discharge from the affected eye.

The condition occurs in approximately 2% to 6% of newborns. Onset is usually within the first few weeks of life.

CAUSE

Persistence of a membrane at the lower end of the nasolacrimal duct results in incomplete canalization of the duct and its consequent obstruction.

HISTORY AND PHYSICAL FINDINGS

- Usually unilateral but may be bilateral
- Conjunctival erythema and irritation minimal
- Tearing within the affected eye
- Pooling or puddling of tears
- Epiphora (frank overflow of tears)
- Accumulation of mucoid or mucopurulent discharge in the affected eye, which results in crusting (usually evident upon awakening)
- Erythema or maceration of the skin under the eye
- Expression of clear fluid or mucopurulent discharge when the area of the nasolacrimal sac is massaged, which may be intermittent or continuous over several months
- URTI may exacerbate the condition

DIFFERENTIAL DIAGNOSIS

- Early signs of congenital glaucoma
- Photoph obia
- Cloudy cornea
- Excessive lacrimation

COMPLICATIONS

- *Dacryocystitis:* inflammation of the nasolacrimal sac, accompanied by edema, erythema and tenderness of the skin over the area of the affected duct (acute or chronic)
- *Pericystitis:* inflammation of the tissues surrounding the affected duct
- *Mucocele:* a bluish, subcutaneous mass below the medial canthal tendon
- *Periorbital cellulitis:* inflammation around the ipsilateral eye (this is an eye emergency)

DIAGNOSTIC TESTS

- Eye swab for culture and sensitivity (if purulent discharge present)

MANAGEMENT

In 90% of cases, the condition resolves, with conservative management, once the child reaches 1 year of age.

Goals of Treatment

- Observe, to monitor for and prevent complications

Nonpharmacologic Interventions

- Provide reassurance to parents or caregiver
- Offer support and encouragement, as condition may take many months to resolve
- Recommend nasolacrimal massage two or three times daily, followed by cleansing of the eyelid with warm water
- Suggest gentle massage of lacrimal sac toward the nose, to clear the passage
- Teach parents or caregiver the signs and symptoms of complications, and instruct them to report any that occur

Pharmacologic Interventions

Topical antibiotics for mucopurulent drainage:

erythromycin 0.5% eye ointment (Ilotycin) (**A class drug**), hs

Referral

Refer to a physician if the condition has not responded to conservative management by the time the child reaches 6 months of age or any time there are complications (e.g., dacryocystitis, pericystitis or periorbital cellulitis, an eye emergency).

A surgery consult may be necessary for lacrimal probing, which may be repeated once or twice. Definitive surgery is indicated if lacrimal probing (performed up to three times) fails to resolve the problem.

STRABISMUS (SQUINTING)

DEFINITION

Any abnormality in the alignment of the eyes.

The classification of strabismus is complex. On an etiologic basis, it may be paralytic or non-paralytic, but it can also be classified as congenital or acquired, intermittent or constant, or convergent or divergent.

Pathogenesis

When the eyes are positioned so that an image falls on the fovea (the area of best visual acuity) of one eye, but not the other, the second eye will deviate so that the image falls on its fovea as well. This deviation may be up, down, in or out and results in strabismus.

- *Esotropia:* both eyes converge medially (crossed eyes)
- *Esotrophia:* one eye deviates medially
- *Exotrophia:* one eye deviates laterally
- *Hypertrophia:* one eye deviates upward
- *Hypotrophia:* one eye deviates downward

Early recognition and treatment are important for the development of both normal binocular vision and good cosmetic results. Persistent, untreated strabismus may lead to decreased visual acuity of the deviating eye. For best results, strabismus must be treated before the child reaches 5 years of age.

Main Types

Heterophoria

Intermittent (latent) tendency to misalignment.

- Eyes deviate only under certain conditions (e.g., stress, fatigue, illness)
- Common
- May be associated with transient double vision, headaches, eye strain

Heterotropia

Constant misalignment of eyes.

- Occurs because normal fusional mechanisms are unable to control eye deviation
- Child is unable to use both eyes to fixate on an object and learns to suppress the image in the deviating (non-fixating) eye
- *Alternating:* child uses either eye for fixating and the other eye deviates; vision develops normally in both eyes because there is no preference for fixation
- *Consistent:* one eye is used consistently for fixating, and the other eye consistently deviates; child is prone to defective development of vision in the deviating eye (because of constant suppression of the visual image)

CAUSES

Paralytic

- Weakness or paralysis of one or more ocular muscles
- Deviation is asymmetric
- *Congenital:* secondary to developmental defect in muscle or nerves or to congenital infection
- *Acquired:* due to extraocular nerve palsies; indicates a serious underlying problem (e.g., fracture of facial bone, CNS tumor, neurodegenerative disease, myasthenia gravis, CNS infection)

Non-paralytic

- Most common type of strabismus
- Extraocular muscles and the nerves that control them are normal
- Occasionally, this form may be secondary to underlying ocular or visual defects such as cataracts or refraction errors
- Overall, seen in 3% of children

Pseudostrabismus

Young infants have a broad nasal bridge; therefore, less of the inner eye is seen, which may give the impression of squinting.

Intermittent eye convergence (crossed eyes) in infants 3–4 months of age is usually normal but should be monitored. If it persists, the child should be evaluated by a physician.

HISTORY

– Family history (about 50% of cases are hereditary)
– Constant or variable squint in one or both eyes
– Squinting worse with fatigue or stress
– Child tilts head or closes one eye (compensatory mechanisms for weak eye)

PHYSICAL FINDINGS

First assess the following:

– Extraocular eye movements (by having child visually follow an object): watch for asymmetry of movement
– Visual acuity (with Snellen or similar chart)

Then assess alignment with the following two main techniques.

Corneal Light Reflex Test (Hirschberg Test)

Direct a small, focal light toward the child's face, and observe the reflections in each cornea. If the eyes are aligned, the reflection should be on symmetric points of the corneas.

Cover–Uncover Test

Child is asked to fix gaze on an object. Examiner alternately covers each eye, after allowing time for the eyes to drift.

– *Normal alignment:* no movement of either eye
– *Phoria:* when deviating eye is covered, it tends to move; therefore, when the deviating eye is uncovered, the examiner can observe the eye as it resumes its former position (Fig. 8-2), i.e., movement is seen on uncovering the deviating eye
– *Tropia:* when fixating eye is covered, the deviating (uncovered) eye moves, i.e., movement is seen on covering the deviating eye

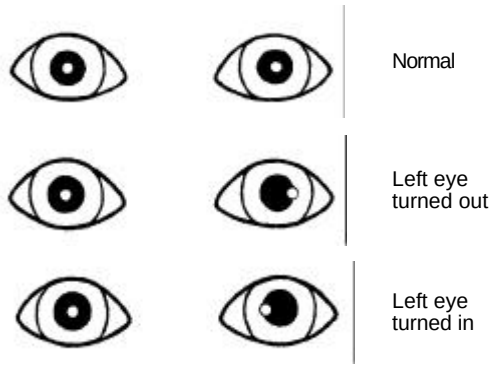


Fig. 8-2: Cover–Uncover Test (what practitioner sees when facing child)

COMPLICATIONS

– Amblyopia

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Prevent complications

Monitoring and Follow-Up

A young infant with intermittent, non-paralytic strabismus may be kept under observation until he or she reaches 6 months of age, when referral may become necessary.

Referral

– Refer all children with suspected strabismus to a physician for evaluation
– All children with fixed (paralytic) strabismus need more urgent referral, particularly if the paralytic strabismus is acquired

Early referral and treatment give the best chance for good vision in both eyes and good ocular alignment.

HORDEOLUM OR STYE

See "Hordeolum or Stye," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CHALAZION

See "Chalazion," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

EMERGENCY PROBLEMS OF THE EYE

ORBITAL CELLULITIS

DEFINITION

Bacterial infection of the deep tissues of the posterior orbital space.

Orbital cellulitis and periorbital cellulitis *(see next section)* may coexist in the same person.

CAUSES

Usually a serious complication of acute sinusitis or other facial infection or trauma.

- *Streptococcus pneumoniae*
- *Hemophilus influenzae* (non-typable)
- *Branhamella catarrhalis*
- *Staphylococcus* (less common)

HISTORY

- Preceding history of acute sinusitis (although such a history is not often present in young children, i.e., <6 years old)
- Often no obvious antecedent event in children
- Low- to high-grade fever
- Mild or marked swelling and pain on movement of the eye
- Mild to marked visual impairment

PHYSICAL FINDINGS

- Inflammation and swelling of the surrounding orbital tissues and eyelids
- Exophthalmos (proptosis) may be present in severe cases
- Mild to moderate ophthalmoplegia (inability to move eye)
- Mild to significant decrease in visual acuity
- Child may appear mildly ill to moribund, depending on severity of infection

Assess for any neurologic complications and level of consciousness *(see pediatric Glasgow coma scale, Table 15-1, in chapter 15, "Central Nervous System")*.

DIFFERENTIAL DIAGNOSIS

- Periorbital cellulitis
- Insect bite
- Allergic reaction
- Conjunctivitis
- Dacryocystitis
- Eczematoid dermatitis
- Rhabdomyosarcoma

COMPLICATIONS

- Intracranial cavernous sinus thrombosis (associated with signs of CNS irritation, puffiness of the face, deterioration in level of consciousness)
- Orbital or subperiosteal abscess
- Infection of other orbital structures
- Meningitis
- Intracranial abscess
- Blindness

DIAGNOSTIC TESTS

- Swab any discharge for culture and sensitivity before starting antibiotics

MANAGEMENT

Goals of Treatment

- Treat infection
- Prevent complications

Appropriate Consultation

Consult a physician immediately.

Adjuvant Therapy

- Start IV therapy with normal saline to keep vein open

Nonpharmacologic Interventions

Client Education

- Explain to the parents or caregiver the nature, course, expected treatment and outcomes of disease

Pharmacologic Interventions

- IV antibiotics should be started urgently, before transport
- Discuss choice of antibiotics with a physician
- Antibiotic of choice: cefuroxime (Zinacef) (**B class drug**)

Referral

Medevac to hospital.

PERIORBITAL CELLULITIS (PRESEPTAL)

DEFINITION

Infection of the tissues anterior to the orbital septum.

Periorbital cellulitis and orbital cellulitis *(see previous section)* may coexist in the same person.

CAUSES

Bacteria gain access to the tissues around the orbit through trauma, skin pustules, insect bites, URTIs, infections of the teeth and occasionally sinusitis.

- *Hemophilus influenzae* (type B) — very important in children <5 years old
- *Staphylococcus aureus*
- *Streptococcus pyogenes*

HISTORY

- May be a preceding history of trauma or insect bites to the eye area, but frequently there is no antecedent history
- Child may have other systemic features, such as fever and irritability
- Parents or caregiver may have noticed that the eyes are swollen to the point of shutting
- Examination of the child may be very difficult, because of edema, pain and anxiety

PHYSICAL FINDINGS

- Child febrile, ill-looking
- No pain on movement of the eye
- Visual acuity usually normal (if it can be assessed)
- Orbital edema and erythema
- Discharge from the eyelid and surrounding tissues

Unless other complications have occurred, the child should show no evidence of neurologic problems.

DIFFERENTIAL DIAGNOSIS

- Orbital cellulitis

COMPLICATIONS

- CNS infection
- Meningitis

DIAGNOSTIC TESTS

- Swab any discharge for culture and sensitivity before starting antibiotics

MANAGEMENT

Appropriate Consultation

Consult a physician for all cases of suspected periorbital cellulitis.

Nonpharmacologic Interventions

Client Education

- Explain to parents or caregiver the nature, course, expected treatment and outcomes of the disease
- If child is being treated on an outpatient basis, counsel parents or caregiver about appropriate use of medications (dose, route, side effects)

Pharmacologic Interventions

Discuss with a physician. If the infection is extensive, IV antibiotics may have to be started before transfer to hospital. If the infection is mild or moderate, the physician may decide to treat the child as an outpatient, using oral antibiotics (e.g., amoxicillin/clavulanate [Clavulin])

Referral

Medevac for admission to hospital and treatment with IV antibiotics may be needed for more severe infections.

CORNEAL ABRASION

See "Corneal Abrasion," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CONJUNCTIVAL, CORNEAL OR INTRAOCULAR FOREIGN BODIES

See "Conjunctival, Corneal or Intraocular Foreign Bodies," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ACUTE ANGLE-CLOSURE GLAUCOMA

See "Acute Angle-Closure Glaucoma," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CHEMICAL BURNS

See "Chemical Burns," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

BLUNT OR LACERATING OCULAR TRAUMA

See "Blunt or Lacerating Ocular Trauma," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

UVEITIS (IRITIS)

See "Uveitis (Iritis)," in chapter 1, "The Eyes," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CHAPTER 9 — EARS, NOSE AND THROAT (ENT)

Table of Contents

For more information on the history and physical examination of the ears, nose and throat in older children and adolescents, see chapter 2, "Ears, Nose and Throat (ENT)," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

For **otitis externa**, **chronic otitis media (purulent draining ear)** and **sinusitis**, clinical presentation and management are the same in adults and children. For information on these conditions, see chapter 2, "Ears, Nose and Throat (ENT)," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ASSESSMENT OF THE EARS, NOSE AND THROAT

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

GENERAL

The following characteristics of each symptom should be elicited and explored:

- Onset (sudden or gradual)
- Chronology
- Current situation (improving or deteriorating)
- Location
- Radiation
- Quality
- Timing (frequency, duration)
- Severity
- Precipitating and aggravating factors
- Relieving factors
- Associated symptoms
- Effects on daily activities
- Previous diagnosis of similar episodes
- Previous treatments
- Efficacy of previous treatments

CARDINAL SYMPTOMS

In addition to the general characteristics outlined above, additional characteristics of specific symptoms should be elicited, as follows.

Ears

- Recent changes in hearing
- Itching
- Earache
- Discharge
- Tinnitus
- Vertigo
- Ear trauma

Nose

- Nasal discharge or postnasal drip
- Epistaxis
- Obstruction of airflow
- Sinus pain
- Itching
- Nasal trauma

Mouth and Throat

- Dental status
- Oral lesions
- Bleeding gums
- Sore throat
- Dysphagia (difficulty swallowing)
- Hoarseness or recent voice change

Neck

- Pain
- Swelling
- Enlargement of glands

Other Associated Symptoms

- Fever
- Malaise
- Nausea and vomiting

MEDICAL HISTORY (SPECIFIC TO ENT)

- Seasonal allergies
- Frequent ear or throat infections
- Sinusitis
- Trauma to head or ENT area
- ENT surgery
- Audiometric screening results indicating hearing loss
- Prescription or OTC medications used regularly

FAMILY HISTORY (SPECIFIC TO ENT)

- Others at home with similar symptoms
- Seasonal allergies
- Asthma
- Hearing loss

PERSONAL AND SOCIAL HISTORY (SPECIFC TO ENT)

- Feeding methods (breast or bottle), bottle propping
- Frequent exposure to water (swimmer's ear)
- Use of foreign object to clean ear
- Insertion of foreign body in ear
- Crowded living conditions
- Poor personal hygiene
- Exposure to cigarette smoke, wood smoke or other respiratory toxins

EXAMINATION OF THE EARS, NOSE AND THROAT

GENERAL APPEARANCE

- Apparent state of health (e.g., appearance of acute illness)
- Hydration status
- Degree of comfort or distress
- Color (flushed or pale)
- Character of cry (in infants < 6 months old)
- Activity level (spontaneous activity or lethargy)
- Mental status (whether alert and active)
- Degree of cooperation, consolability
- Emotional reaction to parent (or caregiver) and examiner
- Hygiene
- Posture
- Difficulty with gait or balance

SAFETY TIP

For examination, it may be necessary to restrain a struggling child. For example, lay the child in a supine position and have the parent or caregiver hold the child's arms extended, in a position close to the sides of the head. This will limit side-to-side movements while you are examining ENT structures. Brace the otoscope, and guard against sudden head movements.

EARS

Inspection

- External ear: position (in relation to eyes)—low-set or small, deformed auricles may indicate associated congenital defects, especially renal agenesis
- Pinna: lesions, abnormal appearance or position
- Canal: discharge, swelling, redness, wax, foreign bodies
- Eardrum: color, light reflex, landmarks, bulging or retraction, perforation, scarring, air bubbles, fluid level

Estimate hearing by producing a loud noise (e.g., by clapping hands) for an infant or young child (which should elicit a blink response) or by performing a watch or whisper test for an older child. Perform tympanography (if equipment available).

Clinical tip: For the best view of the eardrum in an infant or a child < 6 years old, pull the outer ear upward, outward and backward.

Palpation

- Tenderness over tragus or mastoid process
- Tenderness on manipulation of the pinna
- Pre- or post-auricular nodes

NOSE

Inspection

- External: inflammation, deformity, discharge, bleeding
- Internal: color of mucosa, edema, deviated septum, polyps, bleeding points
- Transilluminate sinuses to check for dulling of light reflex

Palpation

- Check for sinus and nasal tenderness (only in older children who can cooperate and provide a response)

Percussion

- Check for sinus and nasal tenderness (only in older children who can cooperate and provide a response)

MOUTH AND THROAT

Inspection

- Lips: color, lesions, symmetry
- Oral cavity: breath odor, color, lesions of buccal mucosa
- Teeth and gums: redness, swelling, caries
- Tongue: color, texture, lesions, tenderness of floor of mouth
- Throat: color, tonsillar enlargement, exudate

NECK

Inspection

- Symmetry
- Swelling
- Masses
- Redness
- Enlargement of thyroid

Palpation

- Tenderness, enlargement, mobility, contour and consistency of nodes and masses
- Thyroid: size, consistency, contour, position, tenderness

COMMON PROBLEMS OF THE EARS, NOSE AND THROAT

OTITIS EXTERNA

See "Otitis Externa," in chapter 2, "Ears, Nose and Throat (ENT)," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ACUTE OTITIS MEDIA

DEFINITION

Acute suppurative infection of the middle ear, often preceded by a viral upper respiratory tract infection (URTI).

Occurs more frequently in the following groups and situations:

- Children with cleft palate
- Children with Down's syndrome
- Daycare environment
- Children of Aboriginal origin
- Possibly bottle-fed children, if the child is propped up for feeding or goes to sleep with a bottle of milk at night
- Children who use pacifiers when sleeping at night
- Children 6 months to 3 years old
- During winter months
- More common in boys than girls
- Children exposed to cigarette smoke

CAUSES

Viral Organisms

- In 25% to 30% of cases
- Respiratory syncytial virus (RSV)
- Influenza A virus
- Coxsackievirus
- Adenovirus
- Parainfluenza virus

Common Bacterial Organisms

- *Branhamella catarrhalis*
- *Hemophilus influenzae*
- *Pseudomonas aeruginosa*
- *Staphylococcus aureus*
- *Streptococcus pneumoniae*
- *Streptococcus pyogenes*

Less Common Organisms

- *Mycoplasma*
- *Chlamydia*

Other Miscellaneous Causes

- Immunoreactivity
- Allergic rhinitis

HISTORY

- Otalgia (pain is absent in 20% of children)
- Fever
- Irritability (in infants)
- Hearing loss
- Vomiting or diarrhea may be present
- Non-specific sensation of tugging at ears
- Restless sleep

PHYSICAL FINDINGS

- Fever
- May appear acutely ill

Inspection of the tympanic membrane is the key to diagnosis:

- Light reflex and bony landmarks usually disappear in acute otitis media
- Tympanic membrane appears dull, red and bulging in acute otitis media
- Reduction in or lack of movement of the tympanic membrane on pneumatic otoscopy

Wax and other debris should be removed from the ear canal to allow a clear view of the tympanic membrane.

Redness of the tympanic membrane in the absence of other signs may be due to crying agitation, a common cold, aggressive examination or manipulation of the external ear canal, or serous otitis media with effusion *(see "Serous Otitis Media [Otitis Media with Effusion]," below, this chapter)*.

Guidelines for Pneumatic Otoscopy

Anyone can learn pneumatic otoscopy, but practice is needed. This method consists of applying air pressure to the tympanic membrane and watching the resultant movement.

- Tools: a battery-operated bright light with a well-charged battery and a hermetically sealed otoscope with pneumatic attachment
- Client must remain still during the examination (it may be necessary to restrain a child)
- Apply positive pressure (by squeezing a full bulb) and negative pressure (by releasing the bulb), and observe any movement of the eardrum
- Lack of movement implies the presence of fluid in the middle ear or chronic stiffness of the tympanic membrane

DIFFERENTIAL DIAGNOSIS

- Acute otitis externa
- Pharyngitis or tonsillitis
- Non-infectious middle ear effusion
- Trauma to or foreign body in ear canal
- Referred pain from dental abscess
- Mastoiditis (rare)

COMPLICATIONS

- Perforated tympanic membrane
- Serous otitis media
- Mastoiditis (rare)

DIAGNOSTIC TESTS

- Swab any drainage for culture and sensitivity

MANAGEMENT

Goals of Treatment

- Control pain and fever
- Relieve infection
- Prevent complications
- Avoid unnecessary use of antibiotics

Appropriate Consultation

Usually not necessary if condition is uncomplicated.

Nonpharmacologic Interventions

Client Education

- Recommend increased rest in the acute febrile phase
- Counsel parents or caregiver about appropriate use of medications (dosage, compliance, follow-up)
- Explain disease course and expected outcome
- Recommend avoidance of flying until symptoms have resolved

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4–6h prn

If there is any doubt about the diagnosis, and there is a possibility that the child does not have acute otitis media, do not give antibiotics. In 70% of cases, acute otitis media resolves on its own with supportive care only.

Antibiotic therapy, first-line drug:

amoxicillin (Amoxil) (**A class drug**), 40 mg/kg per day, divided tid, PO for 10 days

Consider second-line antibiotic therapy under the following conditions:

- Penicillin allergy
- Acute otitis media unresponsive to a 3- or 4-day trial of amoxicillin and accompanied by persistent fever, irritability or pain
- Early recurrence of otitis media (< 2 months after initial bout), which is often due to bacteria that produce ß-lactamase and are thus resistant to amoxicillin, pneumococci with reduced susceptibility to penicillins or cephalosporin, or organisms resistant to sulfamethoxazole–trimethoprim
- Persistence of middle ear infection after a standard 10-day antibiotic course
- Immunocompromise (e.g., leukemia)
- Infection in newborns <2 months old
- Preference for alternative dosing schedule (e.g., working parents)

  sulfamethoxazole–trimethoprim suspension (e.g., Septra or Bactrim) (**A class drug**), 8–10 mg/kg daily, divided bid, PO for 10 days

  or

  erythromycin–sulfisoxazol (Pediazole) (**A class drug**), 40 mg/kg daily, divided qid, PO for 10 days

  or

  cefaclor (Ceclor) (**B class drug**), 40 mg/kg daily, divided tid, PO for 10 days

Drug choice should be based on efficacy, cost and acceptability to the child.

Antihistamines and decongestants have no proven efficacy in the treatment of acute otitis media and should be avoided.

Monitoring and Follow-Up

Instruct parents or caregiver to bring the child back to the clinic in 3 days if symptoms do not diminish or if symptoms progress despite therapy.

Otherwise, follow up in 14 days:

- If ear is normal, do not give any treatment
- If ear is still dull but asymptomatic (no pain or hearing loss), follow up again in 6 weeks
- If condition is unresolved, consider treatment with a second-line antibiotic

Look for development of serous otitis media.

Assess hearing 1 month after treatment is complete.

In 70% to 80% of patients, effusion persists after 2 weeks, and 10% still have effusion at 3 months and may exhibit conductive loss of hearing *(see "Serous Otitis Media [Otitis Media with Effusion]," below, this chapter)*.

Referral

Not necessary if condition is uncomplicated.

RECURRENT ACUTE OTITIS MEDIA

Recurrence of this condition is very common in children.

- If infection recurs less than 2 months after the previous infection, use one of the second-line antibiotics
- If infection recurs more than 2 months after the previous infection, treat as acute otitis media with amoxicillin (Amoxil)

Antibiotic Prophylaxis Guidelines

Consider prophylaxis in children who have had multiple episodes of acute otitis media (three episodes in 6 months). Prophylaxis is intended for prevention primarily during the winter months. Consult with a physician before starting prophylaxis

amoxicillin (Amoxil) (**A class drug**), 20 mg/kg daily PO hs

or (in older children)

sulfamethoxazole–trimethoprim (Septra) (**A class drug**), 4–20 mg/kg daily PO hs

Monitoring and Follow-Up

- Assess compliance with medication for treatment of acute episode and for prophylaxis
- Observe closely for acute recurrent attacks
- Assess hearing monthly

Referral

Refer to a physician any child with multiple episodes of acute otitis media (more than five episodes in a single year) that are unresponsive to medical management. An ENT consultation is advisable.

Myringotomy with insertion of T-tubes (plus adenoidectomy) may be indicated.

CHRONIC OTITIS MEDIA (PURULENT DRAINING EAR)

Otitis media is considered chronic or persistent in the following situations:

- Six episodes by 6 years of age
- Five episodes within 1 year
- Three episodes within 6 months

The diagnosis and management of chronic otitis media in children is the same as in adults. *See "Chronic Otitis Media (Purulent Draining Ear)," in chapter 2, "Ears, Nose and Throat (ENT)," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).*

SEROUS OTITIS MEDIA (OTITIS MEDIA WITH EFFUSION)

DEFINITION

Presence of non-infective fluid in the middle ear for longer than 3 months (following a bout of acute otitis media) without evidence of acute infection.

CAUSE

- Unclear
- Bacteria are isolated from a significant proportion of middle-ear aspirates

HISTORY

- Previous asymptomatic otitis media
- Feeling of fullness in the ear
- Tinnitus (uncommon)
- Hearing reduced (as indicated by hearing examination)

PHYSICAL FINDINGS

- Tympanic membrane dull, translucent or bulging; landmarks diminished or absent
- Reduction of mobility of tympanic membrane, indicated by pneumatic otoscopy *(for description of technique, see "Acute Otitis Media," above, this chapter)*

DIFFERENTIAL DIAGNOSIS

– Acute otitis media
– Dysfunction of eustachian tube

COMPLICATIONS

– Secondary infection
– Chronic serous otitis media
– Hearing loss

Complicating factors, such as nasal allergy, submucous clefts and nasopharyngeal tumors, must be excluded.

DIAGNOSTIC TESTS

– Tympanography (if available) may support the diagnosis of effusion

MANAGEMENT

Goals of Treatment

– Prevent hearing loss

Nonpharmacologic Interventions

– Observation for 2–3 months is appropriate
– Ensure appropriate seating at school (e.g., close to front of classroom)
– Encourage compliance and regular follow-up
– Encourage parents or caregiver to speak clearly and directly to child
– Measure hearing by audiology if effusion persists at 2–3 months

Pharmacologic Interventions

None.

Antihistamines, decongestants and steroids have no proven efficacy.

Monitoring and Follow-Up

– Check ears and hearing every 2 weeks
– In a young child, follow for language development while effusion persists

Appropriate Consultation

Consult a physician about antibiotic therapy if effusion persists for more than 3 months.

Referral

Refer to a physician if the effusion persists. An ENT consultation regarding surgical management may be indicated.

General indications for myringotomy and T-tubes:

– Persistent effusion for more than 6 months, with associated hearing loss
– Recurrent, acute ear infections in addition to chronic effusion and anatomic alteration of the tympanic membrane (e.g., retraction pocket, granulomas)
– Poor language development

FOREIGN BODY IN THE NOSE

Children frequently put foreign bodies in their nostrils. Occasionally, the foreign body (anything from a small pea to a small bead or toy part) obstructs the airway or becomes embedded, causing significant infection.

HISTORY

– Generally unilateral
– History of purulent rhinorrhea and difficulty with breathing through the affected nostril
– Typically, the parent or caregiver relates that a very foul smell is emanating from the child
– Fever and other systemic features uncommon

PHYSICAL FINDINGS

– Obvious mucopurulent discharge, generally unilateral
– Nasal blockage may be so severe that adequate visualization of the foreign body is impossible
– Suction may be necessary to visualize the foreign body

It is important to explore the opposite nostril and ears for other foreign bodies.

DIFFERENTIAL DIAGNOSIS

– Sinusitis

COMPLICATIONS

– Sinus infection
– Epistaxis

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Relieve obstruction
– Prevent recurrence

Nonpharmacologic Interventions

Foreign bodies can usually be removed by means of a blunt plastic hook. The hook can be maneuvered along the wall of the nostril beyond the foreign body, then turned inward to rest behind the foreign body, and finally pulled out.

Round, smooth, hard objects may be more difficult to remove. If such an item has become embedded behind granulation tissue, consultation with an ENT specialist and removal under general anesthesia may be necessary.

It is not recommended to attempt removal of a foreign body beyond the dictates of common sense. The child will become increasingly frightened and the procedure increasingly difficult.

Educate the parents or caregiver about the problems associated with foreign bodies, particularly the risk of aspiration and the need to remove foreign bodies under general anesthetic.

STOMATITIS

DEFINITION

Ulcers and inflammation of the tissues of the mouth, including the lips, buccal mucosa, gingiva and posterior pharyngeal wall.

CAUSES

For most cases in young children:

– Herpes simplex virus
– Coxsackievirus

HISTORY

– Fever
– Pain
– Drooling
– Difficulty swallowing
– Decreased nutritional intake
– Associated respiratory or GI symptoms
– Associated skin rash

PHYSICAL FINDINGS

– Temperature increased in infectious types (temperature is often very high with herpes infection)
– Painful lesions

Examine outside of lips first. Next, gently retract the lips with a tongue depressor to examine the anterior buccal mucosa and gingiva. Then gently attempt to separate teeth and depress the tongue. Look for the following features:

– Erythema (herpangina)
– Vesicles (early stages of all infectious types)
– Ulcers: check distribution (confluent ulcers may appear as large, irregular white areas)
– Submandibular lymph nodes (most prominent in herpes)

See Table 9-1 for the features of common forms of stomatitis.

DIFFERENTIAL DIAGNOSIS

– Vincent's infection (Vincent's angina)
– Lichen planus
– Mononucleosis
– Immunologic: gingival hyperplasia
– Systemic lupus erythematosus
– Congenital: epidermolysis bullosa
– Erythema multiforme

Table 9-1: Features of Common Forms of Stomatitis in Children

Disease	Cause	Type of Lesions	Site	Diameter	Other Features
Herpangina or hand-foot-and-mouth disease	Coxsackievirus, echovirus, enterovirus 71	Vesicles and ulcers with erythema	Anterior pillars, posterior palate, pharynx and buccal mucosa	1–3 mm	Dysphagia, vesicles on palms of hands and soles of feet and in mouth
Herpes stomatitis	Herpes simplex virus	Vesicles and shallow ulcers, which may be confluent	Gingiva, buccal mucosa, tongue, lips	>5 mm	Drooling, coalescence of lesions Duration about 10 days
Aphthous stomatitis	Unknown	Ulcers with exudate	Buccal mucosa, lateral tongue	>5 mm	Pain, no fever Usually only one or two lesions

COMPLICATIONS

- Pain
- Dehydration
- Secondary infection (e.g., gangrenous stomatitis)
- Ludwig's angina

DIAGNOSTIC TESTS

None.

MANAGEMENT

There are as yet no specific treatments for any of these conditions. An educated guess must be made as to the cause.

Herpes stomatitis usually lasts 10 days and the child can feel miserable for this period. Herpangina lasts for only a few days and has few complications. Aphthous stomatitis requires no treatment.

Do not treat this condition with antibiotics, as they are not indicated and are not helpful.

Goals of Treatment

- Relieve symptoms
- Prevent complications

Nonpharmacologic Interventions

- Maintenance of hydration is important
- Increase oral intake of fluids (i.e., maintenance requirements + fluid deficits caused by fever)

Client Education

- Counsel parents or caregiver about the expected duration of this illness and the signs and symptoms of dehydration
- Recommend dietary adjustments: bland, non-acidic fluids (such as milk and water); older children may eat Popsicles, ice cream and similar food items; avoid citrus foods, such as orange juice
- Recommend local mouthwashes (1:1 hydrogen peroxide and water), especially after eating
- To prevent spread of infection, recommend avoidance of direct contact with infected individuals (e.g., kissing, sharing glasses and utensils, hand contact)
- Provide support to parents or caregiver to help them cope with a "cranky" child

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO or PR q4h prn

Monitoring and Follow-Up

Reassess the young child (<2 years of age) in 24–48 hours to ensure maintenance of hydration.

Appropriate Consultation and Referral

The disease is self-limiting, so consultation and referral are usually unnecessary, unless there are complications.

PHARYNGOTONSILLITIS

DEFINITION

A painful condition of the oropharynx associated with infection of the mucous membranes of the pharynx and palatine tonsils. Peak prevalence is in children <5 years old.

The condition may be caused by a bacteria or virus, and it may be difficult to differentiate between these two forms clinically. Viral infections are the most common cause of pharyngotonsillitis in younger children; bacterial pharyngotonsillitis is very rare in children <3 years old, but its prevalence increases with age.

The next two sections describe bacterial and viral pharyngotonsillitis in detail.

BACTERIAL PHARYNGOTONSILLITIS

CAUSES

- Group A ß-hemolytic streptococci (accounting for 15% to 40% of cases of acute pharyngotonsillitis); unusual in children <3 years old
- *Mycoplasma pneumoniae* (accounting for 10% of cases of pharyngotonsillitis in adolescents)
- Pneumococci, anaerobic organisms of the mouth
- *Staphylococcus aureus*, *Hemophilus influenzae* (both of which are rare)
- Predisposing factors: previous episodes of pharyngitis or tonsillitis, overcrowding, poor nutrition

Pharyngotonsillitis may be secondary to diphtheria or infectious mononucleosis.

HISTORY

- Acute onset
- Very sore throat
- Fever
- Headache
- Abdominal pain and vomiting
- General malaise

PHYSICAL FINDINGS

- Significant fever
- Tachycardia
- Pharyngeal and tonsillar erythema
- Petechiae of soft palate
- Tonsillar exudate (particularly with streptococcal infection, diphtheria or mononucleosis)
- Anterior cervical lymphadenopathy
- Erythematous "sandpaper" rash of scarlet fever (may be present with streptococcal infection)
- Erythematous rash (particularly if child is receiving amoxicillin) and lymphadenopathy with splenic enlargement in children with mononucleosis
- Usually not associated with coryza
- Cough minimal or absent (this is a helpful diagnostic clue)

DIFFERENTIAL DIAGNOSIS

- Viral pharyngotonsillitis
- Epiglottitis
- Gonococcal pharyngitis in sexually active adolescents

COMPLICATIONS

- Peritonsillar or retropharyngeal abscess
- Acute rheumatic fever (after group A ß-hemolytic streptococcal infection)
- Obstruction of the upper airway (with diphtheria); *see "Diphtheria," in chapter 18, "Communicable Diseases"*

DIAGNOSTIC TESTS

- Swab throat for culture and sensitivity in clinically symptomatic children

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Prevent complications
- Prevent spread of group A streptococcal infection to others
- Decide whether to treat as viral or bacterial pharyngotonsillitis—consider differential diagnosis of mononucleosis *(see "Mononucleosis," in chapter 11, "Communicable Diseases," in the adult clinical guidelines [First Nations and Inuit Health Branch 2000])* or diphtheria *(see "Diphtheria," in chapter 18, "Communicable Diseases," these pediatric clinical guidelines)*

Appropriate Consultation

Consult a physician if the child has significant dysphagia or dyspnea signaling obstruction of the upper airway, or if you are concerned about an underlying pathologic state, such as peritonsillar abscess or rheumatic fever.

Nonpharmacologic Interventions

- Increased rest during febrile phase
- Increase oral fluids during febrile phase
- Avoidance of irritants (e.g., smoke)
- Warm saline gargles qid (for older children)
- Appropriate surveillance of community with respect to complications of rheumatic fever

Pharmacologic Interventions

Indications for the introduction of antibiotics:

- Child appears acutely ill
- Child has a history of rheumatic fever
- Child has an illness that is clinically compatible with scarlet fever
- Evidence of early peritonsillar abscess (consult a physician)

In the absence of the above situations, and if the child is relatively asymptomatic, it is appropriate to await culture results before administering antibiotics, if cultures can be obtained quickly. This approach will not increase the risk of acute rheumatic fever but avoids unnecessary use of antibiotics. If the culture results are positive, the child can be recalled for initiation of antibiotic treatment.

Antibiotics:

penicillin V (Pen Vee K) (**A class drug**), 25–50 mg/kg per day, divided tid or qid, PO

or

erythromycin (E-Mycin in tablet form) (**A class drug**), 30–40 mg/kg per day, divided qid, PO

or (for infants)

erythromycin ethylsuccinate suspension (EES-200) (**A class drug**), 30–40 mg/kg per day, divided qid, PO

Many children are carriers of group A ß-hemolytic *Streptococcus*. However, assuming compliance with the antibiotic regimen, only routine follow-up is required; culture is not indicated.

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg q4–6h prn

Monitoring and Follow-Up

Follow-up is recommended in 48–72 hours. Ascertain culture results at that time.

Repeat culture on the completion of antibiotic therapy is unnecessary, and cultures need not be obtained from asymptomatic family contacts.

Referral

Children who have had five or more documented group A ß-hemolytic streptococcal infections should be referred to a physician regarding an ENT consultation. They may benefit from tonsillectomy.

VIRAL PHARYNGOTONSILLITIS

CAUSES

- Adenovirus or enterovirus (the latter is more common in children <3 years old)
- Influenza virus
- Parainfluenza virus
- Coxsackievirus
- Echovirus
- Epstein–Barr virus (mononucleosis)
- Herpes simplex virus

HISTORY

- Acute sore throat combined with symptoms consistent with a viral URTI (rhinorrhea, cough and often hoarseness)

PHYSICAL FINDINGS

- Fever (low-grade to significant)
- Tachycardia
- Pharyngeal and tonsillar erythema and swelling
- Petechiae of soft palate
- Tonsillar exudate similar to that occurring with bacterial infection may be present, particularly in adenovirus pharyngotonsillitis
- Anterior cervical lymphadenopathy
- Vesicles and ulcers may be present with coxsackievirus infection (e.g., hand, foot and mouth ulcers occur with coxsackievirus A-16 infection [usually in the area of the soft palate]) or herpes infection (usually in the anterior portion of the mouth)

DIFFERENTIAL DIAGNOSIS

- Bacterial pharyngotonsillitis
- Epiglottitis

COMPLICATIONS

- Secondary bacterial infection

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Supportive care to relieve symptoms

Nonpharmacologic Interventions

- Rest and reassurance
- Increase oral fluids during febrile phase
- Avoidance of irritants (e.g., smoke)
- Warm saline gargles qid (for older children)

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4–6h prn

Occasionally, children are unable to drink secondary to the pain of pharyngotonsillitis caused by some viral infections, particularly coxsackievirus and herpesvirus. In such situations, admission to hospital may be required for IV administration of fluids (to prevent dehydration).

SINUSITIS

Sinusitis is uncommon in young children (<10–12 years old).

See "Acute Sinusitis" and "Chronic Sinusitis," in chapter 2, "Ears, Nose and Throat (ENT)," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

EMERGENCY PROBLEMS OF THE EAR, NOSE AND THROAT

RETROPHARYNGEAL AND PERITONSILLAR ABSCESS

DEFINITION

Retropharyngeal Abscess

A collection of pus in the retropharyngeal space.

Peritonsillar Abscess

A collection of pus between the tonsil capsule and either the anterior or posterior tonsillar pillar.

CAUSES

May be viewed as a complication of bacterial pharyngotonsillitis.

Retropharyngeal Abscess

– Penetrating trauma to the oropharynx

Peritonsillar Abscess

– Infection spreads from superior pole of the infected tonsil

HISTORY

Retropharyngeal Abscess

– More common in young children than adolescents
– Fever, drooling and refusal to swallow
– May present with stridor
– Rule out trauma to the oropharynx

Peritonsillar Abscess

– Much more common in adolescents than in younger children
– Previous history of sore throat often present
– Fever prominent
– Pain, drooling and dysphagia
– Trismus (difficulty opening mouth) may be present
– Breathing may be difficult

PHYSICAL FINDINGS

Before examining the pharynx, consider the diagnosis of epiglottitis. If epiglottitis is suspected, do not examine the throat.

Retropharyngeal Abscess

– Child appears acutely ill
– Stiffness of the neck and possibly refusal to flex the neck
– Obvious redness and swelling on inspection of the posterior pharynx
– Exudate may be seen on the tonsils
– Cervical lymphadenopathy generally present

Peritonsillar Abscess

– Child appears acutely ill
– Inspection reveals unilateral swelling of the anterior or posterior tonsillar pillar
– Tonsils displaced, with uvula shifted to the opposite side from the infection
– May be difficult to examine children because of trismus

DIFFERENTIAL DIAGNOSIS

– Epiglottitis (if there is stridor, drooling and fever); *see "Epiglottitis," in chapter 10, "Respiratory System"*
– Diphtheria
– Mononucleosis

COMPLICATIONS

– Obstruction of the airway
– Parapharyngeal abscess
– Aspiration (if abscess ruptures)

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Relieve symptoms
– Prevent complications

Appropriate Consultation

Consult with a physician immediately. Referral to hospital and an ENT specialist is in order.

IV antibiotic treatment may be instituted while awaiting transfer, especially if the transfer is expected to take a period of many hours.

Mild cases in an older child may be treated on an outpatient basis, but only on the advice of a physician.

Adjuvant Therapy

– Start IV therapy with normal saline, at a rate adequate to maintain hydration (rate depends on size and hydration status of the child)

Nonpharmacologic Interventions

– Bed rest
– If child is drooling, give nothing by mouth
– Give sips of cold liquids only if the child is able to swallow saliva

Pharmacologic Interventions

Antibiotics:

penicillin G sodium (Crystapen) (**A class drug**), 100 000 to 300 000 units/kg daily, divided q6h, IV

For children with allergy to penicillin:

erythromycin (Erythrocin) (**A class drug**), 20–50 mg/kg daily, divided q6h, IV

Monitoring and Follow-Up

Monitor child closely to ensure that an adequate airway is maintained.

Referral

Medevac to hospital. Consultation with an ENT specialist is usually necessary, and the condition may require surgical intervention.

GENERAL GUIDELINES FOR TONSILLECTOMY

– Documented cases of recurrent tonsillitis (child symptomatic or positive culture for group A ß-hemolytic *Streptococcus*)—five episodes per year for 2 years is generally considered an indication for the procedure
– Throat infection complicated by peritonsillar or retropharyngeal abscess requiring drainage
– Suspected malignant lesion of tonsil
– Cor pulmonale
– Obstructive sleep apnea
– Severe upper airway obstruction

EPISTAXIS

DEFINITION

Bleeding from the nostril. Very common in childhood.

CAUSES

– Mechanical dysfunction of the nose secondary to mucosal drying (e.g., from wood heat or dry air), trauma or inflammation
– Bleeding from the anterior nasal septum (Little's area or Kiesselbach's plexus) is most common
– Posterior bleeding (usually from the sphenopalatine artery) is much less common in childhood
– Uncommon causes (tumor, foreign body, leukemia, rheumatic fever, high blood pressure and bleeding disorders) must always be considered, but are rare in childhood

HISTORY

– Bleeding may range from mild trickling of blood to significant bleeding because of trauma or neoplasm
– Usually, bleeding is almost entirely from the anterior nostril
– In posterior epistaxis, bleeding tends to be more brisk and severe, and blood flows into the nasopharynx and mouth even when the child is in a sitting position
– Ask about possibility of trauma, nose-picking, or blood noticed on pillow or bedding
– Rule out possibility of underlying bleeding disorder, ingestion of ASA or other factors that might increase risk of bleeding
– Ask about level of humidity in the house

PHYSICAL EXAMINATION

Examine child sitting up and leaning forward so that the blood will flow forward. Good illumination is essential; you will need an appropriate flashlight, as well as suction to remove the blood and secretions; topical vasoconstrictors may be helpful for visualization.

- Assess ABCs and vital signs, and stabilize as required
- Blood pressure normal, unless bleeding is severe enough to cause loss of volume
- Heart rate may be elevated because of fear or if bleeding is severe enough to cause loss of volume
- Obvious deformity or displacement may be present
- Bleeding from anterior portion of septum may be present
- Inspect throat for posterior bleeding
- Sinuses may feel tender
- Septum may be deviated
- Try to ensure that there is no foreign body, polyp or tumor

DIFFERENTIAL DIAGNOSIS

- Mild infection of nasal mucosa
- Dryness and irritation of nasal mucosa
- Nasal fracture
- Foreign body
- Malignant lesion
- Tuberculosis
- Blood dyscrasias

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Stop loss of blood
- Prevent further episodes

Nonpharmacologic Interventions

Most bleeding will be stopped by application of pressure to both sides of the nose, with firm pressure against the nasal septum for 5–15 minutes.

Client Education

- Recommend increasing room humidity (a pot of water should be kept on the stove at all times, especially in winter)
- Counsel parents or caregiver about appropriate use of medication, including dosage and side effects, as well as avoidance of overuse
- Recommend avoidance of known irritants and local trauma (e.g., nose-picking, forceful nose-blowing)
- Instruct parents or caregiver (and the child, if of an appropriate age) about first-aid control of recurrent epistaxis (child should sit up and lean forward, applying firm, direct pressure to nasal septum)
- Recommend use of ice packs to control acute bleeding
- Recommend liberal use of lubricants such as petroleum jelly (Vasoline) in the nares to promote hydration of the nasal mucosa
- Advise parents or caregiver to keep the child's fingernails trimmed to avoid trauma from nose-picking

Pharmacologic Interventions

If direct pressure alone is insufficient to stop the bleeding, use a vasoconstricting nose drop (except in children <6 years old):

xylometazoline 0.05% pediatric drops (Otrivin) (**A class drug**)

Soak a cotton ball with the solution. Place the medicated cotton ball in the anterior portion of the nose. Press firmly against the bleeding nasal septum for 10 minutes.

For older children (³12 years of age), use procedures presented in "Anterior Epistaxis" and "Posterior Epistaxis," in chapter 2, "Ears, Nose and Throat (ENT)," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

Appropriate Consultation

Consult with a physician if:

- The above measures fail to control bleeding
- More severe bleeding occurs
- The bleeding is suspected to be coming from the posterior nasal area
- The epistaxis is recurrent and there is concern about a serious underlying problem

If bleeding persists, it may be necessary to apply either anterior or posterior packing of the nose, a procedure which should be done only if the healthcare provider has previous experience and only after a physician has been consulted.

Monitoring and Follow-Up

– Monitor ABCs if significant bleeding has occurred or is still occurring
– Follow up as necessary if current bleeding resolves with first-line treatment

Referral

In rare cases, a child may require evacuation for consultation with an ENT specialist, with a view to arterial ligation, but only if all three steps above (pressure, application of medicated cotton ball, and packing) have failed to control the bleeding.

A telephone consultation with a physician is mandatory before transporting any child with epistaxis.

If there has been trauma, it is important to rule out septal hematoma. Hematoma of the nasal septum must be managed surgically, and medevac is necessary.

If the problem is recurrent, electively refer child to a physician to rule out other pathology.

COMMON DENTAL PROBLEMS IN INFANTS

ERUPTION CYST

DEFINITION

Small white, gray or bluish translucent eruptions on crest of maxilla or mandible.

CAUSE

Remnants of dental lamina, which are usually shed after birth.

MANAGEMENT

Reassure parents or caregiver that this condition will resolve on its own and needs no treatment.

EPSTEIN PEARLS

DEFINITION

Small, white, keratinized lesions along the midline of the palate.

CAUSE

Remnants of epithelial tissue trapped as the fetus grows, which usually fall off after birth.

MANAGEMENT

Reassure parents or caregiver that this condition will resolve on its own and needs no treatment.

NEONATAL TEETH

DEFINITION

Eruption of teeth in neonatal period. In 80% of cases, such teeth are lower primary incisors. They tend to be hypermobile because of inadequate root formation.

MANAGEMENT

Reassure parents or caregiver that this condition will resolve without sequelae.

Referral

Refer to a dentist. Removal is recommended to prevent aspiration of the teeth.

NORMAL TOOTH DEVELOPMENT

By about 5 or 6 years of age, a child's jaws have grown enough to make space for the permanent teeth. At 6 to 7 years of age, the first permanent teeth (the first molars) start coming in at the back of the mouth, behind, not under, the last baby teeth. Table 9-2 presents the ages when the permanent teeth are likely to appear (refer to Fig. 9-1 for position of various teeth on the jaw).

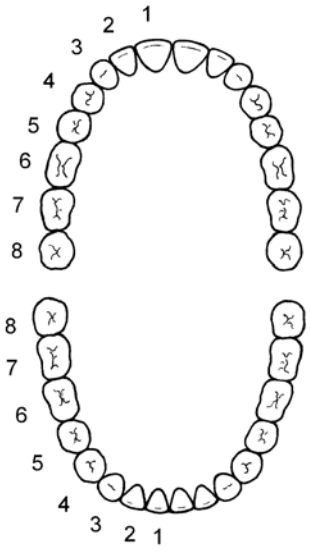


Fig. 9-1: Position of Permanent Teeth in Upper and Lower Jaws

Table 9-2: Age at Eruption of Permanent Teeth

Tooth*	Age
Upper teeth (maxillary)	
Central incisor (1)	7–8 years
Lateral incisor (2)	8–9 years
Cuspid (3)	11–12 years
First bicuspid (4)	10–11 years
Second bicuspid (5)	10–12 years
First molar (6)	6–7 years
Second molar (7)	12–13 years
Third molar (8)	17–21 years
Lower teeth (mandibular)	
Third molar (8)	17–21 years
Second molar (7)	11–13 years
First molar (6)	6–7 years
Second bicuspid (5)	11–12 years
First bicuspid (4)	10–12 years
Cuspid (3)	9–10 years
Lateral incisor (2)	7–8 years
Central incisor (1)	6–7 years

*Numbers correspond to designations in Fig. 9-1.

COMMON ORAL AND DENTAL PROBLEMS IN OLDER CHILDREN

ANKYLOGLOSSIA (TONGUE-TIE)

DEFINITION

A condition in which a short lingual frenum attaches the tongue to the floor of the mouth, interfering with protrusion of the tongue.

MANAGEMENT

No treatment is warranted if the tongue can be protruded beyond the lips. In 95% of cases, reassurance is all that is required.

Referral

Very occasionally, a thick fibrous band of tissue interferes with the tongue's protrusion beyond the lips. In such cases, consultation with an ENT specialist is suggested with a view to possible surgical release.

MIGRATORY GLOSSITIS (GEOGRAPHIC TONGUE)

DEFINITION

Tongue demonstrates several smooth, red areas outlined by elevated gray margins of epithelial tissue.

CAUSE

Unknown.

MANAGEMENT

Reassure child and parents or caregiver.

THUMB SUCKING

This generally benign activity may result in protrusion of the maxillary incisors and anterior open bite. However, most children suffer no effects to their dentition.

MANAGEMENT

Reassure the parents or caregiver. Children entering school generally stop sucking the thumb as a result of peer pressure.

Referral

In rare cases, the child with a severe thumb-sucking problem may need referral to a dentist and close follow-up for anterior open bite.

CONGENITAL ABSENCE OF TEETH (ANODONTIA)

Very rare. Teeth usually begin to erupt by 6 months, but may be delayed until up to 12 months.

PARTIAL ABSENCE OF TEETH (OLIGODONTIA)

This condition is more common with the permanent dentition, particularly the third molars, the mandibular second bicuspids, the maxillary lateral incisors and the maxillary second bicuspids.

MANAGEMENT

Referral

Appropriate dental referral should be made.

OTHER COMMON ABNORMALITIES OF THE TEETH

- Delayed eruption
- Rotation of incisors
- Bulging of alveolar ridge
- Large space between maxillary central incisors

MANAGEMENT

Referral

Children should be assessed by a dentist by age 7 years if any of these common abnormalities have presented.

COMMON MALOCCLUSIONS

DEFINITION

Anterior open bite (protrusion of maxillary anterior teeth) or crossbite (maxillary teeth positioned behind the mandibular teeth).

MANAGEMENT

Referral

Children with significant malocclusions should be referred to a dentist.

DENTAL CARIES

With the introduction of fluoride into the drinking water of some urban and rural communities and most toothpaste, and with increased attention to dental health, there has been a decrease in the prevalence of pediatric dental caries in most southern populations.

Environmental factors (such as hygiene and diet), particularly as influenced by the parents or caregiver, are the most significant predictors of childhood dental problems.

MANAGEMENT

Prevention

Encourage appropriate dental hygiene: tooth-brushing from the time of tooth eruption, flossing from the time the child reaches school age, low sugar consumption.

Where water is not fluoridated, children up to 14 years of age may need fluoride supplements. *See the fluoride recommendations of the Canadian Paediatric Society in the section "Vitamin and Mineral Supplements," chapter 7, "Nutrition."*

Check with the regional office for the local policy regarding fluoride supplementation.

MILK CARIES

DEFINITION

Caries of the deciduous teeth, most commonly the maxillary incisors and mandibular premolars and molars. May be severe enough to cause dental abscess.

Very common in Aboriginal groups in Canada, often resulting in extraction of the affected teeth and problems with permanent teeth.

CAUSES

- Secondary to prolonged nursing (either bottle or breast) at bedtime
- Liquid pools around the child's teeth, causing significant caries, particularly in the maxillary incisors

MANAGEMENT

Prevention of this problem is a major public health concern, and public health measures to discourage bottle caries are of primary importance:

- Discourage bottle propping
- Discourage use of sweet fluids in bottle
- Encourage drinking from a cup by 1 year and weaning by 18 months
- Encourage good oral hygiene: cleaning of teeth with gauze as soon as they erupt and cleaning of toddlers' teeth with a soft toothbrush; to ensure effective brushing, an adult must supervise the child until 6 years of age
- Encourage parents or caregiver to take children for their first dental assessment by 3 years of age
- Fluoride supplements may be appropriate for infants and children ≤14 years of age

Referral

Appropriate management includes referral to a dental practitioner for dental fillings. The repair procedure may require a general anesthetic, particularly for milk bottle caries. Repair involves fillings that last for 8–10 years.

Occlusion sealants (organic polymers) that bond to the enamel are intended for teeth with deep developmental grooves and help in preventing caries. However, this method is not cost-effective for primary molars.

CHAPTER 10 — RESPIRATORY SYSTEM

Table of Contents

For more information on the history and physical examination of the respiratory system in older children and adolescents, see chapter 3, “Respiratory System,” in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

GENERAL INFORMATION

Respiratory illnesses in children are the most common cause of nursing station visits and hospital admissions among Aboriginal children. Such illnesses are more common in children who live in crowded housing and those who are exposed to cigarette or wood smoke. Because of the contagious nature of many of the viral illnesses, outbreaks are common. Careful assessment is necessary to prevent morbidity.

ASSESSMENT OF THE RESPIRATORY SYSTEM

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

GENERAL

The history varies according to the child's age.

- Onset of illness (sudden or gradual)
- Symptoms (acute or chronic)
- Fever
- Runny nose
- Sore throat
- Chest pain (older children may complain of this symptom)
- Shortness of breath
- Cough, night cough, exercise-induced cough (see Table 10-1)
- Stridor
- Wheeze
- Cyanosis
- Fatigue
- Pallor
- Previous similar episodes
- Medications
- Allergies
- Family history of respiratory ailments (e.g., asthma)

EXAMINATION OF THE RESPIRATORY SYSTEM

Use the **IPPA** approach:

- I for **inspection**
- P for **palpation**
- P for **percussion**
- A for **auscultation**

Some of these techniques (specifically palpation and percussion) are difficult to perform on infants and toddlers, and may not yield useful information.

VITAL SIGNS

- Respiratory rate: normally 30–40 breaths/minute in infants, 20 breaths/minute at 6 years of age, 16 breaths/minute in adolescents
- Very rapid respiratory rate suggests disease of the lower airway, not the upper airway
- Respiratory rhythm and depth
- Heart rate
- Temperature

INSPECTION

Signs of Distress

- Child appears acutely ill (may indicate septicemia)
- Fatigue
- Pallor
- Cyanosis of nails and mucous membranes (late sign)
- Nasal flaring (especially in infants)
- Drooling: sign of upper airway disease (e.g., epiglottitis)
- Grunting (especially in infants)
- Prolonged expiration (may indicate asthma or bronchiolitis)
- Symmetry of chest movements (asymmetry may indicate pneumonia)
- Accessory muscles of breathing: use of sternocleidomastoid muscles suggests upper airway obstruction, such as croup or epiglottitis; use of intercostal and abdominal muscles in children <6 years old suggests lower airway disease, such as pneumonia or bronchiolitis

Table 10-1: Types of Cough and Most Likely Illness

Nature of Cough	Likely Type of Illness
Paroxysmal	Pertussis
Loose, productive	URTI, bronchitis
Sharp, barky	Croup, foreign body
Tight, productive	Pneumonia, bronchiolitis
Chronic	Asthma, bronchiectasis, tuberculosis

Signs of Chronic Disease

- Clubbing (may indicate bronchiectasis, cystic fibrosis)
- Eczema (may indicate asthma)
- Hyperinflation (“barrel chest”)

PALPATION

Not useful in children <3 years old, although it may be useful in older, cooperative children. Allows further assessment of respiratory excursion.

