Pediatric Nursing 13

The icon ✦ denotes content of special importance for NCLEX®.

GROWTH AND DEVELOPMENT

GENERAL PRINCIPLES

A. Growth: increasing number and/or size of cells as they divide and synthesize new proteins resulting in increased size and weight of the whole and/or any part.
B. Development: gradual change and advancement from less to more complex; emerging and expanding capacities, new activities, and patterns of behavior.
C. Maturation: increasing competence and adaptability with physical change in the complexity of body structures, allowing functioning at a higher level.
D. Differentiation: process of developing from simple to more complex activities and functions. Often used in reference to early structures and cells as they are modified from mass to specific to achieve specific characteristics.
E. Growth proceeds in cephalocaudal (head-to-tail) and proximodistal (midline to peripheral) direction.
F. Sensitive periods exist during all phases of prenatal and postnatal growth and development, when the individual interacts with positive or negative environmental influences and is more susceptible to these influences.
G. All individuals develop in a fixed, predictable sequence, but great variation exists in rate of development and age at which milestones are reached.
H. See Piaget and Erikson tables in Chapter 3.

PHYSICAL GROWTH

Infants

A. Adjustments are made for premature infants, in corrected gestational age. Guidelines below are for term infants.
✦ B. Birth–6 months.
1. Birth weight generally should double by 6 months.
2. Length increases by about 2.5 cm (0.98 inch) per month (measured supine, head to heel) for the first 6 months, then 1.2 cm (0.47 inch) per month for the remainder of the first year.
3. Head (orbitofrontal cortex; OFC) circumference: average newborn head is 33–35.5 cm (12.99 to 13.97 inches) (range from 32–38 cm or 12.6 to 14.9 inches), increases about 1.5 cm (0.6 inch) per month for the first 6 months.
4. Anterior fontanelle: should be flat and soft (usually closes by 12–14 months). It may close as late as 18 months.
5. Posterior fontanelle usually closes by 6–8 weeks.
✦ C. 6–12 months.
1. Birth weight approximately triples at end of 12 months.
2. Birth length increases approximately 50% by 12 months.
3. OFC approximately equal to chest circumference at 12 months; grows approximately 0.5 cm per month from 6–12 months.

Children (1–6 Years)

✦ A. Toddlers (1–3 years).
1. Birth weight quadruples by 2½ years; yearly gain 2–3 kg, roughly 2.25 kg (or 5 lbs.).
2. Height increases about 12 cm by 24 months, about 6–8 cm from 24–36 months, roughly 7.5 cm (or 3 inches).
3. Measure height standing at 24 months old; continue measuring OFC until 36 months.
✦ B. Preschoolers (3–6 years).
1. Weight gain 2–3 kg per year, roughly 2.25 kg (or 5 lbs.).
2. Measure height standing; should grow 5.5 cm (2 inches) per year.

Middle Childhood to Adolescence

A. School age (6–12 years).
1. Weight continues to increase 2–3 kg per year.
2. Height slows to about 5 cm per year.
B. Adolescents (prepubertal 10–13 years; 12–18 years).
1. Characterized by pubertal growth spurt: 10–14 years in females and 11–16 years in males.
2. Females gain 7–25 kg (mean 17.5 kg) and 5–25 cm (mean 20.5 cm) during this time. Onset of menses most commonly at 10–13 years.
3. Males gain 7–30 kg (mean 23.7 kg) and 10–30 cm (mean 27.5 cm) between 11 and 16 years.

DEVELOPMENTAL MILESTONES

✦ Neonates

A. Physiologic development (transition to extrauterine life).
✦ 1. Onset of breathing is the most important task to successfully transition to extrauterine life. Careful monitoring is required. Neonates

normally may cough and sneeze to clear fluid present from intrauterine development.

✦ 2. Major changes occur in the cardiovascular system with the closure of fetal shunts and increase in pulmonary blood flow.

✦ 3. Neurologic function characterized by generalized, reflexive responses to stimuli. Primitive reflexes present include sucking, rooting, gagging, grasping, Babinski, Moro, startle, asymmetric tonic neck reflex, and stepping.
   a. Adequate functioning of autonomic nervous system important in regulating respiratory and cardiovascular status, maintaining acid–base balance and thermoregulation.
   b. Should be able to focus and follow object, turn toward noises, console to parental comfort. Should have flexed posture.

4. Must be able to ingest, digest, absorb, and metabolize food in order to survive.
   a. Liver must be able to handle by-products and toxins (and conjugate bilirubin). Any jaundice (yellow hue to the skin) before 24 hours of age has a pathological cause.
   ✦ b. Meconium should pass in first 24–48 hours after birth, followed by transitional stools. Stools will vary depending on milk ingested (breast milk or formula).
   c. Normal blood glucose at birth should be 40–60 mg/dL on Day 1, then 50–90 mg/dL thereafter.

5. Renal functioning—kidneys must be able to cope with changing fluid and electrolyte status and concentrate urine. Structures must be patent to allow adequate urine output. The expected urinary output for newborns is one to two wet diapers per 24 hours initially and six wet diapers per 24 hours by Day 4. The normal specific gravity of the newborn's urine ranges from 1.002–1.010. Normal output values can range from 2–5 mL/kg/hour.

6. Thermoregulation—newborns subject to heat loss and stress from cold, due to large body surface area and thin subcutaneous fat. Neonates are incapable of shivering. Brown fat stores may help in heat regulation.

7. Newborns should demonstrate normal hearing as measured by noninvasive hearing screening tests (evoked otoacoustic emissions or auditory brainstem responses prior to discharge from the hospital).

B. Behavioral development.

✦ 1. Major developmental task is bonding to parents.

✦ 2. Sleep patterns: average neonate sleeps 16–22 hours per day. Varying "states" evident from birth: sleep, quiet alert, active alert, crying, drowsy, etc.

3. Developmental theorists.
   ✦ a. Erikson: trust versus mistrust.
   ✦ b. Piaget: sensorimotor.
   c. Freud: oral.

✦ C. Anticipatory guidance.
1. Car seats (rear-facing in the back seat of the car).
2. Place the infant supine on a firm surface with loose bedding or toys. Use a crib next to the mother's bed. Discourage co-sleeping. Place infant on abdomen for "tummy time play" when awake and being observed.
3. Feeding issues and position upright to feed.
4. Care of umbilicus and circumcision. Clean umbilical cord with water only when necessary; keep it clean and dry. After circumcision, change the bandage with each diaper change, and apply a dab of petroleum jelly to the tip of the penis to keep it from sticking to the diaper.
5. Regular well-child exam and immunization schedule.
6. Thermoregulation.
7. Prevention of diaper rash.
8. Bathing (water temperature).
9. Stress management/prevention of child abuse/shaken baby syndrome.

Infants

A. General concepts.

✦ 1. Rapid period of physical and cognitive development.

2. Role transition in family structure, important to successfully incorporate infant into family unit.

✦ 3. Interest in auditory stimuli begins by 2 months, turns to sounds by 4–6 months.

✦ 4. "Stranger danger" (anxiety) begins by 6 months.

5. Responds to own name and begins to play interactive games (peek-a-boo, pat-a-cake) by 9 months.

B. Behavioral development.

✦ 1. Erikson: trust versus mistrust.

✦ 2. Piaget: sensorimotor (primary to secondary circular reactions).

3. Freud: oral.

C. Moral development: Kohlberg "amoral" stage.

D. Language development.

1. Cooing stage usually beginning by 2 months.

✦ 2. Reciprocal babbling by 2–6 months. Attentive to voices, smiles, laughs, and squeals at 4 months.

3. Understands simple commands and may imitate sounds by about 9 months.

4. By 12 months, usually can say a few words, imitates variety of vocalizations, waves "bye-bye."

E. Motor development.
✦ 1. 2 months: some head control in upright position; when prone can lift head, neck, and upper chest with support on forearms.
✦ 2. 4 months: able to roll from prone to supine; when prone holds head erect and raises body on hands.
   a. Reaches for and bats at objects.
   b. Grasps rattle, opens hands and holds own hands.
✦ 3. 6 months: rolls over; no head lag when pulled to sitting; sits with support; able to stand and bear weight when placed.
   a. Grasps objects and brings to mouth.
   b. Begins to self-feed.
   c. Interested in toys, transfers objects from one hand to another, rakes for small objects.
✦ 4. 9 months: sits independently; crawls, creeps, or scoots to move forward.
   a. May pull to stand; shakes, bangs, or throws objects.
   b. Feeds self with fingers, starts to use cup, uses inferior pincer grasp.
5. 12 months: pulls to stand, cruises, may take a few steps alone.
   a. Feeds self.
   ✦ b. Has precise pincer grasp, bangs two blocks together.

F. Anticipatory guidance.
✦ 1. Birth to 2 months.
   ✦ a. General safety issues: use of car seats at all times. Continue to put baby to sleep in supine position (on back), turn hot water heater temperature down to 120°F, (48.8°C) and continue to test water before bathing. Keep home a nonsmoking environment; caution when out in sun, fall prevention (never leave baby alone or with young sibling or pet) and smoke detectors in home. Recognition of early signs of illness, immunizations, and emergency procedures.
   ✦ b. Nutrition: Ensure adequate nutrition and hydration, do not put infant to bed with a bottle. See **Appendix 13-1**.
   ✦ c. Breast milk or formula only until 6 months is recommended. Needs 100–108 Kcal/kg/day.
   d. Supplemental vitamin D 400 IU daily is recommended for breastfed infants and infants who consume less than 1 liter (or 33 oz) of vitamin D–fortified formula per day.
   ✦ e. Stress management: Never shake baby—may result in shaken baby syndrome.
   f. Immunizations (see schedules, **Appendix 13-2**): First dose of hepatitis B vaccine is given at birth and the second dose of hepatitis B is given 1–2 months later. The regular immunization schedule begins at approximately 8 weeks of age.
   g. Car seat recommendations: Infants should be in a rear-facing car seat, properly installed in the rear seat of the vehicle and properly buckled, according to manufacturer's recommendations. Use of rear-facing car seats advised to at least 24 months of age.
✦ 2. 4 months.
   a. General safety issues: aforementioned items plus keep sharp objects out of reach. Do not allow infant to play with plastic bags, balloons, or small objects. Keep poisonous objects in a safe place, out of baby's reach and sight.
   b. Nutrition: Continue to ensure adequate nutrition. Exclusively breastfed infants need iron supplements. See previous vitamin D supplementation recommendations.
   c. Play: Encourage play with appropriate toys. Establish a bedtime routine. Do not use walkers or rolling wheels.
✦ 3. 6 months.
   a. General safety issues: Continue car seat use, teach fall prevention, and keep hazardous items up and out of baby's reach. Put plastic plugs in electrical sockets, check floor from baby's eye level for hazards. Keep baby away from tubs and swimming pools, lower crib mattress, avoid dangling cords, and install safety locks on cabinets and drawers. Begin dental health (see Appendix 13-1); establish consistent sleep habits.
   ✦ b. Nutrition: Introduce solids at 6 months starting with single-grain iron-fortified cereals, adding one new food only every 4–7 days in 1 teaspoon to 1–2 tablespoon amounts, then pureed fruits and vegetables; add pureed meats last. Begin offering cup; avoid objects that can be aspirated (hot dogs, peanuts, raw vegetables, whole grapes). Always supervise eating, no bottles in bed, limit juice to 4–6 oz per day. No honey until after 1 year old.
   c. Begin cleaning teeth with eruption—using soft gauze or toothbrush without toothpaste.
   d. Play: Provide opportunities for exploration, read to baby, play music. Play interactive games (peek-a-boo and pat-a-cake). Introduce transitional object, play with age-appropriate toys.

✦ 4. 9 months.
   a. General safety issues: car safety and injury prevention as in previous months. Fall prevention—install gates at top and bottom of stairs, safety devices on windows. Learn child cardiopulmonary resuscitation (CPR). Continue to keep hazardous substances and items out of sight and reach. Vigilance around swimming pools, lakes, ponds, or ocean. Careful selection of caregivers.
   b. Nutrition: Continue to supervise meals. Introduce small bite-sized table foods; baby has increased interest in self-feeding. Cup feeding continues. Avoid foods that can be aspirated.
   c. Play: Encourage vocalizations, play imitative games, continue talking and reading to baby. Provide age-appropriate toys, avoiding small objects that can be aspirated.

✦ 5. 12 months.
   a. General safety issues: Continue car safety, fall prevention, poisons out of reach, water safety, hot water precautions. Keep smokers out of baby's environment. Test smoke detectors yearly. Keep away from cars, lawn mowers, and driveways—keep stairs gated. Begin brushing teeth with tiny amount of toothpaste.
   b. Nutrition: Begin to feed at family mealtimes with two to three nutritious snacks per day. Allow child to self-feed; amounts eaten will vary. Continue cup training and wean from bottle. Avoid high-sugar drinks; change from formula to whole milk. Avoid foods that may be aspirated (peanuts, popcorn, hard candy, whole grapes).
   c. Play: Encourage exploration and initiative. Provide push and pull toys that encourage large motor skills, teddy bears or transitional objects, musical toys, picture books; read to child daily.
   d. Discipline: Praise good behavior. Set limits and use distraction, "time out," removal from conflict situation. Discipline geared toward teaching and protection, not punishment.

Toddlers (12–36 Months)

✦ A. General concepts.
   1. Time of intense curiosity and exploration of the environment.
   2. Often characterized as the "terrible twos"; obstinacy, temper tantrums, and negativism prevail.
   3. Physical growth slows after infancy. Senses of vision, hearing, taste, and smell develop well and become coordinated.
   4. Respiratory tract continues to mature, increase in size and number of functioning units, and lessen some factors predisposing to frequent illness.
   5. Gastric and bladder capacities increase; sphincter control occurs around 24 months (physiological readiness for toilet training).
   6. Most children walk well. Stoop and climb stairs by 15 months, throw ball by 18 months.
      a. Refine gross motor skills between 2 and 3 years.
      b. Fine motor control continues to improve; able to stack two blocks and can drop a pellet into narrow bottle at 15 months. Uses a spoon by about 24 months.
   7. Separation from mother and differentiation from others begins. Toilet training, sibling rivalry, tantrums, and regression during illness are all common in toddlerhood.

B. Behavioral development.
✦ 1. Erikson: autonomy versus shame and doubt.
✦ 2. Piaget: sensory motor (tertiary circular reactions) to preconceptual phase (preoperational).
   3. Freud: anal.
   4. Development of spirituality, sexuality, and body image begin.

C. Moral development.
   1. Kohlberg: preconventional (good/bad, right/wrong).
✦ 2. Magical thinking begins ("bad" thoughts make "bad" things happen).

D. Language development.
   1. Ability to understand far outweighs words spoken.
   2. By age 2, has vocabulary of around 300 words, uses short sentences, speaks intelligibly to family, and understands simple instructions.
   3. By age 3, has vocabulary of over 900 words and can follow two-step instructions and speaks intelligibly to strangers.

✦ E. Anticipatory guidance.
✦ 1. Injury prevention: car seats, in rear seats only in car with air bags. Car seats must also have upper anchorage devices and locking clips, or Universal Child Safety Seat System (UCSSS). Child should remain in an approved rear-facing car seat until age 2 or have reached height and weight requirements required by car seat manufacturer. After age 2, the child should be placed in an upright forward-facing safety seat with a three- to five-point harness (American Academy of Pediatrics [AAP], 2011). Water

safety, prevention of burns, poisoning prevention, preventing falls, aspiration and choking precautions.

2. Monitor for obesity. Obtain body mass index (BMI) for age beginning at age 2. At risk if BMI for age > 85th percentile. Considered obesity if BMI > 95th percentile.
   a. If present, monitor blood pressure (BP) for hypertension, blood glucose (for type 2 diabetes), and lipid profile.
   b. Risk factors are genetics, psychosocial issues, inactivity, and minority and low-income family.
   c. Dietary counseling aimed at the family and increasing exercise and can prevent obesity in even preschool children.
3. General issues.
   a. Toilet training.
   b. Dental health—first visit to dentist should occur at 12–24 months.
   c. Sleep and activity—total hours of sleep decrease; encourage routines.

F. Nutrition.
1. Toddlerhood is the phase of "physiological anorexia."
2. Intake varies daily, may eat large amounts one day and almost nothing the next.
3. Eating habits established in first 3 years may last whole life—avoid using food as punishment or reward; mealtimes should be enjoyable, give appropriate-size portions, make snacks nutritious.

G. Play.
1. Increased locomotion skills; beginning tricycles, wagons, balls, low slides—safety should be foremost in toy selection.
2. Interest in artwork begins—crayons, finger paints, chalk.
3. Puzzles, blocks—toys that stimulate creativity, freedom of expression.
4. Limit use of television and other electronic devices.

H. Discipline.
1. Provide limits. Allow choices when possible.
2. Tell child specifically and briefly why discipline is necessary and be consistent.
3. Avoid power struggles with toddlers.
4. Use "time out" when needed, teach toddler about disciplinary measures when child is fed, rested, and not angry. "Catch" the child being good and offer praise.

Preschoolers (3–6 Years)

A. General concepts.
1. Physical growth slows, potbelly of toddlerhood disappears, child becomes taller, more slender, sturdy, and agile.
2. Gross motor skills continue to improve and become more coordinated. Child is able to run well, climb, ride tricycle, balance on one foot, skip; can roller skate by 5 years.
3. Fine motor skills improve with improved hand–eye coordination. Child can draw recognizable person with three parts by age 4; can dress self without help by age 5, print letters, and copy shapes.
4. Preschoolers are energetic learners and most eagerly anticipate social and educational opportunities at preschool. Enjoy magical thinking and "make believe."
5. Beginning to test limits with adults, but respond well to clearly stated rules and praise.
6. Becoming curious about own bodies, sexual identity, and exploration begins to emerge.
7. Sleep problems common—difficulty falling asleep, nightmares, sleep terrors. Routine bedtime rituals helpful in helping child settle down for sleep. Average preschooler sleeps 12 hours at night with infrequent daytime nap.

B. Behavioral development.
✦ 1. Erikson: stage of initiative versus guilt.
2. Piaget: preoperational stage—age 2–7.
   a. Age 2–4 is preconceptual phase.
   b. Age 4–7 is intuitive thought phase.
3. Freud: Oedipal phase.

✦ C. Moral development.
1. Kohlberg: preconventional stage—from 2 to 4 years, child's moral thinking and behavior is guided by punishment and obedience orientation.
2. From 4 to 7 years, thinking is more self-centered and concrete sense of justice, characterized as "naive instrumental orientation"; is sensitive to feelings of others.

D. Language development.
1. Speech and language become more complex. Child speaks intelligibly to strangers. At age 5, able to use the past tense and sentences of four or five words, up to short paragraphs.
2. From age 3–4, speech is telegraphic (only most essential words used).
3. At age 4, can remember nursery rhymes, may have some stuttering.
4. At age 5, able to recite address and phone number, may have vocabulary of > 2100 words, understands opposites.

✦ E. Anticipatory guidance.
1. Injury prevention.
✦ a. Child is ready for a properly installed and fitted booster seat when child reaches the top weight or height allowed for infant/toddler car seats, shoulders are above harness slots and ears have reached top of the seat. A high seat back is preferred.
b. Bicycle safety, water safety—swimming lessons feasible, use of sunscreen, smoke detectors and fire drills in home, poisons/toxins out of reach and locked.
2. Parents should be conscious of role-modeling healthy behavior, encouraging regular exercise, limiting television use.
3. Child should be taught about personal hygiene, sexuality, and keeping their own bodies safe.
4. Establish dental hygiene habits.

F. Nutrition.
1. Preschoolers should have three meals and two snacks at regular times during the day. Encourage healthy breakfast at home or at school.
2. Calorie requirements approximately 90 cal/kg and 1.2 g/kg protein per day. Energy needs vary from 1400–1800 kcal/day according to size, gender, and activity level (see U.S. Department of Agriculture Web site ChooseMyPlate.gov for guidelines and daily menus). Many are "picky" eaters and refuse to try new foods.
3. By age 5, child may be able to sit through adult meal; important for parents to role-model good eating habits.

G. Play/social development.
1. Most preschool play is associative; groups involved in similar activities. Play centers on motor skills—running, jumping, riding tricycles and bicycles. Becomes attached to a "favorite" toy, may engage in elaborate fantasy play ("house"), plays interactive games with peers. Can sit still to listen to a story; improving manual dexterity allows interest in drawing, painting, simple carpentry, and sewing. May have imaginary playmate.
2. Preschoolers more eager to please, can verbalize desires and usually heed warnings of danger.
3. By 4–5 years, begin to test boundaries.

✦ H. Discipline.
1. Promote physical activity without aggressiveness. Set developmentally appropriate limits. Use time out, removal of source of conflict for unacceptable behavior, establish consequences for unacceptable behavior.
2. Help child learn how to get along with peers, teach to respect authority, how to manage anger and resolve conflicts without violence. Parents should be aware of importance of role modeling.

School-Age Children (6–12 Years)

✦ A. General concepts.
1. Height and weight continue to increase at slower pace. Boys and girls are similar size until pubescent growth spurt. Bodies become slimmer, fat distribution changes and diminishes, legs lengthen, and muscle groups become stronger.
2. Deciduous teeth are lost and replaced by permanent teeth during middle childhood; "the ugly duckling years"; dental hygiene more important.
3. Physiologic maturity continues in gastrointestinal (GI) system; fewer GI upsets occur and stomach capacity increases. Immune system continues to become more competent; child has fewer illnesses normally than during preschool years.
4. Increase in stress-related complaints in older school-age children.
a. Somaticized as stomach pain, headache, sleep disturbances, changes in eating.
b. Generally are less fearful than preschoolers, but worry about bodily harm, occasionally about frightening events heard on news (kidnapping, violence).
5. Curiosity increases about bodily functions and sex.
a. Ideal time for matter-of-fact sex education and information about sexual maturation and reproduction.
b. Girls need concrete information about menstruation, as age of menarche continues to decline in United States.
6. Neighborhood and friends take on a more important role. Children begin to look outside parents/family for approval.

B. Behavioral development.
✦ 1. Erikson: industry versus inferiority.
2. Piaget: concrete operations; characterized by conservation (age 5–7) and classification skills in later school-age years.
3. Freud: latency period.

✦ C. Moral development.
1. Kohlberg: Children interpret accidents or mishaps as punishment for bad behavior.
2. Called "conventional morality" phase; child views rules for the good of all, and by following the rules, he or she is viewed as a "good" child.

D. Language.
   1. Speech becomes progressively more complex, begins to use proper nouns, pronouns, and prepositions. By end of school-age period, has basic mastery of grammar.
   2. Able to write letters by age 6–7.
   3. Reading proficiently by 8–9 years.

✦ E. Anticipatory guidance.
   1. Promote healthy habits, encourage regular exercise/physical activity, limit television to 1 hour/day, personal care, and hygiene.
   2. Car seat recommendations.
      a. Children should ride in back seat only until age 13.
      b. Children should stay in a booster seat in rear seat until child reaches about 4 feet 9 inches (114 cm) in height and is 8–12 years of age.
      c. Child is ready to use a lap and shoulder seat belt when belt fits properly.
   3. Bike/skateboard helmets, water safety—swimming lessons, sunscreen, protection from assault.
   4. Safety rules in home, ensure guns are locked and unloaded, ensure child has supervision before and after school, teach a family "password" to protect from strangers.
   5. Begin smoking, drug, and alcohol education/avoidance.
   6. Help child learn to get along with peers and conflict resolution—promote positive interactions between the child, teachers, peers, and adults.
   7. Begin sexuality education; prepare girls for menstruation, boys for development and nocturnal emissions.

F. Nutrition.
   1. Encourage three regular meals and healthy snacks. Avoid fad diets, sugary drinks, and consumption of "junk food."
   2. Parents should model healthy eating and encourage meals together with family.
   3. Calorie needs decrease relative to body size, need approximately 2000 cal/day and 28 g protein, depending on gender, size, and activity levels (See ChooseMyPlate.gov).
   4. Monitor for obesity. At risk if BMI for age > 85th percentile.
      a. If present, monitor BP for hypertension, blood glucose (for type 2 diabetes), and lipid profile.
      b. Risk factors are genetics, psychosocial issues, inactivity, and minority and low-income family.
      c. Dietary counseling, weight loss, and exercise programs aimed at children as young as age 6 have been proven to be effective.
   5. Encourage regular activity/exercise.

G. Play/social development.
   1. Trend toward earlier participation in organized competitive sports. Friends become bigger part of life; focus on group activities. Commonly enjoy model or construction kits, swimming, bicycling, skateboarding, video games, swimming, painting, pottery, card and board games.
   2. Children usually can be responsible for designated household chores with financial compensation (allowances).

✦ H. Discipline.
   1. Parents should be encouraged to set limits and establish consequences for bad behavior. Children should be expected to follow family rules for bedtime, TV, and chores.
   2. Reasoning works well with school-age children; allow some choices. Children can help problem solve.
   3. Withholding privileges is generally effective disciplinary consequence—also contracting and imposing penalties.

Adolescents (12–18 Years)

✦ A. General concepts.
   1. Major development is onset of puberty and development of primary and secondary sex characteristics; secretion of estrogen and androgens.
   2. Physical growth marked by the adolescent growth spurt—begins between 9 and 14 years in girls, and 10 and 16 years in boys.
      a. The final 20–25% of height occurs over a 24–36-month period. Amount of growth varies; boys may gain 10–30 cm (3.9-11.8 inches) and 7–30 kg (15.4-66 lbs); girls gain 5–20 cm (1.96-7.8 inches) and 7–25 kg. (15.4 to 55 lbs).
      b. Growth ceases about 2 years after menarche for girls; at 18–20 years in boys.
   3. Physiologic growth in size and strength of muscles, particularly heart, respiratory volume and vital capacity dramatically increase; exercise performance increases dramatically.
   4. Parents become less important and influential; peer relationships play major role as adolescents struggle for autonomy and separation from parents.

5. Experimentation in risky behavior is common—sexual activity; alcohol, drug, and cigarette use; other risk taking with automobiles and sporting activities.
6. Attitudes and values formulated by late adolescence, which will affect future behavior and quality of life.
7. Stress, depression, and social withdrawal common—parents should be aware of alarming symptoms.
8. Adolescents seek some financial independence—household chores and allowance—often obtain part-time employment.
9. Physical exam should include screening for human immunodeficiency virus/sexually transmitted diseases (HIV/STDs), scoliosis, blood pressure, weight, hemoglobin (Hbg) and hematocrit (Hct) in girls with heavy menses, weight loss, athletic development; screening for diabetes mellitus and hyperlipidemia if positive family history or BMI for age > 85–95th percentile.

B. Behavioral development.
✦ 1. Erikson: identity versus role diffusion.
2. Piaget: formal operations, characterized by formal operations.
3. Freud: genital stage.

✦ C. Moral development.
1. Kohlberg: Adolescents begin to substitute their own set of values and beliefs for parents'; phase of "principled morality"—based on what is "universally ethical" on basis of own conscience.
2. Moral conduct is based largely on the desire to avoid the loss of respect of the peer group and a sense of obligation to democratic law.

✦ D. Social development.
1. Primary task is to separate from parents, reestablish relationship with family based on "mutual affection and equality" rather than parental dominance. Separation often difficult for adolescent and parents; conflict is common.
2. Peer group more important, school important as academic and social focus. Groups important, as are best friends and emergence of heterosexual friendships of varying "seriousness."
3. Some adolescents identify as homosexual by late teens; sexual activity encountered by the majority by age 18.

✦ E. Anticipatory guidance.
1. Immunizations at age 11–12 for both girls and boys: tetanus, diphtheria, pertussis (Tdap), human papillomavirus vaccine (HPV), and the meningococcal vaccine: MCV4 (Menactra or Menveo). A second meningococcal vaccine should be given at age 16 (most current recommendations found at Centers for Disease Control and Prevention [CDC] Web site: www.cdc.gov).
2. Becoming responsible for own body and health, establishing healthy activities, avoiding risky behavior.
3. Injury prevention: focusing on automobile safety, water safety, respect for firearms, prevention of substance use/abuse. Use of sunscreen, protective sports gear, and helmet use for bicycles and motorcycles.
4. If sexually active, protection from HIV, birth control; self-defense and avoidance of potentially abusive relationships/situations.
5. Mental health issues: stress management, conflict resolution, seeking help if depressed, hopeless, or angry; setting realistic goals; increasing self-confidence; time management for school, friends, family, and employment.
6. Mental health: Monitor for depression, suicidal thoughts, aggressive behavior, antisocial activity.

F. Nutrition.
1. High caloric and protein requirements during periods of rapid growth. Protein requirements in males 45–60 g/day (age 11–18), females 44–46 g/day (age 11–18); caloric needs: approximately 2500–3000/day in males (age 11–18) and approximately 2200/day in females (see ChooseMyPlate.gov).
2. Menstruating girls need extra iron, especially if physically active. Frequent time for girls to diet—observe for continued weight loss.
3. Adolescents (especially girls) need 1000–1300 mg of calcium per day and sufficient vitamin D to prevent osteoporosis while bone is being formed during period of rapid growth.

G. Sleep and activity.
1. Sleep needs are variable—many teens have propensity for staying up late at night, sleeping late in morning whenever possible.
2. Regular patterns of exercise should become established during adolescence and maintained into adulthood.

GENERAL ASSESSMENT OF THE CHILD

GENERAL PRINCIPLES FOR ASSESSING CHILDREN

A. Maturational ability of the child to cooperate with the examiner is of major importance to adequate physical assessment.
B. When planning physical assessment of the child, the following points should be considered:
✦ 1. Establish a relationship with the child prior to the examination.
   a. Determine child's developmental level.
   b. Allow the child an opportunity to become accustomed to the examiner, preferably an opportunity to observe the examiner from a distance.
✦ 2. Explain in terms appropriate to the child's level of understanding the extent and purpose of the examination.
3. Realize that the physical examination may be a stressful experience for the child, who depends on others for protection.
4. Limit the physical examination to what is essential in determining an adequate nursing diagnosis when a focused assessment is desired.
5. Proceed from the least to the most intrusive procedures.
6. Allow active participation of the child whenever possible.
7. Allow parents to participate in assessment of younger children. Allow adolescents the option of having parent stay during the exam. (See **Table 13-1**.)
8. Consider cultural influences and practices—incorporate appropriately into exam.

✦ Table 13-1 PEDIATRIC PHYSICAL ASSESSMENT

Assessment	Normal	Abnormal
Measurements		
Measure height and weight and plot on a standardized growth chart	Height/weight proportional Sequential measurements: pattern follows normal growth curves	Height/weight below fifth percentile Sudden drop in percentile range of height and/or weight: possible sign of disease process or congenital problem (R/O FTT—failure to thrive) Sudden and persistent increase (above 95th percentile)
Assess temperature (axillary or tympanic until 6 years of age)	Axillary 36.5°–37.5°C (97.7°F) Rectal 36.6°–37.2°C (97.8°F) Elevations following eating or playing not unusual	Temperature of 104°–105°F: corresponds roughly with 101°–102°F in an adult Large daily temperature variations Hypothermia: usually result of chilling, may indicate sepsis in neonates
Measure circumference of head and chest Examine or check circumferences when child is less than 2 years old Compare measurements with standardized charts	Head at birth: about 2 cm greater than chest During first year: equalization of head and chest After 2 years: rapid growth of chest; slight increase in size of head	Increase in head circumference greater than 2.5 cm per month: sign of hydrocephalus
Assess pulse apically	Birth–1 year: 100–180 1 year: 80–150 2 years: 80–130 3 years: 80–120 Over 3 years: 70–110	Pulse over 180 at rest after first month of life: cardiac or respiratory condition Inability to palpate or very weak femoral and pedal pulses: possible coarctation of the aorta
Assess respirations	Birth: 30–50 6 years: 20–25 Puberty: 14–16 (Young children have abnormally high respiration rate with even slight excitement)	Consistent tachypnea: usually a sign of respiratory distress Respiratory rate over 100: lower respiratory tract obstruction Slow rate: may be sign of CNS depression
Assess blood pressure	Birth: 55–60/80–90 mm Hg systolic 20–60 mm Hg diastolic	Elevated blood pressure in upper extremities and decrease in lower extremities: coarctation of aorta

(*Continues*)

✦ Table 13-1 PEDIATRIC PHYSICAL ASSESSMENT (*Continued*)

Assessment	Normal	Abnormal
Measurements (*Continued*)		
	1 year: 90–60 Rise in both pressures: 2–3 mm Hg per year of age Adult level reached at puberty	Narrowed pulse pressure (normal or elevated diastolic with lowered systolic; less than 30 mm Hg difference between systolic and diastolic readings): possible sign of aortic or subaortic stenosis or hypothyroidism Widened pulse pressure: possible sign of hyperthyroidism Children and adolescents with elevated BP should be followed and reevaluated for possible hypertension
Appearance		
Observe general appearance	Alert, well-nourished, comfortable, responsive	Lethargic, uncomfortable, malnourished, gross anomalies, dull
Listen to voice and cry	Strong, lusty cry	Weak cry, low- or high-pitched cry: may indicate neurological problem or chromosomal abnormality Stridor: possible upper airway edema or obstruction or hoarse cry
	Facial expression animated No indications of pain	Expressionless, unresponsive Doubling over, rubbing a body part, general fretfulness, irritability
Assess presence of odor	No odor	Musty odor: sign of phenylketonuria, diphtheria Odor of maple syrup: may be maple syrup urine disease Odor of sweaty feet: one type of acidemia Fishy odor: may be metabolic disorder Acetone odor: acidosis, particularly diabetic ketoacidosis
Skin Assessment		
Assess pigmentation	Usually even Pigmented nevi common Large, flat, black and blue areas over sacrum, buttocks (mongolian spots)	Multiple cafe au lait spots: possible neurofibromatosis Cyanosis Jaundice Pallor
Assess lesions	Usually none Adolescence: acne	Erythematous lesions Multiple macules, papules, or vesicles Petechiae and ecchymoses: may indicate coagulation disorder Hives (allergy) Subcutaneous nodules: may indicate juvenile rheumatoid arthritis
Note consistency of skin	Good turgor Smooth and firm Check fontanelles in infant (should be soft and flat)	Poor turgor (tenting) Dryness Edema or dehydration Lack or excess of subcutaneous fat: sign of malnutrition or excess nutrition (obesity)
Assess nails	Nailbeds: normally pigmented Good nail growth	Cyanosis Pallor Capillary pulsations Pitting of the nails: possible sign of fungal disease or psoriasis Broad nailbeds: possible sign of Down syndrome or other chromosomal abnormality
Assess hair (consistency appropriate to ethnic group)	No excessive breaking Consistent growth pattern	Dry, coarse, brittle hair: possible sign of hypothyroidism Alopecia (loss of hair): may be psychosomatic or due to drug therapy Unusual hairiness in places other than scalp, eyebrows, and lashes: may indicate hypothyroidism, vitamin A poisoning, chronic infections, reaction to Dilantin therapy Tufts of hair over spine or sacrum: may indicate site of spina bifida occulta or spina bifida Absence of the start of pubic hair during adolescence: possible hypothyroidism, hypopituitarism, gonadal deficiency, or Addison's disease
Assess lymph nodes	Nontender, movable, discrete nodes up to 3 mm in diameter in occipital post-auricular, parotid, submaxillary, sublingual, axillary, and epitrochlear nodes Up to 1 mm in diameter inguinal and cervical nodes	Tender or enlarged nodes: may be sign of systemic infection

✦ Table 13-1 PEDIATRIC PHYSICAL ASSESSMENT

Assessment	Normal	Abnormal
Head and Neck Assessment		
Assess scalp	Usually without lesions	Ringworm, lice (pediculosis capitis)
Assess frontal and maxillary sinuses	Nontender	Tenderness: indicative of inflammatory process Seborrheic dermatitis
Assess face	Symmetrical movement	Asymmetry: signs of facial paralysis Twitching: could be due to psychosomatic causes or Tourette's syndrome, vitamin/mineral deficiency
Evaluate the eyes Gross screening of vision Snellen chart	With younger child, ability to focus and follow movement and to see objects placed a few feet away	Inability to follow movement or to see objects placed a few feet away
Sclerae	Completely white	Yellow sclera: sign of jaundice Blue sclera: may be normal or indicative of osteogenesis imperfecta
Placement in eye socket	Normally placed	Exophthalmos (protrusion of eyeball) Enophthalmos (deeply placed eyeball)
Iris	At rest: upper and lower margins of iris visible between the lids	Setting sun sign (iris appears to be beneath lower lid): if marked, may be sign of increased intracranial pressure or hydrocephalus
Movement	In newborn, intermittent strabismus or nystagmus	Fixed strabismus or intermittent strabismus continuing after 6 months of age: indication of muscle paralysis or weakness Involuntary, repetitive oscillations of one or both eyes: normal with extreme lateral gaze Nystagmus: may be cerebellar dysfunction indicative of use of certain drugs (anticonvulsants, barbiturates, alcohol)
Eyelids	Fully covers eye Fully raised on opening	Ptosis of eyelid: may be an early sign of a neurological disorder Sty
Conjunctiva	Clear	Inflammation (conjunctivitis) Hemorrhage Stimson's lines (small red transverse lines on conjunctiva)
Cornea	Clear	Opacity: sign of ulceration Inflammation Redness
Discharge	Tears	Purulent discharges: note amount, color, consistency (bacterial conjunctivitis)
Pupils	Clear, equal Brisk reaction to light Accommodation reflex (pupil contraction as object is brought near the eye)	Sluggish or asymmetrical reaction to light: indicates intracranial disease Lack of accommodation reflex
Lens	Clear	Opacities (cataracts)
Evaluate the ears Sinuses	None present	Small holes or pits anterior to ear: may be superficial but could indicate the presence of a sinus leading into brain
Position	Top of ear above level of eye	Top of ear below level of eye: associated with some congenital defects
Discharge	None	Discharge: note color, odor and amount
Hearing	In infant: turning to sound In older child: responds to whispered command	Diminished hearing in one or both ears
Assess the nose	No secretions	Secretions: note characteristics Any unusual shape or flaring of nostrils
	Breathing through nose	Breathing through mouth
Assess the mouth		Circumoral pallor: possible sign of cyanotic heart disease, scarlet fever, rheumatic fever, hypoglycemia; also seen in other febrile diseases Asymmetry of lips: seen in nerve paralysis
	Intact palate	Cleft palate
	Teeth in good condition In older child, presence of permanent teeth	Delayed appearance of deciduous teeth: may indicate cretinism, rickets, congenital syphilis, or Down syndrome; may also be normal Poor tooth formation: may be seen with systemic diseases Green or black teeth: seen after iron ingestion or death of tooth Stained teeth: may be seen after prolonged use of tetracyclines

(*Continues*)

✦ Table 13-1 PEDIATRIC PHYSICAL ASSESSMENT (*Continued*)

Assessment	Normal	Abnormal
Head and Neck Assessment (*Continued*)		
Assess the gums	Retention cysts in newborn	Inflammation, abnormal color, drooling, pus, tenderness (gingivitis) Black line along gums: may indicate lead poisoning
Assess the tongue	Moves freely	Tremors on protrusion: may indicate chorea, hyperthyroidism, cerebral palsy Protruding tongue—Down syndrome White spots (thrush) Tongue-tie (frenulum)
	Pink, with conical, filiform non-tender papillae	Strawberry tongue (scarlet fever)
Assess the throat	Tonsils normally enlarged in childhood	White or gray membrane over tonsils (diphtheria) White pus on sacs, erythema (bacterial pharyngitis), tender: vitamin deficiencies, anemia
Assess the larynx	Normal vocal tones	Hoarseness or stridor: possible upper respiratory tract obstruction (laryngotracheobronchitis)
Assess the neck	Short in infancy Lengthens at 2–3 years Trachea slightly right of midline	Trachea deviated to left or right: may indicate shift with atelectasis or tension pneumothorax
Thyroid	Not enlarged	Enlarged: may be due to hyperactive thyroid, malignancy, goiter
Motion	Full lateral and upward/downward motion	Limited movement with pain: may indicate meningeal irritation, lymph node enlargement, rheumatoid arthritis, or other diseases
Lungs and Thorax Assessmen		
Assess the lungs	Normally clear breath sounds bilaterally No retractions	Presence of rhonchi, crackles, or wheezes Diminished breath sounds heard over parts of lung Mild to severe intercostal, supraclavicular or sternal retractions indicative of respiratory distress
	Symmetry of diaphragmatic movement	Asymmetry of movement (phrenic nerve damage)
Assess the sputum	None or small amount of clear sputum in morning	Thick, tenacious sputum with foul odor Blood-tinged or green sputum
Assess the breasts	Slightly enlarged in infancy Generally slightly asymmetrical at puberty	Discharge or growth in males Masses (especially solid, fixed nonmobile) in older adolescent Premature development (precocious puberty)
Heart Assessment		
Assess heart sounds	S_1, S_2, S_3	S_4 indicates congestive heart failure
Assess femoral pulses	Strong	Weak (shock, coarctation of aorta)
Note edema	None present	Edema—note location (initially periorbital) and duration, bulging fontanelles—fluid overload, CHF
Note clubbing of fingers	None present	Clubbing (congenital cyanotic heart defects)—note location and duration
Note murmurs		Murmur grade three or higher is always abnormal No change in quality with positional changes
Note cyanosis	None normally present	Circumoral or peripheral cyanosis: indicates respiratory or cardiac disease (hypoxemia); congenital heart defects
Abdomen Assessment		
Assess skin condition	Soft	Hard, rigid, tender
Assess for peristaltic motion	Not visible	Visible peristalsis—may indicate pyloric stenosis (olive-shaped mass, palpable, in area of pylorus)
Assess shape	"Pot-bellied" toddlers Slightly protuberant in standing adolescent Umbilical protrusion	Large protruding abdomen: may indicate pancreatic fibrosis, hypokalemia, rickets, hypothyroidism, bowel obstruction, constipation, inguinal hernias, unilateral or bilateral:observe for reducibility Umbilical hernia
Assess hepatic border	At costal margin or 1–2 cm below	> 3 cm below costal margin (hepatic enlargement)

✦ Table 13-1 PEDIATRIC PHYSICAL ASSESSMENT

Assessment	Normal	Abnormal
Genitourinary Tract Assessment		
Assess female genitalia	No signs of sexually transmitted disease (herpes, chlamydia, HPV, or abuse)	Signs of trauma or sexual abuse, pustules or lesions consistent with herpes, HPV, chlamydia, or other STDs
Discharge	Mucoid, no odor	Foul or copious discharge; any bleeding prior to puberty
	Tanner stage consistent with age	Early or delayed pubescent development
Assess male genitalia	Orifice on distal end of penis	Hypospadias or epispadias (urethral orifice along inferior or dorsal surface)
Presence of urethral orifice		
Urethral opening	Normal size	Stenosis of urethral opening
Foreskin	Covers glans completely	Foreskin incompletely formed ventrally when hypospadias present
		Undescended testes
Placement of testes	Descended testes	Enlarged scrotum
		Early or delayed pubescent development
	Tanner stage consistent with age	
Assess urine output	Full, steady stream of urine	Urine with pus, blood, or odor (infection)
		Excessive urination or nocturia: possible sign of diabetes
Check anus and rectum	No masses or fissures present	Hemorrhoids, fissures, prolapse, pinworms
		Dark ring around rectal mucosa: may be sign of lead poisoning
Musculoskeletal Assessment		
Assess extremities	Coloration of fingers and toes consistent with rest of body	Cyanosis—indicates respiratory or cardiac disease, or hypothermia in newborn
		Clubbing of fingers and toes indicates cardiac or respiratory disease
	Quick capillary refill on blanching	Sluggish blood return on blanching indicates poor circulation
	Temperature same as rest of body	Temperature variation between extremities and rest of body indicates neurological or vascular anomalies
	Presence of pedal pulses	Absence of pedal pulses indicates circulatory difficulties
	No pain or tenderness	Presence of localized or generalized pain
	Straight legs after 2 years of age	Any bowing after 2 years of age may be hereditary or indicate rickets
	Broad-based gait until 4 years of age; feet straight ahead afterwards	Scissoring gait indicates spastic cerebral palsy
		Persistence of broad-based gait after 4 years of age indicates possible abnormalities of legs and feet or balance disturbance
		Any limp or ataxia
Assess fine motor movements	Presence of fine motor activity approximate to age—symmetrical	Continued presence of primitive reflexes after fading of reflex should normally occur may indicate brain damage
Assess spine	No dimples	Presence of dimple or tufts of hair indicates possible spina bifida
	Flexible	Limited flexion indicates central nervous system infections
		Hyperextension (opisthotonos) indicates brain stem irritation, hemorrhage, or intracranial infection
		Presence of lordosis (after age 2 years), kyphosis, or scoliosis
Have child bend forward at waist and check level of scapulae (scoliosis screening) Assess hips	No lateral curvature or excessive anterior posterior curvature	
	Scapulae at same height	
Assess joints	Full range of motion without pain, edema, or tenderness	Pain, edema, or tenderness indicates tissue injury
Assess muscles	Good tone and purposeful movement	Decreased or increased tone
		Spasm or tremors may indicate cerebral palsy
	Ability to perform motor skills approximate to development level	Atrophy or contractures
Signs of abuse	No external signs	Bruises, welts, swelling, burns, discharge, bleeding

Assessment of the Infant

A. Accomplish as much of the examination as possible while the infant is sleeping or resting undisturbed.
B. History: gestational age/birth weight, discharge from hospital, weight gain, and sleep patterns.
✦ C. Assess general condition.
1. Symmetry and location of body parts.
2. Color and condition of the skin.
3. State of restlessness and sleeplessness.
4. Adjustment to feeding regimen.
5. Quality of cry.
6. Interactions with parents/caregivers present.
D. Utilize screening procedures for assessment.
1. Developmental screening: Current recommendations include the use of evidence-based quality developmental–behavioral screening tools such as "Parents Evaluation of Developmental Status" (PEDS), the "Ages and Stages Questionnaire" (ASQ), or other products listed in *Performing Preventive Services, A Bright Futures Handbook* (American Academy of Pediatrics, 2010).
a. Properly administering the Denver II can take up to 2 hours—by a *skilled* examiner—and the DDST II does not have the same specificity and sensitivity as evidence-based tools listed above.
b. If indicated, the nurse may refer the child for further screening.
2. Vision.
3. Hearing.
4. Growth charts: head circumference, weight, length available on CDC Web site (www.cdc.gov).
5. Hemoglobin to screen for anemia at age 9–12 months.
6. Lead screening (serum lead level if indicated at 12 months).
7. Tuberculosis screening questionnaire (tuberculin skin test [TST] if indicated).
E. Provide teaching in the following areas:
1. Growth and development changes.
2. Language development.
3. Anxiety toward strangers.
4. Separation anxiety.
5. Transitional objects.
✦ F. Anticipatory guidance.
1. Accident prevention: use of car seats, fall prevention, poisoning, water heater temperature, prevention of foreign body aspiration.
2. Immunizations, influenza vaccine beginning at age 6 months.
3. Feeding—introduction of solids, weaning from breast or bottle.
4. Eruption of deciduous teeth and dental hygiene.
G. Assess for nonaccidental trauma.

Assess for Congenital Anomalies

✦ A. Neurological system.
1. Reflexes: absent or asymmetrical (see Neurological section, see pages 652–662).
2. Head circumference: microcephaly, hydrocephaly (from growth chart).
3. Fontanelles: closed or bulging.
4. Eyes: cataracts, lid folds, spots on iris, pupillary responses, abnormal eye movements, and absence of red reflex (if in scope of practice).
✦ B. Respiratory system.
1. History: prematurity, apnea, siblings, previous children with sudden infant death syndrome (SIDS).
2. Signs of respiratory distress: tachypnea, retractions, nasal flaring, head bobbing, grunting, stridor, cough, asymmetry of chest, crackles, wheezes.
✦ C. Cardiovascular system.
1. Perfusion: Assess pulses in all four extremities; temperature of extremities, quality of peripheral pulses (for age), oxygen saturation, capillary refill time, skin color, color of mucous membranes and nail beds (pale, mottled or cyanotic).
2. Auscultation: regularity, tachycardia, bradycardia, relationship to respiratory cycle.
3. Activity: Infant tires and may become cyanotic.
a. Does infant tire with feeding?
b. Does skin color change with cry?
4. Umbilical vessels: normally two arteries and one vein.
✦ D. Gastrointestinal tract.
1. History of polyhydramnios.
2. Patency: coughing, choking, mucus, spitting, cyanosis, ability to pass nasogastric (NG) tube to stomach, pass meconium stool?
3. Mouth: palate and lips intact?
4. Anus: patent? Stool present? Passage of meconium?
5. Olive-shaped mass in region of pyloric valve with history of forceful projectile vomiting and immediate hunger may indicate hypertrophic pyloric stenosis.
✦ E. Genitourinary system.
1. Urine: stream and position of meatus.
2. Masses: abdominal (possible Wilms' tumor. DO NOT PALPATE).

3. Boys: undescended testicles, hernia, urethra—position of testicles, position of urethral meatus on penis, presence of hernia.
4. Girls: labia mobile, structures identifiable, presence of discharge.
5. Genitalia: clearly male or female or ambiguous?

✦ F. Skeletal system.
1. Clavicles: intact or fractured?
2. Hips: check for dislocation (asymmetric major gluteal or thigh folds, hip clunk on adduction).
3. Legs and feet: clubbing, without straight tibial line.
4. Spine: curved, flexibility, open, presence of masses or dimples.

Common Problems

✦ A. Respiratory infections.
1. Assess duration and severity of symptoms, medications given.
2. Look for signs of respiratory distress: wheezing, barking cough, anxiety, restlessness, use of accessory muscles.
3. Check for white patches on tonsils, unless toxic appearing and drooling.
4. Feeding difficulties—crying with swallowing, hydration status.
5. Chronic lung disease in infants with history of prematurity.

✦ B. Ear infections.
1. Assess for fever, irritability, pulling or rubbing ear(s).
2. Determine if change in eating habits has occurred recently. (Does infant go to bed with a bottle?)
3. Previous or recent upper respiratory infections (URI).
4. Previous ear infections.

C. Rashes.
1. Assess onset, duration, and location; association with new foods/medications, aggravating or alleviating factors.
2. Elicit accurate description of rash.

D. Contact dermatitis.
1. Assess if history of allergies, and family history.
2. Evaluate diaper area rash: use of lotions, powders, frequency of diaper changes, type of diaper used (cloth vs. paper).
3. Determine method of cleaning cloth diapers.
4. Atopic dermatitis: rashes in skin creases and scalp, oozing blisters, or dry scales.

E. Hernias.
1. For inguinal, assess for lump in groin, reducible—with or without pain.
2. For umbilical, determine if lump can be pushed back without difficulty or pain.

F. Scalp: "cradle cap" (seborrheic dermatitis).
1. Assess for scaling or crusted areas.
2. Determine method of washing hair.
3. Evaluate lotions or balms applied to hair.

G. Birthmarks.
1. Assess for change in size, color, or shape.
2. Look for any bleeding or irritation.

H. Eye symmetry.
1. Assess position of eyes, presence of doll's eye reflex, ability to focus and follow 180 degrees.
2. Determine presence of conjunctivitis (redness, discharge).
3. Evaluate for strabismus/amblyopia; determine if light reflex is symmetrical in both eyes, assess extraocular movements, perform cover/uncover test.

Assessment of the Toddler and the Preschool Child

A. General considerations.
✦ 1. Remember that separation anxiety is most acute at toddler age and body integrity fears are most acute at preschool age.
✦ 2. Involve the parent in examination as much as possible.
3. Give simple explanation of each portion of the exam. Proceed in calm and matter-of-fact fashion. Start with least invasive moving to more invasive.
4. Allow the child to handle the equipment and try out on teaching doll; use play and distraction as needed.
5. Take into account child's need for autonomy.
6. Do not disparage imaginary friends.
7. Allow for rituals and routines, security objects.

B. Utilize screening procedures for assessment.
1. Developmental landmarks: Denver II data or results using evidence-based screening tools such as PEDS or ASQ (see page 644).
2. Vision.
3. Hearing.
4. Language: At age 18 months, autism-specific screening is indicated, using a product such as the Modified Checklist for Autism in Toddlers (M-CHAT).
5. Growth charts: head circumference, weight, length, and BMI for age.
6. Hemoglobin and lead screening (serum lead level, if indicated).
7. Tuberculosis screening questionnaire (TST if indicated).
8. Skin and teeth.

C. Immunization history, annual influenza vaccine.

D. Blood pressure measurement, preferably with appropriate size manual cuff by age 3, or sooner if cardiac or renal disease is suspected.
✦ E. Anticipatory guidance: car seats/seat belts, avoidance of accidental ingestions, hot water heater temp, traffic safety, bicycle helmets, dental hygiene, water safety.

Common Problems

A. Feeding and eating.
1. Review food intake for last 72 hours, commonly "picky" eaters.
2. Assess types of food ingested (amount of fat and sweets).
3. Ensure adequate source of vitamins and minerals, use of supplements.

B. Temper tantrums.
1. Assess frequency and duration.
2. Determine precipitating event.
3. Evaluate response of caretaker.

C. Toilet training.
1. Ability to ambulate (fine and gross motor capability—neuromuscular maturity).
2. Determine if child is bothered by wet diapers.
3. Evaluate child's and parent's interest in toilet training.

D. Respiratory infections.
1. Assess duration and severity of symptoms.
2. Look for wheezing, barking cough, anxiety, restlessness, use of accessory muscles.
3. If throat is sore, check for white patches on tonsils, unless toxic appearing and drooling.

E. Communicable diseases. (See **Appendix 13-5**).
1. Assess exposures and onset of symptoms.
2. Evaluate progression of disease.
3. Determine treatment of symptoms.
4. Look for complications.

F. Gastrointestinal infections.
1. Assess onset and duration.
2. Evaluate intake and output (I&O).
3. Check for signs of dehydration (dry mucous membranes, tachycardia, tachypnea, decreased urine output).

G. Dental caries.
1. Examine teeth for obvious caries.
2. Dental care and use of fluoride (if indicated).

Assessment of the School-Age Child

A. General considerations.
✦ 1. Modesty important, heightened concern for privacy.
2. Explain all procedures clearly.
3. Direct questions to child, not to parent.

B. Utilize screening procedures for assessment.
1. Snellen vision testing.
2. Sweep check audiometry.
3. Height, weight, and BMI for age measurements.
4. Hemoglobin.
5. Skin and teeth.
6. Assess for scoliosis. (Routine screening no longer indicated—assess if concerned.)
7. Tuberculosis screening questionnaire (TST if indicated).
8. Baseline lipid screening at age 10.

C. Blood pressure measurement, preferably with appropriate size manual cuff.
D. Immunization history (catch-up if needed; annual influenza vaccine).

Common Problems

✦ A. School.
1. Determine child's attitude toward school, ability and participation.
2. Assess for signs of school-related problems: procrastination, GI symptoms, depression, anger.

✦ B. Nervous habits.
1. Assess onset and duration of such habits as stuttering, twitching.
2. Determine precipitating event.
3. Evaluate anxiety of child and parent over problem.

✦ C. Anticipatory guidance: seat belts, bicycle helmets, skateboarding gear (helmets and pads), water safety, sports participation (protective gear); diet, nutrition; dental hygiene—need for orthodontics, cavity prevention.

D. Accidental trauma.
1. Provide anticipatory guidance.
2. Assess if physical limitations may have caused accident.

E. Respiratory infections.
1. Assess duration and severity of symptoms.
2. Look for wheezing, barking cough, anxiety, restlessness, use of accessory muscles.
3. If throat is sore, check for white patches on tonsils.

F. Gastrointestinal infections.
1. Assess onset and duration.
2. Evaluate intake and output.
3. Check for signs of dehydration.

G. Dental caries.
1. Examine teeth for obvious caries.
2. Dental care and use of fluoride (if indicated).

Assessment of the Adolescent

A. General considerations.
✦ 1. Privacy is important. Give the *adolescent* the choice of having the parent present.
2. Note signs of puberty (Tanner stages).
3. Ascertain feelings about body image.
B. Utilize screening procedures for assessment.
1. Snellen vision testing.
2. Sweep check audiometry.
3. Height, weight, and BMI for age measurements.
✦ 4. Hemoglobin.
5. Tuberculosis screening questionnaire (TST if indicated).
6. Scoliosis screening, if a concern.
7. Skin and teeth.
C. Blood pressure measurement.
D. Provide anticipatory guidance in the following areas.
1. Hazards of cigarette smoking, alcohol, drugs, and firearms.
2. Transmission, symptoms, and prevention of STDs, HIV.
3. Sex education and need for contraception.
4. Accident prevention, particularly automobile; seat belts and traffic safety.
5. Principles of nutrition, assess for obesity or excessive dieting, eating disorders (e.g., anorexia nervosa, bulimia).
6. Breast and testicular self-exam.
7. Sports participation and proper protective equipment.
8. Dental problems.
9. Mental health assessment: signs of depression or suicidal thoughts, eating disorders, bipolar disease, schizophrenia, antisocial or sociopathic behavior, substance abuse, sexual or physical abuse.

Common Problems

A. Obesity, eating disorders, nutritional habits.
1. Determine eating patterns; investigate intake of calcium and iron.
2. Evaluate family concern and handling of problem.
3. Assess amount of exercise.
B. Dysmenorrhea.
1. Evaluate degree of pain (i.e., absences from school).
2. Determine use of analgesics.
3. Assess amount of exercise.
C. Mood changes.
1. Be alert to signs of depression.
2. Inquire about outlook for future, attentive to any indication of suicidal thoughts.
3. Assess anger management strategies.
D. Acne.
1. Evaluate existing skin care program.
2. Assess child's personal hygiene.

IMPACT OF HOSPITALIZATION

INFANT

Assessment

A. Obtain history and usual behavior/developmental milestones achieved.

✦ B. Assess psychosocial implications of hospitalization on child.
   1. Separation from the parent.
   2. Decrease in sensory stimuli.
   3. Breakdown in parent–infant relationship due to:
      a. Parental guilt.
      b. Unfamiliar hospital environment.
      c. Feelings of inadequacy in the parenting role.
      d. Subordination of the parents by the staff.

✦ C. Assess behavior of infant in response to illness.
   1. Indication of discomfort or pain.
      a. Cries frequently.
      b. Displays excessive irritability.
      c. Appears lethargic or prostrate.
      d. Low-grade fever.
      e. Poor feeding.
      f. Grimaces or cries to touch.
      g. Use of NIPS (Neonatal Infant Pain Scale).
      h. Use of FLACC scale (Face, Limbs, Activity, Cry, Consolability).
   2. Positive reaction behaviors.
      a. Cries loudly.
      b. Appears fussy and irritable.
      c. Rejects everyone except parent.
   3. Negative reaction behaviors.
      a. Withdraws from everyone.
      b. Cries monotonously.
      c. Appears completely passive.

Implementation

✦ A. Nursing actions help lessen the detrimental effects of hospitalization.

✦ B. Hold a prehospitalization nursing interview with the parents and give a tour of the pediatric unit when possible.
   1. Parents should meet the staff, have procedures and regulations explained to them, and be told the rationale behind the rules.
   2. They should be encouraged to visit frequently and/or to room in if possible.

C. Counsel the parents regarding the infant's illness, and elicit their understanding of the disease and its course of action. Correct any misconceptions, and if appropriate, reassure them that they are not the cause of the illness.

✦ D. Encourage the parents to participate in the infant's care.
   1. Teach the parents procedures they can perform at appropriate times for learning.
   2. Show respect for their superior knowledge of infant's likes, dislikes, and habits.
   3. Most institutions now allow/encourage 24-hour visitation. Encourage rooming-in and allow parent to be primary caregiver whenever possible.

TODDLER AND PRESCHOOLER

Assessment

✦ A. Assess psychosocial implications of hospitalization.
   1. Hospitalization is a very threatening experience to the child because of the total number of new experiences involved.
   2. Because of the threat involved, hospitalization has the potential for disrupting the toddler's new sense of identity and independence.
   ✦ 3. Separation anxiety—the child mourns the absence of parent through protest, despair, and denial.
      a. Cries loudly, throws tantrums.
      b. Child withdraws and shows no interest in eating, playing, etc.
      c. Behavior often mistaken for happy adjustment; ignores parent and may regress.
      d. Nursing behaviors: Reassure the parent, build a relationship with the child, and provide warmth and support to the child during long hospitalization.
   ✦ 4. The child fears the loss of "body integrity" (prevalence of magical thought). The child also has no realistic perception of how the body functions and may overreact to a simple procedure. Some toddlers believe that drawing blood will leave a hole and that the rest of their blood will leak out.
   ✦ 5. The child resents the disruption of normal rituals and routines. Toddlers are often very rigid about certain procedures, which allows them a sense of security and control over otherwise frightening circumstances.
   6. Loss of mobility is frustrating to the child.
   7. Regression—the toddler frequently abandons the most recently acquired behaviors and reverts to safer, less mature patterns.

✦ B. Assess behavior of toddlers and preschoolers in response to illness.
   1. Indications of discomfort or pain.
      a. Cries frequently.

b. Displays excessive irritability.
c. Appears lethargic, withdrawn.
d. Changes eating pattern.
e. Verbalizes discomfort or becomes stoic.
f. Use pain assessment tool (Wong-Baker Faces or Oucher).

2. Positive reaction behaviors.
a. Shows aggressive behavior.
b. Appears occasionally withdrawn.
c. Fantasizes about illness and procedures.
d. Shows regressive behavior.

3. Negative reaction behaviors.
a. Appears completely passive or excessively aggressive.
b. Displays excessive regressive behavior.
c. Withdraws from everyone.

Implementation

✦ A. Suggest that the parent leave a favorite object of his or hers that the child would recognize for the child to "care for" until he or she can return. This procedure assures the child that the parent will return.

✦ B. Encourage the parents to be honest about when they are going and coming (i.e., do not tell the child they will stay all night and then leave when the child is asleep).

✦ C. Use puppet or doll play to explain procedures and to gain an understanding of the child's perception of hospitalization. Use puppets or dolls to work out child's anxiety, anger, and frustration.

✦ D. During developmental history, elicit exact routines and rituals that the child uses; attempt to modify hospital routine to continue these rituals.

E. Keep consistency among nursing staff in guidelines for behavior that is acceptable; set firm limits.

F. Maintain a schedule that is consistent and as closely resembling the usual routine as possible.

Problem Behaviors

✦ A. Depressed behavior.
1. Encourage child to express himself or herself through play. (See **Table 13-2**.)
2. Talk through a doll or stuffed animal for younger children.
3. Don't avoid child; continue to interact and support.
4. Consult with other professionals.

✦ B. Aggressive behavior.
1. Channel energy positively: Older children may enjoy competitive activities; younger children can release tension through pounding boards, large motor activity, or clay projects.
2. Set limits and praise for jobs well done.
3. Help child gain a sense of mastery.

✦ C. Passive behavior.
1. Structure the child's day, provide consistency.
2. Spend more time with the child and attempt to stimulate interest.
3. Provide "win–win" choices.

✦ D. Regressed behavior.
1. Regression is acceptable to a point because it allows child a brief return to a less mature and demanding time.
2. Support independence, mastery of tasks, and self-care.

SCHOOL-AGE CHILD

Assessment

✦ A. Assess psychological implications of hospitalization.
1. The school-age child wants to understand why things are happening.
2. There is a heightened concern for privacy.
3. The child is modest and fears disgrace.
4. Hospitalization means an interruption in the child's busy school life, and the child fears that he or she will be replaced or forgotten by peer group.
5. Absence from peer group means a disruption of close friendships.

B. Assess behavior of school-age children in response to illness.
1. Indications of discomfort or pain.
a. Expresses that something is wrong. ("I feel sick.")
b. Cries easily.
c. Tells adult he or she is ill so adult can do something about it.
2. Use pain assessment tool (e.g., Eland Color Tool, Visual Analog Scale, or Wong-Baker Faces).
3. Positive reaction behaviors.
a. Shows anger.
b. Feels guilty.
c. Fantasizes and is fearful.
d. Displays increased activity in response to anxiety.
e. Reacts to immobility by becoming depressed or angry or by crying.
f. Cries or aggressively resists treatment.
g. Needs parents and authority.

✦ 4. Negative reaction behaviors.
a. Is excessively guilty and angry and is unable to express feelings.
b. Experiences night terrors.
c. Displays excessive hyperactivity.
d. Will not talk about experience.

✦ Table 13-2 MANAGING BEHAVIOR THROUGH PLAY

Nursing Goals	Nursing Interventions
To bathe child	Give tub toys such as boats, cups, bottles, bulb syringe.
	Give child something he or she can wash, such as a doll or a car.
To administer soaks	Give child something to look at, such as a picture book or kaleidoscope.
	Read a story or have child tell you one.
	Set a timer so that child has the concept of time.
	For hand and foot soaking, give child something to hold down or count.
To encourage mobility	Extend environment through use of "fantasy trips," decoration of bed and surrounding area, or imaginative movement.
	Move bed outdoors or to a playroom or a different room.
	Have other children come to visit restricted child.
	Use video games for older children.
To ambulate	Give child something to pull or push or ride on.
	Set reasonable distance goal for child to reach.
	Take to visit another child or place.
	Have a parade with hats, horns, etc.
	Have child walk for a reward, such as a visit to a sibling or the cafeteria.
To encourage deep breathing	Give child bubbles, straws, non-latex gloves to blow into.
	Have child blow through straws to race cotton balls.
	Have child play kazoos or harmonicas.
	Give child straws to suck up pieces of paper or cotton balls.
To encourage coughing	Put squeaky toy on child's abdomen so toy makes a noise when the child coughs.
	Have child squeeze a pillow or stuffed animal for splinting.
To maintain NPO status	Arrange special activities during mealtime, such as a walk, visit to a special place, video or game.
To encourage child to eat	Sit child with other children who are eating.
	Encourage family to bring appropriate favorite foods from home.
	Serve familiar and liked food in small portions on a small plate.
	Use a game or story to encourage eating.
	Have child prepare foods that he or she likes.
To restrict fluids	Give child a choice of fluids and time when he or she wants to drink them.
	Measure and place in tall narrow container.
To encourage child to drink	Give small amounts of liquid frequently over a period of time.
	Use a special decorated cup.
	Let child use syringe instead of straw or cup.
	Give Popsicles, gelatin, or slushes.
	Sit child with other children and have a tea party.
To administer medication	Give child a choice of methods to take medication: whole, cut up, with water or apple juice, liquid vs. pill form.
	Let older child give medication to himself.
	Give rewards (stars, stickers) for taking medication.
	Allow parents to administer if desired and able.

e. Is regressive and completely withdrawn.
f. Shows excessive dependency.
g. Has insomnia.

Implementation

✦ A. Teach the child about his or her illness; take the opportunity to explain the functioning of the body.

B. Explain all procedures completely; allow the child to see special rooms (e.g., intensive care, cardiac catheter lab) prior to being sent there for treatments. Whenever possible, provide honest and direct explanations in age-appropriate language.

✦ C. Provide opportunities for the child to socialize with peer group.
1. Allow telephone privileges for calls to home and friends.
2. Provide outlets for anger and frustration (perhaps Velcro or suction dartboard).

D. Give the child the opportunity to make choices and be independent, whenever possible.

E. Protect child's privacy.

F. Continue child's schooling by providing tutors, time for schoolwork, quiet, needed supplies, turning off television and/or video games.

G. Provide child with the opportunity to master developmental tasks of age group.

ADOLESCENT

Assessment

✦ A. Assess psychological implications of illness.
   1. Disruption of social system and peer group.
   2. Alteration of body image.
   3. Fear of loss of independence or actual loss.
   4. Alteration in plans for future.
   5. Interruption in development of relationships.
   6. Loss of privacy.
   7. The degree to which the young adult is affected is dependent on:
      a. Whether the illness is chronic or acute.
      b. Whether the prognosis necessitates a change in the client's future aspirations.
      c. How many changes must be accepted.

B. Assess behavior of adolescents in response to illness.
   1. Indications of discomfort or pain.
      a. Realizes something is wrong and seeks help.
      b. Shows high anxiety level.
      c. Verbalizes discomfort.
      d. Use pain assessment tool (e.g., Eland Color Tool or 1–10 Visual Analog Scale).
   2. Positive reaction behaviors.
      a. Shows resistance to accepting illness.
      b. Rebels against authority.
      c. Demands control and independence.
      d. Is fearful.
      e. Temporarily withdraws from social scene.
      f. Verbalizes how illness has affected him or her.
   3. Negative reaction behaviors.
      a. Holds in feelings about illness.
      b. Tries to manipulate staff.
      c. Becomes completely dependent.
      d. Denies illness.
      e. Becomes stoic and doesn't acknowledge pain.

Implementation

✦ A. Adolescents should be in rooms with other adolescents, away from young children.

B. Allow telephone and visitation privileges, with some limit setting.

C. Encourage the feeling of self-worth by allowing as much independence as possible.

D. Allow relationships to develop within reason.

E. Provide for privacy.

F. Assist client in identifying role models.

✦ G. Realistically discuss problems of illness.
   1. Always provide information honestly.
   2. Encourage the adolescent, if possible, to accept some responsibility on the hospital unit.

NEUROLOGICAL SYSTEM

The central nervous system (CNS) (brain and spinal cord), the peripheral nervous system (cranial and spinal nerves), and the autonomic nervous system comprise the neurological system; together these provide control functions for the entire body.

System Assessment

A. History.
   1. Birth history, developmental milestones, immunizations, and exposures.
   2. Recent trauma.
   3. Current illness.

✦ B. Level of consciousness.
   1. Interaction with environment.
   2. Glasgow Coma Scale score (infant or adult).

C. Size and shape of head (infants).
   1. Size and quality of fontanelles and sutures.
   2. Recent acute increase in head circumference.

D. Assessment of motor function.
   1. Symmetry of movements.
   2. Muscle tone and strength.
   3. Tremors or twitching.
   4. Seizure activity.

E. Pupil size and reactivity, eye movements.

✦ F. Cranial nerve (CN) assessment.
   1. Incorporate into other areas of physical exam when possible.
   2. Test CNs II, III, IV, VI (optic, oculomotor, trochlear, and abducens) together by checking pupils and having child follow light.
   3. Check CNs V, VII, XII (trigeminal, facial, and hypoglossal) together by having older child bite down, show teeth, and stick out tongue. Test younger infant's ability to root for nipple, and check CN X (vagus) by observing ability to swallow.
   4. Test CN VIII (hearing)—Rinne and Weber exam with tuning fork.
   5. Check CNs VII and IX (facial and hypoglossopharyngeal) by tasting sweet, sour, and bitter solutions (older children only).
   6. Test CN I (olfactory) in older children only.

G. Reflexes. (See **Table 13-3**.)
   1. Infant/persistent.
   2. Symmetry.
   3. Presence of clonus.

H. Developmental exam.
   1. Obtain history from reliable caregiver.
   2. Use evidence-based quality screening tools to evaluate attainment of major milestones (PEDS, ASQ).
   3. Use specific autism screening tool during toddler period (18 months).

✦ Table 13-3 NEWBORN REFLEXES

Reflex	Response	Stimulus	Duration
Babinski's sign	Toes, especially the great toe, hyperextend	Stroke lateral side of the sole of the foot from heel to base of toes	Present at birth; disappears between 12 and 18 months
Neck righting reflex	Shoulder, arms, and legs of opposite side will flex to follow head in turn	Turn infant's head to left or right	Evolving at 4 months; involuntary movement disappears at approx. 9–12 months
Palmar grasp	Grasps and holds adult finger; automatic reflex of full-term newborns	Place finger in infant's palm	Present at birth; disappears at approx. 4 months
Asymmetrical tonic neck reflex	Assumes fencer's position: arm extends on side to which head is turned; opposite arm is flexed	Turn infant's head to one side	Present at birth; disappears at approx. 4 months
Startle reflex	Body stiffens; legs are drawn up; arms are brought up, out, and then in front in an embracing position	Make a loud noise	Present at birth; disappears at approx. 4 months
Reciprocal kicking (stepping)	Steps alternately from one foot to the other	Hold infant upright with feet touching a firm surface	Evolving at birth; disappears at approx. 9 months
Rooting reflex	Turns head to side that has been stimulated	Brush infant's cheek with fingertips	Present at birth; rooting while awake disappears at approx. 3–4 months; rooting while asleep at 7–8 months
Sucking reflex	Makes sucking movements	Touch infant's lips with any object	Present at birth; involuntary sucking disappears at approx. 9 months

4. Communicate concerns/delays to other healthcare providers.

I. Behavioral history and assessment.
   1. Assess mood, eating, and sleep patterns; any recent changes.
   2. Assess ability to concentrate, school progress, and difficulty with relationships.
   3. Assess irrational or aggressive behavior (especially with history of head trauma or CNS infection).
   4. Family history of behavioral disorders.

J. Respiratory pattern and vital signs. (See **Table 13-4**.)
   1. Assess altered respiratory pattern (cluster, ataxic, Cheyne–Stokes, apneustic).
   2. Evaluation of fever or signs of infection.

✦ K. Indications of neurological problems.
   ✦ 1. Meningeal signs.
      a. Irritability, nuchal rigidity, opisthotonos.
      b. Positive Kernig's and Brudzinski's signs.
   ✦ 2. Seizures.
      a. History.
      b. Medications.
      c. Duration and assessment of motor involvement.
   ✦ 3. Signs of increased intracranial pressure (ICP).
      a. Altered level of consciousness (LOC).
      b. Irritability or lethargy.
      c. Headache, nausea, vomiting.
      d. Sunset eyes, bulging fontanelles, high-pitched cry, poor feeding in infants.

Diagnostic Procedures

Client and family preparation must precede all procedures unless emergency. Nurses should be available to answer questions concerning the procedure and how the parents can help the client through the procedure.

✦ Lumbar Puncture

A. Withdrawal of cerebrospinal fluid (CSF) by insertion of a hollow needle between lumbar vertebrae L3 and L4 or L4 and L5 into subarachnoid space to identify intracranial pressure, signs of infection, or hemorrhage. Fluid is analyzed for CSF chemistries, cell count, Gram stain, culture, and sensitivity.

B. Nursing responsibilities prior to procedure.
   1. Maintain baseline record of vital signs.
   2. Explain to the parents and child exactly what will happen.
   3. Ensure that consent has been obtained for the procedure.

C. Nursing responsibilities during procedure.
   1. Place child on side in knee–chest position with head flexed on chest.
   2. Help child remain steady in this position and reassure child throughout procedure.

D. Nursing responsibilities following procedure.
   1. Keep child flat in bed.
   2. Encourage fluid intake.
   3. If headache occurs when sitting up, return child to flat position and give analgesic.
   4. Observe neurological status for signs of deterioration.

E. Lumbar puncture (LP) should not be performed in clients at high risk for bleeding; extreme caution should be used if elevated ICP is suspected.

✦ Computerized Tomography Scan

A. Provides visualization of neuroanatomy; differentiates tissue density compared to water.

B. Visualizes brain along vertical or horizontal plane from any axis.

C. Can distinguish hemorrhage, tumors, congenital abnormalities, and inflammatory or hypoxic processes.

D. May use contrast medium for enhanced views.

E. Nursing considerations.
   1. Client/family education about what to expect. Machine may provoke claustrophobia.
   2. Ensure that consent has been obtained prior to the procedure.

Table 13-4 ASSESSMENT OF VITAL SIGNS

Age	Range of Normal Pulse	Average Pulse	Average Blood Pressure	Average Respiration
Newborn	100–180	140	80/55	30–50
1 year	80–150	120	96/60	20–40
2 years	80–130	110	99/65	20–30
4 years	80–120	100	99/65	20–25
6 years	75–115	100	100/56	20–25
8 years	70–110	90	105/56	15–20
10 years	70–110	90	110/58	15–20

3. Client required to lie still during procedure. May require restraints or sedation.
4. Assess carefully for allergy or anaphylaxis to contrast (iodine based). Observe intravenous (IV) site carefully to avoid extravasation.
5. Recent evidence that repeated CT scans in young children *may* increase radiation-related cancers. CT scans should be performed only for clearly delineated purposes.

✦ **Magnetic Resonance Imaging**

A. Allows high-quality imaging of morphology of structures.
B. Distinguishes structures by response to radio frequency pulses in a magnetic field.
C. Tissue differentiation superior to other techniques.
D. Requires immobilization throughout procedure (sedation and respiratory monitoring *required* for young clients).
E. Nursing considerations.
   1. Education of client/family about procedure and what to expect. Reassure older children.
   2. Ensure that consent has been obtained prior to procedure.
   3. Reinforce medical information as needed.
   4. Remove all metal items from the child before entering MRI room.
   5. Follow sedation protocol.
   6. Careful monitoring of vital signs, arterial oxygen saturation (SaO_2), and respiratory status during procedure.
   7. Observe carefully for reaction to contrast medium.