PERCUSSION

Useful only in older children (>2 years old).

- Resonance is normal
- Dullness to percussion over areas of fluid or solid tissue is present in lobar pneumonia, pleural effusion and collapsed lung
- Increased resonance over areas of hyperinflation (sounding like percussion of a puffed-out cheek) is present in bronchiolitis, asthma, foreign body with obstruction to lung behind and pneumothorax

AUSCULTATION

- Quality of breath sounds (tracheobronchial, bronchovesicular, vesicular)
- Volume of air entry
- Ratio of inspiration to expiration
- Adventitious sounds: crackles, wheezes, pleural rub, stridor, bronchial breathing

In infants and small children, the sounds may be transmitted easily and may therefore be difficult to localize. Breath sounds often seem louder in children because of the thinness of the chest wall.

Decrease in Breath Sounds

- Pneumonia
- Collapsed lung
- Pleural effusion
- Pneumothorax

Prolonged Expiratory Phase

- Asthma
- Bronchiolitis

Localized Crackles

- Pneumonia
- Bronchiectasis

Diffuse Crackles

- Severe pneumonia
- Bronchiolitis (also conges tive heart failure)

Crackles that disappear after coughing usually have no significance. You may not hear crackles if the child is breathing shallowly. Try to have the child take deep breaths.

Some children with pneumonia may not have crackles or any signs other than tachypnea.

Wheezes

- May be inspiratory or expiratory
- Suggest asthma or bronchiolitis

Pleural Rub

- Sounds like two pieces of leather being rubbed together
- Suggests pneumonia

X-RAYS IN CHILDREN

X-rays should be performed on site (when possible), according to regional or zone policy only, in children who have signs consistent with acute involvement of the lower respiratory tract, including tachypnea, persistent crackles or high fever, if such imaging will help to clarify a diagnosis and/or affect management. Otherwise, manage the illness on clinical grounds.

X-rays are not useful in the diagnosis or treatment of asthma or bronchiolitis or for children who do not appear acutely ill (“happy wheezers”).

COMMON PROBLEMS OF THE RESPIRATORY SYSTEM

UPPER RESPIRATORY TRACT INFECTION (URTI)

DEFINITION

Viral infection and inflammation of the upper airway structures. Also known as the common cold.

CAUSES

- Viral condition
- Many different viruses may cause symptoms of URTI

HISTORY

- Onset over 1–2 days
- Usually runs a 3- to 7-day course
- Fever
- Runny nose
- Cough
- Little distress (infants, who are obligate nose breathers, may experience more distress because of blockage)
- Exposure to others with URTI
- Decrease in appetite

PHYSICAL FINDINGS

General

- If temperature is elevated, look for pharyngitis or otitis media
- Examine ears, nose, mouth and neck lymph nodes
- Fever unusual with simple URTI
- Usually no respiratory distress
- May have macular rash (viral exanthem)
- Tympanic membranes may be slightly red
- Nares may be red and swollen with clear to purulent discharge
- Pharynx, tonsils may be slightly red

Lungs

- Breath sounds usually normal, with good bilateral air entry
- Crackles that clear with coughing may be present

DIFFERENTIAL DIAGNOSIS

- Bacterial URTI

COMPLICATIONS

- Bacterial URTI (e.g., sinusitis)

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Primarily to relieve symptoms

Nonpharmacologic Interventions

- Rest
- Adequate fluids
- Normal saline nose drops for infants with nasal congestion that interferes with feeding

Pharmacologic Interventions

Antipyretic for fever:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO or PR q4–6h prn

Decongestants and cough suppressants are symptomatic medications and have little proven value. They should be used judiciously and only in older children.

Do not use decongestants or antihistamines in children <1 year old.

Monitoring and Follow-Up

Follow-up is necessary only if symptoms worsen or do not resolve as expected.

Advise the parents or caregiver to watch for the following symptoms:

- Development of bronchiolitis (especially in infants)
- Development of otitis media
- Precipitation of wheezing in asthmatic children
- Development of secondary pneumonia

Referral

Not usually required.

UPPER AIRWAY DISORDERS

Disorders of the upper airway are common clinical problems. Differentiation of the various disorders is often difficult. See Tables 10-2 and 10-3 for some helpful information on the clinical manifestations of these disorders. Several of these disorders are discussed in detail in this chapter.

CROUP (LARYNGOTRACHEOBRONCHITIS)

DEFINITION

Acute upper airway illness causing subglottic obstruction. Occurs predominantly in late fall and late spring.

Most common cause of stridor in children. Occurs most often in children 6 months to 4 years of age (peak age <3 years). Occurs more often in boys than girls (ratio 3:2).

May also occur in younger infants. Because of their smaller airways, the risk of respiratory distress is much greater in this age group.

Course is variable, with symptoms usually improving by 3 to 5 days.

CAUSES

Contagious: may be contracted by direct contact or inhalation of airbone secretions.

Viruses

- Parainfluenza virus (most common causative organism)
- Respiratory syncytial virus (RSV)
- Adenovirus

Bacteria

- *Mycoplasma pneumoniae*

HISTORY

- Preceded by URTI (fever, runny nose)
- Sore throat
- Brassy, barky, seal-like cough

Most children are not markedly ill. Some may show symptoms of upper airway compromise:

- Decreased drinking
- Drooling
- Dysphagia
- Loud stridor
- Hoarse voice or cry, aphonia

Symptoms most pronounced at night.

Rule out any trauma to neck, choking episode or ingestion of a foreign body.

Table 10-2: Features of Upper Airway Disorders

Entity	Usual Age Range	Mode of Onset of Respiratory Distress
Severe tonsillitis	Late preschool or school age	Gradual
Peritonsillar abscess	Usually >8 years	Sudden increase in temperature, appears acutely ill, unilateral throat pain, “hot potato” speech
Retropharyngeal abscess	Infancy to adolescence	Fever and appearance of acute illness after URTI, pharyngitis or penetrating injury
Epiglottitis	1–7 years	Acute onset of hyperpyrexia, dysphagia and drooling
Croup	6 months to 4 years	Gradual onset of stridor and barking cough after mild URTI
Foreign-body aspiration	Late infancy to 4 years	Choking episode resulting in immediate or delayed respiratory distress
Bacterial tracheitis	Infancy to 4 years	Moderately rapid onset of fever, appearance of acute illness, respiratory distress

Table 10-3: Clinical Features of Acute Upper Airway Disorders

Clinical Feature	Supraglottic Disorders (Epiglottitis)	Subglottic Disorders (Croup)
Stridor	Quiet	Loud
Voice alteration	Aphonic, muffled	Hoarse
Dysphagia	+	–
Postural preference	+	±
Barky cough	–	+
Fever	+++	±
Appearance of acute illness	++	–

Note: +, present in mild form; ++, present in moderate form; +++, present in severe form, ±, may be present or absent; –, absent.

PHYSICAL FINDINGS

Signs may be minimal to marked. First priority is assessment of respiratory function, not diagnosis. If the child shows signs of respiratory distress, avoid invasive techniques such as taking temperature or performing throat or ear examination.

- Irritability, anxiety (may indicate hypoxia)
- Lethargy (may be due to hypercarbia)
- Temperature increased (fever is usually low-grade)
- Assess hydration status
- Tachypnea
- Pulse oximetry may be altered if the child is in respiratory distress
- Respiratory effort may be labored

Signs of Respiratory Distress

- Inspiratory stridor (at rest)
- Cyanosis
- Indrawing (suprasternal greater than intercostal), nasal flaring
- Breath sounds usually normal, but transmitted upper airway stridor can be heard
- Associated wheezing and hyperinflation

Tripod or sniffing position suggests laryngeal or higher-level obstruction (e.g., epiglottitis).

DIFFERENTIAL DIAGNOSIS

- Epiglottitis
- Bacterial tracheitis
- Retropharyngeal abscess
- Diphtheria
- Aspiration of a caustic substance
- Foreign-body aspiration
- Thermal injury
- Smoke inhalation
- Laryngeal fracture
- Congenital problems (e.g., tracheomalacia, hemangioma of larynx)
- Neurologic disease causing hypotonia
- Allergic angioedema

COMPLICATIONS

- Respiratory distress
- Respiratory failure
- Hypoxia
- Dehydration
- Pulmonary edema

DIAGNOSTIC TESTS

- Pulse oximetry (if available and child is in respiratory distress)

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Prevent complications

MILD CROUP

There is no specific treatment for this form, in which the child feeds well, is not acutely distressed and seems happy, but has a barking cough.

Nonpharmacologic Interventions

Client Education

- Explain the nature, course and expected outcomes of the illness
- Warn parents or caregiver that croup may worsen at night
- Advise parents or caregiver to watch for signs of respiratory distress
- Recommend that child be given adequate fluids to prevent dehydration
- Recommend increasing humidity through use of a cool-mist humidifier, exposure to a steamy bathroom or going outside in the cool air

Pharmacologic Interventions

Antipyretic and analgesic for fever and sore throat:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO or PR q4–6h prn

Monitoring and Follow-Up

Follow up in 24–48 hours (sooner if symptoms worsen).

Referral

Refer electively to a physician any child with recurrent croup (even if it is mild), for evaluation of coexisting problems (e.g., subglottic stenosis, hemangioma of larynx).

MODERATE TO SEVERE CROUP

Appropriate Consultation

Consult a physician if the child shows signs of respiratory distress.

Adjuvant Therapy

Give oxygen if there is any evidence of respiratory distress:

- 6–10 L/min or more by mask
- Keep oxygen saturation at >97%

Nonpharmacologic Interventions

- Increase fluid intake to prevent dehydration
- Nurse the child in upright position

Pharmacologic Interventions

The following drugs must be ordered by a physician:

racemic epinephrine, aerosolized (Vaponefrin) (**B class drug**), 0.5 mL in 3 mL normal saline

and

corticosteroids (e.g., dexamethasone [Decadron]) (**B class drug**), 0.6 mg/kg PO or IM (one dose before transfer)

Monitoring and Follow-Up

Monitor ABCs and pulse oximetry (if available), hydration, intake and output.

If child appears acutely ill and has a high fever, consider diagnosis of bacterial tracheitis (*Staphylococcus* or *Hemophilus influenzae*) and consult a physician about antibiotic therapy.

Referral

Medevac.

BRONCHIOLITIS

DEFINITION

Acute viral syndrome of the bronchioles characterized by wheezing and respiratory distress. This is an illness of young children (<2 years old) and occurs most often in the winter and spring. The illness runs its course over 4 or 5 days, but can last longer in young infants.

Acute Course

- In 80% of cases, clinical improvement will be evident within 3 or 4 days of initial presentation (recovery is usually dramatic)
- Radiologic changes normalize over the following 9 weeks

Prolonged Course

- In 20% of cases, the course is protracted, and the condition lasts from weeks to months
- Persistent wheezing and hyperinflation
- Abnormal gas exchange and lung function
- Some children experience lobar collapse

CAUSES

- Respiratory syncytial virus (RSV) (most common causative organism)
- Parainfluenza virus
- Adenovirus

HISTORY

Prodrome

- Mild URTI for several (1–4) days
- Rhinitis (serous nasal discharge)
- Sneezing
- Cough
- Low-grade fever (38.5°C to 39°C)
- Anorexia with poor feeding
- Irritability

PHYSICAL FINDINGS

Various degrees of respiratory distress, from none to severe.

Mild Cases

- Gradual onset, resolves within 1–3 days
- Low-grade fever
- Paroxysmal wheezing, tight cough

Signs of Worsening

- Tachypnea (60–80 breaths/minute)
- Tachycardia (>200 beats/minute)
- Hypoxia with or without cyanosis, pallor
- Nasal flaring, indrawing, chest retractions
- Lethargy and apnea
- Audible wheezing
- Breath sounds decreased
- Prolonged expiratory phase
- Widespread, fine end-inspiratory and early-expiratory crackles

Severely ill children may not have wheezes because they are unable to move air. Therefore, beware of the silent chest. Such children look sick. Check hydration status.

DIFFERENTIAL DIAGNOSIS

- Pneumonia
- Asthma
- Foreign-body aspiration
- Inhalation of noxious material (e.g., chemicals, fumes, toxins)
- Gastroesophageal reflux disease (GERD)

COMPLICATIONS

Acute

- Dehydration
- Febrile seizures
- Respiratory distress with prolonged apneic spells
- Respiratory failure
- Death (mortality rate <1%, but among children with underlying disease it is >1%)

Chronic

- RSV bronchiolitis
- Asthma
- Strong association between proven RSV bronchiolitis and subsequent development of asthma (about 30% to 50% of those with RSV bronchiolitis go on to develop asthma)
- Adenovirus bronchiolitis
- Bronchiolitis obliterans (chronic bronchiolitis)

DIAGNOSTIC TESTS

- Pulse oximetry (if available)

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Observe closely for and prevent complications

MILD BRONCHIOLITIS

Characterized by increased respiratory rate (but still <50 breaths/minute); child is happy although wheezy, feeds and sleeps well.

Appropriate Consultation

Contact physician for any child with mild symptoms who is at increased risk:

- Is unable to tolerate food
- Has an underlying illness (e.g., lung disease, congenital heart disease, neuromuscular weakness or immune deficiency)
- Was born prematurely
- Is less than 3 months of age
- Cannot be watched carefully at home for signs of respiratory distress

Nonpharmacologic Interventions

If the parents are able caregivers and they live near the healthcare facility, send the child home with the following instructions:

- Child should sleep in propped-up position
- Use cool-mist humidifier
- Ensure adequate fluid intake (maintenance requirements + deficits resulting from fever or tachypnea)
- Monitor closely for signs of respiratory distress

Initiate rehydration therapy as necessary if the child is dehydrated *(see instructions for rehydration therapy in "Dehydration in Children," in chapter 4, "Fluid Management")*.

Pharmacologic Interventions

A trial of bronchodilators should be given if there is significant wheezing. Infants with a history of prior wheezing or a family history of asthma are more likely to respond to bronchodilators.

Trial:

salbutamol (Ventolin) (**D class drug**) by nebulizer and face mask, doses of 0.03 mL/kg in 3 mL normal saline (maximum dose 1 mL)

or

salbutamol (Ventolin) (**D class drug**), by MDI, 1 or 2 puffs

If there is a response to the trial, consult a physician about continued use at home, as follows:

salbutamol (Ventolin) (**D class drug**), by MDI, 1 or 2 puffs q4h prn

Monitoring and Follow-Up

Reassess daily until symptoms have diminished (usually 3–5 days).

MODERATE TO SEVERE BRONCHIOLITIS

Characterized by respiratory distress with or without apneic spells, cyanosis or high-risk patient.

Appropriate Consultation

Contact a physician immediately for any child with moderate to severe symptoms.

Adjuvant Therapy

- Give oxygen at 6–10 L/min
- Keep oxygen saturation at >97%
- Start IV therapy with normal saline
- Administer enough fluid to maintain hydration

Pharmacologic Interventions

Bronchodilator

A trial of bronchodilators should be given if there is significant wheezing. Infants with a history of prior wheezing or a family history of asthma are more likely to respond to bronchodilators:

salbutamol (Ventolin) (**D class drug**), by nebulizer and face mask, doses of 0.03 mL/kg in 3 mL normal saline (maximum dose 1 mL)

or

salbutamol (Ventolin) (**D class drug**), by MDI, 1 or 2 puffs

Antibiotics

Antibiotics are not indicated unless there is evidence of secondary bacterial infection, such as clinical deterioration with or without sepsis.

Antiviral Agent

Ribavirin (Virazole) is a synthetic antiviral agent directed against viral DNA. This guanine analog prevents viral replication and is intended to shorten the clinical course of the disease. It can reduce the severity of bronchiolitis if administered early in the course of the disease. It is administered in hospital by continuous inhalation as a small-particle mist for 12–20 hours per 24 hours for a period of 3–5 days. It is indicated for use in high-risk patients.

Monitoring and Follow-Up

Monitor child closely in the healthcare facility until he or she can be transported to hospital:

- ABCs
- Oxygen saturation: monitor for hypoxia
- Apnea monitoring
- Hydration status: intake and output

Referral

Medevac child if he or she has any of the following:

- Signs of respiratory distress
- Episodes of cyanosis with apnea
- Decreased oxygen saturation
- Inability to tolerate feeding
- Underlying illness (e.g., lung disease, congenital heart disease, neuromuscular weakness or immune deficiency)
- Was born prematurely
- Less than 3 months of age
- Cannot be watched carefully at home for signs of respiratory distress

For transport, consider:

- Supplemental oxygen (if the child is cyanotic, has a markedly increased respiratory rate or appears fatigued)
- IV therapy (if the child is severely distressed or poorly hydrated)
- Administration of bronchodilator (if the child needs continuing medication en route)

PNEUMONIA

DEFINITION

Inflammation and infection of the lung. Often classified by anatomic location:

- *Lobar pneumonia:* localized to one or more lobes of the lung
- *Bronchopneumonia:* inflammation around medium-sized airways, which causes patchy consolidation of parts of the lobes
- *Interstitial pneumonia:* inflammation of lung tissue between air sacs, usually generalized, often viral

CAUSES

- Viral form most common in children (RSV, parainfluenza virus, influenza A or B, adenoviruses)
- Bacterial organisms in 10% to 30% of cases
- *Mycoplasma*, *Chlamydia*
- Inhaled toxins
- Fungi (uncommon)
- Tuberculosis: still a factor in chronic pneumonia in Aboriginal children
- Often spread from an intercurrent infection elsewhere (e.g., otitis media)

See Table 10-4.

HISTORY

Viral

- Gradual onset
- Symptoms of URTI appear first

Bacterial

- Acute onset

General Symptoms

- Fever (less prominent in viral form, high in bacterial form)
- Chills
- Malaise
- Headache
- Lethargy
- Anorexia or poor feeding in infants

Respiratory Symptoms

- URTI symptoms, especially with viral form
- Chest pain (older child may complain of this symptom)
- Shortness of breath
- Cough

In children, there is often no history of sputum production.

If there is any eye discharge, consider *Chlamydia* or adenovirus as the cause.

PHYSICAL FINDINGS

- Temperature elevated (more likely with bacterial form in older children)
- Tachypnea
- Tachycardia
- Signs of URTI (e.g., runny nose, red throat)
- Indrawing, nasal flaring
- Decreased unilateral chest excursion over area of lobar pneumonia (chest excursion may be normal in bronchopneumonia or interstitial pneumonia)
- Tactile fremitus increased in lobar pneumonia, decreased in pleural effusion
- Dullness to percussion in lobar pneumonia and pleural effusion
- Breath sounds decreased or absent or may be increased over consolidation
- Crackles may be present over affected lobes (other lobes normal) in lobar pneumonia
- Scattered crackles in bronchopneumonia
- Scattered crackles and wheezes in interstitial pneumonia
- Pleural rub (localized in lobar pneumonia)

DIFFERENTIAL DIAGNOSIS

- Bronchitis
- Asthma
- Foreign-body aspiration or inhalation of toxin
- Tumor
- Pulmonary trauma
- Cystic fibrosis
- Heart failure
- Intra-abdominal pathology causing splinting or reactive effusion

Table 10-4: Common Causes of Pneumonia According to Age

Age	Bacterial	Viral
0–4 weeks	Group B *Streptococcus*, gram-negative rods, *Mycoplasma*	CMV, herpesvirus
4–16 weeks	*Chlamydia*, *Hemophilus influenzae*, *Staphylococcus aureus*, *Streptococcus pneumoniae*	CMV, RSV
4 months to 5 years	*Hemophilus influenzae*, *Mycoplasma*, *Staphylococcus aureus*, *Streptococcus pneumoniae*	RSV, adenovirus
>5 years	*Mycoplasma*, *Streptococcus pneumoniae*	Influenza virus

COMPLICATIONS

- Respiratory failure and cardiovascular collapse
- Pleural effusion
- Empyema
- Lung abscess
- Pneumothorax
- Bacteremia
- Sepsis
- Pericarditis

DIAGNOSTIC TESTS

Chest x-ray (if available), but only if the diagnosis is in doubt and the outcome of the x-ray will affect management; otherwise, treat on clinical basis.

MANAGEMENT

Management depends on the cause and severity of the disease and the age of the child.

Goals of Treatment

- Relieve infection
- Prevent complications

Appropriate Consultation

Consult a physician if any of the following apply:

- Moderate to severe respiratory distress
- Age less than 6 months
- Underlying cardiac or lung disease
- Immunosuppression
- Failure to respond to oral antibiotics within 24–48 hours
- Inability to tolerate oral antibiotics
- Symptoms involving other systems (e.g., diarrhea)

Adjuvant Therapy

- Give oxygen (humidified), by mask at 6–10 L/min or more, to any child who is in respiratory distress
- Start IV therapy with normal saline during transport to hospital, and run at a rate adequate to maintain hydration

Nonpharmacologic Interventions

- Rest
- Assure adequate hydration
- Nurse in propped-up position if child is short of breath

Pharmacologic Interventions

Choice of and route for antibiotic therapy are based on age and the most likely infective organism.

Neonate

Cover for group B *Streptococcus* and coliform bacteria before transfer:

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q8h, IV

and

gentamicin (Garamycin) (**B class drug**), 2.5 mg/kg IV bid

1–4 Months of Age

Cover for *Hemophilus influenzae*, *Staphylococcus aureus* and *Streptococcus pneumoniae.*

Treat "less sick" child as an outpatient:

amoxicillin (Amoxil) (**A class drug**), 40 mg/kg per day, divided q8h, PO for 10 days

For a sick child awaiting transfer to hospital:

cefuroxime (Zinacef) (**B class drug**), 75 mg/kg per day, divided q8h, IV or IM

or

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q6h, IV

>4 Months to 5 Years Old

Treat "less sick" child as an outpatient:

amoxicillin (Amoxil) (**A class drug**), 40 mg/kg per day, divided q8h, PO for 10 days

or

erythromycin–sulfisoxazol (Pediazole) (**A class drug**), 30–50 mg/kg, divided q6h, PO for 10 days

For a sick child awaiting transfer to hospital:

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q6h, IV

or

cefuroxime (Zinacef) (**B class drug**), 75 mg/kg per day, divided q8h, IV or IM

>5 Years Old

Treat "less sick" child as an outpatient:

erythromycin ethylsuccinate suspension (EES-200) (**A class drug**), 30–50 mg/kg per day, divided q6h, PO for 10 days

or (in an older child)

erythromycin (E-Mycin) (**A class drug**), 250 mg, 1 tab PO q6h for 10 days

For a sick child awaiting transfer to hospital:

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q6h, IV

or

cefuroxime (Zinacef) (**B class drug**), 75 mg/kg per day, divided q8h, IV or IM

Monitoring and Follow-Up

- Outpatient: Follow up in 24–48 hours to assess progress and again when course of antibiotics is complete
- Child awaiting transport to hospital: Monitor ABCs, pulse oximetry (if available and child is in respiratory distress) and hydration

Referral

Medevac in the following situations:

- Moderate to severe respiratory distress
- Age less than 3 months
- Underlying cardiac or lung disease
- Immunosuppression
- Failure to respond to oral antibiotics within 24–48 hours
- Inability to tolerate oral antibiotics
- Adequate care at home cannot be guaranteed

ACUTE ASTHMA

DEFINITION

Reversible obstructive disease of the lungs characterized by hyperreactivity of the airways, which leads to recurrent episodes of cough and wheezing. It occurs in 5% to 10% of children, and the prevalence is increasing, for unknown reasons.

Three major events lead to obstruction:

- Mucosal edema with inflammation
- Increased production of mucus
- Smooth-muscle hyperreactivity (bronchospasm)

CAUSES

Precipitating Factors

- Severe or recurrent RSV bronchiolitis
- Recurrent pneumonia
- Familial tendency

Triggers

- Allergens (e.g., pollens)
- Exercise
- Cold air
- Cigarette smoke
- Woodsmoke
- Respiratory infection
- Emotions (e.g., fear, anger, crying, laughing)

HISTORY AND PHYSICAL FINDINGS

Acute Episodes

- History of preceding URTI
- Exposure to known allergen (e.g., smoke)
- Wheeze
- Cough
- Dyspnea
- Chest tightness

Impact of Asthma on Child

- Number of school days missed
- Limitation of activity because of frequency of attacks
- Number of visits to clinic or emergency department for treatment
- Number of admissions to hospital or ICU
- Number of courses of systemic steroids needed to manage acute episodes

Environmental History

- Type of home
- Heating source
- Carpeting
- Pets
- Exposure to secondhand smoke
- Stuffed animals

Signs of Atopic Disease

- Eczema
- “Allergic shiners” (dark circles under eyes)
- Transverse nasal crease
- Frequent nose rubbing
- Watery eyes and nose

DETERMINING SEVERITY OF ACUTE ASTHMA EXACERBATION

Mild Exacerbation

- Cough, wheeze, some dyspnea
- Inspiratory and expiratory wheezes
- Oxygen saturation >95% on room air
- PEFR 75% of personal best

Moderate Exacerbation

- Cough, wheeze, dyspnea
- Intercostal indrawing, tracheal tug
- Inspiratory and expiratory wheezes
- Oxygen saturation 92% to 95% on room air
- PEFR 40% to 75% of personal best

Severe Exacerbation

- Anxiety, confusion, fatigue, decreased level of consciousness
- Dyspnea, with inability to speak or eat
- Respiratory rate greater than 2 SD above norma l rate for age

Signs of Severe Airway Obstruction

- Cyanosis
- Nostril flaring, tracheal tug, intercostal indrawing
- Supraclavicular indrawing
- Use of accessory muscles, especially sternocleidomastoid muscles
- Pulsus paradoxus greater than 20 mm Hg
- Breath sounds faint or absent (because of lack of air entry)
- Marked expiratory wheezes, prolonged expiratory phase
- Oxygen saturation <91% on room air
- PEFR less than 40% of personal best or standard level

Beware the silent chest. A very quiet chest is common in severe asthma, because there is little movement of air.

RISK FACTORS FOR SEVERE ASTHMA

History of the following features:

- Poorly controlled asthma
- Frequent asthma attacks (more than two per week)
- Recent severe attack
- Recent visit to emergency room or admission to hospital or ICU for asthma
- Severe present attack
- Duration of current symptoms longer than 24 hours
- More than 10 puffs of salbutamol (Ventolin) in past 24 hours
- Recent use of high-dose steroids
- Long delay in seeking medical care

DIFFERENTIAL DIAGNOSIS

- Pneumonia
- Croup
- Bronchiolitis
- Foreign-body aspiration
- Cystic fibrosis
- Pulmonary edema
- GERD with recurrent aspiration

COMPLICATIONS

- Frequent absences from school
- Frequent admission to hospital
- Restrictions in physical activity
- Psychologic impact of chronic illness
- Localized bronchiectasis
- Death

DIAGNOSTIC TESTS

- Pulse oximetry (if available)
- PEFR (can be attempted in an older child, if he or she is not too distressed)
- Chest x-ray (if available) to rule out pneumothorax before medevac by air

MANAGEMENT OF ACUTE ASTHMA EXACERBATION

Goals of Treatment

- Relieve symptoms
- Prevent complications
- Prevent recurrence

Appropriate Consultation

Consult a physician for:

- Any child with previously undiagnosed (suspected) asthma
- Any child with known asthma who is experiencing acute symptoms
- Any child receiving long-term prophylaxis whose symptoms are not well controlled with the current medication regimen

Adjuvant Therapy

- Give oxygen (6–10 L/min or more by mask) to keep oxygen saturation at >95%
- Start IV therapy with normal saline in children with moderate to severe respiratory distress

Nonpharmacologic Interventions

- Nurse in an upright position
- Give liberal oral fluids to prevent dehydration and to help liquefy secretions

Pharmacologic Interventions

In a case of acute asthma, try to consult a physician before giving any medication to the child.

Aerosolized β_2-agonists:

salbutamol (Ventolin) (**D class drug**), 5 mg/mL by nebulizer, q20min, for a maximum of 3 times (may be given continuously if needed)

Dose is based on child's weight:

≤10 kg: 1.25–2.5 mg/dose, in 3 mL normal saline

11–20 kg: 2.5 mg/dose, in 3 mL normal saline

>20 kg: 5.0 mg/dose, in 3 mL normal saline

If a full response is achieved, consult a physician about continuing management at home:

salbutamol (Ventolin) (**D class drug**), by MDI, 1 or 2 puffs q2–4h prn for relief, depending on severity

and

prednisone (APO-Prednisone) (**B class drug**), 1–2 mg/kg per day (to a maximum of 60 mg) PO od for 5 days

If only a partial response is achieved:

Continue β_2-agonist q20min as above and add the following:

ipratropium bromide (Atrovent) (**B class drug**), 250 µg q1h, by nebulizer with salbutamol (Ventolin) (**D class drug**)

and

hydrocortisone (Solu-Cortef) (**D class drug**), 4–6 mg/kg load IV (to a maximum of 500 mg)

Monitoring and Follow-Up

Monitor ABCs, pulse oximetry (if available), hydration and level of consciousness while awaiting transport.

Referral

Medevac.

Criteria for Hospital Admission

- Child is critically ill (moderate to severe airway obstruction with respiratory distress)
- Poor response to emergency therapy: needs more than three or four salbutamol (Ventolin) treatments, post-treatment PEFR is less than 40% of predicted, post-treatment oxygen saturation <95% on room air
- Social considerations: parents or caregiver unreliable, home is far from health facility

Discharge Home after Treatment of Acute Episode

- Provide instructions (preferably written) to the parents or caregiver on symptoms and signs of respiratory distress
- Advise parents or caregiver to bring the child back to the clinic if there is no response to β_2-agonists or the response lasts less than 2 hours
- Counsel about appropriate use of drugs, including dosages, administration techniques (e.g., use of MDI with spacer), effects and side effects
- Explain strategies to prevent further attacks
- Prophylactic medication regimen as required

CHRONIC ASTHMA

DEFINITION

- *Mild chronic asthma:* mild activity limitation, infrequent episodic illness
- *Mild persistent asthma:* occasional night cough relieved by β_2-agonists or exercise-induced bronchospasm regularly relieved by β_2-agonists
- *Moderate asthma:* regular use of β_2-agonists at night for cough, activity limitations despite use of β_2-agonists, recent emergency treatment for acute symptoms or use of prednisone for control of symptoms
- *Exercise-induced asthma*

MANAGEMENT

Goals of Treatment

- Prevent symptoms (e.g., cough, shortness of breath, wheeze that interferes with daytime activities, exercise, school attendance or sleep)
- Prevent need for regular use of rescue medications (e.g., salbutamol [Ventolin])
- Prevent visits to emergency department or admission to hospital
- Normalize PEFR and FEV_1 on pulmonary function testing

Appropriate Consultation

Consult a physician for:

- Any child with previously undiagnosed asthma
- Any child with known asthma who is experiencing acute symptoms
- Any child receiving long-term prophylaxis whose symptoms are not well controlled with the current medication regimen

Nonpharmacologic Interventions

Client Education

- Discuss diagnosis and expected course of illness
- Counsel parents or caregiver about appropriate use of medications (dose, frequency, side effects)
- Advise child about proper use of aerosol delivery device, Aerochamber and spacer
- Review inhaler techniques regularly and often to ensure optimal use
- Teach parents or caregiver how to monitor for symptoms and how to use peak flow meter (if deemed beneficial for managing symptoms)
- Provide instruction on worsening signs of asthma
- Provide written instruction on a plan of action that the parents or caregiver should initiate when signs of worsening are first occurring (e.g., increasing need for usual rescue medications)
- Counsel parents (or caregiver) and child about how to minimize local side effects (oral candidiasis) by careful rinsing of the mouth and gargling

Pharmacologic Interventions

Long-Term Prophylactic Management of Chronic Asthma

To be prescribed only by a physician.

Various medication regimens may be prescribed for prophylaxis, including the following.

Bronchodilators (β_2-Agonists)

- Short-acting (e.g., salbutamol [Ventolin] [**D class drug**])
- Long-acting (e.g., salmeterol [Serevent] [**B class drug**])

Anti-inflammatory Agents

- Corticosteroids (e.g., budesonide [Pulmicort] [**B class drug**] or fluticasone [Flovent] [**B class drug**])
- Mast cell stabilizers (e.g., sodiumcromoglycate [Intal] [**B class drug**])
- Theophylline (**B class drug**): may have a role for children receiving optimal anti-inflammatory therapy but still needing more bronchodilation than they are obtaining from β_2-agonists
- Leukotriene receptor antagonists (e.g., montelukast): may help with exercise-induced asthma and may have steroid-sparing properties, which allow better control of asthma at lower doses of inhaled steroids

For Mild Chronic Asthma

aerosolized salbutamol (Ventolin) (**D class drug**), 100–200 µg (1 or 2 puffs) q4–6h

For younger children, a home nebulizer for use with aerosol solution should be considered. If unable to obtain a nebulizer, mild chronic asthma in very young children can be managed with regular inhaler and spacer, such as the Aerochamber.

For Mild Persistent Asthma

β_2-agonist prn (e.g., salbutamol [Ventolin] [**D class drug**])

and

sodium cromoglycate (Intal) (**B class drug**)

or

inhaled steroids (e.g., budesonide [Pulmicort] [**B class drug**]), 200–800 µg/day

For Moderate Chronic Asthma

β_2-agonists prn (e.g., salbutamol [Ventolin] [**D class drug**])

and

inhaled steroids (e.g., budesonide [Pulmicort] [**B class drug**]), 200–800 µg/day

or

fluticasone (Flovent) (**B class drug**), 100–500 µg/day

and

prednisone (APO-Prednisone) (**B class drug**), 0.5–1 mg/kg per day for exacerbations, PO (maximum 5-day course)

For Exercise-Induced Asthma

salbutamol (Ventolin) (**D class drug**), 100–200 mg (1 or 2 puffs) 15 minutes before exercise

For Night Cough

inhaled steroids (e.g., budesonide [Pulmicort] [**B class drug**]), 200–800 µg/day

or

fluticasone (Flovent) (**B class drug**), 100–500 µg/day

or

salbutamol (Ventolin) (**D class drug**), 100–200 mg (1 or 2 puffs) hs

Monitoring and Follow-Up

See children with chronic asthma at least several times a year to assess if there is adequate control of symptoms. Watch for growth failure in children taking more than 800 µg of inhaled steroids per day.

Referral

Refer as needed to a physician to assess control and to prescribe medications for long-term prophylaxis.

PERSISTENT COUGH

DEFINITION

Cough is a forceful explosive expiration and release of air, which serves to remove secretions and foreign material from the respiratory tract. Chronic or persistent cough is a cough lasting longer than 3 weeks. Cough is a symptom of some other specific diagnosis.

DIFFERENTIAL DIAGNOSIS

Infection

- URTI with irritation or postnasal drip (or both); may be associated with sinusitis
- Bronchitis caused by or related to virus, *Mycoplasma*, pertussis, tuberculosis or (rarely) other organisms or parasites
- Pneumonia, especially that caused by *Mycoplasma*

Post-infection

- After bronchiolitis or pneumonia
- Allergy: allergic rhinitis with postnasal drip
- Asthma: cough may predominate, rather than wheeze

Suppurative Lung Disease

- Bronchiectasis
- Cystic fibrosis

Environmental Irritants

- Dry air
- Fumes
- Smoke

Aspiration

- Foreign body: onset of cough is usually sudden, but symptoms may be chronic if aspirated material is small
- Gastroesophageal reflux with aspiration
- Neuromuscular disorders: aspiration especially associated with feeding

Anatomic Defects

- Compression of airways by lung or blood vessel anomalies or tumors

HISTORY

Nature of Cough

- Production of sputum indicates pneumonia or bronchiectasis
- Presence of whoop indicates pertussis
- Paroxysmal nature (i.e., continuous, short coughs on a single expiration) indicates pertussis, parapertussis, some viruses such as adenovirus
- Dry hacking cough indicates tracheal irritation
- Brassy cough indicates tracheal or bronchial compression
- Increase in cough in supine position indicates sinusitis with postnasal drip, gastroesophageal reflux
- Nocturnal cough indicates asthma
- Exercise-induced cough indicates asthma

Associated Symptoms and Events

- URTI symptoms
- Postnasal drip
- Allergic “shiners”
- Exposure to infectious persons
- Diarrhea, poor weight gain (cystic fibrosis)

Past History

- Developmental delay
- Neuromuscular abnormalities
- Eczema (may precede asthma)
- Viral pneumonia (due to RSV or adenovirus) may be followed by airway damage, chronic cough and wheeze

PHYSICAL EXAMINATION

Assess for:

- Presence of respiratory distress (respiratory rate, use of accessory muscles)
- Nasal congestion
- Allergic “shiners”
- Dullness over areas of lung consolidation
- Sound of cough
- Breath sounds
- Adventitious sounds
- Skin rash
- Muscle wasting
- Developmental delay

MANAGEMENT

Management depends on the diagnosis.

Goals of Treatment

– Identify underlying diagnosis

Appropriate Consultation

Consult with a physician about the need for investigation and, in some cases, referral to tertiary care center.

Do not use any cough medications without establishing diagnosis.

EMERGENCY PROBLEMS OF THE RESPIRATORY SYSTEM

EPIGLOTTITIS

DEFINITION

Acute, life-threatening infection, consisting of cellulitis of the epiglottis and resulting in critical narrowing of the airway. Progresses rapidly (less than 12 hours from onset to respiratory distress). Usually occurs in children 3–7 years old. Children inadequately immunized against *Hemophilus influenzae* type B may be particularly susceptible.

CAUSES

Usually a bacterial infection:

– *Hemophilus influenzae* type B (accounted for more than 90% of cases before vaccines were introduced, but is now rare)
– *Staphylococcus aureus*
– *Streptococcus pneumoniae*
– *Streptococcus pyogenes*, group A

HISTORY

– Abrupt onset
– Limited or no prodrome
– High fever (>39°C)
– Sore throat with drooling
– Dysphagia
– No cough, runny nose or other symptoms of URTI

Check that primary immunization series (for *Hemophilus influenzae* type B) is complete.

PHYSICAL FINDINGS

Do not attempt to examine oropharynx, since this may provoke sudden obstruction. Examination should be minimal to minimize distress to the child.

– Child looks acutely ill and anxious
– High fever
– Cyanosis
– Slow, labored breathing
– Suprasternal indrawing
– Drooling
– Child will not talk and sits erect in the classic "sniffing" position, leaning forward with hyperextension of the neck
– Stridor relatively quiet, given the degree of distress
– Breath sounds normal, with transmitted stridor
– Air entry reduced

DIFFERENTIAL DIAGNOSIS

– Croup (see Table 10-5)
– Bacterial tracheitis
– Peritonsillar or retropharyngeal abscess
– Uvulitis
– Diphtheria
– URTI in the presence of congenital or acquired airway disease (e.g., subglottic stenosis or laryngeal web)

COMPLICATIONS

– Complete obstruction of airway causing respiratory arrest, hypoxia and death
– Sepsis
– Septic shock

Table 10-5: Comparison of Epiglottitis and Croup

Feature	Epiglottitis	Croup
Age	2–8 years	6 months to 4 years
Onset	Acute	Gradual; child often has a cold first
Temperature	High (>39°C)	Low (<38°C)
Swallowing	Difficulty; salivation	No difficulty
Position	Sitting up, leaning forward	Variable

DIAGNOSTIC TESTS

None.

MANAGEMENT

ABCs are the first priority!

Goals of Treatment

- Relieve infection
- Prevent complications

Appropriate Consultation

Consult a physician as soon as possible, but ensure that the child's ABCs are stabilized first.

Adjuvant Therapy

- Give oxygen by mask at 6–10 L/min or more, unless this is distressing to the child
- Oxygen by nasal prongs at 2–4 L/min may be less distressing
- Start IV therapy with normal saline to keep vein open, unless this is likely to distress the child and thereby to increase respiratory distress

Nonpharmacologic Interventions

- Nurse the child in the parent's or caregiver's arms
- Give nothing by mouth
- Allow the child to assume any position that makes him or her comfortable

Pharmacologic Interventions

Administration of antibiotics effective against *H. influenzae* should be started before transport, if possible.

A child with epiglottitis has septicemia and should be given initial doses of antibiotic therapy, unless he or she is likely to become distressed by this treatment. Discuss with a physician.

cefuroxime (Zinacef) (**B class drug**), 75 mg/kg per day, divided q8h, IV

and

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q6h, IV

and

chloramphenicol (Chloromycetin) (**B class drug**), 50–75 mg/kg per day, divided q6h, IV

Rifampin prophylaxis (20 mg/kg daily in a single dose for 4 days) is recommended for the child and for family, household and possibly daycare contacts. Discuss prophylaxis with a physician.

Monitoring and Follow-Up

Monitor ABCs and pulse oximetry (if available) as frequently as possible, but be discreet and try not to agitate the child.

Referral

Medevac immediately to a facility where controlled intubation is possible.

A physician or paramedic skilled in intubation should accompany the child during transfer.

NEONATAL RESUSCITATION

DIAGNOSIS

Try to anticipate situations in which a child may need resuscitation. The following situations represent some of the predisposing factors.

History of Maternal Perinatal Complications

- Preterm labor
- Placental abnormalities: placenta previa, abruptio placentae or cord compression
- Amniotic fluid abnormalities: polyhydramnios or oligohydramnios
- Infectious process: maternal fever
- Infectious agents (maternal source): group B *Streptococcus*, gram-negative bacteria, viruses (e.g., HSV, toxoplasmosis, CMV, HIV)
- Maternal abnormalities: diabetes mellitus, size of pelvic outlet
- Neonatal abnormalities: genetic, anatomic or cardiac
- Maternal drugs: prescription or illicit

Physical Examination and Evaluation

The physical examination may have to be done while resuscitation is performed.

- Airway: Is it patent? Is foreign material (e.g., meconium) present?
- Breathing effort: Present or absent?
- Circulation: Is pulse present? What is heart rate? What is infant's color?
- Disability: neurologic status, floppy tone, absence of reflex and grimace
- Environment: heat loss
- Apgar score: should be assessed 1 and 5 minutes after birth (Table 10-6)

PROCEDURE FOR RESUSCITATION

1. Position the airway.
2. Suction the mouth and nasopharynx.
3. Dry the neonate and keep warm with thermal blanket or dry towel. Cover scalp.
4. Stimulate by drying the baby and rubbing his or her back.
5. Clamp and cut the cord.
6. Evaluate respirations.
7. Use blow-by method or simple face mask to deliver 100% oxygen for neonate in mild distress. For an infant with apnea or severe respiratory depression, begin assisted breathing with bag-valve mask (BVM) and 100% oxygen; ventilate at 30 breaths/minute.
8. Check heart rate (apical beat).

If heart rate < 60 beats/minute:

9. Continue assisted ventilation (30 breaths/minute).
10. Begin chest compressions at 90/minute.
11. If no improvement after 30 seconds, continue ventilation and compressions.
12. If no improvement after a further 30 seconds, establish vascular access and give epinephrine solution (1:10 000) (**D class drug**) at 0.01–0.03 mg/kg IV or IO. Subsequent doses must be ordered by a physician.
13. Reassess heart rate and respirations.

If heart rate 60–80 beats/minute:

9. Continue assisted ventilation.
10. If no improvement after 30 seconds of ventilation with 100% oxygen, begin chest compressions. Ratio of compressions to ventilations should be 3:1 (90 compressions to 30 ventilations).
11. Reassess heart rate and respirations each minute.

If heart rate 81–100 beats/minute and rising:

9. Give 100% oxygen by mask or blow-by method.
10. Provide tactile stimulation.
11. Reassess heart rate and respirations after 15–30 seconds. If heart rate < 100 beats/minute, begin assisted BVM ventilation with 100% oxygen.
12. Reassess heart rate after 15–30 seconds.

If heart rate > 100 beats/minute:

9. Check skin color. If peripheral cyanosis is present, give oxygen by mask or blow-by method.
10. Reassess heart rate after 1 minute.

See Table 10-7 for a summary of the steps in neonatal resuscitation.

Table 10-6: Determination of Apgar Score*

Feature Evaluated	0 Points	1 Point	2 Points
Heart rate	0	<100 beats/min	>100 beats/min
Respiratory effort	Apnea	Irregular, shallow or gasping breaths	Vigorous, crying
Color	Pale or blue all over	Pale or blue extremities	Pink
Muscle tone	Absent	Weak, passive tone	Active movement
Reflex irritability	Absent	Grimace	Active avoidance

*Sum the scores for each feature. Maximum score = 10, minimum score = 0.

Table 10-7: Summary of Steps in Neonatal Resuscitation: ABCDEF

A for Airway

- Clear or suction airway
- Consider giving oxygen prn

B for Breathing

- Support breathing with oral airway and bag-valve mask prn
- 100% oxygen

C for Circulation

- No support needed if heart rate >100 beats/minute
- If heart rate ≤100 beats/minute, ventilate and observe
- If there is a response (heart rate increases to >100 beats/minute), no further support is needed

If response is poor (heart rate 60–80 beats/minute), recheck airway; if airway and breathing are adequate, initiate chest compressions

If "ABC" (above) fail to produce a response, consider "D" (as follows)

D for Drugs

- IV fluid (for volume expansion): 0.9% NS
- epinephrine solution (1:10 000) (**D class drug**), 0.01–0.03 mg/kg IV or IO (at slow rate of infusion)
- Consider naloxone (Narcan) (**D class drug**), if there is a possibility of maternal narcotics

E for Exposure

- Keep infant under radiant warmer or surrounded by warmed blankets

F for Final Steps

- Consult pediatric and neonatal departments at nearest tertiary care facility
- Transfer to neonatal ICU if child needs more than simple oxygen and transient (for <5 minutes) assisted ventilation with bag-valve mask

POST-RESUSCITATION CARE

Signs of Continuing Perinatal Asphyxia

- Altered gaze, slack face
- Increasing irritability
- Seizures
- Decreased muscle tone
- Decreased suck, swallow or gag reflex
- Breathing irregularities
- Stupor or coma
- Signs of increased intracranial pressure (e.g., bulging fontanel, frequent emesis, blunted reflexes, "sunset" eyes)

Stabilization

Monitoring and Assessment

- Observe infant continuously
- Do not leave unattended
- Handle gently

Vital Signs

Record vital signs every 15 minutes or more frequently, depending on situation.

- Heart rate: normally 120–160 beats/minute (use pulse oximetry, if available)
- Respiratory rate: normally 40–60 breaths/minute (airway can be kept open by slightly extending the position of the head and suctioning as necessary)
- Axillary temperature: normally 36.5°C to 37°C
- Blood pressure: difficult to assess in newborns without special equipment; signs of adequate perfusion include good capillary refill, good color, adequate urinary output and normal alertness; determine capillary refill time (to assess skin perfusion) by blanching area with digital pressure (normal refill time is 2–4 seconds)

Thermoregulation

Provide warmth to maintain normal body temperature. Ambient temperature at which an infant uses the least energy to maintain body temperature depends on the infant's weight, gestational age at birth and postnatal age. Prolonged cold stress results in increased oxygen consumption and abnormal glucose utilization, which can lead to hypoglycemia, hypoxemia and acidosis.

Measures to Maintain Warmth

- Dry the baby and keep the environment warm and humid
- Maintain a warm room temperature, keep the infant away from cold windows and use double-walled incubators or radiant heaters (if available)
- Warm linen in contact with the baby and change wet linen

Maintenance of Oxygenation and Ventilation

Signs of Respiratory Distress

- Periodic breathing
- Tachypnea (respiratory rate > 60 breaths/minute)
- Grunting
- Chest wall retractions
- Nasal flaring

Common Causes of Respiratory Distress in Newborns

- Respiratory distress syndrome
- Aspiration syndrome
- Pneumonia
- Pulmonary air leak

In these situations, consult a physician.

Respiratory Failure and Mechanical Ventilation

- Progressively increased oxygen demands and respiratory distress
- If there is evidence of respiratory failure, take steps immediately to provide positive pressure ventilation (PPV)
- Maintain oxygen saturation in the range of 90% to 95% by pulse oximetry (if available)
- Initiate PPV with infant resuscitation bag at 30 respirations/minute and pressure of 20–30 cm H_2O
- Effectiveness of ventilation judged by infant's clinical response, symmetric chest movement and auscultation of air entry to both lungs
- Major cardiopulmonary failure may be prevented by early intervention with 100% oxygen and PPV

Maintenance of Circulation

Adequate cardiac output is essential to maintain circulation. The best way to maintain circulation is provision of adequate fluids and electrolytes. Babies with unstable conditions are usually given nothing by mouth, and an IV infusion is started.

Conditions Necessitating IV Infusion

- Extreme prematurity
- GI anomalies (e.g., gastroschisis)
- Cardiac anomalies
- Respiratory distress syndrome
- Dehydration
- Shock

Fluid Administration Guidelines for Newborns

- Term infant: 80–100 mL/kg every 24 hours
- Preterm infant: 100–140 mL/kg every 24 hours

Maintenance of Homeostasis

The most common problem is hypoglycemia, which occurs in a variety of situations:

- Prematurity
- Restricted intrauterine growth
- Asphyxia during birth
- Hypothermia
- Diabetic mother

Use a reagent strip or blood glucose monitor to assess blood glucose level every hour. Maintain glucose levels at greater than 2 mmol/L.

IV administration of a 10% dextrose solution (approximately 3–4 mL/kg each hour) is usually adequate to correct transient hypoglycemia. Persistent hypoglycemia should be treated with a bolus of D5W or D10W (2–3 mL/kg). Discuss with a physician.

Abnormalities such as hypocalcemia, hypomagnesium, hyponatremia and hyperkalemia can complicate homeostasis, especially if resuscitation and stabilization processes are prolonged.

Infection

If sepsis is suspected, obtain swabs from ear canal, umbilicus and tracheal secretions. Obtain blood for culture if possible. IV administration of antibiotics should not be delayed. Discuss with a physician.

Usual antibiotic dosages:

ampicillin (Ampicin) (**D class drug**), 25–37.5 mg/kg q12h by slow IV push

and

gentamicin (Garamycin) (**B class drug**), 2.5 mg/kg q12h by slow IV push or IM

Management of Special Conditions

Aspiration of Meconium

If infant shows signs of respiratory distress, suction thick meconium from the airway as soon as possible after delivery.

Pneumothorax

Depending on respiratory compromise, needle aspiration of pneumothorax (if tension) may be necessary. Keep infant in oxygen-rich environment.

Seizures

Administer anticonvulsants to control seizure activity:

lorazepam (Ativan) (**D class drug**), 0.05 mg/kg per dose IV

Shock

If shock is suspected, volume expansion is indicated (e.g., 20 mL/kg bolus of normal saline or Ringer's lactate).

Exposed Abdominal or Neural Contents

Treat infant with sterile technique. Wrap defect in warm, sterile saline dressing and cover with plastic wrap to prevent drying. Position so that no pressure is applied to the defect.

Gastrointestinal Obstruction

Examples include duodenal atresia, ileal atresia and anal atresia. Give nothing by mouth. Insert an orogastric tube to remove gastric contents and prevent abdominal distension. Establish IV infusion with normal saline.

APPENDIX 10-1: OXYGEN DELIVERY TECHNIQUES

Appendix 10-1: Oxygen Delivery Techniques

Device	Flow (L/min)	Oxygen (%)
Nasal prongs	2–4	24–28
Simple face mask	6–10	35–60
Face tent	10–15	35–40
Venturi mask	4–10	25–60
Partial rebreathing mask	10–12	50–60
Oxyhood	10–15	80–90
Nonrebreather mask	10–12	90–95

CHAPTER 11 — CARDIOVASCULAR SYSTEM

Table of Contents

For more information on the history and physical examination of the cardiovascular system in older children and adolescents, see chapter 4, "Cardiovascular System," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

EXPLANATORY NOTE

Cardiovascular disease is uncommon in childhood. The major problems seen include congenital heart disease (usually abnormalities of the great vessels, hypoplastic heart, pulmonary or aortic atresia, and tetralogy of Fallot), cardiac failure, rheumatic fever carditis and myocarditis.

Functional or innocent heart murmurs are common.

Congestive heart failure at birth is rare and usually suggests severe valvular deformities.

Symptoms of ventricular septal defect, including heart failure, usually occur at approximately 6 weeks of age.

ASSESSMENT OF THE CARDIOVASCULAR SYSTEM

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

Symptoms of cardiovascular disease vary with the age of the child.

GENERAL

Ask about:

- Rapid or noisy breathing
- Cough
- Cyanosis
- Sleeping patterns
- Exercise tolerance: indicated in a young child by ability to feed and in an older child by ability to keep up with peers during play

IN INFANTS

Cyanosis

- An abnormality of oxygen transport related to heart, lungs or blood
- Causes bluish discoloration of mucous membranes, nail beds and skin and is a significant clinical finding

Exercise Intolerance

- Eats slowly
- Tires during feeding
- Cyanosis appears with feeding
- Often described by parents or caregiver as a “good baby”: always quiet, sleeps a lot

Difficulty Breathing

- Tachypnea
- Retractions
- Anxious appearance
- Grunting

Excessive Perspiration

- Infant’s head described as “always wet”
- Infant perspires freely and easily, especially with excretion and feeding

Slow Growth

- Child usually exhibits slow weight gain, relative to height gain
- Difficulty in feeding may contribute to this problem
- Metabolic demands increased

Respiratory Infections

- More common with congestive heart failure
- More severe with increased pulmonary flow

IN CHILDREN

- Slow growth
- Respiratory infections
- Chest pain
- Palpitations
- Dizzy spells or blackouts
- Exercise intolerance
- Squatting with cyanotic episodes (“tetralogy spells”)

MEDICAL HISTORY (SPECIFIC TO CARDIOVASCULAR SYSTEM)

- Prematurity (associated with a higher prevalence of congenital cardiac malformation)
- History of illnesses related to heart disease (e.g., strep throat)
- “Flu-like” illness
- Joint pains or swelling
- Down’s syndrome (associated with a higher prevalence of congenital heart disease)

PHYSICAL FINDINGS

An examination of the cardiovascular system involves more than just examining the heart. The examination generally covers two systems: the central cardiovascular system (head, neck and precordium [anterior chest]) and the peripheral vascular system (extremities). Examination of the cardiovascular system must also include a full assessment of the lungs and neuromental status (for signs of confusion, irritability or stupor).

VITAL SIGNS

- Heart rate
- Respiratory rate
- Blood pressure (in both an upper and a lower limb, if possible)
- Temperature (may be elevated with myocarditis or acute rheumatic fever)
- Cardiovascular problems may present as failure to thrive (weight and height below percentiles for age) or as a sharp decline in the growth curve across a major percentile line

INSPECTION

- Respiratory distress
- Cyanosis: central and peripheral
- Hands and feet: cyanosis, clubbing
- Precordium: visible pulsations
- Edema

PALPATION

- Apical beat is located at fourth intercostal space, lateral to the mid-clavicular line in infants, and at fifth intercostal space, lateral to the mid-clavicular line in older children
- Brief, localized apical tap is normal
- Apical beat may be laterally displaced, which indicates cardiomegaly
- Thrills or heaves may be palpable through chest wall; check supraclavicular area for thrills (in children with a thin chest wall, normal heart movements can be easily palpated and should not be confused with true thrills and heaves)
- Hepatomegaly
- Pulses: brachial, radial, femoral, popliteal, posterior tibial, dorsalis pedis (also check for synchrony of radial and femoral pulses)
- Check for presence, rate, rhythm, amplitude and equivalence of peripheral pulses, especially femoral pulses (which are bounding in patent ductus arteriosus, absent in coarctation of aorta)
- Edema: pitting (rated 0 to 4) and level (how far up the feet and legs the edema extends); sacral edema
- Skin: temperature, turgor

AUSCULTATION

- S1 and S2 heart sounds
- Physiologic splitting of S2 heart sound
- Added heart sounds (S3 and S4): determine their location and relation to respiration
- Murmurs: determine location (where murmurs are best heard), radiation, their timing in cardiac cycle, intensity (grade; see Table 11-1) and quality
- Bruits: may occur in carotid arteries, abdominal aorta, renal arteries, iliac arteries, femoral arteries
- Crackles in lungs: may indicate heart failure (in infants and children, this usually occurs as a late sign)

Table 11-1: Characteristics of Heart Sounds of Various Grades

Grade	Characteristics
I	Very quiet, barely audible
II	Quiet but audible
III	Easily heard
IV	Thrill can be felt, murmur is easily heard
V	Thrill can be felt and loud murmur can be heard with stethoscope placed lightly on chest
VI	Thrill can be felt and very loud murmur can be heard with stethoscope held close to chest wall

COMMON PROBLEMS OF THE CARDIOVASCULAR SYSTEM

HEART MURMURS

GENERAL

Most murmurs are innocent flow murmurs, which are present in up to 50% of children; *see "Innocent Heart Murmur," below, this chapter.*

A heart murmur may signify congenital anatomic, infectious or inflammatory damage to valves and outlets of the four chambers of the heart.

PHYSICAL FINDINGS: AUSCULTATION

Auscultation helps to distinguish significant murmurs from innocent murmurs.

Murmurs must be recognized in relation to other physiologic and pathologic sounds of the cardiac cycle.

- The first heart sound is caused by the closure of the mitral and tricuspid valves, which usually occurs simultaneously. The first sound is best heard at the cardiac apex.
- The second heart sound occurs with the closure of the aortic and pulmonary valves. Because the closure of these two valves is somewhat asynchronous, what is known as the second heart sound actually consists of two sounds. The separation of the two component sounds is often difficult to detect in young children, although it is more pronounced during inspiration. Wide separation of the second heart sound is often a significant pathologic finding. The second heart sound is best heard in the second and third left intercostal spaces.
- A third heart sound may occur after the second heart sound. This may be found in healthy children. It is a sign of heart failure in a symptomatic child. The third heart sound is best heard when listening at the apex of the heart (in the fourth and fifth intercostal spaces); a left side-lying position may accentuate the sound. Use the bell part of the stethoscope.
- Ejection "clicks" may be present in certain conditions; they are always abnormal.

If a murmur is present, several characteristics should be determined.

Timing within Cardiac Cycle

- Systolic ejection murmurs occur after the first sound. They are caused by turbulence in the blood as it leaves the heart.
- Pansystolic murmurs begin with the first heart sound and end with the second. They most often occur in association with ventricular septal defects.
- Diastolic murmurs begin with the second heart sound. They are always abnormal.

Location on the Thorax

There are four general auscultatory areas:

- *Aortic:* left ventricular outflow murmur (usually ejection)
- *Pulmonary:* right ventricular outflow murmur, patent ductus arteriosus
- *Tricuspid:* tricuspid murmurs increase on inspiration; ventricular septal defects are heard best in this area
- *Mitral:* murmur at the cardiac apex

Radiation

Radiation of the murmur to the back, sides and neck should be carefully auscultated. Radiation of the murmur may give important diagnostic clues (e.g., aortic stenosis radiates to the neck).

Intensity of Murmur

- Intensity expressed as a fraction of 6 (e.g., 1/6, 2/6), where a very loud murmur = 5/6 or 6/6, a loud murmur = 3/6 or 4/6, and a soft murmur = 1/6 or 2/6.
- Intensity (loudness) does not necessarily correlate with the severity of the condition. Soft murmurs may be dangerous, whereas loud murmurs are not necessarily so. A murmur associated with a thrill has an intensity of at least 4/6.
- Intensity may also increase with increased blood flow, as with exercise.

Quality

- Blowing
- Rumbling
- Clanging

INNOCENT HEART MURMUR

DEFINITION

Heart murmur that occurs in the absence of anatomic or physiologic abnormalities of the heart and therefore has no clinical significance.

Such murmurs occur in 50% of children. The age at onset is most frequently 3–8 years.

PATHOPHYSIOLOGY

Most innocent heart murmurs are produced by the forward flow of blood, which creates turbulence in the chambers of the heart or the great vessels. Because the intensity of the murmur parallels the ejection velocity of blood from the ventricles, innocent murmurs usually occur during early to mid-systole, are short in duration, have a crescendo–decrescendo contour (especially an ejection murmur), are less than 3/6 in intensity and are never diastolic.

CLINICAL FEATURES

Innocent heart murmurs are asymptomatic and are usually found on routine physical examination.

DIAGNOSTIC TESTS

- ECG
- Echocardiography (only as ordered by a physician)

MANAGEMENT

- No treatment necessary
- Reassure the parents or caregiver

Referral

Refer child electively to a physician for assessment when a murmur is found.

EMERGENCY PROBLEMS OF THE CARDIOVASCULAR SYSTEM

CYANOSIS IN THE NEWBORN (BIRTH TO 6 WEEKS)

DEFINITION

Bluish discoloration of the skin and mucous membranes secondary to hypoxia.

CAUSES

Congenital Heart Disease

Cardiac cyanosis is due to left-to-right shunting, so that systemic venous blood bypasses the pulmonary circulation and enters the arterial systemic circulation.

Settings of increased risk of congenital heart disease:

- Genetic syndromes (e.g., Down's syndrome)
- Certain extracardiac anomalies (e.g., omphalocele)
- Maternal diabetes that is poorly controlled in the first trimester
- Exposure to a cardiac teratogen (e.g., lithium, isotretinoin [Accutane])
- Family history of significant congenital heart disease

Non-cardiac Causes

- Pulmonary infection (e.g., group B streptococcal infection)
- Aspiration of meconium
- Pulmonary hypoplasia
- Respiratory distress syndrome (e.g., in premature infants)
- Hypoventilation (e.g., neurologic depression)
- Persistent fetal circulation: seen in post-term infants with perinatal distress or those with pulmonary disease

CLINICAL FEATURES OF INFANTS WITH CYANOTIC HEART DISEASE

The clinical features usually present in the first week of life but may present later.

- Difficulty feeding; infant appears to tire easily
- Lethargy
- Cyanosis when feeding or active (e.g., while crying)
- Perspiration on face or forehead, especially when feeding or active
- Rapid, noisy breathing

PHYSICAL FINDINGS

- Lethargy
- Cyanosis, initially of the oral mucosa; in severe cases, the cyanosis becomes generalized
- Tachypnea
- Poor perfusion (e.g., pallor or gray, ashen appearance; extremities cool; capillary refill diminished; peripheral pulses diminished)
- In coarctation of aorta, pulse quality and blood pressure may differ in different extremities
- Heart sounds may be loud
- Precordium may appear hyperdynamic (heaves or thrills may be present)
- Heart murmur may be present
- Hepatomegaly (if infant is in heart failure)

DIFFERENTIAL DIAGNOSIS

- Pulmonary causes as listed above
- Sepsis

COMPLICATIONS

- Cardiac failure
- Failure to thrive
- Death

DIAGNOSTIC TESTS

- Pulse oximetry (if available)

MANAGEMENT

Appropriate Consultation

- Consult a physician immediately and prepare to medevac

Adjuvant Therapy

- Give oxygen 6–10 L/min (more, if necessary) by mask
- Consider IV therapy with normal saline if infant is feeding poorly or is in significant clinical distress

Nonpharmacologic Interventions

- Nurse in an upright position
- Feed small amounts frequently

Monitoring and Follow-Up

- Monitor level of consciousness, vital signs, heart and lung sounds, perfusion, pulse oximetry (if available), and intake and output
- Watch for signs of cardiac failure *(see "Cardiac Failure," below, this chapter)*

Referral

- Medevac as soon as possible

RHEUMATIC FEVER (CARDITIS)

DEFINITION

A diffuse inflammatory disease of the connective tissues, which involves the heart, joints, skin, CNS and subcutaneous tissue. It tends to recur. The disease arises from immune complications of group A ß-hemolytic streptococcal infection.

Rheumatic fever is much more common in Aboriginal children and those living in lower socioeconomic circumstances. It may occur at any age but is most common in school-age children. The risk is higher in families in which there is a history of the disease.

CAUSES

- Precedent group A streptococcal infection (pharyngitis) and subsequent immune response

HISTORY

The disease is nearly always preceded by streptococcal pharyngitis (occurring 2–5 weeks earlier).

The presenting symptoms are variable, but may include the following:

- Fever
- Joint pain, redness and swelling (a constellation of symptoms known as migratory arthritis, typically involving the large joints)
- Emotional lability
- Involuntary, purposeless muscular movements (known as Sydenham's chorea)
- Shortness of breath, edema, cough, fatigue (representing heart failure)
- Rash (erythema marginatum)
- Subcutaneous nodules along tendon sheaths

PHYSICAL FINDINGS

The physical findings are variable and depend on the degree of involvement of various parts and systems of the body.

- Low-grade fever
- Tachycardia (increase in resting heart rate)
- Tachypnea

Cardiovascular Signs

- Dyspnea, cyanosis, edema and hepatomegaly if the child is in heart failure
- Thrill or heave may be present
- New heart murmurs, often pansystolic
- Rubs may be audible with inspiration and expiration if disease is associated with pericarditis
- Decrease in intensity of heart sounds

Musculoskeletal Signs

- Joints hot, tender and swollen at several sites

Skin

- Rash (erythema marginatum)
- Nodules may be palpated in subcutaneous tissue, usually on extensor surfaces of limbs

Other Symptoms

- Emotional lability
- Involuntary, purposeless muscular movements (Sydenham's chorea)

The diagnosis is based on a complicated collection of signs known as Jones' criteria (Table 11-2).

Table 11-2: Jones' Criteria for Diagnosis of Rheumatic Fever*

Major Criteria	Minor Criteria
Carditis	Fever
Polyarteritis	Arthralgia
Chorea	Previous rheumatic fever
Erythema marginatum	Laboratory findings
Subcutaneous nodules	

*Any combination of two major criteria or one major and two minor criteria is indicative of the diagnosis.

DIFFERENTIAL DIAGNOSIS

- Congenital heart disease (previously undiagnosed)
- Viral carditis
- Rheumatoid arthritis
- Tics (which may mimic chorea)

COMPLICATIONS

- Carditis
- Congestive heart failure
- Rheumatic heart disease (valvular damage, usually to the mitral valve)

DIAGNOSTIC TESTS

None.

MANAGEMENT

The diagnosis and treatment of rheumatic fever require evacuation to hospital. Emergency treatment of congestive heart failure may be necessary; *see "Cardiac Failure," below, this chapter.*

Goals of Treatment

- Identify the disease early
- Prevent complications

Primary Prevention

- Aggressive treatment of group A streptococcal throat infections with a complete course of antibiotic medications

ACUTE PHASE

Appropriate Consultation

Consult a physician immediately and prepare to medevac.

Nonpharmacologic Interventions

- Bed rest

Pharmacologic Interventions

Medications should not be started until the diagnosis has been clearly established. Medications are prescribed only by a physician.

salicylates (ASA) (**B class drug**), 100 mg/kg per day

If carditis is present, the following is sometimes used:

prednisone (APO-prednisone) (**B class drug**), 2 mg/kg per day

Monitoring and Follow-Up

Monitor for signs of cardiac failure.

If child is in cardiac failure, see "Cardiac Failure," below, this chapter.

Referral

Medevac.

POST-ACUTE PHASE

Pharmacologic Interventions for Prophylaxis

Because of the risk of recurrence, continual penicillin prophylaxis must be maintained. The risk of recurrence is greatest in the first 5 years after the initial bout. A physician would initially prescribe prophylaxis, usually one of the following commonly used drug regimens:

penicillin G benzathine (Bicillin) (**A class drug**), 1.2 million units per month IM

Oral penicillin should be used only in exceptional cases, as ensuring compliance is difficult.

For children with allergy to penicillin:

erythromycin (E-Mycin) (**A class drug**), 250 mg PO q12h

Prophylaxis for children without carditis should be maintained for at least 5 years and preferably throughout childhood.

If valvular disease results, lifetime prophylaxis is recommended or at least to 21 years of age.

CARDIAC FAILURE

DEFINITION

The inability of the heart to pump blood commensurate with the body's needs. The symptoms and signs correlate with the degree of failure.

CAUSES

- Congenital abnormality of cardiac structures
- Inflammatory (e.g., rheumatic fever)
- Infectious (e.g., viral cardiomyopathy, subacute bacterial endocarditis)
- Severe anemia (i.e., hemoglobin < 40 g/L)
- Other high-output states (e.g., thyrotoxicosis , arteriovenous malformation)
- Extracardiac disease (e.g., chronic pulmonary disease, pulmonary hypertension)

HISTORY

The history varies according to the child's age.

- Difficulty with feeding
- Shortness of breath
- Excessive sweating
- Poor weight gain
- Anxious appearance

PHYSICAL FINDINGS

- Tachycardia
- Tachypnea
- Blood pressure usually normal but may be reduced (if so, this is cause for concern, as it may indicate cardiogenic shock)
- Temperature: if higher than normal, consider inflammatory or infectious cause
- Irritable
- Anxious
- Fontanel full
- Nostrils flared
- Cyanosis
- Peripheral swelling (in older children)
- Increased venous distension
- Heave or thrill
- Gallop rhythm (with extra S3 heart sound)
- Increased murmurs
- Crackles in lung fields
- Hepatomegaly

DIFFERENTIAL DIAGNOSIS

- Respiratory disease (e.g., bronchiolitis or pneumonia)
- Metabolic abnormality (e.g., hypoglycemia; poisoning, as with salicylates)
- Sepsis

COMPLICATIONS

- Decreased cardiac output (shock)
- Death

DIAGNOSTIC TESTS

- Pulse oximetry (if available)

MANAGEMENT

Goals of Treatment

- Improve hemodynamic function
- Prevent complications

Appropriate Consultation

Consult with a physician regarding emergency treatment.

Nonpharmacologic Interventions

- Nurse the child in head-elevated position (do not allow neck to become kinked)
- Restrict oral fluids to no more than the quantity required to maintain hydration

Adjuvant Therapy

– Start IV therapy with normal saline to keep vein open
– Give oxygen 6–10 L/min or more by mask

Pharmacologic Interventions

Diuretics to decrease volume:

furosemide (Lasix) (**D class drug**), 1 mg/kg IV stat

The following drug, to increase contractility, must be ordered by a physician:

pediatric digoxin (Lanoxin) (**B class drug**), 0.04 mg/kg IV or PO

Total dose usually divided as follows: half dose given stat, quarter dose given 6 hours later and quarter dose given 12 hours after first dose (i.e., 6 hours after second dose)

Monitoring and Follow-Up

Acute Phase

Monitor ABCs, vital signs, pulse oximetry (if available), heart and lung sounds, intake and output until child is transferred to hospital.

Over the Long Term

Children with cardiac illness should be monitored regularly within the community to ensure normal growth and development and to watch for complications. Frequency of follow-up depends on the severity of the condition.

Referral

Medevac immediately.

CHAPTER 12 — GASTROINTESTINAL SYSTEM

Table of Contents

For more information on the history and physical examination of the gastrointestinal system in older children and adolescents, see chapter 5, "Gastrointestinal System," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ASSESSMENT OF THE GASTROINTESTINAL SYSTEM

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

ABDOMINAL PAIN

- Site
- Frequency
- Duration
- Character (e.g., crampy or constant, sharp or stabbing)
- Radiation
- Onset (sudden or gradual)
- Progression
- Aggravating and relieving factors
- Associated symptoms

VOMITING OR REGURGITATION

- Frequency
- Volume
- Force (e.g., projectile)
- Color
- Hematemesis
- Relationship to food intake

BOWEL HABITS

- Frequency, quantity, color and consistency of stool
- Presence of blood
- Pain before, during or after defecation

OTHER CHARACTERISTICS AND SYMPTOMS

- Growth history (when possible, obtain actual measurements)
- Appetite
- Food and fluid intake since onset of illness
- Usual nutrition and food habits: type of foods eaten, variety of foods in diet, quantity of food eaten, dietary balance, fiber content of diet
- Dysphagia
- Unusual weight loss or weight gain
- Color (e.g., presence of jaundice)
- Skin (e.g., pruritis, rash)
- Activity level
- History of previous GI diseases or abdominal surgery
- Medications (e.g., iron)
- Allergies, especially known allergies to food (e.g., lactose intolerance)

EXAMINATION OF THE ABDOMEN

GENERAL

- Apparent state of health
- Appearance of comfort or distress
- Color (e.g., flushed, pale, jaundiced)
- Nutritional status (obese or emaciated)
- State of hydration (skin turgor)

VITAL SIGNS

- Temperature may be elevated in infection
- Blood pressure usually normal
- Tachycardia may be present
- Respiratory rate usually normal

INSPECTION

Observe abdomen from a distance:

- Size, shape and contour; note any distension or asymmetry (in infancy, abdomen is typically protuberant; in early childhood the abdomen is still protuberant, but flattens when the child is lying down)
- Peristaltic waves
- Visible masses
- Guarding and positioning for comfort (child's behavior can also give very good clues as to the severity of any abdominal pain)

AUSCULTATION

Auscultation, to listen for bowel sounds, should be done before palpation.

Increase in bowel sounds alone is not significant, because this can occur with anxiety or mild gastroenteritis. However, it may also be a sign of obstruction.

Absence of bowel sounds indicates ileus, which can be due to a variety of factors, including metabolic problems, infection or peritoneal irritation.

PERCUSSION

- General percussion in all four quadrants for normal tympany
- Increased tympanitic sound in a distended abdomen indicates gas, which may be a result of obstruction, perforation, ileus or swallowed air
- Dullness in association with abdominal distension indicates fluid
- Delineate outline of liver; upper border is in the mid-clavicular line, between the fourth and sixth intercostal spaces; upper limit of liver span ranges from 8 cm at 5 years of age to 13 cm at puberty
- Determine spleen size
- If ascites is present, there will be dullness to percussion on the dependent side when the child is in a side-lying position; the border of the percussion note will change to a new position several moments after the child assumes a supine recumbent position

PALPATION

Ideally, palpation is performed with the child lying supine, with hands by the sides and relaxed. In reality, it must sometimes be done on the run. Be sure your hands are warm. The child's abdomen must be completely exposed. Examine all four quadrants in succession. If there is pain, start with the painless areas, and palpate the painful area last. Palpation should be light at first, with progression to deep palpation by the end of the examination.

Light Palpation

- Assess tenderness, guarding, superficial masses
- Watch the child's facial expression

Deep Palpation

- Feel for organs (liver, spleen, bladder and kidneys) and masses
- Assess for rebound tenderness (pain that occurs upon suddenly releasing the hand after deep palpation), which indicates peritoneal irritation
- Assess for referred tenderness (pain that is felt in an area distant to the area being palpated), which can be a clue to the location of the underlying disease

RECTAL EXAMINATION

- Anal patency (check this feature only in newborns)
- Skin tags
- Sphincter tone
- Fissures
- Tenderness
- Masses
- Occult blood

COMMON PROBLEMS OF THE GASTROINTESTINAL SYSTEM

GASTROENTERITIS

DEFINITION

Inflammatory process (usually infectious) involving the GI tract and resulting in diarrhea and vomiting. It is very common, especially among infants. The danger of dehydration from diarrhea is much greater in children than adults because of high body water content and large surface area for weight. Significant diarrhea and vomiting must be taken seriously in small children.

CAUSES

Numerous organisms can cause gastroenteritis, including bacteria, viruses and parasites. These organisms can be categorized according to the mechanism by which they produce diarrhea (secretory, cytotoxic, osmotic or dysenteric mechanism).

Viruses

- Rotavirus: most common cause in children 6–24 months of age
- Norwalk virus: affects older children
- Enteric adenovirus: common in children <2 years old

Bacteria

- *Salmonella*
- *Shigella*
- *Escherichia coli*
- *Campylobacter*

Parasites

- *Giardia*

Other Causes

- Food poisoning
- Adverse reaction to antibiotic therapy causing *Clostridium difficile* infection
- Hyperthyroidism
- Hirschsprung's disease (congenital megacolon)
- Overfeeding (in newborns)

HISTORY

- Onset and duration of symptoms
- Vomiting: frequency, color, amount
- Stool pattern: frequency, quantity (record amount in cups), consistency (formed or watery), color, presence of blood or mucus
- Thirst
- Oral intake from all sources
- Voiding: frequency and duration, number of wet diapers and their degree of saturation
- Alertness and activity level
- Alterations in mental state (e.g., irritability, lethargy)
- Diet history, focusing on water source and intake of poultry, milk and fish
- Family history: other family members or close contacts with similar symptoms
- Exposure to infected contacts at daycare center
- Past medical history, including other recent illness, recent antibiotic use (which may lead to infection with *C. difficile*), GI surgery
- Recent travel to an area where diarrheal illness is endemic

PHYSICAL FINDINGS

Weight (with child unclothed) must be recorded for future comparison.

Vital Signs

- Temperature elevated in infectious gastroenteritis
- Tachycardia if febrile or in compensated shock
- Respiration normal, unless in shock
- Blood pressure normal, unless in shock from dehydration
- Color: pale, mottled skin may indicate dehydration

Hydration Status

- Mucous membranes: check for dryness
- Fontanel sunken in dehydration
- Skin turgor decreased in dehydration; skin may be doughy; when pinched, skin may remain in a tent shape for several seconds before slowly resuming its normal shape
- Mental state (e.g., irritability, listlessness)

See Table 4-3, "Clinical Features of Dehydration," in chapter 4, "Fluid Management"

Abdominal Examination

- Distension
- Bowel sounds: high-pitched, rushing sounds in secretory or dysenteric gastroenteritis; may be decreased with ileus in dysenteric or malabsorptive conditions
- Mild, diffuse, generalized tenderness is usual

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

- Viral gastroenteritis: 80% of cases in children <2 years old
- Bacterial gastroenteritis: 20% of cases in children <2 years old

Infections outside the GI tract can also cause diarrhea and vomiting, especially in younger children. Otitis media, pneumonia and urinary tract infections are among the most frequent non-GI infections associated with diarrhea and vomiting.

MANAGEMENT

Goals of Treatment

- Maintain adequate hydration
- Rehydrate if dehydrated
- Prevent complications

Appropriate Consultation

Consult a physician in the following situations:

- Any infant or child who shows signs of dehydration on initial presentation
- Any infant or child who does not improve on home therapy
- Any infant or child whose diarrhea increases with re-introduction of cow's milk formula

Nonpharmacologic Interventions

See "Dehydration in Children," in chapter 4, "Fluid Management"

- Fluid therapy is based on assessment of degree of dehydration
- Therapy should include the following elements: rehydration, maintenance of fluids and replacement of ongoing losses
- *To determine degree of dehydration, see Table 4-3, "Clinical Features of Dehydration," in chapter 4, "Fluid Management"*
- *To calculate fluid deficit, see Table 4-4, "Calculating Fluid Deficit," in chapter 4, "Fluid Management"*
- *To calculate daily maintenance requirements, see Tables 4-1, "Daily Maintenance Fluid Requirements," and 4-2, "Conditions Modifying Daily Fluid Requirements," in chapter 4, "Fluid Management"*

Mild Diarrhea without Dehydration

- Breast-feeding and normal dietary intake should continue at home, with fluid intake dictated by thirst
- Maintenance oral replacement solution (e.g., Pedialyte) should be offered *ad libitum*
- High-osmolality fluids (e.g., undiluted juices or soda pop) and plain water should be avoided

Mild Dehydration (<5%)

- Assessment and treatment under close observation is recommended
- Rehydration phase: oral replacement solution (e.g., Pedialyte), 10 mL/kg per hour, with reassessment q4h
- Rehydration should be achieved over 4 hours
- Breast-feeding should continue
- For bottle-fed children, usual formula should be re-started within 6–12 hours
- Extra oral replacement solution (at 5–10 mL/kg) may be given after each diarrheal stool

Moderate Dehydration (5% to 10%)

- Rehydration phase: oral replacement solution (e.g., Pedialyte), 15–20 mL/kg per hour, under direct observation
- Frequent reassessment, including weight and state of hydration, is required during the rehydration phase (q1–2h)
- Rehydration should be achieved over 4 hours
- If dehydration is corrected, continue fluid therapy for maintenance and to make up for ongoing losses
- Extra oral replacement solution (at 5–10 mL/kg) may be given after each diarrheal stool
- If dehydration persists, repeat rehydration phase
- Breast-feeding should continue
- For bottle-fed children, usual formula should be re-started within 6–12 hours

Severe Dehydration (>10% or Signs of Shock)

Requires IV therapy, in addition to oral rehydration.

- Start IV therapy with normal saline or Ringer's lactate
- Give a bolus of 20 mL/kg over 20 minutes
- Reassess status and repeat bolus (to a maximum of three boluses in 1 hour) if shock or other signs of severe dehydration persist
- Once a response occurs, calculate the remaining deficit; replace 50% of the deficit over 8 hours and remainder over the next 16 hours; be sure to include maintenance requirements in total IV therapy
- Intraosseous infusion should be used if an IV line cannot be established (*see "Intraosseous Access," in chapter 2, "Pediatric Procedures"*)

Fluid and Feeding Guidelines

- Fluids may be given by nasogastric tube if necessary
- Oral replacement solution should be given slowly but steadily in small aliquots (to minimize vomiting)
- Oral replacement solution alone should not be given for more than 24 hours
- Encourage the mother to administer the fluid by syringe or spoon in small frequent doses
- Breast-feeding should continue during rehydration
- Regular feeding (breast or bottle) should begin within 6–12 hours
- Full diet should be re-instituted within 24–48 hours, if possible

There is evidence that diarrhea lasts longer if starvation occurs.

If the reintroduction of formula exacerbates diarrhea, consider the possibility of lactose intolerance, which may be secondary to loss of the GI brush border *(see "Lactose Intolerance," in chapter 17, "Hematology, Endocrinology, Metabolism and Immunology")*. If this adverse reaction to formula persists for more than 2 days, consult a physician about switching to a lactose-free formula (e.g., Prosobee or Isomil) for 5–7 days.

Pharmacologic Interventions

Antispasmodic and antidiarrheal agents should not be used. It should be explained to the parents or caregiver that it is best to consider the diarrhea as a purging process, to rid the intestinal tract of organisms, and that the most important part of managing diarrhea is the replacement of lost fluids. There is also a very limited role for antiemetic agents.

Specific antimicrobial agents are usually not indicated, even for bacterial infection. An exception is gastroenteritis caused by *Giardia lamblia*, which is usually treated as follows:

metronidazole (Flagyl) (**A class drug**), 15–20 mg/kg per day, divided tid

Monitoring and Follow-Up

Gastroenteritis without Dehydration

Re-evaluate the child with mild symptoms (treated at home) within 24 hours. Ensure that the parent or caregiver is aware of the signs and symptoms of dehydration, and instruct him or her to return immediately if dehydration occurs or worsens or if the child cannot ingest an adequate quantity of fluid.

Gastroenteritis with Dehydration

Record vital signs, clinical condition, intake and output, and weight frequently when rehydrating a child with dehydration, and keep child under observation at the clinic.

Referral

- Infants or children with mild dehyration who respond after 4 hours of rehydration may be sent home on maintenance therapy; if dehydration persists and there are continuing fluid losses, child should be medevaced
- The decision to continue home management should be made in consultation with a physician and depends primarily on the ability of the parents or caregiver to provide adequate care and on other factors, such as the distance of their home from the treatment facility
- Most children with significant dehydration (≥5%) should be evacuated to hospital
- Many children with 5% to 10% dehydration can be rehydrated substantially in the nursing station while awaiting transport

INGUINAL HERNIA

DEFINITION

Protrusion of part of the abdominal contents into the inguinal canal.

This type of hernia is common in children, affecting more boys than girls and occurring on the right side more often than the left.

CAUSE

- Embryologic failure of closure of the processus vaginalis

HISTORY

- Mass may be present in the groin at birth or may appear anytime after birth
- Mass that can be pushed back inside the abdomen wall (termed "reducible")

If the hernia becomes incarcerated:

- Pain may occur
- Mass becomes impossible to reduce

If incarceration lasts long enough to cause infarction of the bowel, there may be signs of intestinal obstruction. *See "Bowel Obstruction," below, this chapter.*

PHYSICAL FINDINGS

- Vital signs usually normal, unless bowel infarction has occurred
- Mass visible in the inguinal area, especially when the baby is crying
- If the mass is not visible, feel the inguinal canal by invaginating the upper part of the scrotum or labia with a finger; if the inguinal canal admits a finger it is too large
- Gentle palpation of the lower inguinal area near the pubis may give a feeling like rubbing two layers of silk together
- During transillumination of scrotum (by shining a flashlight behind the scrotum), hernial contents will not be transilluminated because they contain viscera
- Try to reduce the hernia with the child in a supine or head-down position, so that gravity will assist the procedure
- If the hernia proves difficult to reduce, do not force abdominal contents back, because this can internalize or incarcerate the hernia, and the child remains at risk for all the complications of hernias *(see "Complications," below, this section)*

DIFFERENTIAL DIAGNOSIS

- Hydrocele
- Undescended testis (cryptorchism)
- Scrotal trauma
- Seminoma, teratoma
- Lymphadenopathy

COMPLICATIONS

- Incarceration of hernia
- Strangulation of hernia
- Bowel obstruction
- Testicular infarction

Cryptorchism is associated with inguinal hernia.

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Observation until surgery
– Prevent complications

Appropriate Consultation

Consult a physician and prepare to medevac if the hernia is not reducible and there are signs of complications. If the hernia is not incarcerated (and is reducible), this is not an emergency situation.

Nonpharmacologic Interventions

Reassure the parents or caregiver.

Client Education

Teach the parents or caregiver the following:

– How to check and reduce the hernia
– Signs and symptoms of complications (e.g., incarceration, strangulation, bowel obstruction)

Emphasize the need to have the child assessed immediately if the hernia becomes difficult to reduce.

Pharmacologic Interventions

None.

Monitoring and Follow-Up

Assess the size and reducibility of the hernia every 3 months while awaiting surgical consultation and surgery.

Referral

Refer all asymptomatic children electively to a physician for assessment. A surgical referral will be necessary. Because of the risk of incarceration, surgery is recommended for all infantile inguinal hernias.

UMBILICAL HERNIA

DEFINITION

Protrusion of abdominal contents through the diastasis recti, causing an out-pouching of the umbilicus. Very common in First Nations children.

CAUSE

– Weakness of the diastasis recti muscles of the abdomen

HISTORY AND PHYSICAL FINDINGS

– Enlargement and protrusion of the umbilicus

COMPLICATIONS

Complications are rare.

– Incarceration or strangulation of hernia
– Bowel obstruction

DIAGNOSTIC TESTS

None.

MANAGEMENT

In spite of the size of umbilical hernias, they almost never become incarcerated, and surgery is not required. They usually disappear by the time the child reaches 2 or 3 years of age. All that is necessary is to reassure the parents or caregiver.

Strapping and taping are not of clinical value but may help to ease parental concerns and are usually not harmful.

CONSTIPATION

DEFINITION

Infrequent passage of hard, often dry stool. In 99% of cases, the cause of the constipation is never proven definitively. The condition is common in children, and often (in 60% of cases) occurs during the first year of life.

Constipation is a symptom, not a diagnosis. In all cases, the underlying cause must be sought, as many of the causes are correctable.

CAUSES

Dietary

– Introduction of cow's milk
– Inadequate fluid intake
– Under-nutrition
– Diet high in carbohydrates or protein (or both)
– Low-fiber diet

Organic

– Diseases causing abnormally dry stool
– Diabetes insipidus or diabetes mellitus
– Fanconi's syndrome
– Idiopathic hypercalcemia

Gastrointestinal Anomalies

– Hirschsprung's disease (congenital megacolon)
– Anorectal stenotic lesion, stricture or fissure
– Masses (intrinsic or extrinsic)
– Anterior anal displacement

CNS Lesions

- Hypotonia (benign congenital hypotonia)
- Hypertonia (cerebral palsy)
- Infectious polyneuritis or poliomyelitis
- Myelodysplasia

Other Causes

- Hypothyroidism
- Prune-belly syndrome
- Coercive toilet training

HISTORY

- Frequency of bowel movements: in children older than infancy, a period of more than 3 days without a bowel movement is one of the best indicators of this condition
- Consistency of stool is usually hard
- In severe constipation, stools may be very thick
- Pain on defecation
- Blood on stool
- Straining at stool
- Intermittent, crampy abdominal pain
- Constipation present since birth (in this situation, consider Hirschsprung's disease)
- Dietary history, specifically low fiber content (the best sources of fiber are whole wheat bread and flour, bran, whole grain cereals, vegetables and some fruits)
- Family history of constipation
- Drugs that are constipating (e.g., iron)
- Concurrent bladder incontinence or abnormal anal tone (neurologic)
- Hypothyroidism (dry skin, lethargy, slow growth of hair and nails)

PHYSICAL FINDINGS

- Assess height for short stature

Abdominal Examination

- Fecal masses can usually be felt along the descending colon or in the suprapubic area

Rectal Examination

- Rectum may be large, dilated and full of stool
- Normal tone of external sphincter
- Reflex contraction of anus on gentle scratching of the perianal skin with a sharp object (anal wink reflex)
- Anal placement should be midline and midway between posterior fornix and coccyx
- Evidence of precipitating event (e.g., anal fissure)

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

In infancy, the possibility of Hirschsprung's disease causes the greatest concern. This diagnosis is most likely in a baby who has been severely constipated from birth and in whom passage of meconium was delayed (i.e., >24 hours after birth). During rectal examination of a child with this disease, the examining finger can usually be inserted a long way before dilatation of the rectum is encountered; in contrast, in functional constipation, the rectum is dilated right down to the external sphincter. Occasionally, short-segment Hirschsprung's disease may present later in life as constipation.

COMPLICATIONS

- Overflow incontinence (encopresis) with fecal soiling (may be incorrectly characterized as diarrhea)
- Impaction with chronic dilatation
- Urinary tract infection with or without vesico-ureteral reflux
- Intestinal obstruction

Constipation also seems to be related to enuresis.

DIAGNOSTIC TESTS

- Check urine (culture and sensitivity) to exclude UTI, which can complicate chronic constipation

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Establish regular bowel function
- Rule out any underlying cause
- Prevent or treat complications
- Encourage wise use of laxatives, to prevent dependence on these drugs

Nonpharmacologic Interventions

Interventions depend on age and severity of constipation.

- Newborns: add brown sugar to formula or water (1 tsp in 4–8 oz. or 5 mL in 125–250 mL)
- Infants: as solid foods are introduced, gradually increase fruits and vegetables as proportion of the diet
- Older children: prunes or prune juice may be effective
- Increase dietary fiber if low
- Increase fluids

Client Education

- Explain pathophysiology to family (and child, if old enough): draw a diagram of GI system and explain how stool is formed and the mechanism of constipation.
- Encourage high-fiber diet. Most children eat a diet very low in fiber. A commitment on the part of the whole family is usually required to change this aspect of the diet. A good rationale for promoting a high-fiber diet for all family members is that high fiber intake may reduce the risk of cancer in later life and also smoothes out carbohydrate absorption.
- Stress importance of follow up.
- Educate about proper toilet training for toddlers: regular attempts just after meals, proper position (hips flexed, feet flat).

Pharmacologic Interventions

Medication is used only if organic pathology has been ruled out.

Infants (if distressed):

infant glycerin suppository (**A class drug**), 1.5 g; give one suppository and repeat as necessary

Older children:

magnesium hydroxide (Milk of Magnesia) (**A class drug**), 6.5–15 mL PO hs (2–6 years) or 15–30 mL PO hs (6–12 years)

or

mineral oil (**A class drug**), 5–20 mL PO hs

Limit the use of these agents to 3 or 4 days at most for acute constipation, unless complications such as encopresis are present.

Monitoring and Follow-Up

If you treat the child for acute functional constipation, reassess in 2 or 3 days to see if the condition has resolved.

Referral

The following factors may alert you to the need for referral:

- History: failure to pass meconium in the first 24 hours of life in an infant now presenting with difficulty passing stool
- Rectal examination: rectum empty, despite stool in colon (as revealed by abdominal exam)
- Abnormal size and location of anus (ectopic or imperforate)
- Abnormal findings on neurologic examination of the lower extremity
- Evidence of sexual abuse

The following factors may indicate the need for emergency medevac:

- Clinical indications of intestinal obstruction (e.g., vomiting, abdominal pain, decrease in bowel sounds)
- Clinical indications of Hirschsprung's disease (e.g., delayed passage of meconium at birth, fever, pain, distension, bloody diarrhea)
- Clinical indications of acute surgical abdomen (e.g., fever, abdominal tenderness, mass)

GASTROESOPHAGEAL REFLUX DISEASE (GERD)

DEFINITION

Physiologic or pathologic reflux of an abnormal quantity of gastric contents into the esophagus, which results in GI, respiratory or neurobehavioral manifestations.

The prevalence is unknown. In children, the peak age at onset is 1–4 months of age.

Physiologic Regurgitant Reflux

Reflux occurs occasionally in all infants and children, and brief episodes of reflux (small quantities) after meals are normal. It is important to differentiate physiologic from pathologic reflux.

Pathologic Regurgitant Reflux

Pathologic reflux differs from physiologic reflux in two ways:

- Abnormally large quantity of material refluxed
- High frequency or long duration of episodes (or both)

CAUSES

Disturbance of the normal functioning of the esophagus and related structures results in a defective anti-reflux barrier.

Gastric Dysfunction

- Large volume of gastric contents
- High abdominal pressure (because of obesity or tight clothes)

Dysfunction of Lower Esophageal Sphincter (LES)

- Transient relaxation of LES (major cause of reflux)
- Basal relaxation of LES (minor cause of reflux)

Esophageal Dysfunction

– Impairment of esophageal clearance of refluxate

Predisposing Factors

– Supine position
– Certain foods and medications *(see "Management," below, this section)*

HISTORY AND PHYSICAL FINDINGS

Infants

Gastrointestinal Manifestations

– Failure to thrive
– Malnutrition
– Esophagitis
– Feeding problems
– Irritability
– Hematemesis
– Anemia

Respiratory Manifestations

– Apnea (obstructive)
– Chronic cough
– Wheeze
– Pneumonia (chronic or recurrent)
– Cyanotic spells
– Others (e.g., stridor, hiccups, hoarseness)

Reflux with respiratory manifestations is more likely to be observed in association with certain disorders in both infants and children (e.g., esophageal atresia, cystic fibrosis, bronchopulmonary dysplasia and tracheo-esophageal fistula).

Neurobehavioral Manifestations

– Arching and stiffening of back
– Hyperextension of the neck or marked flexion of the neck to one side (torticollis)

Children and Adolescents

Gastrointestinal Manifestations (Esophagitis)

– Chest pain (heartburn)
– Dysphagia (difficulty swallowing)
– Halitosis (due to refluxate in mouth)
– Odynophagia (painful swallowing)
– Water brash (flow of sour saliva into mouth)
– Hematemesis
– Anemia (iron-deficient form)

Respiratory Manifestations

– Recurrent or chronic pneumonia
– Recurrent wheeze
– Chronic cough
– Others (e.g., stridor, hoarseness)

DIFFERENTIAL DIAGNOSIS

– Infection as a cause of vomiting (e.g., gastroenteritis)
– Neurologic problem (e.g., hydrocephalus, brain tumor)
– Metabolic problem (e.g. phenylketonuria, galactocemia)
– Food intolerance (e.g., milk allergy, celiac disease)
– Anatomic malformations (e.g., pyloric stenosis, esophageal atresia, intussusception)

COMPLICATIONS

– Esophagitis
– Esophageal stricture
– Failure to thrive
– Recurrent aspiration pneumonia
– Reactive airways disease, asthma
– Apnea, near-miss SIDS
– Anemia

DIAGNOSTIC TESTS

– Hemoglobin level (if there is a concern about anemia)
– Chest x-ray (if available), to rule out aspiration or recurrent pneumonia

MANAGEMENT

Goals of Treatment

– Eliminate detrimental effects of reflux (GI, respiratory and neurobehavioral manifestations)

Nonpharmacologic Interventions

Client Education

Discuss diagnosis with parents or caregiver and explain difference between physiologic and pathologic reflux.

Positioning

– Place child in upright positions
– Avoid supine or semi-seated position
– Elevation of head of bed onto 6-inch (15-cm) blocks may be useful

Feeding

- Thicken infant foods (add 1 tbsp [15 mL] dry rice cereal for each ounce of formula)
- Fasting for a few hours before child goes to sleep
- Avoid large meals (i.e., smaller but more frequent feedings)
- Diet for weight loss may be considered in an older child, if he or she is overweight or obese
- Avoid foods that decrease LES pressure or increase gastric acidity (e.g., carbonated drinks, fatty foods, citrus fruits, tomatoes)
- Avoid tight-fitting clothes
- Avoid exposure to tobacco smoke

Appropriate Consultation

Consult a physician in the following circumstances:

- You think that diagnostic tests are necessary to confirm the diagnosis, or you think that medications are needed
- Conservative measures fail to control reflux
- There is evidence of complications (e.g., failure to thrive)

Pharmacologic Interventions (for Older Children and Adolescents)

Medications for an infant or young child must be ordered by a physician.

The medications presented here are for older children and adolescents (≥12 years old).

Acid-Reducing Agents

Used more often in older children who have pain associated with esophagitis:

aluminum–magnesium–simethicone suspension (e.g., Mylanta) (**A class drug**), 0.5–1.0 mL/kg PO 3–6 times per day

Histamine Antagonists

cimetidine (Tagamet) (**C class drug**), 5–10 mg/kg PO qid

ranitidine (Zantac) (**C class drug**), 2 mg/kg PO tid

Prokinetic Agents

Mechanism of action of prokinetic agents is to raise the basal LES pressure, improve esophageal clearance and increase the rate of gastric emptying. Such an agent is usually started on a trial basis for 8 weeks.

dopamine antagonist (e.g., domperidone [Motilium]) (**B class drug**), as first-line therapy, before feeding

Monitoring and Follow-Up

Reassess monthly while the child is symptomatic. Watch carefully for signs of complications (e.g., failure to thrive, recurrent pneumonia, asthma, erosive esophagitis or anemia). Monitor growth and development, hemoglobin level and lung sounds.

Referral

Refer any infant with suspected GERD to a physician in the following situations:

- Simple measures fail to relieve the problem
- There are symptoms of complications (e.g., failure to thrive, recurrent pneumonia)

Surgery may be necessary in severe cases.

Indications for surgery:

- Failure of medical management
- Severe or intractable detrimental effects (e.g., failure to thrive, recurrent pneumonia, peptic stricture)
- Neurologically impaired children with or without gastrostomy tube

Prognosis

- Most infants with mild or moderate reflux become asymptomatic and can discontinue medical therapy by 1 year of age
- Of infants with severe reflux, 60% to 65% become asymptomatic without therapy by 2 years of age
- Children more resistant to complete resolution have good response to medical therapy but experience relapse when medications are discontinued

EMERGENCY PROBLEMS OF THE GASTROINTESTINAL SYSTEM

ABDOMINAL PAIN (ACUTE)

Abdominal pain is a common symptom in children. In very young children, it may be difficult to verify that the pain is abdominal, as the child cannot describe the pain. In younger children, abdominal pain may be a non-specific symptom of disease in almost any system. In older children, the symptoms become more specific, but can still be caused by a wide variety of more and less serious conditions.

Abdominal pain is often categorized as acute, chronic or recurrent. The latter is usually defined as pain that recurs at least monthly over a 6-month period. Pain that requires surgical intervention is almost always acute.

CAUSES

Infants

- Infant colic
- Hernia
- Intussusception (in children 3 months to 2 years old)
- Volvulus
- Duplication of bowel

Pre-school Children

- Pneumonia
- Hydronephrosis
- Pyelonephritis
- Appendicitis (especially in children ≥3 years old)
- Urinary tract infection

6–18 Years Old

- Appendicitis
- Mittelschmerz (pain at the midpoint of menstrual cycle, presumably related to ovulation)
- Tonsillitis
- Urinary tract infection
- Functional cause

HISTORY

Characteristics of Pain

Use the following mnemonic to characterize the pain:

- O for **onset**
- P for **progression**
- Q for **quality**
- R for **radiation**
- S for **site**
- T for **timing**
- A for **aggravating** factors and **associated** symptoms

Review of Systems and Medical History

- Respiratory system
- Urinary system
- Diet
- Sexual history (in female adolescents)
- Trauma
- Medications

PHYSICAL FINDINGS

- Temperature
- Heart rate
- Blood pressure
- Respiratory rate

General Observations

- Color
- Sweating
- Distress
- Facial expression

Abdominal Examination

- Abdominal distension (may be caused by organomegaly, infection, obstruction or ascites)
- Peristaltic waves present in obstruction (e.g., pyloric stenosis in small infants)
- Guarding with or without decrease in activity level
- Involuntary guarding
- Bowel sounds: high-pitched, rushing (may indicate obstruction) or absent (may indicate ileus)
- Tympany increased with severe distension or perforation
- Tenderness (generalized or localized)
- Muscle rigidity (voluntary or involuntary)
- Localized rigidity may indicate peritoneal irritation
- Masses, pulsation, hernia
- Rebound tenderness (pain on sudden release of palpation pressure) may indicate peritoneal irritation; cough or jumping also may elicit rebound tenderness
- Obturator sign (pain on internal and external rotation of hip)
- Psoas sign (pain on raising straight leg by means of obturator muscle) may indicate abscess
- Referred pain (pain felt in an area different from that palpated) may indicate site of lesion
- Board-like abdomen may indicate perforation
- Murphy's sign (pain in right upper quadrant when child is breathing in and examiner is applying pressure over the liver)
- Enlargement of liver or spleen
- Tenderness of costovertebral angle

Rectal Examination

- Indicated if you suspect a surgical problem (e.g., appendicitis)
- Feel for hard stool
- Palpate for tenderness in the area of the appendix

Pelvic Examination

- Bimanual pelvic exam (optional), to feel uterus and adnexa in sexually active adolescent females

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

The lists of causes given above are by no means comprehensive, but most of the urgent conditions are listed there. Once urgent conditions have been ruled out, the child can often be treated symptomatically until a physician has been able to make an assessment.

DIAGNOSTIC TESTS (IF AVAILABLE)

- Hemoglobin
- WBC count
- Urinalysis (for blood, protein, nitrates and WBCs)
- Pregnancy test for all reproductive-age females
- Chest x-ray (upright), to rule out pneumonia

MANAGEMENT

Specific management is based on the most likely cause of the abdominal pain.

Initial Decision

Decide whether to admit and observe, discharge, or refer for surgical opinion.

Goals of Treatment

- Identify or rule out urgent causes of pain
- Refer child with an urgent cause to a center where surgery is available
- Treat treatable conditions
- Provide relief and reassurance for conditions that are not serious

Appropriate Consultation

Consult a physician if the diagnosis is unclear, if the presentation looks at all serious (e.g., surgical abdomen) and before administering any analgesia.

Nonpharmacologic Interventions

- Give nothing by mouth until the diagnosis is clear
- Insert nasogastric tube if there is vomiting, bleeding or suspected bowel obstruction
- Insert Foley catheter as necessary

Adjuvant Therapy

- Start IV therapy with normal saline
- Determine expected fluid losses and current level of hydration, and hydrate accordingly

Pharmacologic Interventions

Unless the diagnosis is clear, do not administer any analgesia until you have consulted a physician.

Although classic surgical teaching has been that medication for pain may confuse the diagnosis of abdominal pain in the emergency setting, this is not supported by the literature. In fact, if anything, the diagnosis may be clarified by pain relief, which may result in fewer unnecessary surgical procedures.

Monitoring and Follow-Up

Monitor pain, ABCs, vital signs and any associated fluid losses closely. Serial exams over a few hours may clarify the diagnosis.

Referral

Medevac for evaluation if the diagnosis is uncertain and the child's condition warrants urgent evaluation.

Keep child under observation if you are unsure of the diagnosis. For any child with acute abdominal pain who has been sent home, the parents or caregiver should be warned that it is difficult to diagnose appendicitis early in the course of this condition and that if the pain increases in severity or becomes constant or fixed in one spot (especially the right lower quadrant), they should bring the child back to the clinic.

APPENDICITIS

DEFINITION

Inflammation of appendix.

This condition is rare in children <3 years old. It can be very difficult to diagnose, especially in younger children. Therefore, the index of suspicion should be high.

CAUSE

Obstruction of the opening of the appendix by stool. Infection may occur later.

HISTORY

The following outlines the classic pattern of acute appendicitis. However, in younger children, this history is less likely. If the child is older and has a retrocecal or retroperitoneal appendix, the presentation may be confusing, with pain radiating to the back or bladder, or the presence of bowel irritation.

- Vague, diffuse periumbilical or epigastric pain
- Pain shifts within hours to right lower quadrant
- Anorexia
- Nausea
- Vomiting usually occurs a few hours after onset of pain, but may not be present
- Low-grade fever may be present
- Urinary frequency, dysuria and diarrhea may develop if tip of appendix irritates the bladder or bowel
- In adolescent girls, date of most recent normal menstrual period and any recent menstrual irregularity should be noted

PHYSICAL FINDINGS

Presentation is variable, depending on whether the child presents early or late in the evolution of the disease process.

- Temperature mildly elevated
- Tachycardia (although heart rate may be normal in early stages)
- Most children are pale and appear to be in pain
- Variable level of distress
- Body position and gait are useful in diagnosis: in many full-blown cases, the child is bent over and experiences pain on movement or avoids any movement or activity

Abdominal Examination

- Bowel sounds variable: hyperactive to normal in early stages, reduced to absent in later stages
- Localized tenderness in right lower quadrant
- Muscle guarding in right lower quadrant
- Rebound tenderness may be present
- Psoas stretch test positive

Another test for peritoneal irritation is to have the child jump off the examining table. If the child can do this without pain, he or she probably does not have appendicitis.

Rectal Examination

- Tenderness in right lower quadrant if tip of appendix is near the rectum

DIFFERENTIAL DIAGNOSIS

Appendicitis is known as the “great mimic.” The actual signs and symptoms depend on the location of the appendix within the abdomen.

- Gastroenteritis
- Crohn’s disease
- Stone in ureter
- Mittelschmerz
- Ruptured follicular cyst
- Ectopic pregnancy
- Pelvic inflammatory disease
- Twisted ovarian cyst
- Pyelonephritis
- Biliary colic
- Cholecystitis

COMPLICATIONS

- Abscess
- Localized peritonitis
- Perforation
- Generalized peritonitis
- Sepsis

DIAGNOSTIC TESTS

- WBC count (if available)
- Urinalysis

MANAGEMENT

Goals of Treatment

- Maintain hydration
- Prevent complications

Appropriate Consultation

Consult a physician as soon as possible.

Nonpharmacologic Interventions

- Bed rest
- Nothing by mouth
- Insert a nasogastric tube if abdomen is distended

Adjuvant Therapy

- Start IV therapy with normal saline
- Adjust IV rate according to age and state of hydration

Pharmacologic Interventions

Although classic surgical teaching has been that medication for pain may confuse the diagnosis of abdominal pain in the emergency setting, this is not supported by the literature. In fact, if anything, the diagnosis may be clarified by pain relief, which may result in fewer unnecessary surgical procedures. Nonetheless, do not administer analgesia until you have consulted a physician.

If the diagnosis is clear, the physician may recommend that broad-spectrum antibiotics be started before transport to hospital. For example, for suspected gangrenous or perforated appendix:

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q6h, IV

and

gentamicin (Garamycin) (**B class drug**), 7.5 mg/kg per day, divided q8h, IV

and

clindamycin phosphate (Dalacin-C) (**B class drug**), 40 mg/kg per day, divided q6–8h, IV

Monitoring and Follow-Up

Monitor vital signs and general condition frequently.

Referral

Medevac as soon as possible; surgical consultation is required.

BOWEL OBSTRUCTION

DEFINITION

Blockage of small or large bowel. Most common in newborns. Less common in older children, unless they have a specific risk factor.

CAUSES

Newborns

- Atresia: duodenal (often associated with Down's syndrome), jejunal or ileal
- Imperforate anus
- Malrotation
- Duplication of bowel
- Volvulus

Infants

- Atresia: duodenal (often associated with Down's syndrome), jejunal or ileal
- Imperforate anus
- Malrotation
- Duplication of bowel
- Volvulus
- Pyloric stenosis
- Post-surgical adhesions
- Intussusception (most common in children 3 months to 2 years of age)

Older Children

- Post-surgical adhesions
- Intussusception (unusual but possible)
- Malrotation
- Duplication of bowel
- Tumor

HISTORY

- Vomiting: often with sudden onset; may be stained with bile if obstruction is below ligament of Treitz; may be projectile if obstruction is high in the GI tract; may be stained with feces if obstruction is very low in the GI tract
- Diarrhea: bloody or color of red currant jelly (indicates intussusception)
- Abdominal pain: severe and initially crampy
- Bowel movements decreased or absent
- Abdominal distension
- History of GI surgery
- History of similar pain

PHYSICAL FINDINGS

- General observations of color, hydration and facial expression
- Temperature normal or mildly elevated
- Tachycardia
- Blood pressure normal, unless child is in shock
- Capillary refill normal, unless child is in shock

Abdominal Examination

- Abdominal distension, unless the obstruction is located very high in the GI tract
- Peristaltic waves may be visible
- Bowel sounds may be increased in early stages and disappear later
- Diffuse tenderness
- Shifting dullness can help to distinguish distension caused by ascites from obstruction

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

COMPLICATIONS

- Perforation
- Peritonitis
- Strangulation of bowel segment
- Sepsis
- Hypotension, shock
- Death

DIAGNOSTIC TESTS

- Examination of stool for occult blood
- Urinalysis

MANAGEMENT

Goals of Treatment

Treatment is directed to cause and is thus usually surgical.

- Relieve distension
- Maintain hydration
- Prevent complications

Appropriate Consultation

Consult a physician and prepare to medevac.

Adjuvant Therapy

- Start a large-bore IV (14- or 16-gauge) with normal saline
- Give enough fluid for maintenance or more, according to state of hydration
- If there is evidence of hypovolemia or shock, give a bolus of IV fluid (20 mL/kg) over 20 minutes; repeat as necessary until hypovolemia is corrected (up to three times in 1 hour)

See "Shock," in chapter 20, "General Emergencies and Major Trauma."

Nonpharmacologic Interventions

- Bed rest
- Nothing by mouth
- Insert a nasogastric tube and attach to low suction or to straight drainage
- Insert urinary catheter; measure hourly urinary output

Pharmacologic Interventions

Analgesia may be necessary or prudent if transfer is delayed. Discuss with a physician first.

meperidine (Demerol) (**D class drug**), dosage depending on age and weight of child

Monitoring and Follow-Up

Monitor ABCs, vital signs, intake and output, abdominal findings and general condition frequently while awaiting transfer.

Referral

Medevac as soon as possible.

INTUSSUSCEPTION

DEFINITION

Telescoping of one section of bowel into another. In children, the most common form of intussusception is prolapse of the terminal ileum into the colon. (Some clinicians suspect that this is less common in Aboriginal children, but there is no proof of such a difference.)

CAUSE

Unknown.

HISTORY

- Usually starts with crampy abdominal pain, which is manifested as regular, intermittent episodes of colic during which the baby draws his or her feet up to the knee–chest position
- Vomiting
- "Currant jelly" stool: almost pathognomonic when present
- Other signs of obstruction, including abdominal distension, may be present
- Lethargy: may become extreme, very similar to coma

PHYSICAL FINDINGS

- Vital signs usually normal in the early stages

Abdominal Examination

- Careful palpation may reveal an empty feeling in the right lower quadrant and a sausage-shaped mass in the area of the transverse colon

Rectal Examination

- May reveal bloody or currant jelly stool

DIFFERENTIAL DIAGNOSIS

- Infection
- Parasitic infestation (e.g., *Enterobius*)
- Tumor
- Hirschsprung's disease (congenital megacolon)
- Obstruction of the bowel
- Meckel's diverticulum
- Incarcerated hernia
- Malrotation of the gut with incarceration

In children who are extremely lethargic, a clinical history, physical examination and high index of suspicion are needed to rule out conditions such as meningitis, various metabolic conditions, enterocolitis caused by coxsackievirus and trauma.

COMPLICATIONS

- Bowel necrosis
- GI bleeding
- Bowel perforation
- Sepsis
- Shock

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Identify the condition early (keep a high index of suspicion)
- Maintain hydration
- Prevent complications

Appropriate Consultation

Consult a physician and prepare to medevac.

Adjuvant Therapy

- Start IV therapy with normal saline and run at a rate sufficient to maintain hydration
- If there is evidence of hypovolemia or shock, give a bolus of IV fluid (20 mL/kg) over 20 minutes; repeat as necessary until hypovolemia is corrected (up to three times in 1 hour)

See "Shock," in chapter 20, "General Emergencies and Major Trauma."

Nonpharmacologic Interventions

- Nothing by mouth
- Insert nasogastric tube

Pharmacologic Interventions

None.

Monitoring and Follow-Up

Monitor ABCs, vital signs, intake and output, and abdominal findings frequently while awaiting transfer.

Referral

- Once this diagnosis is suspected, the child must be transferred to a center where pediatric surgery and radiology can be carried out.
- If the intussusception has been present for less than 18 hours and there is no free air on x-ray of the abdomen, a barium enema with hydrostatic pressure can be attempted to reduce the intussusception. This procedure is successful in up to 70% of cases and avoids the need for a surgical procedure.
- If the attempted reduction of the intussusception is unsuccessful or if there appears to be a lead point (e.g., tumor), surgery is required immediately.