Electroencephalogram

A. Provides information about electrical activity of cerebral cortex.
B. Used to assess neuronal functioning and to diagnose seizure activity; shows characteristic abnormalities for seizures.
C. Also may be used in part to determine brain death.
D. May be combined with simultaneous video recording.
✦ E. Nursing responsibilities.
   1. Explain procedure and sensations to expect.
   2. Ensure that consent has been obtained prior to the procedure.
   3. Activities during procedure may include hyperventilation, sleep deprivation, and antiseizure drug withdrawal.
   4. Shampoo head afterward to remove all glue and gel.
   5. Clarify any misconceptions (client does not receive shocks via leads, etc.).

✦ **Electromyelogram**

A. Records electrical activity in muscle fibers.
   1. Nerve conduction velocity is measured by placing needles in muscles and applying electrical current.
   2. May do computed tomographic (CT) myelogram or lumbar myelography. Contrast medium is injected into subarachnoid space to visualize structures around spinal canal.
B. Nursing responsibilities prior to procedure.
   1. Ensure that child is NPO 6–8 hours before procedure (follow sedation protocol).
   2. Maintain baseline record of vital signs and neurological status.
   3. Administer sedative as ordered.
   4. Educate client and family about sensations to expect (aches or needle pricks).
   5. Ensure that consent has been obtained.
C. Nursing responsibilities following procedure.
   1. Frequently observe neurological signs and vital signs and compare to baseline.
   2. Assure adequate hydration.
   3. Activity may be restricted.
   4. Watch for signs of infection or hematoma at insertion sites.
   5. Slightly elevate head (30 degrees for at least 8 hours if contrast media is used for CT-myelography).

✦ **Angiogram**

A. Radiopaque substance is injected into cerebral vasculature or its extracranial sources to evaluate vascular anomalies, lesions, or tumors.
B. Nursing responsibilities prior to procedure.
   1. Ensure that consent has been obtained.
   2. Prep area where cannulization is to be made (usually femoral or brachial).
   3. Ensure that child has no solid food for 6–8 hours prior to procedure.
   4. Keep baseline record of neurological and vital signs.
   5. Sedation usually necessary (occasionally anesthesia—follow protocol).
   6. Observe closely for reaction to contrast medium.
C. Nursing responsibilities following procedure.
   1. Observe for changes in level of consciousness, transient hemiplegia, seizures, sensory or motor deterioration, or elevation of blood pressure with widening pulse pressure.
   2. Check circulation, movement, sensation (CMS) in extremity used (adequate pulses, color, swelling, temperature).
   3. Encourage fluid intake.

System Implementation

For Infants

✦ A. Record head circumferences, and graph results, at least every 24 hours.
✦ B. Observe for changes in fontanelles.
C. Note activity level and interactions with significant others.
D. Observe for the continuous presence of sunset sign, high-pitched cry, feeding problems.
E. Observe for presence of all newborn reflexes. Note the symmetry of movement and the presence of hypertonia or hypotonia.

✦ For Children

A. Note activity level and observe for changes in activity.
B. Control and prevent seizure activity. (For specific actions, refer to Seizure Disorders, page 657.)
C. Carefully position child to prevent aspiration if vomiting is an actual or potential problem.
D. Check pupillary responses or movements at least every shift. Note presence of nystagmus or strabismus, abnormal responses.
E. Assess vital signs every 4 hours or more frequently if unstable.
F. Report I&O every 24-hour period.
G. Evaluate the nutritional status of the child if vomiting is present.
H. Provide sterile field for any treatment that involves an area with open entry to the nervous system.
I. Evaluate level of consciousness (see Neurological System, Medical–Surgical Nursing).
✦ J. Assess child for presence of meningeal irritation.
1. **Kernig's sign**: Extension of leg causes spasm of the hamstring, pain and resistance when child is in supine position with thigh and knee flexed to right angle.
2. **Brudzinski's sign**: Flexion of head causes flexion of knees and both thighs at the hips.
K. Support the family through accurate reports of the child's condition and by allowing the family to participate in the child's care as much as possible.
L. Explain all procedures in truthful manner to the child. Allow time for questions.

CONGENITAL DEFECTS

Neural Tube Defects

Definition: Failure of posterior portion of lamina of bony spine to form, causing an opening in spinal column. Spina bifida and anencephaly are two most common forms. Spina bifida may involve (1) meninges and spinal fluid (meningocele) or (2) meninges, nerves, and spinal fluid (meningomyelocele). Neural tube defects (NTDs) occur in approximately 1 in every 1000 pregnancies in the United States.

Classification

A. **Spina bifida occulta**.
1. Involves a bony defect only and does not involve the spinal cord or the meninges, not visible externally.
2. Generally requires no treatment.
B. **Meningocele**.
1. Meninges of the spinal cord extend through opening in spine.
2. Usually causes no paralysis.
3. Treatment involves closure of sac.
C. **Meningomyelocele**.
1. Nerves, meninges, and CSF protrude through defect in spine.
2. This defect causes neuromuscular involvement, which can vary from flaccidity and lack of bowel and bladder innervation to weakness of lower extremities.

Assessment

A. May be detected prenatally by elevated concentrations of alpha-fetoproteins and by prenatal ultrasonography.
✦ B. Assess for presence of hydrocephalus.
C. Assess neurological involvement.
D. Check urological involvement.
1. Frequent bladder infections.
2. Potential for progressive renal damage.
3. Ileal conduit surgery is frequently required.
4. Credé method of managing urinary retention involves systematic "milking" of the bladder at periodic intervals.
E. Assess for orthopedic involvement.
F. Evaluate bowel function.

Implementation

✦ A. *Prevention*: American Academy of Pediatrics recommends consumption of 400 mcg of folic acid daily by all women capable of becoming pregnant.
1. This can prevent 70% of NTDs.
2. Folic acid intake should increase to 400 mcg per day at least 1 month before becoming pregnant, and continue throughout the first trimester. Folic acid supplementation during the remainder of the pregnancy has been increased to up to 600–800 mcg/day.
B. Treatment dependent on severity of condition.
C. Neurological interventions.
1. Observe for signs of hydrocephalus, a frequent complication.
2. Measure head circumference at least every 24 hours.
3. Observe for signs of increased intracranial pressure and signs of CNS infection (meningitis).

4. Surgical closure performed as soon as tolerated. Until closure, the sac should be covered with a sterile, moist, nonadherent dressing (changed every 2–4 hours) and the infant kept in a prone position.

D. Urological interventions.
1. If child is catheterized, use sterile technique.
2. Keep a careful record of intake and output.
3. Teach parents Credé method if treatment is ordered.
4. Observe for signs of urinary tract infection.
   a. Increased temperature.
   b. Foul-smelling urine.
   c. Cloudy urine with possible mucus.

E. Orthopedic interventions.
1. Provide opportunities for the child to exercise and develop unaffected areas, in conjunction with physicians and physical therapists.
2. Prevent contractures through proper positioning.
   a. Provide foot brace to prevent foot drop.
   b. Provide support for legs to prevent external rotation of the hips.
3. Implement range-of-motion (ROM) exercises.

F. Special considerations.
1. Children with NTDs are especially prone to developing latex allergies. Exposure to latex should be limited or avoided in infants and throughout all treatment.
2. Use of folic acid supplements in pregnancy has shown to decrease the incidence of NTDs.

Hydrocephalus

✦ *Definition*: A condition in which the normal circulation of the spinal fluid is altered, resulting in pressure on the brain, deformity, and the progressive enlargement of the head. May occur as congenital defect or as the result of trauma, infection, or surgery.

Assessment

✦ A. Assess for gradual enlargement of the head (no more than 2.5 cm per month). Below are approximate normal head sizes for comparison.
1. 35 cm at birth.
2. 40 cm at 3 months.
3. 45 cm at 9 months.
4. At birth, the head size is 2 cm larger than the chest. Equals or exceeds chest until 2 years of age.

✦ B. Check for separation of skull sutures.

C. Assess for sunset sign (sclera visible above iris).

D. Check for hyperactive reflexes.

E. Evaluate presence of irritability, failure to thrive, and high-pitched cry.

F. Assess for presence of projectile vomiting.

G. Prepare child and family for CT or MRI.

Implementation

A. Actions depend on the cause of increased pressure.
1. Removal of part of choroid plexus to decrease production of cerebral spinal fluid.
2. Shunting of the fluid out of the brain to the heart or to the peritoneal cavity.
3. An endoscopic third ventriculostomy which allows CSF to bypass the third and drain into the fourth ventricle (for children older than 2 years).
4. Removal of obstruction (mass lesion) to CSF flow.

✦ B. Preoperative care.
1. Prevent pressure sores on head by changing child's position, placing child's head on gel form or other skin protective device, or by holding the infant.
2. Provide good head support when the child is sitting in Fowler's position.
3. Promote optimal nutritional status.
4. Keep eyes free of irritation.

✦ C. Postoperative care.
1. Observe for shunt malfunction and valve patency: Watch for progressive increase in head circumference and signs of increased intracranial pressure; evaluate pupils and eye movements carefully.
2. Observe for infection: increased temperature, rapid pulse, irritability, nausea, or vomiting.
3. Position child flat on unoperated side.
4. Prevent postoperative complications: Turn every 4 hours, evaluate lung sounds, and assess for signs of infection.
5. Administer antibiotics as ordered.
6. Protect the operative site: Avoid pressure on the site; ensure sterile dressing changes.
7. Maintain adequate fluid and nutritional status.

NEUROLOGICAL DISORDERS

Cerebral Palsy

✦ *Definition*: A nonspecific term used to describe a group of disorders characterized by motor and postural impairments due to abnormal muscle tone; cerebral palsy may also involve language, perceptual, and intellectual deficits. The most common permanent physical disability of childhood, occurring in approximately 1.1 in 1000 live births.

Assessment

A. Etiology is thought to be multifactorial, with many types of prenatal, perinatal, and postnatal causes possible.
1. Cerebral palsy is associated with premature and low-birth-weight infants.

2. However in many cases, no cause is found and the infant is born at term and has a normal weight.

✦ B. Assess for abnormal movements.
1. Spasticity.
a. Voluntary muscles lose normal smooth movements and respond with difficulty to both active and passive movement.
b. Increased deep tendon reflexes, scissoring, increased hip flexion, and toe-walking.
c. Contractures of antigravity muscles.
d. Persistence of primitive (infant) reflexes.
e. Lack of normal postural control.
2. Athetoid (dyskinetic).
a. Involuntary muscle action with smooth, writhing movement of extremities.
b. Reflexes usually normal.
3. Ataxia: lack of coordination and possibly hypotonia.

C. Assess for seizures, which occur in many children with cerebral palsy.

D. Check for vision disturbance, which occurs in 20% of these children.

✦ E. Assess mental functioning; at least 50% function at a subnormal level. Many cerebral palsy children are diagnosed as mentally retarded due to slow motor skills or aphasia, but possess normal or high intelligence.

F. Speech and swallowing difficulties because of muscle spasticity and lack of coordination.

Implementation

A. Each child requires an individualized program according to the particular manifestations of the disease and the child's capacities.

✦ B. Major focus of interventions is to:
1. Develop motor control and increase mobility.
a. Intrathecal continuous infusion pump with Lioresal (baclofen) to decrease spasticity may be used.
2. Develop communication skills.
3. Provide adequate nutrition.
4. Prevent orthopedic complications.

Seizure Disorders

✦ *Definition*: A series of seizures that result from focal or diffuse paroxysmal discharges in cortical neurons—symptoms of abnormal brain function. May be congenital or acquired.

Etiology

A. Seizure disorders are idiopathic (cause unknown or acquired) or the result of brain injury caused by trauma, hypoxia, infection, toxins, or other acquired factors.

B. Seizures more common during first 2 years than any other period.

C. Most common cause by age group.
1. Young infants: birth injury, hemorrhage, anoxia, and congenital defects of the brain.
2. Late infancy and early childhood: infections, trauma; middle childhood–onset epilepsy is uncommon.
3. Children older than 3 years: idiopathic epilepsy most common.

Assessment

A. Febrile seizures.
1. Very common; occurs in 3–4% of all children, usually in children 6 months to 6 years of age. Usually occurs within 24 hours of onset of fever to > 102.2°F or 39°C (but rapidity of rise in fever may be more important than height of fever).
2. Simple febrile seizure—lasts < 15 minutes, generalized may occur once per 24 hours.
3. Complex febrile seizure lasts > 15 minutes, has focal onset, and occurs more than once per 24 hours.
4. Seizure is generally benign, but lab work indicated to locate source of fever. An LP may be performed depending on the child's history. Not usually hospitalized. Risk of developing epileptic syndrome is low.
5. Treatment: PRN rectal Valium (diazepam) occasionally prescribed. Long-term prophylaxis not indicated.

✦ B. Simple partial seizures (focal seizures without loss of consciousness).
1. Localized (begins focally in one hemisphere) and does not impair level of consciousness. May involve motor symptoms, accompanied by autonomic or somatosensory symptoms.
2. Localized (confined to a specific area) motor symptoms, accompanied by autonomic or somatosensory symptoms.
✦ 3. Manifestations.
a. Aversive seizure—most common motor seizure in children. Eye(s) turn away from focus side.
b. Sylvan seizures—most common during sleep. Tonic–clonic movements involving face.

✦ C. Complex partial (psychomotor) seizures (focal WITH loss of consciousness).
1. Jacksonian march—rare in children. Sequential clonic movements.
2. Area of brain most involved is temporal lobe (thus, this type of seizure is called psychomotor).

3. Most common in children from 3 years to adolescence.
4. Characterized by complex sensory phenomena, a period of altered behavior, and amnesia (child is not aware of behavior). Seizure begins focally in one hemisphere and impairs LOC.
5. May perform such mannerisms as lip smacking, chewing, picking at clothes, etc.
6. Seizure lasts several minutes and is accompanied by aura and postictal phase. May have secondary generalization (such as Jacksonian march; spreads to other hemisphere).

✦ D. Generalized seizures.
1. Definitions: *Tonic*: sustained muscle contraction; *Clonic*: rapid jerking and flexor spasms of extremities.
✦ 2. Tonic–clonic seizures, formerly known as "grand mal."
a. May begin with an aura, then a tonic phase (lasting 10–20 seconds): stiffening or rigidity of muscles, particularly arms and legs; eyes roll up; followed by loss of consciousness; may be apneic and become cyanotic.
b. Clonic phase follows (lasts about 30 seconds, but may last as long as 30 minutes): hyperventilation with rhythmic violent jerking of all extremities; may foam at the mouth and become incontinent; full recovery may take several hours.
c. Status epilepticus—a series of seizures that run together and do not allow the child to regain consciousness between attacks.
(1) A neurological emergency with generalized tonic–clonic seizures.
(2) Status epilepticus can lead to exhaustion, respiratory failure, and death.
(3) Usually treated with IV Valium or Ativan (lorazepam). Respiratory monitoring is **essential** after administration of benzodiazepines.
✦ 3. Absence seizures, formerly known as "petit mal."
a. Brief duration, often just 5–10 seconds, brief loss of consciousness; almost no change in muscle tone.
b. May occur 20–30 times/day.
c. Common in children; may appear to be daydreaming, or inattentive.
d. The child may have a blank stare or roll eyes as only symptoms.
✦ 4. Myoclonic seizure.
a. Characterized by a brief, generalized jerking or stiffening of the extremities.
b. Seizure may throw person to the floor; no loss of consciousness.
✦ 5. Atonic or akinetic seizures, also called "drop attacks."
a. Onset between 2 and 5 years of age.
b. Characterized by sudden, brief loss of muscle tone.
c. Child may fall to ground, momentary loss of consciousness.
✦ 6. Infantile spasms.
a. Most common in first 6–8 months of life; more common in males; usually associated with low intelligence later in life.
b. Characterized by sudden, brief, symmetrical contractions; head flexed, legs drawn up, arms extended.
c. May experience numerous attacks during the day without postictal drowsiness.

Implementation

✦ A. Prevent injury during seizure.
✦ 1. Remove any objects that may cause harm.
2. Remain with child during seizure and provide privacy if possible.
3. Do not force jaws open during seizure—no padded tongue blades necessary.
4. Do not restrict limbs or restrain.
5. Loosen restrictive clothing.
✦ 6. Check that airway is open. Do not initiate artificial ventilation during a tonic–clonic seizure without first administering appropriate antiepileptic medications.
7. Apply oxygen by blow-by if available or appropriate.
8. Following seizure, turn head to side to prevent aspiration and allow secretions to drain; suction as needed.

B. Observe and document seizure pattern.
1. Note time, LOC, and presence of aura before seizure.
2. Record type, character, progression of movements.
3. Note duration of seizure and child's condition throughout.
4. Observe and record postictal state.

✦ C. Administer and monitor medications (see **Appendix 13-3**)—complete control achieved in 50–70% of epileptic children.
1. Commonly used antiseizure medications include: Tegretol (carbamazepine), Dilantin (phenytoin), Luminal (phenobarbital), and Depakene or Depakote (valproic acid), most of which require serum drug levels.
2. Absence seizures: Zarontin (ethosuximide) and others.
3. Newer antiseizure medications such as Keppra (levetiracetam), Neurontin (gabapentin),

Topamax (topiramate), Gabitril (tiagabine), and Lamictal (lamotrigine) are generally indicated as second-line medications, but their use is increasing, even in young children. Most have fewer side effects, fewer drug interactions, and do not require serum drug levels.

✦ D. Implement postseizure procedures—increases speed of recovery.
1. Reduce stimuli—noise, lights, conversation.
a. Place sources of light behind client.
b. Keep away from fluorescent lights.
2. Remain with child after consciousness returns.
a. Speak and move slowly.
b. Use simple phrases—give child time to respond.
3. Encourage rest following a seizure (child will be exhausted) and maintain privacy.
✦ 4. Provide seizure precautions in hospital—keep bed rails raised, pad side rails of bed, suction and oxygen on standby.
5. At home, child should carry medical identification, wear helmet (if atonic seizures), and use precautions with hazardous activities or activities requiring supervision (e.g., swimming).
6. A ketogenic diet and vagal nerve stimulation may be adjunctive measures if antiseizure medication fails to control the seizures.

Traumatic Brain Injury

Definition: Any trauma to the scalp, skull, meninges, or brain caused by mechanical force or penetration.

Characteristics

✦ A. Accidental injury is the major single cause of death in the pediatric age group, primarily from head injury sustained in motor vehicle accidents (MVAs). Approximately 500,000 children present in the emergency room every year for evaluation and treatment of head and brain injury.

B. Causes.
✦ 1. Falls occur most frequently under 1 year of age; 75% result in some type of head injury.
a. More boys than girls are injured by falls.
b. 5- to 19-year-old age group—result of accidents involving bicycles, skateboarding, or athletics. Helmets have significantly reduced the incidence of traumatic brain injuries as a result of accidents.
✦ 2. Motor vehicle accidents are the most frequent cause in adolescents. Athletic injuries are also common.

✦ C. Types of injuries.
1. Most head injuries are caused by physical forces that impact on the head through acceleration and deceleration.
✦ a. **Acceleration**: Slower-moving contents of cranium strike bony prominences or dura (coup).
✦ b. **Deceleration**: Moving head strikes fixed object and brain rebounds, striking opposite side of cranium (contrecoup).
✦ 2. Concussion is most common: violent jarring of the brain within the skull, temporary loss of consciousness, seizure activity.
a. Postconcussion syndrome manifested by memory loss, confusion, headache, dizziness, inability to concentrate, irritability, and fatigue.
b. There have been recent efforts to prevent athletes from returning to play after sustaining a concussion and to allow for "cognitive rest" so that the brain can recover. Investigation continues regarding long-term effects of concussion.
✦ 3. Contusion and laceration: the bruising of the brain and tearing of cerebral tissue.
4. Closed head injuries: Skull is intact.
5. Open head injuries include deep scalp lacerations that require suturing.
6. Fractures: The majority of fractures are linear; other types are depressed, compound, and comminuted. A child's skull can withstand a great amount of force before it fractures.

D. Complications.
✦ 1. Epidural hemorrhage: usually the result of skull fracture. Bleeding is generally arterial, and brain compression develops quickly. Blood accumulates between dura and skull and forms a hematoma.
a. Signs of intracranial compression occur within a few minutes or hours after the injury—with classic Cushing's triad symptoms (hypertension, bradycardia, and altered respirations). Often there is a period of lucidity followed by rapid increase of intracranial pressure.
b. Clinical signs include headache, vomiting, hemiparesis, and loss of consciousness.
✦ 2. Subdural hemorrhage: bleeding between dura and cerebrum (common in infants due to birth trauma). Bleeding is usually venous and develops more gradually than epidurals. Much more common than epidurals.
a. Most common clinical signs are seizures, vomiting, and irritability.
b. May be evidence of increased intracranial pressure.

3. Subarachnoid and intracerebral hemorrhages may also occur from head injury.
4. Cerebral edema (diffuse brain swelling) leads to signs of increased intracranial pressure but no focal signs.

Assessment

✦ A. Assess LOC; changes appear earlier than changes in vital signs.
B. Check for nausea and vomiting.
C. Observe for pupillary changes: pupil dilates on ipsilateral side of injury.
D. Monitor changes in vital signs, reflecting increased intracranial pressure or shock.
E. Observe for seizure activity and describe fully if noted.
F. Observe for changes in position and movement: nuchal rigidity; opisthotonos.
G. Check for headache. (If child is too young to verbalize, he or she may be fussy and irritable.)
H. Observe for vasomotor or sensory losses.
I. Assess for rhinorrhea and otorrhea due to CSF leak (infrequent in children).
   1. Bleeding from ear suggests basilar skull fracture.
   2. Drainage from nose should be tested with Dextrostix; if glucose present, it is evidence of cerebrospinal damage.
J. Observe child for any unusual behavior: Make interpretation of this behavior in terms of child's normal behavior.
K. Identify any overt scalp or skull trauma.

Implementation

✦ A. Monitor for complications: Determine neurological status. (See previous section.)
   ✦ 1. Check for signs of increased intracranial pressure.
      a. LOC: alert and easily aroused or lethargic; in a stupor or coma.
      b. Restless, irritable, crying behavior.
      c. Vital signs: changes in respiratory rate, increased blood pressure, pulse pressure, decreased pulse.
   ✦ 2. Avoid actions that might increase intracranial pressure.
      a. Sudden changes in position.
      b. Bowel straining.
      c. Confused, noisy environment.
✦ B. Monitor vital signs. Report changes immediately.
C. Maintain adequate respiratory exchange. Increased carbon dioxide levels increase cerebral edema.
✦ D. Protect from injury by using safety measures.
   1. Maintain bed rest.
   2. Keep padded side rails up.
✦ E. Position head to promote fluid drainage, promoting venous return from brain: Elevate head of bed 15–30 degrees with head straight.
F. Monitor and protect child if seizure activity.
   1. Observe and record type of seizure.
   2. Note behavior that preceded seizure.
G. Prevent infection if there is drainage from auditory canal or nose.
   1. Place dry, sterile cotton loosely at orifice.
   2. If drainage from nose is positive for glucose, do not suction nares (risk of secondary infection).
   3. Maintain strict asepsis.
H. Provide adequate nutrition and hydration.
   1. Provide clear liquids as ordered.
   2. Measure intake and output accurately.
   3. Monitor IV if in place.

NEUROLOGICAL INFECTIONS

Meningitis

Definition: An acute inflammation of meninges that is caused by bacteria or viruses and may progress rapidly to neurologic problems, permanent brain damage, or death. Highest incidence is between birth and 2 years, greatest risk immediately following birth and 3–8 months.

Assessment

A. Assess airway, breathing, circulation, and fever; act immediately on abnormalities.
B. Complete neurological examination; assess for nuchal rigidity, positive Kernig's and Brudzinski's signs, headache, irritability, nausea, vomiting, seizure activity, other signs of increased ICP.
C. Often results from sepsis and invasion of the blood–brain barrier; may be caused by direct spread of otitis media or sinusitis, direct inoculation during surgery or trauma.
D. Diagnosis is confirmed by LP and CSF examination.
   1. Usual causes vary with age.
      a. Immediately after birth, cause is usually Group B *Streptococcus*, *Escherichia coli*, or *Listeria*.
      b. After 1 month, usual cause is *Streptococcus pneumoniae*, *Haemophilus influenzae* type B, or *Neisseria meningitidis*.
   2. Viral meningitis is much less serious.
E. Prevention—incidence of meningitis due to *H. influenzae* Type B, *S. pneumoniae*, and *N. meningiditis* have decreased with compliance with current immunization schedules (HIB, PCV, and MCV4 vaccines, respectively). Nevertheless, *N. meningitidis* meningitis persists in adolescents and young adults who live in crowded conditions (military barracks and college dormitories).

✦ **Implementation**

✦ A. Evaluate airway, breathing, and circulation—client may present in septic shock.
✦ B. Maintain patent airway; administer oxygen as ordered; respiratory arrest possible with deteriorating neurologic status.
✦ C. Isolate child until the causative agent is identified.
D. Maintain optimal fluid balance (see **Appendix 13-4**), support cardiovascular system, monitor ICP.
E. Monitor neurological signs carefully.
F. Observe for signs of subdural effusion (collection of fluid in the subdural space).
1. Increasing intracranial pressure.
2. Irritability.
G. Administer antibiotics on time if bacterial cause.
H. If cause is *Neisseria meningococcus*, contacts should receive antibiotic prophylaxis.
I. Maintain bed rest and position child comfortably; most children prefer a side-lying or flat position; sitting up increases pain. May elevate head of bed with increased ICP.

Encephalitis

Definition: Inflammation of the parenchyma of the brain, resulting from direct viral invasion or hypersensitivity initiated by a virus or another foreign protein.

Assessment

A. Fever, headache, altered LOC, sometimes with seizures and focal neurologic deficits.
B. A GI or respiratory prodrome may precede neurological symptoms.
C. Diagnosis: Requires CSF analysis and neuroimaging.
1. Most common cause is herpes simplex virus (type 1 or type 2).
2. Usual mortality rate is around 1%, but morbidity is higher.
3. West Nile encephalitis has spread throughout the United States, with an associated mortality of about 9%.

Implementation

A. Mainly supportive, and may include antiviral medications.
B. Monitor for status epilepticus or coma, which suggests severe brain inflammation and poor prognosis.

Reye's Syndrome

✦ *Definition*: Acute encephalopathy with fatty degeneration resulting in marked cerebral edema and enlargement of the liver with marked fatty infiltration.

Characteristics

A. Children from 2 months to adolescence contract illness; ages 6 to 11 years most often affected.
✦ B. Usually follows a viral infection, especially varicella and influenza B.
✦ C. Aspirin (because of links to development of Reye's) is now contraindicated with influenza—Tylenol (acetaminophen) is medication of choice.
D. Incidence of Reye's decreased dramatically with decreased use of aspirin in nonspecific viral illness.

Assessment

A. Assess for prodromal symptoms: malaise, cough, rhinorrhea, sore throat.
B. Evaluate LOC.
C. Observe temperature changes.
✦ D. Evaluate clinical stages of the syndrome.
1. Stage 1: vomiting, lethargy, and drowsiness.
2. Stage 2: CNS changes, disorientation, delirium, aggressiveness and combativeness, central neurologic hyperventilation, hyperactive reflexes, and stupor.
3. Stage 3: comatose, hyperventilation, decorticate posturing.
4. Stage 4: increasing comatose state; loss of ocular reflexes; fixed, dilated pupils.
5. Stage 5: seizures, loss of deep tendon reflexes, flaccidity, and respiratory arrest.
E. Evaluate lab findings.
1. Associated with liver dysfunction; serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), and lactic dehydrogenase (LDH) are all elevated, dependent clotting factors, decreased prothrombin time (PT), bilirubin, and alkaline phosphate unchanged.
2. Associated with renal dysfunction: reduced blood sugar levels to below 50 mg/100 mL, reduced insulin levels, and decreased glucagon response.
F. Assess fluid and electrolyte balance; intake and output.

Implementation

Applies to increased intracranial pressure in general and to Reye's syndrome.

✦ A. Most important nursing function is to monitor for signs of increased intracranial pressure; rapidly increasing ICP can result in death.
1. Invasive ICP monitoring usually used.
2. Major effort is toward recognizing and reducing cerebral edema, as this may lead to death.
3. Administer IV Osmitrol (mannitol) as ordered to reduce blood osmolarity while increasing urine output, thus reducing cerebral edema.

✦ B. Prepare for tracheal intubation and controlled ventilation (to decrease ICP).
✦ C. Provide respiratory care; suctioning, ventilation, and oxygen as ordered.
D. Monitor vital signs frequently and decrease temperature as needed.
E. Monitor closely for signs of seizure activity, treat promptly, and utilize seizure precautions.
✦ F. Provide nursing care appropriate for semiconscious and unconscious client as neurological status alters.
1. Maintain head elevation at 15–30 degrees (depend on degree of increased intracranial pressure).
2. Monitor reflexes as indicative of clinical stage of syndrome.
✦ G. Provide adequate fluid balance.
1. Ensure adequate urinary output of at least approximately 2 mL/kg/hr (actual value depends on the age of the child).
2. Provide and monitor intravenous fluids.
3. Observe closely for cerebral edema or dehydration.
H. Provide emotional and supportive care for client and family.

CARDIOVASCULAR SYSTEM

The heart is the center of the cardiovascular system, which, by contracting rhythmically, pumps blood through the body to nourish all of the body tissues and cells. This is one of the most essential body systems because failure to function results in death of the client.

System Assessment

A. History.
   1. Family history of congenital or acquired heart disease.
   2. Perinatal and antenatal course.
   3. Gestational age (at birth).
   4. Birth weight, length of hospital stay at birth.
   5. Significant illnesses, frequent respiratory infections, family history, rheumatic fever.

✦ B. Inspection.
   1. Evaluate skin color (pink, pale, mottled, cyanosis).
   2. Evaluate LOC and interaction with caregivers and environment.
   3. Observe for signs of respiratory distress (head bobbing, nasal flaring, cough, retracting). Note oxygen saturation.
   4. Assess periorbital area, sacrum, scrotum, hands, and feet for edema.
   5. Observe for clubbing of fingers and toes.

✦ C. Palpation.
   1. Palpate peripheral pulses for rate and quality (fullness); be sure to check brachial, femoral, and pedal pulses.
   2. Assess skin temperature, moisture (diaphoresis), and capillary refill time.
   3. Palpate liver (should be 1–2 cm below right costal margin).
   4. Evaluative precordium for lifts, thrills, or heaves; position of point of maximal impulse.
   5. Assess blood pressure (all four extremities if femoral and pedal pulses weak).

D. Percussion.
   1. Percuss hepatic margins; spleen if possible.
   2. Percuss lung fields if suspect fluid or consolidation.

✦ E. Auscultation.
   1. Auscultate heart at aortic, pulmonic, mitral, and tricuspid positions.
   2. Assess heart rate for rhythm and regularity, if apical–radial deficit.
   3. Evaluate S_1 and S_2, note if splitting of S_2 on inspiration. Assess for additional heart sounds (S3, S4).
   4. Evaluate murmur detected for intensity (grade I–VI), pitch, timing in cardiac cycle, and changes detected with positional change.
   5. Evaluate for friction rub, venous hum, clicks in relation to cardiac cycle.
   6. Auscultate lung fields for crackles and wheezes.

F. Assess growth and development.
   1. Feeding patterns or difficulties (tiring easily, sweating, tachypnea).
   2. Assess growth patterns (plotted on growth charts—note failure to thrive or obesity).
   3. Normal development milestones achieved.

G. Evaluate any other symptoms or history.
   1. Chest pain—muscular vs. gastrointestinal versus respiratory, and occurrence at rest or with exercise.
   2. Syncope—requires further investigation, family history of sudden death, electrocardiogram (ECG) evaluation, relationship to exercise and illness.
   3. Infections—recent streptococcal or rashes on hands and mouth.
   4. Blood pressure—screening for hypertension.

Diagnostic Procedures

Fetal Ultrasonography

A. "Routine" scan performed at 18–22 weeks' gestation, if a quality scan and personnel are available. Cardiac, spinal, intracranial, and facial abnormalities can be diagnosed during this time.
B. A Level II ultrasound may be performed, targeting specific anomalies seen on the screening (Level I exam).
C. Proper referral to tertiary medical facility is necessary if further antepartum diagnosis and treatment are advised.

✦ Echocardiography

A. A noninvasive cardiac procedure that records high frequency sound vibrations and reflects mechanical cardiac activity.
B. Usually used to diagnose valvular and other structural anomalies, thickness of septum and ventricular walls, intracardiac defects.
C. May require sedation in young clients—follow institutional protocol.
D. May also be performed via transesophageal route; requires sedation.
E. Nursing responsibilities.
   1. Before procedure, assure child that procedure is painless, and prepare child for procedure to help ensure cooperation. Show child and family equipment.
   2. After procedure, provide general reassurance; recover from sedation per protocol.

✦ **Electrocardiography**

A. 12-lead ECG used to diagnose arrhythmias as in adults.
B. May need to time with nap schedule in small children unable to hold still for ECG.

✦ **Tilt-Table Testing**

A. Used in definitive diagnosis of syncope in young clients (or adults) after careful history and physical examination in clients experiencing a syncopal event suspected to be of cardiac origin.
   1. Syncope associated with exercise is associated with sudden death.
   2. Most syncope is neurogenic or vasodepressor in origin, and is benign; tilt-table test and monitoring help discern those with potentially lethal cardiac conditions.
B. Tilt test simulates orthostatic stress to provoke a syncopal event while clients are closely monitored with 15-lead ECG monitoring and frequent automatic blood pressure evaluation.
C. Protocols may vary among institutions, but most clients start in supine position, then are tilted up 70–80 degrees for up to 30 minutes to duplicate symptoms, while observing for cardiac changes.

Cardiac Catheterization

✦ A. A procedure in which a catheter is passed into the heart and its major vessels for examination of blood flow, pressures in all chambers and vessels, and oxygen content and saturation. The catheter may be passed through the arterial system into the left side of the heart or through the venous system into the right side of the heart, usually via the femoral artery or vein.
B. Nursing responsibilities before procedure.
   1. Prepare client and/or parents and child for procedure by showing equipment, room, monitors, and pictures.
   2. Establish baseline vital signs.
   3. Assess for evidence of illness. Assure NPO status maintained.
   4. Ensure that consent is obtained.
C. Nursing responsibilities during procedure.
   1. Carefully observe vital signs.
   2. Observe for cyanosis or pallor, bradycardia, arrhythmias, and apnea.
   3. Follow sedation protocol.
   4. Assist in comforting the child.
✦ D. Nursing responsibilities following procedure.
   1. Check for peripheral pulses, distal to the site in the extremity used for catheter.
   2. Check for bleeding at the site of the extremity used for catheter.
   3. Take and record vital signs every 15 minutes; observe for subnormal temperature.
   4. Observe for thrombosis: warmth of extremities, weak arterial pulses, cyanosis, blanching of extremity, skin color.
   5. Check for progressive return to normal.
   6. Observe for hypotension (internal bleeding) and signs of infection.
   7. Check incision site for bleeding or hematoma, maintain pressure dressing as ordered.
   8. Observe for reactions to dye used in procedure.
   9. Recover from sedation according to protocol (when done via transthoracic route).

✦ System Implementation—General Principles

A. Monitor supplemental oxygen concentration to ensure appropriate levels, monitor oxygen saturations (continuously or intermittently).
B. Obtain vital signs at least every 4 hours or more frequently if warranted.
C. Monitor strict I&O and daily weights for changes that may indicate fluid overload.
D. Observe for signs of impending heart failure.
   1. Increase in weight, edema, positive (excess) fluid balance.
   2. Increased pulse and respirations.
   3. Presence of adventitious breath sounds, respiratory distress.
   4. Increase in cyanosis.
   5. Liver margin palpable more than 1–2 cm below costal margin.
   6. Tires easily with activity and/or feeding, difficulty sucking nipple (use soft nipples).
   7. Monitor for increased tachypnea, diaphoresis, or feeding intolerance (vomiting).
   8. Feed the infant or child in a quiet and relaxed environment.
   9. Provide frequent, small feedings as they may be less tiring.
   10. Hold infant in upright position; may provide less stomach compression and improve respiratory effort.
   11. If child unable to consume appropriate amount of formula during 30-minute feeding q3h, consider nasogastric feeding.
   12. Concentrating formula to 27 kcal/oz will increase caloric intake without increasing infant's workload.
E. Monitor for signs of polycythemia. Oxygen saturation of arterial blood that is less than 92% on 100% oxygen may indicate cyanotic heart disease. Hematocrit higher than 52% may be a sign of polycythemia.
F. Position cyanotic infants in the knee–chest position during hypercyanotic episodes. The

Table 13-5 FETAL TO INFANT CIRCULATION

	Fetal Circulation	Infant Circulation
Ductus venosus	Oxygenized blood from umbilical vein to inferior vena cava; shunts blood past portal circulation	Becomes nonfunctional at birth
Foramen ovale	Opening between right and left atria; shunts blood past lungs	Functional closure by 3 months
Ductus arteriosus	Connects aorta and pulmonary artery; shunts blood past lungs	Contracts and becomes occluded by 4 months
Aorta	Receives mixed blood from heart and pulmonary arteries	Carries oxygenated blood from left ventricle
Pulmonary artery	Carries some mixed blood to lungs	Carries unoxygenated blood to lungs
Ventricles	Ejecting chambers of the heart; pump blood	Ejecting chambers of the heart
Umbilical vein	Carries oxygenated blood from placenta to fetus	Obliterated at birth
Umbilical arteries	Two arteries; carry oxygenated (venous) blood from fetus to placenta	Obliterated at birth
Inferior vena cava	Carries oxygenated blood from umbilical vein and ductus venosus and mixed blood from body	Carries unoxygenated blood back to heart from lower half of body

toddler may assume the squatting position by himself.

G. Organize care and feedings to provide sufficient periods of rest.

H. Feed the child by nipple or nasogastric tube. Formula should contain appropriate caloric concentration and fluid volume.

I. Encourage family to participate in infant's care—provide nurturing environment, promote bonding/support child's development.

CONGENITAL HEART CONDITIONS

Fetal Circulation

✦ A. Major structures of fetal circulation. (See **Table 13-5**.)

1. Ductus venosus: a structure that shunts blood past the portal circulation.
2. Foramen ovale: an opening between the right and left atria of the heart that shunts blood past the lungs.
3. Ductus arteriosus: a structure between the aorta and the pulmonary artery that shunts blood past the lungs in uterine development.