CHAPTER 13 — GENITOURINARY SYSTEM

Table of Contents

For more information on the history and physical examination of the genitourinary system in older children and adolescents, see chapter 6, "Urinary and Male Genital Systems," and chapter 13, "Women's Health and Gynecology," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

For **balanitis** and **testicular torsion** (a medical emergency), clinical presentation and management are the same in adults and children. For information on these conditions, see chapter 6, "Urinary and Male Genital Systems," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ASSESSMENT OF THE GENITOURINARY SYSTEM

GENERAL

The genitourinary (GU) system may be affected by infection, external problems, congenital abnormalities and diseases of the kidneys. Some of the more common problems are discussed below.

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

The following symptoms are those most commonly associated with urinary tract infection (UTI) in children:

- Fever
- Unexplained crying
- Holding of genitals
- Enuresis (bed-wetting)
- Constipation (chronic)
- Toilet-training problems
- Dysuria
- Frequency
- Urgency
- Change in color of urine
- Abdominal pain and back pain
- Scrotal or groin pain, vaginal discharge
- Genital sores, swelling, discoloration

The following symptoms are associated with nephrotic syndrome and glomerulonephritis:

- Swelling (e.g., ankles, around eyes)
- Headaches
- Nosebleeds (an occasional symptom of hypertension, but nosebleeds also occur frequently in normal children)
- Hematuria
- Decreased urinary output

A complete history of the GU system should include questions related to the following topics:

- Sexual activity (for adolescents)
- Problems related to inappropriate touching by others (i.e., sexual abuse)

Children must be asked such questions with sensitivity and without the use of leading questions. The parents or caregiver can be asked about these topics directly.

PHYSICAL EXAMINATION

VITAL SIGNS

- Temperature
- Heart rate
- Blood pressure

URINARY SYSTEM (ABDOMINAL EXAMINATION)

For full details, see "Examination of the Abdomen," in chapter 12, "Gastrointestinal System."

Inspection

- Check specifically for any abdominal distension (a sign of ascites)
- Masses
- Asymmetry

Percussion

- Liver span (may be increased in glomerulonephritis)
- Ascites (dull to percussion in flanks when child is supine; location of dullness shifts when child changes position)
- Tenderness over costovertebral angle

Palpation

- Size of liver and any tenderness because of congestion
- Kidneys are often palpable in infants, the right kidney being most easily "captured"; perform deep palpation to determine kidney size and tenderness (place one hand under the back and the other hand on the abdomen to try to "capture" the kidney between the hands)

MALE GENITALIA

Perform examination with the child supine and, if possible, in the standing position.

Penis

Inspection

- Position of urethra (e.g., epispadias, hypospadias)
- Discharge at urethra (sign of urethritis)
- Inflammation of foreskin or head of penis (sign of balanitis)

Palpation

- Foreskin adherent at birth
- In 90% of uncircumcised male children, the foreskin becomes partially or fully retractable by 3 years of age
- Inability to retract foreskin (phimosis)
- Inability of retracted foreskin to return to normal position (paraphimosis)

Scrotum and Testicles

Inspection

- Scrotum may appear enlarged
- Check for edema (a sign of glomerulonephritis), hydrocele (transillumination should be possible), hernia or varicocele

Palpation

- Cremasteric reflex (absent in testicular torsion)
- Testicular size, consistency, shape and descent into scrotum
- Testicular tenderness: consider torsion or epididymitis (pain is actually in the epididymis, not the testicle)
- Swelling in inguinal canal: consider hernia or hydrocele of spermatic cord

For information about examining the adolescent male, see "Physical Examination of the System," in chapter 6, "Urinary and Male Genital Systems," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

FEMALE GENITALIA

- Child should be in supine frog-leg position for examination
- Do not perform an internal vaginal examination in a prepubescent child or an adolescent who is not sexually active
- Spread labia by applying gentle traction toward examiner and slightly laterally to visualize introitus

Inspection

- Vulvar irritation
- Erythema (in prepubescent girls, the labia normally appears redder than in adult women, because the tissue is thinner)
- Urethral irritation (sign of UTI)
- Vaginal discharge (may indicate vaginitis or sexual abuse)
- Bleeding (may indicate vaginitis or sexual abuse in a prepubescent girl)
- Enlargement of vaginal orifice (may indicate sexual abuse)

For information about examining the adolescent female, see "Examination of the Female Reproductive System," in chapter 13, "Women's Health and Gynecology," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

COMMON PROBLEMS OF THE GENITOURINARY SYSTEM

URINARY TRACT INFECTION (UTI)

DEFINITION

Bacterial invasion of the GU tract with resulting infection.

- *Cystitis:* infection affecting only the lower GU tract (e.g., the bladder)
- *Pyelonephritis:* ascending infection involving the upper GU tract (e.g., the ureters and kidneys)

UTI is the most common genitourinary disease in children. It occurs more frequently in girls than in boys, except in infancy. In fact, UTI is unusual in boys, and further investigation of the GU tract is appropriate when it occurs.

CAUSES

Bacterial invasion by one of the following organisms:

- *Escherichia coli*
- *Klebsiella*
- Enteric *Streptococcus*
- *Staphylococcus*
- *Proteus*
- Predisposing factors: congenital GU tract abnormalities (e.g., short urethra), although most children with UTI have normal GU tract; perineal fecal contamination because of inadequate hygiene; infrequent voiding; perianal infections; sexual activity

HISTORY

The history depends on the child's age.

Neonates and Infants

- Primarily non-specific, non-urinary symptoms
- May present with septicemia
- Fever
- Irritability ("colic")
- Poor feeding
- Vomiting, diarrhea
- Jaundice (particularly in neonates)
- Hypothermia
- Failure to thrive
- Decreased activity, lethargy

Younger Children (£3 Years Old)

- More abdominal complaints than GU complaints
- Fever
- Abdominal pain
- Vomiting
- Frequency, urgency, dysuria, enuresis, strong-smelling urine
- Urinary retention

Older Children (>3 Years)

- Frequency
- Dysuria
- Urgency
- Enuresis
- Flank or back pain (this probably indicates pyelonephritis, not cystitis)
- Fever
- Vomiting

PHYSICAL FINDINGS

- Fever (may be absent in simple cystitis)
- Suprapubic tenderness (in cystitis)
- Tenderness of abdomen, flank and costovertebral angle (more likely with pyelonephritis)

Be sure to assess hydration status.

DIFFERENTIAL DIAGNOSIS

Distinguish between cystitis and pyelonephritis.

Infection of the Lower GU Tract

- Urethral irritation (e.g., bubble bath)
- Urethral trauma
- Diabetes mellitus
- Masses adjacent to bladder

Infection of the Upper GU Tract

- Gastroenteritis
- Pelvic inflammatory disease (PID)
- Tubo-ovarian abscess
- Appendicitis
- Ovarian torsion

COMPLICATIONS

- Recurrent UTI
- Sepsis, especially in neonates and infants <6 months of age
- Renal damage leading to adult hypertension, renal failure

DIAGNOSTIC TESTS

Urinalysis for routine and microscopy (midstream specimen for children, catheter specimen for infants):

- WBCs
- Bacteriuria
- Some hematuria (blood in urine)
- Positive for nitrates (although UTI can occur with organisms that do not produce nitrate)

Urine for culture and sensitivity:

- Preferable to use first morning specimen
- If multiple organisms present on culture, suspect contamination, not true infection

MANAGEMENT

Lower GU infections (e.g., cystitis) are generally less severe and can be managed safely on an outpatient basis. Pyelonephritis is more severe and may require hospital care for IV antibiotics. The decision about hospitalization depends on the child's age and the severity of the clinical condition.

Goals of Treatment

- Relieve infection
- Prevent recurrence
- Identify underlying factors

Appropriate Consultation

Consult a physician for any of the following:

- Neonatal infections, for which medevac is required; these are often associated with bacterial sepsis, so more aggressive treatment is needed
- Suspected pyelonephritis, for which child may be admitted to hospital (depends on age and severity of illness)

CYSTITIS

Nonpharmacologic Interventions

- Increased rest if febrile
- Increased oral fluids

Pharmacologic Interventions

Do not treat as UTI unless results of urine dipstick are indicative of such a diagnosis (e.g., positive for nitrates or WBCs).

Antibiotics:

amoxicillin (Amoxil) (**A class drug**), 100 mg/kg per day, divided tid, PO for 10 days

or

sulfamethoxazole– trimethoprim (Septra) (**A class drug**), 5–10 mg/kg per day, divided bid, PO for 7–10 days

PYELONEPHRITIS (SUSPECTED)

Adjuvant Therapy

- IV therapy with normal saline may be necessary for children with pyelonephritis (before transfer)
- Run at a rate sufficient to maintain hydration

Pharmacologic Interventions

IV antibiotics may be started before transfer, on the advice of a physician:

ampicillin (Ampicin) (**D class drug**), 200 mg/kg per day, divided q6h, IV

and

gentamicin (Garamycin) (**B class drug**), 2.5 mg/kg per dose tid

Monitoring and Follow-Up

- If treating as an outpatient, follow up in 24–48 hours. Check sensitivity of organisms to antibiotics when urine cultures are available.
- If no response to oral antibiotics after 48–72 hours or if symptoms are deteriorating, consult with a physician about changing the antibiotic or the need for IV antibiotic therapy
- Perform follow-up urinalysis and culture 1 week after completion of treatment and then monthly for 3 months (if anatomy of the GU tract is normal)

Referral

- Medevac all neonates
- Older infants and children with suspected pyelonephritis may require medevac, depending on their age and clinical condition
- Refer to a physician (for evaluation) any child with culture-proven UTI who has been treated on an outpatient basis

Radiologic evaluation may be indicated in any girl who has had more than two or three culture-proven lower UTIs, in any boy who has had one culture-proven lower UTI and in any child who has had pyelonephritis; such evaluation includes renal ultrasonography and voiding cystourethrography (VCUG).

HYDROCELE (PHYSIOLOGIC)

DEFINITION

In infant boys, a mild scrotal swelling, resulting from a collection of fluid around the testicle (unilateral or bilateral). It may be confused with a groin node. Usually present from birth and usually due to patency of the processus vaginalis.

Occurs only rarely in infant girls, in whom it presents as a firm swelling in the groin.

CAUSE

Unknown.

HISTORY

- Painless swelling in scrotum, of variable size
- Congenital or acquired
- Most cases resolve by age 1 year
- Swelling may fluctuate in size

PHYSICAL FINDINGS

- Should be able to palpate an upper border of the swelling
- Testis is usually felt behind the mass, but may be difficult to feel
- Transillumination of the swelling should be possible
- Inguinal hernia may also be present

Hydrocele of the spermatic cord may also be seen:

- Painless cystic swelling along the inguinal canal
- Swelling may transilluminate

DIFFERENTIAL DIAGNOSIS

- Enlargement of groin node
- Inguinal hernia
- Trauma
- Cystic lesion
- Hematoma
- Neoplasm

COMPLICATIONS

- Slight increase in risk of inguinal hernia

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Observe until condition resolves spontaneously or surgical referral becomes necessary

Appropriate Consultation

Consult physician in the following circumstances:

- Diagnosis is unclear
- There are signs of complications (e.g., infection)
- There is an associated inguinal hernia

Nonpharmacologic Interventions

- Explain to parents or caregiver the pathophysiology of the defect
- Reassure the parents or caregiver
- Advise parents or caregiver to return to the clinic if the mass enlarges

Monitoring and Follow-Up

Reassess every 3 months until resolution occurs or referral becomes necessary.

Referral

Referral to a physician may be necessary if there are signs of complications (e.g., if there is an associated inguinal hernia) or resolution does not occur when expected (by 1 year of age).

Surgical treatment is considered in the following circumstances:

- No signs of resolution by age 1 year
- Hernias are associated with the hydrocele

PREPUBESCENT VAGINAL DISCHARGE

For vaginal discharge in adolescents, see "Vulvovaginitis," in chapter 13, "Women's Health and Gynecology," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

DEFINITION

Physiologic discharge:

- Mucoid
- Non-malodorous
- Seen in newborns and premenarchal girls (Tanner stage II and III); *(for definition of Tanner stages, see "Puberty," in chapter 19, "Adolescent Medicine"*)
- Normal vaginal secretions are often increased midcycle in adolescents

Any other discharge is a symptom of underlying problems.

Vaginal discharge is uncommon in girls <9 years old.

CAUSES AND ASSOCIATED ORGANISMS

- Poor hygiene (*Escherichia coli*)
- Autoinoculation from associated URTI (*Hemophilus influenzae*, group B *Streptococcus*) or skin infections (*Staphylococcus*)
- Pinworms (*E. coli*)
- Foreign body (associated with *E. coli*)
- Specific infection: *Candida*, *Chlamydia*, *Neisseria gonorrhoeae*, *Trichomonas* (uncommon), bacterial vaginosis

If *N. gonorrhoeae* or *Chlamydia* is the cause of the discharge and the child is underage for consensual sex (i.e., <14 years), sexual abuse must be considered.

HISTORY

- Various degrees of perineal discomfort or itching
- Dysuria
- Frequency
- Associated illnesses (e.g., URTI, skin problems, pinworms)
- Hygiene
- Possible sexual abuse

PHYSICAL FINDINGS

Do not perform a vaginal speculum examination.

- Suboptimal general or perineal hygiene
- Signs of URTI or skin disease

Labial Irritation

- Consider problems with perineal hygiene
- *Candida*
- Sexual abuse

Marked Erythema

- Consider *Candida*

Vaginal Discharge

- May be fairly non-specific
- Thick, white, cheesy: *Candida*
- Frothy, green: *Trichomonas*

Foreign Body

- May be visualized better if child is in knee–chest position
- May be able to palpate a foreign body while doing a rectal examination

DIFFERENTIAL DIAGNOSIS

Non-infectious

- Poor hygiene
- Chemical irritation (e.g., from bubble bath)
- Foreign body
- Trauma

Infectious

- Group A *Streptococcus* infection
- Non-specific bacterial infection
- Pinworms
- *Candida* (less common)
- STD (consider sexual abuse)

COMPLICATIONS

The complications depend on the underlying cause.

- Localized perineal irritation
- UTI
- Abdominal pain (with pinworms or UTI)
- Vaginitis
- Bleeding (from trauma)

DIAGNOSTIC TESTS

If child is cooperative, attempt to swab vaginal orifice (using small Calgi I swab); avoid touching the hymenal edge. Swab for *Chlamydia*, *N. gonorrhoeae*, culture and sensitivity, and hanging drop, in that order.

MANAGEMENT

Management depends on cause.

Goals of Treatment

- Identify and correct underlying cause

Appropriate Consultation

Consult a physician if child is febrile or has abdominal pain, or if you suspect sexual abuse.

If the child is <14 years old and there was sexual activity involving an adult partner, the legal definition of sexual abuse specifies that legal (e.g., police) and child protection authorities must be notified.

Nonpharmacologic and Pharmacologic Interventions

For Poor Hygiene

- Improve perineal hygiene (e.g., use of clean cotton panties, frequent changing of underwear)
- Avoid bubble baths
- Wipe from front to back, but avoid scrubbing genitalia

For Foreign Body

In an older child who can cooperate, remove the foreign body, if possible; otherwise consult a physician about removal.

Give:

amoxicillin (Amoxil) (**A class drug**), 40 mg/kg per day, divided tid, PO for 7–10 days while awaiting removal of foreign body

For Pinworms

See "Pinworms," in chapter 18, "Communicable Diseases."

For Candidal Infection

nystatin cream (Mycostatin) (**A class drug**), PV od for 6 days

For Trichomonal Infection

metronidazole (Flagyl) (**A class drug**), 1–2 g PO stat

For Bacterial Vaginosis

metronidazole (Flagyl) (**A class drug**), 1–2 g PO stat

For Sexually Transmitted Disease

Consult a physician if you suspect an STD in a preadolescent child. Refer to and follow the *Canadian STD Guidelines* (Health Canada 1998).

If the cause of the discharge is uncertain, send samples for culture (according to child's age), as above, and treat with amoxicillin (Amoxil) pending results of culture.

Report as suspected sexual abuse all cases of gonorrhea and *Chlamydia* infection in girls <14 years old who have been sexually active with an adult (in accordance with the legal definition of sexual abuse). Other cases of vaginitis may be reportable, depending on the circumstance.

GLOMERULONEPHRITIS

DEFINITION

Disease in which there is immunologic or toxic damage to the glomerular apparatus of the kidneys. It can occur acutely, or it may have a chronic or insidious onset.

Some types of g lomerulonephritis are self-limiting, and others may go on to cause permanent kidney damage.

The most common type in northern Canada is post-streptococcal glomerulonephritis, described below. Any suspected glomerulonephritis should be fully investigated.

CAUSES

- Usually secondary to previous streptococcal infection (e.g., of the throat or skin)
- Follows pharyngitis by 1–3 weeks
- Lag time after skin infections is variable, but most frequently 1–2 weeks

HISTORY

- Acute onset
- Usually history of pharyngitis or impetigo about 10 days before the abrupt onset of dark urine
- Acute phase lasts about 1 week

Systemic Symptoms

- Anorexia
- Abdominal pain
- Fever
- Headaches
- Lethargy
- Fatigue, malaise
- Weakness
- Rash, impetigo
- Joint pain
- Weight loss

PHYSICAL FINDINGS

The physical findings are variable and may include the following:

- Edema (in about 75% of cases)
- Hypertension (in about 50% of cases)
- Hematuria (two-thirds of children have gross hematuria)
- Proteinuria
- Oliguria
- Renal failure (to variable degree)
- Congestive heart failure
- Encephalopathy (rare)

Edema, hypertension and hematuria are the most common and most worrisome symptoms.

DIFFERENTIAL DIAGNOSIS

- Other forms of glomerulonephritis, which have many similar features (distinguished by laboratory tests, renal biopsy and other diagnostic methods)
- Acute hemorrhagic cystitis (no edema, hypertension, renal failure; does involve dysuria, frequency, urgency)
- Acute interstitial nephritis

COMPLICATIONS

- Acute renal failure
- Congestive heart failure
- Hyperkalemia
- Hypertension
- Chronic renal failure

DIAGNOSTIC TESTS

The diagnosis is made on a clinical basis and is confirmed by the following tests:

- Urinalysis (hematuria, proteinuria)
- Hemoglobin decreased (mild anemia), WBC count increased
- Recent throat swab positive for *Streptococcus* A infection

MANAGEMENT

Goals of Treatment

- Prevent, if possible, by early treatment of all streptococcal infections (skin and pharyngeal)
- Prevent or treat complications

Appropriate Consultation

Consult a physician immediately if you suspect this disorder.

Nonpharmacologic Interventions

While awaiting transfer:

- Bed rest
- Fluid restriction (to 60 mL/kg per day + urine losses)

Pharmacologic Interventions

None, unless complications develop. Treat complications **only** on physician's instruction.

Monitoring and Follow-Up while Awaiting Transfer

- Fluid restriction (to 60 ml/kg per day + urine losses)
- Monitor blood pressure and vital signs
- Monitor intake and output
- Watch for major life-threatening problems, such as acute renal insufficiency with electrolyte abnormalities, fluid overload, pulmonary edema, congestive heart failure, acute hypertension

Monitoring and Follow-Up over the Long Term

- Will depend on cause and type of condition
- Post-streptococcal glomerulonephritis usually has no long-term sequelae, but other types of glomerulonephritis may have long-term complications, including recurrence and chronic renal failure
- Consulting specialist will provide instructions for surveillance

Referral

Medevac.

BALANITIS

See "Balanitis," in chapter 6, "Urinary and Male Genital Systems," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

EMERGENCY PROBLEMS OF THE MALE GENITAL SYSTEM

TESTICULAR TORSION

See "*Testicular Torsion*," in chapter 6, "*Urinary and Male Genital Systems*," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

CHAPTER 14 — MUSCULOSKELETAL SYSTEM

Table of Contents

For detailed information on the clinical presentation, assessment and management of other musculoskeletal problems occurring in children, see chapter 7, "Musculoskeletal System," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ASSESSMENT OF THE MUSCULOSKELETAL SYSTEM

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

History varies with age and type of condition.

GENERAL

The following characteristics of each symptom should be elicited and explored:

- Onset (sudden or gradual)
- Acuity or chronicity (subacute, acute or chronic)
- Chronology
- Location
- Radiation
- Quality
- Timing (frequency, duration)
- Whether intermittent or constant
- Severity
- Precipitating and aggravating factors
- Relieving factors
- Associated symptoms
- Effects on daily activities and play
- Previous diagnosis of similar episodes
- Previous treatments
- Efficacy of previous treatments
- Ask about fever

BONES AND JOINTS

- Pain
- Swelling
- Redness
- Heat
- Stiffness
- Time of day when symptoms are most bothersome
- Relation of symptoms to movement
- Limitation of movement
- Change of gait (e.g., limp)
- Deformity
- Extra-articular findings (e.g., rash)
- Trauma (obtain accurate description of exact mechanism of injury)

MUSCLES

- Pain
- Weakness
- Wasting
- History of previous injuries and treatment received

NEUROVASCULAR STRUCTURES

- Paresthesia
- Paresis
- Paralysis
- Skin: look for signs of physical abuse (e.g., bruises, welts, cigarette burns)

FUNCTIONAL ASSESSMENT

- Inability or refusal to use limb or to bear weight (especially in a young child)
- Self-care deficits (e.g., in bathing, dressing, toileting, grooming)
- Mobility and use of mobility aids

MEDICAL HISTORY (SPECIFIC TO MUSCULOSKELETAL SYSTEM)

- Recent infection, such as URTI (may be associated with septic arthritis)
- Recent immunization (specifically if vaccine was administered in a limb)
- Previous trauma (to bones, joints, ligaments)
- Arthritis (juvenile rheumatoid arthritis)
- Recent immobilization of an extremity
- Medications (e.g., those used to treat musculoskeletal symptoms)
- Obesity

FAMILY HISTORY (SPECIFIC TO MUSCULOSKELETAL SYSTEM)

- Rheumatoid arthritis
- Diabetes mellitus
- Lupus erythematosus

PERSONAL AND SOCIAL HISTORY (SPECIFIC TO MUSCULOSKELETAL SYSTEM)

- Absenteeism from school (multiple days)
- Sports activities (e.g., contact sports involving repetitive motion)
- Risk behaviors for injuries, especially in adolescents (e.g., snowmobiling, illicit drug use, alcohol abuse [specifically drinking and driving])
- Dietary calcium and vitamin D intake
- Smoking
- Exercise habits

PHYSICAL EXAMINATION

Although the musculoskeletal and neurologic systems *(see chapter 15, "Central Nervous System")* are discussed separately in this set of guidelines, they are usually examined together.

VITAL SIGNS

- Temperature may be elevated in inflammatory or infectious disease
- Tachycardia from pain or shock if major trauma is involved
- Blood pressure normal, unless child is in shock from major trauma

INSPECTION

The inspection is perhaps the most important part of the exam, so take your time.

- Apparent state of health (child may look acutely ill)
- Appearance of comfort or distress
- Child may look acutely ill because of an infectious or inflammatory process
- Distress (related to pain) is usually evident if there is an infectious, inflammatory or fracture-related cause
- Significant trauma to an extremity may result in shock-like appearance
- Color (e.g., flushed, pale)
- Nutritional status (obese or emaciated)

Observe:

- Mobility
- Gait and posture
- Presence of limp or unwillingness to bear weight

Determine ability to perform activities of daily living (e.g., sitting, standing, walking, dressing, playing).

Compare corresponding paired joints and bones for the following characteristics.

Swelling:

- Around joint area (may indicate arthritis: chronic, acute or infectious)
- Over bony area (may indicate trauma, fracture or tumor)
- In soft tissue (may indicate trauma or infection)

Redness:

- Implies inflammatory process or infection
- Note any induration and extent of redness
- Rash

PALPATION

- Swelling and induration (e.g., tissues feel tense, "boggy")
- Presence of heat implies inflammatory process or infection (if an area feels hot to the touch, compare with uninvolved joints or skin)
- Subcutaneous nodules
- Swelling around joints (may indicate joint effusion or infection)
- Crepitus may be palpable with joint movement or in soft tissue overlying bony fractures
- Range of motion of joints (active and passive)
- Resistance to or pain on movement of joint
- Degree of joint movement achieved
- Stability and integrity of ligaments
- Tendon function

NEUROVASCULAR FUNCTION

- Pallor
- Limb temperature (especially coolness)
- Paresthesia
- Peripheral pulses
- Paralysis

COMMON PROBLEMS OF THE MUSCULOSKELETAL SYSTEM

LIMB PAIN

Often presents as an alteration of activity or gait or an unwillingness to bear weight or use a limb.

The affected joint may not be the one the child complains about; for example, pain may be referred from disease of the hip joint to the knee, and the child presents with knee pain.

HISTORY

- Trauma: acute or subacute
- Infection (pain may be related to URTI or skin infection)
- Distress variable, from significant (as in septic arthritis) to mild (as in chronic juvenile rheumatoid arthritis, in which stiffness is predominant)
- Fever (high in cases of septic joints)
- Variable degree of limitation of activity (e.g., child with septic joint or significant trauma is less likely to be able to bear weight)

PHYSICAL FINDINGS

Physical findings are variable, depending on the specific underlying cause. Look for:

- Fever or change in vital signs (distress may cause increase in heart and respiratory rates)
- Heat, redness, swelling, obvious deformity
- Decrease in mobility
- Bone tenderness

Perform a general physical examination to look for signs of other illnesses (e.g., rash with Henoch-Schönlein purpura or heart disease with rheumatic fever).

DIFFERENTIAL DIAGNOSIS

- Cellulitis (of the overlying areas only; no involvement of bones or joint spaces)
- Septic arthritis (this is an emergency situation)
- Transient viral arthritis
- Juvenile rheumatoid arthritis
- Transient toxic synovitis (commonly seen in the hip); related to previous URTI
- Osteomyelitis
- Trauma (e.g., hemarthrosis)
- Post-immunization arthritis (especially after immunization for rubella)
- Bleeding disorder (e.g., hemophilia)
- Henoch-Schönlein purpura (look for abdominal pain and rash)
- Sprain or strain
- Slipped capital femoral epiphysis
- Legge-Calvé-Perthes disease
- Growing pains
- Rickets
- Malignant lesion
- Rheumatic fever

The diagnosis of limb pain is difficult and should be undertaken with the help of a physician. Septic arthritis and osteomyelitis can be life-threatening, as can fractures to large bones and joints.

DIAGNOSTIC TESTS

Discuss with a physician.

MANAGEMENT

Goals of Treatment

- Ensure proper diagnosis
- Minimize risk of further injury (e.g., by immobilization)

Appropriate Consultation

Consult a physician if there is acute pain with significant compromise in function, if you are unsure of the diagnosis, if there is significant trauma or if there is a possibility of joint or bone infection.

Adjuvant Therapy

If the child appears acutely ill, if infection is suspected (e.g., cellulitis, septic arthritis), or if there is significant trauma:

– Start IV therapy with normal saline and run at a rate sufficient to maintain hydration

For daily maintenance fluid requirements and signs of dehydration, see chapter 4, "Fluid Management."

Nonpharmacologic Interventions

– Bed rest
– Immobilize extremity to prevent damage, ease pain

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4h prn

Acute inflammation of a joint in association with fever but no obvious cause for the inflammation should be treated as an infection (with the advice of a physician). While awaiting transfer, the physician may order antibiotics, such as the following:

cefuroxime (Zinacef) (**B class drug**), 100–150 mg/kg per day, divided q8h, IV

or

cefazolin (Ancef) (**B class drug**), 50–100 mg/kg per day, divided q8h

Monitoring and Follow-Up

Monitoring and follow-up vary, depending on the diagnosis.

Referral

Most cases of acute limb pain require medevac.

Cases of mild, non-acute limb pain can be referred electively to a physician for evaluation.

IN-TOEING

DEFINITION

Inward pointing of toes. If mild, may resolve on its own; if extreme, treatment is required.

CAUSES

– *Metatarsus varus:* adduction of forefoot on hindfoot (lateral border of foot is curved instead of straight); presents in infancy
– *Tibial torsion:* in-turning of entire foot (medial twisting of tibia); presents in early childhood
– *Femoral anteversion:* in-turning of leg (medial twisting at hip); presents in early childhood

HISTORY

– May be associated with stumbling
– Sleeping with feet tucked underneath legs (tibial torsion)
– Sitting in the W-position, with knees together and feet spread laterally (femoral anteversion)

PHYSICAL FINDINGS

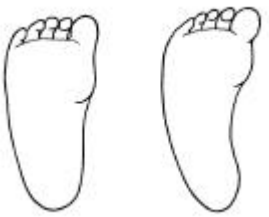


Fig. 14-1: Metatarsus Varus

Fore foot is turned medially on the hindfoot. Ankle joint has normal dorsiflexion and plantar flexion.

Physiologic metatarsus varus can lead to adduction of forefoot past midline (no treatment needed).

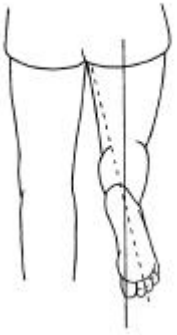


Fig. 14-2: Tibial Torsion

Measured by angle between foot and thigh with ankle and knee positioned at 90°. The foot normally rotates externally with age (about 2° at about 1 year of age, about 20° at 15 years of age). In tibial torsion, this angle is smaller.

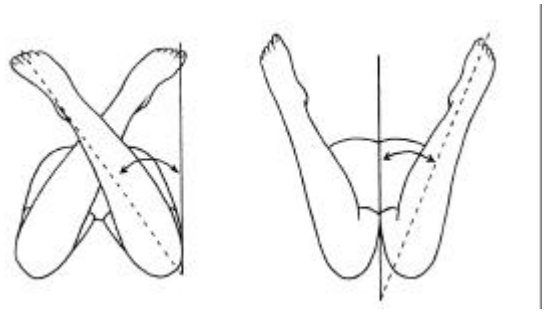


Fig. 14-3: Measuring Rotation in Femoral Anteversion

Decreased external rotation of the hip; if external rotation is less than 20°, in-toeing may result.

DIFFERENTIAL DIAGNOSIS

– More severe congenital deformity with clubfoot (rigid deformity of whole foot, evident at birth)

COMPLICATIONS

– Gait difficulties if left unattended

MANAGEMENT

Goals of Treatment

– Improve foot position

Metatarsus Varus

Usually requires no treatment if the condition is mild. Reassure the parents or caregiver and follow up closely. *See "Referral," below, this section.*

Tibial Torsion

– Discuss with a physician
– Advise change in sleeping position

Increased Femoral Anteversion

– Change sitting position to tailor position
– Most children require no other intervention

Monitoring and Follow-Up

Monitor gait every 3 or 4 months.

Referral

– *Metatarsus varus:* Refer to a physician if the condition persists for more than 3 months or if there is a non-flexible deformity at birth.
– *Tibial torsion:* Refer to a physician. May require orthopedic consult.

CONGENITAL DISLOCATION OF HIP (DEVELOPMENTAL HIP DYSPLASIA)

DEFINITION

Failure of femoral head to rest in acetabulum of pelvis (Fig. 14-4). There are three presentations: hip may be dislocated, dislocatable or subluxated.

This condition is commonly seen in some First Nations communities, but is almost never seen in Inuit people.

A check for congenital problems of the hip is part of routine neonatal screening. This condition is best diagnosed before the child begins walking. *See section on the musculoskeletal system in "Physical Examination of the Newborn," in chapter 1, "Guidelines for Pediatric Health Assessment."*

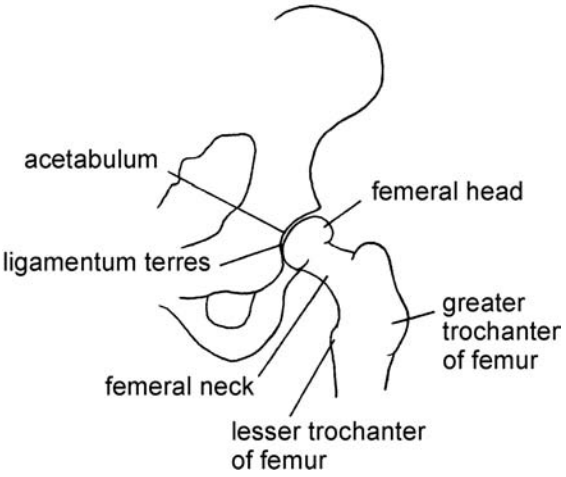


Fig. 14-4: Hip Joint

CAUSES

– Congenital
– Condition exacerbated by use of tikanagans (cradle boards) or other means of swaddling
– Often able to identify other affected family members
– Breech birth

HISTORY

– If diagnosed after the child is walking, presents as a limp with or without pain

PHYSICAL FINDINGS

Inspection of the Newborn

- Asymmetric fat folds in thigh
- Extra skin folds on involved side

Inspection of the Older Child

- Legs unequal in length
- Limp
- Trendelenburg sign: lurching toward affected side

Palpation

- Examine child in supine position (on back)
- With thighs flexed, should be able to abduct to 90° in each hip; diagnosis should be suspected if abduction is limited to 60° to 70°

Ortolani–Barlow hip examination for screening newborns:

- Place middle fingers over greater trochanters (outer upper legs)
- Position thumbs on medial sides of knees
- Abduct the thigh to 90° by applying lateral pressure with thumb
- Move knee medially and then replace knee in starting position
- If there is a "clunk," the hip may be dislocatable
- If there is a "click," the hip may be subluxable

DIFFERENTIAL DIAGNOSIS

- Congenital short femur
- Synovial click
- Congenital adduction contraction
- Fixed dislocation in arthrogryposis

COMPLICATIONS

- Long-term disturbance of the gait if left undiagnosed and untreated
- Osteoarthritis

MANAGEMENT

Goals of Treatment

- Develop improved or normal femoral insertion into acetabulum
- Normalize gait

Nonpharmacologic Interventions

Early detection is important. Hence, the hip exam is an essential part of newborn screening. In addition, infants should be screened several times by nurse and physician during the first year of life, as the problem may not be evident at birth.

Educate community about potential treatments, such as decreased use of tikanagan.

Definitive treatments:

- Splint (e.g., Pavlik harness for children from birth to 8 months of age)
- Casting
- Surgery

Referral

Refer child as soon as possible for assessment by a physician.

LIMP

DEFINITION

Gait abnormality.

This complaint should always be taken seriously. A limp may arise from problems in joints, bones, ligaments or soft tissues. In diagnosing a limp, it is difficult to distinguish bone pain from muscle and joint pain. Younger children (toddlers) may refuse to bear weight. Severe illness involving bone, joint or muscle may present as a limp.

CAUSES

Joint

Infection:

- Bacterial (septic arthritis)
- Viral

Inflammatory:

- Juvenile rheumatoid arthritis or rheumatic fever
- Reactive synovitis

Trauma

Bone

- Trauma
- Fracture
- Osteomyelitis
- Tumor

Muscle

- Sprains
- Strains
- Inflammatory process

Ligaments (Soft Tissue)

- Trauma
- Infection (cellulitis)
- Post-immunization

Limp may develop with spinal or abdominal involvement or injury.

HISTORY

- Trauma
- Fever
- Viral URTI in preceding week
- Pain
- Inability to bear weight
- Decreased mobility

PHYSICAL FINDINGS

Look for:

- Heat
- Swelling
- Redness
- Pain on movement
- Decrease in ability to bear weight
- Decrease in active and passive range of motion

Perform abdominal and general examinations if the cause is not evident on limb examination (e.g., incarcerated hernia may present as a limp).

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

COMPLICATIONS

Depends on the cause of the limp.

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Diagnose accurately
- Treat underlying cause
- Maintain a high index of concern about possible pathology

Appropriate Consultation

Consult with a physician if you are unsure of the diagnosis or the symptoms are significant.

Nonpharmacologic Interventions

Immobilization may be required to rest the limb, reduce pain and prevent further damage.

Pharmacologic Interventions

Analgesic for pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4h prn

Monitoring and Follow-Up

Depends on the diagnosis.

Referral

Refer to a physician or to hospital as indicated by severity of symptoms and possible diagnosis.

GROWING PAINS

DEFINITION

An idiopathic symptom complex that affects 10% to 20% of school-age children. Pain usually occurs in shins or thigh muscles. Joint pain is rare. The pain is intermittent, usually occurring at night, and lasts from 30 minutes to several hours.

CAUSES

Unknown, although probably related to over-exertion and fatigue. Emotional factors may also play a role.

HISTORY

- Usually non-articular
- Calves or thighs usually involved
- Deep aching, usually worse at night
- May waken the child at night
- May be relieved with massage, rubbing

PHYSICAL FINDINGS

No physical signs.

DIFFERENTIAL DIAGNOSIS

- Acute infection or inflammation
- Trauma

COMPLICATIONS

None.

MANAGEMENT

Goals of Treatment

– Rule out more severe disease or pathology

Nonpharmacologic Interventions

– Reassure child and family

Client Education

– Explain course of the condition and prognosis
– Counsel parents or caregiver about appropriate home management with rest, heat and analgesia
– Advise that heating pad or moist hot packs prn may help

Pharmacologic Interventions

Analgesic for pain (for children >6 years old):

acetaminophen (Tylenol) (**A class drug**), 325 mg, 1–2 tabs PO q6h prn

Monitoring and Follow-Up

Reassess the child if attacks become more frequent or increase in severity.

Referral

Referral to a physician is not usually needed, unless the diagnosis is unclear or incorrect, or the symptoms are worsening.

OSGOOD-SCHLATTER DISEASE

DEFINITION

Traction apophysitis of the tibial tubercle. Considered an overuse syndrome in which repetitive microtrauma causes partial avulsion of the patellar tendon at its insertion on the tibia. It occurs during the pubertal growth spurt.

Risk Factors

– Male gender
– Active in sports (e.g., football, soccer)
– Recent growth spurt

CAUSE

– Activity (e.g., sports and running), which causes microtrauma

HISTORY AND PHYSICAL FINDINGS

– Knee pain around the tibial tuberosity
– Swelling
– Limp
– Tenderness and prominence of the tibial tubercle

Symptoms increase with activity (e.g., running, jumping, going up and down stairs, kneeling) and are relieved by rest.

DIFFERENTIAL DIAGNOSIS

– Patellar tendinitis
– Osteomyelitis
– Knee sprain
– Ligamentous strain
– Patellar femoral syndrome
– Osteosarcoma

COMPLICATIONS

– Detachment of cartilage fragments from the tibial tuberosity
– Decrease in capacity for physical activity
– Osteoarthritis

DIAGNOSTIC TESTS

None.

MANAGEMENT

Nonpharmacologic Interventions

– Reassure child and parents or caregiver as to the benign cause and favorable prognosis
– Rest the limb
– Apply ice packs prn
– Decrease activities that aggravate symptoms
– Knee immobilization (e.g., via splint), but for short-term use only (e.g., a few days)
– Counsel parents or caregiver about appropriate use of medications, including dosage and side effects

Pharmacologic Interventions

Anti-inflammatory and analgesic:

acetaminophen (Tylenol) (**A class drug**), 325 mg, 1–2 tabs PO q6h prn for 7–10 days

or

ibuprofen (Motrin) (**A class drug**), 200 mg, 1–2 tabs PO q6h prn for 7–10 days

Monitoring and Follow-Up

Follow up in 1–2 weeks. The condition is usually self-limiting and resolves over several months.

Referral

Refer to a physician for evaluation if symptoms do not improve with conservative measures in 6–8 weeks.

The condition becomes chronic in 5% to 15% of cases, with persistent tenderness, swelling and formation of ossicles, which may need surgical removal.

PATELLAR FEMORAL SYNDROME

DEFINITION

Osteochondritis involving the patella, resulting in knee pain and swelling. It is considered an overuse syndrome not involving avascular necrosis or an inflammatory process, and as such it develops over a period of time.

Usually unilateral, but sometimes bilateral. Onset during adolescence.

Most of those affected show a mild degree of patellar femoral malalignment, which, with activity, causes instability of the patella and gradual destruction of the patellar cartilage.

Risk Factors

- Female gender
- Physical activity

CAUSES

Soft Tissue

- Prepatellar bursitis
- Patellar tendinitis
- Meniscal tear

Articular

- Chondromalacia patellae
- Patellar osteoarthritis
- Osteochondritis dissecans of the knee
- Chondral fracture

Functional

- Patellar instability
- Synovium caught between patella and femur

Referred Pain

- Back pain
- Hip pain
- Ankle pain

Mechanism

- Overuse syndrome in athletes
- Sports involving running, jumping, or quick stops and turns (pivots)
- Contact sports (e.g., football)
- Direct impact to patella
- Degeneration of patella
- Chondromalacia patellae
- Patellar osteoarthritis
- Anatomic variation, such as increased angle between femur and tibia (Q-angle; note that females more often have larger Q-angle) or shallow outer patellofemoral groove (patella prone to sublux or dislocate laterally)

HISTORY

- Acute or chronic anterior knee pain and pain on underside of patella
- Gradually progressive, general aching or grating pain
- Sensation of the knee “giving out” and instability (reflex response to pain); child is unable to keep knee in flexed position for any length of time
- Grinding, popping or clicking sound on knee flexion

Provocative Factors

- Going up or down stairs or going down hills
- Running
- Prolonged sitting with knee bent

PHYSICAL FINDINGS

- No knee effusion
- No decrease in range of motion of affected knee
- Tenderness of undersurface of medial or lateral patella
- Grinding, popping or clicking sound on knee flexion, detected on manipulation of patella
- Positive patellar inhibition test: child refuses to actively extend knee when patella is compressed against the femoral condyles; patella is displaced with knee extension
- Chronic pain may result in disuse atrophy of the quadriceps
- Crepitation when determining range of motion of knee
- Q-angle increased
- Abnormal patellar alignment

Apprehension Sign

- Hold patella as child lies with knee in extension
- Ask child to tense quadriceps muscle
- Positive result: child experiences pain
- Child may refuse to do the test in anticipation of pain

DIFFERENTIAL DIAGNOSIS

- Knee sprain
- Ligamentous strain
- Osgood-Schlatter disease

COMPLICATIONS

- Interference with daily activities

DIAGNOSTIC TESTS

None.

MANAGEMENT

Nonpharmacologic Interventions

- Rest; child can continue most activity, but for a short period in the acute stage (1–2 weeks), activities that require flexion of the knee should be limited
- Ice packs prn
- Tensor bandage may provide some comfort (should be worn only while child is awake)

Exercises to Strengthen Quadriceps

- Isometric progressive resistance exercises
- Leg-sled press (45°)

Exercises to Stretch Lower Extremity

- Quadriceps stretches
- Hamstring stretches
- Iliotibial band stretches
- Ankle stretches
- Gastrocnemius muscle stretches
- Soleus muscle stretches

Pharmacologic Interventions

Ant-inflammatory agents (NSAIDs) for short course (1–2 weeks):

ibuprofen (Motrin) (**A class drug**), 200 mg, 1–2 tabs PO tid

or

naproxen (Naprosyn) (**A class drug**), 125 mg, 1–2 tabs PO bid to tid

Monitoring and Follow-Up

Reassess every 1–2 weeks during the acute stage. Ascertain adherence to exercise program, and provide support and encouragement.

Surgical arthroscopy may be needed (in 5% to 10% of cases) to remove bony or cartilaginous fragments or to shave the underside of the patella.

Referral

Refer to a physician for assessment if there is no improvement with conservative management after 6–8 weeks.

EMERGENCY PROBLEMS OF THE MUSCULOSKELETAL SYSTEM

MUSCULOSKELETAL INJURY

Trauma to the musculoskeletal tissue may cause damage that ranges from minor (e.g., sprain) to major (e.g., fracture or dislocation). See Table 14-1 for comparative information on the common symptoms of musculoskeletal injury.

Table 14-1: Symptoms of Musculoskeletal Injury

Symptom	Fracture	Dislocation	Sprain	Strain
Pain	Severe	Moderate to severe	Mild to moderate	Mild to moderate
Swelling	Moderate to severe	Mild	Mild to severe	Mild to moderate
Bruising	Mild to severe	Mild to severe	Mild to severe	Mild to severe
Deformity	Variable	Marked	None	None
Function	Loss of function	Loss of function	Limited	Limited
Tenderness	Severe	Moderate to severe	Moderate	Moderate
Crepitus	Present	Absent	Absent	Absent

FRACTURES

DEFINITION

A break in the continuity of the bone.

The fracture line through the bone may be transverse, oblique or spiral.

Clavicle fracture is one of the most common types of fracture in children.

The most serious bony injury of the upper limb is supracondylar fracture of the elbow.

Fractures involving the epiphysis of a bone are serious, as they may damage the epiphyseal plate so much that growth is arrested.

Fractures of the pelvis, hip, femur and epiphyseal separations about the knee are all major injuries requiring prolonged care in a hospital situation.

CAUSES

Trauma is the most common cause.

Occasionally, pre-existing pathologic conditions may predispose to fractures:

- Osteogenesis imperfecta
- Rickets
- Scurvy
- Bony cyst
- Malignant lesion

In the case of a fracture in an infant or toddler, the possibility of abuse should be considered.

Types of Fractures

- *Closed (simple) fracture:* fracture that does not communicate with the external environment
- *Open (compound) fracture:* fracture that communicates with the external environment (through laceration of skin)
- *Comminuted fracture:* fracture involving three or more fragments
- *Avulsion fracture:* fracture in which fragment of bone is pulled from its normal position by muscular contraction or resistance of a ligament
- *Greenstick fracture:* incomplete angulated fracture of a long bone, seen most often in children
- *Undisplaced fracture:* fractured bone stays in alignment
- *Displaced fracture:* fractured bone goes out of alignment

HISTORY

Usually a history of trauma, except if there is pre-existing bone pathology (including osteopenia, which is seen in children with cerebral palsy, among other conditions).

The fracture site and type can usually be linked to the description of the injury.

- Determine exact mechanism of injury
- Pain
- Swelling
- Loss of function
- Possible numbness distal to fracture site

In cases of abuse, classic features of the history may not be present or may not fit the reported injury.

PHYSICAL FINDINGS

- Respiratory rate, heart rate and blood pressure increased (because of pain)
- If there is significant associated blood loss, blood pressure may drop
- In older children, fracture of tibia, femur or pelvis may be associated with traumatic shock
- Child is distressed because of pain
- Skin lacerations with protruding bones may be present if fracture is compound
- Bruising and swelling
- Range of motion decreased
- Visible deformity if displaced
- Affected part may be pale if blood flow to the area is compromised
- Limb cool, pulses absent and sensation decreased if blood supply has been compromised
- Check temperature of area and presence of pulses distal to site of injury
- Test sensory function (to sharp and dull stimuli) distal to site of injury
- Affected area extremely tender
- If bones are displaced, crepitations may be felt

DIFFERENTIAL DIAGNOSIS

- Severe sprain
- Severe contusion
- Dislocation

COMPLICATIONS

Immediate (within First Few Hours)

- Hypovolemia from blood loss
- Shock
- Damage to arteries, neurovascular bundle and surrounding soft tissues

Early (within First Few Weeks)

- Wound infection
- Fat embolism
- Respiratory distress syndrome
- Chest infection
- Disseminated intravascular coagulopathy
- Osteomyelitis (if fracture is compound)
- Malunion and compartment syndrome may result from casting

Late (Months or Years Later)

- Deformity
- Osteoarthritis of adjacent or distant joints
- Aseptic necrosis
- Traumatic chondromalacia
- Reflex sympathetic dystrophy

DIAGNOSTIC TESTS

- X-ray, if available and only if result will affect clinical decision to transfer child to hospital
- If no fracture is seen on x-ray, but there is bony tenderness, it is prudent to treat as a fracture
- Type I fractures (growth plate fractures) often appear normal on x-ray

MANAGEMENT

Most bones join in 4–6 weeks; lower-limb bones may take longer, and some greenstick fractures in children may take less time.

Goals of Treatment

- Stabilize fracture
- Relieve pain
- Prevent or manage complications

Appropriate Consultation

Consult physician for all suspected or confirmed fractures.

Adjuvant Therapy

If there is a history of or clinical findings indicating significant trauma, and for all major fractures (e.g., femur, pelvis, hip):

- Start IV therapy with normal saline and run at a rate sufficient to maintain hydration, unless hypotension is present

If hypotensive, treat for shock:

- Give oxygen at 10–12 L/min using a non-rebreather mask to obtain highest oxygen concentrations
- Keep oxygen saturation >97%
- Start 2 large-bore IVs with normal saline (or Ringer's lactate) or establish intraosseous access if IV access cannot be established within 60–90 seconds; *see "Intraosseous Access," in chapter 2, "Pediatric Procedures"*
- Deliver bolus of 20 mL/kg over 20 minutes
- Repeat bolus as necessary until there is a response

See also "Shock," in chapter 20, "General Emergencies and Major Trauma."

Nonpharmacologic Interventions

- If spinal injury is suspected, keep child recumbent and use backboard with neck brace for transport
- Immobilize fracture site with a splint extending across joint, above and below site of injury
- Use a back slab cast or sling (for upper extremities) as appropriate
- Apply traction for displaced femoral fracture (use Thomas splint, if available)
- For compound fracture, wrap skin wound with sterile dressing and protect by splinting
- Do not cast a fracture.
- Do not attempt to reduce a displaced fracture.
- For child with displaced fracture, give nothing by mouth, as surgery may be needed

Pharmacologic Interventions

Analgesia may be necessary for significant fractures. Consult with a physician if at all possible before using narcotic analgesics.

meperidine (Demerol) (**D class drug**), IM

or

codeine syrup (**B class drug**), PO

For both meperidine and codeine, the dose depends on the age and size of the child. Check the *Compendium of Pharmaceuticals and Specialties* for guidance.

Antibiotics are necessary if the fracture is compound. Consultation with a physician is required. IV or IM antibiotics are to be given only on the advice of a physician.

cefuroxime (Zinacef) (**B class drug**), 50–100 mg/kg per day, divided q8h, IV

or

ceftriaxone (Rocephin) (**B class drug**), 50–75 mg/kg per day, in one dose, IM or IV (maximum dose 2 g)

Tetanus toxoid should be given if required. Refer to *Canadian Immunization Guide*, 5th edition (Health Canada 1998) for recommendations.

Monitoring and Follow-Up

Monitor ABCs, vital signs, pain control and neurovascular status of area distal to the fracture site while awaiting transfer to hospital.

After emergency treatment, take the opportunity to follow up with the child and parents or caregiver to offer guidance about accident prevention.

Referral

Medevac.

DISLOCATION OF A MAJOR JOINT

DEFINITION

Displacement of a bone from normal anatomic insertion or attachment.

CAUSE

– Trauma is the most common cause

Specific Childhood Issues

Dislocations and fractures in infants and toddlers should be examined with consideration of the possibility of an abusive situation.

Pulled elbow is common in toddlers. It is caused by a sudden pull or jerk (trauma), during which the radial head is pulled out of the attached ligament (subluxation). Dislocation of the knees and elbows are true emergencies because of the potential for neurovascular problems.

HISTORY

– Associated trauma consistent with site and type of injury
– If history is not consistent with injury, consider the possibility of abuse
– Pain, often aggravated by movement
– Loss of function

PHYSICAL FINDINGS

– Tachycardia and tachypnea (related to pain)
– Swelling (mild)
– Bruising (mild to severe)
– Marked deformity of affected joint
– Tenderness (moderate to severe)

DIFFERENTIAL DIAGNOSIS

– Fracture
– Soft-tissue injury

COMPLICATIONS

– Vascular or nerve damage

MANAGEMENT

Goals of Treatment

– Control pain
– Realignment

Appropriate Consultation

Consult a physician. If a larger joint is dislocated, medevac will probably be needed.

Nonpharmacologic Interventions

– Give nothing by mouth, in case surgery is required
– Immobilize the site with a back slab cast or sling (for upper extremities), as appropriate

Pharmacologic Interventions

Analgesia may be necessary for significant injury. Consult with a physician if at all possible before using narcotic analgesics.

meperidine (Demerol) (**D class drug**), IM

or

codeine syrup (**B class drug**), PO

For both meperidine and codeine, the dose depends on the age and size of the child. Check the *Compendium of Pharmaceuticals and Specialties* for guidance.

Monitoring and Follow-Up

Monitor for control of pain and to determine the neurovascular status of the involved limb.

Referral

Medevac for orthopedic consult and definitive treatment.

DISLOCATION OF A SMALLER JOINT

The physician may advise that small joints (e.g., fingers) be realigned by gentle traction.

Once relocated, immobilize the joint to allow for healing. The duration of immobilization will depend on the joint involved and should be determined by a physician. Fingers should never be immobilized for more than 3 or 4 days.

CHAPTER 15 — CENTRAL NERVOUS SYSTEM

Table of Contents

For more information on the history and physical examination of the central nervous system in older children and adolescents, see chapter 8, “Central Nervous System,” in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ASSESSMENT OF THE CENTRAL NERVOUS SYSTEM

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

It is important to obtain a complete history and details of all presenting symptoms, including information about onset (sudden or gradual), duration and progression.

- Change in level of consciousness (e.g., lethargy, stupor)
- Irritability
- Changes in cry (in infants <6 months old)
- Changes in feeding patterns
- Presence of headache and its characteristics: site, duration, alleviating factors, association with vomiting or visual disturbance
- Visual disturbance (e.g., double vision [diplopia] indicates involvement of cranial nerves)
- Changes in hearing, smell or taste in older child
- Vertigo (indicates inner ear disturbance)
- Muscle weakness or wasting
- Involuntary motor movements (e.g., tics, chorea)
- Abnormal muscle tone (hypertonia [increased tone] or hypotonia [decreased tone])
- Abnormal changes in sensation (e.g., tingling, numbness)
- Detailed description of any seizures, fainting or other spells: skin color, respiration, precipitants, duration, associated limb and eye movements, level of consciousness, behavior before and after the seizure
- Chronology of attainment of normal developmental milestones
- Previous history of neurologic disorder
- Family history of neurologic disorder (many disorders are familial)
- Details of mother's pregnancy, labor, delivery and neonatal period (especially for children <2 years old)

PHYSICAL EXAMINATION

A general physical examination, as well as a detailed neurologic examination, is important. Assess the following:

- Level of consciousness (can be quantified by means of the pediatric Glasgow coma score — Table 15-1)
- Mental status
- Speech
- Eye examination: full-range extraocular movements, PERRLA (pupils equal, round and reactive to light; accommodation normal), funduscopy for clarity and vascularity of optic disk
- Head shape and size, fontanel and suture size
- Facial dysmorphism (may indicate a genetic syndrome)
- Cutaneous birthmarks (may indicate a neurocutaneous disorder)
- Cranial bruit (may indicate an intracranial vascular malformation)
- Sinus of lower back and hair tuft
- Tone, strength and reflexes of limbs
- Observation of child with respect to achievement of major age-appropriate developmental milestones (e.g., crawling, walking, playing with toys)
- Observation of gait while child is walking
- Meningeal signs (e.g., neck stiffness, Kernig's sign [pain with passive knee extension and hip flexion], Brudzinski's sign [spontaneous hip flexion with passive neck flexion])
- Respiratory examination: look for underlying pneumonia
- Cardiac examination: listen for murmur (which could indicate embolic stroke or cerebral abscess)
- Abdominal examination: check for enlargement of liver or spleen (which could indicate a liquid storage disorder)

Table 15-1: Scoring for the Pediatric Glasgow Coma Score*

Feature	Score	Age Group and Response		
Eyes opening		**>1 year**	**<1 year**	
	4	Spontaneously	Spontaneously	
	3	To verbal command	To shout	
	2	To pain	To pain	
	1	No response	No response	
Best motor response		**>1 year**	**<1 year**	
	6	Obeys	NA	
	5	Localizes pain	Localizes pain	
	4	Flexion withdrawal	Flexion normal	
	3	Flexion abnormal (decorticate rigidity)	Flexion abnormal (decorticate rigidity)	
	2	Extension (decerebrate rigidity)	Extension (decerebrate rigidity)	
	1	No response	No response	
Best verbal response		**>5 years**	**2–5 years**	**Birth to 23 months**
	5	Oriented and converses	Appropriate words and phrases	Smiles, coos, cries appropriately
	4	Disoriented and converses	Inappropriate words	Cries
	3	Inappropriate words	Cries and/or screams	Inappropriate crying and/or screaming
	2	Incomprehensible sounds	Grunts	Grunts
	1	No response	No response	No response

*Score is obtained by determining the score for each of the three criteria (eye-opening, best motor response, best verbal response) and summing them.

Note: NA = not applicable.

COMMON PROBLEMS OF THE CENTRAL NERVOUS SYSTEM

HYPOTONIA ("FLOPPY INFANT")

DEFINITION

Lower-than-normal muscular resistance to passive movement of a joint. Muscle strength is a key component of this resistance.