✦ B. Normal changes in circulation at birth.

1. The umbilical arteries and vein and the ductus venosus become nonfunctional.
2. The lungs expand, reducing pulmonary vascular resistance, and greater amounts of blood enter the pulmonary circulation.
3. Increased blood in the pulmonary circulation elevates the return of blood to the left atrium, which initiates the closure of the flap of tissue covering the foramen ovale.
4. The ductus arteriosus contracts and the blood flow decreases; eventually, the duct closes. Absence of hypoxemia provides the stimulus for ducts to close.

✦ Table 13-6 CONGENITAL HEART DEFECTS

Cyanotic Defects

Conditions that allow unoxygenated blood into the systemic circulation or conditions that result in obstruction of pulmonary blood flow.

A. Signs and symptoms.
   1. Cyanosis.
   2. Retarded growth and failure to thrive.
   3. Lack of energy.
   4. Frequent respiratory infections.
   5. Polycythemia.
   6. Clubbing of fingers and toes.
   7. Squatting.
   8. Cerebral changes—fainting, confusion, CVAs.

B. Diseases in the cyanotic category.
   1. Complete transposition of the great vessels.
   2. Tetralogy of Fallot.
   3. Truncus arteriosus.
   4. Tricuspid atresia.
   5. Total anomalous pulmonary venous connection.
   6. Hypoplastic left heart syndrome.

Acyanotic Defects

Conditions that interfere with normal blood flow through the heart either by slowing it down or by shunting blood from the left to the right side of the heart.

A. Signs and symptoms.
   1. Audible murmur.
   2. Discrepancies in pulse pressure in the upper and lower extremities.
   3. Tendency to develop respiratory infections.
   4. May develop heart failure with little stress.

B. Diseases in the acyanotic category.
   1. Patent ductus arteriosus.
   2. Atrial septal defect.
   3. Coarctation of the aorta.
   4. Pulmonic stenosis.
   5. Aortic stenosis.
   6. Atrioventricular canal (endocardial cushion defects).

C. Indications of heart disease in newborns. (See **Table 13-6**.)

✦ 1. Heart failure.
   a. Biventricular failure most common in infants (signs of left and right heart failure).
   b. Cyanosis (persistent with administration of 100% oxygen).

✦ 2. Arrhythmias.

CYANOTIC DEFECTS

Definition: Cyanotic heart defects are a group of congenital heart defects (CHDs) in which the child may appear cyanotic (blue) due to deoxygenated blood bypassing the lungs and entering the systemic circulation. Cyanotic defects account for approximately 25% of all CHDs. Causes include transposition of the great arteries (TGA) and defects that involve right-to-left or bidirectional shunting.

Characteristics

A. Causes: No specific cause is known, but may be associated with drug use, chemical exposure, or infections during pregnancy.
B. Types of cyanotic CHD: tetralogy of Fallot, TGA, Ebstein's anomaly, tricuspid atresia, total anomalous pulmonary venous return, pulmonic stenosis, truncus arteriosus, hypoplastic left heart syndrome (HLHS), critical pulmonary valvular stenosis or atresia, severe coarctation of the aorta, interrupted aortic arch.

Assessment

A. Symptoms: central and peripheral cyanosis, dyspnea (may assume squatting position), hypoxic "spells," syncope, and chest pain. Child may have clubbed fingers, murmur, crackles.
B. Diagnostic tests: chest x-ray, complete blood counts (CBC), arterial blood gases (ABGs), electrocardiogram, echo-Doppler, transesophageal echocardiography (TEE), cardiac catheterization, and electrophysiologic studies.

Implementation

A. General management: treatment of heart failure, palliative procedures to improve pulmonary blood flow (septostomy, central Gore-Tex shunt, Glenn shunt).
B. Monitor polycythemia (hematocrits that are > 50% put child at risk for stroke, infectious endocarditis, brain abscess, impaired growth, and pulmonary hypertension).

Tetralogy of Fallot

✦ *Definition*: A cardiac malformation characterized by presence of four anatomic abnormalities caused by the underdevelopment of the right ventricular infundibulum.

Characteristics

A. Ventricular septal defect.
B. Dextroposition of aorta so that it overrides the defect.
C. Hypertrophy of the right ventricle.
D. Varying degrees of stenosis of the pulmonary artery.
E. Hemodynamics: A right-to-left shunt arises in this anomaly due to the degree of pulmonary stenosis, position of the aorta, and the hypertrophied right ventricle; thus unoxygenated blood is sent back to the systemic circulation.
F. Cyanosis may not be immediately evident in the newborn due to patent ductus arteriosus (PDA), and will be determined by the amount of pulmonary stenosis.

Assessment

✦ A. Observe for symptoms of cyanotic conditions: squatting, clubbing of fingers.
B. Assess heart rate; arrhythmias are common.
C. Evaluate fatigue with exercise.
D. Observe for dyspnea and tachypnea.
E. Observe for signs of polycythemia (can lead to clotting problems and cerebral vascular diseases).
F. Assess for hypercyanotic episodes—"TET spells" and potential for seizure activity.
G. Failure to thrive.

Implementation

A. Provide appropriate nursing interventions discussed under general implementation section.
B. Provide postoperative care for child having palliative shunting procedure, increasing blood flow to the lungs.
C. Provide postoperative care for corrective treatment of pulmonary stenosis and ventricular septal defect.
D. Provide support and education to family.

Transposition of the Great Vessels

✦ *Definition*: In this condition, the aorta arises from the right ventricle and the pulmonary artery arises from the left ventricle, leading to blood flowing in two parallel circuits. This defect is not compatible with survival unless there is a large defect present in the ventricular or atrial septum, allowing for mixing of oxygenated and unoxygenated blood.

Characteristics

✦ A. Babies are blue at birth, not responsive to oxygen.
B. Aorta is anterior to pulmonary artery.
C. Pulmonary artery ascends parallel to aorta rather than crosses it.
D. Ventricular septal defect may or may not be present.
E. Atrial septal defect must be treated by balloon septostomy (Rashkind procedure) to create mixing of oxygenated and unoxygenated blood.
F. Patent ductus arteriosus is life preserving in the neonate; allows some oxygenated blood to enter the systemic circulation.
G. Alprostadil (prostaglandin E_1) may be given to prevent PDA from closing until baby can be transferred to a cardiac center.

Assessment

A. Evaluate for development of subvalvular pulmonic stenosis, decreased pulmonary blood flow, hypoxia, and polycythemia.
B. Observe for profound cyanosis.
C. Assess for signs of heart failure.

Implementation

A. Provide appropriate nursing interventions as listed under general implementation section.
B. Alprostadil infusion (0.005–0.1 micrograms/kg/minute) may be used in cyanotic newborns to maintain patency of the ductus arterosus and improve pulmonary blood flow. Monitor for respiratory distress, seizures, apnea, hypotension, bradycardia, and hypoglycemia.
C. Provide postoperative care for palliative surgery (creation or enlargement of a large septal defect, allowing for greater mix of oxygenated and unoxygenated blood).
D. Provide postoperative care for palliative surgery (creation of a patent ductus arteriosus or pulmonary artery banding to decrease blood flow through lungs).
✦ E. Provide postoperative care for corrective surgery: arterial switch procedure.
    1. In arterial switch procedures, the great arteries are transected and reanastomosed so that the distal aorta arises from the left ventricle and distal pulmonary aorta arises from the right ventricle. Coronary arteries must be reimplanted to the functional aorta and is crucial to survival.
    2. This procedure is ideally done in the first few weeks of life.
F. Family support and teaching about possible treatments, follow-up, prognosis. Refer to appropriate agencies and support groups.

Truncus Arteriosus

✦ *Definition*: Persistence of a single arterial trunk arising from both ventricles that supplies the systemic, pulmonary, and coronary circulations. Normally, the truncus arteriosus divides at about 34 days of gestation. A ventricular septal defect is usually present, as is a single, defective, semilunar valve.

Assessment

✦ A. Assess for mottled skin and ashen color; signs of poor cardiac output or hypoxemia.
✦ B. Evaluate for cyanotic symptoms; if present, provide measures to reduce oxygen demand and increase oxygen supply.
C. Determine if murmur is present.

Implementation

A. Provide nursing care as outlined in general intervention section.
B. Provide postoperative care for palliative treatment or complete repair.

Tricuspid Atresia

✦ *Definition*: Complete obstruction of the tricuspid valve associated with hypoplastic right ventricle, accompanied by atrial septal defect; necessary for survival.

Assessment

✦ A. Evaluate for a right-to-left shunt through the atrial septal defect. Should hear gurgle S_2 on auscultation; may be variable murmur—often no murmur. Blood mixes with pulmonary venous blood and enters the left ventricle. From the left ventricle, some blood is shunted to the right ventricle and then to the pulmonary artery. The rest passes into the aorta.
B. Assess for symptoms of cyanotic conditions.
C. Observe for cyanosis at birth.

Implementation

A. Provide nursing care as outlined in general intervention section.
B. Provide postoperative care for palliative surgery designed to increase pulmonary blood flow until corrective surgery may be performed.

INCREASED PULMONARY FLOW (ACYANOTIC) DEFECTS

Patent Ductus Arteriosus

✦ *Definition*: A patent ductus arteriosus is present when closure of the fetal shunt after birth fails to occur. The potential for difficulty with this defect is dependent on the amount of blood passing through the defect. PDA occurs often in association with other cardiac defects.

Assessment

✦ A. Assess for loud, continuous machinery-type murmur at left upper sternal border.
B. Palpate for possible thrill.
✦ C. Check for low diastolic blood pressure and for widened pulse pressure.
✦ D. Evaluate for poor feeding habits, diaphoresis, and easy tiring.
E. Check for frequent respiratory infections and distress.
F. Palpate for bounding peripheral pulses.

Implementation

A. Provide appropriate nursing care as listed under general implementation.
✦ B. Closure may be achieved in neonates (especially preemies) with Indocin (indomethacin; IV or orally), which inhibits prostaglandins.
C. Provide appropriate nursing care following occlusion procedure in cardiac catheter lab.
D. Provide postoperative care for surgical ligation of ductus and postoperative thoracotomy care.

Atrial Septal Defect

✦ *Definition*: A communication between the left and right atria persisting after birth.

Characteristics

✦ A. Patent foramen ovale.
1. In 20% of all births, a slit-like opening remains in the atrial septum.
2. This defect usually presents as a functional murmur and requires no surgical intervention, unless symptoms are present.

✦ B. Ostium secundum defects.
1. A defect high in the atrial septum (ostium secundum) in which the foramen ovale fails to close, or the septum fails to fuse.
a. Frequently asymptomatic.
b. Murmur in area of pulmonary artery.
c. May be well tolerated in childhood, as the shunting of blood from the left atrium to the right atrium is under relatively low pressure.
✦ 2. A defect low in the atrial septum (ostium primum) in which there is inadequate development of endocardial cushions. The atrial septum allows a flow of blood from the left high pressure chamber to the right atrial chamber.
a. May be accompanied by mitral insufficiency.
b. Asymptomatic if there are no valvular abnormalities.

Assessment

✦ A. Assess for widely split and fixed S_2 heart sound.
B. Auscultate for systolic ejection murmur.
C. Monitor for signs of heart failure (initially no signs of heart failure in infants and children unless there is pulmonary artery hypertension).

Implementation

A. Provide symptomatic care preoperatively.
✦ B. Provide postoperative care (see Cardiac Catheterization) following occlusion procedure or following surgical closure (requiring cardiopulmonary bypass).

Ventricular Septal Defect

✦ *Definition*: A communication occurring between the left (higher pressure) and right (lower pressure) ventricles allowing oxygenated blood to shunt back into the pulmonary circulation, causing pulmonary volume and/or pressure overload. Ventricular septal defects (VSDs) account for more than 20% of all congenital heart defects and are the most common defect.

Assessment

✦ A. Signs and symptoms depend on size of defect and amount of shunting. Position of defect also impacts severity. Usually children with large defects present with symptomatology.
1. Cardiac enlargement.
2. Pulmonary engorgement.
3. Dyspnea.
4. Frequent respiratory infections.
5. Loud systolic murmur, thrill.
6. Signs may not present until after 4–6 weeks of age and pulmonary vascular resistance falls (creating a pressure gradient across the defect, and shunting of blood through the VSD from right to left. Then the unoxygenated blood mixes with oxygenated blood and travels to the systemic circulation via the aorta). Presentation of symptoms depends on size of defect and gestational age of child.

B. Assess for signs of heart failure.
C. Observe for tendency to tire easily.
D. Assess for frequent respiratory infections.
E. Check for poor weight gain, failure to thrive.
F. Evaluate for murmur, may radiate over entire left chest.

Implementation

✦ A. Usually no nursing care needs for child with small asymptomatic defects; up to 50% may close spontaneously.
B. Provide symptomatic nursing care for child with large defects as shunting of blood can produce pulmonary vascular resistance over time.
C. Provide preoperative and postoperative care for repair of VSD. Closure of defect is accomplished using a patch or direct suturing. Requires cardiopulmonary bypass.

OBSTRUCTIVE DEFECTS

Pulmonary Stenosis

✦ *Definition*: Narrowing of the pulmonary artery proximally, at the valve, in the outflow tract or in the branch pulmonary arteries.

✦ **Assessment**

A. Some children with pulmonary stenosis (PS) may be asymptomatic.
B. Evaluate for a decrease in exercise tolerance, evidence of tiring easily, and dyspnea.
C. Help facilitate diagnostic procedures to evaluate right ventricular pressure, hypertrophy, and degree of severity of PS (echocardiography, ECG, cardiac catheter).
D. Assess for signs of congestive heart failure.
E. Observe for cyanosis in critical pulmonary stenosis.

Implementation

A. Provide symptomatic nursing care. Children with mild or moderate stenosis may not need intervention.
B. Monitor drug and oxygen therapy if needed.
C. Provide preoperative nursing and monitor postop problems: reactive pulmonary hypertension, arrhythmias, and conduction problems.

Aortic Stenosis

✦ *Definition*: The narrowing or the stricture of the aortic valve. Stenosis may occur in the valve itself or above or below the annulus.

Assessment

✦ A. Infants can be asymptomatic, may present with critical aortic stenosis (AS) and congestive heart failure (CHF).
✦ B. Evaluate child's exercise tolerance.
✦ C. Assess older children for chest pain during exercise. Be aware that in rare conditions sudden death may occur after exercise because of inadequate blood flow to the heart muscle.
D. Observe for episodes of syncope or vertigo, assist in obtaining detailed history of events.
E. Assist in preparation and obtaining diagnostic evaluations of left ventricular status and degree of AS (echocardiography, ECG, cardiac catheter).

Implementation

A. Teach children to evaluate their exercise tolerance and to not exceed their limit. Parents may be encouraged to limit child's activity and minimize stress until corrective procedure is performed.
B. Provide preoperative and postoperative care for surgical intervention; possible prosthetic valve or Ross procedure.

Coarctation of Aorta

✦ *Definition*: The constriction of the lumen of the aorta, usually occurring below the level of the ductus arteriosus, or occasionally above (infantile form or interrupted aortic arch).

Assessment

✦ A. Assess for high blood pressure and bounding pulses in areas of the body that receive blood from vessels proximal to the constriction that may result in these conditions (upper extremities).
B. Evaluate for a diminished blood supply in areas of the body distal to the defect (legs and feet).
✦ C. Infant diagnosis: Assess for discrepancies in pulses and blood pressure between upper and lower extremities and left–right sides.
✦ D. Older child diagnosis: Assess for increased cerebral flow—headache, dizziness, epistaxis, fainting.
E. Evaluate for possible complications (in untreated cases): intracranial hemorrhage, stroke, hypertension, or congestive heart failure.
F. Assess for leg pain after exertion.

Implementation

A. Provide symptomatic nursing care as necessary.
B. Monitor blood pressure and neurological signs in nonsurgical clients.
✦ C. May be surgically repaired or some cases may be balloon dilated in cardiac catheter lab.
D. Provide preoperative and postoperative nursing care.
E. Observe for postsurgical signs of gastrointestinal disturbance and systemic hypertension (mesenteric irritation resulting from increased blood flow postoperatively).

ACQUIRED CARDIAC CONDITIONS

Heart Failure

✦ *Definition*: Cardiac output that is insufficient to meet the metabolic demands of the body, resulting in a series of sympathetic responses. The most common cause of heart failure (HF) in children is related to congenital anomalies.

Assessment

✦ A. Observe for the following signs of pulmonary and systemic venous congestion:
1. Tachycardia.
2. Tachypnea, progressing to respiratory distress.
3. Intercostal, supraclavicular, substernal retractions.
4. Crackles, wheezing, or rhonchi.
5. Fluid retention (weight gain), periorbital edema, hand and foot edema.
6. Hepatic enlargement.

✦ B. Infant signs and symptoms: increased respiratory rate and infections; crackles; enlarged liver and spleen, generally little edema, may see periorbital edema; babies do not display distended jugular veins, but fontanelles may be full or bulging.

Implementation

✦ A. Increase oxygen supply and reduce oxygen demand.
1. Ensure that child has secure airway.
2. Administer oxygen via most appropriate route.
3. Continuously monitor ventilation, respiratory effort, and SaO_2.

✦ B. Monitor medication administration.
✦ 1. Afterload reducing medications (ACE inhibitors, e.g., Capoten [captopril] and Vasotec [enalapril]).
a. Drugs inhibit renin-angiotensin system, producing vasodilation in pulmonary and systemic vasculature.
b. Monitor I&O and heart rate (HR), and observe carefully for hypotension and renal dysfunction.
✦ 2. Lanoxin (digoxin).
a. Monitor vital signs every hour during digitalization. If pulse under 90–100, notify physician; may hold dose.
b. Observe for Lanoxin toxicity; nausea, vomiting, and diarrhea (early signs seen most often in children); anorexia, dizziness and headaches, arrhythmias, and muscle weakness.
✦ 3. Diuretics—important part of treatment.
a. Observe for electrolyte abnormalities.
b. Weigh child daily.
c. Common diuretics: Lasix (furosemide) and Diuril (chlorothiazide) deplete potassium, and Aldactone (spironolactone) preserves potassium.
4. Seriously ill children require intensive care unit (ICU) monitoring and inotropic support.

✦ C. Monitor for signs of complications (other than medications).
1. Fluid balance—important to keep child adequately hydrated, dehydration may occur from vigorous fluid restriction; maintain strict I&O.
2. Electrolyte imbalance.
3. Dysrhythmias.
4. CNS complications (from poor cardiac output and hypoxemia).
5. Cardiovascular collapse—pallor, cyanosis, shock.

✦ D. Promote rest for child with heart failure.
1. Provide outlets such as drawing, doll play, and reading for child with restricted activity.
2. Organize care to promote child's rest periods.

E. Supervise diet.
1. Provide small, frequent feedings.
2. Failure to thrive often present, so meals should be high calorie, attractive, and foods child will eat; may need nasogastric tube to provide sufficient calories for growth and daily energy needs.

F. Prepare family for home care of infant or child.
1. Encourage family to participate in care.
a. Administration of medications.
b. Signs of medication toxicity.
c. Techniques for conserving children's energy.
d. How to contact others for help and guidance.
2. Support family relationships.
a. Reinforce positive coping mechanisms.
b. Assist family to express feelings and fears.
c. Support as normal a life as possible for child.

Rheumatic Fever

Definition: A systemic inflammatory (collagen) disease that usually follows a group A beta-hemolytic *Streptococcus* infection.

Assessment

✦ A. Jones criteria utilized by healthcare professionals for diagnosis (there is no single clinical pattern).
B. Evaluate supporting evidence.
1. Recent scarlet fever.
✦ 2. Positive throat culture for group A streptococci.
3. Increased streptococcal antibodies: ASO (antistreptolysin O) titer

✦ **Implementation**

A. Provide antibiotic therapy against any remaining streptococci.
B. Maintain fluid balance.
C. Ensure sufficient bed rest.
D. Prevent further infection.
E. Instruct on use of long-term antibacterial prophylaxis—Permapen (penicillin).

JONES CRITERIA

Two major criteria, or one major and two minor criteria, are necessary for a diagnosis.

- **Major criteria.**
  1. Assess for carditis.
  2. Check for polyarthritis.
  3. Evaluate if chorea is present.
  4. Assess for erythema marginatum.
  5. Ascertain if subcutaneous nodules are present.
- **Minor criteria.**
  1. Fever.
  2. Arthralgia.
  3. Supportive evidence of preceding streptococcal infection, history of recent scarlet fever, positive throat culture for group A beta-hemolytic streptococci, increased antistreptolysin O titer, or other streptococcal antibodies.
  4. Elevated erythrocyte sedimentation rate (ESR) or positive C-reactive protein (CRP).
  5. Determine if P-R interval is prolonged.

Infective (Bacterial) Endocarditis

✦ *Definition*: An infectious disease involving abnormal heart tissue, particularly rheumatic lesions or congenital defects.

✦ **Assessment**

A. Look for insidious onset of symptoms.
B. Assess for fever (unexplained, low-grade, intermittent).
C. Check for lethargic behavior and general malaise.
D. Assess for anorexia and weight loss.
E. Evaluate for splenomegaly.
F. Assess for splinter hemorrhages under the nails, and on the palms and the soles (Janeway spots), petechiae on oral mucous membranes.
G. A new murmur.

Implementation

✦ A. Current practice for giving antibiotic therapy before surgery or dental procedures: no longer recommended (American Heart Association, 2007) except for clients with the highest risk of infective endocarditis.
✦ B. Provide several weeks of IV antibiotic therapy for diagnosis of infective endocarditis, usually penicillin or cephalosporin, depending on organism.
C. Support cardiovascular function.
D. Ensure adequate bed rest.
E. Monitor erythrocyte sedimentation rate (ESR) and increased leukocytes.
F. Repeat blood cultures as ordered.

Kawasaki Disease

✦ *Definition*: An acute systemic vasculitis—a children's disease, most frequently seen in boys under age 5 of Asian ancestry. It responds like a viral disease of lymph nodes; cause is suspected to be an immune-mediated vasculitis triggered by an acute infection or by a bacterial toxin. One in five children with Kawasaki disease develops coronary artery aneurysms.

Assessment

A. Assess for age, sex, and ancestry to determine if child fits usual profile.
✦ B. Assess for acute symptoms: persistent high fever without a specific cause, generalized rash over the trunk, swollen hands and feet, redness of the conjunctivae, swollen lymph glands in the neck, cracking of lips, strawberry tongue. Subacute phase: fissures on skin, joint pain, thrombocytosis, and cardiac disease.
C. Assess for potential heart involvement (aneurysm, blocked coronary artery leading to a heart attack, myocarditis or pericarditis; arrhythmias, ST segment changes, and enzyme elevations can also occur).
✦ D. Lab findings include: elevated ESR, elevated platelet count and elevated C-reactive protein level, elevated liver enzymes.
E. Thrombocytosis (peaks at 3–4 weeks; may go very high), anemia, or leukocytosis.

Implementation

A. Since cause is unknown, no specific treatment is ordered.
✦ B. Intravenous immunoglobulin (IVIG) is administered to prevent coronary artery disease (must be given early).
1. Commonly given initially in high doses for its anti-inflammatory effect.
2. Later given in low doses for its antiaggravation platelet action.
✦ C. Monitor high doses of aspirin to reduce fever, pain, and inflammation—high doses may be given to reduce inflammation.
1. Dose: 80–100 mg/kg/day given when fever is high.
2. Given until platelet count is normal (to prevent thrombocytosis).
D. Anticoagulation and thrombolytic therapy may be required.
E. Corticosteroids may be added if the child does not improve with IVIG and aspirin.

CARDIAC SURGERY

Assessment

A. Preoperative.
1. Determine if child is physically prepared for surgery.
2. Determine if child and family are psychologically prepared for surgery.
3. Assess readiness of child and family to learn postoperative procedures; perform teaching.
4. Observe for signs of infection and CHF.
5. Check that all laboratory tests are completed.
✦ B. Postoperative.
1. Observe for patency of the airway, administer appropriate support to reduce respiratory work and maintain oxygenation and ventilation.
2. Evaluate cardiovascular function, vital signs, quality of pulses, temperature of extremities, and fluid balance. Manage invasive monitoring lines.
3. Evaluate chest tube drainage, clotting, and signs of postoperative bleeding.
4. Monitor cardiac rate and rhythm.
5. Assess need for inotropic support as needed, vigilant monitoring of prescribed fluid balance.

6. Evaluate child's hydration and nutrition status frequently. Advance feedings carefully, when appropriate.
7. Ensure environment provides opportunity for rest.
8. Evaluate pain (efficacy of analgesics and sedation).
9. Observe for postoperative complications and HF.
10. Promote return to activity as indicated.

Implementation

✦ A. Preoperative.
1. Evaluate laboratory values for presence of infection or other abnormalities.
2. Discuss with the parents of the child the extent of preparation that the child has received.
3. Plan with the parents the approach and timing of preoperative teaching.
4. Ensure that written consent is obtained.
5. Utilize dolls or models to explain the surgery and postoperative treatment.
6. Conduct a tour of the intensive care unit for the parents and the child and introduce the child to the staff.
7. Teach the child how to cough and deep-breathe using blow bottles or other devices.

✦ B. Postoperative.
✦ 1. Maintain adequate pulmonary function.
a. Maintain patent airway.
b. Maintain ventilator if required by child.
c. Administer oxygen as ordered.
d. Check rate and depth of respirations.
e. Suction as necessary.
f. Instruct child to deep-breathe and cough.
g. Encourage use of incentive spirometry.
✦ 2. Maintain adequate circulatory functioning.
a. Monitor hemodynamic status and check vital signs.
b. Monitor rate of IV replacement fluids.
c. Replace blood when required.
d. Maintain very accurate hourly intake and output records.
✦ 3. Monitor chest tube drainage and patency.
4. Provide adequate analgesia (and sedation if warranted).
5. Provide for rest through organized care.
6. Establish adequate hydration and nutrition.
7. Encourage ambulation and activity as tolerated.
8. Observe for complications of cardiac surgery.
a. Pneumothorax.
b. Hemothorax.
c. Shock.
d. Cardiac failure.
e. Heart block.
f. Cardiac tamponade.
g. Hemorrhage.
h. Hemolytic anemia.
i. Postcardiotomy syndrome: sudden fever, carditis, and pleurisy.
j. Postperfusion syndrome (3–12 weeks after surgery): fever, malaise, and splenomegaly.
k. Embolism, air or clot.
9. Observe for late complications.
a. Respiratory: pneumonia.
b. Infection: incision area.
c. Congestive heart failure.
d. Postpericardiotomy syndrome (assess for symptoms of fever, pericardial friction rub, and pleural effusion).
e. Postperfusion syndrome (assess for fever, hepatosplenomegaly, leukocytosis, malaise, and maculopapular rash).

Heart Failure

Definition: Heart failure (HF) occurs when cardiac output is insufficient to meet the body's metabolic needs or when the heart cannot adequately pump venous return, causing pulmonary congestion (left ventricular failure), systemic edema (right ventricular failure), or both. HF in infants and children has many other causes. Acute severe HF in neonates or infants is a medical emergency. The increased volume of blood in the lungs decreases pulmonary compliance and increases the work of breathing. Fluid leaks into the interstitial space and alveoli and causes pulmonary edema.

Assessment

A. In infants, signs of HF include tachycardia, tachypnea, dyspnea with feeding, diaphoresis, chest retractions, nasal flaring, wheezing, and restlessness and irritability.
B. Dyspnea causes insufficient caloric intake and poor growth, which may be accentuated by increased metabolic demands in HF and frequent respiratory tract infections.
C. Hepatomegaly is common and liver is easily palpated.
D. Most infants do not have distended neck veins and dependent edema; occasionally have periorbital edema.
E. Findings in older children with HF are similar to those in adults.
F. Children with severe heart failure (cardiogenic shock) appear extremely ill and have cold extremities, diminished pulses, low BP, and reduced response to stimuli.
G. Diagnosis: HF is a clinical diagnosis based on auscultation, pulse oximetry, ECG, and chest x-ray. Echocardiography usually confirms the diagnosis.

COMMON CAUSES OF HEART FAILURE IN CHILDREN

Age at Onset	Causes
Antenatal (rare)	Chronic anemia (maternal or fetal)
	Myocarditis
	Sustained intrauterine tachycardia
Birth through first few days	Any of the above
	Critical aortic or pulmonic stenosis, or severe cyanotic heart defects (TGA, HLHS)
	Intrauterine or neonatal supraventricular tachycardia
	Large systemic arteriovenous fistulas
	Metabolic disorders (hypoglycemia, hypothermia, severe metabolic acidosis)
	Perinatal asphyxia with myocardial damage
	Severe intrauterine anemia (hydrops fetalis)
Up to 1 month	Any of the above
	Anomalous pulmonary venous drainage, particularly with pulmonary vein obstruction
	Severe coarctation of aorta
	Complete heart block (associated with structural heart anomalies)
	Increased pulmonary flow defects (e.g., patent ductus arteriosus, VSD)
Infancy (especially 6 to 8 weeks)	Anomalous pulmonary venous return
	Bronchopulmonary dysplasia (causing right ventricular failure)
	Rare metabolic disorders (e.g., glycogen storage disease)
	Supraventricular tachycardia
	Defects increasing pulmonary blood flow (VSD, atrial septal defect [ASD] atrioventricular canal, truncus arteriosus)
Childhood	Acute rheumatic fever with carditis or valvular involvement
	Infective endocarditis
	Acute severe hypertension (as with acute glomerulonephritis)
	Dilated cardiomyopathy
	Severe nutritional deficiencies
	Viral myocarditis
	Volume overload in a noncardiac disorder (renal failure, iatrogenic fluid overload)
	Chronic anemia (severe)

Implementation

A. Medical treatment of HF is similar to that in adults.
B. Treatment may include a diuretic (e.g., Lasix) and ACE inhibitor (e.g., Capoten) and/or Lanoxin. (See **Table 13-7**.)
C. Nursing care.
   1. Enhanced caloric content feedings are recommended. Some children require nasogastric or gastrostomy feedings to maintain growth.
   2. Surgical repair of the anomaly is indicated if weight gain is not established, with appropriate postoperative nursing care.
   3. Cardiac monitoring and meticulous I&O monitoring.
   4. Humidified O_2 should be given by mask, or nasal prongs with adequate F_{IO2} to prevent cyanosis and alleviate respiratory distress.
      a. When possible, F_{IO2} should be kept < 40% to prevent pulmonary epithelial damage in neonates.
      b. Upright position may benefit small infants and children, by reducing pressure in the thorax from abdominal organs and reducing work required for breathing.

Table 13-7 ORAL DIGOXIN DOSAGE IN CHILDREN*

Age	Digitalizing Dose (μg/kg)	Maintenance Dose† (μg/kg BID)
Preterm neonates	20	2.5
Term neonates	30	4–5
1 month to 2 years	40–50	5–6
2–10 years	30–40	4–5
> 10 years	10–15	1.25–2.5

* The IV dose is 75% of the oral dose.
† The maintenance dose is 25% of the digitalizing dose, given in two divided doses.
Notes: All doses based on ideal body weight.
The digitalizing dose is usually necessary only when treating arrhythmias or acute congestive heart failure. The total digitalizing dose is usually given over 24 hours with half the dose given twice separated by 8- to 12-hour intervals with ECG monitoring.

RESPIRATORY SYSTEM

The respiratory system accomplishes pulmonary ventilation through the process of inspiration and expiration. The act of breathing involves a complex chemical and osmotic process in which oxygen is taken into the lungs and carbon dioxide, the end product, is given off.

Pulmonary System Assessment

A. History.
   1. Perinatal history—maternal problems, infections, illnesses, smoking.
   2. Gestational age—length of hospitalization, pulmonary problems, neonatal intensive care unit (NICU) stay.
   3. Respiratory problems since birth—exposures, frequent infections, hospitalizations, chronic diseases, cough, smokers in household.

✦ B. Inspection.
   1. Observe respiratory rate and effort (know normal rates for age).
   2. Assess skin color—pale, pink, mottled, dusky, cyanotic.
   3. Assess level of consciousness and interaction with environment.
   4. Observe for drooling, unwillingness to swallow, inspiratory stridor, and signs of upper airway obstruction.
   5. Evaluate signs of respiratory distress—nasal flaring, head bobbing, tachypnea, cough, audible wheezing, grunting, retractions, decreased oxygen saturation.
   6. Evaluate sputum and secretions from nose and eyes.
   7. Assess chest expansion for symmetry, and shape of chest.
   8. Observe nail beds for color and clubbing.

✦ C. Palpation.
   1. Evaluate areas of tenderness over chest.
   2. Assess lymph nodes.
   3. Assess respiratory excursion and tactile fremitus.

D. Percussion.
   1. More useful in older children.
   2. Should hear resonance over lung surfaces.
   3. Note location of any areas of dullness (consolidation); percuss margins.

✦ E. Auscultation.
   1. Using diaphragm, systematically evaluate lungs from apices to bases, comparing side to side. (See **Figure 13-1**.)

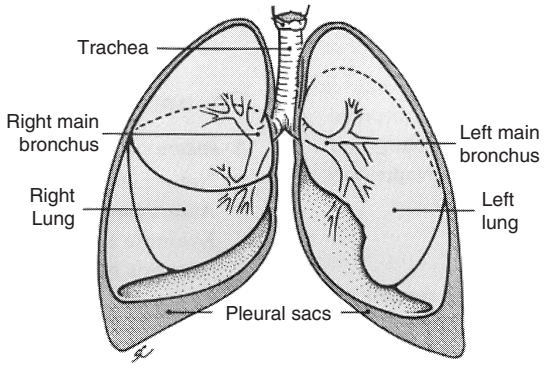

Figure 13-1 Anatomy of the lungs

   2. In infants and young children, auscultate in axillae comparing side to side; allow infant/child to sit in lap of caregiver.
   3. Note quality of respirations, depth, rate, crackles, or wheezes, any abnormal finding.

F. Hydration.
   1. Color and moistness of mucous membranes and secretions.
   2. Assess skin turgor.
   3. Evaluate for bulging or sunken fontanelles.
   4. Assess recent intake and output.

G. Current symptoms.
   1. History of illness/onset/recurrences.
   2. Medications taken; therapies used.
   3. History of asthma/wheezing.
   4. Immunization status; recent exposures.

Anatomic Differences in Pediatric Respiratory System

A. Larynx is more cephalad and anterior.
B. Decreased airway size—smaller diameters are more susceptible to change due to swelling and secretions.
C. Narrowest point of the airway is at cricoid cartilage rather than at larynx.
D. Fewer number of airway divisions and alveoli.
E. Ribs are oriented more in horizontal plane.
F. Poorly developed intercostal muscles (thin chest walls).

Physiological Differences in Pediatric Respiratory System

✦ A. Infants are obligate nose breathers until 4–6 weeks of age.
B. Primary muscle of respiration is the diaphragm ("belly breathers").
C. Decreased tidal volume and functional reserve volume.
D. "Stiffer" lungs (with more compliant chest walls).
E. Higher basal metabolic rate (BMR) and oxygen consumption relative to body surface area.

✦ F. Infants are at high risk for heat and volume loss from high respiratory rates.
✦ G. Increased susceptibility to infective organisms.

System Implementation

✦ A. Monitor for signs of respiratory distress.
  ✦ 1. Early signs.
    a. Increased respiratory rate (tachypnea).
    b. Nasal flaring, head bobbing.
    c. Retractions.
    d. Tachycardia.
    e. Decreasing SaO_2.
  ✦ 2. Late signs.
    a. Cyanosis.
    b. Dyspnea.
    c. Decreased level of consciousness.
    d. Bradycardia.
B. Ensure patency of airway—administer oxygen as ordered.
  1. Monitor O_2 saturation levels.
  2. Provide postural drainage, coughing, deep-breathing, chest physiotherapy, and suctioning to aid in the removal of secretions.
  3. Provide cool mist for humidifying air.
C. Maintain IV and/or oral fluid levels.
D. Administer antibiotic therapy if bacterial infection is present.
E. Administer antipyretic medication, such as Tylenol (acetaminophen) or Advil (ibuprofen), tepid sponge baths, or cooling mattress.
F. Ensure adequate rest and provide a less stressful environment.
G. Organize nursing care to give adequate rest periods.
H. Support family and prepare for discharge.

UPPER AIRWAY OBSTRUCTIVE CONDITIONS

Laryngotracheobronchitis ("Croup")

✦ *Definition*: Viral croup is a syndrome caused by a variety of inflammatory conditions of the upper airway. Viral croup is the most common. More commonly seen in children less than 3 years old. (See **Table 13-8**.)

✦ Table 13-8 SYMPTOMS OF UPPER AIRWAY AND LOWER RESPIRATORY TRACT OBSTRUCTION

High Obstruction (Inspiration Problems)	Low Obstruction (Expiration Problems)
1. Toxicity	1. Toxicity
2. Fatigue	2. Fatigue
3. Air hunger	3. Air hunger
4. Marked inspiratory stridor with hoarseness	4. Increasingly severe dyspnea
5. Increasing dyspnea	5. Intercostal retractions
6. Severe sternal reactions	6. Prolonged expiratory phase
7. Prolonged inspiratory phase	7. Increased respiratory rate
8. Increased respiratory rate	8. Increased cardiac rate
9. Increased heart rate	9. Harsh cough
10. Barking cough	10. Expiratory wheeze and grunt
	11. Crackles

✦ Assessment

A. Obtain accurate history—ascertain if rhinitis and cough have preceded croup for several days.
B. Assess for gradual onset, then barking cough and inspiratory stridor—usually for 3–7 days, worse at night.
C. Assess for mild elevation in temperature (below 102°F/38.8°C).
D. Observe for hypoxemia, decreasing SaO_2 (resulting in anxiety and restlessness).
E. Assess for cyanosis, a late sign, which may indicate complete airway obstruction.

Implementation

✦ A. Plan for home treatment if no inspiratory stridor.
  1. Instruct parents in signs of airway obstruction.
    a. Tachypnea.
    b. Increased anxiety.
    c. Pallor, mottling, or cyanosis (circumoral or around eyes).
  ✦ 2. Instruct parents in providing cool mist therapy. Steam from the shower is less desirable, but may be effective.
B. Treatment.
  1. For moderate to severe croup that doesn't respond to cool mist and PO fluids, oral or inhaled steroids may be prescribed.
  2. For severe croup, Vaponefrin, a nebulized racemic epinephrine treatment, is administered.
  3. Children should be observed in the emergency department (ED) or clinic setting for 1–2 hours after receiving Vaponefrin because of the risk of "rebound."
✦ C. Provide hospital care for acute onset with inspiratory stridor.
  ✦ 1. Monitor vital signs every 1–2 hours; check temperature frequently if in cool mist tent.
  ✦ 2. Check respiratory status at least hourly, depending on severity of distress.
  3. Monitor accompanying signs and symptoms.
    a. Respiratory rate.
    b. Grunting, flaring, retracting.
    c. Stridor.
    d. Color.

e. Auscultation of breath sounds.
f. Restlessness.
g. Use of accessory muscles.
h. Oxygen saturation (pulse oximetry).