CAUSES

- Static encephalopathy related to perinatal or prenatal insult (e.g., hypoxia, ischemia at birth, intracranial hemorrhage)
- Direct CNS injury (e.g., spinal cord transection)
- Muscular atrophy of the spine
- Myasthenia gravis
- Congenital myopathy
- Myotonic dystrophy
- Muscular dystrophy
- Systemic illness (e.g., congenital heart disease, hypothyroidism, celiac disease, inborn errors of metabolism)
- Infantile botulism

HISTORY

- Onset (acute or gradual)
- Duration
- Past history of any acute illness (e.g., meningitis)
- Family history of myopathy
- Social history: infant–parent interaction, siblings' history (many babies are "floppy" because of lack of stimulation)

Associated Symptoms

- Respiratory and feeding difficulties
- Fasciculations
- Ptosis
- History of any delays in reaching milestones
- Inappropriate weight gain for age

Prenatal Symptoms

- Physiologic insults during pregnancy or birth
- Maternal health problems (e.g., hypertension, diabetes mellitus)
- Maternal use of neurotoxic drugs

PHYSICAL FINDINGS

- Vital signs
- General physical examination to rule out any underlying cause
- Complete CNS exam *(see "Physical Examination," above, this chapter)*
- Assessment of developmental milestones for age
- Assessment of primitive reflexes of the newborn *(see "Physical Examination of the Newborn," in chapter 1, "Guidelines for Pediatric Health Assessment")*
- Muscle tone decreased (hypotonia)

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

COMPLICATIONS

- Long-term disability

DIAGNOSTIC TESTS

None.

MANAGEMENT

Management depends on the cause of the hypotonia.

Goals of Treatment

- Identify underlying cause early
- Minimize long-term disability

Appropriate Consultation

Consult a physician immediately to discuss the case.

Referral

A hypotonic child should be evacuated for evaluation and investigation. The urgency of evacuation depends on the child's clinical condition and possible causes of the hypotonia.

EMERGENCY PROBLEMS OF THE CENTRAL NERVOUS SYSTEM

SEIZURE DISORDERS

DEFINITION

Neurologic manifestations of involuntary and excessive neuronal discharge. The symptoms depend on the part of brain that is involved and may include any of the following:

- Altered level of consciousness
- Tonic–clonic movements of some or all body parts
- Eye movements
- Visual, auditory or olfactory disturbance

Most seizures in children involve loss of consciousness and tonic–clonic movements, but auditory, visual or olfactory disturbance, behavioral change or absences in attention may also occur.

Seizures must be differentiated from other "spells" (e.g., fainting, arrhythmia, vertigo, tic).

Types

Generalized Seizure

- Affects both hemispheres
- Characterized by change in level of consciousness
- Bilateral motor involvement
- Examples: absence seizure or grand mal seizure with tonic–clonic movements of all four limbs

Simple Partial Seizure

- Affects only part of brain (focal, motor or sensory)
- Formerly called focal seizures
- May progress to generalized seizures

The history is important, because the anticonvulsants used for partial seizures differ from those used for generalized seizures.

Complex Partial Seizure

- Partial seizure with affective or behavioral changes

Febrile Seizure

- Associated with temperature >38°C
- Occurs in children <6 years old (prevalence is 2% to 4% among children <5 years old)
- No signs or history of underlying seizure disorder
- Often familial
- Uncomplicated and benign if seizure is of short duration (<5 minutes)
- Involves tonic–clonic movements
- Bilateral

Other complex seizures (not covered by categories listed above) may require more complete tertiary assessment.

HISTORY

- Previous episodes (i.e., known seizures)

Nature of Current Seizures

- Onset (sudden or gradual)
- Date and time of onset
- Whether consciousness has been regained since onset of seizure activity
- Duration of seizure
- Sequence of seizures
- Type of seizure (generalized or partial)
- Association with fever
- Association with head injury
- Ingestion of poisonous substance or other poisoning (e.g., lead encephalopathy)

Other Factors

- Compliance with anticonvulsant therapy in child known to have epilepsy
- Other chronic disease
- Medication use
- Allergies to medications
- Symptoms of intercurrent illness (e.g., fever, malaise, cough)

PHYSICAL FINDINGS

Acute Seizure

- Temperature normal unless underlying infection is present
- Heart rate elevated and may be irregular
- Respiration irregular (absent during seizure, present between seizures)
- Blood pressure elevated or low
- Oxygen saturation may be decreased
- Loss of consciousness
- Skin pale or cyanotic
- Evidence of loss of bowel and bladder control
- Repeated episodes of tonic–clonic movements
- Foaming at mouth may be present
- Blood around or in mouth if child has bitten tongue
- Abnormalities suggesting underlying cause (e.g., stiff neck and bulging fontanel would suggest meningitis)
- Focal neurologic findings (e.g., hemiparesis or abnormal deep tendon reflexes would be of specific concern)

Always consider meningitis in a child with an apparent simple febrile convulsion. Meningitis can usually be diagnosed on clinical grounds alone, but if in doubt, contact a physician.

For any child who is having a generalized grand mal seizure on arrival and for whom the exact time of onset of the convulsion is unknown, manage as you would for status epilepticus (a condition lasting longer than 30 minutes and characterized by continuous seizure activity or intermittent convulsive activity with failure to regain consciousness between convulsions). *See "Management," below, this section.*

DIFFERENTIAL DIAGNOSIS

- Epilepsy
- Drugs (non-compliance with prescription, withdrawal syndrome, overdose, multiple drug abuse)
- Hypoxia
- Brain tumor
- Infection (e.g., meningitis)
- Metabolic disturbances (e.g., hypoglycemia, uremia, liver failure, electrolyte disturbance)
- Head injury

COMPLICATIONS

- Hypoxia during seizures
- Status epilepticus
- Arrhythmia
- Injury during seizure (e.g., from a fall)
- Brain damage
- Death

DIAGNOSTIC TESTS

Acute Seizure

- Random glucose stick test
- Pulse oximetry (if available)

MANAGEMENT

ACUTE SEIZURE (STATUS EPILEPTICUS)

Goals of Treatment

- Protect airway
- Stabilize cardiorespiratory function
- Stop seizures

ABCs are the first priority:

- Ensure airway is clear and patent
- Suction secretions as necessary
- Insert oropharyngeal airway
- Assist ventilation as needed by means of Ambu-bag with oxygen

Appropriate Consultation

Consult a physician as soon as possible after emergency care.

Adjuvant Therapy

- Give oxygen 6–10 L/min by mask or more as necessary to maintain oxygen saturation
- Keep oxygen saturations >97%
- Start IV therapy with normal saline, adjusting rate according to state of hydration

Nonpharmacologic Interventions

- Nurse child in side-lying position
- Keep child warm
- Give nothing by mouth until child has fully recovered

Pharmacologic Interventions

lorazepam (Ativan) (**D class drug**), 0.05–0.10 mg/kg IV (maximum 4 mg per dose), repeat q10min for 2 more doses (administer slowly over 5 minutes, maximum rate 2 mg/min)

or

diazepam (Valium) (**D class drug**), 0.3 mg/kg IV (maximum 5 mg per dose for child ≤5 years old, 10 mg per dose for child >5 years old), repeat q5min for 2 more doses (administer slowly over 5 minutes, maximum rate 2 mg/min)

If unable to achieve IV access, diazepam can be given effectively by the rectal route, as follows. Use IV solution without dilution and administer by inserting the smallest possible syringe or a small catheter affixed to the end of a syringe (if the dose is less than 5 mg, a tuberculin syringe is ideal):

diazepam (Valium) (**D class drug**), 0.5 mg/kg per dose PR (maximum dose 10 mg), repeat q5–10min for total of 2 doses (maximum rate 2 mg/min)

The medication should be placed a distance of 4 cm into the rectum, adjacent to the rectal mucosa. The buttocks should be elevated and squeezed together for 5 minutes to avoid evacuation of the rectal contents after administration of the drug. Two doses may be given, 5–10 minutes apart.

Risks of Drug Therapy

- Hypotension
- Respiratory depression

Monitoring and Follow-Up

- Identify focal neurologic deficits
- Observe for return to normal level of consciousness
- Monitor vital signs, ABCs, pulse oximetry (if available)
- Monitor closely for continued seizure activity

Referral

- Medevac for diagnostic work-up is indicated if this is a previously undiagnosed seizure or you suspect meningitis or another underlying metabolic cause
- Afebrile seizures or seizures associated with severe infection must be referred and investigated
- Benign febrile seizures can usually be handled in the community
- Investigation is required only if the seizures are of long duration (≥15 minutes) or they are complicated (e.g., focal, residual paralysis)

It is important that seizures be controlled before transport. If at all possible, obtain the assistance of an experienced critical care pediatric professional in stabilizing and transferring the child to hospital.

CHRONIC SEIZURE DISORDER

Management depends on underlying cause and severity of symptoms.

Goals of Treatment

- Control seizures
- Prevent recurrence
- Allow child to return to a normal lifestyle
- Achieve good adherence to treatment regimen over a long period
- Discontinue medications eventually, with continued control of seizures

Nonpharmacologic Interventions

Provide reassurance.

Client Education

- Explain prognosis
- Emphasize importance of adhering to medic ation regimen
- Counsel about first aid during seizures
- Advise supervision during swimming
- Advise that the child be treated as a normal child would be
- Advise about possible teratogenic effects of medications (e.g., phenytoin) for sexually active females

Pharmacologic Interventions

Anticonvulsants are tailored to the specific type of seizure. Monotherapy is ideal, but 10% to 15% of patients need two or more medications. Poor compliance is the major cause of seizure recurrence.

Commonly Used Anticonvulsants (B Class Drugs)

- carbamazepine (Tegretol)
- lamotrigine (Lamictal)
- phenobarbital (Phenobarb)
- phenytoin (Dilantin)
- primidone (Mysoline)
- valproic acid (Depakene)
- vigabatrin (Sabril)

Monitoring and Follow-Up

- Follow up every 6 months if seizures are well controlled, more frequently if child is having breakthrough seizures
- Assess adherence to medication regimen
- Monitor serum drug levels every 6 months if stable, more frequently if necessary

Referral

- Refer electively for review by a physician at least annually if seizures are well controlled
- Refer urgently if child is having breakthrough seizures
- Consider neurologic follow-up if symptoms are not controlled on current medications

HEAD TRAUMA

Head trauma is common among children and results in a significant number of visits to emergency clinics.

Children are more predisposed than adults to head injury because their head to body ratio is greater, their brains are less myelinated and thus more prone to injury, and their cranial bones are thinner. Although the incidence of mass lesions is lower among children than among adults, children are more likely to suffer from a unique form of brain injury called malignant brain edema. In addition, children may lose relatively large amounts of blood from scalp lacerations and subgleal hematomas and may present in hemorrhagic shock.

HISTORY

Head trauma may be due to child abuse or serious neglect by a parent or caregiver. In all cases, a thorough history should be obtained of past injuries and of the circumstances surrounding the present injury. It may be impractical to review old records for all children with head injuries, but in suspicious cases these records must be reviewed and appropriate follow-up arranged. Ascertain the following:

- Mechanism of injury
- Time of injury
- Loss of consciousness (a brief seizure at the time of injury) may not be clinically significant
- Loss of memory
- Amnesia
- Irritability
- Visual disturbance
- Disorientation
- Abnormal gait
- Lethargy, pallor or agitation may indicate severe injury
- Vomiting
- Symptoms of increased intracranial pressure (vomiting, headache, irritability)

Many children will vomit two or three times after even a minor head injury. However, protracted vomiting and retching, associated with other symptoms or signs, indicates a more severe head injury.

The child's complete medical history must be obtained. Evidence of conditions such as a predisposition to seizures or bleeding problems is important and will affect the clinical management.

PHYSICAL FINDINGS

Severity of intracranial injury can be assessed from a variety of characteristics (Table 15-2).

Table 15-2: Classification of Severity of Intracranial Injury

Mild	Moderate	Severe
Asymptomatic	Progressive lethargy	Focal neurologic signs present
Mild headache	Progressive headache	
No evidence of skull fracture, facial injury or other trauma	Signs of basal skull fracture; possible penetrating injury or depressed skull fracture; serious facial injury, multiple trauma	Penetrating skull injury; palpable depressed skull fracture or compound skull fracture; serious facial injury or multiple trauma
Three or fewer episodes of vomiting	Vomiting protracted (more than three episodes) or associated with other symptoms	
Glasgow coma score 15	Glasgow coma score 11–14	Glasgow coma score ≤10; a decrease of 2 or more points in serial Glasgow coma scores, not clearly caused by seizures, drugs, decreased cerebral perfusion or metabolic factors
Loss of consciousness for <5 minutes	Loss of consciousness for ≥5 minutes	Unconscious
	Post-traumatic amnesia or seizure	

Adapted, with permission, from Canadian Paediatric Society, Emergency Paediatrics Section. 1990. Management of children with head trauma. [Ref. No. EP90-01; approved by CPS Board of Directors 1990]. *Canadian Medical Association Journal* 142(9):949-952. Also available: http://www.cps.ca/english/statements/EP/ep90-01.htm.

Vital Signs

- Temperature usually normal
- Tachypnea: rapid heart rate may signify blood loss, in which case evidence of other injuries should be sought
- Bradycardia with hypertension (Cushing response): usually a late response in children with increased intracranial pressure and therefore not very reliable
- Hypertension: late sign of increased intracranial pressure
- Hypotension signifies shock: look for other injuries, since shock is not a usual sign of brain injury

Signs of Skull Fracture

- Hematotympanum
- Periorbital or post-auricular ecchymosis
- Cerebrospinal fluid otorrhea or rhinorrhea
- Depressed fracture or penetrating injury

Palpate scalp hematomas and contusions for underlying depressions, which signify depressed skull fracture. Before suturing, explore all full-thickness skull lacerations to ensure that the underlying bone is intact.

Neurologic Examination

- Pediatric Glasgow coma scale: see Table 15-1
- Papilledema (increased intracranial pressure)
- Pupillary light reflexes (PERRLA)
- Cranial nerve examination
- Movement of extremities
- Abnormal posture (decorticate or decerebrate)
- Muscle flaccidity, spasticity
- Plantar responses

Injuries to other areas such as the thorax or abdomen should be sought and treated promptly, since they may contribute to morbidity and death.

Clues to increased intracranial pressure:

- Decrease in Glasgow coma score of 2 points or more
- Abnormality or changes in pupillary size and reaction to light
- Respiratory abnormalities
- Development of paresis in absence of shock
- Hypoxia
- Seizures
- Elevation of blood pressure
- Decrease in heart rate
- Decrease in respiratory rate

Maintain a high index of suspicion for child abuse.

MANAGEMENT

MILD INJURY

Children with mild intracranial injury may be discharged home. An instruction sheet should be given to the parents or caregiver concerning observation and precautions (Table 15-3).

Table 15-3: Instructions to Parents or Caregivers for Observation at Home of Children with Head Trauma

Bring child back to clinic immediately if any of the following signs and symptoms appear within the first 72 hours after discharge:

- Any unusual behavior
- Disorientation as to name and place
- Inability to wake child from sleep
- Increasing headache
- Seizures
- Unsteadiness on feet
- Unusual drowsiness and sleepiness
- Vomiting more than two or three times

MODERATE TO SEVERE INJURY

Management Priorities

ABCs must be assessed before any detailed history-taking or neurologic examination. Instability of the cardiorespiratory system may be due to severe intracranial injury, intracranial hypertension or injury to other areas, such as the thorax or the abdomen. Prompt ventilatory support and treatment of shock are mandatory, since these factors, if left uncorrected, will result in secondary intracranial trauma.

See "Shock," in chapter 20, "General Emergencies and Major Trauma."

Stabilizing Head and Cervical Spine

Manual in-line stabilization must be maintained until injury to the cervical spine has been excluded or the neck is properly immobilized on a flat, hard surface with weights on either side of the neck.

Suture scalp lacerations, as major blood loss can occur from such lesions.

Appropriate Consultation

For any loss of consciousness, investigation and treatment should be discussed with a physician.

Adjuvant Therapy

- Start IV therapy with normal saline to keep vein open (unless the child is in shock from other injuries)
- Give oxygen at 6–10 L/min or more, as necessary

Nonpharmacologic Interventions

- Elevate head of bed by 30° to 45°
- Place head and neck in midline position
- Minimize stimuli (e.g., suctioning and movement)
- Restrict fluids to 60% of normal intake (except in cases of shock)
- To control increased intracranial pressure: above measures *plus* establish controlled hyperventilation

Pharmacologic Interventions

Medications should be given only if prescribed by a physician.

Diuretics if intracranial pressure is increased (and there is documented deterioration) despite measures outlined above:

mannitol (**B class drug**), 0.5–1 g/kg IV

Monitoring and Follow-Up

Monitor ABCs, vital signs, pulse oximetry (if available), level of consciousness (with serial pediatric Glasgow coma scores), intake and output.

Referral

Medevac.

HEADACHE

DEFINITION

Acute

Pain in the head involving blood vessels, meninges, and bony and soft-tissue components of the head.

Chronic or Recurrent

Pain in the head occurring on a chronic basis with three broad categories of causes: vascular cause (migraines), muscle contraction (tension headaches) and organic cause. Occurs in 20% of school-age children. Onset may occur at any age.

CAUSES

Vascular causes (leading to migraine) and muscle contraction (leading to tension headaches) are the most common causes of headache in children.

Vascular Lesions

- Arteriovenous malformation
- Berry aneurysm
- Cererbral infarction
- Intracranial hemorrhage

Migraine

Vascular headaches (migraine) are common in children, who often have incomplete manifestations of this condition. This type of headache should be considered in any recurrent problem with headache.

- Classic
- Common
- Cluster

Complicated Migraine

- Basilar artery
- Hemiplegic
- Ophthalmoplegic

Variants of Migraine

- Acute confusional state
- Benign paroxysmal vertigo
- Cyclic vomiting

Muscle Contraction

- Tension

Infection

- Brain abscess
- Dental infection
- Encephalitis
- Meningitis
- Sinusitis (chronic)

Trauma

- Neck injury
- Post-concussion syndrome
- Subdural hematoma

Toxic Effects

- Carbon monoxide
- Heavy metal poisoning (e.g., lead)
- Non-medicinal agents
- Excess intake of vitamins

Psychogenic

- Conversion
- Depression
- Factitious

Other Causes

- Food allergy or sensitivity
- Refractive error
- Ocular muscle imbalance
- Temporomandibular joint (TMJ) dysfunction

Traction

- Brain tumors
- Hydrocephalus
- Hypertension

HISTORY

Gather history from many sources, including the affected child and his or her parents (or caregiver) and teachers. It is best to get a description of both the initial and the most recent headaches. Children >4 years old may be able to give a good description of their symptoms.

Onset

- When headache began
- Conditions associated with initial headache (e.g., trauma, drug ingestion)
- Aura: visual, auditory

Location

- Unilateral or bilateral

Radiation

- Where headache starts
- Where headache hurts the most
- Whether headache spreads to other areas
- Occipital radiation: neck problems, occipital neuralgia, basilar migraine
- Facial radiation: sinus, dental or TMJ

Quality

- Sharp, dull or tight
- Throbbing or pounding (characteristic of vascular headaches)
- Whether character of pain changes over time

Severity

- Severity of the headache on a scale of 1 to 10, with 10 representing the worst pain ever felt
- Whether pain is increasing or decreasing in intensity over time
- Whether headache interferes with child's day-to-day activities

Timing

- Constant or intermittent
- Frequency per day, week and month
- Whether frequency is increasing over time
- Association with particular time of day, week, month or season
- Duration and whether duration is increasing over time

Associated Symptoms(Functional Inquiry)

- Nausea and vomiting with or without abdominal pain (typical of migraine)
- Photophobia, facial pain, fever
- Transient neurologic signs
- Acute confusion, hemiplegia, ophthalmoplegia, syncope, vertigo, paresthesias, phonophobia
- Depression
- Anorexia, declining school performance, insomnia, weight loss
- Other medical problems
- Past medical history
- Family history of headaches

In the absence of other symptoms, recurrent headaches of more than 3 months' duration are rarely due to an organic cause. Headaches of relative recent onset (<3 weeks) that are increasing in frequency and severity are worrisome.

PHYSICAL FINDINGS

Physical findings are usually minimal with headaches.

- Blood pressure usually normal
- Temperature may be elevated with infectious process (e.g., meningitis)
- Height and weight

HEENT (Head, Eyes, Ears, Nose and Throat)

- Pained facies
- Nuchal rigidity
- Funduscopic examination (disks, blood vessels); results usually normal
- Spasm or tenderness of neck muscle, tenderness of TMJ
- Deficits of cranial nerves
- Purulent rhinorrhea
- Halitosis, dental abscesses
- Cephalic bruits: use bell of stethoscope over the frontotemporal areas and orbits

Neurologic Examination

- Level of consciousness
- Mental status: general demeanor, confusion, depression, stress
- Cutaneous lesions (café au lait spots)
- Focal abnormalities (e.g., tics, limb paresis)
- Sensory deficits
- Abnormal deep tendon reflexes
- Mental confusion

Clinical Characteristics of Specific Types of Headaches

Traction

- Headaches increase rapidly in frequency and severity
- Headache worst upon awakening in the morning, diminishes during the day
- Headache wakens child from sleep
- Aggravated by coughing or valsalva maneuver
- May be relieved by vomiting
- Associated symptoms: focal neurologic findings; altered gait; changes in behavior, personality, cognition or learning

In 88% of children with a brain tumor, abnormal neurologic signs will be evident within the first 4 months after onset of headache.

Classic Migraine

- Headache pulsatile (throbbing), periodic, separated by symptom-free intervals and associated with at least three of the following symptoms: abdominal pain and nausea or vomiting, aura (motor, sensory, visual), family history of migraine
- Unilateral
- Headache relieved by sleep

Tension Headache

- Band-like tightness or pressure in the bifrontal, occipital or posterior cervical regions lasting for days or weeks but not disrupting regular activities; not associated with a prodrome; seen at any age
- Associated symptoms: tight neck muscles, sore scalp; nausea, vomiting and aura are uncommon

Refractive Error

- Persistent frontal headache, which is worse while reading or doing schoolwork

TMJ Dysfunction

- Temporal headache
- Associated symptoms: local jaw discomfort, malocclusion (crossbite), decreased range of motion of mouth, click with jaw movement, bruxism (grinding of teeth)

Chronic Sinusitis

- Frontal headache
- Tenderness to percussion over the frontal, maxillary or nasal sinuses
- Associated symptoms: prolonged rhinorrhea and congestion, chronic cough and postnasal drip, anorexia, low-grade fever, malaise

It is unusual for children <10 years old to have recurrent headaches secondary to chronic sinusitis.

DIFFERENTIAL DIAGNOSIS

See "Causes," above, this section.

COMPLICATIONS

- Recurrent or chronic headaches can be debilitating and may cause absences from school and social withdrawal
- Intracranial lesions, masses or infections are life-threatening

DIAGNOSTIC TESTS

Most headaches can be diagnosed from the history and physical examination. For recurrent or chronic headache, diagnostic information may include daily headache record (see Appendix 15-1).

MANAGEMENT

Goals of Treatment

Goals of treatment depend on the cause of the headache.

Acute

- Rule out serious organic pathology
- Relieve pain

Recurrent or Chronic

- Relieve pain
- Prevent recurrence
- Avoid disruption of normal life tasks, such as attending school

Appropriate Consultation

Consult a physician immediately in the following circumstances:

- Concern about an underlying organic cause for headaches
- Uncertainty about the diagnosis
- Headaches are chronic and unresponsive to simple analgesia

Nonpharmacologic Interventions

Supportive reassurance and education are appropriate for non-organic headaches only:

- Advise parents or caregiver that headaches in children are common and real
- Reassure family that headache is unlikely to indicate brain tumor
- Explain underlying pathophysiology of vascular and muscle contraction headaches (which are benign and have a favorable prognosis)
- Counsel about avoiding factors that trigger headaches
- Identify stressors and advise on how to deal with them
- Counsel about use of medications (dose, frequency, side effects)

Relaxation and Imagery Therapy

- Abdominal breathing exercises
- Visual imagery exercises

Pharmacologic Interventions

For tension headaches and mild migraines, analgesics are useful:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg per dose (usually analgesic of choice)

Children >6 years old may be given 325 mg, and children >12 years old may be given 325–650 mg PO q4h prn.

or

Nonsteroidal anti-inflammatory drugs (NSAIDs):

ibuprofen (Motrin) (**A class drug**), 5–10 mg/kg per dose PO q8h prn, to daily maximum of 40 mg/kg

NSAIDs are associated with a risk of GI side effects.

Do not use ASA, as it is associated with Reye's syndrome.

For migraines:

- Avoid precipitants (triggers)
- Simple analgesic (acetaminophen, ibuprofen) may be given at first sign of aura or headache
- Avoid narcotics

On the advice of a physician, migraine prophylaxis may be ordered, but this is rarely necessary in young children.

For information on treatment and prophylaxis of migraines, see "Migraine Headache," in chapter 8, "Central Nervous System," in adult clinical guidelines (First Nations and Inuit Health Branch 2000).

Monitoring and Follow-Up

During follow-up visits:

- Review headache diary if unable to identify cause on first visit, as well as to monitor management
- Reinforce balanced health habits of sleep, exercise and diet

Referral

Medevac any child with acute symptoms in whom organic pathology is evident or cannot be ruled out without investigation. If symptoms are mild, refer the child electively to a physician.

APPENDIX 15-1: EXAMPLE OF A FORM TO RECORD HEADACHES AND SEIZURES

NAME
B D
CHART NO.
WARD

CHILDREN'S CENTER

MONTHLY RECORD

OF HEADACHES/SEIZURES

DAY OF MONTH	JAN		FEB		MAR		APR		MAY		JUNE		JULY		AUG		SEPT		OCT		NOV		DEC	
	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
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31																								
Totals																								

Note: D=day; N=night

DATE & TIME	DESCRIPTION: duration, precipitating factors, record of everything eaten in the 24 hours before headache

CHAPTER 16 — THE SKIN

Table of Contents

For more information on the history and physical examination of the skin in older children and adolescents, see chapter 9, "The Skin," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

For **ringworm (tinea)**, including **tinea corporis** and **tinea pedis**, and for **warts (verrucae)**, clinical presentation and management are the same in adults and children. For information on these conditions, see chapter 9, "The Skin," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

ASSESSMENT OF THE INTEGUMENTARY SYSTEM

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEM

GENERAL

The following characteristics of each symptom should be elicited and explored:

- Onset (sudden or gradual)
- Skin site involved
- Chronology
- Date(s) and site(s) of recurrence(s)
- Current situation (improving or deteriorating)
- Nature of symptom: intermittent or continuous
- Influence of environmental factors
- Potential causative factors
- Measures taken to relieve symptoms

CARDINAL SYMPTOMS

In addition to the general characteristics outlined above, additional characteristics of specific symptoms should be elicited, as follows.

Skin

- Changes in texture, color, pigmentation
- Unusual dryness or moisture
- Itching
- Rash
- Bruises, petechiae
- Lesions
- Changes in moles or birthmarks

Hair

- Changes in amount, texture, distribution

Nails

- Changes in texture, structure

MEDICAL HISTORY (SPECIFIC TO INTEGUMENTARY SYSTEM)

- Allergic manifestation (e.g., asthma, hay fever, urticaria, eczema)
- Recent or current viral or bacterial illness
- Allergies to drugs, foods or other chemical substances
- Sensitivity to sunlight
- Medications: current and past prescription and OTC drugs
- Immunosuppression (e.g., HIV/AIDS)
- Seborrheic dermatitis
- Dermatitis
- Psoriasis
- Diabetes mellitus

FAMILY HISTORY (SPECIFIC TO INTEGUMENTARY SYSTEM)

- Allergies (e.g., seasonal hay fever, allergies to foods)
- Asthma
- Seborrheic dermatitis
- Psoriasis
- Others at home with similar symptoms (e.g., rash)

PERSONAL AND SOCIAL HISTORY (SPECIFIC TO INTEGUMENTARY SYSTEM)

- Obesity
- Inadequate personal hygiene
- Hot or humid environment, poor environmental sanitation
- Exposure to new chemicals (e.g., soaps), foods, pets or plants
- Emotional disturbance
- History of sensitive skin
- Others at home, work or school with similar symptoms
- Recent travel

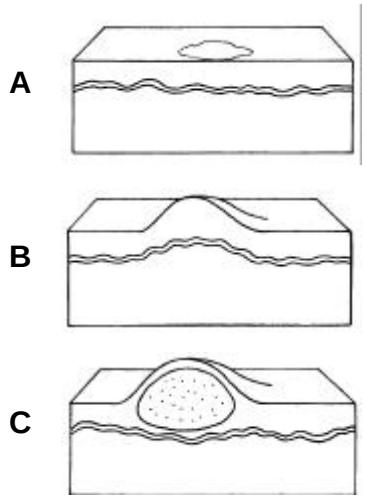
PHYSICAL EXAMINATION

GENERAL APPEARANCE

- Apparent state of health
- Appearance of comfort or distress
- Color (e.g., flushed, pale)
- Nutritional status (obese or emaciated)
- State of hydration
- Vital signs (temperature may be elevated)

INSPECTION AND PALPATION OF THE SKIN

- Color
- Temperature, texture, turgor
- Dryness or moisture
- Scaling
- Pigmentation
- Vascularity (erythema, abnormal veins)
- Bruising, petechiae
- Edema (dependent, facial)
- Induration (firm to touch)
- Individual lesions (color, type, texture, general pattern of distribution, character of edge, whether raised or flat)
- Hair (amount, texture, distribution)
- Nails (shape, texture, discoloration, grooving)
- Mucous membranes (e.g., moisture, lesions)
- Skin folds (e.g., rashes, lesions)
- Joint involvement



A: Macule, a flat, circumscribed area of discoloration of the skin or mucous membrane up to 1 cm in its greatest dimension. **B**: Papule, a solid, elevated lesion of the skin or mucous membrane up to 1 cm in its greatest dimension. **C**: Vesicle, a fluid-filled, superficial, elevated lesion of the skin or mucous membrane, up to 1 cm in its greatest dimension.

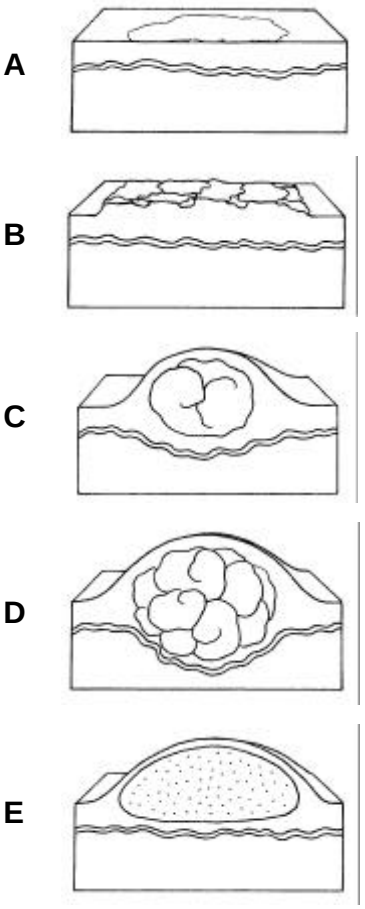
Fig. 16-1: Skin Lesions Up to 1 cm in Greatest Dimension

OTHER ASPECTS

- Examine lymph nodes
- Examine area distal to enlarged lymph nodes

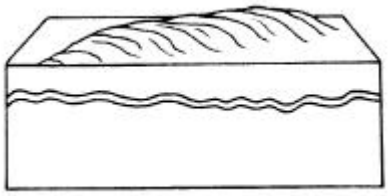
TYPES OF LESIONS

Lesions of the skin and mucous membranes are characterized by their size, elevation, contents and color (Figs. 16-1 to 16-3).



A: Patch, a flat, circumscribed area of discoloration of the skin or mucous membrane, with at least one dimension greater than 1 cm. **B**: Plaque, a solid, elevated lesion of the skin or mucous membrane, with at least one dimension greater than 1 cm. **C**: Nodule, a solid, elevated lesion of the skin or mucous membrane, with the added dimension of depth into the underlying tissue, with at least one dimension greater than 1 cm. **D**: Tumor, a solid, elevated lesion of the skin or mucous membrane, with the added dimension of depth into the underlying tissue (to a greater extent than for a nodule), with at least one dimension greater than 1 cm. **E**: Bulla, a fluid-filled, superficial, elevated lesion of the skin or mucous membrane, with at least one dimension greater than 1 cm.

Fig. 16-2: Skin Lesions Greater than 1 cm in at Least One Dimension



Wheal, an irregularly shaped, elevated, solid, changing, transient lesion of the skin or mucous membrane, due to cutaneous edema. Other lesions of variable size include pustules (vesicle or bulla containing pus rather than clear fluid) and telangiectasias (fine, often irregular red lines produced by dilatation of a capillary).

Fig. 16-3: Skin Lesions of Variable Size

COMMON PROBLEMS OF THE SKIN

SCABIES

DEFINITION

Infestation of the skin with a mite parasite. Skin eruptions consist variably of wheals, papules, vesicles, burrows and superimposed eczematous dermatitis. The lesions are intensely pruritic, especially at night, which leads to marked excoriation.

In infants, the face, scalp, palms and soles are most commonly involved. In adolescents, the lesions, which often appear as threadlike burrows, occur in the interdigital spaces, the groin and genitalia, the umbilicus, and the axillae and on the wrists, elbows, ankles and buttocks.

CAUSE

- Itch mite, *Sarcoptes scabiei,* which burrows under the skin
- Usually transmitted by direct contact and (rarely) fomites (e.g., clothes, linen)

Risk Factors

- Failure to recognize an infestation
- Faulty application of treatment
- Failure to treat close contacts
- Failure to eradicate mites from clothing and bed linen
- Exposure to someone with scabies

The Aboriginal population in some areas may be at risk from a number of additional factors, such as the following:

- Crowded housing, shared beds, crowded schools and daycare centers
- High pediatric population
- Lack of running water, which may predispose to poor hygiene and secondary skin infection

HISTORY

- Severe itching
- Itching generally worse at night
- Rash on hands, feet, flexural folds
- Symptoms may take 1–2 months to develop after contact with mite
- Symptoms are due to hypersensitivity to mite and its products

PHYSICAL FINDINGS

- Usually affects interdigital web spaces, flexures of wrists and arms, axillae, belt line, lower folds of buttocks, genitalia, areolae of nipples
- Diffuse red rash
- *Primary lesions*: papules, vesicles, pustules, burrows
- *Secondary lesions*: scabs, excoriations, crusts, nodules, secondary infection
- Lesions in various stages present at the same time
- Secondary lesions may predominate
- Burrows (gray or flesh-colored ridges 5–15 mm long) may be few or many
- Burrows commonly seen on anterior wrist or hand and in interdigital web spaces
- In infants, burrows are much less common

DIFFERENTIAL DIAGNOSIS

- Pediculosis
- Impetigo
- Eczema (atopic dermatitis)
- Contact or irritant dermatitis
- Viral exanthem
- Chickenpox
- Drug reaction

COMPLICATIONS

- Impetigo
- Cellulitis

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Eradicate infestation
- Control secondary infection
- Relieve symptoms

Appropriate Consultation

Consult physician if you are unsure of the diagnosis.

Nonpharmacologic Interventions

Client Education

- Counsel parents or caregiver (and child, if old enough) about proper use of medication and its side effects

Control Measures

- Prophylactic therapy is essential for all household members, since signs of scabies may not appear for 1–2 months after the infection is acquired
- Treat all household members at the same time to prevent re-infection
- All bed linen (sheets, pillow slips) and clothing worn next to the skin (underwear, T-shirts, socks, jeans) should be laundered in a hot soapy wash and dried with a hot drying cycle, as available
- If hot water is not available, place all bed linen and clothing into plastic bags and store away from the family for 5–7 days, as the parasite cannot survive beyond 4 days without skin contact
- Placing bedding outside in the cold or in ultraviolet light will also help
- Children may return to daycare or school the day after treatment is completed
- Healthcare workers who have had close contact with people who have scabies may themselves require prophylactic treatment
- Community education, aimed at early recognition and awareness of scabies, is important
- In widespread scabies epidemics, prophylactic treatment of a whole community may constitute optimal management

Pharmacologic Interventions

Scabicide cream or lotion, applied to entire body, from chin to toes. Emphasize that scabicide must be applied in skin creases, between fingers and toes, between buttocks, under breasts and to external genitalia.

permethrin 5% dermal cream (Nix) (**A class drug**) (drug of choice)

Leave on skin for 8–14 hours. A single application is usually curative, but medication may be re-applied after 1 week if symptoms persist.

The safety of permethrin for infants <3 months old has not been established.

Pruritus may be a problem, particularly at night. Advise the child and the parents or caregiver that itching will persist for up to 2 weeks. To manage itching:

diphenhydramine hydrochloride (Benadryl) (**A class drug**) (as 2.5 mg/mL elixir), 1.25 mg/kg PO q4–6h prn, maximum dose 300 mg/day (over 6 doses)

Children <2 years old: 2–3 mL

Children 2–4 years old: 5 mL

Children 5–11 years old: 5–10 mL

Children ≥12 years old: 10–20 mL or 25–50 mg in capsule form

Topical steroids may be useful after antiscabietic treatment, because the rash and itching may persist for several days:

hydrocortisone 0.5% (Unicort) (**A class drug**), applied od or bid

Monitoring and Follow-Up

- Follow up in 1 week to assess response to treatment
- Advise parents or caregiver to bring child back to the clinic immediately if signs of secondary infection develop

Referral

Rarely necessary if original diagnosis is correct and adequate eradication treatment is adhered to by the child and his or her contacts.

IMPETIGO

DEFINITION

Highly contagious, superficial bacterial infection of the skin.

CAUSES

- *Streptococcus*, *Staphylococcus* or both
- Predisposing factors: local trauma, insect bites, skin lesions from other disorders (e.g., eczema, scabies, pediculosis)

HISTORY

- More common on face, scalp and hands, but may occur anywhere
- Involved area is usually exposed
- Usually occurs during summer
- New lesions usually due to auto-inoculation
- Rash begins as red spots, which may be itchy
- Lesions become small blisters and pustules, which rupture and drain
- Discharge dries to form characteristic golden yellow crusts
- Lesions painless
- Fever and systemic symptoms rare
- Mild fever may be present in more generalized infections

PHYSICAL FINDINGS

- Thick, golden yellow, crusted lesion on a red base
- Numerous skin lesions at various stages present (vesicles, pustules, crusts, serous or pustular drainage, healing lesions)
- Bullae may be present
- Lesions and surrounding skin may feel warm to touch
- Local lymph nodes may be enlarged, tender

DIFFERENTIAL DIAGNOSIS

- Infection associated with eczema, contact dermatitis or scabies
- Herpes simplex infection with blisters or crusts
- Chickenpox infection with blisters or crusts
- Shingles (herpes zoster) with blisters or crusts
- Insect bites

COMPLICATIONS

- Localized or widespread cellulitis
- Post-streptococcal glomerulonephritis
- Invasive group A streptococcal disease (invasive GAS)

DIAGNOSTIC TESTS

– Wound swab for culture and sensitivity (may be confirmatory)

MANAGEMENT

Goals of Treatment

– Control infection
– Prevent auto-inoculation
– Prevent spread to other household members

Appropriate Consultation

Consult a physician if there is no response to therapy.

Nonpharmacologic Interventions

– Warm saline compresses to soften and soak away crusts qid and prn
– Cleanse with an antiseptic antimicrobial agent to decrease bacterial growth

Client Education

– Counsel parents or caregiver about appropriate use of medications (including dose, frequency and compliance)
– Offer recommendations about hygiene as necessary
– Cut fingernails to prevent scratching
– Counsel parents or caregiver about prevention of future episodes
– Suggest strategies to prevent spread to other household members (e.g., proper hand-washing, use of separate towels)

Pharmacologic Interventions

Apply topical antibiotic preparation after each soaking:

mupirocin ointment (Bactroban) (**A class drug**), qid for 7–10 days

or

fusidic acid (Fusidin) (**A class drug**) qid for 7–10 days

Oral antibiotics may be necessary if there are multiple lesions that appear infected:

cloxacillin (Orbenin) (**A class drug**), 25–50 mg/kg per day, divided q6h, PO

or

erythromycin (E-Mycin tabs or EES suspension) (**A class drug**), 40 mg/kg per day, divided q6h, PO

Topical antibiotics such as mupirocin (Bactroban) may be used alone for small areas or in conjunction with oral antibiotics for larger areas.

Monitoring and Follow-Up

– Follow up in 3 to 5 days to assess response to treatment
– Instruct parents or caregiver to bring the child back for reassessment if fever develops or infection spreads despite therapy

Referral

Not usually necessary unless complications develop.

CELLULITIS

DEFINITION

Acute, diffuse, spreading infection of the skin, involving the deeper layers of the skin and subcutaneous tissue.

Periorbital cellulitis is a special form of cellulitis that usually occurs in children. In this form of cellulitis, unilateral swelling and redness of the eyelid and orbital area, as well as fever and malaise, are usually present. Be alert for any child who is unable to elevate or move the eyeball and any child with forward displacement of the eyeball, which indicates that the infection has extended into the orbit (orbital cellulitis). *See "Periorbital Cellulitis (Preseptal)," in chapter 8, "The Eyes."*

Facial, periorbital and orbital cellulitis are particularly worrisome, as they can lead to meningitis.

CAUSES

– Bacteria: most commonly *Staphylococcus* or *Streptococcus*
– Predisposing factors: local trauma, furuncle, underlying skin ulcer

If a bite was the original trauma, different organisms are involved. *See "Skin Wounds," in chapter 9, "The Skin," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).*

Facial cellulitis in children <3 years old may be due to *Hemophilus influenzae*.

HISTORY

– Localized pain
– Redness
– Swelling
– Area increasingly red, warm to touch, painful
– Area around skin lesion also tender
– Mild fever and headache may be present

PHYSICAL FINDINGS

- Temperature may be elevated
- Heart rate may be elevated
- Redness, swelling
- Advancing edge of lesion diffuse, not sharply demarcated
- Small amount of purulent discharge may be present
- Skin surrounding lesion red and swollen, may be tense
- Edema
- Tenderness
- Induration (firm to touch)
- Regional lymph nodes may be enlarged and tender

DIFFERENTIAL DIAGNOSIS

- Folliculitis
- Foreign body
- Abscess
- Contact dermatitis

COMPLICATIONS

- Extension of infection
- Abscess formation
- Sepsis

DIAGNOSTIC TESTS

- Swab any wound discharge for culture and sensitivity

MANAGEMENT

Goals of Treatment

- Control infection
- Identify abscess formation

MILD CELLULITIS

Treat on an outpatient basis.

Nonpharmacologic Interventions

- Apply warm saline compresses to affected areas qid
- Elevate, rest and gently splint an affected limb

Client Education

- Counsel parents or caregiver about appropriate use of medications (dose, frequency, compliance)
- Encourage proper hygiene of all skin wounds to prevent future infections
- Stress importance of close follow-up

Adjuvant Therapy

If original lesion was caused by trauma, check for tetanus immunization; if not up to date, administer tetanus vaccine.

Pharmacologic Interventions

Oral antibiotics:

cloxacillin (Orbenin) (**A class drug**), 50–100 mg/kg per day, divided q6h, PO for 7–10 days (for most cases involving limbs and trunk)

For children who are allergic to penicillin:

erythromycin (EES suspension or E-Mycin tabs) (**A class drug**), 40 mg/kg per day, divided q6h, PO for 7–10 days

Analgesic and antipyretic for pain and temperature control:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4–6h

Monitoring and Follow-Up

- Follow up daily to ensure that infection is controlled
- Instruct parents or caregiver to bring child back for reassessment immediately if lesion becomes fluctuant, if pain increases or if fever develops

MODERATE TO SEVERE CELLULITIS

Appropriate Consultation

Consult physician if any of the following conditions exist:

- Cellulitis is moderate to severe (e.g., large area is involved)
- Cellulitis is progressing rapidly, which may indicate an invasive streptococcal infection
- Condition affects hands, feet, face or a joint
- Child is immunocompromised (e.g., has diabetes mellitus)
- Child is febrile, appears acutely ill or shows signs of sepsis

Do not underestimate cellulitis. It can spread very quickly and may progress rapidly to necrotizing fasciitis. It should be treated aggressively.

Adjuvant Therapy

- Start IV therapy with normal saline to keep vein open; adjust rate according to state of hydration and age
- If original lesion was caused by trauma, check tetanus immunization; if not up to date, administer tetanus vaccine

Pharmacologic Interventions

Administer IV antibiotics only as directed by a physician:

Children <2 years old: cefuroxime (Zinacef) (**B class drug**), 75 mg/kg per day, divided q8h, IV

Children ≥2 years old: cloxacillin (Orbenin) (**A class drug**), 100–150 mg/kg per day, divided q6h, IV

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg per dose PO q4–6h prn

Monitoring and Follow-Up

Monitor vital signs and affected area frequently for progression.

Referral

Medevac.

ECZEMA (ATOPIC DERMATITIS)

DEFINITION

Inflammatory skin disorder characterized by erythema, edema, pruritus, exudate, crusting, pustules and vesicles. It may be an allergic phenomenon.

Eczema is a common problem in children, and those affected are predisposed to impetigo. Eczema can begin in infancy, often becoming quiescent later in childhood. Recurrences and exacerbations are common.

CAUSES

- Largely unknown
- Often a familial predisposition
- May be associated with allergic rhinitis and asthma

HISTORY

- Erythema
- Weeping patches
- Pruritus
- In infancy, cheeks, face and extensor surfaces of arms and legs are involved
- In childhood and adolescence, flexural surfaces are common sites

PHYSICAL FINDINGS

- Erythematous, dry, pruritic lesions
- In severe cases, lesions may weep
- Multiple sites
- Purulent scabs and crusts, indicating superinfection, may be present
- Lesions may be indurated

DIFFERENTIAL DIAGNOSIS

- Seborrheic dermatitis
- Scabies
- Allergic dermatitis
- Hereditary polymorphic light eruption

COMPLICATIONS

- Drying and thickening of skin (lichenification)
- Secondary infection

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Identify and control environmental causes (for allergic cases)
- Prevent secondary infection

Nonpharmacologic Interventions

- Offer support to child and family, as it can be difficult to live with this irritating chronic condition
- Assist parents (or caregiver) and child to identify precipitating and aggravating factors, and encourage avoidance

Client Education

- Counsel parents (or caregiver) and child about appropriate use of medications (dose, frequency, application)
- Encourage proper hygiene, to prevent secondary bacterial infection
- Recommend that child wear loose-fitting cotton clothing and avoid coarse materials and wool
- Recommend that soap not be used on face
- Recommend avoidance of overheating
- Recommend avoidance of irritants
- Recommend avoidance of perfumes, detergents and soap, as much as possible (and use of a soap substitute, such as Aveeno)
- Suggest that greasy lubricants be applied within minutes of leaving shower or bath to “lock in” moisture (e.g., Lubriderm, Sofsyn, Dermabase)
- Advise parents or caregiver to stop application of steroid preparations once acute lesions have healed, as steroids do not have any preventive effect and can further irritate and damage the skin

Wet Lesions

Promote drying and cooling:

aluminum acetate compresses (Burrows solution, diluted 1:20), qid prn

or

normal saline compresses, qid prn

Dry Lesions

Promote lubrication:

Glaxal base, Nivea cream or petroleum jelly (Vaseline) bid (i.e., after bathing and prn)

Pharmacologic Interventions

Reduce inflammation if itch is moderate or severe:

hydrocortisone 0.5% cream or ointment (Unicort) (**A class drug**), bid or tid for 1–2 weeks

Steroids should be used only sparingly on the face and then only for brief periods.

Gels and creams are used for acute, weeping eruptions. Ointments are used for dry or lichenified lesions. Lotions are used for hairy areas.

Monitoring and Follow-Up

Follow up in 1–2 weeks to assess response. Advise parents or caregiver to bring child back to the clinic sooner if there are signs of infection developing.

Appropriate Consultation

Consult a physician if there is no response to therapy after a 1- to 2-week trial. Higher-potency steroids, if necessary, must be ordered by a physician.

Referral

Arrange elective follow-up with a physician if there is no response to treatment outlined above.

DIAPER RASH

DEFINITION

Inflammation of skin over area covered by diaper; may include erythema, papules, vesicles and occasionally bullae.

CAUSES

- Reaction to friction and prolonged contact with urine and feces
- Candidal dermatitis

HISTORY

- Sore, red rash in diaper area
- Candidal infection may be associated with oral antibiotics being given for other reasons
- Candidal infection may be seen in other creased areas, such as neck and axillae, and may be associated with thrush

PHYSICAL FINDINGS

Contact Diaper Dermatitis

- Erythematous rash over area covered by diaper
- Creases usually spared in cases of simple contact dermatitis associated with exposure to urine

Candidal Infection

- Erythematous rash with sharply demarcated edges
- Weepy, red rash of diaper area
- Satellite pustules outside demarcated edge
- Rash often involves creases

DIFFERENTIAL DIAGNOSIS

- Irritative contact dermatitis
- Candidal infection
- Staphylococcal infection
- Seborrheic dermatitis

COMPLICATIONS

- Secondary infection with other bacteria

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Reduce exposure to irritants
- Treat any secondary infection

Nonpharmacologic Interventions

- Frequent diaper changes
- Washing with warm water and mild soap and air drying at each change
- Exposure of child's bottom to air for longer periods
- Application of topical protection (e.g., zinc oxide cream [Zincofax]) at each change
- Family and caregiver education about bathing, diaper changing and skin maintenance

Pharmacologic Interventions

Contact diaper dermatitis may require mild steroids:

hydrocortisone 0.5% ointment (Unicort) (**A class drug**), applied sparingly bid or tid until rash resolves (5–7 days)

For candidal diaper dermatitis:

nystatin cream (Mycostatin) (**A class drug**), applied bid or tid until rash resolves

For severe cases of candidal diaper dermatitis:

nystatin cream (Mycostatin) (**A class drug**), applied bid or tid until rash resolves

and

hydrocortisone 0.5% cream (Unicort) (**A class drug**), bid

Monitoring and Follow-Up

Advise follow-up in 1 week if the rash has not improved, or sooner if there are signs that the infection is worsening.

Referral

Not usually necessary, unless the condition is recurrent or unresponsive to therapy.

POISON IVY DERMATITIS

DEFINITION

A type of contact dermatitis, secondary to exposure to poison ivy.

CAUSE

– Exposure to poison ivy oleoresin

HISTORY

– Recent work or play in the bush
– Intensely pruritic, erythematous, weeping rash

PHYSICAL FINDINGS

– Erythema
– Vesicular, bullous lesions
– Weeping rash
– Linear streaks
– Edema of affected tissue

DIFFERENTIAL DIAGNOSIS

– Eczema (atopic dermatitis)
– Psoriasis
– Other contact dermatitis

COMPLICATIONS

– Secondary bacterial skin infection

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Prevent infection
– Relieve itch

Appropriate Consultation

Consult a physician for advice if the rash is severe or widespread.

Nonpharmacologic Interventions

– Cleanse the skin to prevent further eruption
– Wash hands, cleaning especially well under nails
– Wash clothing contaminated by the oleoresin

Client Education

– Counsel parents (or caregiver) and children about appropriate clothing to be worn for outside (bush) activities (e.g., long sleeves, long pants)

Pharmacologic Interventions

For mild to moderate cases:

hydrocortisone 0.5% cream (Unicort) (**A class drug**), applied tid to affected area

For intense pruritus:

diphenhydramine hydrochloride (Benadryl) (**A class drug**) (as 2.5 mg/mL elixir), 1.25 mg/kg PO q4–6h prn, maximum dose 300 mg/day (over 6 doses)

Children <2 years old: 2–3 mL

Children 2–4 years old: 5 mL

Children 5–11 years old: 5–10 mL

Children ≥12 years old: 10–20 mL or 25–50 mg in capsule form

or

hydroxyzine (Atarax) (**A class drug**)

Children <6 years old: 50 mg/day, divided q6h

Children ≥6 years old: 50–100 mg/day, divided q6h

Occasionally, a tapering course of oral steroids (prednisone) is required (1–2 mg/kg per day for 14–21 days). Steroids should be given only on the order of a physician.

Monitoring and Follow-Up

Reassess as necessary in 2 or 3 days.

Referral

Usually a self-limiting problem.

HEREDITARY POLYMORPHIC LIGHT ERUPTION

DEFINITION

Skin lesions occurring in areas exposed to the sun, without other cause. Commonly seen in Aboriginal people throughout North and South America.

CAUSES

- Hypersensitivity to sunlight
- Hereditary condition
- Probably an immunologic phenomenon

HISTORY

- Erythematous, vesicular, bullous rash and papules in exposed areas, usually occurring in late winter through summer
- Recurrence common
- Often pruritic

PHYSICAL FINDINGS

- Erythematous rash on face, hands and other exposed surfaces
- Often involves cheilitis (inflammation of the lips)
- Distribution is a significant clue to diagnosis

DIFFERENTIAL DIAGNOSIS

- Eczema (atopic dermatitis)
- Contact dermatitis
- Impetigo
- Seborrheic dermatitis

COMPLICATIONS

- Secondary infection
- Lichenification
- Depigmentation

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Decrease exposure to sunlight

Nonpharmacologic Interventions

- Use of high-level (>30 SPF) sunscreens
- Coverage of exposed parts (with clothing, wide-brimmed hats, etc.)
- Family education about dress and sunscreen use

Pharmacologic Interventions

Topical steroids may be tried, starting with:

hydrocortisone 0.5% cream (Unicort) (**A class drug**), applied od or bid for 1–2 weeks

Fluorinated steroids (e.g., betamethasone) may be necessary on body parts other than the face. Such drugs must be ordered by a physician.

Referral

Refer child to a physician for evaluation if the treatment is unsuccessful.

HEMANGIOMATA

DEFINITION

Vascular nevi, which may be superficial or deep, capillary or cavernous. Often most visible in infancy, tending to diminish in size with age.

CAUSE

- Congenital vascular defect with genetic propensity

HISTORY

- Visible vascular lesion
- Usually from birth or early infancy
- Lesion changes over time

Capillary (Strawberry) Hemangioma

- Usually presents between birth and 2 months of age
- Most common on face, scalp, back or chest
- Expands rapidly initially
- Involuted by 5 years of age in 60% of cases
- Involuted by 9 years of age in 95% of cases

Cavernous Hemangioma

- Red hemangioma
- Deeper, not as well defined or demarcated as strawberry hemangioma
- Period of growth followed by period of regression

PHYSICAL FINDINGS

Capillary (Strawberry) Hemangioma

– Red, protuberant, compressible and sharply demarcated lesion

Cavernous Hemangioma

– Poorly defined red hemangioma
– Lesion may be compressible
– Lesion may be completely covered with skin

DIFFERENTIAL DIAGNOSIS

Capillary (Strawberry) Hemangioma

– Cavernous hemangioma

Cavernous Hemangioma

– Capillary (strawberry) hemangioma

COMPLICATIONS

Capillary (Strawberry) Hemangioma

– Secondary infection or breakdown with involution
– Trauma
– Small scars may remain after involution

Cavernous Hemangioma

– Secondary infection
– May involve underlying structures, including bone
– Large cavernous hemangioma may be associated with hemorrhage or thrombocytopenia

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Reassure child and parents or caregiver
– Treat secondary infection

Nonpharmacologic Interventions

– Reassurance of family

Pharmacologic Interventions

For cavernous hemangioma, steroids (e.g., prednisone [**B class**], 1 mg/kg per day) may be useful. However, steroids can be prescribed only by a physician.

Referral

– Refer child electively to a physician for assessment
– More urgent evaluation may be necessary if there is significant secondary infection, if the hemangioma obscures a vital organ (e.g., the eye), or if the lesion is large enough to trap platelets
– Some children require plastic surgery consultation

MONGOLIAN SPOTS

DEFINITION

Benign lesions, presenting as bluish black discoloration of the skin. Commonly seen in black, oriental, Inuit and First Nations children. They diminish or disappear during childhood.

CAUSE

– Unknown

HISTORY

– Bluish discoloration
– Asymptomatic
– Lesions fade with age

PHYSICAL FINDINGS

– Bluish spots of various sizes
– May occur anywhere on the body, but most common in lumbosacral areas and on back, shoulders and legs

DIFFERENTIAL DIAGNOSIS

– Bruising from trauma

These lesions are sometimes confused with bruising and can be inaccurately interpreted as evidence of child abuse.

COMPLICATIONS

None.

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Make accurate diagnosis

Nonpharmacologic Interventions

– Reassurance of family

MOLLUSCUM CONTAGIOSUM

DEFINITION

Viral condition of the skin, with firm, round, translucent papules.