4. Obtain baseline ABG/CBG (capillary blood gases), CBC, and throat culture, if ordered.
✦ 5. Provide cool humidified air or oxygen as ordered.
6. Check oxygen saturations frequently or continuously via pulse oximetry, to keep above 93–94%.
✦ 7. Monitor hydration status.
a. Encourage cool fluid PO intake (cool fluids will help decrease inflammation).
b. If respiratory rate (RR) > 60 and NPO, administer adequate intravenous fluids; if RR < 60 and will take fluids, give fluids carefully to maintain hydration, clear liquids as tolerated; supplemental IV.
c. Maintain patency of IV.
d. Monitor urinary output, specific gravity, and skin turgor.
8. Treat fever with Tylenol or Advil.
9. Place on cardiorespiratory monitor if signs of hypoxia or impending respiratory failure.

RESPIRATORY SCORING SYSTEM

Inspiratory Stridor
- None (0 points)
- When agitated (1 point)
- On/off at rest (2 points)
- Continuous at rest (3 points)

Retractions
- None (0 points)
- Mild (1 point)
- Moderate (2 points)
- Severe (3 points)

Air Movement/Entry
- Normal (0 points)
- Decreased (1 point)
- Moderately decreased (2 points)
- Severely decreased (3 points)

Cyanosis (Color)
- None (0 points)
- Dusky (1 point)
- Cyanotic on room air (2 points)
- Cyanotic with supplemental oxygen (3 points)

Level of Alertness (Mentation)
- Alert (0 points)
- Restless or anxious (1 point)
- Lethargic/obtunded (2 points)

In general, children with a croup score of less than 4 have mild croup, with a score of 5–6 have mild/moderate croup, with a score of 7–8 have moderate croup, and with a score of greater than 9 have severe croup.

✦ Epiglottitis

Definition: An acute bacterial infection of the epiglottis, may occasionally be of viral origin. Usually caused by *Haemophilus influenzae* type B or *Streptococcus pneumoniae*. May produce severe upper airway obstruction.

Assessment

✦ A. Observe that illness occurs most frequently in young children, 3–7 years of age who are seen leaning forward in a tripod position.
B. Ascertain if illness was preceded by an upper respiratory infection.
C. Assess for rapid onset with marked inspiratory stridor and retractions, cough, muffled voice. (The four Ds: dysphonia, dysphagia, drooling, distressed respiratory efforts).
✦ D. Assess for high temperature (100–104°F or 37.7–40°C).
E. Evaluate difficulty in swallowing as manifested by excessive drooling and refusal to take liquids.

Implementation

✦ A. Prepare for lateral neck films STAT to confirm diagnosis. Keep child in upright and "sniffing" position. Supine position may cause occlusion of the airway and respiratory arrest.
✦ B. Never use restraints; never use a tongue blade or place *anything* into pharynx.
✦ C. Do not elicit a gag reflex—may cause further spasm of epiglottis and complete airway obstruction.
D. Prepare child for the operating room if elective intubation is to be done under anesthesia.
E. Maintain tracheostomy set/intubation tray at bedside.
F. Provide cool oxygen mist at all times.
G. Monitor vital signs with respiratory status continuously.
1. Respiratory rate, stridor, color, restlessness.
2. Auscultate breath sounds; evaluate use of accessory muscles.
3. Place on continuous cardiorespiratory monitor and pulse oximetry.
✦ H. Monitor hydration status. Keep child NPO.
1. Start IV (after airway is secure).
2. Check urinary output, specific gravity, skin turgor, tears.
✦ I. Administer broad-spectrum antibiotic after IV line secure and patent.
✦ J. Monitor temperature and administer antipyretics.
✦ K. Droplet isolation for 24 hours after start of antibiotic therapy.
✦ L. Maintain endotracheal tube patency if intubation necessary (see Medical–Surgical content for care of the intubated client).

Tonsillitis and Adenoiditis

Definition: Infection and inflammation of the palatine tonsils and adenoids. Primary causes are Group A beta-hemolytic *Streptococcus* and viruses.

✦ Assessment

A. Assess for difficulty swallowing or breathing.
B. With adenoiditis, child is unable to breathe through nose and must mouth-breathe (may be noisy, snoring at night).
C. Observe for fever, sore throat, and anorexia.
D. Assess for general malaise and dehydration.
E. Assess for pain in ear and recurring otitis media.
F. Evaluate indications for possible surgery.
   1. Surgery is performed only when necessary because tonsils are thought to have protective immunologic functions; it is delayed until age 3 years to allow the structures of the mouth and throat to grow larger.
   2. Assess for difficulty in swallowing, indicating enlargement of tonsils or adenoids.
   3. Assess for repeated episodes of tonsillitis, indicating infection (at least three in 1 year).
   4. Observe for signs of respiratory distress.
   5. Evaluate for hearing, chronic otitis media.

Implementation

Preoperative Interventions

✦ A. Review lab work (CBC, Hgb, Hct, bleeding and clotting time), serologic tests, and throat culture (should not have an active infection at the time of the surgery).
B. Obtain complete health history, including history of allergies.
✦ C. Provide emotional support and preoperative teaching for the child (for same-day outpatient procedure).
   1. Hospital admission processes.
   2. The operative procedure and recovery room.
   3. Ensure that written consent if obtained prior to procedure.

Postoperative Interventions

✦ A. Maintain in prone or Sims' position until fully awake to facilitate drainage of secretions and prevent aspiration. Then change to semi-Fowler's.
✦ B. Avoid suctioning and coughing to prevent hemorrhage.
✦ C. Observe for signs of postoperative bleeding and shock.
   1. Restlessness.
   2. Alterations in vital signs (increased pulse, decreased blood pressure, increased respiration).
   3. Frequent swallowing (caused by blood dripping down the back of throat).
   4. Excessive thirst due to fluid loss and inability to swallow fluids.
   5. Vomiting of bright red blood (coffee ground appearance is "old" blood).
   6. Pallor.
D. Maintain calm, quiet environment to prevent anxiety.
✦ E. Provide ice collar.
F. Encourage fluids.
   1. Encourage cold fluids, Popsicles, ice chips, or any food or liquid child will take. Avoid red Popsicles or fluids; may mask bleeding.
   2. Do not use straws.
G. Administer analgesics for pain as ordered.
H. Discharge teaching.
   1. Avoid highly seasoned or irritating food.
   2. Activity limitations.
   3. Use of analgesics—use around the clock in the first 24 hours.
   4. Signs of bleeding—most likely to occur in the first 24 hours or 7–10 days later when sloughing occurs. Avoid coughing, gargling, and clearing the throat.
   5. Signs of infection (temperature > 101°F or 38.3°C). Note that "bad" breath and a whitish appearance to the throat is to be expected after the surgery.

Acute Otitis Media

✦ *Definition*: A common complication of an acute respiratory infection that occurs when edema of the upper respiratory structures traps the infection in the middle ear.

Characteristics

A. Etiology: viruses and bacteria such as *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* most often associated with an upper respiratory tract infection or nasal congestion from allergies.
B. Children living with smokers and who attend day care have significant increase in acute otitis media (AOM) episodes.
C. AOM primarily results from dysfunctional Eustachian tubes with retention of secretions in the middle ear.
D. Incidence is greatest from 6 months to 3 years old, slightly more frequent in boys and most often in winter months.

Assessment

✦ A. Assess for fever and associated upper respiratory infection.
✦ B. Observe for pulling or rubbing of one or both ears.
C. Observe for crying, irritability, restlessness, lethargy, and anorexia.

D. Monitor for language delays in young children with frequent acute otitis media since the drainage of fluid (effusion) from the middle ears resolves over a period of weeks.

Implementation

✦ A. Supervise use of antibiotics.
   1. Children have usually been treated with antibiotics for acute otitis media.
      a. AAP (American Academy of Pediatrics) recommends that children be treated a high or double dose of Amoxil (amoxicillin), which is 80 or 90 mg/kg/day.
      b. If the Amoxil doesn't work after 48–72 hours or if the child has a fever at or above 102.2°F or 39°C, then high-dose Augmentin (amoxicillin and clavulanate) or Augmentin ES (extra strength) should be used.
   2. Because of increasing bacterial resistance to antibiotics and fewer *Streptococcus pneumoniae* ear infections due to use of the pneumococcal vaccine (PVC-13), current guidelines are to delay antibiotic treatment for 48–72 hours after diagnosis for children 6 months to 2 years with nonsevere illness while treating symptomatically (see B below).

B. Administer analgesics and/or analgesic ear drops for pain, and Tylenol (acetaminophen) or Advil (ibuprofen) for fever.

C. Advise parents that during the course of the infection the child may have a conductive hearing loss.

D. Maintain adequate diet and fluid intake.

E. Provide education and support if myringotomy and/or insertion of tympanostomy (pressure equalizing; PE) tubes is necessary for chronic otitis infection, recurrent otitis media, and conductive hearing loss.

✦ F. Parents of infants should be taught to never put child in bed with a bottle, to never prop a bottle, and to feed infants in upright position.

G. Strongly encourage family members to keep child's environment smoke free.

LOWER RESPIRATORY OBSTRUCTIVE CONDITIONS

Bronchitis

✦ *Definition*: Inflammation of the large airways, usually associated with a URI. (See Table 13-8.)

✦ Assessment

A. Assess for "hacking" and moderately productive cough.

B. Examine for crackles and wheezes.

C. Assess for acute respiratory distress with acute bronchitis.

D. Evaluate fever and hydration.

✦ Implementation

A. Perform chest physiotherapy as ordered (not after meals).

B. Administer humidified air or oxygen as necessary.

C. Increase and monitor fluid intake.

D. Instruct child how to cough and breathe deeply.

E. Administer cough suppressants and expectorant as ordered.

Bronchiolitis/Respiratory Syncytial Virus

✦ *Definition*: An acute infection characterized by thick production of mucus causing spasm and occlusion of the bronchioles and small bronchi. It occurs most frequently in winter and spring in infants and children under age 2, and is usually preceded by a viral upper respiratory infection. Respiratory syncytial virus (RSV) is responsible for over half of all bronchiolitis. Adenoviruses and parainfluenza virus may also cause bronchiolitis.

✦ Assessment

✦ A. Assess for rapid respiratory rate, nasal flaring, and intercostal retractions with prolonged expiratory wheezes, and coarse lung sounds throughout. A noisy chest indicates that the infant has sufficient air exchange.

B. Evaluate cough, which is usually moist with thick nasal secretions.

C. Assess for tachycardia, hydration status, nutritional intake, and fever

D. Assess oxygenation via continuous pulse oximetry.

E. Infants may present with apnea episodes.

✦ Implementation

✦ A. Place upright with the head of bed elevated at least 30 degrees.

✦ B. Administer cool, humidified oxygen by delivery mode best tolerated (mask for nasal cannula).

C. Maintain adequate hydration and encourage intake of fluids.

D. IV fluids are necessary if marked respiratory distress and unable to tolerate PO feedings (in infant with respiratory rate > 60/min).

E. Conserve energy, allow to rest. Encourage parents to stay at bedside to calm infant.

F. Place infant in contact isolation alone or with other children with same diagnosis. RSV infection is diagnosed by a nasopharyngeal swab.

G. Suction thick nasal secretions and thin with saline solution as needed.

H. Administer or coordinate chest physiotherapy, as ordered, to loosen secretions.

I. Administer medications.
   1. Antibiotics, if secondary pneumonia occurs in conjunction with RSV bronchiolitis.
   2. Proventil (albuterol) nebulized treatments and/or corticosteroids may be ordered for suspected underlying reactive airway disease.
   3. Antipyretics for elevated temperature. Remove heavy thick blankets. Cooling measures (sponge baths, etc., do not reduce fever as effectively as antipyretics in children).

J. To prevent RSV infection, administer Synagis (palivizumab), a passive immune vaccine.
   1. Give to children < 2 years old with chronic lung disease and congenital cardiac defects and to premature infants born < 32 weeks' gestation.
   2. Give 15 mg per kg of body weight monthly by intramuscular injection during months with highest RSV incidence (usually October–December onset through March–May).

Pneumonia

Definition: Inflammation of the pulmonary parenchyma caused by bacteria, viruses, mycoplasma organisms, aspiration, or inhalation. May be lobar, lobular, or interstitial in location.

Characteristics

A. Viruses cause cellular destruction and accumulation of debris in the bronchioles and alveoli. Bacteria cause fluid accumulation and cellular debris in bronchioles and alveoli, causing consolidation. Impaired gas exchange occurs from atelectasis and from the inflammatory process with both viruses and bacteria.
B. Pneumonia in children is commonly caused by viruses, especially since the use of HIB and PCV-13 vaccines.

SIGNS OF DEHYDRATION

- Sunken fontanelle.
- Pale, cool skin.
- Poor skin turgor.
- Prolonged capillary refill (> 2 seconds for a child).
- Dry mucous membranes (absent salivation or tearing).
- Decreased and concentrated urinary output.
- Thirst, irritability, lethargy.
- Rapid heart rate (more serious weak and thread).
- Respirations normal (more serious increased to compensate for metabolic acidosis).
- Blood pressure normal (if decreased, a serious sign of decompensation).
- Weight loss: If possible calculate percentage of loss.

C. Children with chronic conditions and very young infants are likely admitted to the hospital for treatment with IV fluids, IV antibiotics, and supportive care that includes oxygen, suctioning, and chest physiotherapy.

✦ Assessment

A. Tachypnea, for infant often > 60/min; know respiratory rates for age.
B. Fever (higher with bacterial causes).
C. Retractions, crackles, wheezing more common with RSV-related pneumonia.
D. Absent or decreased breath sounds.
E. Cough, nonproductive or productive.
F. Pallor, malaise, fatigue.
G. Normal or decreased oxygen saturation.
H. Assess for fluid loss, decreased intake by mouth, and poor appetite.
I. May be accompanied by headache, abdominal pain, nausea, and/or vomiting.

✦ Implementation

✦ A. Place child in transmission-based isolation, depending on the suspected organism (droplet most likely).
B. Administer IV antibiotics specific to suspected organism, often a second- or third-generation cephalosporin and a macrolide like Zithromax (azithromycin).
C. Splint the chest when the child coughs. Administer analgesics for pain.
D. See RSV on previous page for nursing care.

Asthma

Definition: A reversible obstructive airway disease characterized by increased airway responsiveness to a variety of stimuli mediated by immunoglobulin E (IgE) receptors on the sensitized airway mast cells resulting in bronchospasm, inflammation of mucous membranes that line the small airways, and accumulation of thick secretions.

Characteristics

A. An asthma episode can be triggered by cold air, smoke, allergens (e.g., pollen, dander, cockroach, dust, mold), viral infection, stress, exercise, odors, environmental pollutants, and occasionally, food allergy.
B. Improvement of symptoms in response to nebulized bronchodilators as measured by pulmonary function testing (PFT) is necessary for diagnosis in children over 5 years of age.
C. Asthma symptoms vary from mild wheezing and dry cough intermittently to acute respiratory distress. Management varies depending on the classification of the disease.

✦ **Assessment**

A. Classification. (See **Table 13-9**.)
   1. Mild intermittent (no *daily* medication needed); Proventil, a bronchodilator, is used when symptoms occur (wheeze, cough, or shortness of breath).
   2. Mild persistent (symptoms requiring a bronchodilator > 2/week but < 1/day). Preferred treatment: daily use of a low-dose inhaled corticosteroid (ICS) in a metered-dose inhaler (MDI) or dry powder inhaler (DPI) for "controlling" symptoms. ICS include Flovent (fluticasone), Pulmicort (budesonide), Beclovent (beclomethasone), and others. A bronchodilator is used for "rescue." Another option for a "controller" drug is a leukotriene inhibitor such as Singulair (montelukast), but ICS are preferred.
   3. Moderate persistent: daily meds—low-dose inhaled corticosteroids and long-acting inhaled beta$_2$ agonists, often in a combination inhaler such as Flovent and Advair (salmeterol). A leukotriene inhibitor may be added in for moderate to severe persistent asthma. A bronchodilator is used for "rescue."
   4. Severe persistent—continual/frequent meds needed. Prefer high-dose inhaled corticosteroids AND long-acting inhaled beta$_2$ agonists AND systemic corticosteroids, if needed for exacerbations. A bronchodilator is used for "rescue." Systemic corticosteroids may be given PO, IM, or IV and include Medrol (methylprednisolone) and Deltasone (prednisone). Children with severe asthma over 12 years may receive anti-immunoglobulin E antibody (anti-IgE) called Xolair (omalizumab), given IM at regular intervals.

B. Obtain history of conditions that led to asthmatic attack: exposure to certain foods, infections, vigorous activity, or emotional factors.

C. Assess for spasms of bronchiole tubes manifested by increased wheezing, increased mucus, and shortness of breath.

D. Assess cough, which can be dry or productive, and when it occurs.

E. Assess for symptoms of acute respiratory distress: retractions, tachypnea, prolonged expiratory wheezing, absent air exchange, decreasing oxygen saturation, client "winded" when speaking, tripod position, poor color, and altered mental status.

✦ **Implementation**

A. National Heart Lung and Blood Institute guidelines for asthma are aimed at four components:
   1. Assessment and monitoring the severity of symptoms in order to classify the type of asthma and treat accordingly.
      a. Peak flow monitoring and/or symptom diary on a daily basis; a peak flow meter may also be used before and after use of

Table 13-9 CLASSIFYING SEVERITY OF ASTHMA EXACERBATIONS

	Symptoms and Signs	Initial PEF (or FEV_1)	Clinical Course
Mild	Dyspnea only with activity (assess tachypnea in young children)	PEF ≥ 70% predicted or personal best	Usually cared for at home. Prompt relief with inhaled, short-acting beta$_2$ agonists (SABA). Possible short course of oral systemic corticosteroids.
Moderate	Dyspnea interferes with or limits usual activity	PEF 40–69% predicted or personal best	Usually requires office or ED visit. Relief from frequent inhaled SABA. Oral systemic corticosteroids; some symptoms last for 1–2 days after treatment is begun.
Severe	Dyspnea at rest; interferes with conversation	PEF < 40% predicted or personal best	Usually requires ED visit and likely hospitalization. Partial relief from frequent inhaled SABA. Oral systemic corticosteroids; some symptom last for > 3 days after treatment is begun. Adjunctive therapies are helpful.
Subset: Life-threatening	Too dyspneic to speak; perspiring	PEF < 25% predicted or personal best	Requires ED/hospitalization; possible ICU. Minimal or no relief from frequent inhaled SABA. Intravenous corticosteroids. Adjunctive therapies are helpful.

ED, emergency department; FEV_1, forced expiratory volume in 1 second; ICU, intensive care unit; PEF, peak expiratory flow; SABA, short-acting beta$_2$ agonist.

a bronchodilator to determine degree of improvement.
b. Development of an asthma action plan for home and school.
c. Routine follow-up visits with the health-care provider.

2. Education of parents and child to manage symptoms
3. Treatment of comorbid conditions (sinusitis, allergic rhinitis, gastroesophageal reflux). May include allergy skin testing or radioallergosorbent (RAST) testing. Treat underlying infections.
4. Determine compliance with client's use of daily "controller" medications and frequency of use of "rescue" bronchodilator. Ensure that child knows how to use spacer devices and inhaler devices.

✦ B. Treatment of acute exacerbations of asthma: continuous Proventil nebulized treatments; PO, inhaled, or intravenous corticosteroids; oxygen as needed.
C. Identify and remove suspected allergens and avoid triggers if possible ("allergy-proof" the home).
✦ D. Supervise medication administration (see medications listed under Classification on the previous page).

Cystic Fibrosis

✦ *Definition*: Cystic fibrosis (CF) is an autosomal recessive genetic disorder of the exocrine glands characterized by thick and viscous mucus and decreased pancreatic enzyme production. CF affects approximately 30,000 children and adults in the United States; approximately 10 million are carriers.

Characteristics

A. Cystic fibrosis may be identified with a screening blood test during pregnancy or by routine neonatal blood testing enabling children to be diagnosed soon after birth.
B. Cystic fibrosis is a multisystem disorder affecting
1. The respiratory system with excess mucus, which leads to secondary bacterial infections.
2. The digestive system: Thick mucus blocks pancreatic enzymes used to digest and absorb nutrients. Eventually the hepatic bile ducts and gallbladder are also blocked by mucus.
3. Metabolic system: Excess sodium chloride production by sweat glands causes hyponatremia.
4. Reproductive system: Ovarian ducts and vas deferens are blocked with mucus, causing sterility.

Assessment

A. Failure to pass meconium—often presenting sign in neonates.
B. Weight loss, protruding abdomen with thin extremities; may have increased appetite to make up for loss of nutrients with undigested food.
✦ C. Recurrent respiratory infections (sinusitis, bronchitis, pneumonia).
D. Crackles, wheezes, or diminished breath sounds; prolonged expiration.
E. Barrel chest.
F. Clubbing, as a sign of chronic low oxygen saturation.
G. With chronic disease and resulting liver damage and/or cor pulmonale, distended neck veins, and edema.
✦ H. Bulky malodorous stools caused by malabsorption of fats and proteins (steatorrhea).
I. Parents report that the child has a salty tasting skin.
J. Evaluate diagnostic tests, including the sweat test for elevated chloride content and trypsin test. (< 60 mEq/L chloride in sweat is considered diagnostic of CF. Trypsin is absent in cystic fibrosis.)

Implementation

✦ A. Provide adequate nutritional intake of calories, protein, and fat. Clients with CF require 130% more kcal and protein than usual daily requirements for age.
✦ 1. Replace pancreatic enzymes such as Viokase and Cotazym, which are given just *prior* to each meal and with snacks.
2. Water-soluble vitamins and fat-soluble vitamins (A, D, E, K in water-miscible form) as well as mineral supplements should be given daily.

B. Prevent gastrointestinal blockage by giving sufficient fluids, fiber, and stool softeners.
✦ C. Major objective is to keep lungs clear of mucus.
1. Pulmozyme (dornase alfa) improves lung function.
a. Breaks down extracellular DNA in thick sputum.
b. Administration via inhalation through nebulizer device helps liquefy secretions.

2. Postural drainage and vibration with an oscillator vest, following breathing treatments.
3. Breathing exercises: forced exhalation and incentive spirometer. (Children tend to breathe shallowly.)
4. Low-dose humidified oxygen as needed.

D. Administer antibiotics as ordered to treat infection.
   1. Inhaled antibiotics like Tobrex (tobramycin) useful in children with chronic *Pseudomonas aeruginosa* infection.
   2. IV antibiotics may include Pipracil (piperacillin), Timentin (ticarcillin), Keflex (cephalexin), Fortaz (ceftazidime), or Cipro (ciprofloxacin).

E. Provide parental education and support.
   1. Information about the disease and its long-term effects.
   2. Genetic counseling.
   3. New drugs: Most target gene therapy attempting to replace gene causing CF, adding normal genes to airways to correct defective cells.
   4. Resource centers such as Cystic Fibrosis Foundation (www.cff.org) and local organizations.
   5. Care of the child at home.
      a. Normal family routine.
      b. Children are irritable, frightened, and insecure.
      c. Children need attention, discipline, and reassurance.

Bronchopulmonary Dysplasia

✦ *Definition*: Chronic lung disease seen in infants who were born prematurely (often less than 30 weeks' gestation) managed with mechanical ventilation, requiring high inspiratory pressures and oxygen concentrations. Alveolar damage ensues, with hyperinflation, atelectasis, pulmonary edema, inflammation and hypertension, and chronic oxygen dependence.

✦ Assessment

A. Infant is barrel chested and oxygen dependent.
B. Infants exhibit failure to thrive and are difficult feeders.
   1. Obtain history and feeding habits.
   2. Assess ability to feed in conjunction with respiratory exam.
C. Assess respiratory effort.
   1. Tachypnea, retractions, and wheezing.
   2. Circumoral and nail bed cyanosis (if chronic hypoxia).
   3. Chest x-ray shows lung disease, scattered areas of hyperinflation, and patchy infiltrates.
   4. ABGs show chronic respiratory acidosis.
D. Prevent respiratory infections and RSV: Administer Synagis vaccine during the winter months. Strict hand hygiene.
E. Infants often require frequent hospitalizations for infections, acute respiratory distress or failure, and congestive heart failure.
   1. Assess family functioning and parental bonding.
   2. Evaluate degree of developmental delay present, related to gestational age.

Implementation

✦ A. Goal is to maintain adequate oxygenation and ventilation.
✦ B. Usual therapy includes oxygen, bronchodilators, diuretics, surfactant, Respbid (theophylline), and caffeine.
C. Monitor pulse oximetry carefully to adjust oxygen requirements. Need for supplemental oxygen will vary according to activity.
   1. Assist family in preparing for discharge with home oxygen therapy.
   2. Teach family members methods of monitoring oxygen needs and administration.
D. Monitor electrolytes carefully if on diuretic therapy.
E. Administer and teach families to administer inhaled bronchodilators (e.g., Proventil) and occasionally inhaled corticosteroids (ICS) like Beclovent.
✦ F. Nutritional support is a key component of management.
   1. High-calorie diet should be administered in low volumes.
   2. Infants frequently are "difficult feeders" and families may require extensive teaching.
   3. Observe for gastroesophageal reflux and treat accordingly.
✦ G. Families require *extensive support*.
   1. If hospitalized, involve parents in daily care and teach to do as much of care as possible.
   2. Prepare for home care: skilled nursing care may be required, or respite care may need to be arranged.
   3. Educate families on signs of deterioration and need for medical evaluation/intervention.
   4. Support infant's development and provide appropriate stimulation.
   5. BPD is a *chronic* condition, requiring multidisciplinary planning and teamwork, but infants can recover and develop to optimal capabilities with adequate support.

GASTROINTESTINAL SYSTEM

The primary function of the alimentary tract is to provide the body with a continual supply of nutrients, fluids, and electrolytes for tissue nourishment. This system has three components: a tract for ingestion and movement of food and fluids; secretion of digestive juices for breaking down the nutrients; and absorption mechanisms for the utilization of foods, water, and electrolytes for continued growth and repair of body tissues.

System Assessment

A. History: family history, perinatal events, prior feeding or stooling disorders, anorexia, emesis, pain, fever, allergies, usual bowel and bladder patterns.
B. Inspection.
   1. Assess symmetry and contour standing and lying ("pot-belly" in the toddler).
   2. Observe umbilicus for evidence of hernia.
   3. Observe for visible peristaltic waves (often indicates obstruction).
   4. Inspect area around anus for fissures or polyps. Inspect skin for diaper rash.
C. Auscultation (be sure to do before palpation).
   1. Listen to all four quadrants.
   2. High-pitched, "tinkling" sounds indicative of diarrhea or gastroenteritis.
   3. Children's bowel sounds often "hyperactive."
D. Percussion.
   1. Tympany normally heard throughout abdomen.
   2. Dullness usually along right costal margin to 1–3 cm below.
   3. Dullness around symphysis pubis indicative of full bladder and is normal.
E. Palpation.
   1. Palpate last any areas identified as painful.
   2. Ticklish children can place their hand under examiner's to palpate.
   3. Spleen tip can be felt 1–2 cm below left costal margin during inspiration in infants and young children.
   4. Kidneys may be palpable in neonates, rarely in any other age group.
   5. Sigmoid colon may be felt as a tender, sausage-shaped mass.
   6. Palpate for inguinal and femoral hernias.
F. Assess hydration status.
   1. Skin color, temperature, turgor, fontanelles.
   2. Recent intake and output history.
G. Nutritional status.
   1. Failure to gain weight—evaluate growth patterns on chart.
   2. Abnormal stools, pattern, recent changes.
   3. Usual diet.

Diagnostic Procedures

For additional GI tests, please refer to Chapter 11.

Oropharyngeal Motility (Swallowing) Study

A. Child is given small amounts of a liquid containing barium to drink with a bottle, spoon, or cup.
B. A series of x-rays are taken to evaluate what happens as child swallows the liquid.

Ultrasound

A. High-frequency sound waves create computer-generated images of blood vessels, tissues, and organs; used to view internal organs as they function.
B. Helpful in diagnosing appendicitis and structural abnormalities.

Colonoscopy

A. Colonoscope is inserted through the rectum up into the colon.
B. The colonoscope allows the physician to see the lining of the colon, remove tissue for further examination, and possibly treat some problems that are discovered.
C. Client may require conscious sedation.

Endoscopic Retrograde Cholangiopancreatography

A. Procedure allows the physician to diagnose and treat problems in liver, gallbladder, bile ducts, and pancreas.
B. Combines x-ray and use of an endoscope—guided through the mouth and throat, esophagus, stomach, and duodenum.
C. Tube is then passed through scope and a dye is injected that allows internal organs to appear on x-ray.

Esophagogastroduodenoscopy (Upper Endoscopy)

A. Esophagogastroduodenoscopy (EGD) allows physician to look at inside of the esophagus, stomach, and duodenum.
B. Endoscope allows physician to view inside of this area of the body and to insert instruments through a scope for removal of a sample of tissue for biopsy (if necessary).

Esophageal pH Monitoring

A. Measure acidity inside of esophagus—helpful in evaluating gastroesophageal reflux disease (GERD).
B. A thin plastic tube is placed into a nostril, guided down the throat and then into esophagus. The tube stops just above lower esophageal sphincter.

C. At end of the tube inside the esophagus is a sensor that measures pH or acidity.
D. The other end of the tube (outside body) is connected to a monitor that records the pH levels for a 12- to 24-hour period.
   1. Normal activity is encouraged during the study, and a diary is kept of symptoms experienced or activity that might be suspicious for reflux, such as gagging or coughing.
   2. The pH readings are evaluated and compared to child's activity for that time period.

Anorectal Manometry
A. Helps determine strength of muscles in rectum and anus and is helpful in evaluating anorectal malformations and Hirschsprung's disease, among other problems.
B. A small tube is placed into rectum, and pressures inside the anus and rectum are measured.

Esophageal Manometry
A. Helps determine strength of the muscles in the esophagus.
B. Useful in evaluating gastroesophageal reflux and swallowing abnormalities.
   1. Small tube is guided into the nostril, then into the esophagus.
   2. The pressure that esophageal muscles produce at rest is then measured.

✦ **Barium Enema**
A. A procedure in which a barium mixture is placed in the large intestine via a rectal catheter for x-ray visualization of the entire large intestine.
B. Nursing responsibilities prior to procedure.
   1. Cleanse the bowel through enemas.
   2. Restrict diet (clear fluids for 24 hours).
   3. Prepare child and family through teaching.
C. Nursing responsibilities following procedure.
   1. Avoid impaction from barium.
      a. Provide child with large fluid intake.
      b. Administer laxative or cleansing enemas.
   2. Advise parents and child that stools will be white for 24–72 hours following procedure.

✦ **Upper Gastrointestinal Radiography**
A. Radiographic study of esophagus, stomach, and small bowel using barium contrast.
B. Client must be NPO before procedure.
C. Children often are resistant to swallowing barium.

✦ **Small Bowel Follow-Through**
A. Radiographic study of lower small intestine using sequential films as barium contrast progresses.
B. Test may take up to 90 minutes depending on intestinal transit time, sequential films taken.

✦ **Liver Biopsy**
A. Many liver diseases are diagnosable only by direct biopsy.
B. Sample of liver tissue is obtained with large-bore needle.
C. Requires sedation per institutional protocol.
D. Child must have normal coagulation studies or receive vitamin K or fresh frozen plasma with procedure.

✦ **Cholangiography**
A. Variety of tests to examine gallbladder and biliary tree.
B. Contrast medium may be administered orally and/or IV, or pushed into biliary tree from duodenal endoscope or directly injected into liver.

System Implementation

A. Evaluate vital signs.
   1. Increased temperature and pulse are signs of infection.
   2. If significant dehydration has occurred, respirations and heart rate may be rapid.
B. Maintain hydration status.
C. Use contact precautions for child with vomiting or diarrhea until the causative organism is identified, then isolate depending on the organism identified.
D. Maintain nutritional status.
   1. Compare child's growth with standardized growth chart.
   2. Evaluate food intake and meal pattern; vomiting pattern.
   3. Record stooling pattern and reaction to feedings. (If fatty, bulky stools, assess for malabsorption problem.)
   4. Evaluate laboratory results of stool culture.
   5. Determine child's likes and dislikes and orient diet accordingly.
   6. Allow bottle if child regresses and is comforted by sucking.
   7. Allow between-meal snacks that are both nutritious and fun (Popsicles, fruit bars).
E. Provide meticulous skin care, especially if diapered.

ANATOMIC DEFECTS

Cleft Lip

✦ *Definition*: A congenital defect that involves a fissure resulting from incomplete merging of embryonic processes that normally form the face or jaws. The development of a cleft lip is usually considered to be of multifactorial origin, but may be familial.

Characteristics

A. The prevalence of cleft lip and/or cleft palate is more common among Asians and Native Americans.
B. Cleft lip is more common in males than females.
C. Incidence of isolated cleft lip (CL) is about 1 in 700–800, may occur with cleft palate.
D. Cleft lip is readily diagnosed through inspection of the lip. Diagnosis may also be made in utero with ultrasound.

Assessment

A. Assess respiratory status.
B. Assess for adequate nutrition.
C. Assess vital signs for baseline data.
D. Assess for parent–child bonding because of the child's altered appearance.

Implementation

✦ A. Prior to surgical repair.
  ✦ 1. May use special feeding techniques, obturators, unique nipples and feeders, or a syringe with tubing to administer feeding; may use a regular or soft nipple or a crosscut nipple. Breastfeeding may be possible.
  ✦ 2. A soft compressible bottle will prevent the child from having to suck vigorously because the milk can be squeezed into the mouth. A longer nipple may allow the milk to be swallowed without entering the nose.
  3. Place nipple on opposite side from cleft.
  4. Feed the child slowly and provide short periods of rest for swallowing. Burp frequently.
  5. Advise parents that babies will be "noisy eaters."
  6. Mouth should be rinsed with water after feeding.
✦ B. Postoperative care. (Surgery usually done by 3 months of age.)
  1. Observe for respiratory distress and swelling of tongue, nostrils, and mouth.
  2. Avoid circumstances that will cause crying.
  3. Watch for hemorrhage.
  4. Use elbow restraints and provide supervised rest periods to exercise arms.
  5. Secure lip-protecting device used to prevent trauma to suture site.
  6. Modify feeding technique to adapt to surgical site, feeding upright, and teaching parents in preparation for home care.
  7. After feeding, keep infant upright to decrease chance of aspiration.
  8. Clean the suture line as directed by the surgeon to prevent crust formation on suture line. Often normal saline is used to rinse followed by antibiotic ointment.
  9. Lay infant on unoperated side or back with support; goal is to prevent rubbing suture site on the sheet.
C. Support family and promote bonding.
  1. Provide education and support to families of neonates.
  2. Prepare for discharge needs.

Cleft Palate

✦ *Definition*: A birth defect in which the primary and secondary palatine plates—openings between nose and roof of mouth—fail to close properly. It is usually considered hereditary. Types include clefted soft palate, clefted hard palate, and a cleft that infrequently involves the nose.

Characteristics

A. Incidence of cleft palate (CP) (without CL) is approximately 1 in 2000.
B. Cleft palate is more common in females.
C. Diagnosis may be made in utero with ultrasound and by a more complete examination during the immediate newborn period.

Assessment

✦ A. Assess for difficulty in sucking.
B. Formula coming out of the nose; because the volume of liquid with colostrum is only a small amount, breast milk coming out of the nose is not as noticeable.
C. Assess for increase in upper respiratory infections.
D. Evaluate mother–child relationship (e.g., mother feels frustrated and baby is fussy).

✦ Treatment

A. Surgical repairs: Some surgeons prefer to wait until the palate has had the opportunity to grow or child is 9–18 months old. Most prefer to operate prior to the onset of speech.
B. Repair in stages: may be required with extensive defects.
C. Surgical repair usually needs to be followed by treatment from an orthodontist, a speech therapist, and a plastic surgeon.

Implementation

A. Care prior to surgery.
  1. Observe for respiratory infections.
  2. Ensure that child is sitting up when fed.
  3. Provide frequent mouth care.
  ✦ 4. Introduce the method of postoperative feeding; for example, have the child drink from a cup, or feeder to be used after surgery.
  5. Practice arm restraints on the child, so that child becomes familiar with them.

6. Prepare parents and give them support.
7. Before surgery, devices such as a Latham device may be placed in the mouth to expand and realign the palate or to decrease the size of a wide lip cleft.

B. Postoperative care.

✦ 1. Immediate postoperative period.
   a. Place child on abdomen to prevent aspiration of mucus or blood.
   b. Observe for signs of airway obstruction and have suction apparatus at the bedside.
   c. Observe for shock or hemorrhage.
   d. Utilize elbow restraints but release every 2 hours for 10–15 minutes one side at a time, while distracting the child.
   e. Rinse suture line frequently.
   f. Oral packing may be in place for 2–3 days.

✦ 2. Second postoperative day prior to discharge.
   a. Start introducing fluids by cup; avoid straws and spoons. Avoid other hard objects (suction catheters, tongue blades, pacifiers). Do not brush the teeth for 1–2 weeks after surgery.
   b. Advance diet as tolerated. Usually child is discharged on a blenderized or soft diet.
   c. Rinse sutures following feedings.

3. Provide support and education to families.

Esophageal Atresia with Tracheoesophageal Fistula

✦ *Definition*: Failure of the esophagus to be continuous from the pharynx to the stomach. Tracheoesophageal fistula (TEF) is an abnormal connection between the trachea and the esophagus. Defects may occur separately or in combination, and are rapidly fatal if not detected.

Characteristics

A. Anomaly occurs during embryonic development. Cause is unknown. (Occurs in about 1 in 3000 births.)

✦ B. There are several different types of esophageal atresia.
   1. The most simple type involves the narrowing of the esophagus.
   2. The second type involves the upper and lower segments of the esophagus that are not attached to each other, creating two blind pouches.
   3. Other types involve fistulas between the upper and/or lower segments of the esophagus and trachea.