CAUSE

– Viral infection

HISTORY

– Clusters of papules occurring anywhere on the body

PHYSICAL FINDINGS

– Discrete, skin-coloured, dome-shaped papules of various sizes
– Central umbilication
– Occurring anywhere on the body, but with predilection for face, eyelids, neck, axillae and thighs

DIFFERENTIAL DIAGNOSIS

– Warts

COMPLICATIONS

– Rare
– Scarring, if papule becomes infected

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Make accurate diagnosis
– Prevent secondary infection

Nonpharmacologic Interventions

– Benign neglect is the treatment of choice (most of the lesions disappear within 2 years)
– Reassure child and parents or caregiver as to benign nature of lesions
– Advise against scratching or picking at lesions, to prevent secondary infection

Pharmacologic Interventions

Podophyllin, silver nitrate or trichloroacetic acid can be used to eradicate the lesions, if necessary. Do not use unless ordered by a physician.

Referral

Refer child electively to a physician regarding definitive treatment if the parents (or caregiver) are concerned and desire such treatment.

RINGWORM OF THE SCALP (TINEA CAPITIS)

DEFINITION

Superficial infection of the scalp by the fungus *Microsporum* or *Trichophyton*.

CAUSE

– Fungal infection, usually acquired through direct contact with an infected person

HISTORY

– Alopecia
– Other family members with same condition

PHYSICAL FINDINGS

– Alopecia or patchiness of hair
– Gray scaling
– Broken hairs
– Lesion usually well demarcated

DIFFERENTIAL DIAGNOSIS

– Seborrhea
– Trichotillomania (hair-pulling)
– Psoriasis
– Alopecia areata

COMPLICATIONS

– Damaged hair follicles
– Spread of infection

DIAGNOSTIC TESTS

– Take scrapings of skin or hair for fungal examination
– Wood's lamp test
– Potassium hydroxide (KOH) wet prep

MANAGEMENT

Goals of Treatment

– Make accurate diagnosis
– Relieve infection

Appropriate Consultation

Consult a physician about treatment if you confirm this diagnosis, since topical antifungal agents are ineffective on the scalp.

Nonpharmacologic Interventions

– Provide reassurance to parents or caregiver
– Offer support, as therapy is long and arduous

There is no need to shave the head.

Pharmacologic Interventions

Topical antifungal agents are ineffective on the scalp.

Consult a physician to order:

griseofulvin (Fulvicin) (**B class drug**), 15 mg/kg per 24 hours for 8–12 weeks

This drug is not on the nurses' formulary.

Griseofulvin can have many side effects, including GI disturbances, hepatotoxicity and leukopenia, but it is generally well tolerated by children.

Monitoring and Follow-Up

Follow up every 2 or 3 weeks while the child is receiving medication, to assess adherence, to determine whether there are signs of improvement and to offer support to the parents or caregiver.

It may be necessary to monitor CBC, creatinine level and liver function. Discuss with a physician.

ACNE VULGARIS

DEFINITION

Chronic inflammatory disease of the skin with an eruption of papules or pustules. Most common skin disorder in adolescents and seen to some degree in all adolescents.

Although not life-threatening, acne may have serious psychological effects on self-conscious adolescents.

CAUSES AND PATHOGENESIS

Acne involves the sebaceous follicles, which are sebaceous glands emptying into hair follicles. Found mainly on the face, chest and back, these follicles are stimulated at puberty by increasing levels of androgen. The follicles produce greater amounts of sebum (oil), which combines with keratin from the lining of the follicle to form plugs (comedones). Bacteria (specifically *Propionibacterium acnes*) invade the comedones and produce lipases, which break down the sebum into free fatty acids. These compounds cause inflammation and subsequent rupture of the follicle.

HISTORY

- Rash, lesions on face
- Psychological effects, including embarrassment and social withdrawal

PHYSICAL FINDINGS

Comedones

- Blocked follicle
- *Open comedo (blackhead):* epithelium-lined sac filled with keratin and lipids with a widely dilated orifice, cylindrical, 1–3 mm in length; black color because of melanin pigment in dermis and exposure to air (which causes discoloration of lipids and melanin); color is not due to dirt
- *Closed comedo (whitehead):* precursor to inflammatory lesion; small, flask-shaped, skin-colored, slightly elevated papule just beneath the surface of the skin

Papules

- Develop from obstructed follicles that become inflamed

Pustules

- Larger lesions, more inflamed than papules; superficial or deep

Nodules and Cysts

- *Nodules:* Formed when deep pustules rupture and form abscesses
- *Cysts*: End product of pustules or nodules
- Seen in more severe cases
- Prone to re-inflammation
- May scar on healing

DIFFERENTIAL DIAGNOSIS

- Fungal infection
- Acne rosacea
- Flat warts

COMPLICATIONS

- Scarring
- Hyper-pigmentation of affected areas of the skin

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Control symptoms
- Prevent complications

Nonpharmacologic Interventions

Client Education

- Encourage regular use of non-irritating soaps, since strong soaps may cause irritation and lead to increased production of sebum
- Recommend mild soaps containing sulfur and salicylic acid
- Affected areas should be cleansed two or three times daily
- Encourage persistence with medication (e.g., tretinoin), even if condition worsens temporarily after 2–3 weeks of treatment
- Provide education about the "myths" of acne (e.g., not related to junk food or poor hygiene)
- Recommend avoidance of oily hair products and make-up

Pharmacologic Interventions

Benzoyl Peroxide (Benzagel) (A class drug)

- Decreases sebum production and comedo formation
- Has antibacterial effects
- Available in 2.5% to 10% gels
- Preferred application: 5% gel bid
- Side effects: dryness and irritation

Oral Antibiotics

tetracycline (Tetracyn) (**A class drug**), 250 mg tid for 3 weeks, tapering to once a day

This drug may be given over the long term, until acne resolves.

Monitoring and Follow-Up

See adolescent every 2 or 3 weeks at beginning of treatment.

Referral

Refer any adolescent to a physician electively if there is failure to respond to first-line therapies or if the person has severe nodulocystic disease.

RINGWORM (TINEA)

See "Ringworm (Tinea)," in chapter 9, "The Skin," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

WARTS (VERRUCAE)

See "Warts (Verrucae)," in chapter 9, "The Skin," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

DERMATOLOGICAL EMERGENCIES

PEDIATRIC BURNS

DEFINITION

Tissue injuries resulting from thermal injury to skin (epidermis) or mucosal surfaces. May include injury to the underlying dermis, subcutaneous tissue, muscle or bone. The extent of injury (the depth of the burn) depends on the intensity of heat (or other exposure) and the duration of exposure.

Burns are common in children and can cause significant morbidity and mortality. They constitute the leading cause of accidental death in children.

TYPES OF BURNS

Superficial (First-Degree)

- Affects epidermis only
- Painful and erythematous

Partial-Thickness (Second-Degree)

- *Superficial:* Affects epidermis and outer half of dermis; hairs are spared
- *Deep:* Affects epidermis, with destruction of reticular dermis; can easily convert to full-thickness burn if secondary infection, mechanical trauma or progressive thrombosis occurs

Full-Thickness (Third-Degree)

- Tissue dry, pearly white, charred, leathery
- Healing occurs by epithelial migration from the periphery and by contracture
- May involve adipose, fascia, muscle or bone

CAUSES

- Sunlight
- Hot fluids
- Steam
- Flame
- Contact with hot objects
- Caustic chemicals or acids (there may be few signs or symptoms for the first few days after exposure)
- Electricity (may result in significant injury with very little damage to overlying skin)

Open flames and hot liquids are the most common cause (heat usually 15°C to 45°C or greater) .

Risk Factors

- Excess sun exposure
- Hot water heaters set too high
- Exposure to chemicals or electricity
- Young children with thin skin are more susceptible to injury
- Carelessness with burning cigarettes
- Inadequate or faulty electrical wiring

Specific Pediatric Issues

- Body surface area is proportionately high for weight in younger children
- The relative contribution of various body parts to body surface is different in children than in adults (e.g., head relatively larger, legs relatively smaller)
- In children <3 years old, scald burns from spilled hot liquids are the most common type of burn
- Electrical burns to the mouth can occur in toddlers who chew electrical cords

Intentional Burn Injuries

A form of child abuse that can sometimes be recognized by specific burn patterns. It can be difficult to diagnose. Accurate diagnosis requires a careful history, physical examination and assessment of the child's developmental capabilities, as well as consultation with a physician or admission to hospital for assessment.

- Consider child abuse when a child presents with hot-water burns
- Observe distribution of burns
- Pay attention to straight-line burns, especially if bilateral

HISTORY

Defer history until ABCs have been assessed and stabilized.

- Obtain accurate description of exact mechanism of injury
- Inquire about any treatment given at home (e.g., cooling, application of oils)
- Obtain medical history (but only when time permits)
- Determine medications (but only when time permits)
- Determine allergies (but only when time permits)
- Determine tetanus immunization status

PHYSICAL FINDINGS

- Assess ABCs
- Temperature may be elevated if wounds are infected
- Heart rate may be elevated because of pain
- Blood pressure may be low if child is in shock
- Determine depth (Table 16-1) and extent (Tables 16-2 and 16-3) of the burn
- Determine nature of the burn according to injury pattern (Table 16-4)

Table 16-1: Assessing Depth of a Burn

Characteristic	Superficial (First-Degree)	Partial Thickness (Second-Degree)	Full Thickness (Third-Degree)
Blisters	None	Present	None
Color	Red	Red	White, charred
Moisture	Dry	Wet	Dry
Sensation	Present	Present	Absent
Pain	Moderate	Severe	Absent

Table 16-2: Assessing Extent of Burns in Children

	% of Child's Body Surface Area, by Age				
Area	**Birth to 11 months**	**1 year**	**5 years**	**10 years**	**15 years**
Head	19	17	13	11	9
Neck	3	3	3	3	3
Trunk	26	26	26	26	26
Buttocks	4	4	4	4	4
Genitals	1	1	1	1	1
Arm	7	7	7	7	7
Hand	2.5	2.5	2.5	2.5	2.5
Thigh	5.5	6.5	8.5	8.5	9.5
Leg	5	5	5.5	6	6.5
Foot	3.5	3.5	3.5	3.5	3.5

Table 16-3: Classification of Burns by Severity (Surface Area Involved)

Minor
<10% surface area in second-degree burn
<1% surface area in third-degree burn
Moderate
10% to 20% surface area in second-degree burn
1% to 10% surface area in third-degree burn
Severe
>20% surface area in second-degree burn
>10% surface area in third-degree burn
Any burns on hands, feet, face, eyes, ears, perineum
Any inhalation injury

Table 16-4: Classification of Burns by Injury Pattern

Sunburn
Areas exposed to sun
Splash or scald burns
Maximal burns at location of impact, with lesser burns in dependent areas where fluid has cooled and dropped
Multiple small satellite areas of burned skin may occur around scalded areas of skin
Electrical burns
Burns of the mouth and lip, mucosal swelling and coagulation
May have minor entrance and exit wounds, with severe underlying tissue destruction along route of current
Forced immersion burn
Indicative of abuse
Areas of severe burn in immersed areas usually separated from normal skin by sharp demarcation, without splash marks
May be in a stocking distribution or may involve trunk
Spared sharp-edged areas may be present in dependent areas where part of the body is in contact with immersion container
Contact burns
Burned areas bear patterns of specific hot object in contact with the skin (e.g., grate, stove element)
May be accidental or intentional
Flame burns
Associated inhalation damage may cause acute respiratory failure
Cigarette burns
Usually discrete circular lesions, well circumscribed
May be a form of child abuse and can be confused with impetigo
Adapted, with permission, from Ludwig, S.; Fleisher, G. 1988. *Textbook of Pediatric Emergency Medicine*. 2nd ed. Williams and Wilkins, Baltimore, MD. p. 902-3.

DIFFERENTIAL DIAGNOSIS

- Toxic epidermal necrolysis
- Scalded skin syndrome

COMPLICATIONS

- Hypoglycemia (may occur in children because of limited glycogen storage)
- Burn wound sepsis (usually gram-negative organisms)
- Decreased mobility, with possibility of future flexion contractures
- Gastroduodenal ulceration (Curling's ulcer)
- Pneumonia

DIAGNOSTIC TESTS

- Glucose level (hypoglycemia may occur in children because of limited glycogen storage)
- For electric burns, electrocardiogram

MANAGEMENT

Management is based on the depth of the burns and an accurate estimate of total body surface area (see Tables 16-2 and 16-3).

Goals of Treatment

- Promote healing and restoration of tissue
- Prevent complications
- Prevent recurrences

First Aid Measures for All Burns

- *Thermal burn:* Cool the area if it is still warm to the touch. Burns caused by liquid should be cooled rapidly, and any clothing in contact with the area should be removed rapidly, to decrease contact time. Immerse the body part briefly in cool water to reduce heat and prevent extension of burn. Do not immerse or apply cold water if the burns involve more than 10% of the body surface area.
- *Chemical burn:* Irrigate. If dry powder is still visible on the skin, brush it away before irrigating the skin with water. Irrigate with copious amounts of water for at least 15 (preferably 30) minutes after powders have been removed. This process should be started at the accident scene if possible. Alkali burns should be irrigated for 1–2 hours after injury. Call the poison control center for specific instructions.
- *Tar burn:* Cool, clean gently and apply a petrolatum-based antibacterial ointment (e.g., Polysporin) or other petroleum-based products. Do not attempt to scrape tar off the skin surface, as this can cause further damage. Avoid chemical solvents, which may cause additional burns. After 24 hours the tar can be washed away and the injury treated as a thermal burn.
- *Electrical burn:* Be cautious and observe the child closely. Watch for cardiac arrhythmias. Cardiac monitoring for 24 hours is essential if there was significant exposure to electrical current. Apply a cervical collar. Look for long bone fractures secondary to muscle contraction. An electrical burn may cause thrombosis of any vessel in the body. Clean and dress as for a thermal burn (see below).

TREATMENT OF LESS SEVERE THERMAL BURNS (<10% BODY SURFACE AREA)

Nonpharmacologic Interventions

Superficial Burns

- Cleanse with normal saline or sterile water
- *Dressings:* Cover area lightly with clean, dry gauze dressing

Partial-Thickness (Superficial or Deep) Burns

- Remove any attached clothing and debris
- Cleanse with normal saline or sterile water
- Gently débride using sterile technique
- Small blisters may be left intact
- Remove larger blisters with forceps and scissors (blister fluid is an excellent culture medium)
- *Dressings:* Small, less severe second-degree burns (superficial partial-thickness burns) do not require antimicrobial ointment or impregnated dressings; instead, apply non-adherent porous mesh gauze dressings (e.g., Jelonet)
- Elevate a burned extremity to reduce swelling
- Increase fluid intake over the next 24 hours

Client Education

- Counsel family about appropriate use of medications (dose, frequency)
- Suggest that analgesics be taken 1 hour before dressing changes
- Recommend that dressing be kept clean and dry until the area has healed
- Recommend use of sunscreen
- Recommend that child's access to electrical cords and outlets be prevented
- Suggest that household chemicals be placed out of child's reach
- Suggest low temperature setting for hot water heater
- Recommend that household smoke detectors be installed, with special emphasis on maintenance
- Recommend a family and household evacuation plan in case of fire
- Recommend proper storage and use of flammable substances

Adjuvant Therapy

Check whether tetanus immunization is up to date; give tetanus vaccine as needed (refer to the *Canadian Immunization Guide*, 5th edition [Health Canada 1998])

Pharmacologic Interventions

Analgesic for pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg per dose, PO q4h prn

(for children >6 years old, 325 mg, 1–2 tabs PO q4h prn)

Larger, more severe, deep partial-thickness burns require topical antibiotic ointment or impregnated dressings (ointments can make evaluation of drainage difficult). Apply:

bacitracin ointment (Baciguent) (**A class drug**), od or bid

or

Sofratulle dressing (**A class drug**), od

or

silver sulfadiazine (Flamazine) (**C class drug**), od or bid

Relative contraindication to silver sulfadiazine: possible cross-sensitivity to other sulfonamides.

Prophylactic antibiotics should rarely be required but may be considered for:

- immunocompromised children
- any child at high risk of endocarditis

Broad-spectrum coverage with first-generation cephalosporin or with a penicillinase-resistant penicillin plus an aminoglycoside may be used if necessary.

Discuss choice with a physician.

Monitoring and Follow-Up

- Follow up in 24 hours and daily until the burn is healed
- Re-evaluate depth and extent of injury
- Monitor for healing and development of infection
- Cleanse and débride prn; tub soaks can help loosen coagulum and speed separation of necrotic debris
- Reapply bacitracin or silver sulfadiazine and dry sterile dressing

Absolute sterility is not mandatory during dressing changes; however, cleanliness and thorough cleansing of hands, sinks, tubs and any instruments used is emphasized. Acetic acid (0.25%) can be applied for pseudomonal prophylaxis.

TREATMENT OF MAJOR BURNS

Appropriate Consultation

Consult a physician as soon as the child's condition is stabilized, and prepare to medevac.

Primary Survey

- Stabilize ABCs
- Establish airway and assist ventilation as required
- Give oxygen so as to keep oxygen saturations >97% to 98%

Nonpharmacologic Interventions

Fluid Resuscitation

Calculate fluid resuscitation from time of burn, not from time treatment begins.

- Start IV therapy with normal saline or Ringer's lactate
- Initiate IV therapy if more than 10% of child's body surface area has been burned
- Replace fluid losses
- Rule of thumb for fluid replacement in children with major burns: 4 mL × body weight (kilograms) × % of body surface area burned
- Half of this volume is given in the first 8 hours, a quarter in the second 8 hours and the last quarter in the third 8 hours
- This quantity is given in addition to maintenance fluids and is adjusted according to urine output and vital signs

Burn shock usually takes hours to develop. If shock is evident on initial presentation, look for other causes of volume loss, such as major injury elsewhere in the body. *See "Shock," in chapter 20, "General Emergencies and Major Trauma."*

Special Considerations for Resuscitation

- Restlessness may be secondary to hypoxia
- Assume smoke inhalation; *see "Inhalation of Toxic Material," in chapter 3, "Respiratory System," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000)*
- Monitor for respiratory distress or failure

Secondary Survey

- Identify associated injuries
- Insert urinary catheter
- Insert nasogastric tube
- Assess peripheral circulation if child has circumferential burns on extremities
- Monitor color, capillary refill, paresthesia and deep tissue pain

Wound Care

- Cover burns with clean wet dressings
- Do not break blis ters
- Do not immerse or apply cold water if burns involve more than 10% of body

Pharmacologic Interventions

For analgesia, consult a physician first, if possible; otherwise give:

morphine (**D class drug**) in small, frequent doses (0.1 mg/kg per dose), IV

Be alert for respiratory depression with narcotics.

There is no indication for prophylactic antibiotics.

Monitoring and Follow-Up

- Monitor ABCs and vital signs frequently
- Watch for signs of shock (it usually takes hours for burn shock to develop)
- In circumferential burns, extensive extremity burns or electrical burns, watch for vascular or neurologic compromise, which indicates a developing compartment syndrome; immediate escharotomy is required
- Elevate extremities to minimize swelling
- Wrap child in clean sheet and cover with blankets to conserve heat and prevent hypothermia

Referral

Medevac (using criteria in Table 16-5).

Table 16-5: Criteria for Transfer of Burn Patient to Hospital (All Serious Burns)

Second-degree burns over 10% body surface area, any third-degree burn
Burns of hands, feet, face or perineum
Electrical or lightning burns
Inhalation injury
Chemical burn
Circumferential burn

CHAPTER 17 — HEMATOLOGY, ENDOCRINOLOGY, METABOLISM AND IMMUNOLOGY

Table of Contents

EXPLANATORY NOTE

For this chapter, history and examination of the system are not discussed as such, because hematologic, endocrine, metabolic and immunologic disorders often manifest symptoms and signs in more than one body system. The cardiovascular, GI, neurologic, endocrine and integumentary systems in particular should be evaluated, as problems or symptoms of hematologic, endocrine, metabolic and immunologic disorders commonly manifest in these systems.

See individual chapters for information on history and physical examination relevant to each of these systems.

COMMON HEMATOLOGIC PROBLEMS

IRON DEFICIENCY ANEMIA IN INFANCY

See also "Iron Deficiency Anemia," in chapter 10, "Hematology, Metabolism and Endocrinology," in adult clinical guidelines (First Nations and Inuit Health Branch 2000).

DEFINITION

Abnormally low quantities of circulating RBCs, hemoglobin and hematocrit.

Iron deficiency anemia is most common in infancy, and in some communities up to 65% of Aboriginal infants have iron deficiency between 6 and 24 months of age. The peak age is 10–15 months.

Normal mean hemoglobin levels vary according to the age of the child (Table 17-1).

Table 17-1: Normal Hemoglobin Levels in Children

Age	Hemoglobin Level (g/L)
1 month	115–180
2 months	90–135
3–12 months	100–140
1–5 years	110–140
6–14 years	120–160

CAUSES

- Inadequate dietary intake of iron (common in children and adolescents)
- Increased requirements for iron without concomitant increase in intake (during growth spurts in infants, young children and adolescents)
- Poor iron stores at birth related to insufficient absorption from mother in utero
- Nutritional deficiencies (e.g., folic acid)
- Infection
- Toxic effects
- Bone marrow failure
- Defects in hemoglobin structure
- Predisposing factors: premature infant, fetal and/or neonatal blood loss, use of non-iron-fortified cow's milk formula

Anemia persisting beyond 2 years of age is most likely caused by something other than iron deficiency.

HISTORY

- Diet consisting almost exclusively of milk
- Child 6–24 months of age (usually)
- Symptoms of irritability or lethargy may be present

PHYSICAL FINDINGS

- Obesity
- Pallor
- Tachycardia
- Systolic murmur
- In severe cases, signs of heart failure may be present (e.g., hepatomegaly, gallop rhythm); *see "Cardiac Failure," in chapter 11, "Cardiovascular System"*

DIFFERENTIAL DIAGNOSIS

- Anemia of chronic disease
- Hemolytic anemia
- Anemia of acute hemorrhage
- Aplastic anemia
- Thalassemia
- Vitamin B_{12} deficiency
- Folate deficiency
- Failure to thrive because of decreased nutritional intake

COMPLICATIONS

- Frequent infection
- Side effects of iron therapy
- Cardiac failure (only if the anemia is severe)

DIAGNOSTIC TESTS

- CBC
- Blood smear: small, pale RBCs
- Ferritin level: decreased
- Serum iron level: decreased
- Hemoglobin level: decreased for age (<110 g/L)
- Serum iron-binding capacity: increased

MANAGEMENT

Goals of Treatment

- Prevent dietary deficiencies of iron
- Reverse anemia and increase iron stores

Appropriate Consultation

Consult a physician:

- For medication orders once anemia has been identified
- For any child with obvious symptoms of anemia; this is especially urgent if there is evidence of heart failure

Nonpharmacologic Interventions

- Encourage appropriate intake of iron-rich foods, such as cereals and meats
- Encourage use of iron-fortified infant formula
- Children with extremely severe anemia may need transfusion initially

Pharmacologic Interventions

For mild anemia without heart failure:

ferrous sulfate (Fer-in-Sol) (**B class drug**), 5 mg/mL solution, 6 mg/kg daily, for 3 months

Prophylactic iron supplementation of infants weighing less than 2500 g at birth and those receiving excessive amounts of evaporated milk formulas:

ferrous sulfate drops, 2 mg elemental iron per kilogram of body weight per day, from birth

Monitoring and Follow-Up

Reassess at monthly intervals to check adherence to treatment plan and to re-check hemoglobin level.

Referral

Refer the child to a physician if there is no response to iron therapy after 1 month of treatment.

COMMON ENDOCRINE AND METABOLIC PROBLEMS

FAILURE TO THRIVE

DEFINITION

A symptom (rather than a disease) characterized by failure to gain weight commensurate with gain in height. Length or height and head circumference are affected in severe cases.

This syndrome may extend through a range of situations from inexperience on the part of the parents or caregiver to neglect and abuse. It is recognized that the parent–child relationship may play a role in failure to thrive (Bennett 1996).

The prevalence of failure to thrive is unknown. However, 3% to 5% of pediatric inpatient admissions are for evaluation of this common, yet difficult-to-diagnose problem. Most affected children are 6 to 12 months of age, and almost all are <5 years old. Boys and girls are equally affected.

CAUSES

Environmental Deprivation of Food

- About 70% of cases
- One-third of these cases involve simple educational problems, such as incorrect feeding techniques, incorrect formula preparation and substitution with too much fruit juice
- Other causes are poor maternal–child bonding and child neglect

Organic Causes

- Less than 20% of cases
- Usually a GI or neurologic condition preventing sufficient caloric intake (e.g., cleft palate or choanal atresia)
- Defect in food assimilation (e.g., giardiasis, protein-losing enteropathy such as celiac disease)
- Excessive loss of ingested calories (e.g., through chronic diarrhea, pediatric gastroesophageal reflux disease)
- Immunodeficiency
- Pediatric AIDS
- Malignant lesion
- Cyanotic heart disease
- Renal disease
- Prenatal causes (e.g., intrauterine infection)

Normal, Small-Statured Children

- About 10% of cases
- This is not true failure to thrive

Risk Factors

- Parent(s) or caregiver with psychosocial problems
- Child born prematurely or sick at birth
- Infant with physical deformity
- Unstable, dysfunctional family unit

HISTORY

- Parents or caregiver may describe child as having a difficult personality
- Sleep problems
- Previous weight, height and head circumference for comparison (for premature infant, adjust expected values to correct for gestational age at birth)

Feeding History

- Dietary intake
- Psychosocial events associated with feeding time
- Food preparation
- Quality and quantity of food
- Consider detailed 1- to 3-day diary of dietary intake

Nursing and Breast-Feeding

- Infrequent, brief feedings
- Maternal ingestion of milk suppressants (e.g., alcohol, diuretic drugs)
- Inadequate milk supply
- Nipple problems
- Inadequate let-down, poor sucking reflex
- Maternal malnutrition, exhaustion or depression

Social History

- Interference with adequate care-taking

Risk Factors

- Economic stress
- Dysfunctional family
- Social isolation
- Parental depression

Growth Patterns

Expected weight gain:

0–3 months of age: 26–31 g/day

3–9 months: 13–18 g/day

9–14 months: 10–11 g/day

15–24 months: 7–9 g/day

PHYSICAL AND ENVIRONMENTAL FINDINGS

- Weight low for age (below third percentile) or weight < 80% of median weight in relation to height
- Growth chart shows significant deceleration of weight gain (line recording weight gain on growth chart crosses two major percentile lines)
- Child apathetic and withdrawn or watchful and alert
- Poor hygiene
- Signs of inflicted trauma
- Primary caregiver characteristics: psychosocial problems, commonly depressed
- Family characteristics: unstable, dysfunctional
- Signs of neurologic disorders such as fetal alcohol syndrome

DIFFERENTIAL DIAGNOSIS

- Any condition of sufficient severity to cause failure to gain adequate weight, including child abuse and neglect

COMPLICATIONS

The long-term prognosis for children with failure to thrive due to environmental deprivation is not encouraging: many of these children remain small, and most demonstrate developmental and educational deficiencies and personality disorders; only one-third ultimately develop normally.

- Lower scores on intelligence testing
- Poor language development and reading skills
- Social immaturity, more frequent behavior problems

Source: Oates (1985)

DIAGNOSTIC TESTS

Careful, detailed history and physical examination are the most valuable diagnostic tools.

- Observation of infant and his or her interaction with caretakers and environment
- Careful plotting of growth curves, including weight, height and head circumference

Plotting of growth curve should be done at every visit; observe the growth curve carefully.

Routine laboratory work-up should be kept to a minimum and should be done only if, after consultation with a physician, it is decided to manage the case initially on an outpatient basis:

- CBC
- Urinalysis
- Urine culture
- Chemical profile, including BUN, calcium, phosphorus
- Erythrocyte sedimentation rate
- Other studies as dictated by results of history and physical examination (e.g., thyroid activity profile if there are GI symptoms such as diarrhea; stool samples for culture and sensitivity and occult blood)

MANAGEMENT

Goals of Treatment

- Identify the cause of failure to thrive
- Protect child from permanent sequelae
- Improve parenting skills of caregivers

Appropriate Consultation

Consult a physician as soon as possible. Admission to an inpatient setting is often the first step in sorting out the cause of this condition.

Nonpharmacologic Interventions

Diet

- Provision of balanced, high-calorie diet on both a scheduled and ad lib basis
- Intake should be 150–200 kcal/kg per day
- During observation period, discontinue all solids with fewer calories per ounce than formula or milk

Client Education

- Depends on cause (e.g., provide information about preparing formula if inadequate dietary intake is the suspected cause)
- When environmental deprivation is established, attempts to re-educate the family in a non-punitive way are essential

Behavioral and Family Treatment

- Involve parents or caregiver actively in investigation and therapy
- Recognize that parents or caregiver may experience frustration and guilt
- Restore adequate caregiving
- Modify child's maladaptive learned feeding responses
- Address interactional difficulties between parents (or caregiver) and child

Other Measures

- Provision of stimulation,cuddling and affection to both inpatients and outpatients

Pharmacologic Interventions

- Routine infant vitamin supplementation

Monitoring and Follow-Up

- When the cause is organic, follow-up depends on the particular disease involved.
- When environmental deprivation is established, extremely close follow-up (weekly, both at home and in the clinic) is essential. If the family fails to comply with necessary measures, child protection authorities must be notified, and foster care may be necessary.

Referral

Referral for investigations to rule out organic causes is advisable. The urgency of such referral depends on the particular situation. Protection of the child from further harm is the most compelling factor.

Long-term multifaceted intervention is necessary for non-organic failure to thrive:

- Support and encourage positive parenting skills
- Psychiatric and social services
- Developmental stimulation
- Community infant-stimulation programs

DIABETES MELLITUS IN ABORIGINAL CHILDREN

For more detailed information, see "Diabetes Mellitus," in chapter 10, "Hematology, Metabolism and Endocrinology," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000), as well as the 1998 Canadian diabetes guidelines (Meltzer et al. 1998).

DEFINITION

Disorder of carbohydrate metabolism characterized by hyperglycemia, which is due to reduced insulin secretion, increased tissue resistance to insulin action or both.

CLASSIFICATION

There are two main types of diabetes, both associated with serious long-term complications, including cardiovascular diseases, hypertension, kidney failure, retinopathy leading to blindness and neuropathy.

Type 1

- Near complete loss of insulin production
- Onset may occur anytime during childhood or early adulthood
- Without insulin, ketosis develops and death may occur
- Extremely rare (almost non-existent) in Aboriginal children

Type 2

- Previously known as non-insulin-dependent diabetes mellitus
- Relative lack of insulin or blunted response to insulin
- Often associated with obesity
- Ketosis is unusual

In recent years, more and more cases of type 2 diabetes have been recognized in First Nations teenagers and young children.

Other Disorders of Carbohydrate Metabolism

- Impaired fasting glucose tolerance
- Impaired glucose tolerance

The focus here is on type 2 diabetes.

CAUSES

- Genetic
- Autoimmune disorder

Risk Factors

- Family history
- Central obesity
- High-fat diet

HISTORY

- Polyuria (excessive urination)
- Polydipsia (excessive thirst)
- Polyphagia (excessive ingestion of food)
- Fatigue
- Irritability
- Blurred vision
- Nausea and vomiting
- Fu-like symptoms that do not resolve
- Family history of diabetes

Past History

- Large-birth-weight infant of a diabetic mother
- Recurrent urinary tract infections or yeast infections (or both)

Current Health

- Eating habits (food choices, meal patterns)
- Physical activity
- Smoking
- Alcohol use

PHYSICAL FINDINGS

- Vital signs normal unless there are complications
- Weight changes (child may have a history of weight gain over the years before onset and may lose weight after onset)
- Obesity (most commonly truncal obesity) may be present in association with type 2 diabetes
- Some children may show signs of dehydration (e.g., sunken eyes, dry mucous membranes)
- Most affected children look normal, but may appear ill if the diabetes is of sudden onset

DIAGNOSTIC TESTS

- Urinalysis for glucose, ketones, protein
- In type 1 diabetes, there may be large amounts of ketones, but these compounds are not usually present in type 2 diabetes

Diagnostic Blood Glucose Levels

Guidelines for diagnosis of diabetes mellitus on the basis of serum blood glucose level:

- Random blood glucose level ≥11.0 mmol/L
- Fasting blood glucose level ≥7.0 mmol/L
- 2-hour pc blood glucose level ≥11.0 mmol/L
- For impaired fasting glucose tolerance: fasting blood glucose 6.1–6.9 mmol/L
- For impaired glucose tolerance: 2-hour pc blood glucose level after oral glucose load 7.9–11.0 mmol/L

In the presence of persistent symptoms, only one abnormal glucose result is required for diagnosis. Without symptoms, two abnormal values are needed for the diagnosis.

MANAGEMENT

Goals of Treatment

- Improve carbohydrate metabolism
- Reduce symptoms
- Prevent long-term complications

Appropriate Consultation

An urgent consultation with a physician is advisable for all children with newly diagnosed diabetes mellitus.

If a diagnosis of type 2 diabetes is confirmed, and the symptoms and signs are not severe, medical treatment is not necessarily urgent. The diagnosis is more likely to constitute a medical emergency if there are moderate to large quantities of ketones in the urine and other clinical signs of ketoacidosis (e.g., dehydration). However, ketoacidosis is rarely seen in type 2 diabetes.

Nonpharmacologic Interventions

Diet is the main focus of diabetes management. It is usually advisable to completely restructure the diet of the entire family.

A diabetic child's diet should be low in raw carbohydrates, moderate in complex carbohydrates (starches) and high in fiber. A system of dietary exchanges, as recommended by the Canadian Diabetes Association, is useful.

Where feasible, both the parents (or caregiver) and the child should participate in a diabetes education program, including nutritional and lifestyle counseling. Where this is not possible, nurses, physicians and CHRs must work together to provide as much information as possible to affected families.

Calorie reduction for weight loss is recommended for obese children.

Exercise reduces blood glucose and facilitates entry of glucose into the cells. Regular exercise also decreases the risk of cardiovascular disease and assists in weight loss. All children with type 2 diabetes should be encouraged to develop a regular exercise program. All community resources (e.g., a physical education teacher at the school and a community recreation director, if there is one) should be asked to help in this effort.

Prevention

Although it is unproven that diabetes can be prevented, there is fairly good evidence that diabetes was rare among Aboriginal people 40 years ago. Changes in diet and lifestyle have probably contributed to the increasing prevalence of this condition.

It makes sense to try to prevent diabetes by increasing community knowledge of nutrition, reducing consumption of sugar (e.g., candy, chocolate bars and soft drinks), teaching about diabetes in the schools, and encouraging regular exercise and development of recreation programs and facilities.

Pharmacologic Interventions

The two main types of drug treatment are insulin and oral hypoglycemic agents.

These treatments should not be started without a trial of nonpharmacologic management and may be ordered only by a physician, preferably one who will be following the child over the long term.

Monitoring and Follow-Up

Children with type 2 diabetes need close, regular medical follow-up. The most useful features are weight and general health. Fasting blood glucose and Hb_{A1c} (glycosylated hemoglobin) levels can serve as indicators of diabetes control, but the focus should be on lifestyle, weight loss and exercise.

Monitoring for complications should include blood pressure, eye examination, urinalysis (for protein and microalbuminuria), glucose and renal function, sensory function in extremities and lipid profiles.

The Canadian Diabetes Association has made the following recommendations for screening for complications of diabetes.

Retinopathy

- Type 2 diabetics >15 years old should be screened for retinopathy by an ophthalmologist at the time of diagnosis
- Those with little or no retinopathy should then be screened every 2 years
- Those with retinopathy on initial screening should be followed appropriately by an ophthalmologist according to severity of retinopathy

Nephropathy

- Type 2 diabetics >15 years old should be screened annually for urinary microalbuminuria if dipstick urine shows trace or negative protein
- Recommended screening: albumin to creatinine ratio in a random, daytime urine sample
- If ratio > 2.8 mmol/L for females or > 2.0 mmol/L for males, test should be repeated and possibly confirmed with a 24-hour urine to determine microalbuminuria rate

Neuropathy

- Type 2 diabetics should be assessed annually for peripheral neuropathy (loss or decrease in vibration sense, loss of sensitivity to a 10-g monofilament at the big toes or loss of ankle reflexes, or any combination of these)

Foot Care

- Assess at least annually for structural abnormalities, neuropathy, peripheral vascular disease, ulcers and evidence of infection

Cardiovascular Disease and Hypertension

- Monitor blood pressure at every visit
- Fasting lipid profile should be done for all type 2 diabetics >15 years old, repeated every 1–3 years as clinically indicated

Referral

Medevac if there is evidence of ketonuria or ketoacidosis.

Otherwise, the child should be evaluated by a physician as soon as feasible. Once the child's condition has been stabilized by means of a diabetic regimen, the case should be reviewed by a physician every 3–6 months, including a yearly retinal examination. More frequent follow-up with a physician is advisable if the diabetes is not well controlled or there is evidence of complications.

The long-term management of type 2 diabetes is a collaborative effort between physicians, nurses, CHRs, nutritionists, educators and others.

TYPE 2 DIABETES IN ADOLESCENT PREGNANCY

There are special considerations for the management of diabetes in pregnant adolescent girls. Good control of blood glucose is desirable to reduce the risk of a large baby with congenital malformations or stillbirth.

Careful monitoring of glucose and regular care by a physician are indicated. Pharmacotherapy is often indicated. Oral hypoglycemic agents are contraindicated because of their potential teratogenic effect. Many of these girls must be treated with insulin during pregnancy and require specialized prenatal care.

For detailed information on diabetes in pregnancy, see "Gestational Diabetes," in chapter 12, "Obstetrics," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

COMMON IMMUNOLOGIC PROBLEMS

ALLERGIES

DEFINITION

Any untoward physiologic event caused by an immunologically mediated response.

Atopy is an allergic condition based on an IgE-mediated mechanism, with a strong genetic predisposition; may manifest as urticaria, anaphylaxis, eczema, asthma, insect sting allergy, food allergy or allergic rhinitis.

HISTORY

- Age at onset
- Progression of symptoms
- Seasonality (e.g., if allergy occurs in early spring, it is probably related to trees; if in early summer, to grass; if in fall, to ragweed)
- Exposure to animals
- Exposure to dust
- Exposure to mold in damp places
- Complete history of environment (both indoor and outdoor)
- Record of activities, eating habits
- Complete review of systems, since allergic symptoms may involve any system

Most Common Symptoms

- Skin: itch, rash, dryness
- Swelling of lips, eyes, ears
- Nasal symptoms: clear discharge, coryza, sneezing, snoring
- Respiratory symptoms: wheezing, difficulty breathing, cough (especially at night)
- GI symptoms: cramps, loose stools

PHYSICAL FINDINGS

- Vital signs change only with severe reactions (respiratory rate increases, heart rate increases, blood pressure declines)
- Allergic facies: dark circles under eyes, folds below eyes, transverse crease over bridge of nose, adenoid facies caused by chronic mouth breathing, deep nasolabial folds, high arching of palate, enlargement of tonsils and adenoids
- Skin: dry, follicular prominence, scaling, thickening and darkening of skin in flexor creases of elbows and at back of knees
- Rash: when present, includes urticaria and eczema
- Growth: growth failure and failure to thrive may occasionally result from food allergies
- Lungs: wheezing from bronchospasm

SPECIFIC CONDITIONS

The following specific allergic conditions are presented in this chapter:

- Urticaria (hives)
- Milk protein sensitivity
- Lactose intolerance

URTICARIA (HIVES)

DEFINITION

Red, blotchy wheals of the superficial skin or mucous membranes, which blanch with pressure and are usually very itchy.

Acute urticaria is common among children (approximately 10% to 15% will experience at least one episode).

CAUSES

Mechanism is release of vasoactive peptides (e.g., histamine, prostaglandins, leukotrienes and platelet-activating factor), which cause dilatation of the blood vessels in the skin and leakage of fluid into the surrounding tissue.

The following are frequent causes of urticaria:

- Drug reactions
- Foods
- Infections (viral, streptococcal)
- Inhalants (e.g., pollen, animal dander)
- Insect bites and stings
- Systemic diseases (e.g., rheumatoid disease, malignant lesions, endocrine problems)
- Hereditary causes
- Physical causes (e.g., exercise, cold, heat, exposure to sun)

HISTORY

- Onset
- Duration
- Frequency (if recurrent)
- Diet
- Exposure to inhalants
- Family history
- Fever
- Sore throat
- Other systemic symptoms
- Exposure to drugs

PHYSICAL FINDINGS

- Temperature normal
- Heart rate normal or increased
- Blood pressure normal or decreased
- Rash is usually the only symptom

If swelling of the lips and subcutaneous tissues occurs or there is respiratory difficulty or wheezing, emergency treatment is required. *See "Anaphylaxis," in chapter 20, "General Emergencies and Major Trauma."*

DIFFERENTIAL DIAGNOSIS

- Insect bites
- Erythema multiforme
- Vasculitis
- Viral exanthem

COMPLICATIONS

None related to urticaria.

If urticaria is associated with anaphylaxis, respiratory failure and death could ensue. If urticaria is due to an underlying disease, treatment must be directed to the specific disease.

DIAGNOSTIC TESTS

None.

In an older child, allergy testing may be useful. Consult a physician about such testing.

MANAGEMENT

Goals of Treatment

- Eliminate cause
- Provide symptomatic relief

Appropriate Consultation

Consult a physician if urticaria is extensive and acute respiratory symptoms are involved.

Nonpharmacologic Interventions

- Avoid contact with anything that appears to be related to the onset of urticaria

Pharmacologic Interventions

If symptoms are mild, some degree of symptomatic relief can be obtained from common antihistamines:

diphenhydramine hydrochloride (Benadryl) (**A class drug**) (as 2.5 mg/mL elixir), 1.25 mg/kg PO q4–6h prn, maximum dose 300 mg/day (over 6 doses)

Children <2 years old: 2–3 mL

Children 2–4 years old: 5 mL

Children 5–11 years old: 5–10 mL

Children ≥12 years old: 10–20 mL or 25–50 mg in capsule form

For urgent treatment of anaphylaxis, see "Anaphylaxis," in chapter 20, "General Emergencies and Major Trauma."

Monitoring and Follow-Up

Follow up in 24 hours to ensure that symptoms are diminishing.

Referral

Prepare for possible medevac if symptoms are severe or anaphylaxis is involved. Otherwise, refer child electively to a physician for evaluation.

MILK PROTEIN SENSITIVITY

DEFINITION

Abnormal GI response related to the protein in cow's milk formula.

Manifests in the first 2 months of life. More common in boys and in children with a family history of allergies. Most children who are allergic to milk protein lose this sensitivity by 2 or 3 years of age.

CAUSE

- Unknown
- Predisposing factors: significant family history of allergies

HISTORY AND PHYSICAL FINDINGS

- Vomiting
- Diarrhea
- Abdominal pain
- Steatorrhea
- Respiratory symptoms (e.g., wheezing)
- Eczema
- Poor weight gain
- Edema

DIFFERENTIAL DIAGNOSIS

- Lactose intolerance
- Malabsorption syndrome
- Gastroenteritis

COMPLICATIONS

- Obstruction of gastric outlet
- GI blood loss leading to anemia
- Protein malabsorption leading to growth retardation (e.g., failure to thrive)
- Edema secondary to hypoproteinemia

DIAGNOSTIC TESTS

- Serum eosinophil elevated
- Serum immunoglobulin E (IgE) elevated

MANAGEMENT

Outpatient care is acceptable except in cases of malnutrition.

Goals of Treatment

- Primary prevention
- Reduce symptoms
- Prevent complications

Nonpharmacologic Interventions

Allergy avoidance strategies:

- Identify the at-risk infant early (prenatally or soon after birth; document highly atopic families)
- Breast-feeding should be advocated as a means of preventing food allergy, especially in atopic families
- Delay introduction of cow's milk (i.e., not before 12 months of age)
- Calcium-fortified juices now available for those who cannot drink milk

Up to 25% of children with cow's milk protein sensitivity may also be allergic to soy protein, so switching to a soy-based formula may not help.

Monitoring and Follow-Up

- Monitor as necessary until symptoms are under control
- Monitor growth to ensure that child is gaining weight

Referral

Refer to a physician for evaluation if symptoms are not controlled by dietary measures or if you are concerned about another underlying pathologic condition, such as inflammatory bowel disease, or if the child is not thriving.

LACTOSE INTOLERANCE

DEFINITION

Inability to digest lactose (the primary sugar in milk) into its constituents, glucose and galactose, because of low levels of lactase enzyme in the brush border of the duodenum.

Congenital Lactose Intolerance

- Very rare

Primary Lactose Intolerance

- Occurs after weaning, usually beginning in late childhood
- Age at presentation usually teenage or adult
- Symptoms are experienced after consumption of milk
- Intolerance varies with amount of lactose consumed
- Prevalence varies according to ethnic background: 100% among aboriginal people in the United States, 80% to 90% among blacks, Asians, Jews and those of Mediterranean extraction, and less than 5% among descendants of northern and central Europeans

Secondary Lactose Intolerance

- Caused by any condition injuring the intestinal mucosa (e.g., diarrhea) or a reduction of available mucosal surface (e.g., because of resection)
- Usually transient, with duration of intolerance determined by the nature and course of the primary condition
- 50% or more of infants with acute or chronic diarrhea (especially those with rotavirus disease) have lactose intolerance
- Also fairly common with giardiasis and ascariasis, inflammatory bowel disease and AIDS malabsorption syndrome
- Age at presentation varies with underlying condition

Breast milk contains a large quantity of lactose but does not seem to worsen diarrhea associated with viral or bacterial diseases.

Lactose Malabsorption

- Inability to absorb lactose
- Does not necessarily parallel lactose intolerance

CAUSES

Primary Form

- Normal decline in lactase activity in the intestinal mucosa after weaning
- This decline is genetically controlled and permanent, so primary lactose intolerance is also permanent

Secondary Form

- Associated with gastroenteritis in children
- Usually temporary, although it may persist for several months after the inciting disease has been cured
- Also associated with non-tropical and tropical sprue, regional enteritis, abetalipoproteinemia, cystic fibrosis, ulcerative colitis and immunoglobulin deficiencies in both adults and children

HISTORY AND PHYSICAL FINDINGS

- Bloating
- Cramping
- Abdominal discomfort
- Diarrhea or loose stools
- Flatulence
- Rumbling (borborygmus)
- Vomiting common in children
- Frothy, acidic stool occurs in children
- Malnutrition may occur *(see Table 7-4, "Physical Signs of Nutritional Deficiency Disorders," in chapter 7, "Nutrition")*
- Inadequate weight gain

Degree of symptoms varies with lactose load and with other foods consumed at the same time.

DIFFERENTIAL DIAGNOSIS

- Sucrase deficiency
- Diseases mentioned under "Secondary Lactose Intolerance," in "Definition," above, this section
- Cystic fibrosis
- Failure to thrive

COMPLICATIONS

- Calcium deficiency

DIAGNOSTIC TESTS

- Stool samples: low fecal pH and low quantity of reducing substances in stool; such results are valid only when stool has been collected fresh and assayed immediately, and even in these circumstances, the test is fairly insensitive
- Lactose breath hydrogen test is especially useful in children (to be ordered only by a physician)

MANAGEMENT

Outpatient care, except in severe cases of malnutrition.

Nonpharmacologic Interventions

Dietary Adjustments

- Reduce or restrict dietary lactose to control symptoms
- Yogurt and fermented products such as hard cheeses are tolerated better than milk
- Prehydrolyzed milk (Lactaid) is effective
- Calcium-fortified juices for children > 1 year old who cannot drink milk
- Lactose-free formulas (e.g., Prosobee)

Client Education

- Recommend avoidance of lactose in large quantities, to relieve symptoms
- Suggest that parents (or caregiver) and child learn what level of lactose is tolerable
- Stress that parents or caregiver must read labels on commercial products, because milk sugar is used in many products, which therefore may cause symptoms
- Lactose-intolerant children may tolerate whole milk or chocolate milk better than skim milk
- Lactose is tolerated better when it is consumed with other food products than when it is consumed alone

Pharmacologic Interventions

lactase (e.g., Lactaid, Lactrase), 1 or 2 capsules or tabs before ingestion of milk products (or may be added to milk before ingestion)

These products are not in the nurses' drug formulary.

These agents vary in effectiveness at preventing symptoms. In some areas, milk with added lactase is available.

Supplementary calcium (calcium carbonate) may become necessary if dietary intake is too low.

Monitoring and Follow-Up

Monitor as necessary until symptoms are under control. Monitor growth to ensure that the child is gaining weight.

Referral

Refer to a physician for evaluation if symptoms are not controlled by dietary measures or if you are concerned about another underlying pathologic condition, such as inflammatory bowel disease, or if the child is not thriving.

OBESITY

See "Obesity," in chapter 7, "Nutrition."

CHAPTER 18 — COMMUNICABLE DISEASES

Table of Contents

The clinical presentation and management of **infectious mononucleosis** are the same in adults and children. For information on this condition, see chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

COMMON COMMUNICABLE DISEASES

HISTORY OF PRESENT ILLNESS AND REVIEW OF SYSTEMS

When a communicable disease is suspected, a thorough history is essential. Because microorganisms can affect every system, a thorough review of systems is indicated. The following points should be emphasized:

- Onset (date and time) and duration of illness
- Fever, chills or rigors
- Pain
- Rash: site, color, consistency
- Involvement of mucous membranes or conjunctiva
- Coryza
- Cough
- Sore throat
- Drooling
- Vomiting
- Diarrhea
- Level of consciousness
- Irritability
- Seizures
- Contact with a person with similar symptoms or known communicable disease
- Travel history (specifically, recent travel to an area where a communicable disease is endemic)

PHYSICAL EXAMINATION

VITAL SIGNS

- Temperature
- Heart rate
- Respiratory rate
- Blood pressure prn

INSPECTION

- Color
- Coryza
- Pharynx: redness, lesions
- Mucous membranes: moistness, lesions (e.g., Koplik's spots)
- Skin: rash or petechiae
- Joints: swelling and mobility
- Anal excoriation in diarrheal illnesses

PALPATION

- Fontanel (in infants): size, consistency
- Neck rigidity
- Tactile characteristics of rash
- Lymphadenopathy
- Hepatosplenomegaly
- Joint movement
- Skin turgor and hydration

AUSCULTATION (HEART AND LUNGS)

- Breath sounds
- Crackles
- Wheezing
- Heart sounds
- Pleuritic or cardiac rubs
- Murmurs

ACQUIRED IMMUNODEFICIENCY SYNDROME (AIDS)

AIDS is still rare among children in Canada. However, it may result from neonatal vertical transmission (from mother to newborn) and can occur in adolescents who are involved in prostitution or drug abuse. Adolescents engaged in such activities constitute the child population at greatest risk for AIDS.

CLINICAL CHARACTERISTICS

- Insidious onset of illness
- Fever
- Diarrhea
- Fatigue
- Weight loss
- Lymphadenopathy

The person may present with opportunistic infections, sometimes severe and life-threatening:

- *Pneumocystis carinii* pneumonia
- Cryptosporidiosis
- Toxoplasmosis
- *Cryptococcus* infection
- Tuberculosis

Alternatively, the person may have unusual cancers:

- Kaposi's sarcoma
- Primary brain lymphoma

Other conditions associated with AIDS:

- Wasting syndrome
- Encephalopathy

Health Canada's First Nations and Inuit Health Branch (formerly Medical Services Branch) has prepared a manual on HIV infection and AIDS, which contains detailed information about this complicated condition (Medical Services Branch 1995). The reader is also encouraged to refer to the *Canadian STD Guidelines* (Health Canada 1998).

BOTULISM

DEFINITION

Illness produced by neurotoxins associated with *Clostridium botulinum* infection, which cause an acute, descending, flaccid paralysis.

There are three forms of botulism:

- *Classical (food-borne):* occurs after ingestion of food containing pre-formed toxins; common in the North
- *Infantile:* suspected to occur when ingested organisms produce toxin in the gut; rare
- *Wound:* occurs after contamination of a wound in which anaerobic conditions develop; rare

CAUSES

Any one of five neurotoxins produced by *Clostridium botulinum*.

Transmission

- In infants (infantile botulism): probably through ingestion of *C. botulinum* spores; honey frequently contains such spores, and corn syrup has also been identified as a source of spores
- In older children and adults: ingestion of food contaminated by toxin

Incubation

- Food-borne: 12–36 hours after eating improperly processed food
- Infantile: unknown
- Wound: 4–14 days after contamination of wound

Contagion

Botulism is not known to be contagious; however, the precise mechanism by which infantile botulism is acquired is still unknown.

Communicability

Not applicable.

HISTORY

Food-Borne Botulism

– Exposure to home-prepared foods or honey. Botulism has occurred in Inuit communities in the Far North after ingestion of contaminated fermented seal flipper; it may also follow ingestion of improperly home-canned meats, such as salmon on the west coast.
– Vomiting
– Diarrhea, followed initially by constipation
– Weakness
– Dry mouth
– Visual problems (e.g., blurring of vision, loss of accommodation, diplopia)
– Dysphagia
– Dysarthria

Within 3 days, onset of the following symptoms:

– Descending symmetric paralysis
– Cranial nerves affected first
– Mentation clear, except for fear and anxiety

Infantile Botulism

– Constipation often the first symptom
– Weakness
– Progressive lethargy
– Poor feeding

A history of constipation followed by progressive weakness and decreased activity in an afebrile infant should prompt consideration of botulism as the diagnosis.

Occasionally, the onset and progression of lethargy and weakness is rapid, but the usual duration of symptoms before presentation is 1–20 days.

Wound Botulism

– Fever may be present but is not a diagnostic criterion
– Constipation
– Purulent discharge from wound
– Unilateral sensory changes

PHYSICAL FINDINGS

– Fever may be present
– Ptosis
– Blurring of vision
– Dysphagia (due to bulbar paralysis)
– Hypotonia and weakness
– Respiratory insufficiency
– Neuromuscular respiratory failure

DIFFERENTIAL DIAGNOSIS

– In older children, various infections (e.g., bacterial sepsis, meningitis, poliomyelitis, tic syndrome); however, absence of fever and clear sensorium make sepsis and meningitis less likely
– Guillain-Barré syndrome, which usually presents with ascending paralysis

The descending and symmetric nature of the paralysis, a history of ingestion of home-processed foods and early, more severe involvement of the cranial nerves are clues to the diagnosis.

COMPLICATIONS

– Dehydration
– Aspiration pneumonia
– Paralysis
– Respiratory failure
– Death

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Provide supportive care

Prevention

Provide instruction in the proper preparation of foods. In particular, boiling of contaminated home-processed foods for a period of 3 minutes destroys the toxins.

In the Arctic, botulism seems to have increased with the introduction of plastic bags, which are now used by many Inuit for caching seal flipper and walrus for fermentation, perhaps because *Clostridium* grows best in an anaerobic environment. Conversely, there is a suggestion that botulism is less likely if porous material is used for fermentation, because the bacteria grow poorly in an aerobic environment. Education should be provided to those who wish to continue this traditional means of food preservation.

Discourage use of honey or corn syrup in formula and on pacifiers.

Appropriate Consultation

A physician should be contacted immediately if this condition is suspected.

Adjuvant Therapy

– Start IV therapy with normal saline, and run at a rate sufficient to maintain hydration
– Give oxygen if there are signs of respiratory complications

Nonpharmacologic Interventions

– Nothing by mouth

Control

– Notify medical health officer immediately in outbreaks of food-borne disease
– Identify food suspected of causing the outbreak, as antitoxin is recommended for all others who have ingested this food

Pharmacologic Interventions

Antitoxin, which is given when the botulism has been caused by food-borne or wound infection, may be used in older children but is not usually used in infants.

The antitoxin, if available, is administered only on the order of a physician. Arrangements may be made to have the antidote delivered in an emergency situation.

Antibiotics for wound infection may be instituted on the advice of a physician before transfer:

penicillin G sodium (Crystapen) (**A class drug**), 250 000 units/kg per day, divided q6h

Monitoring and Follow-Up

Monitor ABCs, vital signs, airway protective reflexes, lung sounds, pulse oximetry (if available), intake and output.

Referral

Medevac.

EXANTHEMS (RASH)

DEFINITION

A rash that "bursts forth or blooms" in association with some infections. Characteristically widespread, symmetrically distributed on the child's body, and consisting of red, discrete or confluent flat spots (macules) and bumps (papules) that (at least at first) are not scaly.

Diseases that begin with exanthem or rash may be caused by bacteria, viruses or reactions to drugs.

Some exanthems are accompanied by oral lesions, the most well known of which are the Koplik's spots of rubeola and the oral lesions found in hand-foot-and-mouth disease.

Exanthems were previously numbered according to their chronological appearance in the child:

– First disease: rubeola (measles)
– Second disease: scarlet fever (group A streptococcal infection)
– Third disease: rubella (German measles)
– Fourth disease: Duke's disease (probably coxsackievirus or echovirus); this condition is difficult to distinguish as a diagnostic entity; therefore it is not specifically covered in these guidelines
– Fifth disease: erythema infectiosum (coxsackievirus)
– Sixth disease: roseola infantum (herpesvirus 6 infection, exanthem subitum)

Many viral infections of childhood are characterized by a rash occurring toward the end of the disease course. Often, the rash starts on the head and progresses down the body and out onto the extremities. About the time the rash appears, the fever associated with the infection usually disappears and the child starts to feel a lot better. Several viral illnesses are associated with rashes that are reliable for diagnosis (e.g., rubeola, rubella, erythema infectiosum, roseola infantum, chickenpox), but the rashes of most viral illnesses are too variable to allow accurate diagnosis. That is why healthcare professionals often tell the client simply "It's a virus."

RUBEOLA (MEASLES)

DEFINITION

Exanthematous disease with a relatively predictable course.

CAUSE

– Measles virus

Transmission

– Airborne droplets
– Direct contact with secretions

Incubation

– About 10 days (range 8–12 days) from exposure to onset of illness

Contagion

– High

Lifelong immunity is likely after a person has this disease.

Communicability

The disease may be transmitted during the prodrome and from 1 or 2 days before up to 4 days after appearance of the rash.

HISTORY

– Exposure to an infected person
– Fever
– Cough
– Coryza
– Malaise
– Pink eye with discharge
– Red rash on face and trunk

PHYSICAL FINDINGS

– Fever (up to 40°C)
– Koplik's spots (white spots on buccal mucosa early in disease process)

Rash

– Appears on day 3 to 7
– Erythematous, maculopapular
– Often starts on face and nape of neck, but then becomes generalized
– Spreads from head to feet
– Lesions may become confluent (blotchy)
– After 3 or 4 days, the rash disappears, leaving a brownish discoloration and fine scaling
– Conjunctivitis, pharyngitis, cervical lymphadenopathy and splenomegaly may accompany rash

DIFFERENTIAL DIAGNOSIS

– Unspecified viral exanthem
– Rubella (German measles)
– Adverse drug reaction
– Sensitivity to sunlight
– Roseola infantum
– Coxsackievirus infection
– Kawasaki disease (rash much like rubeola; fever lasts 7–10 days; characterized by inflammation of mucous membranes and swelling of cervical lymph nodes; cause unknown)
– Erythema infectiosum (fifth disease) ("slapped-cheek" appearance and "lacy" rash on limbs and trunk, which often comes and goes over several weeks; not usually associated with high fever); *see "Erythema Infectiosum (Fifth Disease)," below, this chapter*
– Scarlet fever
– Stevens–Johnson syndrome

COMPLICATIONS

– Otitis media
– Pneumonia
– Encephalitis

DIAGNOSTIC TESTS

– Blood sample for serum IgG or IgM: a fourfold rise in serum antibody IgG between acute and convalescent serum samples or the presence of measle-specific IgM in cases with compatible clinical features is diagnostic
– Urine for viral culture
– Nasopharyngeal swab for viral culture

MANAGEMENT

Prevention and Control

– Immunize children at 12 months of age or as soon thereafter as possible
– Measles vaccine (as measles–mumps–rubella [MMR]) is given in two doses: first dose after child's first birthday, second dose as a booster at school entry (4–6 years of age) (the timing of the second childhood MMR dose differs from province to province; check with the provincial department of health)
– Unimmunized contacts should be given gamma globulin (0.25 mL/kg IM) within 6 days of exposure or measles vaccine within 72 hours of exposure

Goals of Treatment

– Provide supportive care
– Prevent spread of disease to others

Appropriate Consultation

Consult a physician if you are unsure of the diagnosis . Rubeola is not frequently seen in a properly immunized population and can be difficult to diagnose.

Nonpharmacologic Interventions

- Rest
- Fluids in adequate amounts to prevent dehydration
- Keep children home from school for 5 days after rash starts
- Advise families to receive no visitors, especially unimmunized children and pregnant women, for 5 days after rash starts
- Notify public health officer

Pharmacologic Interventions

Antipyretic for fever:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4h p rn

Antibiotics are to be used only if bacterial complications occur.

Monitoring and Follow-Up

Advise parents or caregiver to bring the child back to the clinic if there are signs of complications.

Referral

This is usually a self-limiting illness, and referral is usually not necessary. Be alert for complications such as pneumonia, and refer as needed.

SCARLET FEVER

DEFINITION

Syndrome caused by a group A streptococcal toxin. It is characterized by the scarlatina form rash.

CAUSE

- Erythrogenic toxin produced by group A streptococci (which are normal flora of the nasopharynx)
- Usually associated with pharyngitis but, in rare cases, follows streptococcal infections at other sites
- Infections may occur year-round, but prevalence of pharyngeal disease is highest among school-age children (5–15 years of age), in the winter and spring, and in settings of crowding and close contact

Transmission

Person-to-person spread by respiratory droplets is the most common method of transmission.

Incubation

- 12 hours to 7 days

Contagion

- Those affected are contagious during both the acute illness and the subclinical phase
- Occurs predominantly in school-age children (5–15 years of age)

HISTORY

Prodrome

- Fever
- Sore throat
- Headache
- Vomiting
- Abdominal pain

PHYSICAL FINDINGS

- Child appears moderately ill
- Face flushed, with circumoral pallor
- Fever
- Tachycardia
- Tonsils edematous, erythematous and covered with a yellow, gray or white exudate
- Petechiae on the soft palate
- Tender anterior cervical lymphadenopathy

Characteristics of Scarlatina Rash

- Appears 12–24 hours after the onset of the illness, first on the trunk and then extending rapidly over the entire body to finally involve the extremities
- Usually spreads from head to toe
- Diffusely erythematous
- In some children, rash is more palpable than v isible
- Usually has the texture of coarse sandpaper
- Erythema blanches with pressure
- Skin may be pruritic but is not usually painful
- A few days after the rash becomes generalized over the body, it becomes more intense along the skin folds and produces lines of confluent petechiae, known as Pastia's lines (which are caused by increased capillary fragility)
- Three or four days after the onset of the rash, it begins to fade, and the desquamation phase begins, with peeling of flakes from the face; peeling from the palms and around the fingers occurs about 1 week later; desquamation lasts for about 1 month after the onset of the disease

Appearance of Tongue

– During the first 2 days of the disease, the tongue has a white coating through which the red, edematous papillae project; this phase is referred to as white strawberry tongue.
– After 2 days, the tongue also desquamates, which results in a red tongue with prominent papillae, called red strawberry tongue

DIFFERENTIAL DIAGNOSIS

– Exfoliative dermatitis
– Erythema multiforme
– Mononucleosis
– Erythema infectiosum (fifth disease)
– Kawasaki disease
– Rubeola (measles)
– Pharyngitis
– Pneumonia
– Rubella (German measles)
– Pityriasis rosea
– Scabies
– Staphylococcal scalded skin syndrome
– Syphilis
– Toxic epidermal necrolysis
– Toxic shock syndrome
– Drug hypersensitivity
– Unspecified viral exanthem

COMPLICATIONS

– Cervical adenitis
– Otitis media or otitis mastoiditis
– Ethmoiditis
– Sinusitis
– Peritonsillar abscess
– Pneumonia
– Septicemia
– Meningitis
– Osteomyelitis
– Septic arthritis
– Rheumatic fever
– Acute renal failure from post-streptococcal glomerulonephritis

DIAGNOSTIC TESTS

– Throat swab for culture and sensitivity

MANAGEMENT

Goals of Treatment

– Eradicate infection
– Prevent complications
– Prevent spread to others

Appropriate Consultation

Consult a physician if you are unsure of the diagnosis or there are complications.

Nonpharmacologic Interventions

– Rest
– Fluids in adequate amounts to maintain hydration

Prevention

Children should not return to school or daycare until the first 24 hours of antibiotic therapy is complete.

Client Education

– Instruct parents or caregiver that child must complete the entire course of antibiotics, even if symptoms resolve
– Warn parents or caregiver of generalized exfoliation over the next 2 weeks
– Emphasize the warning signs of complications of the streptococcal infection, such as persistent fever, increased throat or sinus pain, and generalized swelling

Pharmacologic Interventions

Antipyretic for fever:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4–6h prn

Antibiotics:

penicillin V (Pen Vee) (**A class drug**)

Children <12 years old: 25–50 mg/kg per day, divided qid (to a maximum of 3 g/day), PO for 10 days

Children ≥12 years old: 300 mg PO qid for 10 days

or

penicillin G benzathine (Bicillin) (**A class drug**)

Children <12 years old: 25 000 to 50 000 U/kg IM (one dose only; maximum dose of 1.2 million U)

Children ≥12 years old: 1.2 million units IM (one dose only)

For children allergic to penicillin:

erythromycin (EES suspension or E-Mycin tabs) (**A class drug**)

Children <12 years old: 40 mg/kg per day, divided qid, PO for 10 days

Children ≥12 years old: 250 mg PO qid for 10 days

Monitoring and Follow-Up

Follow up in 1 or 2 days. Monitor for signs of complications.

Referral

Usually not necessary unless complications arise. Prognosis for recovery is excellent with treatment.

RUBELLA (GERMAN MEASLES)

DEFINITION

Viral exanthematous illness, often mild and subclinical. Rarely seen in an adequately immunized population.

CAUSE

– Rubella virus

Transmission

– Airborne spread of respiratory droplets
– Direct contact with nasopharyngeal secretions
– May also be passed through the placenta to the fetus

Incubation

– 14–23 days

Contagion

– High

Communicability

– 1 week before to 14 days after rash erupts

HISTORY

– Mild illness
– Up to 50% of cases are asymptomatic
– Low-grade fever
– Mild systemic signs (e.g., headache, malaise)
– Arthralgia (joint pain), more common in adolescents

PHYSICAL FINDINGS

– Low-grade fever
– Conjunctivitis
– Macular rash, which starts on face and progresses to trunk and then the extremities
– Rash does not coalesce and lasts about 3 days
– Lymphadenopathy (especially post-auricular, posterior cervical and suboccipital nodes)
– Arthritis (in adolescents)

DIFFERENTIAL DIAGNOSIS

– Rubeola (measles)
– Unspecified viral exanthem
– Adverse drug reaction
– Scarlet fever
– Erythema infectiosum (fifth disease)
– Mononucleosis

COMPLICATIONS

In Fetus

Congenital rubella syndrome may result in any of the following fetal anomalies:
– Deafness
– Cataracts
– Microcephaly
– Mental retardation
– Cardiac lesions
– Hepatosplenomegaly
– Jaundice

The risk is highest in the first trimester.

In Children

– Thrombocytopenia

In Adolescents

– Arthritis
– Encephalitis

DIAGNOSTIC TESTS

None.

MANAGEMENT

Prevention of Congenital Rubella Syndrome in Fetus

- All female adolescents and women of childbearing age should be given measles–mumps–rubella (MMR) vaccine unless they have documented proof of immunity
- Women immunized against rubella are advised not to become pregnant for at least 1 month after receiving the vaccine
- The vaccine-type virus can cross the placenta; however, no case of congenital rubella has ever occurred in newborns of women who were inadvertently immunized while pregnant
- The fetal risk in women "accidentally" immunized during pregnancy is minimal and does not mandate automatic termination of the pregnancy
- If a pregnant woman is exposed to rubella (native disease, not associated with vaccine), an antibody titer should be obtained immediately; if antibody is present, the woman is immune and not at risk
- If antibody is not detectable, a second titer should be obtained 3 weeks later; if antibody is present in the second specimen, infection has occurred and the fetus is at risk for congenital rubella syndrome
- If antibody is not detectable in the second specimen, a third titer should be obtained 3 weeks later (i.e., 6 weeks after exposure); a negative result at this time means that infection has not occurred, whereas a positive result means that infection has occurred, and the fetus is at risk for congenital rubella syndrome
- Immune globulin may be given to a pregnant woman exposed during the first trimester
- Consult a physician about use of immune globulin for prophylaxis during pregnancy, as it predictably and reliably prevents rubella and congenital rubella syndrome

For further information, see the *Canadian Immunization Guide*, 5th edition (Health Canada 1998).

Prevention and Control of Disease in Children

- Rubella vaccine (as measles–mumps–rubella [MMR]) is given in two doses: first dose after child's first birthday, second dose as a booster at school entry (4–6 years of age)

The timing of the second childhood MMR dose differs from province to province. Check with the provincial department of health.

Goals of Treatment

- Treat the symptoms of the illness
- Prevent spread to others

Nonpharmacologic Interventions

- Rest
- Fluids in adequate amounts to maintain hydration
- Parents or caregiver should be advised to limit new visitors to the home, especially pregnant women, for 14 days after appearance of rash
- Report all cases to the public health department

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:
acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg q4h prn

Antibiotics are to be used only if bacterial complications occur.

Monitoring and Follow-Up

- Advise parents or caregiver to bring the child back to the clinic if there are signs of complications
- Complete recovery usually occurs in 1–2 weeks

Referral

This is usually a self-limiting illness, so referral is usually not necessary. Be alert for complications such as encephalitis, and refer as needed.

ERYTHEMA INFECTIOSUM (FIFTH DISEASE)

DEFINITION

Usually a benign viral childhood illness characterized by a classic "slapped-cheek" appearance and lacy exanthem.

Slightly more females than males are affected. Approximately 70% of all cases occur in children 5–15 years old, whereas infants and adults are affected infrequently.

Disease incidence peaks in winter and early spring. Epidemics of infection with the causative organism appear to occur in cyclic fashion every 4–7 years.

CAUSE

– Human parvovirus B19

Transmission

– Respiratory secretions
– Possibly through fomites
– Parenterally by vertical transmission from mother to fetus
– Transfusion of blood or blood products

Fetal transmission may lead to severe anemia resulting in congestive heart failure and fetal hydrops (in fewer than 10% of primary maternal infections). Recent studies have reported that the risk of fetal death in pregnant women exposed to active infection with human parvovirus is 1% to 9%, with greatest risk of fetal loss in the first trimester.

Incubation

– Usually 7–10 days, but can range from 4 to 21 days

Contagion

– Once the rash appears, the person is no longer infectious

HISTORY

Usually a biphasic illness: prodrome followed by viral rash, separated by a symptom-free period of about 7 days.

Prodrome

– Prodromal symptoms (especially joint symptoms) occur more typically in adults; children remain active and relatively asymptomatic
– Prodromal symptoms usually mild, beginning approximately 1 week after exposure and lasting 2–3 days
– Headache
– Fever
– Sore throat
– Pruritus
– Coryza
– Abdominal pain
– Arthralgias

Rash

– Typical viral rash (exanthem) occurs in three phases *(see "Physical Findings," below, this section)*

PHYSICAL FINDINGS

– Rash seen in approximately 75% of children with human parvovirus B19 but in less than 50% of infected adults
– Begins as bright red, raised, "slapped-cheek" rash with circumoral pallor (nasolabial folds usually spared)
– 1–4 days later, erythematous maculopapular rash appears on proximal extremities (usually arms and extensor surfaces) and trunk (palms and soles usually spared)
– Maculopapular rash fades into classic lace-like or reticular pattern as confluent areas clear
– Rash clears and recurs over a period of several weeks or (occasionally) months, possibly in response to stimuli such as exercise, irritation or overheating of skin from bathing or sunlight
– Rash may be pruritic
– Arthritis may also occur, affecting (in order of frequency) metacarpophalangeal and interphalangeal joints, knees, wrists, ankles

DIFFERENTIAL DIAGNOSIS

– Hand-foot-and-mouth disease
– Rubeola (measles)
– Parotitis (mumps)
– Roseola infantum
– Rubella (German measles)
– Scarlet fever
– Systemic lupus erythematosus
– Adverse drug reaction
– Allergic rash
– Unspecified viral exanthem

COMPLICATIONS

– Complications most often seen in children with underlying chronic hemolytic anemia or a congenital or acquired immunodeficient state
– Arthralgia or arthropathy occurs in up to 10% of affected children
– Aplastic anemia

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

– Provide supportive care

Nonpharmacologic Interventions

Rash is usually self-resolving, but may last several weeks or months with exacerbations caused by heat or sunlight.

– Avoid excessive heat or sunlight (which can cause flare-ups of the rash)
– Thorough hand-washing should be encouraged

Client Education

– Emphasize in discussion with parents or caregiver that otherwise healthy children are not infectious once the rash appears, so there is no need isolate or restrict the child from school or daycare
– Infected children with hemolytic disease or immunosuppression may be quite infectious; in these cases, respiratory isolation, especially from pregnant, chronically anemic or immunosuppressed individuals, should be observed

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg PO q4h prn

Monitoring and Follow-Up

Follow up as necessary if complications develop or symptoms do not resolve in the expected period of time (up to 20 days or more).

Referral

Usually not necessary unless complications arise.

ROSEOLA INFANTUM

DEFINITION

Acute benign disease characterized by a prodromal febrile illness, lasting approximately 3 days and followed by defervescence and the appearance of a faint pink maculopapular rash.

May present as an acute febrile illness associated with respiratory or GI symptoms. Most cases present within the first 2 years of life, with the peak age of occurrence between 7 and 13 months. Roseola appears more commonly in the spring and fall.

CAUSE

Human herpesvirus 6 (HHV-6) was identified as the etiologic agent in 1988. There are two major strains of this virus, A and B. Strain B is responsible for most of the primary infections in children.

Transmission

– Probably through respiratory secretions of asymptomatic individuals

Incubation

– About 9 days (range 5–15 days)

Contagion

– Most likely to spread during febrile and viremic phases of the illness
– Viremia usually noted on third day of illness, just before appearance of rash
– By eighth day of illness, antibody activity peaks and viremia resolves

HISTORY

Roseola is classically characterized by high fever followed by rapid defervescence and a characteristic rash.

– Prodromal symptoms (in 14% of cases): listlessness, irritability
– Fever (often as high as 40°C)
– Rash (usually fades within a few hours but may last up to 2 days)
– Maculopapular or erythematous lesions
– Rash typically begins on the trunk and may spread to involve the neck and extremities
– Non-pruritic
– Lesions blanch on pressure
– Seizures (in 6% to 15% of cases)
– Diarrhea (in 68% of cases)

PHYSICAL FINDINGS

- Child appears alert, not acutely ill
- Fever
- Rash
- Rose-pink macules or maculopapules approximately 2–5 mm in diameter
- Lesions characteristically discrete, rarely coalescing together and blanching with pressure
- Typically involves the trunk or back, with minimal involvement of the face and proximal extremities
- Some lesions may be surrounded by a halo of pale skin
- Nagayama's spots (erythematous papules on the soft palate and uvula)
- Periorbital edema, most commonly in the pre-exanthematous stage
- Cervical, post-auricular and post-occipital lymphadenopathy
- Splenomegaly
- Conjunctival erythema

DIFFERENTIAL DIAGNOSIS

- Mononucleosis
- Febrile seizures
- Erythema infectiosum (fifth disease)
- Rubeola (measles)
- Meningitis or encephalitis
- Rubella (German measles)
- Adverse drug reaction

COMPLICATIONS

Roseola is usually a self-limiting illness with no sequelae.

- Seizures during the febrile phase of the illness
- Encephalitis
- Meningitis
- Hepatitis

Fulminate hepatitis, hemophagocytic syndrome and disseminated infection with HHV-6 are extremely rare manifestations.

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Provide supportive care

Nonpharmacologic Interventions

- Rest
- Maintain adequate fluid intake
- Reassure parents or caregiver as to benign nature of illness

Client Education

- Educate family about signs and symptoms of complications
- For an older child, recommend that he or she cover nose and mouth when sneezing or coughing

Pharmacologic Interventions

Antipyretic for fever:
acetaminophen (Tylenol) (**A class drug**),
10–15 mg/kg PO q4h prn

Monitoring and Follow-Up

The illness is usually benign and brief. Follow-up is necessary only if complications develop.

Referral

Not necessary, unless complications develop.

CHICKENPOX (VARICELLA)

DEFINITION

Usually benign viral infection characterized by vesicular eruptions.

CAUSE

- Herpes zoster virus

Transmission

- Direct contact
- Inhalation of airborne droplets

Incubation

- Usually 13–17 days, or up to 3 weeks
- Chickenpox typically develops 2 weeks after contact

Contagion

- Very high

Communicability

- Most infectious 12–24 hours before the rash appears

HISTORY

- Slight fever
- Mild constitutional symptoms
- Skin lesions, possibly extensive, in successive crops
- Lesions may involve mucous membranes
- There may be only a few lesions
- Rash usually starts on trunk or neck

PHYSICAL FINDINGS

- Fever usually mild
- Skin lesions begin as macules
- Skin lesions at various stages may be present concurrently
- Lesions become vesicular after 3–4 days, then break open with development of scabs

Lifelong immunity is likely, although as immunity wanes with age, herpes zoster (shingles) may occur, usually in elderly people. Shingles is a local recurrence of the same virus, and may be slightly contagious to non-immune individuals.

DIFFERENTIAL DIAGNOSIS

- Scabies
- Impetigo
- Herpes
- Infection with coxsackievirus

COMPLICATIONS

- Impetigo
- Cellulitis
- Encephalitis
- Pneumonia

MANAGEMENT

Goals of Treatment

- Provide supportive care

Nonpharmacologic Interventions

- Calamine lotion or Aveeno baths to control itching and to help dry lesions
- Chickenpox is non-reportable in most of Canada, but check provincial regulations

The Canadian Paediatric Society recommends that children with mild chickenpox be allowed to return to school or daycare as soon as they feel well enough to participate in all activities, regardless of the state of their rash. Practice may vary in your area, depending on local school policy.

Pharmacologic Interventions

hydroxyzine (Atarax) (**A class drug**), 2 mg/kg, divided bid or tid, PO

or

diphenhydramine hydrochloride (Benadryl) (**A class drug**) (as 2.5 mg/mL elixir), 1.25 mg/kg PO q4–6h prn, maximum dose 300 mg/day (over 6 doses)

Children <2 years old: 2–3 mL

Children 2–4 years old: 5 mL

Children 5–11 years old: 5–10 mL

Children ≥12 years old: 10–20 mL or 25–50 mg in capsule form

Immunocompromised children must receive varicella zoster immune globulin (VZIG) with 24 hours of exposure. Immune globulin is also recommended for newborns and for mothers who develop chickenpox between 5 days before and 48 hours after delivery. Discuss with a physician.

Monitoring and Follow-Up

Follow up after 1 week.

Referral

Not usually necessary unless complications arise.

Prevention

A varicella vaccine (Varivax) was licensed in Canada in December 1998. Another vaccine is currently under consideration. At the time of writing, the vaccine was not yet part of routine provincial immunization programs. Check with the regional office or public health department to find out about availability of the vaccine in your area.

DIPHTHERIA

DEFINITION

Acute infectious disease affecting primarily the membranes of the upper respiratory tract. Occurs most frequently in children <15 years old who are inadequately immunized.

CAUSE

- *Corynebacterium diphtheria* (toxigenic or non-toxigenic strain)

Transmission

- Direct contact with affected person or carrier through airborne respiratory droplets

Incubation

– 1–6 days

Contagion

– Moderate

Communicability

– May be transmitted until virulent bacilli have disappeared from infected person's system
– Rarely, chronic carriers may shed the organism for months

HISTORY

– Acute onset
– Fever
– Aural discharge
– Nasal discharge
– Sore throat
– Aural diphtheria presents as otitis externa with a purulent, malodorous discharge
– Nasal diphtheria, common in infants, starts with mild rhinorrhea that gradually becomes serosanguineous, then mucopurulent; discharge is often malodorous
– Pharyngotonsillar diphtheria begins with anorexia, malaise, low-grade fever and sore throat
– Nasal and/or pharyngeal membrane appears within 1 or 2 days
– Cervical lymphadenitis and edema of the cervical soft tissues may be severe, and respiratory and cardiovascular collapse may occur
– Laryngeal diphtheria most often represents an extension of pharyngeal infection and presents clinically as typical croup; acute airway obstruction may occur
– Cutaneous (skin) diphtheria is characterized by non-healing ulcers with a gray membrane that may serve as a reservoir of respiratory diphtheria in endemic areas
– Skin is the major reservoir of infection in Canadian Aboriginal communities

PHYSICAL FINDINGS

Findings are variable, depending on the site and the extent of infection, but may include any of the following:

– Fever
– Tachycardia out of proportion to fever
– Child appears acutely ill
– Ear discharge
– Nasal discharge
– Adherent nasal and/or pharyngeal gray or white membrane
– Neck swollen
– Moderate to severe lymphadenopathy
– Skin lesions, which may resemble impetigo
– Cough, hoarseness
– Stridor
– Respiratory distress

DIFFERENTIAL DIAGNOSIS

– Streptococcal pharyngitis
– Peritonsillar abscess (quinsy)
– Vincent's infection (Vincent's angina)
– Infectious mononucleosis

COMPLICATIONS

– Respiratory obstruction
– Toxic effects (including nerve palsies and myocarditis) 2–6 weeks after resolution of initial symptoms

DIAGNOSTIC TESTS

– Obtain throat and/or nasopharyngeal swabs for culture and sensitivity to confirm diagnosis

MANAGEMENT

Prevention

Diphtheria toxoid given as diphtheria–pertussis–tetanus–polio (DPTP) combination vaccine for children <7 years old or as tetanus–diphtheria (Td) combination vaccine for children ≥7 years old, according to recommended immunization schedule; see *Canadian Immunization Guide*, 5th edition (Health Canada 1998).

For Contacts of Index Cases

Antibiotics should be given:

erythromycin (E-Mycin) (**A class drug**) for 7 days

– If contact has been previously immunized but has not had a booster in the past 5 years, give booster dose of diphtheria vaccine
– If contact has never been immunized, use antibiotics as described here, obtain culture before and after initiation of antibiotic, and start an age-appropriate series of immunizations with diphtheria vaccine

Goals of Treatment

– ABCs are the first priority
– Stabilize any airway difficulty

Appropriate Consultation

Immediate consultation with a physician is essential.

Adjuvant Therapy

– Start IV therapy with normal saline, and run at a rate sufficient to maintain hydration
– Give oxygen prn if there are signs of respiratory distress

Nonpharmacologic Interventions

– Nothing by mouth
– Bed rest

Pharmacologic Interventions

Antibiotics may be instituted before transfer, but only on the advice of a physician:

Usual antibiotic therapy:

erythromycin (Erythrocin) (**A class drug**), 40 mg/kg per day, divided bid, IM or IV

Carrier state may be treated with:

erythromycin (E-Mycin tabs or EES suspension) (**A class drug**), 40 mg/kg per day, divided qid, PO for 7 days

Monitoring and Follow-Up

Monitor ABCs, pulse oximetry (if available), respiratory, cardiovascular and neurologic systems, hydration status, intake and output.

Referral

Medevac.

PAROTITIS (MUMPS)

DEFINITION

Acute viral infection characterized by painful swelling of the parotid and other salivary glands.

CAUSE

– Mumps virus

Transmission

– Airborne droplets
– Direct contact with saliva

Incubation

– 2–3 weeks

Contagion

– Low to moderate

Communicability

– 6 days before to 9 days after parotitis appears

HISTORY

– Exposure to infected person
– Inadequate immunization
– Pain and swelling of parotid glands (may be unilateral or bilateral)
– Dysphagia

Prodrome

– Fever
– Malaise
– Anorexia
– Headache
– Myalgia (sore muscles)

PHYSICAL FINDINGS

– Swelling of parotid glands (may be unilateral or bilateral)
– Glands very tender to the touch
– Ear on affected side displaced upward and outward
– Submaxillary and sublingual glands may also be swollen
– Dysphonia

DIFFERENTIAL DIAGNOSIS

– Sialolithiasis (parotid stones)
– Sjögren's syndrome (parotitis, keratoconjunctivitis, absence of tears)
– Purulent parotitis
– Parotid tumor
– Buccal cellulitis

COMPLICATIONS

- Orchitis
- Oophoritis
- Deafness
- Pancreatitis
- Encephalitis
- Aseptic meningitis

DIAGNOSTIC TESTS

None.

MANAGEMENT

Prevention and Control

- Mumps vaccine (as measles–mumps–rubella [MMR]) is given in two doses: first dose after child's first birthday, second dose as a booster at school entry (4–6 years of age)
- See *Canadian Immunization Guide*, 5th edition (Health Canada 1998)

The timing of the second childhood MMR dose differs from province to province. Check with the provincial department of health.

Goals of Treatment

- Provide supportive care
- Prevent complications
- Prevent spread to others

Appropriate Consultation

Consult a physician if you are unsure of the diagnosis. Parotitis is not frequently seen in a properly immunized population and so can be difficult to diagnose.

Nonpharmacologic Interventions

- Rest
- Fluids in amounts adequate to prevent dehydration
- Child may return to school 9 days after the onset of parotid swelling
- Advise parents or caregiver to limit visitors, especially unimmunized children and pregnant women, for 5 days after swelling starts
- Notify public health officer

Pharmacologic Interventions

Antipyretic and analgesic for fever and pain:

acetaminophen (Tylenol) (**A class drug**)

Children <6 years old: 10–15 mg/kg q4h prn

Children 6–12 years old: 325 mg, q4h prn

Children >12 years old: 325–650 mg q4h prn

Antibiotics are to be used only if bacterial complications occur.

Monitoring and Follow-Up

- Advise parents or caregiver to bring the child back to the clinic if there are signs of complications
- Complete recovery usually occurs in 1–2 weeks

Referral

This is usually a self-limiting illness, so referral is usually not necessary. Be alert for complications such as pneumonia, and refer as needed.

PERTUSSIS (WHOOPING COUGH)

DEFINITION

Acute bacterial illness of the upper respiratory tract.

CAUSE

- *Bordetella pertussis*

Incubation

- 7–10 days

Contagion

- High in unimmunized people

Communicability

- Highly transmissible in early catarrhal stage, before paroxysmal cough stage
- Negligible after 3 weeks
- Usually extends 5–7 days after onset of therapy

HISTORY

Catarrhal Stage

- 1–2 weeks
- Symptoms of URTI: rhinorrhea, fever, conjunctival redness , lacrimation

Paroxysmal Stage

- 2–4 weeks or longer
- Paroxysmal cough, increasing in frequency and severity, with a high-pitched inspiratory whoop at end of paroxysm
- Vomiting may occur after coughing paroxysm
- Cyanotic and apneic spells common in infants
- Feeding difficulties

Whoop does not usually occur in young infants and is not necessary for diagnosis.

PHYSICAL FINDINGS

- Fever
- Rhinorrhea
- Lacrimation (tearing)
- Conjunctival redness
- Apnea and cyanosis (may be seen during paroxysmal stage and may be present without the paroxysmal cough)
- Lungs normal, unless pneumonia or atelectasis have occurred

DIFFERENTIAL DIAGNOSIS

- Viral infections (consider respiratory syncytial virus, adenovirus, parainfluenza virus)
- Asthma
- Tuberculosis

COMPLICATIONS

- Hypoxia
- Apnea in young infants (<6 months old)
- Pneumonia
- Seizures

DIAGNOSTIC TESTS

- CBC (high WBC count, with predominance of lymphocytes)
- Culture of nasopharyngeal specimens using calcium alginate or Dacron swab and special culture media (if these culture materials are available) should be attempted to confirm diagnosis

The causative organism is usually cultured only in the catarrhal or early paroxysmal stage.

MANAGEMENT

Prevention and Control

- Immunization according to standard schedule with DPTP combination vaccine (2, 4, 6 and 18 months and before starting school [i.e., 4–6 years of age])
- See *Canadian Immunization Guide*, 5th edition (Health Canada 1998)
- Pertussis vaccine is not currently administered after the child reaches 6 years of age

For Contacts of Index Cases

Close contacts <6 years old who have not received their primary DPTP series should be given one dose of DPTP.

Goals of Treatment

- Treat infection
- Prevent complications
- Prevent spread to others

Appropriate Consultation

Consult a physician if you suspect this diagnosis in a younger child, especially in an infant, as this age group is most at risk for complications.

Nonpharmacologic Interventions

- Rest
- Fluids in amounts adequate to maintain hydration
- Report any suspected or confirmed cases to public health officer

Client Education

- Educate the parents or caregiver about the signs of complications
- Counsel the parents or caregiver about appropriate use of medications (dose, frequency, side effects)
- Advise parents or caregiver to limit new visitors to the home until 5 days after antibiotic therapy is started

Pharmacologic Interventions

erythromycin (E-Mycin tabs or EES suspension) (**A class drug**), 40 mg/kg per day, divided qid, for 14 days

If the child is allergic to erythromycin, consult a physician for alternatives.

For Contacts of Index Cases

erythromycin (E-Mycin tabs or EES suspension) (**A class drug**), 40 mg/kg per day for household or daycare contacts

Monitoring and Follow-Up

The paroxysmal stage may last up to 4 weeks, and the convalescent stage up to several months. Follow up every 1–2 weeks as necessary, to monitor for complications and to provide support.

Referral

Infants and older children with severe disease manifestations (e.g., apnea, cyanosis or feeding difficulties) should be admitted to hospital for supportive care.

PINWORMS

DEFINITION

Parasitic infestation of the cecum of the large bowel. More common in girls, occurring in late fall and winter. Unrelated to personal hygiene.

CAUSE

– *Enterobius vermicularis*

Transmission

– Direct transfer of eggs from anus to mouth
– Contact with fomites contaminated with eggs

Incubation

– 4–6 weeks (duration of organism's life cycle)

Contagion

– Medium to high

Communicability

– About 2 weeks (as long as eggs are laid on perianal skin and remain intact)

HISTORY

– Anal itching, worst at night
– Irritability
– Restlessness during sleep
– Diffuse, non-specific abdominal pain may occur

PHYSICAL FINDINGS

– Small white worms visible in perineal area or stool

DIFFERENTIAL DIAGNOSIS

– Hemorrhoids
– Tapeworms

COMPLICATIONS

– Perianal excoriation from scratching
– Vulvovaginitis

DIAGNOSTIC TESTS

– Scotch Tape test: apply transparent tape to perianal region, remove tape early in the morning and examine microscopically for eggs

MANAGEMENT

Goals of Treatment

– Relieve infestation
– Prevent spread to others

Nonpharmacologic Interventions

– Wash bed clothes, towels and clothing
– Vacuum house

Client Education

– Educate all members of the family about personal hygiene (hand-washing, cutting fingernails)

Pharmacologic Interventions

pyrvinium pamoate (Vanquin) (**A class drug**), 5 mg/kg, single dose, suspension

or

pyrantel pamoate (Combatrin) (**A class drug**), 11 mg/kg, single dose, tabs or suspension

The whole family should be given treatment concurrently.

Monitoring and Follow-Up

Symptoms should improve in several days. Usually there is no need to re-treat, although recurrence is common.

Referral

None.

HEPATITIS

HEPATITIS A

See "Hepatitis," in chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000) for detailed information on the clinical presentation and management of acute hepatitis A.

Control

immune serum globulin 0.02–0.04 mL/kg IM to household and daycare contacts

HEPATITIS B

See "Hepatitis," in chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000) for detailed information on the clinical presentation and management of acute hepatitis B.

Prevention in the Newborn

- If a newborn is exposed to hepatitis B (i.e., mother is positive for hepatitis B surface antigen [HB_sAg]), hepatitis B immune globulin (0.5 mL IM) is given within 24 hours of birth, and hepatitis B vaccine (0.5 mL) may be administered within 7 days after birth and at 1 and 6 months of age
- Because administration of immune globulin and vaccine is not consistent or routine across all provinces, check provincial guidelines
- School programs for hepatitis B vaccines also vary across provinces; check provincial guidelines

TUBERCULOSIS

See "Tuberculosis," in chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000) for detailed information on the clinical presentation and management of tuberculosis.

In addition, detailed information on the prevention, diagnosis and treatment of pulmonary tuberculosis can be found in *Canadian Tuberculosis Standards* (Canadian Lung Association 2000).

Tuberculosis has been a significant cause of morbidity and mortality among Canada's Aboriginal peoples in the past 50 years. Over the past 20 years, the incidence of TB has decreased dramatically in Canada as a whole, although there is currently an upward trend because it occurs frequently in people with AIDS. In addition, TB remains endemic among Aboriginal Canadians.

- Most prevalent in people with crowded living conditions
- Children particularly susceptible

PREVENTION AND CONTROL OF TB IN CHILDREN

BCG vaccine is routinely administered to Aboriginal newborns. It protects against TB meningitis and disseminated (miliary) TB. It may be less effective in preventing pulmonary TB.

MONONUCLEOSIS

See "Mononucleosis," in chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

COMMUNICABLE DISEASE EMERGENCIES

MENINGITIS

DEFINITION

Inflammation of the meningeal membranes of the brain or spinal cord. Most cases (70%) occur in children <5 years old. May be secondary to other localized or systemic infections (e.g., otitis media).

CAUSES

Meningitis may be caused by bacteria, viruses, fungi and (rarely) parasites.

Bacterial

- In children <1 month old: group B *Streptococcus*, *Escherichia coli*
- In children 4–12 weeks old: *E. coli*, *Hemophilus influenzae* type B, *Streptococcus pneumoniae*, group B *Streptococcus*, *Neisseria meningitidis* (meningococcal)
- In children 3 months to 18 years old: *Streptococcus pneumoniae* (most common cause), *N. meningitidis*, *H. influenza* type B (rare)
- *Mycobacterium tuberculosis*

Viral

- Approximately 70 strains of enteroviruses

Fungal

- *Candida*

Aseptic

- Lyme disease

All cases of suspected meningitis occurring in northern communities should be treated as bacterial until proven otherwise.

Transmission

- Meningitis caused by *H. influenzae*: airborne droplets and secretions
- Meningococcal meningitis (caused by *N. meningitidis*): direct contact with droplets or secretions

Incubation

- Meningitis caused by *H. influenzae*: 2–4 days
- Meningococcal meningitis (caused by *N. meningitidis*): 2–10 days

Contagion

- Meningitis caused by *H. influenzae*: moderate; high risk of transmission in daycare centers and other crowded environments
- Meningococcal meningitis (caused by *N. meningitidis*): low; spreads most rapidly in crowded conditions

Communicability

- Meningitis caused by *H. influenzae*: as long as organisms are present; non-communicable within 24–48 hours after treatment is started
- Meningococcal meningitis (caused by *N. meningitidis*): until organism is no longer present in secretions from nose and mouth

HISTORY

- Usually preceded by URTI
- High fever

In children <12 months old the symptoms are non-specific. The following symptoms are commonly reported by the parent or caregiver:

- Irritability
- Child sleeps “all the time”
- Child is “not acting right”
- Child cries when moved or picked up
- Child won’t stop crying
- “Soft spot bulging”**?**
- Vomiting (often without preceding nausea)
- Poor feeding

Older children may complain of the following symptoms:

- Photophobia
- Headache that becomes increasingly severe
- Headache made worse with movement, especially bending forward
- Neck pain
- Back pain
- Changes in level of consciousness, progressing from irritability through confusion, drowsiness and stupor to coma
- Seizures may develop
- Rash (purple spots)

PHYSICAL FINDINGS

Perform a full head and neck examination to identify a possible source of infection.

- Temperature elevated
- Tachycardia or bradycardia with increased intracranial pressure
- Blood pressure normal (low if septic shock has occurred)
- Child in moderate-to-acute distress
- Flushed
- Level of consciousness variable
- Possible enlargement of the cervical nodes
- Focal neurologic signs: photophobia, nuchal rigidity (in children >12 months old), positive Brudzinski's sign (spontaneous hip flexion with passive neck flexion; in children >12 months old), positive Kernig's sign (pain with passive knee extension and hip flexion; in children >12 months old)
- Petechiae with or without purpura may be present in meningococcal meningitis
- Shock (septic)

DIFFERENTIAL DIAGNOSIS

- Bacteremia
- Sepsis
- Septic shock
- Brain abscess
- Seizures

COMPLICATIONS

- Seizures
- Coma
- Blindness
- Deafness
- Death
- Palsies of cranial nerves III, VI, VII, VIII

DIAGNOSTIC TESTS

It is important to culture several specimens before initiating antibiotic therapy in cases of suspected meningitis, to increase the chance of isolating the organism. Consultation with a physician should be attempted before initiating collection of these specimens.

- Three blood samples for culture, drawn 15 minutes apart
- Urine for routine and microscopy, culture and sensitivity
- Throat swab for culture and sensitivity

MANAGEMENT

Goals of Treatment

- Control infection
- Prevent complications

Appropriate Consultation

Consult a physician immediately. Do not delay starting antibiotics if this diagnosis is suspected. If you are unable to contact a physician, follow the guidelines below for IV antibiotics.

Nonpharmacologic Interventions

- Bed rest
- Nothing by mouth
- Foley catheter (optional if the child is conscious)

Adjuvant Therapy

- Start IV therapy with normal saline, and adjust rate according to state of hydration
- Restrict fluid to 50% to 60% of maintenance requirements (unless the child is in septic shock)

Do not overload with fluids, as this could lead to brain edema.

Pharmacologic Interventions

Antipyretic for fever:

acetaminophen (Tylenol) (**A class drug**), 10–15 mg/kg q4h prn

Consult a physician before initiating antibiotic therapy, if you are able to do so. Give initial antibiotic dose as soon as possible.

Infants <6 Weeks Old

ampicillin (Ampicin) (**D class drug**), 75 mg/kg per dose, IV q6h (maximum 2.5 g/dose)

and

gentamicin (Garamycin) (**B class drug**), 2.5 mg/kg per dose q8h

Infants 6 Weeks to 3 Months Old

ampicillin (Ampicin) (**D class drug**), 75 mg/kg per dose, IV q6h (maximum 2.5 g/dose)

and

ceftriaxone (Rocephin) (**D class drug**), 80 mg/kg per dose, IV q12h (for the first 48 hours) (maximum 2 g/dose, 4 g/day)

Children 3 Months to 18 Years Old

ceftriaxone (Rocephin) (**D class drug**), 80 mg/kg per dose, IV q12h (for the first 48 hours) (maximum 2 g/dose, 4 g/day)

Monitoring and Follow-Up

Monitor ABCs, vital signs, level of consciousness, intake and hourly urine output, and watch for focal neurologic symptoms.

Referral

Medevac as soon as possible.

Prevention and Control

Meningitis Caused by *Hemophilus influenzae*

A vaccine is now routinely given to infants as part of the usual childhood immunizations. The type of vaccine and the immunization schedule vary by province. However, the vaccine is usually given at 2, 4, 6 and 18 months of age, along with the DPTP vaccine.

Chemoprophylaxis for household contacts (including adults) in homes where there are children <4 years old:

rifampin (Rifadin) (**B class drug**), 20 mg/kg per dose od for 4 days (maximum dose 600 mg)

Meningococcal Meningitis

Vaccines for certain subtypes are available and are sometimes used in epidemics. Unfortunately, the vaccine does not include the subtype (type B) that commonly causes the disease in the Canadian North. Furthermore, the vaccine is not very effective.

Chemoprophylaxis for household contacts:

rifampin (Rifadin) (**B class drug**)

Infants <1 month old: 5 mg/kg bid for 2 days

Children: 10 mg/kg bid for 2 days

Adults: 600 mg bid for 2 days

CHAPTER 19 — ADOLESCENT HEALTH

Table of Contents

For information about **injury prevention**, see "Injury Prevention Strategies," in chapter 3, "Prevention," these pediatric clinical guidelines.

For information about the clinical presentation and management of **STDs**, see "Sexually Transmitted Diseases," in chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000). In addition, refer to and follow the *Canadian STD Guidelines* (Health Canada 1998).

For information about **suicide**, see "Suicidal Behavior," in chapter 15, "Mental Health," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

INTRODUCTION

Adolescence is a unique time in human development, both physiologically and psychologically. Adolescents in modern society face many health issues, particularly in the areas of mental, emotional and social health. Unfortunately, adolescence is also a period of life when there is little or no contact with healthcare professionals.

Another unfortunate characteristic of adolescence is a propensity for risk-taking behaviors, such as abuse of drugs and alcohol, which cause premature morbidity and death within this age group.

Among adolescents, 77% of deaths are caused by accidents, violence and suicide.

ADOLESCENT DEVELOPMENT

Requirements for healthy development:

- Supportive environment over the long term
- Graded steps toward autonomy

Other factors assisting in healthy development:

- Mutual positive engagement between adolescents and adults
- School and community programs

CHARACTERISTICS OF DEVELOPMENTAL STAGES

Early Adolescence

- Preoccupation with body changes
- High levels of physical activity and mood swings

Mid-Adolescence

- Independence
- Peer group dominates social life
- Risk behaviors more prevalent
- Sexual matters are of most interest

Late Adolescence

- Adult appearance
- More capable of orienting activities toward the future, of mutual caring and of internal control
- Uncertainties about sexuality, future relationships and work possibilities

ADOLESCENT HEALTH CARE

An acute medical need is the most frequent reason for an adolescent to seek medical care. It is important to take this opportunity to discuss other topics important to adolescent health. The mnemonic **SAFE TIMES** is one way of remembering appropriate topics for discussion:

- S for **sexuality** issues
- A for **affect** (e.g., depression) and **abuse** (e.g., drugs)
- F for **family** (function and medical history)
- E for **examination** (sensitive and appropriate)
- T for **timing** of development (body image)
- I for **immunizations**
- M for **minerals** (nutritional issues)
- E for **education** and **employment** (school and work issues)
- S for **safety** (e.g., vehicle)

HISTORY-TAKING

Consider the following points when interviewing an adolescent:

- Ensure that the adolescent is the prime historian. It is preferable to interview the adolescent without his or her parents or caregiver, although it may be necessary to obtain collateral history from parents, caregivers, teachers and others. Assure the adolescent that all important problems will be kept strictly confidential (there are some obvious exceptions, including suicide intention and other high-risk, potentially destructive activity).
- Sensitively explore with the adolescent any problems with sexuality, drugs, alcohol, school and family.
- Try to elicit information about the activities in which the adolescent participates and what his or her peer group is doing. Peer group activities generally reflect the individual's activities.
- If the adolescent is uncommunicative, a multiple-choice approach can be used (e.g., "How would you compare your school performance with that of others? Better, worse or the same?").

FUNCTIONAL INQUIRY

A complete history of the health status of the adolescent should be undertaken whenever an opportunity to do so presents itself. A record of pubertal changes and, for young women, a complete menstrual history, are essential components of this history.

PSYCHOSOCIAL EVALUATION

Issues related to sexuality, drug or alcohol use, and family and school problems should be systematically reviewed. Questions about school attendance and performance and future plans for school and employment should be part of a complete evaluation.

COMPREHENSIVE PHYSICAL EXAMINATION

Emphasis should be placed on common adolescent concerns. Height, weight and blood pressure should be measured yearly in adolescents. Sexual maturation (according to Tanner stages; see Table 19-1) should be noted.

SKIN

Obvious problems, particularly acne, should be noted and treated.

EYES

Visual acuity should be screened, as myopia commonly develops during the adolescent growth spurt.

MOUTH

Dental decay and periodontal disease can be significant problems in adolescence.

BREASTS

Development and symmetry of the breasts should be assessed, and girls should be taught how to perform breast self-examination.

CARDIOVASCULAR SYSTEM

Functional murmurs are common in adolescence, but look for other forms of cardiac pathology (e.g., mitral prolapse).

MUSCULOSKELETAL SYSTEM

Sports injuries, knee problems and other problems of the musculoskeletal system are common in adolescence. Routine screening for scoliosis is of questionable value.

GENITALIA

Assess development of pubic hair to allow Tanner staging (see Table 19-1).

Boys should be examined with respect to normal growth and development of the external genitalia.

Girls who are sexually active should undergo a pelvic examination and Pap smear with appropriate STD screening at least once yearly. General indications for pelvic examination would also include menstrual irregularities, severe dysmenorrhea, vaginal discharge, unexplained abdominal pain or dysuria.

RECTAL EXAMINATION

At some point during the health maintenance program, a rectal examination should be performed on all adolescents, but this can be deferred to the late teens if necessary.

PUBERTY

FEMALE

In the female, puberty begins between the ages of 8 and 14 years and is usually complete within 3 years. Menarche usually occurs 2.5 years after the onset of puberty; in North America, the mean age at menarche is 12.5 years. At menarche the adolescent female has generally attained 95% of her adult height. The female adolescent growth spurt usually occurs between Tanner stages II and IV (see Table 19-1), and during this period she will grow an average of 8 cm per year.

MALE

Puberty usually begins 1.5–2 years later in the male than in the female, and it takes twice as long. The male adolescent growth spurt occurs during Tanner stage V (see Table 19-1). The average increase in height during this period is approximately 10 cm per year.

Table 19-1: Tanner Staging of Adolescent Development*

	Pubic Hair†			
Stage	**Male**	**Female**	**Testes and Penis in Male**	**Breast Development in Female**
I (preadolescent)	No pubic hair present; some fine villous hair covers the genital area	No pubic hair present	Appearance of testes, scrotum and penis identical with that of early childhood	Juvenile breast with elevated papilla and small, flat areola
II	Sparse distribution of long, slightly pigmented hair at the base of the penis	Sparse distribution of long, slightly pigmented, straight hair bilaterally along medial border of labia	Enlargement of testes and scrotum; reddish coloration and enlargement of penis	Breast bud forms; papilla and areola elevates to form small mound
III	Pigmentation of pubic hair increases, and hair begins to curl and spread laterally	Pigmentation of pubic hair increases, and hair begins to curl and spread sparsely over mons pubis	Continued growth of testes in scrotum and continued lengthening of penis	Continued enlargement of breast bud and areola; no separation of breast contours
IV	Pubic hair becomes coarser in texture and takes on adult distribution	Pubic hair continues to curl and becomes coarse in texture; number of hairs continues to increase	Testes and scrotum continue to grow; scrotal skin darkens; penis grows in width, and glans penis develops	Papilla and areola separate from the contour of the breast to form a secondary mound
V	Mature pubic hair chains and adult distribution, with spread to surface of the medial thigh	Mature pubic hair chains; adult feminine triangle pattern, with spread to surface of medial thigh	Mature adult size and shape of testes, scrotum and penis	Mature areolar mound recedes into general contour of breast, papilla continues to project

*Adapted, with permission, from Tanner J.M., 1962. *Growth at Adolescence*. 2nd ed. Blackwell Scientific Ltd., Osney Mead, Oxford. © Blackwell Scientific Publications.

†Distribution and coarseness of pubic hair may differ according to ethnic background (e.g., an Aboriginal adolescent may not have the same distribution of coarse hair as a Caucasian adolescent).

SEXUALITY

Recent estimates suggest that approximately 70% of North American teenagers are sexually active by 17 years of age. This may occur earlier among Aboriginal teens in some communities. Given this prevalence of sexual activity, it is obvious that adolescence is an important time for a person to determine his or her sexual identity and attitudes toward sexual orientation.

In addition, the prevalences of STDs and unplanned pregnancies are high among adolescents. These are very important public health concerns for the community. Questions about sexual activity and the adolescent's peer group may help to identify problems.

HOMOSEXUALITY

Complex physical and social issues arise for all homosexual adolescents. Seventeen percent of boys and 11% of girls report having had at least one homosexual experience by the age of 19 years. It is estimated that half of these adolescents will be homosexual in adulthood.

TEEN PREGNANCY: TESTING AND COUNSELING

A high index of suspicion is necessary. Consider the possibility of pregnancy when an adolescent presents with any of the following somatic complaints:

- Irregular menses
- Unusual vaginal bleeding
- Acute or chronic abdominal pain
- Unreliable menstrual history
- Amenorrhea

URINE PREGNANCY TESTING

Highly specific monoclonal antibody techniques yield positive results in early pregnancy. A urine pregnancy test usually has a positive result by 2 weeks after conception.

COUNSELING

Counseling the adolescent about her options related to pregnancy is an important role for nurses. Options include carrying the fetus to term and keeping the infant, carrying the fetus to term and placing the child for adoption, or therapeutic termination of the pregnancy. The pregnant adolescent will have to decide which option she will pursue, and referral should be available for all options.

FACTORS OF TEENAGE PREGNANCY ASSOCIATED WITH RISKS TO INFANT

- Poor prenatal care (reluctance to seek care)
- Poor nutrition, leading to intrauterine growth retardation
- Smoking (one-third of pregnant teens)
- Use of illicit drugs
- Associated STDs
- Poor parenting skills

FOLLOW-UP

- Nutritional status and weight gain by the adolescent mother constitute one of the most important features of good prenatal care for this age group
- Because the prevalence of STDs is higher among adolescents, the potential of passing such infections to the baby must be stressed; initial and follow-up cultures, as indicated, should be routine
- Assessment for immunity to rubella virus
- Long-term planning with respect to adoption placement or, more commonly, with respect to support for the adolescent mother once her baby is delivered
- Assessment and counseling for drug and alcohol abuse

COMMUNITY HEALTH AIMS AND INTERVENTIONS

- Repeat pregnancy within 2 years after the first child is born to an adolescent female is a recognized problem
- Counseling and interventions with respect to appropriate postpartum contraception are key
- Ongoing surveillance of the adolescent's coping and parenting skills is of prime importance
- Community education programs to prevent unplanned teenage pregnancies, particularly those aimed at school-age children, are also important

CONTRACEPTION

HORMONAL CONTRACEPTION

- The most effective non-surgical methods of preventing pregnancy in adolescents are oral contraception and Depo-Provera injection (every 3 months)
- The main problem with oral contraception as a form of birth control is poor compliance and discontinuation of therapy (which occurs in 25% to 50% of North American teenagers for whom this form of contraception has been prescribed)
- Discontinuation is usually secondary to adverse effects or to family or community pressures regarding childbearing
- Adolescent growth is not affected by the use of hormonal contraceptives

MANAGEMENT OF ADOLESCENT FEMALES REQUIRING CONTRACEPTION

- Detailed history and physical examination, including blood pressure
- Pelvic examination and Pap smear (if the adolescent is not yet sexually active, these tests can be deferred until she becomes sexually active)

CONTRACEPTIVES AND COUNSELING

The nursing profession has a vital role in educating and counseling adolescents about the risks associated with sexual activity. Use of contraception by sexually active adolescents should be encouraged.

Appropriate counseling addresses the various methods of contraception, presenting both their advantages and their disadvantages. The use of condoms must be heavily emphasized. Both contraceptives and condoms should be made readily available at the nursing station, and condoms should be available at other strategic places in the community.

Follow up at 1, 3 and 6 months after initiation of contraception to ensure no significant side effects and to monitor blood pressure.

Condoms and foam should be used as back-up contraception during the first month of oral contraceptive use. Thereafter, condom use, to prevent STDs, should be recommended.

For detailed information about contraceptive methods and choices for oral contraception, see "Contraception," in chapter 13, "Women's Health and Gynecology," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

OTHER ISSUES

Compliance

Compliance is a significant problem in adolescents, and lack of compliance is a major factor in the failure of oral contraception.

The adolescent should understand that initially there is a high likelihood of spotting or break-through bleeding and missed menses with use of hormonal contraceptives. These side effects usually diminish or disappear within 3–6 months.

Rubella

Adolescent females without documented evidence of rubella immunization should undergo rubella titer testing; if negative, measles–mumps–rubella vaccine should be given. Alternatively, those without any recorded evidence of immunization may be immunized without first undergoing rubella titer testing.

Pap Smear

A Pap smear should be obtained for any sexually active adolescent female — at annual intervals if results are normal or more frequently as dictated by findings.

SEXUALLY TRANSMITTED DISEASES

The occurrence of STDs in gay males is a significant public health issue. Consideration should be given to hepatitis B vaccination and to HIV, VDRL and STD testing for all sexually active adolescents.

See "Sexually Transmitted Diseases," in chapter 11, "Communicable Diseases," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

SUICIDE

See "Suicidal Behavior," in chapter 15, "Mental Health," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).

INJURY PREVENTION

See "Injury Prevention Strategies," in chapter 3, "Prevention."

ALCOHOL, NICOTINE, DRUG AND INHALANT ABUSE

Drug abuse is widespread in North American society. The use of so-called gateway drugs, such as alcohol, tobacco and marijuana, usually begins in adolescence, and today's adolescents experiment at earlier ages than adolescents of previous generations. Nicotine is the most commonly abused drug, followed by alcohol, marijuana and then stimulants such as amphetamines and cocaine. In Aboriginal communities, gas and solvent sniffing also constitute a significant hazard. Ecstasy (a drug used at raves) is a new drug of abuse. Generally, adolescent boys abuse all forms of drugs and alcohol to a greater extent than do adolescent girls.