C. Fistulas may be present when the esophagus is patent, when it is narrowed, or when it is not joined to its distal portion.

D. Infants at risk for TEF: premature infants and those with polyhydramnios.

Assessment

✦ A. Assess for excessive amounts of mucus with much drooling.

✦ B. Assess for coughing, choking, and cyanosis when fed (the three Cs of TEF).

✦ C. Assess infant status to ingest formula.
   1. Early recognition of the defect is imperative to prevent aspiration.
   2. Inability to pass NG tube at birth indicates esophageal atresia.

D. Check to see if food is expelled through the nose immediately following feeding.
   1. Assess severe coughing and choking.
   2. Assess struggling with resulting cyanosis.

E. Evaluate frequent respiratory problems; apnea may occur.

F. Check for abdominal distention caused by inspired air going into the stomach.

Implementation

✦ A. Maintain patent airway; observe for signs of respiratory distress.

✦ B. Prevent aspiration pneumonia.
   1. Discontinue oral fluids immediately (NPO status).
   2. Position infant at 30-degree head elevation to decrease potential of aspiration, depending on the type of esophageal atresia/fistula.
   3. Change position every 2 hours.
   4. Suction accumulated secretions frequently.

✦ C. Initiate and monitor IV fluids as ordered to prevent dehydration.

✦ D. Prepare for gastrostomy tube insertion (decompresses stomach and prevents aspiration of gastric contents from fistula).
   1. Administer gastrostomy tube feedings.
   2. Observe for patency of all tubes. Do not clamp gastrostomy tube.
   3. Use gentle suctioning of the upper pouch to minimize aspiration of saliva.
   4. Monitor the gastrostomy tube in place until total repair is performed.

Postoperative Implementation

✦ A. Maintain patent airway.
   1. Suction secretions as necessary.
   2. Position for optimal ventilation.
   3. Administer oxygen as needed.
   4. Maintain care of chest tubes.

✦ B. Prevent infection.
   1. Provide meticulous care of operative site.
   2. Observe for signs of inflammation or infection.

C. Maintain fluid and electrolyte balance.
   1. Monitor IV fluids; record intake and output.
   2. Record weight daily.
   3. Measure specific gravity of urine.

D. Maintain infant in radiant warmer with nebulized humidity.

✦ E. Provide adequate nutrition.
   1. Administer gastrostomy feedings (usually after third postoperative day).
   2. Continue until infant tolerates oral feedings, based on condition of child and degree of healing.
   3. Monitor gradual increase in feedings and elevation of gastrostomy tube.
      a. Feed slowly to allow for swallowing and to provide infant rest.
      b. Position upright to prevent aspiration.
      c. Burp frequently.

F. Meet sucking needs by providing a pacifier (if approved by physician).

G. Prepare parents for discharge.
   1. Teach techniques parents will need for home care: tube feedings, suctioning, etc.
   2. Educate parents to look for signs of complications such as esophageal constriction: difficulty in swallowing, choking, and breathing difficulties.
   3. Provide support and preparation for future procedures.

Imperforate Anus

✦ *Definition*: A congenital abnormality in the formation of the anorectal canal or in the location of the anus, resulting in the rectum ending blindly. A fistula or a severe narrowing of the anal canal.

Assessment

✦ A. Assess patency of anal opening with small finger or soft catheter if the following symptoms are present.
   1. No meconium stool within 24 hours.
   2. Green-tinged urine (presence of meconium in the urine).
   3. Progressive abdominal distention.
   4. Vomiting.
   5. A flat perineum and absence of an intergluteal groove.

B. Assess for presence of other anomalies if imperforate anus is present.

C. Observe for signs of abdominal distress.

Implementation

✦ A. Maintain NPO status when anomaly is diagnosed, monitor IVs.

B. Check vital signs frequently and hydration.

C. Maintain temperature by using Isolette or radiant warmer.

✦ D. Provide postoperative care.
   1. Prevent infection of operative site.
   2. Provide colostomy care if colostomy is performed and prevent skin breakdown.
   3. Check for return of peristalsis so that oral feedings may be started.

E. Provide supportive care to parents before and after surgery.

F. Provide education and appropriate referrals for follow-up.

OBSTRUCTIVE DISORDERS

Obstruction of the Bowel

✦ *Definition*: Cause of the obstruction of the bowel could be mechanical or muscular. If congenital intestinal obstruction occurs, may be life-threatening.

Assessment

A. Absent or abnormal stools.

B. Presence of vomiting—may be projectile.

✦ C. Distended abdomen.
   1. Presence of slightly protuberant abdomen is normal.
   2. If abdomen is distended or excessively hard, evaluate for possible obstruction.
   3. Monitor respiratory status carefully as abdominal distention impinges on ability to expand diaphragm.

✦ D. Hyperactive bowel sounds above level of obstruction, hypoactive or absent below.

Implementation

✦ A. Passage of meconium should occur during first 3 days after birth.
   1. If not, assess the child for abdominal distention.
   2. If more than 20 mL of gastric contents is aspirated through nasogastric tube, assess for lower intestinal obstruction.
   3. Meconium ileus highly associated with cystic fibrosis.

✦ B. Attempt to insert a nasogastric tube into stomach and aspirate contents as ordered.

C. Evaluate for excessive mucus and choking.

D. Observe for presence of cyanosis and choking on first feeding.

✦ E. Check for projectile vomiting following feedings.
   1. Evaluate infant's diet. (Overfeeding can cause projectile vomiting.)
   2. If vomiting occurs, evaluate for signs of infection or increased intracranial pressure.

3. If these conditions are not present, vomiting may be a sign of an obstruction.

F. Document evidence of abdominal pain.

✦ G. Evaluate for absent or abnormal stooling cycle.
1. If the child has very harsh intermittent crying or continual crying, evaluate the stool cycle for normal or abnormal stools.
2. Ribbon-shaped stools; bulky, foul-smelling stools; or other abnormalities can be signs of a gastrointestinal abnormality.

Hypertrophic Pyloric Stenosis

✦ *Definition*: The pyloric canal, which is at the distal end of the stomach and connects with the duodenum, is greatly narrowed. This narrowing is believed to be caused by a combination of muscular hypertrophy, spasms, and edema of the mucous membrane. Occurs in about 5 in 1000 males and 1 in 1000 females.

Assessment

✦ A. Assess for vomiting in newborn. Vomiting usually begins 30–60 minutes after feedings.
1. Progressively increases in frequency and force; usually begins at around 1 week of age.
✦ 2. Projectile vomitus may contain mucus and blood, but usually not bile.
3. May progress to complete obstruction.

✦ B. Check for constant hunger, fussiness, frequent crying, colicky abdominal pain, and abdominal distention.

✦ C. Palpate epigastrium just right of umbilicus for classic "olive"-shaped mass.

D. Evaluate stools for decrease in size and number, and assess for constipation.

✦ E. Observe for peristaltic waves: frequently noted passing from left to right during or immediately following a feeding.

F. Assess for later symptoms, which may include malnutrition, dehydration, electrolyte imbalance, and alkalosis.

G. Evaluate growth since birth for failure to thrive.

Implementation

✦ A. Monitor infant for metabolic alkalosis, and electrolyte imbalances (decreased sodium, decreased chloride, and decreased potassium) from vomiting

✦ B. Provide preoperative care.
1. Ensure accurate regulation of IV to prevent dehydration and correct electrolytes.
2. Accurately record intake and output.
3. Observe feeding behavior for definitive diagnosis.
4. Prepare for possible diagnostic procedures (upper GI or abdominal ultrasound).
5. Support mother and infant.

✦ C. Maintain proper insertion and observation of gastric tube for gastric decompression.
1. Measure length of tube externally on infant from bridge of nose to ear to stomach.
2. Check position of the tube. Infant should show no sign of respiratory difficulty with external end of tube occluded.
3. Aspirate gastric contents and check pH. If < 3 (acidic), tube is in stomach.
4. Keep head of bed flat or slightly elevated.

✦ D. Perform nursing care following surgery. Follow standard postoperative procedures for pyloromyotomy.
1. Maintain patent airway.
2. After anesthesia has worn off, place in semi-Fowler's position.
3. Begin feedings 4–6 hours after surgery and progress slowly.
4. Keep a careful record of feeding behavior to assist physician in determining progress of feedings. (Most infants may vomit in first 24–48 hours after surgery.)
5. Do not handle infant excessively after feeding.
6. Observe for bleeding at wound site or signs of shock.

Intussusception

✦ *Definition*: A segment of the bowel telescopes into the portion of bowel immediately distal to it. Probably results from hyperactive peristalsis in the proximal portion of the bowel, with inactive peristalsis in the distal segment. Usually occurs at the junction of the ileum with the colon, generally in children between 3 and 12 months old, or before age 2. Common in children with cystic fibrosis and celiac disease, but usual cause is unknown.

Assessment

✦ A. Assess for sudden onset of acute abdominal pain.

✦ B. Evaluate for sudden onset of vomiting, abdominal pain, and distention; and later, infrequent stools with blood and mucus (appears like currant jelly).

✦ C. Child frequently pulls knees to chest, indicating pain; may appear normal between painful episodes.

D. Assess level of hydration.

✦ E. Abdomen is distended and tender.

✦ F. Sausage-shaped mass palpable in upper right quadrant.

G. Right lower quadrant "empty."

✦ H. Passage of "normal" brown stool indicates intussusception has reduced.

✦ Implementation

✦ A. Prepare child for barium enema x-ray, which frequently reduces the bowel; making surgery unnecessary if successful.

B. Observe and monitor for recurrence of symptoms. Surgery may need to be performed for bowel reduction.
C. Observe and maintain IV fluid and electrolyte replacement.
D. Perform nasogastric suction to deflate the stomach to prevent vomiting.
E. Gradually reintroduce fluids and foods.
F. Maintain care of operative site following surgery.
G. Prepare family for discharge.

DISORDERS OF MOTILITY

Acute Diarrhea (Acute Gastroenteritis)

✦ *Definition*: Diarrhea occurs when there is a disturbance of the intestinal tract that alters motility and absorption, and accelerates the excretion of intestinal contents (3–30 stools per day). Fluids and electrolytes that are normally absorbed are excreted, causing electrolyte imbalances. Most infectious diarrheas in the United States are caused by a virus (usually rotavirus). Bacterial causes include *Salmonella* groups, *Shigella*, *Yersinia*, *Campylobacter*, and *Clostridium difficile*. Diarrhea can be a separate disease, or it may be a symptom of another disease. Acute diarrhea becomes chronic if it lasts more than 2 weeks.

Assessment

A. Obtain history; ascertain exposures to allergens, new foods; infectious agents or current medications, exposure to rotavirus. Vaccination against rotavirus during the first year of life has decreased the incidence of gastroenteritis from this cause. *Giardia* is the pathogen seen in children who attend day care.
✦ B. Assess child's general state: LOC, activity, and vital signs.
✦ C. Assess quantity and quality of stools.
   1. Assess for increased rate of peristalsis carrying intestinal contents.
      a. Blood, pus, or mucus in stools, which are often green in color.
      b. Increase in frequency of stools of watery consistency.
✦ D. Lab tests ordered when child is moderately to severely dehydrated.
   1. Stool cultures.
   2. Stools examined for ova and parasites if cultures are negative.
   3. CBC, electrolytes, hemoglobin and hematocrit, blood urea nitrogen (BUN), and creatinine indicated if admission is required.
✦ E. Assess amount of dehydration.

Implementation

✦ A. Intravenous fluids begun immediately with severe diarrhea and dehydration. Admission to hospital is usually warranted to replace fluid deficit and correct electrolytes.
B. Provide small, frequent offerings of oral rehydration solutions (ORS) such as Pedialyte throughout course, unless vomiting is severe. The rate of replacement may range from 50–100 mL/kg over a 4–6 hour period, even if the child is vomiting. Give 5–10 mL of ORS every 2 minutes.
✦ C. Breastfeeding should be continued throughout the disease and ORS given to replace ongoing losses.
D. Early reintroduction of the normal diet is becoming common and beneficial in reducing the number of stools and decreasing weight loss.
   1. Discourage the administration of juices, broth, gelatins, or BRAT diet.
   2. Cow's milk and milk-based formulas are usually included unless clearly not tolerated.
✦ E. Maintain contact isolation until causal organism or other factors are determined in a child who is in diapers or standard precautions as needed.
   1. Encourage careful hand washing at home.
   2. Dispose of stools and diapers in proper containers.
F. Maintain careful ongoing assessment and management of dehydration level and acidosis.
G. Complete accurate recording of the number and consistency of stools.
H. Maintain excellent skin care to prevent excoriation caused by alkaline stools; apply appropriate skin protectants (such as zinc oxide).
I. Explain to parents that antidiarrheals are not indicated for diarrhea in children as it keeps the causative agent in the GI tract longer.

Dehydration

Definition: Dehydration can be isotonic, hypotonic, or hypertonic (loss of water with resulting sodium excess). Fluid volume deficit is the nursing diagnosis used when water and sodium losses are proportional, which is isotonic dehydration. Most losses in children are isotonic; "the sum of all losses" adds up to being isotonic. The type of dehydration can be determined by electrolyte values and subtle clinical manifestations.

Assessment

✦ A. Check for increased heart rate and respiratory rate.
B. Assess for increased irritability and fussiness.
✦ C. Assess for depressed fontanelles and eyes that appear sunken.
D. Assess for dry mucous membranes—become dried and cracked.

E. Note dry skin with loss of normal elasticity.
F. Note presence or absence of tears.
G. Assess capillary refill (should be 2–3 seconds).
✦ H. Assess for decreased urine.
1. Urine may be dark in color (concentrated).
2. Increase in urine specific gravity (greater than 1.020 in infants).
3. Acidosis is a common result, with serum CO_2 less than 17.

Implementation

A. Maintain strict recording of I&O. Expect > 2–3 mL/kg output in infants and > 1–2 mL/kg in children.
✦ B. Administer oral rehydration therapy (ORT).
1. See ORS guidelines in section on gastroenteritis.
2. Do not use Gatorade in infants and young children.
3. Approximately 60–120 mL ORS/kg per each diarrheal stool for children under 10 kg and 120–240 mL ORS/kg for child over 10 kg.
C. Continue regular diet while rehydrating.
D. Vomiting children should be given ORS in frequent, small amounts.
✦ E. Severe dehydration (loss of 15% circulating volume) must be treated urgently (shock). Treatment is guided by the serum sodium levels.
F. Parenteral IV fluids indicated if child is severely dehydrated, unable to take fluids by mouth, and continuing fluid replacement is needed. Fluid boluses of 10–20 mL/kg are ordered. NaCl 0.9% or lactated Ringer's solution is ordered.
G. Continue to closely monitor electrolytes.
H. Maintain skin integrity; monitor for diaper rash.
I. Family teaching (hand washing, avoid high-sugar containing fluids to rehydrate, avoid BRAT diet).

Constipation

Definition: The infrequent passage of stools associated with difficulty in passing stool, abdominal pain, passage of small, hard stools sometimes streaked with blood over a period of 2 weeks. Constipation may be caused by changes in diet, dehydration, lack of exercise, emotional stress, certain drugs, pain from anal fissures, inadequate or inconsistent toilet training, or excessive milk intake. May be associated with encopresis or fecal incontinence.

Assessment

A. Obtain history of usual bowel habits and characteristics.
✦ B. Assess diet habits, over-the-counter and prescription medications taken recently, and any used for constipation.
✦ C. Observe for passage of meconium in newborns (possible meconium ileus or Hirschsprung's disease).
D. Closely evaluate diet in constipated infants and older children.
E. Investigate bowel patterns and timing of stools with older children.

Implementation

✦ A. Dietary counseling appropriate to age. May refer to dietitian.
1. Encourage fluid intake and diet higher in fiber.
2. Eliminate any foods known to be constipating.
✦ B. Establish regular time for bowel movements.
1. Encourage child to *take time* to have bowel movement daily (may use times for child to practice sitting longer).
2. Establish a routine time for bowel movements (e.g., 10–15 minutes after a meal).
C. If constipation is persistent, then the healthcare provider will initiate treatment.
1. First disimpaction—enemas, laxatives, or stool softeners.
2. Education about the causes of constipation.
3. Maintenance with laxatives—mineral oil, lactulose, or Miralax (polyethylene glycol 3350).
4. Dietary changes, including limiting milk, increasing water, fiber, and residue.
5. Changing the retention habit.
6. Establish a routine.

Hirschsprung's Disease (Congenital Aganglionic Megacolon)

Definition: A disease caused by the congenital absence of parasympathetic nerve ganglion cells in the distal bowel.

Characteristics

✦ A. The distal portion of the bowel is unable to transmit regular peristaltic waves, which are coordinated with the proximal portion of the bowel.
✦ B. When a stool reaches the diseased area, it is not transmitted down the colon, but accumulates in the segment just proximal to this area, forming a functional obstruction.
C. The bowel above the obstructed portion eventually becomes hypertrophied in its attempts to transmit the stool.

Assessment

✦ A. Assess for failure to pass meconium in newborn; may not be diagnosed until later in infancy or childhood.
B. Assess for symptoms of bile-stained vomiting and reluctance to feed.
✦ C. Evaluate for signs of intestinal obstruction.

D. Evaluate for signs of constipation and abdominal distention.
E. Assess for foul odor of breath and stool.
F. Note that in an older infant or child symptoms of constipation, offensive odor, and ribbonlike stools may be present.

✦ **Treatment**

A. The majority of children require surgical rather than medical treatment. Children beyond the newborn phase may require bowel emptying with enemas and antibiotics to reduce colonic flora preoperatively.
B. The first stage of treatment is usually a transverse or sigmoid colostomy.
C. The child is then brought back to optimal health and nutritional status.
D. The next procedure consists of dissection and removal of the nonfunctional bowel and anastomosis.
E. Final treatment is closure of temporary colostomy.

Implementation

A. Prior to diagnosis, observe carefully for all gastrointestinal manifestations of the disease and report them accurately.
✦ B. Prior to the colostomy procedure.
   1. Cleanse bowel.
      a. Oral antibiotics.
      b. Liquid diet.
      c. Colonic irrigation—saline.
      d. Measure abdominal girth when taking vital signs.
   2. Prepare parents for the procedure.
      a. Clarify the surgical technique.
      b. Describe stoma.
      c. Prepare for care of the child with a colostomy.
      d. Give parents the opportunity to express their feelings about the procedure.
✦ C. Postoperative care.
   1. Maintain optimal nutrition.
   2. Closely observe stools for reestablishment of normal elimination pattern.
   3. Maintain skin care of colostomy and anal areas.
   4. Involve older children in care of ostomy—provide support and referrals to parents in discharge preparations.

Gastroesophageal Reflux Disease

✦ *Definition*: The transfer of gastric contents into the esophagus. A significant problem in approximately 1/300 to 1/1000 children. Occurs as result of relaxation of lower esophageal sphincter.

Assessment

A. Begins in infancy, but only a small percentage continue to have gastroesophageal reflux disease (GERD) after the first year of life as the lower esophageal sphincter matures.
B. History.
   1. Previous TEF surgery, CNS disease, asthma, CF, scoliosis, or developmental delay.
   2. Frequent respiratory symptoms from aspiration.
✦ C. Symptoms.
   1. Stomach contents in esophagus damage the esophageal lining. In some children, the stomach contents go up to the mouth and are swallowed (or potentially aspirated) again.
   2. When refluxed material passes into back of the mouth or enters airway, child may become hoarse, have a raspy voice, or have a chronic cough.
   3. Other symptoms include recurrent pneumonia, wheezing, irritability, choking during feedings, apnea in newborns, difficult or painful swallowing, vomiting, sore throat, weight loss or poor weight gain, and heartburn (in older children).
D. Diagnosed by pH probe test of esophageal acidity, upper GI, endoscopy, and swallowing studies.

Implementation

✦ A. Modify feedings to small and frequent feedings—may use thickening agents.
✦ B. Infants are generally positioned upright or prone during waking hours. (Note placed prone when sleeping because of recommended supine position to prevent SIDS—only exception is if risk of aspiration is greater than risk of SIDS). Avoid placing infants in "infant seats" because slumping posture increases reflux.
✦ C. Pharmacologic therapy (most commonly used in children).
   1. H2 blockers: Pepcid (famotidine) or Zantac (ranitidine).
   2. Proton-pump inhibitors (PPIs) often used to block production of stomach acid—Prilosec (omeprazole), Prevacid (lansoprazole), Protonix (pantoprazole).
   3. Prokinetic agents to improve peristalsis and stimulate gastric emptying: Reglan (metoclopramide).
D. Surgery indicated for severe cases (Nissen fundoplication).
   1. Often combined with pyloroplasty.
   2. Numerous potential complications.
E. Support and education for family.
   1. Feeding techniques.
      a. Have child eat more frequent smaller meals; avoid eating 2–3 hours before bed.

   b. Raise head of child's bed 6–8 inches by putting blocks of wood under bedposts. Just using extra pillows will not help.
   c. Children should avoid carbonated drinks, chocolate, caffeine, and foods that are high in fat or contain a lot of acid (citrus fruits) or spices.
2. Positioning.
3. Respite care and support for parents.
4. Continued reinforcement of therapeutic regimen; teach importance of administering medications in proper relation to feedings and therapeutic regimen.
5. CPR training.
6. Discharge planning and appropriate referrals.

INFLAMMATORY DISEASES

Appendicitis

See Chapter 8.

Inflammatory Bowel Disease

✦ *Definition*: An inflammatory disease of the colon and the rectum in which the mucous membrane becomes hyperemic, bleeds easily, and tends to ulcerate. The exact etiology is unknown; however, the incidence is highest in young adults and middle-age groups. Encompasses ulcerative colitis and Crohn's disease.

✦ Assessment

✦ A. Assess for diarrhea or bloody diarrhea (ulcerative colitis).
B. Evaluate for weight loss—can be moderate to severe.
C. Assess for rectal bleeding.
D. Evaluate for abdominal pain, anorexia, nausea, and vomiting.
E. Assess for presence of anemia.
F. Assess for fever and dehydration.
G. Assess for oral aphthous ulcers.
H. Evaluate for delayed growth and development.
I. Evaluate for fatigue, joint pain.
J. Assess for fistula formation (Crohn's).

Implementation

A. Assist with diagnostic procedures; rule out irritable bowel syndrome.
   1. Upper GI with small bowel follow-through.
   2. Colonoscopy with tissue biopsy.
   3. Ultrasound or CT of abdomen.
   4. Stool for occult blood and white blood cells (WBCs), ova and parasites, *Clostridium difficile*.
   5. CBC, electrolytes, calcium and phosphorus, zinc, and magnesium, total protein, albumin, ESR, C–reactive protein, and liver enzymes.
   6. Ophthalmic exam (Crohn's).
   7. Serum iron, total iron binding capacity, ferritin (ulcerative colitis).

✦ B. Control inflammation and treat symptoms.
   1. Supervise anti-inflammatory medication regimen, which may include (oral, IV, rectal)
      a. Aminosalicylates: Azulfidine (sulfasalazine) or Apriso (mesalamine).
      b. Immunosuppressives: Neoral (cyclosporine), Rowasa (5-ASA), and Imuran (azathioprine).
      c. Corticosteroids.
      d. Remicade (infliximab) therapy (tumor necrosis factor blocker) for Crohn's.
   2. Antibiotics may be used to prevent or treat infections.
   3. Provide adequate hydration with intravenous therapy and oral fluids as indicated.
   4. Pain medication.
   5. Antidiarrheals.

✦ C. Provide rest to intestinal tract.
   1. Observe for amount of bowel activity and symptoms of bleeding and hyperactive peristalsis.
   2. Administer sedatives sparingly; observe for side effects.

✦ D. Support nutrition.
   1. Encourage well-balanced, high-protein, high-calorie diet.
   2. May require special formulas, continuous NG feedings at night, especially successful with elemental formulas.
   3. Total parenteral nutrition (TPN) may be necessary for complete bowel rest.
   4. Record I&O.
   5. Institute vitamin therapy, monitor Hgb, Hct, iron levels, folic acid.
   6. Low fiber, low-residue, low-fat, milk-free diet may be useful (ulcerative colitis).
   7. May avoid sharp cheeses, highly spiced foods, smoked or salted meats, fried foods, raw fruits, and vegetables (foods omitted determined by individual).

E. Surgical treatment may be necessary.
   1. Colectomy may be needed in severe cases, is NOT curative in Crohn's disease.
   2. Variety of procedures possible, some preserve normal defecation.

F. Provide counseling and education to client and family.
   1. Educate child about diet, medication, and symptoms of bleeding, management of chronic disease.
   2. Observe for signs of psychological problems; adaptation to chronic disease; social isolation and poor self-esteem because of need to be near bathroom; initiate appropriate referral if necessary.

INTESTINAL PARASITES

Definition: Worms affect not only the gastrointestinal system, but also are found in the lungs, heart, and other body systems. As parasites, they feed off the host, which leads to a variety of symptoms. More common in children because of frequent hand-to-mouth activity.

Roundworms (*Ascaris Lumbricoides*)

Characteristics

✦ A. Eggs are laid by the worm in the gastrointestinal tract of any host and passed out of the body in feces.
B. After the worms have been ingested, egg batches are laid.
C. Larvae in the host invade lymphatics and venules of the mesentery and migrate to the liver, the lungs, and the heart.
D. Larvae from lungs reach the host's epiglottis and are swallowed; once in the gastrointestinal tract, the cycle is repeated—larvae mature and mate, and the female lays eggs.

Assessment

✦ A. Assess for atypical pneumonia.
✦ B. Assess for gastrointestinal symptoms: nausea, vomiting, anorexia, and weight loss, stooling patterns.
C. Determine if insomnia is present.
D. Evaluate for signs of irritability.
E. Assess for presence of intestinal obstruction, vomiting, and dehydration.
F. Diagnosis confirmed with fecal smear for ova and parasites.

Implementation

A. Prevent infection through the use of a sanitary toilet.
B. Provide hygiene education of the family.
C. Dispose of infected stools carefully.
✦ D. Administer medications: Vermox (mebendazole) or Albenza (albendazole) (treat the entire family).

Pinworms (Enterobiasis)

Characteristics

✦ A. A common parasite infection in United States, especially in warm climates.
B. Eggs are ingested or inhaled.
C. Eggs mature in cecum, then migrate to anus.
✦ D. Worms exit at night and lay eggs on host's skin.

Assessment

A. Assess for acute or subacute appendicitis.
B. Evaluate for eczematous areas of skin.
C. Determine if irritability is present.
D. Ascertain loss of weight and anorexia.
E. Determine if child suffers from insomnia.
✦ F. Diagnose condition by tape test: Place transparent adhesive tape over anus and examine tape for evidence of worms.

Implementation

✦ A. During treatment, maintain meticulous cleansing of skin, particularly anal region, hands, and nails.
B. Ensure that bed linens and clothing are washed in hot water.
C. May use topical ointment to relieve itching.
D. Teach careful hygiene as a preventative measure.
E. Instruct all infected persons living communally that they must be treated simultaneously.
✦ F. Medication: Pin-X (pyrantel pamoate); drug of choice is Vermox.

Giardiasis

✦ *Definition*: The most common intestinal parasitic pathogen in the United States, this condition is caused by the protozoan, *Giardia lamblia*.

Characteristics

A. Often occurs in children in day care centers (estimates are 9–38%).
✦ B. Major mode of transmission is person-to-person, water (especially mountain lakes and streams), food, and animals.
C. Adults may be asymptomatic, but children usually manifest symptoms.

Assessment

✦ A. Infants and young children.
1. Diarrhea.
2. Vomiting and anorexia.
3. May have failure to thrive.
✦ B. Children over 5 years of age.
1. Abdominal cramps and flatulence
2. Loose stools may be intermittent.
3. Stools may be watery, pale, and smelly.
C. Assess condition through stool for ova and parasites—may need six or more over several weeks.

Implementation

✦ A. The most important nursing measure is to teach prevention—meticulous sanitary practices during diaper changes and cleaning of children.
1. Inform parents of importance of hand washing.
2. Drink water that is purified, especially when near potentially contaminated streams.
✦ B. Administer drugs available for treatment: Flagyl (metronidazole).

HEPATIC DISORDERS

Hepatitis

See adult section on hepatitis, Chapter 8. Hepatitis B vaccination is included in vaccination schedule with the first dose given at birth. Hepatitis A vaccination is recommended for all children beginning at age 1 year.

Biliary Atresia

✦ *Definition*: The atresia or absence of bile ducts outside the liver. A progressive inflammatory process causing intrahepatic and extrahepatic bile duct inflammation and obstruction. Affects between 1 in 10,000 and 1 in 25,000 infants without preference to race or sex.

Assessment

A. Diagnosis based on history, physical exam, and diagnostic evaluation.
✦ B. Early signs: jaundice (may be present at birth—generally evident by 2–3 weeks), dark urine, light-colored stools, hepatomegaly, pruritus, irritability, failure to thrive.
C. Etiology is poorly understood; possibly viral, toxin, or chemical injury or immune mechanism.
D. Gradual deterioration of liver function, loss of intralobular ducts and developing cholestasis, and buildup of bile acids and toxins.

Implementation

✦ A. Early surgery yields highest successes (hepatoportoenterostomy—Kasai procedure); segment of small bowel is anastomosed to resected porta hepatis to facilitate bile drainage.
B. Bile drainage achieved in most clients undergoing surgery in first 2 months of life.
C. Large number still have progressive liver failure and go on to require transplantation.
✦ D. Dietary management: medium chain triglycerides (MCT) oil or Polycose added to formula to increase calories; low-salt diet; supplemental vitamins and minerals: vitamins A, D, E, K; calcium, phosphate, zinc.
E. Diuretics.
F. Bile acid binders such as Questran (cholestyramine) aid in excretion of bile salts and decrease in pruritus. Colloidal oatmeal baths for itching. Wear gloves to prevent scratching.
G. Monitor nutritional intake and growth.
H. Support and education for family.
1. Multidisciplinary process.
2. Appropriate community and support group referrals.

GENERAL DISORDERS

Celiac Disease (Gluten-Induced Enteropathy)

✦ *Definition*: A chronic disease of intestinal malabsorption precipitated by ingestion of gluten or protein portions of wheat or rye flour.

Characteristics

✦ A. A major cause of malabsorption in children, second only to cystic fibrosis. Appears in children from 1–5 years of age.
B. Highest incidence occurs in Caucasians.
✦ C. Major problem is an intolerance to gluten, a protein found in most grains.
✦ D. Basic defect is believed to be an inborn error of metabolism or an autoimmune response.
✦ E. Primary physiological effect is inadequate fat absorption; as disease progresses, it affects absorption of all ingested elements.
F. Long-term effects can be anemia, poor blood coagulation, osteoporosis, and lymphoma.

Assessment

A. Assess age disease occurs: usually when infant begins to ingest grains at age 9–12 months of age.
✦ B. Assess for diarrhea or loose stools: foul-smelling, pale, and frothy.
✦ C. Check for failure to gain weight (usually below 25th percentile on growth charts for weight).
D. Check for abdominal distention.
E. Assess for anorexia.
F. Evaluate behavioral changes: irritability and restlessness.
G. Diagnosis:
1. Immunoglobulin A (IgA) antitissue transglutaminase antibody test or the IgA antiendomysial antibody test.
2. Jejunal tissue biopsy is the definitive test.
H. Observe for celiac crisis.
1. Vomiting and profuse diarrhea (acute and severe).
2. Acidosis and dehydration.
3. May be precipitated by respiratory infection, fluid and electrolyte imbalance, emotional upset.
4. Excessive perspiration.
5. Cold extremities.

Implementation

✦ A. Monitor appropriate diet; "gluten-free" diet necessary.
1. Wheat and rye gluten, as well as barley and oats, are eliminated. Corn, rice, and millet are substituted grain sources.
2. Consultation with a nutritionist.
3. Supplemental vitamins and iron.

✦ B. Instruct parents and child how to recognize impending celiac crisis, how to manage diet at home, and deal with school lunches and meals away from home.
   1. Teach primary symptoms of crisis.
   2. Institute medical intervention to correct dehydration and metabolic acidosis.

✦ C. Prevent infection and precipitating events.

D. Provide support and education for child and family.
   1. Teach diet.
   2. Provide for follow-up by home care nurse and nutritionist for continued teaching and assistance. Assess financial strain of special diet on family.
   3. Explain prognosis: Clinical symptoms decrease with increasing age.
   4. Refer to American Celiac Society, other appropriate community agencies, and support groups.

Obesity

✦ *Definition*: The accumulation of body fat resulting from an excess of caloric intake over caloric output, usually from overeating. Often defined as body weight over 120% ideal weight for height, taking into account lean body weight relative to body fat.

Characteristics

A. Obesity is twice as common in adolescents as it was 30 years ago. In the United States, 17% of children and teens are overweight or obese.

B. Most complications of obesity occur in adulthood, but obese school-age and adolescent children are twice as likely to have high blood pressure and type 2 diabetes.

C. Familial tendencies exist, but most childhood and adolescent obesity is attributed to eating too much and exercising too little.

D. Psychosocial causes of overeating should be identified and treated with counseling. Group counseling for overweight children and adolescents is effective, along with dietary and exercise programs. (See anticipatory guidance for appropriate age throughout chapter starting on page 633.)

✦ E. The impact of childhood obesity becomes most obvious at adolescence, when body image and peer approval become important.

Assessment

A. Assess height and weight according to standard growth and development scale.

B. Risk factors: diet (amount and type of food), inactivity, genetics (other family member are overweight), psychosocial factors, poverty.

C. Screening: BMI > 85th–95th percentile, diabetes (type 2), eating and exercise habits, and looking for other health conditions the child may have.

D. Identify possible hormonal or genetic factors related to the child.

E. Evaluate eating patterns and habits, and food types.

F. Assess length of time child has been obese.

G. Acanthosis nigricans–dark, velvety discoloration in body folds and creases.

H. Evaluate child's and family's feelings and attitudes about obesity.

I. Considerable cultural implications of body size and usual diet.

Implementation

✦ A. Provide a balanced diet with limited calories.
   1. Slow and steady weight loss of 1 pound per week to 1 pound per month.
   2. Set achievable goals and plan for long-term lifestyle and eating changes.
   3. Encourage healthy diet (for the entire family), limiting snacks, fast food, and concentrated sweets, while providing a wide assortment of healthy choices.

B. Set up a routine of daily exercise; frequently, groups for after-school exercise programs can be organized by school nurses.

C. Help the young person work through underlying problems causing or caused by obesity.

✦ D. Provide family counseling—family-centered programs have higher success rates.
   1. Examine the eating patterns of the family. Some cultures have a high proportion of starches; others associate large meals with prosperity.
   2. Suggest the use of positive reinforcement for the adolescent rather than shaming the child.
   3. Have family support child by removing high-calorie foods from their meals.
   4. Child and family must be motivated for weight loss to occur (use motivational interviewing to set mutual goals).
   5. Incorporate cultural values and diet considerations into nutritional plan.
   6. Decrease screen time and increase physical activity.

E. Complications: Type 2 diabetes, metabolic syndrome, high blood pressure, asthma, sleep apnea, fatty liver disease, hyperlipidemia, early puberty, polycystic ovary disease, menstrual irregularities, acne, gallbladder disease, slipped capital femoral epiphysis, knee pain.

F. Monitor and treat hypertension if dietary and exercise modifications do not result in decreased blood pressure. Obese children should be monitored for hyperlipidemia (lipid panel), type 2 diabetes (fasting glucose and HA1c), thyroid disease (thyroid-stimulating hormone; TSH), and treated with oral antihyperglycemic agents (Glucophage [metformin]) if indicated.

RENAL SYSTEM

The genitourinary system—the kidneys and their drainage channels—is essential for the maintenance of life. This system is responsible for excreting the end products of metabolism as well as regulating water and electrolyte concentrations of body fluids.

System Assessment

A. History.
   1. Assess perinatal history, family history of renal disease, and/or deafness.
   2. Normal feeding patterns, diet, number of wet diapers/voidings per day, growth patterns, fever, straining or pain with voiding, irritability.
   ✦ 3. Recent infections (especially streptococcal), and other illnesses (e.g., autoimmune, metabolic, recurrent urinary tract infections).

B. Inspection.
   1. Assess male genitalia for urethral orifice and inspect shaft of penis for abnormalities (hypospadias).
   2. Assess scrotum for edema (normally present for several days after birth).
   3. Assess female urethral orifice for redness, swelling, discharge, normal anatomy.
   4. Observe for edema, evaluate periorbital area, sacral region, hands, and feet in infants. Also evaluate fontanelles.
   5. Observe character of urine if cloudy, frothy, with evidence of blood. Evaluate with dipstick test as indicated.
   6. Observe urinary stream.
   7. Evaluate intake and output, daily weights.
   8. Observe general appearance and growth trends on growth charts.

C. Palpation.
   1. Kidneys rarely palpable past the neonatal period.
   2. Bladder often palpable above symphysis pubis.
   3. Palpate infant's fontanelles for fullness if edema suspected.
   4. Palpate for abdominal masses, which may indicate constipation; constipation often associated with urinary tract infections.
   5. Assess quality of pulses (for fullness and bounding character) and if blood pressure elevated, if decreased perfusion indicated by diminished capillary refill.
   6. Palpate for descended testes bilaterally in scrotal sac.
   7. Costovertebral tenderness indicates upper urinary tract infection in the older child.

Diagnostic Procedures

Evaluation of Blood

A. CBC with differential.
B. Blood urea nitrogen (BUN).
C. Creatinine.
D. Uric acid (UA).

Evaluation of Urine (Urinalysis)

A. pH.
B. Protein.
C. Specific gravity.
D. Presence of glucose and ketones.

✦ Cystoscopy

A. Direct visualization of bladder and urethra done under general anesthesia.
B. Nursing responsibilities.
   1. Prior to procedure—NPO 6–8 hours.
   2. Following procedure—check I&O, observe for urinary retention and hematuria.
   3. Sedation per institutional protocol.

✦ Intravenous Pyelogram

A. A radiographic study of kidneys, bladder, and other structures via contrast media injection.
B. Nursing responsibilities.
   1. Prior to intravenous pyelogram (IVP)—NPO 6–8 hours; bowels cleaned with cathartic; have child void.
   2. Following procedure—evaluate for dye reaction; assess child's alertness and gag reflex; check for signs of perforation (intense pain in stomach).

✦ Renal/Bladder Ultrasound

A. Transmission of ultrasound through renal parenchyma, along ureters and over bladder.
B. Noninvasive and without radiation.
C. Useful in assessment of structural abnormalities and masses.

✦ Urodynamic Evaluation

A. Includes voiding cystourethrogram, uroflowmetry, cystometrogram, voiding pressure studies.
B. Provides graphic view of bladder, with volume changes.
C. Valuable for assessing ureters and urethra, voiding dysfunction related to urinary infections, retention, or bladder dysfunction.

✦ CT/MRI

A. Accurate views of cross-sections of kidneys from different axes.
B. Most valuable in viewing masses and differentiating tumors and cysts.

Renal Biopsy

A. May be open or via percutaneous technique.
B. Differentiates between types of nephrotic syndromes.

System Implementation

A. Monitor laboratory results of serum electrolytes. (Refer to Chapter 11 for major electrolyte disorders.)
B. Provide excellent skin care.
C. Monitor IV solutions for appropriate electrolytes depending on the disorder.
✦ D. Monitor urine.
1. Utilize urine dipstick testing for each voiding. Check for presence of blood, protein, and ketones.
2. Describe the appearance of urine: dark, light, cloudy, pink, mucus present.
3. Evaluate the specific gravity of the urine.
4. Monitor for possible urinary tract infection.
E. Monitor edema through daily weights and qualitative assessment.
F. Measure intake and output.
G. Monitor vital signs (especially BP) every 4 hours or more frequently if warranted.
H. Administer medications—antihypertensives may be prescribed.
I. Evaluate for rapid respirations associated with acidosis.
J. Separate children who have an increased susceptibility to infection.
K. Control infection, if present, with appropriate medications.
L. Collect urine specimens from children suspected of having urinary tract infections.
M. Provide diet for degree of renal dysfunction.

Monitoring Urine in Renal Disorders

✦ A. Intake and output.
1. Significant drop in output could signal worsening renal failure.
2. Output should not drop below 2 mL/kg/hr for infants; 1 mL/kg/hr for children. (1 mL/kg/hr is the most minimal expectation for urinary output.)
3. The child must be catheterized for accurate assessment of output.
✦ B. Measure intake and output and observe for signs of diuresis following the initiation of medical intervention.
✦ 1. Normal output dependent on ages and sizes.
2. Always evaluate output in relation to input and insensible water losses (through fever, respiration, and diaphoresis).
C. Urine should be clear and yellow with no ketones, protein, blood, or sugar according to dipstick or urinalysis.
✦ D. Specific gravity.
1. Morning specimen usually concentrated around 1.020–1.030 is normal.
2. Diluted urine around 1.001 may be found in normal infants or in children going through diuresis. Normal values for specific gravity according to age. Under age 2, a specific gravity less than 1.020 is normal.

Monitoring Diet for Renal Conditions

✦ A. If there is a high protein loss in urine, a high protein intake is important.
1. Restrict foods rich in potassium and sodium as prescribed.
2. Allow parents to bring in appropriate foods from home.
3. Sit with child during meals and talk about subjects other than food.
4. Provide nutritious snacks between meals.
✦ B. Provide appropriate diet for degree of renal dysfunction.
1. Glomerulonephritis: no added salt regular diet.
a. Evidence of renal failure: Restrict protein and potassium.
b. If edema, hypertension, or heart failure: Restrict fluids.
2. Nephrotic syndrome: Fluids may be restricted if severe edema is present.

RENAL/URINARY DISORDERS

Urinary Tract Infections

✦ *Definition*: *Urinary tract infection* (UTI) is a term that refers to a wide variety of conditions affecting the urinary tract in which the common denominator is the presence of a significant number of microorganisms.

Characteristics

✦ A. *Escherichia coli* most frequent organism (80% of cases).
✦ B. The most important factor influencing ascending infection is obstruction of free urine flow (vesicoureteral reflux, for example).
1. Free flow, large urine output, and pH are antibacterial defenses.
2. If defenses break down, the result may be an invasion of the tract by bacteria.
C. More common in girls than in boys, most common ages 2–6 years. More common in uncircumcised male infants during early infancy. Symptoms in early infancy are subtle and require septic work-up if less than 2 months of age.

Assessment

✦ A. Obtain urine for culture (clean catch midstream specimen). Aseptic catheterization provides most accurate specimen for culture. Specimen should be taken to lab immediately.

✦ B. Assess symptoms of classic urinary tract infection: burning on urination, cloudy, foul-smelling urine, fever.
   1. In children under 2 years of age, symptoms are nonspecific and include vomiting, poor feeding, failure to gain weight, pallor, diaper rash, and excessive thirst.
   2. Incontinence in a toilet-trained child may signal UTI.
   3. More serious infections signaled by jaundice, seizures, dehydration, abdominal or back pain, blood in urine, edema, hypertension, tachycardia, and tachypnea.

C. Determine presence of bacteria in screening for UTI with urinalysis (nitrites, leukocyte esterase).

D. Evaluate microscopic examination for detailed identification of the organism (presence of white blood cells in the urine diagnostic of UTI with positive culture; may have slightly increased red blood cells).

✦ E. Urine culture: Note that usually a colony count of over 100,000/mL of a single organism from a midstream specimen, or 50,000/mL from a sterile catheterization (according to 2011 American Academy of Pediatrics guidelines), accompanied by pyuria in the urinalysis of a febrile child less than 3 years of age indicate infection.

F. Urosepsis may be present (more commonly in females and young infants), characterized by systemic evidence of bacterial infection with UTI and blood cultures positive for urinary pathogen.

G. Recurrent UTIs should warrant further diagnostic procedures to evaluate structural defects.

Implementation

✦ A. Encourage fluids (after cultures are obtained) to amount appropriate for age.

✦ B. Administer antibiotics as indicated by urine culture and sensitivity results.
   1. Specific for causative bacteria (given 1–2 weeks).
   2. Common drugs—extended spectrum penicillins (Amoxil, Augmentin), sulfonamides, aminoglycosides, Bactrim (trimethoprim-sulfamethoxazole), or cephalosporins (Rocephin [ceftriaxone], Claforan [cefotaxime]). Young infants are treated with IV antibiotics while older children may be given PO antibiotics.
   3. Monitor side effects: nausea, vomiting, vertigo, diarrhea, rash, pruritus, urticaria.

✦ C. Teach mother and child to wipe child front to back, especially for females.

D. If stool in diaper, clean immediately, wiping front to back.

E. Teach early signs of UTI and when to seek medical care.

Vesicoureteral Reflux

✦ *Definition*: The retrograde flow of urine from bladder up into ureters.

Assessment

✦ A. Frequently a cause for recurrent UTIs in children.

B. Obtain history of recent illness, previous UTIs.

C. May result from congenital abnormality or from an acquired disorder.

Implementation

A. Prepare family and child for diagnostic procedures (ultrasound, voiding cystourethrogram).

✦ B. Tests will reveal anatomic abnormality in ureteral insertion into bladder (primary reflux).

C. Vesicoureteral reflux (VUR) also results from acquired condition as with recurrent UTI (secondary reflux).

✦ D. Treatment initially may be antibiotics, in lower doses, with follow-up urine cultures.

E. First-line treatment is endoscopic injection of bulking material, Deflux injectable gel, which builds up a protective wall inside the ureter to prevent the backflow of urine.

F. Surgery indicated if anatomic defects are significant, UTIs continue, two to three failed Deflux treatments, and/or the family is noncompliant with treatment and follow-up.

G. Education and family support essential.

H. Routine preoperative care if surgery indicated.

I. Postoperative management: care of wound, possible management of stents, pain management, and discharge planning.

Acute Glomerulonephritis

✦ *Definition*: Acute glomerulonephritis (AGN) is believed to be an antigen–antibody reaction usually secondary to an infection from group A beta-hemolytic streptococci originating elsewhere in the body (for example, strep throat). The disease can range from minimal to severe, even though the preceding infection may be minimal. It is most common in children 4–7 years of age.

Assessment

✦ A. Assess renal system.
   1. Protein and blood cells present in urine (painless).
   2. Oliguria and occasional anuria.
   3. Mild edema—facial (periorbital). Worse in mornings.
   4. Tea-, cola-colored, or bright red urine.
   5. Elevated BUN and serum creatinine.
   6. Serum complement: C3 decreased with C4 normal.

7. Antistreptolysin O, anti-DNase B, streptozyme +/– positive, reflects previous *Streptococcus* infection.
8. Throat culture +/– beta hemolytic *Streptococcus*.

B. Assess cardiovascular system.
1. Possible hypertension, slowed pulse, and generalized edema.
2. Possible heart failure or circulatory congestion.

C. Assess for preceding infection and fever, symptoms usually appear approximately 10 days after streptococcal infection.

D. Assess for anorexia and fatigue, irritability, headaches, lethargy.

Implementation

✦ A. Maintain rest during acute stage. Bed rest is not necessarily needed once the gross hematuria, edema, azotemia, and hypertension have subsided.

B. Monitor antibiotic treatment if there are positive bacterial cultures.

✦ C. Monitor diet and fluid intake.
1. Elevated BUN and oliguria—protein moderately restricted only if oliguria is prolonged and azotemia is severe.
2. Liberal carbohydrates and fats for energy.
3. Restrict sodium (moderately—no added salt) if edema or hypertension present.

✦ D. Give antihypertensive drugs, e.g., Procardia (nifedipine).

✦ E. Prevent fluid overload—may need fluid restriction.
1. Weigh daily, same time, same scale.
2. Measure intake and output, calculate insensible losses.

F. Prevent complications.
1. Observe for signs of cerebral edema: headache, dizziness, vomiting.
2. Monitor for renal failure: nausea, vomiting, oliguria.
3. Prevent skin breakdown.
4. Antibiotics used only if streptococcal infection is indicated.

G. Support of family and discharge teaching.

Nephrotic Syndrome

Definition: The most common form of glomerular injury in children. A symptom complex with multiple and varied pathological manifestations; usually massive hyperlipidemia, edema, proteinuria, and hypoalbuminemia, the etiology of which is unknown. Nephrotic syndrome occurs primarily in preschool age groups (2–6 years of age). Overall prognosis is good, but relapses common.

Assessment

✦ A. Assess for generalized edema from fluid overload.
1. Periorbital and facial (may be severe) edema.
2. Abdominal edema (ascites); may lead to respiratory distress.
3. Respiratory difficulty with pleural effusion.
4. Diarrhea, vomiting, and malabsorption from edema of gastrointestinal tract.

✦ B. Assess for marked proteinuria (3–4+ on dipstick protein). Microscopic hematuria may be present.

C. Serum albumin is markedly decreased (less than 2.5 g/dl).

D. Serum cholesterol, triglycerides, hematocrit, and hemoglobin are elevated.

E. Assess for malnutrition.

F. Assess for potential hypertension (usually normal blood pressure).

Implementation

✦ A. Administer corticosteroid therapy as ordered, generally oral Deltasone 60–80 mg per day, divided into two to three doses.

✦ B. Monitor edema formation through daily weights and abdominal circumferences; accurate recording of intake and output.
1. Measure abdominal girth at umbilicus.
2. If ascites present, evaluate for respiratory difficulty from pressure on the diaphragm.
3. Place child in semi-Fowler's position if massive edema is present.

✦ C. Provide meticulous skin care.
1. Bathe body surfaces frequently.
2. Turn and position client frequently to prevent skin breakdown.
3. Support edematous areas such as the scrotum.

D. Monitor use of diuretics.

✦ E. Monitor use of steroids. Deltasone, which reduces edema and proteinuria, is drug of choice.
1. Diuresis usually occurs in 7–21 days.
2. Dosage is usually tapered after urine is free of protein and remains normal.
3. Prepare child and family for side effects: Cushing's syndrome, weight gain, acne, hirsutism.
4. Protect from infection.

✦ F. Provide appropriate diet.
1. Protein not usually restricted; may encourage foods rich in protein.
2. Moderate sodium restrictions (no added salt)
3. High-calorie diet.

G. Teaching principles.
1. Emphasize diagnosis and treatment regimen, skin care, diet, monitoring urine at home.
2. Support of family and child.

Hemolytic Uremic Syndrome

✦ *Definition*: Among the most frequent causes of acute renal failure in children. Etiology is unclear but most likely bacterial toxins, chemicals, or viruses, particularly the *E. coli* 0157:h7 serotype.

Characteristics

A. Hemolytic uremic syndrome (HUS) is often associated with *E. coli* infection that results from improperly cooked meat or contaminated dairy products.
B. HUS produces hemolytic anemia, thrombocytopenia, renal injury, and CNS symptoms. The anemia occurs because of fragmentation of red blood cells, which are damaged as they try to pass through the occluded vessels and are removed from circulation by the spleen. The occlusion of the glomeruli causes renal damage.
C. Occurs mainly in young children (younger than 5 years), predominantly in Caucasians.

✦ Assessment

A. Obtain thorough history.
   1. Possible exposures to known causative organisms.
   2. Prodromal illness—gastroenteritis or upper respiratory infection (URI).
   3. Sudden-onset renal failure.
B. Assess CNS status for seizures, irritability, or lethargy.
C. Assist in obtaining lab tests; triad of anemia, thrombocytopenia, and renal failure is diagnostic.
D. Assess renal function.
   1. May be oliguric or anuric.
   2. Elevated BUN and serum creatinine.
   3. Urine has protein, blood, and casts.
   4. Monitor electrolytes.
   5. Renal ultrasound may help with diagnosis of obstruction and postrenal acute renal failure. A renal scan can assess blood flow, kidney function, and obstruction.
E. Evaluate for hypertension or arrhythmias.

Implementation

A. Early diagnosis and management of renal failure most important.
B. Many children managed without dialysis by monitoring fluid, electrolyte, and acid–base status, with recommended nutritional intake (low-sodium, low-potassium, and high-caloric diet).
✦ C. Dialysis (peritoneal or hemo) used if anuric for 24 hours or if seizures or severe hypertension develop.
✦ D. Monitor respiratory status.
   1. Assure airway is protected (CNS status).
   2. Support ventilation and oxygenation as needed.
✦ E. Careful monitoring of cardiovascular status.
   1. Maintain optimal fluid and electrolyte status.
   2. Monitor blood pressure carefully, administer appropriate medications.
   3. Continuous ECG monitoring if arrhythmias likely.
   4. Treat anemia—packed red blood cells (PRBCs) may be given cautiously.
F. Support family and child.
   1. Long-term sequelae develop in 10–50% of cases (chronic renal failure, hypertension, CNS disorders).
   2. Provide teaching and emotional support—teach families to avoid meat cooked < 160°F (71.1°C) (risk of *E. coli* contamination, especially in ground beef).
   3. Discharge planning.

Enuresis

✦ *Definition*: Involuntary urination in a child who is of age to have bladder control, or previously had control. Frequently occurs at night (nocturnal enuresis), may be due to organic causes and occurs more often in boys after 4–5 years old with a family history of enuresis. Many factors associated with enuresis. Because physical maturation varies, nocturnal enuresis is not a concern unless the child is older than 6 years.

Assessment

✦ A. Obtain accurate history (toilet training, prior habits).
B. Assess for UTI, diabetes, pelvic mass.
✦ C. Assess for signs of child abuse or sexual abuse.
D. Evaluate developmental milestones (delays may occur).
E. Assess family response to enuresis.

Implementation

✦ A. Assist with and help prepare child for additional diagnostic procedures if the child has daytime enuresis and history of UTI (ultrasound, voiding cystourethrogram, UA, developmental assessment).
✦ B. The diagnosis is made based on history and clinical symptoms. Urinalysis can rule out a possible UTI and a urine glucose can rule out diabetes. A pinworm evaluation should also be done.
C. Administer and instruct about appropriate medications.
   1. Antibiotics if UTI is the cause.
   2. DDAVP (desmopressin acetate) given as tablet and taken at bedtime (antidiuretic action as "synthetic" antidiuretic hormone [ADH]) for children over 6 years.
   3. Anticholinergic such as Ditropan (oxybutynin) for diurnal enuresis.

D. Emotional care.
   1. Promote child's self-esteem. Give reassurance that bed-wetting is common.
   2. Support and teaching to family.
E. Teaching.
   1. Limit fluids at bedtime; urinate just before bedtime. Avoid sugar and caffeine after 4:00 PM.
   2. Establish bladder routine. Empty the bladder frequently.
   3. Reward systems—stickers to mark a calendar of "dry" nights.
   4. Behavioral conditioning with a moisture-sensitive alarm that goes off when the child starts to void, and awakens the child (must be used consistently for a period of time).

STRUCTURAL DEFECTS

Exstrophy of the Bladder

Definition: A rare defect in which the bladder wall fails to close during development and a portion of the bladder wall extrudes through the abdominal wall; the upper urinary tract is normal.

Assessment

A. A mass of bright red tissue in the lower abdomen where the abdominal wall has not closed.
B. Assess for continual leaking from an open urethra.

Treatment and Implementation

A. Surgical reconstruction in several stages; the initial stage is completed shortly after birth.
B. Some children require permanent urinary diversion because it is impossible to reconstruct a functional bladder.
C. Nursing management.
   ✦ 1. Position infant side-lying to promote drainage and help reduce risk of infection.
   2. Prevent trauma to exposed bladder; avoid abduction of the legs.
   ✦ 3. Clean exposed area daily using meticulous skin care to protect from urine leakage and infection.
   4. Observe for obstruction in drainage tubes (decreased urine output, blood drainage from urethra, bladder spasms).
   5. Complete discharge teaching.
      a. Dressing change protocol.
      b. Prevention of infection.
      c. Observe for changes in urinary function.

Hypospadias/Epispadias

✦ *Definition*: *Hypospadias* is the malposition of the external urethral opening behind the glans penis, along the ventral surface. *Epispadias* is a condition in which the urethra is located on the upper surface of the penis. Hypospadias is more common and has familial tendencies.

Assessment

A. Assess location of urethral opening on penis and ability to void in a normal elevated position.
B. Check for presence of fistulas, chordee.
C. Assess child's understanding of procedure (word for penis, urine).
D. Evaluate parents' understanding of surgery and fears.

Implementation

A. Preoperative care.
   1. Use drawings or dolls to reinforce physician's explanation.
   2. Prepare child for presence of urinary catheter(s).
   3. Prepare child for the possibility of postoperative bladder spasms.
   4. Prepare child for nursing and medical personnel looking at his bandages frequently.
✦ B. Postoperative care.
   1. Maintain adequate hydration.
      a. Measure urine specific gravity.
      b. Encourage fluid as needed.
   ✦ 2. Expect a Foley catheter that may be sutured in place; urine should be rose-colored immediately postop, gradually becoming clear.
   3. If staged repair, may have a suprapubic catheter for urinary diversion and a Foley catheter.
   4. Tape catheters in place securely. (Do not adjust position or remove catheter.)
   5. Administer analgesics as needed.
   6. Remove Foley and clamp suprapubic intermittently to allow child to void through the meatus.
   7. After Foley is removed, note presence of fistula (should not be present).
   8. Chart when the child voids through the meatus; report to physician:
      a. Character of flow, presence of spray, dribbling, leaking, pain.
      b. Expect pain on the first voids, should decrease in subsequent voids.
   9. Discharge teaching and support of family and child.

Cryptorchidism (Undescended Testes)

✦ *Definition*: The failure of one or both testes to descend into the scrotal sac. Occurs more in premature infants and approximately 80% resolve spontaneously within the first 6 months of life.

Assessment

A. Palpate for presence of testis in scrotal sac, may be unilateral or bilateral.
B. Assess for presence of accompanying hernia (present in 50% of clients).
C. If testes not palpable, the child may be evaluated for their presence with hormonal stimulation.
D. May lead to sterility if persists into adolescence; associated with testicular cancer.

Implementation

✦ A. Support child and family during surgery. Orchiopexy as an outpatient procedure may be performed at 6 months, but usually between 9 and 15 months of age.
B. Provide postoperative care: Maintain traction, which anchors testes to scrotum (5–7 days); prevent contamination of incision.
C. Provide adequate postoperative analgesics.
D. Support family and child.
E. Discharge teaching: Monitor pain levels, swelling, voiding patterns, observing for signs of bleeding and infection.

DISORDERS OF THE BLOOD

The circulatory system, a continuous circuit, is the mechanical conveyor of the body constituent called blood. Blood, composed of cells and plasma, circulates through the body and is the means by which oxygen and nutrients are transported to the tissues.

System Assessment

A. History.
   1. Perinatal and birth history, significant family history.
   2. Recent illnesses or appearance of bleeding or bruising, dietary history.

✦ B. Inspection.
   1. Assess skin color for general pallor (especially mucous membranes).
   2. Observe for bruising or petechiae.
   3. Evaluate activity level and general level of energy.
   4. Plot growth on curve, noting downward trends.

✦ C. Palpation.
   1. Palpate liver and spleen margins, noting enlargement.
   2. Palpate peripheral pulses for quality and rate.
   3. Note any enlarged lymph nodes.

D. Percussion—may percuss liver and spleen.

E. Auscultation.
   1. Note heart rate and respiratory rate.
   2. Evaluate cardiac murmur.
   3. Assess blood pressure.

F. Evaluate the CBC.

RED BLOOD CELL DISORDERS

Anemia

Definition: A deficit of red blood cells (RBCs) or hemoglobin caused by impairment of red blood cell production or increased erythrocyte destruction. A reduced oxygen-carrying capacity results, with decreased oxygen available to the tissues.

Assessment

✦ A. Classifications of anemia.
   1. Etiology/pathology: RBC hemolytic, decreased RBC production, or from acute or chronic blood loss.
   2. Morphology: based on RBC size, shape, or color.

✦ B. Assess for general changes in behavior: listlessness, fatigue, poor suck, pica, pallor, tachypnea, tachycardia or shortness of breath, cardiac murmur.

✦ C. Assess for central nervous system manifestations: headache, dizziness, irritability, decreased attention span, apathy, or depression.

D. Observe for signs of shock (poor peripheral perfusion; cool, clammy skin; tachycardia and decreased blood pressure) in severe cases.

✦ E. Determine if nutritional deficiency is present; iron, folic acid, vitamin B_{12}.

F. Evaluate tests for impairment of red blood cell production: red cell, aplastic, or hemolytic anemia or leukemia.

G. Look for sources of blood loss (GI tract) with stool hemoccult exam.

H. Consider racial/ethnic background for genetic causes of anemia.

Implementation

A. Prepare child for blood draws.

✦ B. Decrease oxygen demands (providing rest, quiet activities).

✦ C. Support RBC production by maintaining nutritious diet with vitamin and iron supplements, excellent hygiene, adequate rest, and avoidance of exposure to infections.

D. Teach parents that stools will be dark with iron supplements. Vomiting and diarrhea can occur.

E. Monitor blood transfusions and observe for signs of transfusion reactions.

✦ F. Administer iron preparations or injections by special method (Z-track if severe iron deficiency is present) and take special precautions.

G. Support family, make appropriate consults/referrals, support growth and development, prepare for discharge.

Sickle Cell Anemia

✦ *Definition*: An autosomal disorder in which red blood cells sickle when under low-oxygen tension (hemoglobin A is partly or completely replaced by hemoglobin S). Sickled erythrocytes hemolyze or cause poor blood flow through capillaries and decrease oxygen delivery to tissues. Tissue damage can occur throughout the body and complications result from delayed growth and development, acute and chronic pulmonary dysfunction, stroke, aseptic necrosis of the hip and shoulder, retinopathy, dermal ulcers, severe and chronic pain, and psychosocial problems.

Characteristics

A. Usually confined to African Americans, but may be present in people from Mediterranean areas.

B. Asymptomatic until 4–6 months of age because of presence of fetal hemoglobin. Now diagnosed with routine newborn blood screening (hemoglobin electrophoresis).

C. Sickle cell disease (SCD) may also be diagnosed prenatally or in any child or adult with the sickle-turbidity test (Sickledex).

Assessment

✦ A. Assess major symptoms.
1. Usually asymptomatic until under stress (illness, dehydration, excessive exercise, high altitude).
2. Severe chronic anemia—pallor.
3. Periodic crises with abdominal and joint pain.
4. Lethargy and listlessness.
5. Irritability.
6. High fever
7. Enlarged spleen from increased activity.
8. Jaundice from excessive blood cell destruction.
9. Widening of the marrow spaces of the bones.
10. Renal dysfunction.
11. Decreased growth.

✦ B. Vaso-occlusive crisis
1. Most frequent type.
2. Caused by occlusion of the small blood vessels producing distal ischemia and infarction.
3. Beginning of crises may be characterized by the swelling of the hands and feet or decreased appetite, irritability, or fever.
4. May experience pain and swelling in abdomen.
5. Cerebral vascular accident (CVA) or stroke possible at any age.

✦ C. Sequestration crises.
1. Occurs usually in children under 5 years of age.
2. Caused by pooling of blood in spleen, with circulatory collapse.
3. Enlargement of spleen and loss of spleen function.

D. Acute chest syndrome (new pulmonary infiltrate).
1. Chest pain.
2. Fever.
3. Cough, wheezing, tachypnea, and hypoxia.

E. Aplastic crisis: profound anemia caused by diminished erythropoiesis.
1. Pallor, lethargy, headache, fainting.
2. Transfusion of packed RBCs only treatment.

Implementation

A. Alleviate pain with analgesics.

✦ B. Prevent dehydration with intravenous infusion, if necessary, and increased fluid intake; hydration can reduce sickling.

✦ C. Supplemental oxygen may be administered to optimize tissue oxygenation.

D. Hydroxyurea, which increases the production of fetal hemoglobin that interferes with the RBC sickling process and protects against future sickling episodes.

E. Antibiotics for acute infections (acute chest syndrome).

✦ F. Keep child warm.

G. Offer parents genetic counseling.

H. During sequestration crises, supervise blood transfusions.

✦ I. Teaching: emphasizing preventing crises, signs of crises, emotional support, prescribed activity, supporting development, safe activities for child to participate in, Medic-Alert® bracelet.

J. Discharge planning with appropriate referrals.

K. Genetic counseling for families and young adults considering child rearing.

L. Routine prophylactic Veetids (penicillin V) therapy.

M. Immunizations against HIB, pneumococcal, and meningococcal organisms according to specific recommendations and other routine immunizations.

N. May require splenectomy.

O. Hematopoietic stem cell transplantation a possibility.

Thalassemias

✦ *Definition*: An inherited group of hemolytic anemias caused by too few hemoglobin polypeptide chains. The disorders are categorized by the site of the inadequate globin synthesis (alpha thalassemia, beta thalassemia; one [minor] or two [major] chains may be lacking). A chronic condition. Most often seen in individuals of Mediterranean descent.

Assessment

✦ A. Assess for bronze tone to skin or pallor.

✦ B. Observe for jaundice; serum bilirubin elevated.

✦ C. Enlarged head, frontal and parietal bossing, severe maxillary hyperplasia, malocclusion; wide set eyes and flattened nose.

D. Hepatosplenomegaly.

E. Assess CBC, reticulocyte count, serum iron level, total iron binding capacity, hemoglobin electrophoresis, HbA and HbF levels to confirm the diagnosis. The CBC will reflect microcytic hypochromic RBCs.

Implementation

✦ A. Supportive: rest, decreased activity.

✦ B. Administer packed red cells.

C. Chelating agent for excess iron, Desferal (deferoxamine).

D. Prepare for splenectomy if transfused cells are rapidly destroyed by spleen.

✦ E. Teaching: Explain prognosis and treatment regimen to parents and child, need for frequent transfusions, genetic counseling, support in adapting to chronic illness, appropriate referrals.

F. Routine prophylactic Veetids therapy.
G. Immunizations against HIB, pneumococcal, and meningococcal organisms according to specific recommendations and other routine immunizations.

BLOOD DISORDERS

Infectious Mononucleosis

✦ *Definition*: An acute, self-limited infectious disease, caused primarily by the Epstein–Barr virus, which affects the epithelial cells and the B lymphocytes. Most common in individuals < age 25.

Assessment

✦ A. The incubation period is 4–6 weeks. The infectious period is unknown, the virus is commonly shed before the clinical onset of disease until 6 months after recovery. The acute illness usually lasts 2–4 weeks followed by a gradual recovery.
B. Blood test ("monospot") used to make diagnosis, with clinical signs.
✦ C. Assess for specific symptoms of variable severity.
1. Malaise, fatigue, headache, nausea, abdominal pain.
2. Sore throat with pharyngitis (may be severe).
3. Prolonged fever (may last 2 weeks).
4. Enlargement of the lymph nodes.
5. Splenomegaly.
6. Skin rashes (viral exanthem).

Implementation

✦ A. Provide symptomatic and supportive measures—no specific treatment.
1. Initially bed rest is indicated, promote rest.
2. Encourage high fluid intake. Watch for dehydration if unable to swallow due to sore swollen throat.
3. Increase in activity should be gradual.
4. Tylenol is given for fever, chills, and muscle pain.
5. Prevent secondary infections by limiting contacts while acutely ill.
6. Strenuous activity and contact sports during acute illness should be avoided as long as the spleen is enlarged to prevent splenic rupture.

Hemophilia

✦ *Definition*: A sex-linked disorder in which certain factors necessary for coagulation of the blood are missing. Sex-linked traits are passed from unaffected carrier females to affected males along with the X chromosome.

Characteristics

✦ A. Hemophilia A—Factor VIII deficiency: treated with monoclonal factor VIII concentrate and often DDAVP (for its vasoconstrictor action).
✦ B. Hemophilia B—Factor IX deficiency (Christmas disease): treated with purified, concentrated Factor IX.

Assessment

✦ A. Assess for type A or B.
1. Possible bleeding tendency in neonatal period because factors are not passed through the placenta.
2. Excessive bruising.
3. Large hematomas from minor trauma.
4. Persistent bleeding from minor injuries.
5. Hemarthrosis with joint pain, swelling, and limited movement.
✦ 6. Abnormalities in clotting studies—PT, partial thromboplastin time (PTT), fibrinogen, Factor VIII or IX assay.
7. Possible progressive degenerative changes with osteoporosis, muscle atrophy, and fixed joints.
B. Assess for type C.
1. Usually appears as a mild bleeding disorder.
2. Autosomal dominant trait with both sexes affected.

Implementation

✦ A. Prevent bleeding.
1. Protect child from environment by padding crib and playpen.
2. Supervise child carefully when child is learning to walk.
✦ B. Treatment if bleeding occurs:
1. Apply cold compresses and pressure.
2. Hemarthrosis (effusion of blood into joint).
a. Immobilize joint initially.
b. Initiate passive range of motion within 48 hours to prevent stiffness.
c. Manage pain adequately.
3. Immobilize site of bleeding.
✦ 4. Administer needed factors or blood products, monitor for transfusion reaction.
5. Multidisciplinary education program—genetic counseling, home management, support growth and development, family needs and assistance, appropriate referrals.

HIV and Children

Definition: Considered to have acquired immune deficiency syndrome (AIDS) when at least one complicating illness develops or when CD4 drops below 200. HIV is a viral infection that interferes with the body's ability to fight the organisms that cause disease.

Characteristics

A. Less than 2% of the people infected with HIV in the United States are children or adolescents due to treatment of pregnant women with HIV prenatally, specific obstetric procedures to prevent transmission of HIV during labor, and increased prenatal counseling and testing for HIV.
   1. The incidence of HIV in infants and children is approximately 200 children annually, stable for several years (CDC, 2014).
   2. Heterosexual intimacy and infection through IV drug use are the most common modes of transmission for women and adolescent girls.
   3. HIV may also be transmitted through breast milk.

B. Symptoms and complications of HIV and death result from opportunistic infections from viruses, parasites, and (unlike adults) bacteria.

C. Transmission (see above paragraph).

D. Signs for HIV in children.
   1. Repeated or persistent respiratory tract infections, including otitis media and sinusitis.
   2. Severe bacterial infections.
   3. Opportunistic infections such as *Pneumocystis jiroveci* (PCP) or cryptosporidiosis.
   4. Poor response to treatment.

E. Frequently present, somewhat suggestive signs.
   1. Skin lesions.
   2. Failure to thrive.
   3. Chronic diarrhea.
   4. Thrush.
   5. Hepatosplenomegaly.
   6. Anemia, thrombocytopenia, neutropenia.
   7. Small or absent lymph nodes, tonsils, and adenoids.

Implementation

A. If an infected woman conceives, anti-HIV drugs are fairly effective.

B. Drug treatment.
   1. Woman may receive Retrovir (zidovudine [ZDV], also called AZT) by mouth during the second and third trimesters (last 6 months) of pregnancy with two other antiviral drugs. It will be delayed after the first 12 weeks of pregnancy if the viral load is low enough.
   2. Antiviral drugs given IV during labor and delivery.
   3. Retrovir given daily to the newborn for 6 weeks until the newborn is confirmed HIV negative. If positive to HIV, the infant will begin to receive combination antiviral drug therapy.

C. Cesarean delivery decreases baby's risk of acquiring HIV infection.

D. Drugs given to prevent opportunistic infections.
   1. Children under 1 year will be given Bactrim to prevent PCP infection.
   2. Transmission of infections, such as chickenpox, to the HIV-infected child is a danger. Varicella immune globulin will be given within 96 hours of exposure to varicella or zoster infection.
   3. Infants under 3 months of age will be tested for tuberculosis—with purified protein derivative (PPD).
   4. In most cases, the usual child immunization schedule is followed (may depend on the child's CD4+ count). Whether to administer live virus vaccines (MMR, varicella, rotavirus) determined for each child.

E. CD4+ lymphocyte counts, HIV RNA assays assess an infected young child's immune status, response to therapy, risk for disease progression, and need for PCP prophylaxis after 1 year of age.
   1. **Various combinations of antiviral drugs have been recommended based on the age of the child. (Please refer to the most current guidelines for HIV-infected children** —Guidelines for the Use of Antiretroviral Agents in Pediatric HIV Infection **What's New in the Guidelines.** [Last updated: February 12, 2014; last reviewed: February 12, 2014] http://aidsinfo.nih.gov/guidelines/html/2/pediatric-treatment-guidelines/0)
   2. In general, children are treated aggressively because of the rapid progression of HIV in children.

F. Social issues.
   1. A child with HIV and open skin sores, or who engages in potentially dangerous behavior, such as biting, should not attend child care.
   2. HIV-infected children should participate in as many routine childhood activities as their physical condition allows.
   3. Interaction with other children enhances social development and self-esteem.

G. Standard Precautions should be practiced.

BLOOD TRANSFUSIONS

Please refer to Chapter 8, Medical–Surgical Nursing, for content on blood transfusion

MUSCULOSKELETAL SYSTEM

The musculoskeletal system comprises the bones, joints, and muscles. In order to effectively assess and treat disorders associated with this system, it is necessary to consider the effects of the blood vessels, skin, nerves, and tendons.

System Assessment

A. History.
   1. Pertinent perinatal and birth history.
   2. Family history of musculoskeletal disorders.
   3. Previous injuries, fractures, surgeries, or other musculoskeletal problems.
   4. Any pain, swelling, or current problems.

✦ B. Inspection.
   1. Observe gait (or crawling) for limping, toe-walking, equal movement, and balance.
   2. Inspect spine and curvature of spine. Have child bend forward at waist and observe level of scapulae, ribs, and hips.
   3. Assess shape of back; toddlers normally have lumbar lordosis, older children may have kyphosis from chronic slouching.
   4. Observe strength and size of muscles.
   5. Evaluate length and shape of extremities.
   6. Observe gluteal skin folds for symmetry.

C. Palpation.
   1. Assess strength of upper extremities by having child squeeze examiner's fingers.
   2. Palpate hips of neonate by performing Barlow and Ortolani maneuvers to check for hip dysplasia.
   3. Palpate joints for swelling or pain, evaluate ROM.

System Implementation

✦ A. Identify abnormality of musculoskeletal structure.
   1. Evaluate newborn for congenital abnormality of the musculoskeletal system.
   2. Check for adequate range of motion and strength in all extremities.
   3. Check for normal hip joints in newborn.
   4. Check for abnormal spinal curvature (usually most noticeable in the school-age child.)

✦ B. Prevent abnormal movement.
   1. Limit movement if developing abnormal patterns.
   2. Establish program of teaching ambulation with a physical therapist.

C. Prevent limitation of movement.
   1. Position body parts in proper alignment.
   2. Complete appropriate active and passive range of motion.

D. Control pain.
   1. Schedule painful procedures around analgesic schedule.
   2. Implement measures to reduce pain (e.g., massage, heat and/or cold compresses, relaxation techniques).

E. Promote adequate circulation.
   1. Remove any restrictive garments or bandages.
   2. Check circulation of extremities at frequent intervals.
      a. Capillary filling.
      b. Temperature.
      c. Color.
      d. Peripheral pulses.
      e. Edema.

F. Promote alignment through splinting, casting, or traction.
   1. Check the vascular status of the extremity.
   2. Check the neurological status of the extremity.
      a. Level of sensation, any numbness, paresthesias (tingling).
      b. Movement of extremities and each digit, with or without pain.
   3. Observe traction for intactness in both skeletal and skin traction.

G. Promote healing through proper casting and cast care.
   1. Check the vascular status of the extremity.
   2. Examine the cast for signs of bleeding. If bleeding is present, draw a circle around the site, indicating time and date.
   3. Examine the cast for any pressure areas.
   4. Pull stockinette over cast edges and secure with tape (prevents cast crumbs from falling inside cast).
   5. Keep the cast clean and dry.
   6. If appropriate, keep the level of the cast above the heart to prevent edema formation.

CONGENITAL DEFECTS

Developmental Dysplasia of the Hip

✦ *Definition*: Abnormalities of the hip present at birth, usually accompanied by abnormalities of the acetabulum, subluxation, or dislocation. Occurs in 1 or 2 per 1000 live births, and six times more often in females.

Assessment

✦ A. Check for unequal major gluteal folds in infants, or varying heights of bent knees as viewed distally with infant supine.

✦ B. Assess for presence of a hip "clunk" on abduction as femur slips over acetabulum using the Barlow and Ortolani maneuvers.
C. The hip will have asymmetric abduction or limited abduction when the child is placed supine with the knees and hips flexed.
D. Assess for femur that may appear shortened, or limp in older child.
1. Abnormal tilting of the pelvis on the unaffected side when bearing weight on the affected side (Trendelenburg sign).
2. Waddling gait or abnormal lordosis of spine if bilateral dislocation.
✦ E. Assess degree of dysplasia.
1. Preluxation (acetabular dysplasia): mildest form, femoral head remains in acetabulum but delayed acetabular development occurs.
2. Subluxation: most common form. Femoral head remains in contact with acetabulum, but is partially displaced.
3. Dislocation: Femoral head loses acetabulum contact.