FACTORS ASSOCIATED WITH HIGHER-RISK BEHAVIORS

- Drug and alcohol use
- Sexual activity
- Poor school performance
- Peer pressure
- Poor diet and limited physical activity
- Low socioeconomic status
- Poor relationship with parents or caregiver

RISK FOR SUBSTANCE AND ALCOHOL ABUSE

- Family history of alcohol or substance abuse on either side of the family
- Use of alcohol, marijuana or cocaine in early adolescence
- Use of cross-dependent drugs, such as marijuana, sedatives, tranquilizers
- Drug use within peer group
- Adolescents with attention deficit hyperactivity disorder, learning disability or depression
- Adolescents who are suicidal
- Family dysfunction: divorce, alcohol or drug abuse, child abuse, inconsistent or impulsive stealing
- Adolescents with school problems (e.g., absenteeism) or p roblems with the law

ALCOHOL

GENETIC RISK FACTORS

One-third of surveyed alcoholics reported that at least one parent was alcoholic. Biological studies support this familial trend.

PREVENTIVE MEASURES

- Incorporate questions about alcohol, drug and cigarette use during routine questioning of adolescents, beginning at an early age. Look for a profile consistent with drug abuse (e.g., the T-ACE questionnaire).
- Any adolescent with school or family problems, depressive symptoms, antisocial behavior, a peer group that uses drugs heavily, or a family history of drug- or alcohol-related problems should be assessed for drug or alcohol abuse. Adolescents with a history of repeated accidents, drunk driving offenses, and other similar problems should be considered to have a drug or alcohol problem until proven otherwise.
- Adolescents with antisocial behavior in combination with significant drug or alcohol dependency usually require a long-term treatment program designed for their age group. Finding appropriate treatment programs is difficult, especially in remote areas, and reference to a social worker or a National Native Alcohol and Drug Abuse Program (NNADAP) worker with knowledge of appropriate referral agencies is generally required.

NICOTINE

Nicotine is one of the most addictive (and lethal) drugs known. It is estimated that 85% of adolescents who learn to smoke cigarettes will become addicted.

NURSING INTERVENTION

- Educate children early (when they are of school age) about the risks of tobacco use
- Counsel about the short-term effects: bad breath, staining of the teeth and fingers, foul-smelling clothes, decreased athletic fitness and high financial cost
- Provide those addicted to tobacco with smoking cessation counseling and support

Source: "Tobacco Use among Aboriginal Children and Youth," (CPS, Indian and Inuit Health Committee 1999)

MARIJUANA

This is the illicit drug most commonly used by adolescents and young adults. It is associated with an increase in the risk of respiratory cancer, as well as acute panic attacks, confessional states and acute psychotic reactions (especially in those with a genetic risk for mental illness).

Abuse of marijuana may be associated with chronic depressive illness or abuse of alcohol or other drugs.

INHALANTS

Dozens of inhalants are available in stores. Commonly used products are liquids (such as model glue), contact cement, lacquers and aerosols (such as gasoline, cooking sprays and toiletries [hair spray, cologne]). Inhalants are most often used by younger adolescents.

Acute depression of the CNS can result, and there is a strong potential for accidents, such as burns or drowning. Sudden sniffing death is rare and is probably the result of rapid nasal or pulmonary absorption of the inhalant, which sensitizes the heart to arrhythmias (generally fatal ventricular arrhythmias).

Long-term neurologic deficit secondary to the inhalation of volatile hydrocarbons such as toluene has been documented, although much research is still needed in this category of drug abuse. Hearing loss and other cranial nerve deficits have been suggested, as well as long-term encephalopathy.

INTERVENTIONS IN SUBSTANCE ABUSE

PREVENTION

Healthcare professionals need to promote awareness about the health hazards of substance abuse to children, adolescents, parents and caregivers, teachers, vendors of volatile substances and community leaders.

Education is considered the most effective prevention strategy, particularly if it is initiated before the usual age of experimentation. A progressive school-based curriculum with developmentally appropriate modules, offered throughout elementary school, is seen as the most efficient strategy and should be implemented, particularly in areas where inhalant abuse is prevalent.

Providing alternative activities, such as recreational facilities, and promoting cultural values encourage positive lifestyles and may diminish the risk of inhalant abuse and other destructive behaviors.

TREATMENT

Adolescents with significant alcohol, solvent or other drug problems should be referred to the most appropriate social services (e.g., NNADAP). Provincial alcoholism foundations also sponsor treatment programs specifically aimed at teenagers. In remote areas, consultation with a mental health worker or a physician may be indicated to establish the most effective and practical treatment program.

Source: "Inhalant Abuse," (CPS, Indian and Inuit Health Committee 1999)

CHAPTER 20 — GENERAL EMERGENCIES AND MAJOR TRAUMA

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ASSESSMENT AND MANAGEMENT OF PEDIATRIC TRAUMA

GENERAL COMMENTS

Trauma is the single largest most important in all childhood age groups, except the first year of life. To reduce morbidity and mortality rates in the critical early hours after trauma has occurred (the "golden period"), early resuscitation and rapid transport to hospital are key.

NUANCES OF PEDIATRIC TRAUMA

- Multisystem injury is the rule rather than the exception.
- The priorities of pediatric trauma management are the same for children as for adults; however, children's unique anatomic characteristics deserve special consideration.
- Because of smaller body mass, energy from linear forces (e.g., fenders, bumpers, falls) results in greater force applied per unit body area.
- Children have less fat, less elastic connective tissue and close proximity of organs, which leads to more multisystem organ injuries.
- The skeleton is incompletely calcified and more pliable.
- Internal organs may be damaged without evidence of overlying bone fractures.
- If bones are broken, assume that a massive amount of energy was applied.
- The child's ability to interact and cooperate with parents or caregivers is limited, which makes history-taking and physical examinations difficult.
- Children have a large body surface area in relation to their weight, relatively thin skin and a lack of insulating fat. These characteristics lead to increased loss of water and heat. Appropriate measures must be taken to ensure that injured children do not become hypothermic (e.g., thermal blankets, warmed IV fluids).
- "Normal" systolic blood pressure can be estimated by adding 80 to two times the child's age in years. Normal diastolic blood pressure is roughly two-thirds of the systolic pressure.
- Because of children's excellent capacity for physiologic adaptation, shock may go unrecognized in its early stages.

AIRWAY INJURY

The smaller the child, the greater the disproportion between the size of the cranium and the size of the midface. This produces a greater propensity for the posterior pharyngeal area to buckle as the relatively large occiput forces passive flexion of the cervical spine.

CHEST TRAUMA

The child's chest wall is very compliant, which allows energy to be transferred to the intrathoracic soft tissues, frequently without any evidence of external chest wall injury. Consequently, pulmonary contusions and intrapulmonary hemorrhage are common.

The mobility of the thoracic structures makes the child more sensitive to tension pneumothorax and flail segments.

HEAD TRAUMA

Children are particularly susceptible to the secondary effects of brain injury produced by hypoxia, hypotension, seizures and hyperthermia. Shock resuscitation and avoidance of hypoxia are critically important to a favorable outcome.

Young children with open fontanels and mobile cranial suture lines are more tolerant of expansion of intracranial mass lesions, and decompensation may not occur until the mass lesion has become large. A bulging fontanel or a widened suture is an ominous sign.

SPINAL CORD INJURY

Children may sustain spinal cord injury without radiographic abnormality (known by the acronym SCIWORA). This situation occurs because the pediatric spine is so much more elastic and mobile than the adult spine. The interspinous ligaments and joint capsules are more flexible, the facet joints are flatter, and the relatively large size of the head allows for more angular momentum to be generated during flexion and extension, which in turn results in greater energy transfer. Spinal precautions must be maintained.

GENERAL APPROACH TO THE CHILD WITH TRAUMA

ABCs are your first priority. Primary survey and resuscitation are followed by secondary survey, definitive care and finally transport.

The primary survey and resuscitation are done simultaneously. During this period, a patent airway is established while control of the cervical spine is maintained. Maintenance of airway patency is obviously the most critical factor, and cervical spine injury should be assumed in every seriously injured child, until proven otherwise.

The next priorities are as follows:

- Adequate ventilation
- Treatment of shock
- Identification of life-threatening injuries

The child with multisystem trauma may have both cardiorespiratory failure and shock. A rapid evaluation of the cardiopulmonary system must be performed, along with a rapid thorax-abdominal examination to detect life-threatening chest or abdominal injuries that might interfere with successful resuscitation. For instance, ventilation and oxygen therapies may be ineffective until tension pneumothorax is treated.

Common errors in resuscitation include failure to:

- Open and maintain the airway
- Provide appropriate and adequate fluid resuscitation to children with head injuries
- Recognize and treat internal hemorrhage

PRIMARY SURVEY

The primary survey is performed to identify and simultaneously manage life-threatening conditions. It consists of **ABC plus D and E**:

- A for **airway** maintenance with cervical spine control
- B for **breathing** and ventilation
- C for **circulation** with hemorrhage control
- D for **disability** (neurologic evaluation)
- E for **exposure** and **environmental** control

AIRWAY

Assess for signs of airway obstruction such as foreign bodies or facial, mandibular, tracheal or laryngeal fracture.

The cervical spine must be protected (use chin lift or jaw thrust). Do not hyperextend, hyperflex or rotate the cervical spine. Cervical immobilization should be achieved.

BREATHING AND VENTILATION

Inspection, palpation, percussion and auscultation should be performed to assess for tension pneumothorax, flail chest, pulmonary contusions, open pneumothorax, fractured ribs and any other condition that might compromise breathing.

CIRCULATION WITH HEMORRHAGE CONTROL

Hypotension after trauma should be considered hypovolemic in origin until proven otherwise.

- It is generally assumed that any child who is hypotensive secondary to hypovolemia has lost at least 25% of the blood volume
- Reduction in level of consciousness may be caused by cerebral hypoperfusion
- Ashen gray or white skin color is a sign of hypovolemia
- Rapid, thready pulses and delay of capillary refill are early signs of hypovolemia
- Rapid external blood loss should be managed initially by direct manual pressure on the wound

DISABILITY (NEUROLOGIC EVALUATION)

Use the **AVPU** method, as well as pupillary size and reactiveness, to assess level of consciousness. The pediatric Glasgow coma score (see Table 20-1, below) is always obtained during the secondary survey.

- A for **alert**
- V for responds to **verbal stimuli**
- P for responds only to **painful stimuli**
- U for **unresponsive**

Alteration in the level of consciousness should prompt an immediate re-evaluation of oxygenation, ventilation and circulation. If these are adequate, assume that the trauma is the cause of the decrease in level of consciousness. Alcohol or drugs may also reduce the level of consciousness, but they are diagnoses of exclusion in a person with trauma.

EXPOSURE AND ENVIRONMENTAL CONTROL

Completely undress the child, but protect from hypothermia. Warm blankets, warmed IV fluids and a warm environment must be provided.

RESUSCITATION

AIRWAY

A person with compromised airways and anyone with ventilatory problems needs an oral airway. The airway must be protected and maintained at all times, and ventilation with bag or mask should be performed as required.

OXYGEN

Oxygen should be given to all children with trauma, and should be freely used (10–12 L/min by non-rebreather mask).

INTRAVENOUS THERAPY

Two large-bore IV lines should be inserted. Remember that if an IV line cannot be placed promptly, an intraosseous needle should be inserted instead *(see "Intraosseous Access," in chapter 2, "Pediatric Procedures")*. If the child is in severe shock, go directly to intraosseous access.

Do not try to establish intraosseous access in a fractured bone.

SHOCK

See also "Shock," below, this chapter.

Shock should be assumed to be hypovolemic in origin, since neurogenic shock and cardiogenic shock are rare in children with trauma. Shock should be treated aggressively with fluids.

Fluid resuscitation is generally achieved with normal saline or Ringer's lactate. A fluid bolus of 20 mL/kg is given over a short period of time (e.g., 20 minutes). If normovolemia is not restored, bolus infusions of 20 mL/kg are continued until stabilization is achieved.

A very limited amount of time (60–90 seconds) should be spent establishing a peripheral venous line in the hemodynamically unstable child. Intraosseous infusion provides rapid access to the circulation and is safer. *See "Intraosseous Access," in chapter 2, "Pediatric Procedures."*

ECG MONITORING

If available, ECG monitoring should be used.

- Dysrhythmias, tachycardia, atrial fibrillation, premature ventricular contractions and ST segment changes may all indicate cardiac contusion
- Bradycardia, premature beats or aberrant conduction patterns may indicate hypoxia, hypothermia or hypoperfusion

URINARY CATHETER

Place a urinary catheter, unless urethral transection or injury is suspected.

Genital and rectal examinations are required before insertion of a urinary catheter.

Contraindications to placing a Foley catheter:

- Blood is apparent at the urethral meatus
- Blood is apparent in the scrotum

Verifying adequate urinary output (1–2 mL/kg per hour) is important in the assessment of fluid replacement, but in the immediate time frame of changes associated with resuscitation, the vital signs are more important.

GASTRIC TUBE

A gastric tube should be inserted to reduce stomach distension and to reduce the risk of aspiration.

If fracture of the cribriform plate is confirmed or suspected, consult a phsyician about inserting a gastric tube.

SECONDARY SURVEY

The secondary survey begins once the primary survey (ABCs) is completed, resuscitation has commenced, and the child's ABCs have been reassessed.

The secondary survey serves to identify any potentially life-threatening cardiopulmonary injuries that were not immediately evident in the primary survey. It consists of a head-to-toe evaluation, including all vital signs, accompanied by a complete history and physical examination, a complete neurologic evaluation and the pediatric Glasgow coma score.

1. Record vital signs, including pulse oximetry (if available).

2. Obtain a history of the injury. The history should include especially the time and mechanisms of the injury (e.g., whether it was blunt or penetrating), the child's status at the scene of the incident, any changes in status over time and any complaints the child may have. If the child is younger or unconscious, ask bystanders or witnesses. If the child is unconscious, look for a medical alert tag.

3. The **SAMPLE** mnemonic is useful in obtaining the history from a conscious child:

- S for **symptoms**
- A for **allergies**
- M for **medications**
- P for **past medical history**
- L for **last meal time**
- E for **events** and **environment** related to the injury

4. Perform a detailed head-to-toe physical examination. Use log roll maneuver with spine precautions to assess posterior chest wall, flanks, back and rectum. If you find an impaled object, do not remove it. Instead, stabilize the object in place.

HEAD AND NECK

First, reassess ABCs.

Inspection and Palpation of Skull and Face

- Deformities, contusions, abrasions, penetration, burns, lacerations or swelling
- Tenderness, instability or crepitations
- Battle's sign (bluish discoloration over mastoid process)
- Eyes: conjunctiva, PERRLA (pupils equal, round, reactive to light, accommodation)
- Racoon-like eyes (which could indicate basal skull fracture)
- Clear nasal discharge (which indicates CSF rhinorrhea)
- Ears: blood in canal or hemotympanum (bluish purple color behind eardrum, due to presence of blood; occurs with basal skull fracture)
- Check for voluntary symmetric movement of facial muscles

Inspection and Palpation of Neck

- Distension of neck veins (sign of tension pneumothorax or cardiac tamponade)
- Tracheal deviation
- Deformities, contusions, abrasions, penetration, burns, lacerations or swelling
- Check carotid pulse again
- Assume injury to the cervical spine if trauma has occurred above clavicle
- Ensure adequate immobilization of the neck
- Apply a cervical collar if not already done

CHEST

Inspection

- Respiratory effort
- Equality of chest movement
- Deformity
- Bruising
- Lacerations
- Penetrating wounds

Palpation

- Equality of chest movement
- Position of trachea
- Crepitus, deformity
- Fractures of the lower ribs (splenic or kidney injury may also be present)

Percussion

– Area of dullness

Auscultation

– Air entry
– Quality of breath sounds
– Equality of breath sounds

CARDIOVASCULAR SYSTEM

– Auscultate heart for heart sounds: presence, quality

ABDOMEN

Inspection

– Penetrating wounds, blunt trauma, lacerations
– Bruising (anterior, sides)
– Bleeding
– Distension
– Movement with respiration

Auscultation

– Bowel sounds

Palpation

– Tenderness
– Abdominal guarding, rigidity
– Rebound tenderness
– Fractures of lower ribs (ruptured spleen, possible penetrating wound, bowel injury and intra-abdominal hemorrhage possible)

PELVIS AND GENITALIA

Inspection

– Perineal laceration, hematoma or active bleeding
– Blood coming from urethral meatus

Palpation

– Tenderness of iliac crest and symphysis pubis (indicating pelvic fracture)
– Distension of bladder

Remember that pelvic and femoral fractures can cause extensive loss of blood.

EXTREMITIES

Inspection

– Bleeding, lacerations, bruising, swelling, deformity
– Leg position: unusual external rotation of a leg may indicate fracture of the femoral neck or the limb
– Movement of limbs

Palpation

– Sensation
– Tenderness
– Crepitus
– Muscle tone
– Distal pulses, capillary refill
– Reflexes: presence, quality

Remember that pelvic and femoral fractures can cause extensive loss of blood.

BACK

Perform log roll maneuver with spine precautions to assess back and rectum.

Inspection

– Bleeding
– Lacerations
– Bruising: posterior chest wall, flanks, low back, buttocks
– Swelling

Palpation

– Tenderness
– Deformity
– Crepitus

RECTUM

Inspection

– Occult blood

Palpation

– Integrity of walls, sphincter muscle tone

CENTRAL NERVOUS SYSTEM

Perform a neurologic assessment to evaluate the child's present level of function. Determine the level of consciousness according to the pediatric Glasgow coma score (Table 20-1).

- Cranial nerves
- Pupil abnormalities: position, size, equality, reactivity, funduscopy
- Re-examine nose for rhinorrhea
- Motor function (voluntary movement of fingers and toes)
- Sensation (child's ability to feel your fingers when you touch his or her fingers and toes)

Signs of Skull Fracture

- Periorbital bruising (indicates basal skull fracture)
- Clear nasal discharge (CSF) (indicates basal skull fracture)
- Bruising behind ears, blood coming from ears, blood behind eardrum (indicates basal skull fracture)
- Skull lacerations with palpable bony irregularity or depression (indicates some form of skull fracture)

Remain calm and think clearly. Try to do things in a logical order, as outlined above.

DEFINITIVE CARE

- Resuscitative measures initiated earlier are continued (e.g., airway, IV therapy, oxygen)
- Identified conditions should be managed according to their priority
- Ensure that airway is protected in an unconscious child
- Apply suction as needed
- Administer supplemental oxygen, even if breathing appears adequate
- Treat hypotension aggressively with IV fluid replacement *(see "Shock," below, this chapter)*
- Insert nasogastric tube and apply suction (if not already done), unless the child has facial fractures or a suspected basal skull fracture; if in doubt, do not insert the tube—consult a physician first
- Insert Foley catheter (if no contraindications and not already done)
- Contraindications to catheterization: blood at urethral meatus, blood in scrotum, obvious pelvic fracture

Table 20-1: Scoring for the Pediatric Glasgow Coma Score*

Feature	Score	Age Group and Response		
Eyes opening		**>1 year**	**<1 year**	
	4	Spontaneously	Spontaneously	
	3	To verbal command	To shout	
	2	To pain	To pain	
	1	No response	No response	
Best motor response		**>1 year**	**<1 year**	
	6	Obeys	NA	
	5	Localizes pain	Localizes pain	
	4	Flexion withdrawal	Flexion normal	
	3	Flexion abnormal (decorticate rigidity)	Flexion abnormal (decorticate rigidity)	
	2	Extension (decerebrate rigidity)	Extension (decerebrate rigidity)	
	1	No response	No response	
Best verbal response		**>5 years**	**2–5 years**	**Birth to 23 months**
	5	Oriented and converses	Appropriate words and phrases	Smiles, coos, cries appropriately
	4	Disoriented and converses	Inappropriate words	Cries
	3	Inappropriate words	Cries and/or screams	Inappropriate crying and/or screaming
	2	Incomprehensible sounds	Grunts	Grunts
	1	No response	No response	No response

*Score is obtained by determining the score for each of the three criteria (eye-opening, best motor response, best verbal response) and summing them.

Note: NA = not applicable.

BANDAGING AND SPLINTING

- If necessary, finish bandaging and splinting injuries
- Angulated fractures of the upper extremities are best splinted as found
- Fractures of the lower extremities should be gently straightened with traction splints (e.g., Thomas splint)

MONITORING AND FOLLOW-UP

- Monitor and reassess ABCs frequently
- Monitor vital signs as frequently as possible until condition is stable
- Anytime the child's condition worsens, perform a reassessment survey
- Anytime you carry out an intervention, perform a reassess ment survey
- Monitor hourly urine output (aim for urine output >1 mL/kg per hour)

Irritability or restlessness may be caused by hypoxia, bladder or gastric distension, fear, pain or head injury. However, do not assume head injury. Rule out correctable causes first.

Head injuries are never a cause of hypovolemic shock. Look for other source of hemorrhage elsewhere.

CHECKLIST

- Check airway tubes for patency
- Check oxygen rate
- Check IV lines for patency and rate of infusion
- Check for patency of decompression needle for tension pneumothorax, if inserted
- Check splints and dressings
- Check rate of hyperventilation of any child with decreased level of consciousness

CONSULTATION

Consult a physician at transfer facility as soon as able (e.g., when child's condition is stabilized).

REFERRAL

- Medevac as soon as possible
- Make sure that child's condition is as stable as possible before leaving health facility
- Pressure effects on certain injuries are accentuated in unpressurized aircraft; maximum flying altitudes are applicable; see *Patient Care in Flight Manual* (Medical Services Branch 1985)

MAJOR EMERGENCY SITUATIONS

ANAPHYLAXIS

DEFINITION

Rare and potentially life-threatening allergic reaction. The symptoms develop over several minutes, may involve multiple body systems (e.g., skin, respiratory system, circulatory system) and may progress to unconsciousness only as a late event in severe cases. Rarely is unconsciousness the sole manifestation of anaphylaxis.

Anaphylaxis must be distinguished from fainting (vasovagal syncope), which is a more common and benign occurrence. Rapidity of onset is a key difference. When a person faints, the change from a normal to an unconscious state occurs within seconds. Fainting is managed simply by placing the person in a recumbent position. Fainting is sometimes accompanied by brief clonic seizure activity, but this generally requires no specific treatment or investigation.

CAUSES

- Vaccines
- Injectable drugs
- Insect sting (e.g., bee)

HISTORY

Anaphylaxis usually begins a few minutes after injection of the offending substance and is usually evident within 15 minutes. The symptoms may include the following:

- Sneezing
- Coughing
- Itching
- "Pins-and-needles" sensation of the skin
- Flushing of the skin
- Facial edema (perioral, oral or periorbital urticaria)
- Anxiety
- Nausea, vomiting
- Early respiratory difficulties (e.g., wheezing, dyspnea, tightness of the chest)
- Palpitations
- Hypotension, which may progress to shock and collapse

Cardiovascular collapse can occur without respiratory symptoms.

Severe Reaction

- Severe respiratory distress (lower respiratory obstruction characterized by high-pitched wheezing, upper airway obstruction characterized by stridor)
- Difficulty speaking
- Difficulty swallowing
- Agitation
- Shock
- Loss of consciousness

PHYSICAL FINDINGS

- Tachycardia
- Tachypnea, labored respiration
- Blood pressure low-normal (child hypotensive if in shock)
- Pulse oximetry may show hypoxia
- Child in moderate to severe distress
- Use of accessory muscles of respiration
- Chest: air entry reduced, mild to severe wheezing
- Child flushed and diaphoretic
- Generalized urticaria (hives)
- Facial edema
- Diminished level of consciousness
- Skin feels cool and clammy

DIFFERENTIAL DIAGNOSIS

- Asthma
- Foreign-body aspiration
- Angioedema

COMPLICATIONS

- Hypoxia
- Shock
- Airway obstruction due to edema of upper airway
- Convulsions
- Aspiration
- Death

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Improve oxygenation
- Alleviate symptoms
- Prevent complications
- Prevent recurrence

Early recognition and treatment of anaphylaxis are vital.

Nonpharmacologic Interventions

- Place the child in a recumbent position (elevating the feet if possible)
- Establish an oral airway if necessary
- Place a tourniquet (when possible) above the site of injection; release for 1 minute every 3 minutes

Adjuvant Therapy

Severe Anaphylaxis

- Give oxygen by mask, 10–12 L/min by non-rebreather mask; keep oxygen saturations > 97% to 98%
- Start IV therapy with normal saline to keep vein open, unless severe anaphylaxis and signs of shock are evident *(see "Shock," below, this chapter, for details of fluid resuscitation in shock)*

Pharmacologic Interventions

Promptly administer:

aqueous epinephrine (**D class drug**), 1:1000, 0.01 mL/kg (maximum dose 0.5 mL) SC or IM in the limb opposite that in which the original injection was given

SC epinephrine injection is appropriate for mild cases or those treated early.

In severe cases, an IM injection should be given because this route leads more quickly to generalized distribution of the drug. A single SC injection is usually sufficient for mild or early anaphylaxis. Epinephrine can be repeated twice at 20-minute intervals, if necessary. In severe reactions it may be necessary to give these repeat doses at shorter intervals (10–15 minutes).

If the vaccine causing anaphylaxis was given subcutaneously, an additional dose of 0.005 mL/kg (maximum dose 0.3 mL) of aqueous epinephrine (1:1000) can be injected at the vaccination site to slow absorption of the vaccine. However, if the vaccine was given intramuscularly, local injection of epinephrine at the vaccination site is contraindicated because it will dilate the vessels and speed absorption.

Speedy intervention is of paramount importance. Failure to use epinephrine promptly is more dangerous than using it quickly but improperly.

Epinephrine Dose

The epinephrine dose should be carefully determined. Calculations based on body weight are preferred when weight is known. When body weight is not known, the dose of epinephrine (1:1000) can be approximated from the subject's age (Table 20-2).

Excessive doses of epinephrine can compound a subject's distress by causing palpitations, tachycardia, flushing and headache. Although unpleasant, such side effects pose little danger. Cardiac dysrhythmias may occur in older adults but are rare in otherwise healthy children.

Table 20-2: Epinephrine Dose on the Basis of Age

Age	Dose
2–6 months*	0.07 mL (0.07 mg)
12 months*	0.1 mL (0.1 mg)
18 months* to 4 years	0.15 mL (0.15 mg)
5 years	0.2 mL (0.2 mg)
6–9 years	0.3 mL (0.3 mg)
10–13 years	0.4 mL (0.4 mg)
≥14 years	0.5 mL (0.5 mg)

Source: *Canadian Immunization Guide*, 5th edition (Health Canada 1998).

*Doses for children between 6 and 12 months of age and between 12 and 18 months of age are approximated (intermediate between the values shown or increased to the next larger dose, depending on practicability).

Severe Anaphylaxis

In addition to the epinephrine, give the following:

diphenhydramine hydrochloride (Benadryl) (**A class drug**)

This drug should be reserved for children who are not responding well to epinephrine or may be used to maintain symptom control in those who have responded (since epinephrine is a short-acting agent), especially if transfer to an acute care facility cannot be effected within 30 minutes.

Oral administration of diphenhydramine is preferred for conscious children who are not seriously ill, because pain results when the drug is given intramuscularly. This drug has a high safety margin, which means that precise dosing is less important.

The approximate doses of diphenhydramine for injection (50 mg/mL solution) are shown in Table 20-3.

For Bronchospasm

salbutamol (Ventolin) (**D class drug**), by nebulizer, three doses q20min (dose dependent on body weight)

Weight ≤10 kg: 1.25–2.5 mg/dose in 3 mL normal saline

Weight 11–20 kg: 2.5 mg/dose in 3 mL normal saline

Weight >20 kg: 5 mg/dose in 3 mL normal saline

Monitoring and Follow-up

Severe Anaphylaxis

Monitor ABCs, vital signs and cardiorespiratory status frequently.

Appropriate Consultation

Severe Anaphylaxis

Consult a physician as soon as child's condition stabilizes; discuss use of IV steroids.

Referral

Medevac as soon as possible. In all but the mildest cases, children with anaphylaxis should be hospitalized overnight or monitored for at least 12 hours.

Because anaphylaxis is rare, epinephrine vials and other emergency supplies should be checked regularly and should be replaced if outdated.

Table 20-3: Diphenhydramine Dose on the Basis of Age

Age	Dose
<2 years	0.25 mL (12.5 mg)
2–4 years	0.5 mL (25 mg)
5–11 years	1.0 mL (50 mg)
≥12 years	2.0 mL (100 mg)

SHOCK

DEFINITION

A condition that occurs when perfusion of tissue with oxygen becomes inadequate. As a result, the cells of the body undergo shock, and grave cellular changes occur. Eventually cell death follows.

Shock is categorized in many ways, for example, according to the state of physiologic progression that has occurred:

- *Compensated shock:* vital organ perfusion is maintained by endogenous compensatory mechanisms
- *Uncompensated shock:* compensatory mechanisms have failed; associated with hypotension and impairment of tissue perfusion
- *Irreversible shock:* multiple end-stage organ failure and death occur, despite occasional return of spontaneous cardiorespiratory function

Arterial blood pressure is often preserved by compensatory vasoconstrictive mechanisms until very late in shock. Therefore, an over-reliance on arterial blood pressure readings can delay recognition and timely treatment of shock.

TYPES OF SHOCK

- *Hypovolemic shock:* inadequate perfusion of vital organs because of reduction in circulating blood volume
- *Cardiogenic shock:* due to the inability of the heart to pump blood to tissues (decreased cardiac output), as in congestive heart failure; rare in children
- *Distributive shock:* due to massive vasodilatation from interference with sympathetic nervous system or effects of histamine or toxins, such as in anaphylaxis, septic shock, neurologic injury, spinal cord injury, intoxication with some drugs (e.g., tricyclic antidepressants, iron)
- *Obstructive (mechanical) shock:* obstruction of cardiac filling such as that caused by pericardial tamponade or tension pneumothorax
- *Dissociative shock:* oxygen is not released from hemoglobin to the cells (as in carbon monoxide poisoning)
- *Hypoxemic shock:* caused by respiratory failure from lung injury or obstruction, or disruption of the airway
- *Low-volume shock (absolute hypovolemia):* caused by hemorrhage or other major loss of body fluid
- *High-space shock (relative hypovolemia):* caused by spinal injury, syncope, severe head injury, vasomotor injury from hypoxia

HISTORY

Infant

- May become combative initially, then lethargic
- Poor feeding
- Decreased responsiveness to parents or caregivers
- History of trauma
- History of symptoms of an underlying illness (e.g., cough indicating pneumonia)

Older Child

- Nausea
- Lightheadedness, faintness
- Thirst
- Altered level of consciousness
- Other symptoms depending upon underlying cause
- Trauma

PHYSICAL FINDINGS

Remember: ABCs are the priority.

The physical findings are variable, depending on whether the child is in compensated or decompensated shock. It is generally assumed that any child who is hypotensive secondary to hypovolemia has lost at least 25% of total circulating blood volume.

Do not rely on blood pressure readings. In children, blood pressure is preserved by compensatory vasoconstrictive mechanisms until very late in shock. Appearance, breathing and perfusion are more reliable clinical indicators of shock.

Prolonged capillary refill (>2 seconds) is a sign of decreased tissue perfusion and is more beneficial as a sign of shock in children than in adults.

Persistent tachycardia is the most reliable indicator of shock in children.

Compensated Shock

- Appearance: alert, anxious
- Work of breathing: tachypnea or hyperpnea
- Circulation: tachycardia, cool or pale skin, decreased peripheral pulses

Decompensated Shock

- Appearance: altered mental status, reduced level of consciousness
- Work of breathing: tachypnea or bradypnea
- Circulation: tachycardia or bradycardia, mottled or cyanotic skin, peripheral pulses absent

Source: *APLS: The Pediatric Emergency Medicine Course Manual* (Strange 1998); pages 29–39.

DIFFERENTIAL DIAGNOSIS

- Sepsis
- Anaphylaxis
- Status asthmaticus

COMPLICATIONS

- Myocardial ischemia or infarction
- Cardiorespiratory failure or arrest
- Renal failure
- Death

DIAGNOSTIC TESTS

None.

MANAGEMENT

Remember: ABCs are the priority.

Goals of Treatment

- Restore circulating blood volume
- Improve oxygenation of vital tissues
- Prevent ongoing volume losses

Nonpharmacologic Interventions

- Assess and stabilize ABCs
- Ensure that airway is patent and ventilation is adequate
- Insert oral airway and ventilate with Ambu bag (using oxygen) as needed
- Control any external bleeding: use direct pressure to control bleeding from external wounds
- Place in head-down position

Adjuvant Therapy

- Give oxygen at 12–15 L/min by non-rebreather mask with reservoir; keep oxygen saturation >97% or 98%
- Start 2 large-bore IV lines with normal saline (or Ringer's lactate)
- Give 20 mL/kg IV fluid rapidly as a bolus over 20 minutes
- Reassess for signs of continuing shock
- If shock persists, continue to administer fluid in 20 mL/kg boluses, and reassess after each bolus
- Adjust IV rate according to clinical response
- Ongoing IV therapy is based on response to initial fluid resuscitation, continuing losses and underlying cause
- For maintenance fluid requirements, *see "Fluid Requirements in Children" in chapter 4, "Fluid Management."*
- If unable to access a peripheral vein quickly (in 60–90 seconds or less), institute intraosseous infusion *(see "Intraosseous Access," in chapter 12, "Pediatric Procedures")*

After Initial Resuscitation

- Insert indwelling urinary catheter
- Insert nasogastric tube prn

Monitoring and Follow-Up

- Monitor ABCs, vital signs (including pulse oximetry, if available) and level of consciousness as often as possible until condition is stable
- Frequent reassessment for continuing blood loss is important
- Monitor hourly intake and urine output
- Identify and manage underlying cause of shock (e.g., manage sepsis with IV antibiotics)
- Assess stability of pre-existing medical problems (e.g., diabetes mellitus)

Referral

Medevac.

OVERDOSES, POISONING AND TOXIDROMES

DEFINITION

Ingestion of a potentially toxic substance, including a drug, a household or industrial chemical, plant material or waste products.

One of the unique features of poisoning during childhood is its two very different scenarios. The first involves the young child between 1 and 5 years of age who accidentally ingests a small amount of a substance that may or may not have pharmaceutical properties. The second involves the teenager who intentionally ingests a large amount of one or more substances, usually pharmaceutical.

Although the latter situation can and does result in significant morbidity, it is quite uncommon in young children. In the younger age group, less than 10% of those who ingest a potentially toxic substance are actually poisoned, either because the ingested substance is inherently non-toxic or because the amount ingested is too small to cause toxic effects.

The management of intentional overdose by teenagers is the same as for adults. *See "Overdoses, Poisonings and Toxidromes," in chapter 14, "General Emergencies and Major Trauma," in the adult clinical guidelines (First Nations and Inuit Health Branch 2000).*

INITIAL EVAUATION

ABCs are the first priority.

Ensure that the child's condition is stable. If not, take steps to stabilize before obtaining the history, performing the physical examination and instituting management.

HISTORY

Typically the young child is brought to the healthcare provider very soon after the discovery of the accidental ingestion. In most situations, there has not been enough time for symptoms to have occurred.

Determine:

- Circumstances of ingestion
- What and how much was taken
- The time of ingestion
- When the symptoms began, if any
- Whether symptom intensity has decreased, increased or remained the same

Retrieve the container (send someone to the child's home if necessary) and any spilled pills. If the informant can reliably state how much of the substance had already been used, this information can be used in the calculation:

> Initial volume or number of pills minus amount remaining = maximum ingestion

Always assume maximum ingestion. For example, if two children have shared a bottle of pills, assume that either child could have ingested the whole amount.

Make inquiries about the circumstances of the ingestion:

- How did the child get at the container?
- Was the container left within easy reach?
- Was the child-resistant closure left disengaged?

This information is useful for preventive counseling at the end of the encounter.

Although most childhood poisonings are accidental, always be on guard for purposeful administration by a parent or caregiver. This should be considered especially in children <1 year old and in any child with repeated ingestion of a potentially toxic substance, particularly if the various incidents involve the same compound.

A careful history is the most important part of the assessment, as there may be no clinical signs at the time of presentation.

PHYSICAL EXAMINATION

- ABCs are the priority.
- Vital signs: temperature, heart rate, respiratory rate, depth of respiration, blood pressure
- Level of consciousness
- Closely examine cardiovascular, respiratory and central nervous systems

Signs vary with the type of poison. The main systems involved in poisoning are the cardiovascular, respiratory and central nervous systems, but in certain situations there is a need to focus on other systems (e.g., the mouth and the esophagus after ingestion of caustic alkali).

MANAGEMENT: GENERAL APPROACH

Opiate poisonings in northern populations are rare. Remember that all features of the classic opiate triad (decreased level of consciousness, depressed respiration and pinpoint pupils) need not be present for diagnosis.

If you are concerned about opiate poisoning in a small child, ask if he or she has had access to cough medications.

Nonpharmacologic Interventions

Stabilize ABCs as required.

For all children with decreased level of consciousness without apparent cause:

- Give oxygen, 6–10 L/min or more by mask
- Start IV therapy with normal saline (if there is evidence of compromise in circulation or significant dehydration); run at a rate sufficient to maintain vital signs and hydration

Nasogastric tube may be necessary for a child who is unconscious and who cannot or will not drink.

Administer charcoal therapy *(see "GI Tract Decontamination," below, this section)*.

Insert Foley catheter (in child with altered level of consciousness).

Pharmacologic Interventions

If opiate poisoning is suspected:

> naloxone (Narcan) (**D class drug**), 0.1 mg/kg by IV push

GI Tract Decontamination

Activated charcoal is now recommended as the sole therapy and should be given for ingestion of any toxic material, except iron, hydrocarbons, alcohols and caustic agents.

- Charcoal is supplied in premixed containers as 50 g of charcoal in 250 mL of either water or 70% sorbitol
- Dose for children <6 years old: 25 g of charcoal in water orally or, if child will not drink, by nasogastric tube (use a 12–14 French tube, as smaller ones tend to become clogged)
- The only risk associated with charcoal therapy is aspiration should the child vomit; this might occur if the child ingested theophylline or salicylates or has already been given ipecac
- Shake the bottle thoroughly before opening because the charcoal tends to settle
- Before infusing the charcoal into a nasogastric tube, verify that the tube is in the stomach (by spontaneous return of gastric contents or auscultation of injected air over the left upper quadrant)

Appropriate Consultation

The primary consultant for poisonings is your regional poison control center. This service is immediately available at all times. Be prepared to provide the following information:

- Product ingested
- Approximate dose
- Time of ingestion
- Age and weight of child
- Vital signs
- Level of consciousness
- Any pertinent symptoms or signs

The poison control center will advise whether the exposure is potentially toxic, will provide treatment advice and will suggest whether evacuation to a medical facility is required.

Consult a physician to review unfamiliar management and recommendations for evacuation.

Monitoring and Follow-Up

- Monitor ABCs, vital signs, level of consciousness, cardiorespiratory function, intake and output frequently if the child's condition is unstable and transfer to hospital is planned
- If child is discharged home, next-day follow-up is recommended

Prevention

Information obtained during the initial history is often very helpful for post-encounter preventive counseling. Poison prevention as well as accident prevention counseling should be a regular part of your follow-up and a regular part of well-baby visits beginning after the child reaches 6 months of age.

Referral

The child should be medevaced if there is a possibility that he or she ingested a toxic amount of the compound or there are clinical symptoms of toxic effects.

Remember to obtain a blood sample before evacuation and to note the time that this sample was obtained.

In your letter of referral, include all of the information requested above, as well as any treatment interventions already undertaken, the interim clinical course and the time at which the blood was drawn.

SPECIFIC POISONINGS

Table 20-4 presents the antidotes for specific poisonings likely to occur in the North.

Acetaminophen

This is the most common drug overdose at all ages. Despite the tens of thousands of reported ingestions by children <6 years old, there have been only a few cases of significant toxic effects, primarily because small children usually ingest pediatric formulations.

Ingestions of greater than 150 mg/kg should be a cause for concern, but remember that this figure also incorporates a safety factor, such that significant toxic effects actually manifest at a somewhat higher dose. The organ at risk is the liver, with toxic effects occurring a few days after the ingestion.

Toxic effects can be prevented if the antidote *N*-acetylcysteine is started within 8 hours after the overdose. Although the antidote becomes less effective beyond 8 hours, it is still worthwhile to initiate therapy between 8 and 24 hours after ingestion. In medical facilities, administration of this antidote is determined by acetaminophen blood level, which is unavailable in the nursing station.

History and Examination

Although the child may be completely asymptomatic, there is frequently nausea, vomiting and abdominal cramps in those at risk for hepatic toxicity.

- Obtain history of total maximum ingestion
- Verify ingestion quantity by obtaining the container

Management

See "Management: General Approach," above.

Specific Interventions

All children who have ingested more than 150 mg/kg should receive activated charcoal, and *N*-acetylcysteine (e.g., Mucomyst, Parvolex) (**D class drugs**) may be given according to oral protocol, as follows:

loading dose: 140 mg/kg PO

subsequent doses: 70 mg/kg PO q4h for 17 doses

Once *N*-acetylcysteine has been started, the child should be evacuated to a medical facility. Remember to obtain a blood sample before evacuation and to note the time at which it was obtained.

N-Acetylcysteine (Mucomyst) may also be administered intravenously or via a nebulizer mask.

Iron

Iron poisoning can be quite serious. It usually results from ingestion of a prenatal supplement or other adult dosage form. The toxic effects depend on the amount of elemental iron ingested (ferrous sulfate is 20% elemental iron, ferrous fumarate is 33% elemental iron, and ferrous gluconate is 12% elemental iron). Therefore, for example, a 300-mg tablet of ferrous sulfate contains 60 mg of elemental iron.

History

Verify maximum amount ingested.

With greater amounts ingested, degree of toxic effects also increases. At 20 mg of elemental iron, expect GI symptoms, such as vomiting and diarrhea, with the possibility of blood in the emesis or stool. At 60 mg/kg of elemental iron, there is significant risk of GI hemorrhage, shock and acidosis.

Coma occurs late in the overdose and is a consequence of shock and acidosis.

Physical Examination

- ABCs
- Vital signs
- Level of consciousness
- Hydration
- Circulation

Table 20-4: Antidotes for Poisonings

Toxins and Indications	Antidote	Required Amount
Acetaminophen	*N*-Acetylcysteine (Mucomyst)	Verify protocol with poison control center and physician
Ethylene glycol, methanol	Ethanol	Verify protocol with poison control center and physician
Iron (challenge test or treatment)	Deferoxamine (Desferal)	Verify protocol with poison control center and physician
Isoniazid (INH)	Pyridoxine (vitamin B_6)	50–75 mg
Narcotics	Naloxone (Narcan)	0.1 mg/kg per dose or 2–4 mg for children >5 years old
Organophosphates or carbamate insecticides; cholinergic crisis	Atropine	0.5 mg slowly IV If symptoms of toxicity persist and there are no cholinergic side effects, re-administer q5min to a maximum of 2 mg
Most oral toxins	Activated charcoal	25–50 g

Management

See "Management: General Approach," above.

Iron overdose is one of the few situations in which activated charcoal is ineffective.

Specific Interventions

If more than 20 mg/kg of elemental iron has been ingested, administer syrup of ipecac unless there has already been significant spontaneous emesis (three or more episodes)

Protect the airway.

Deferoxamine is the specific antidote for iron poisoning. It should be administered only after consultation with a poison control center and a physician.

Remember to draw a blood sample for determination of iron level and send it with the child on transfer. It is especially important to obtain this sample before initiating deferoxamine therapy, because the antidote interferes with the laboratory measurement of iron level.

Referral

Medevac any child:

- who has symptoms of iron toxicity
- who has been treated with deferoxamine
- who has ingested more than 40 mg/kg of elemental iron

FEVER OF UNKNOWN ORIGIN (BACTEREMIA AND SEPSIS)

DEFINITION

Fever in infants and toddlers is defined as rectal temperature greater than 38°C. Neonates may present with hypothermia rather than fever as a manifestation of occult bacterial illness or sepsis.

In infants <2 years old, tympanic membrane temperature is not as reliable, so rectal temperature should be used for decision making.

- *Fever of unknown origin:* fever in a child with no readily identifiable source of infection, despite a careful history and physical examination
- *Occult bacteremia:* fever with no obvious focus of infection and a positive result on blood culture
- *Sepsis:* bacteremia with evidence of systemic invasive infection

General Comments

Febrile infants and children <3 years old commonly present for emergency care. The differential diagnosis is broad, ranging from a simple URTI to occult bacteremia and sepsis.

The child's age, the clinical presentation, the likelihood of a particular diagnosis and risk factors for sepsis or bacteremia are important considerations when evaluating a young child with fever.

CAUSES OF OCCULT BACTEREMIA

Most common pathogens causing occult bacteremia in the fully immunized child:

- *Streptococcus pneumoniae* (approximately 98% of cases)
- *Hemophilus influenzae* type B (<2% of cases)
- *Neisseria meningitidis, Salmonella* and others (<1% of cases)

Most common pathogens causing sepsis in the neonate:

- *Escherichia coli*
- Group B *Streptococcus*
- *S. pneumoniae*
- *Listeria monocytogenes*

Most common pathogens causing sepsis in infants (>3 months of age):

- *S. pneumoniae*
- *H. influenzae* (in the unimmunized child)
- *N. meningitidis*
- *Staphylococcus aureus*
- Group A ß-hemolytic *Streptococcus*
- Gram-negative rods

Risk Factors Influencing Susceptibility to Occult Bacteremia

Age is a significant factor influencing susceptibility: the younger the child, the greater the risk. Newborns are at greatest risk for bacterial sepsis, and this condition becomes uncommon by 2–3 years of age. Older children with a serious bacterial infection are more consistently identified by clinical examination (rather than by fever).

Factors contributing to increased risk in neonates:

- *E. coli*, *L. monocytogenes* and group B *Streptococcus* are the most common pathogens causing serious bacterial infections in this age group
- Findings of physical examination are less reliable in the neonate
- The neonate's immune system is not fully developed

In the absence of dehydration or high environmental temperature, sepsis is a common cause of fever in the first week of life.

Other factors influencing susceptibility to occult bacteremia:

- Exposure to communicable pathogens
- Malignant lesions
- Chemotherapy
- Immunocompromised states (e.g., hyposplenism, sickle cell disease)

HISTORY

In general, young infants (<3 months old) with serious bacterial illness present with fever and subtle signs, such as irritability or lethargy. Older children often present with more specific clinical signs.

- Fever documented at home by a reliable caregiver (should be considered equivalent to fever documented in the clinic)
- Change in mental status (e.g., lethargy, somnolence or decreased level of activity) may indicate a serious bacterial illness
- Recent immunizations
- History of prematurity or lack of immunizations (places the child at higher risk)
- Recent exposure to sick contacts
- Recent antibiotic therapy
- Recurrent illnesses
- Immunocompromised children are not only at higher risk for serious bacterial illness, but they are also susceptible to different pathogens
- Response to antipyretics does not differentiate between bacterial and viral pathogens, nor does it aid in identifying children at risk for serious bacterial illnesses
- Impact of environment (overbundling can increase the temperature by 0.4°C to 0.8°C)

PHYSICAL FINDINGS

- Vital signs may reveal hyperthermia, normothermia, hypothermia, tachycardia, tachypnea or hypotension
- If tachycardia is disproportionate to the degree of fever, consider dehydration, sepsis and cardiac abnormalities as potential causes
- Tachypnea out of proportion to the degree of fever may suggest the early stages of bronchiolitis, pneumonia or laryngotracheitis
- Hypothermia in the neonate or immunocompromised child may be the only diagnostic clue to a serious bacterial infection
- Children with sepsis typically appear acutely ill and may exhibit altered mental status (e.g., lethargy), hypotension (easily identified by delayed capillary refill), hypoventilation, hyperventilation or cyanosis

When evaluating infants, the following observational variables can be used as a clinical guide:

- Quality of cry
- Reaction to parental or caregiver stimuli
- Level of arousal
- Color
- Hydration status
- Response to social overtures

In the older infant and child, look for focal findings:

- Meningitis in this age group often presents with nuchal rigidity, a positive Kernig's sign (pain with passive knee extension and hip flexion) and a positive Brudzinski's sign (spontaneous hip flexion with passive neck flexion)
- The integumentary examination is often overlooked and can sometimes provide diagnostic clues (e.g., presence of petechiae and fever represents a broad differential diagnosis that includes meningococcal sepsis and viral exanthems)

DIFFERENTIAL DIAGNOSIS

- Bacteremia and sepsis
- Bronchiolitis
- Chickenpox (varicella)
- Croup (laryngotracheobronchitis)
- Febrile seizures
- Erythema infectiosum (fifth disease)
- Gastroenteritis
- Hand-foot-and-mouth disease
- Kawasaki disease
- Meningitis and encephalitis
- Otitis media
- Pharyngitis
- Pneumonia
- Roseola infantum
- Scarlet fever
- Urinary tract infections, pyelonephritis

COMPLICATIONS

- Serious focal bacterial infections such as meningitis
- Septic shock (which can produce multiorgan system failure)

DIAGNOSTIC TESTS

- Pulse oximetry (if available)
- Blood culture (if available) remains the gold standard for identifying children with occult bacteremia: collect three blood samples for culture (15 minutes apart)
- WBC count (if available) between 15 000 and 20 000 or less than 5000
- Urinalysis and urine culture should be performed; for infants, the most expedient and reliable method of obtaining urine for urinalysis and culture is by catheter
- Chest x-ray (if available) is useful only if there is clinical evidence of a possible respiratory infection (e.g., tachypnea, cough, retractions, use of accessory muscles, crackles or wheezing); such imaging should be done only in older infants and children who are relatively less sick and only if the result would affect the decision to transfer to hospital

MANAGEMENT

The main focus of prehospital care of the febrile child, particularly one who appears acutely ill, should be rapid transport to a hospital emergency department.

Stabilization Interventions

- ABCs are your first priority
- Airway management and venous access are indicated if the child has signs of sepsis

Adjuvant Therapy

- Start IV therapy with normal saline and run at a rate sufficient to maintain hydration, unless there are signs of septic shock *(see "Shock," above, this chapter)*
- Oxygen may be necessary if there are signs of sepsis (6–10 L/min or more; keep oxygen saturation >97% to 98%)
- Foley catheter (may be necessary if in septic shock)

Appropriate Consultation

Once the child's condition has been stabilized, consult a physician according to the following guidelines:

- All infants <3 months old
- All infants 3–36 months old who appear acutely ill or who are at increased risk for occult bacteremia or sepsis

Pharmacologic Interventions

Antibiotics are the standard of care in the management of children with suspected bacteremia or sepsis. The selection of the drug is based on the child's age and the presence of risk factors for unusual pathogens. Antibiotics should be administered promptly after the results of culture(s) have been obtained. Discuss with a physician first, if possible.

The neonate with bacteremia or sepsis should be treated with combination therapy such as ampicillin and gentamicin. Third-generation cephalosporins, such as ceftriaxone (Rocephin), may provide improved CNS penetration and can be substituted for gentamicin.

Older infants and children with bacteremia or sepsis can be treated with ceftriaxone.

Antibiotic therapy:

ampicillin (Ampicin) (**D class drug**)

Neonate <7 days and >2000 g: 75 mg/kg per day, divided q8h, IV

Neonate =7 days and >2000 g: 100 mg/kg per day, divided q6h, IV

Children: 100–200 mg/kg per day, divided q4–6h, IV or IM

and

gentamicin (Garamycin) (**B class drug**)

Neonate <7 days and >2000 g: 2.5 mg/kg per dose IV q12h

Neonate ≥7 days and >2000 g: 2.5 mg/kg per dose IV q8h

Children: 1.5–2.5 mg/kg IV or IM q8–12h

Dose and frequency of gentamicin are based on the child's age and renal function.

or

ceftriaxone (Rocephin) (**A class drug**), 50–75 mg/kg per day, divided q12–24h, IV or IM

Monitoring and Follow-Up

Monitor ABCs, vital signs, pulse oximetry (if available), level of consciousness and urinary output frequently if the child's condition is unstable.

Referral

- Medevac all febrile infants ≤1 month old and all children 1–36 months old who appear acutely ill and in whom bacteremia or sepsis is suspected
- Antibiotics may be administered before transfer, on the advice of a physician.
- In some settings, a pediatric transfer team (which often includes a physician) is available for critically ill children

Some febrile infants and children 1–36 months old may be managed as outpatients. Clinical studies have reported the following criteria identifying the children at lowest risk and hence appropriate for outpatient management:

- Reliable caregivers
- Follow-up within 24 hours
- Child does not appear acutely ill
- Term gestation
- Child previously healthy
- No current antibiotics
- Normal results on urinalysis
- Normal results on chest x-ray (when indicated and if available)

The febrile child 1–36 months old who has a temperature <39°C and no obvious source of infection and who does not appear acutely ill can be managed as an outpatient with administration of antipyretics and close follow-up.

No diagnostic tests are indicated, and antibiotics are not recommended in these children. Avoidance of antibiotics helps to distinguish viral from bacterial meningitis and also to distinguish partial treatment of occult bacteremia from a viral syndrome in the event of clinical deterioration. However, if there are concerns about reliable follow-up or if the child is at higher risk for serious bacterial illness (e.g., presence of immunocompromised state), a more complete diagnostic work-up should be considered.

The management of febrile children 1–36 months old with a temperature ≥39°C, but no identifiable source of infection and without appearance of acute illness, is controversial.

Children in this situation are more likely to have occult bacteremia (approximately 4%), and they may not consistently manifest clinical signs of serious bacterial illness. No matter how extensive the diagnostic evaluation and therapy, these children require close follow-up after discharge to prevent infectious complications. Careful outpatient management should include a reliable caregiver, close follow-up and an established protocol for notification of the parents or primary caregiver of any positive culture results.

ABBREVIATIONS

ABCs	airway, breathing and circulation
ADHD	attention deficit hyperactivity disorder
AIDS	acquired immunodeficiency disorder
ARBD	alcohol-related birth defects
ARND	alcohol-related neurologic disorders
ASA	acetylsalicylic acid
ATV	all-terrain vehicle
BCG	bacille Calmette-Guérin
bid	twice a day
BUN	blood urea nitrogen
BVM	bag-valve mask
CBC	complete blood count
CHR	community health representative
CMV	cytomegalovirus
CNS	central nervous system
CPS	Canadian Paediatric Society
CSF	cerebrospinal fluid
CT	computed tomography
D10W	10% dextrose in water
D5W	5% dextrose in water
DDST	Denver Developmental Screening Test
DNA	deoxyribonucleic acid
DPTP	diphtheria–pertussis–tetanus–polio
ECG	electrocardiogram or electrocardiography
EES	erythromycin ethylsuccinate suspension
ENT	ears, nose and throat
FAE	fetal alcohol effects
FAS	fetal alcohol syndrome
FEV_1	forced expiratory volume in the first second
GAS	group A *Streptococcus*
GERD	gastroesophageal reflux disease
GI	gastrointestinal
GU	genitourinary
Hb_{A1C}	glycosylated hemoglobin
HB_sAg	hepatitis B surface antigen
HEENT	head, eyes, ears, nose and throat
HHV	human herpesvirus
HIV	human immunodeficiency virus
hs	at bedtime
HSV	herpes simplex virus
ICU	intensive care unit
Ig	immunoglobulin
IM	intramuscular
INH	isoniazid
IO	intraosseous
IU	international units
IV	intravenous
KOH	potassium hydroxide
LES	lower esophageal sphincter
MDI	metered dose inhaler
MMR	measles–mumps–rubella combination vaccine
NNADAP	Northern Native Alcohol and Drug Abuse Program (Addictions and Community-Funded Programs)
NS	normal saline
NSAID	nonsteroidal anti-inflammatory drug
od	once daily
ORS	oral rehydration solution
ORT	oral rehydration therapy
OTC	over-the-counter
pc	after a meal
PEFR	peak expiratory flow rate
PERRL	pupils equal, round, reactive to light
PERRLA	pupils equal, round, reactive to light; accommodation normal
PID	pelvic inflammatory disease
PKU	phenylketonuria
PMI	point of maximal impulse
PO	by mouth

PPV	positive pressure ventilation
PR	by rectum
prn	as required
PV	by vagina
q#h	every # hours
qid	four times a day
RBC	red blood cell
RSV	respiratory syncytial virus
SC	subcutaneous
SCIWORA	spinal cord injury without radiographic abnormality
SD	standard deviation
SIDS	sudden infant death syndrome
SPF	sun protection factor
STD	sexually transmitted disease
T_4	thyroxine (free)
TB	tuberculosis
Td	tetanus–diphtheria combination vaccine
tid	three times a day
TMJ	temporomandibular joint
TSH	thyroid-stimulating hormone
URTI	upper respiratory tract infection
UTI	urinary tract infection
VCUG	voiding cystourethrography
VDRL	Venereal Disease Research Laboratory
VZIG	varicella zoster immune globulin
WBC	white blood cell

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Subject index

Note: "URTI" stands for upper respiratory tract infection

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