Implementation

A. Referral and complete evaluation by orthopedic specialist. An ultrasound of the infant's hip is used because ossification is not complete until 1 year of age.
B. Teach parents importance of application of Pavlik harness, and maintaining alignment. It is used for infants less than 5–6 months of age for a duration of about 3–5 months so that the hip is in a continually abducted position so that the femoral head can remain in contact with the acetabulum.
C. Protect skin under the splint.
D. Bring environment to child: Surround with age-appropriate toys, support development.
✦ E. Correction of DDH in older children may require operative reduction; osteotomy usually required and tenotomy of contracted muscles. A short course of traction may be used prior to application of the spica (hip) cast.
1. Cast care teaching essential: diapering, keeping cast clean, checking skin frequently.
2. Feeding more challenging if casted—head must be elevated—may require modified chair.
3. Assist in discharge planning/teaching; focusing on daily activities; bathing, play, car seat adaptations, mobility (wagon, stroller, or scooter).

Congenital Clubfoot

Definition: Congenital deformity in which the foot is twisted out of its normal position. The deformity is described according to the position of the foot and ankle. The most common type is talipes equinovarus (95%), in which the foot is pointed downward and inward. Other forms include talipes varus (foot bends inward), talipes valgus (foot bends outward), talipes equinus (plantar flexion with toes lower than heel), or talipes calcaneus (dorsiflexion with toes higher than heel).

Assessment

✦ A. Assess whether foot deformity is accompanied by other problems such as neurological defects or spina bifida.
B. Assess general health status of infant in preparation for treatment.
C. Determine aspects of treatment: occurs in three stages and includes exercises, manipulation, casting, and splinting.

Implementation

✦ A. Treatment plan consists of correction, maintenance, and follow-up.
1. Correction usually starts with manipulation followed by serial casting (shortly after birth). Casts are changed at regular intervals, as needed due to rapid growth of infant.
2. Another method is the French physiotherapy method in which daily sequential stretching, strengthening, and mobilization of the foot is followed by taping and splinting to allow for gradual correction of the deformity by experienced physical therapists.
3. More severe forms may require surgery.
✦ B. Assist in passive exercises (manipulation) of the foot following a demonstration by physician or physical therapist.
C. Instruct parents in cast and/or splint care.
D. Provide emotional support and encourage bonding and infant development.

Osteogenesis Imperfecta

✦ *Definition*: A congenital defect (most commonly autosomal dominant, but may also occur as autosomal recessive inheritance) resulting in severely brittle and fragile bones. Affected individuals appear to have abnormal precollagen preventing the formation of collagen; classified into four grades of severity. Tendency to fracture may not occur until later in childhood, but may occur at early ages, beginning with a fractured clavicle from the birth process.

Assessment

A. Refer for genetic counseling.
B. Assess skin—often is thin, easily injured, excessive diaphoresis.

C. Assess for blue sclera, discolored teeth, and conductive hearing loss.
D. Radiographs show thin bone shafts; possibly multiple old, healed fractures (must rule out child abuse).
E. Assess ROM, activity, limitations in activities of daily living (ADLs), level of comfort.

Implementation

✦ A. Careful handling of infant to prevent fractures, especially when diapering.
B. Teaching and support in use of casts, braces, or splints utilized.
C. Assist with physical therapy plan.
D. Surgery may be necessary to correct deformities.
E. Support growth and development of infant and child.
F. Teaching principles.
1. Emphasize safety and prevention of fractures.
2. Reinforce medical therapeutic plan and prognosis.
3. Refer to appropriate community agencies and support groups.
4. Teach other healthcare professionals about defect. Families may be wrongfully accused of nonaccidental trauma.

Muscular Dystrophy

Definition: Gradual degeneration of muscle fibers with progressive weakness of symmetric groups of the skeletal muscles. There are more than 30 different kinds of muscular genetic diseases, which vary in their pattern of inheritance and age at onset (most are identified in early childhood).

Characteristics

✦ A. Duchenne's muscular dystrophy is the most common type and the most severe.
✦ B. Genetic pattern is an X-linked recessive; 30–50% have no family history.
C. Usually this disease appears at 3–5 years of age; rare in infancy or at birth; ambulation usually impossible after about 12 years.
D. Death usually occurs from pneumonia or cardiac failure; some live into their 20s or 30s.

Assessment

✦ A. Assess for delay in motor development: clumsiness, walking on toes, waddling gait.
B. Assess for abnormal fatigue when walking or running.
✦ C. Check for presence of Gower's maneuver: climbing up on legs from supine position, marked lordosis when upright.
D. Assess for progressive muscle weakness: axial and proximal before distal, in symmetric muscle groups.
E. Check for elevated serum creatine kinase (CK).
F. Electromyography may be used for evaluation. DNA testing can determine the type of gene mutation.

Implementation

✦ A. Provide support so that child can maintain independence as long as possible.
1. Assist parents to develop physical therapy program.
2. Support use of wheelchair when necessary to maintain mobility.
✦ B. Counsel parents to prevent respiratory infection.
1. Teach deep-breathing exercises.
2. Maintain adequate diet to promote healthy status.
C. Counsel parents to monitor child's weight to promote mobility and health.
D. Assist parents to obtain emotional support to deal with child more adequately at home.
1. Identify community resources that will support family.
2. Refer for genetic counseling.
3. Counsel family to deal with chronic illness and with eventual death of the child.

ACQUIRED DEFECTS

Fracture

See Fractures in Chapter 8.

Legg–Calvé–Perthes Disease

✦ *Definition*: A self-limiting disease in which aseptic necrosis of the femoral head produces hip deformity and dysfunction.

Characteristics

✦ A. Usually affects children 2–12 years of age and males 4–8 years of age; usually unilateral and self-limited. This disorder usually progresses through five stages over a 1–2 year period.
✦ B. Stages.
1. Stage I: The femoral capital epiphysis shows effects of ischemia. Synovitis produces stiffness and pain. Necrosis begins; x-rays show reduction in size and increased density of the femoral head—the avascular stage.
2. Stage II: Once necrosis occurs, the bone weakens and dies, causing collapse of the femoral head—necrotic stage.
3. Stage III: Avascular bone is reabsorbed and healing occurs as new bone is formed—the fragmentation stage.
4. Stage IV: The femoral head and neck begin to re-form—the reossification stage.
5. Stage V: final healing—the reconstitution stage.

Assessment

✦ A. Assess for pain in hip or knee most evident on rising or at end of the day.
B. Assess for limp or joint dysfunction on the affected side—may be intermittent.
C. Assess for stiffness and tenderness over hip capsule.

Implementation

✦ A. Goal of treatment is to keep the head of the femur contained in the acetabulum.
  ✦ 1. Initial therapy is rest to reduce inflammation and restore motion.
    a. Active range of motion exercises.
    b. Anti-inflammatory drugs such as Advil or Motrin.
    c. Weight-bearing as long as the acetabulum remains in femoral head (and is protected).
  ✦ 2. Containment accomplished by several measures.
    a. Non–weight-bearing devices such as abduction brace, leg cast, or leather harness sling that prevents weight bearing on affected limb.
    b. Weight-bearing appliances such as abduction–ambulation brace or cast.
  3. Conservative treatment may be continued for 2–4 years; surgical correction allows the child to resume normal activities in 3–4 months.
  ✦ 4. Disease is self-limiting, but early treatment is essential to avoid permanent damage.
✦ B. Most care is outpatient, so nursing emphasis is on teaching.
  1. Teach family use of corrective device selected for therapy.
  2. Stress importance of compliance for resolution of disease.
  3. Provide support for inactivity forced upon child.
  4. Support normal growth and development and school progress.

Slipped Femoral Capital Epiphysis

✦ *Definition*: The spontaneous displacement of the proximal femoral epiphysis in a posterior and inferior direction. Most often occurs around puberty in obese children (slightly more often in boys).

Assessment

A. Obtain growth history and correct height and weight, recent injury/trauma.
✦ B. X-rays demonstrate widening of growth plate; slipping produces deformity of femoral head and stretching of blood vessels.
C. Assess gait for limping.
D. Evaluate pain (may be hip or knee pain) and ROM of hip.
E. The leg is often externally rotated.

Implementation

✦ A. Usually requires internal fixation with pins.
✦ B. Routine postoperative cast care and pain management.
C. Support family, reinforce diagnosis with child and parents.
D. Teach activity limitations and traction/crutch walking (non–weight-bearing for 4–6 weeks).
E. Discharge planning/teaching; emphasize ADLs and support growth and development.

Scoliosis

✦ *Definition*: Scoliosis is a lateral curvature of the spine and may be "C-shaped" or "S-shaped." In addition to the lateral curvature, there is an actual rotation of the vertebral bodies in the spine, therefore, considered to be a three-dimensional deformity. There are three types of scoliosis: congenital or infantile, juvenile (ages 4–9), and adolescent idiopathic scoliosis (AIS)—the most common type (80% of all cases).

Characteristics

✦ A. Age of onset—the younger the child, the greater the chances for deformity.
  1. Deformity increases during growth periods.
  2. Usually not noticed until adolescence.
  3. Affects more girls than boys.
✦ B. Curves less than 25 degrees require observation for progression regardless of skeletal maturity.
C. Curves of 25-degree angle and still skeletally immature are treated with a back brace worn 22–23 hours/day until 18–24 months post menarche for girls, and until late adolescence for boys—past the time of peak growth velocity.
D. Curves more than 40 degrees or those causing respiratory compromise warrant surgical intervention. The primary goal is to reduce the size of the curve using spinal fusion or an internal fixation system. The goal is provide a well-balanced spine that centers the client's head, shoulders, and trunk over the pelvis.
E. Pattern of curve—when the primary curve is thoracic, there is a greater likelihood that deformity will occur.
F. Can be detected in 2–3% of children aged 10–16 years; 60–80% are girls. One shoulder seems higher than the other or clothes do not hang straight, usually detected during routine physical exam.
G. Scoliosis and its treatment often interfere with an adolescent's self-image and self-esteem. Counseling or psychotherapy may be needed.
✦ H. Types of curvature.
  1. **Kyphosis**: flexion deformity usually at thoracic spine.
  2. **Lordosis**: fixed extension deformity usually occurring to compensate for other abnormalities.

3. **Scoliosis**: lateral curvature of the spine.
   a. Nonstructural: Caused by changes outside the spine; treated with exercises.
   b. Structural: The spine itself has rotated; treated by bracing, exercise, or surgery.

Assessment

✦ A. Assess fatigue in the lumbar region after prolonged sitting or standing. Muscular backaches in areas of strain (e.g., in the lumbosacral angle) or dyspnea may be reported.
B. Question client about ability to breathe and when client usually has difficulty breathing.
✦ C. Adam's forward bend screening exam—expose back and check for deviations. Have client bend forward at waist.
   1. Check level of scapulae.
   2. Assess difference in shoulder height, elbow level, and height of iliac crests.
   3. Look for in-folding of one flank and flattening of another.
D. Assess range of motion of the spine.
E. Observe for deviations of the hips, rib cage, shoulders, and iliac crest.
F. Assess for mild pain and/or discomfort.

Implementation

✦ A. Instruct on use of braces.
   1. Teach adolescent to wear the brace correctly and remove it only to bathe or as prescribed by the physician.
   2. Explain necessity for good skin care where brace touches.
   3. Assist adolescent to understand the need for the brace, and help the client deal with the altered body image.
✦ B. Provide care when child undergoes surgery.

Surgery

A. Primary goal is prevention of curve progression through spinal fusion and partial curve correction.
B. Procedure:
   1. Posterior spinal fusion (PSF) with instrumentation and bone grafting is the most common. Contemporary implants are *segmental* and consist of a variety of hooks, screws, and wires that can be used to attach contoured rods to the spine at multiple vertebrae, or "segments." This provides:
      a. Greater control over positioning and rotation of the spine.
      b. Increased stability of segmental instrumentation.
      c. Early mobilization with ambulation the day after surgery without external support such as a body cast or brace.

TREATMENT

Nonsurgical correction of curvature.

1. Exercise.
2. Plastic braces (orthoses).
3. TLSO (thoracolumbosacral) or Milwaukee brace (usually when curve is 20–40 degrees)—worn 16–23 hours per day.
4. Casting.

✦ **Surgical correction options.**

1. Considerations: Any client with a curve of 40 degrees is considered to be a candidate for surgery—after growth stops, a lateral curve can continue to progress at about 1 degree a year. Surgery is necessary in < 10% of cases.
2. The most common surgical procedure for AIS is a posterior spinal fusion (PSF) with instrumentation and bone grafting. Spinal fusion prevents progression of scoliosis and is done by inserting bone chips to achieve fusion of the vertebrae.
3. Contemporary implants are "segmental" and consists of a variety of hooks, screws, and wires that can be used to attach contoured rods to the spine at multiple vertebrae, or "segments." This provides the surgeon greater control over positioning and rotation of the spine. This method permits early mobilization with ambulation the first day postop without external support such as a body cast or brace.
4. Video-assisted thoracoscopy is currently being performed for anterior fusion and stabilization with promising results.

   2. Anterior instrumentation and fusion may be performed for thoracolumbar and lumbar scoliosis.
      a. Convex side of the spine is exposed by a thoracotomy and/or retroperitoneal approach.
      b. Curve is corrected by shortening the convex side of the deformity.
      c. Advantages of the anterior approach include:
         i. Less blood loss.
         ii. Lower risk of neurologic injury.
         iii. No disturbance of the paraspinal muscles.
      d. Disadvantages include:
         i. Increased complexity.
         ii. Decreased pulmonary function if the thoracic cavity is entered and/or the diaphragm is opened.
   3. Video-assisted thoracoscopic surgery (VATS) for anterior instrumentation of the thoracic spine using instrumentation inserted through several small incisions thoracoscopically. Its use seems to be decreasing.
      a. Advantages of video-assisted thoracoscopic surgery over posterior spinal fusion with thoracic pedicle screws include:
         i. Reduced blood loss.
         ii. Fewer total levels fused.
         iii. Preservation of nearly one caudad fusion level.

b. Disadvantages include:
i. Increased operative times.
ii. Slightly less improvement in pulmonary function.

C. Complications of surgery include:
1. Blood loss.
a. Because of the risk of blood loss, many hospitals provide clients the option of autologous blood donation before surgery.
b. Intra-operative blood salvage ("cell saver").
2. Infection.
3. Implant failure.
4. Neurologic injury.
5. Pseudoarthrosis (failure of fusion).
6. Lung injury.

✦ Preoperative Nursing Interventions

A. Evaluate child's level of understanding regarding condition and development progression.
B. Check preoperative lab work to ensure all values are within normal limits.
✦ C. Assist child with pulmonary function tests.
1. Teach child to use incentive spirometer, cough, and deep-breathe.
2. Explain the importance of doing this postoperatively.
D. Evaluate child's and parents' understanding of surgical procedure.
1. Explain to their level of understanding.
2. Discuss postoperative course with child and parents to help them know what to expect.
3. Answer questions they may have.
4. Have parents review and sign written consent.
E. Visit the ICU, when appropriate, with family and child to familiarize them with the surroundings.

✦ Postoperative Nursing Interventions

✦ A. Check vital signs every 15 minutes until stable, then every hour.
✦ B. Watch for signs and symptoms of hypovolemia, tachycardia, BP. (Blood loss in the operating room can be considerable.)
C. Assess respiratory function: breath stacking (BS), RR, chest excursion, color, grunting, flaring, retractions.
✦ 1. Continual assessment of respiration function with vital signs is essential; pneumothorax or punctured lung is a risk after surgery.
2. Start incentive spirometer after child has been awake for 1 hour. Encourage to cough and deep-breathe between use of incentive spirometer.
D. Check ABGs.
E. Monitor hydration status.
1. Maintain strict I&O.
✦ 2. Monitor urine output hourly. Urine output must be adequate (at least 1 mL/kg/hr). Assess for clinical signs of hypovolemia.
✦ F. Check CMS (circulation–color, movement, sensation) of lower extremities and feet q1h × 8 hrs, q2h × 24 hrs, then q4h.
✦ G. Turn after 1 or 2 hours by logrolling only. Maintain alignment of spine.
H. Medicate child prior to turning or doing procedures (per orders).
1. It is important to keep child comfortable and administer narcotics in appropriate doses—preferably by continuous IV infusion.
2. Observe vital sign changes as indicative of pain.
I. Maintain NPO until child has positive bowel sounds, is passing flatus, or has had a stool.
✦ J. Start diet with ice chips only. (Paralytic ileus is a common side effect.)
K. Check skin and dressing hourly to assess for skin breakdown and bleeding.
L. Instruct child to flex feet to improve circulation and maintain muscle tone.
✦ M. Rehabilitation postoperatively is dependent on procedure and child's ability to progress with movement and ambulation. Thoracoscopic procedures:
1. After the wound is stable and child recovered from anesthesia, child may sit at the side of the bed.
2. Progresses to ambulation. No postoperative immobilization is required.
N. Discharge planning and teaching specific to surgical intervention performed; support of family and growth and development.

INFLAMMATORY DISEASES

Osteomyelitis

✦ *Definition*: Infection usually of the long bones that involves cortex or marrow cavity. It is considered chronic if it lasts longer than 1 month. It is caused most frequently by *Staphylococcus aureus*, including community-acquired methicillin-resistant *S. aureus* (MRSA). In younger children, *Streptococcus pyogenes*, *Haemophilus influenzae*, and group B streptococci may cause osteomyelitis. *Pseudomonas* from the soil causes osteomyelitis from trauma and *Salmonella* causes osteomyelitis in sickle cell disease.

Characteristics

A. Occurs most frequently in children under the age of 6.

B. It is twice as common in boys.
C. The infection can result from exogenous causes (direct bacterial invasion from the outside) or hematogenous spread from a preexisting infection.

✦ **Assessment**

A. Assess for abrupt onset or trauma to affected bone.
B. Assess for recent infection or injury anywhere else in child's body.
C. Evaluate for fever, malaise, and pain.
D. Assess for localized tenderness in the bone at the metaphysis.
E. Evaluate for swelling and redness over affected bone.
F. Observe for fever, irritability, GI symptoms (vomiting or diarrhea).
G. Elevated WBCs, elevated ESR, CRP, positive blood culture.
H. Area of osteomyelitis may be noted on radiography, ultrasound, radionuclide bone scans, MRI, and/or CT scans.

Implementation

✦ A. Control infection.
1. Supervision of high-dose parenteral antibacterial therapy effective against the specific organism.
2. Long-term antibiotic therapy requires a peripherally inserted central catheter (PICC line).
3. Monitor renal and hepatic function with long-term therapy.

B. Control pain.
1. Immobilization of affected limb; casting may be necessary.
2. Analgesics as needed.

C. Surgical drainage of area may be necessary.
✦ D. Monitor hydration and nutrition.
1. Child should be encouraged to drink fluids (supplement with IVs when necessary).
2. Encourage high-calorie foods and supplements; offer frequent snacks.

E. Prepare for discharge—support family and child's growth and development.

Juvenile Idiopathic Arthritis

✦ *Definition*: This is a systemic autoimmune disorder with multiple manifestations, arthritis (swelling of a joint) being the most characteristic. Etiology is unknown. Generally, onset is seen between 2 and 4 years of age, more commonly in girls. One of the most common chronic illnesses in children and leading cause of childhood disability.

Assessment

✦ A. Assess for inflammation of joints—swelling of one or more joints lasting more than 6 weeks suggests juvenile idiopathic arthritis (JIA).
B. Assess for edema and congestion of synovial tissues. (As the disease progresses, synovial material fills the joint, causing narrowing, fibrous ankylosis, and bony fusion.)
C. Assess for premature closure or accelerated epiphyseal growth.
D. Assess joint involvement.
1. Arthritis may start slowly with gradual development of joint stiffness, swelling, and loss of motion.
2. Most frequently affects knees, ankles, feet, wrists, and fingers—although any joint may be involved.
3. Affected joints are swollen, warm, painful, and stiff.
4. Young children appear irritable and anxious, guarding their joints.
5. Weakness and atrophy of muscles appear around affected joints.
6. Chronically affected joints may become deformed, dislocated, or fused.

E. Lab studies.
1. CBC with differential with elevated WBCs during exacerbations.
2. ESR and CRP elevation.
3. Antinuclear antibodies may indicate a risk for uveitis (not always present).
4. Rheumatoid factor may or may not be present; other markers inconsistent.

F. Assess systemic involvement, which frequently occurs.
1. Irritability, anorexia, and malaise.
2. Fever.
3. Intermittent macular rash.
4. Generalized lymphadenopathy.
5. Anemia
6. Uveitis (inflammation of the anterior chamber of the eye).

Implementation

✦ A. Supervise medication administration—major goal is to relieve pain, while maintaining function.
1. Primary drugs are nonsteroidal anti-inflammatory drugs (NSAIDs), which may include Aleve (naproxen), Advil, Clinoril (sulindac), and Celebrex (celecoxib).
✦ 2. Observe for gastric irritation, blood in stool, easy bruising.
✦ 3. Disease-modifying antirheumatic drug (DMARD) such as Trexall (methotrexate).
a. May be given to clients not responding to NSAIDs
b. Monitor CBC and liver function tests.
c. Avoid use of alcohol.
d. Use birth control to avoid birth defects while on Trexall.

4. Immunologic modulators (biologics) to alter the immune response, including Enbrel (etanercept), and others such as Humira (adalimumab), Remicade (infliximab), and Kineret (anakinra).
   a. Weekly or biweekly subcutaneous injections.
   b. Cause immunosuppression (avoid live virus vaccines).
   c. Seek care if suspected infection.
✦ 5. Local injections of corticosteroids to the joints.

B. Maintain joint function.
1. Exercise joints.
2. Provide night splints, provide heat, and encourage proper positioning at rest.
3. Educate parents in how child should perform exercises and impress upon them the child's need for physical therapy and splints.

C. Prevent eye damage—encourage parents to report any signs of eye problems in the child immediately to the physician.

D. Counsel family. Encourage compliance with the treatment plan.
1. Explain physiology and unpredictable nature of the disease to the parents and the child.
2. Provide emotional support to the parents for dealing with a chronically ill child or adolescent.
3. Refer to appropriate support groups.
4. Encourage independence in the child and in ADLs.
5. Encourage mastery of developmental tasks appropriate to the age group of the child; encourage participation in school and school activities.

INTEGUMENTARY SYSTEM

The integumentary system comprises the skin, including the epidermis and the dermis, as well as all the derivatives of the epidermis, such as hair, nails, and various glands. It forms a barrier against the external environment and participates in many vital body functions.

System Assessment

A. History of previous skin conditions, allergies.
B. Inspection.
   1. Observe skin odor (indicative of poor hygiene or infection).
   2. Assess color and pigmentation of skin (as normal within ethnicity, especially in areas less exposed to sunlight), and nail beds, sclera, conjunctiva, lips, and mouth (note cyanosis, pallor, jaundice, yellow or brown discoloration).
   3. Observe moistness of skin and mucous membranes.
   4. Inspect and palpate skin texture for scar tissue, turgor, edema, temperature, and lesions.
✦ C. Note types of abnormal lesions.
   1. **Macule**: small, flat, colored lesion.
   2. **Papule**: small, solid, elevated lesion.
   3. **Vesicle**: elevated lesion filled with fluid.
   4. **Nodule**: larger solid form of papule.
   5. **Petechia**: pinpoint hemorrhage in the skin.
   6. **Ecchymosis**: bruise of variable size initially purple, fades to green and brown (there can be some variability in this process).
   7. **Tumor**: abnormal mass.
   8. **Hives**: eruption of itching wheals.
✦ D. Observe for variations on skin, "birthmarks" in infants.
   1. Mongolian spot (hyperpigmented nevi): large, flat, blue, black, or slate-colored area found on buttocks and lumbosacral area, more often in Asian children.
   2. Salmon patch or "stork beak mark": common in all races; flat, pink mark found on eyelids, nasolabial area, or at nape of neck. Most disappear by 1 year.
   3. Strawberry nevus: begins as defined grayish, white area, becomes red, raised, well defined. May not be obvious at birth. Most resolve spontaneously by 9 years old.
E. Note distribution of lesions with other symptoms that occur simultaneously to assist with diagnosis.

System Implementation

✦ A. Identify and treat cause of skin disorder.
   1. Record the size, shape, and distribution of skin lesions.
   2. Note all other concurrent symptoms.
   3. Evaluate child's recent history, particularly medications, new foods, and exposure to communicable diseases.
   4. Isolate possible allergens and remove from environment.
B. Assist in reducing pruritus.
   1. Apply lotion (e.g., calamine lotion), cool compresses, or colloidal oatmeal bath to reduce itching.
   2. Administer antihistamine if ordered.
   3. Apply topical medication if ordered (steroid creams or antibiotic, antifungal preparations).
C. Note abnormal change in skin lesions.
   1. Describe accurately the placement, size, shape, and distinguishing characteristics of all lesions.
   2. Evaluate for changes on a routine basis.
   3. Teach family to notify physician if any skin lesions such as birthmarks or moles change shape or color or start to bleed.
✦ D. Observe and record any abnormal coloring.
   1. Describe cyanosis if present. Include location and under what conditions (e.g., during feeding) it occurred.
   2. Check the child for other signs of cardiac or respiratory disease.
   3. Evaluate child's laboratory values if pallor is present to determine presence of anemia. Ask for a 24-hour accounting of diet.
   4. Monitor jaundice for change.
E. Correct any abnormal texture.
   1. For poor skin turgor:
      a. Increase the fluid intake.
      b. Monitor intake and output.
      c. Monitor specific gravity.
   2. For edema:
      a. Establish and treat the underlying cause.
      b. Give meticulous skin care.
      c. Monitor intake and output.
F. Prevent secondary infections.
   1. Encourage the child not to scratch the lesions.
   2. Apply mittens to hands.
   3. Keep child's hands and nails clean with the nails trimmed.
   4. Keep infant clean and dry. Change diapers frequently, apply appropriate protection from diaper rash.

G. Prevent allergic responses.
   1. Assist in obtaining an accurate environmental history including exposure to common household allergens, food, and medications.
   2. Educate the family on changes in the environment that are necessary.

H. Provide teaching and anticipatory guidance, especially in avoiding preventable skin conditions.
   1. Use of sunblock and minimizing exposure to sun.
   2. Signs of skin cancers.
   3. Avoidance of known irritants, maintaining good hygiene and overall health.

SKIN DISORDERS

Acne Vulgaris

Definition: The presence of blackheads, whiteheads, and pustules usually found on face, chest, and back; due to plugging of sebaceous glands. Most commonly occurs at the onset of puberty when sebaceous gland activity increases (stimulated by androgens), enlarging and secreting increased amount of sebum.

Characteristics

A. The sebaceous glands become plugged and dilated with sebum.
B. When the enlarged gland is open to the skin surface an open comedo (blackhead) is formed.
C. If the gland does not have an opening, a closed comedo (whitehead) is formed, which can rupture inward causing abscesses and cysts (and scarring).
D. *Propionibacterium acnes*, a bacteria, adds to the inflammatory process.

Assessment

A. Assess areas of inflammation and secondary infection.
B. Assess current self-care practices.
C. Evaluate impact of acne on body image and self-esteem.

Implementation

A. Instruct adolescent to use gentle cleansing products such as Cetaphil or Neutrogena.
B. Do not use astringents and drying agents.
C. Use sunscreen especially with Accutane (isotretinoin) and Oracea (doxycycline).
D. Provide teaching on prescribed regimen.
   1. Topical medications comedolytic and bacteriocidal: Finacea (azelaic acid), Differin (adapalene), Retin A (tretinoin; vitamin A derivative), Relovox (benzoyl peroxide).
   2. Topical antibiotic ointments/gels: Cleocin (clindamycin), Ilotycin (erythromycin).
   3. Advise adolescent that improvement may take several weeks.
   4. Oral antibiotics: Solodyn (minocycline) or Oracea.
   5. Accutane therapy for severe inflammatory acne: suppresses sebum activity and sebaceous gland activity.
      a. Teratogenic.
      b. Must have two negative pregnancy tests prior to starting.
      c. Need for use of two birth control methods if currently sexually active.
      d. Other side effects: cataracts, cheilitis, conjunctivitis, nosebleeds, depression, pruritus, and dry skin.
   6. Estrogen therapy can be used instead of Accutane for young women.
E. Advise the client not to "pick and squeeze" the acne lesions, which may cause more scarring. Trained personnel can mechanically express comedones.
F. Provide support and reassurance that condition improves with age; promote self-esteem.

Impetigo

✦ *Definition*: A skin infection usually caused by *Staphylococcus*. Usually begins as a scratch or scrape that becomes infected.

Assessment

✦ A. Assess for multiple macular-papular rash seen at various stages of healing.
B. Check rupture of papules, which produce honey-colored serous exudate and form a crust, or scab.
C. Assess location: usually found on face, head, and neck, but may spread over any part of the body.
D. May be superimposed on eczema.

Implementation

✦ A. Frequent cleansing with mild soap, may remove crusts.
✦ B. Monitor topical [usually Bactroban (mupirocin) ointment and/or systemic antibiotic therapy (cephalosporins or penicillins if severe).
C. Cut nails to avoid scratching in infants and small children.
D. Document size and appearance of lesions.
E. Emphasize communicability of infection, maintaining thorough hand washing (child and caregiver) and overall good hygiene to avoid spread of infection.

Eczema (Atopic Dermatitis)

✦ *Definition*: A superficial dermatitis generally seen in children with allergic tendencies. It usually begins with pruritic, erythematous, papulovesicular lesions and progresses to crusty, thickened areas.

Assessment

A. Assess for erythema, papules, vesicles, often in the creases of skin, on cheeks.

B. Check drainage if crusting is present.
C. Assess for intense itching.
D. Look for symptoms in children 2 months to 5 years, but may be present in any age group.
✦ E. Assess when symptoms appear; food allergens may place a role in exacerbations.
F. Stress can exacerbate outbreaks.
G. Evaluate family history.

Implementation

✦ A. Interventions aimed at reducing inflammation and pruritus and hydrating the skin.
B. Remove dust-carrying objects in environment (stuffed animals); eliminate molds, cigarettes, and other allergens. Avoid using wool products.
C. Use mild, unscented laundry products and soaps on the skin.
D. Keep the skin moist by applying emollients such as petroleum jelly (Aquaphor or Eucerin) while skin is still damp after bathing. Can wash using Cetaphil instead of soap and water.
✦ E. Teach parents about symptomatic treatment of lesions.
1. Topical corticosteroids (use lowest potency that is effective).
2. Topical calcineurin inhibitors such as Protopic (tacrolimus) and Elidel (pimecrolimus) when topical corticosteroids are not effective—for children 2 years old and above.
F. Prevent scratching; secondary infections may occur and require antibiotics.
G. May use antihistamines if pruritus is intense—Claritin (loratadine), Atarax (hydroxyzine), Benadryl (diphenhydramine).
H. Many children outgrow atopic dermatitis by adolescence.
I. Encourage breastfeeding for the first year and delay introduction of solids until 6 months of age.

Seborrheic Dermatitis

✦ *Definition*: A chronic, recurrent dermatitis due to excessive sebaceous discharge, usually found on the scalp in infants ("cradle cap") or eyebrows. Commonly occurs in infants, may be found in adolescents.

Assessment

A. Appears as patchy lesions covered by yellowish, oily scales.
B. Observe for signs of secondary infection.

Implementation

A. Prevent occurrence with improved hygiene.
✦ B. When scales are present, shampoo with an antiseborrheic shampoo like Sebulex (contains sulfur and salicylic acid), Selsun (selenium), or Denorex (tar). Nizoral (ketoconazole 2%) shampoo has been reported to be safe in infants less than 12 months of age.
1. Shampoo is applied to crusts and allowed to penetrate.
2. After thorough rinsing, remove crusts gently with soft brush or fine-toothed comb.
C. More severe cases may require topical steroids and/or antibiotic therapy.
D. Teach parents or adolescents the importance of good hygiene and frequent use of mild shampoos. Reassure that generally cases resolve easily with simple treatment.

Diaper Dermatitis (Diaper Rash)

Definition: Erythematous lesions and maceration in the diaper area caused by prolonged contact with urine or feces, chemical irritants, bacteria or fungi, or reactions to foods. Incidence peaks at 9–12 months of age; more common in bottle-fed infants.

Assessment

✦ A. Observe for reddened, macerated skin, with sharply demarcated edges on exposed surfaces.
✦ B. Evaluate for signs of candidal infection, characterized by "beefy red" central erythema with satellite lesions.
C. Observe for secondary infection.
D. Assess current diapering habits and history.

Implementation

✦ A. Treatment focuses on teaching.
1. Discuss necessity of keeping area clean and dry. Change diapers as soon as soiled.
2. Avoid alcohol-based wipes and perfumed soaps.
3. Expose skin to air (not heat) for several minutes each day.
4. Apply barrier-type ointment such as Aquaphor when skin is dry.
5. If using cloth diapers, avoid plastic pants—use overwraps allowing air to circulate.
6. If candidiasis is present, apply antifungal creams as prescribed.
B. Reassure parents that baby will become less irritable as rash clears.

Cellulitis

✦ *Definition*: An infection in the subcutaneous tissue or dermis, usually caused by *Staphylococcus aureus*, or group A beta-hemolytic streptococci. Since the introduction of the HIB vaccine, *Haemophilus influenzae* type B infection occurs infrequently.

Assessment

✦ A. Observe for redness, swelling, and tenderness in area.
✦ B. Evaluate systemic symptoms; fever, malaise, or enlarged lymph nodes.
C. X-ray evaluation to rule out osteomyelitis; blood cultures; CBC may be done.
D. Obtain vital signs; evaluate for fever, weight and height, aspiration, and culture of inflamed area.
E. Obtain history of injury and previous treatment.

Implementation

✦ A. Administer or supervise antibiotics.
B. Provide pain relief.
C. Apply warm compresses/soaks as ordered.
D. Administer IV antibiotics and monitor carefully if infection extensive or around eye (periorbital cellulitis).
E. Incision and drainage of cellulitis may be necessary. Community-acquired methicillin-resistant *S. aureus* (MRSA) cellulitis is common. Parenteral antibiotics that show sensitivity to the organisms are administered in the acute care setting.
F. Provide family support and discharge teaching.

Burns

See also Chapters 8 and 10.

✦ Assessment

A. Assess degree and extent of burn.
B. Assess prescribed treatment for burn.
C. Assess for complications associated with burns.
1. Fluid and electrolyte imbalances.
a. In deeper wounds, edema appears around the wound from damage to capillaries.
b. Loss of fluid at the burn area.
c. On the second day, large loss of potassium.
d. Objective of fluid therapy is to maintain adequate tissue perfusion.
2. Circulatory changes.
a. Drop in cardiac output, initially.
b. A decrease in blood volume occurs from loss of plasma protein into extravascular and extracellular spaces.
c. Moderate amount of hemolysis of red blood cells.
3. Pulmonary changes—inhalation injury.
a. Pulmonary edema.
b. Obstruction of the air passages from edema of the face, neck, trachea, and larynx.
c. Restriction of lung mobility from eschar on chest wall.
4. Renal changes.
a. Renal insufficiency caused by reaction to hypovolemic shock.
b. A decreased blood supply to kidneys results in decreased renal perfusion.
c. In burns of 15–20% of the body surface, there is a decreased urinary output that must be avoided or reversed.
d. Urinary tract infections are frequent.
5. Gastrointestinal changes.
a. Acute gastric dilation.
b. Paralytic ileus.
c. Curling's ulcer—producing "coffee ground" aspirant.
d. Hemorrhagic gastritis—bleeding from congested capillaries in gastric mucosa.

Implementation

✦ A. See Interventions for Burns in Chapter 8 pages 395–400 and Chapter 10 pages 494–495.
B. Maintain optimum circulating fluid volume.
C. Relieve pain.
1. Reduce anxiety and fear.
2. Medicate appropriately before dressing changes or procedures.
D. Maintain pulmonary function.
E. Provide adequate nutrition.
1. Give twice the normal amount of calories.
2. Give three to four times the normal requirement for protein.
3. Provide small, frequent, and attractive meals.
4. Encourage child, who is frequently anorexic, to eat. Have parents bring foods from home.
✦ F. Support ability to cope with lifelong disfigurement.
1. Support use of appliances to minimize scarring.
2. Seek referrals for psychological problems associated with disfigurement.
3. Prepare child and family for common issues encountered with long-term plastic surgery.
4. Minimize distortion of self-image and lowering of self-esteem due to disfigurement; encourage participation in group activities.
✦ G. Design activities for the burned child while child is hospitalized.
1. Actively involve the child (e.g., act out part of a story verbally).
2. Provide television, books, and games.
3. Allow the child to associate with friends.
4. Reduce risk for impaired mobility—adhere to physical therapy schedule.
H. Counsel parents.
1. Parents and child have difficulty dealing with disfigurement and need assessment and interventions.
2. Parents frequently feel guilty, although they are usually not at fault and need assistance working out these feelings.
3. Refer to appropriate support groups.
4. Anticipatory guidance.

ENDOCRINE SYSTEM

The endocrine system consists of a series of glands that function individually or conjointly to integrate and control innumerable metabolic activities of the body. These glands automatically regulate various body processes by releasing chemical signals called hormones, which produce specialized effects on their specific target tissues.

System Assessment

A. History: family history, significant perinatal history and events. Assess for history of endocrine disorders, Marfan syndrome, and size of adult relatives.
✦ B. Assess growth patterns; evaluate patterns plotted on growth charts.
   1. Excessive growth; sudden spurts or consistently > 95th percentile.
      a. Pituitary or hypothalamic disorders.
      b. Excess adrenal, ovarian, or testicular hormone.
   2. Retarded growth; consistent pattern < 5th percentile or sudden drop-off.
      a. Endocrine and metabolic disorders; difficult to distinguish from dwarfism.
      b. Hypothyroidism or hypopituitarism possible.
C. Obesity.
   1. Sudden onset suggests hypothalamic lesion (rare); assess dietary practices.
   2. Cushing's syndrome (with characteristic buffalo hump); evaluate medications used (chronic steroid use).
D. Abnormal skin pigmentation.
E. Abnormal hirsutism.
   1. Normal variations in body occur on nonendocrine basis.
   2. May be first sign of neoplastic disease.
   3. Indicates change in adrenal status.
✦ F. Evaluate appetite changes.
   1. Polyphagia is a common sign of uncontrolled diabetes.
   2. Indicates thyrotoxicosis.
   3. Nausea and weight loss may indicate Addisonian crisis or diabetic acidosis.
✦ G. Presence of polyuria and polydipsia.
   1. Symptoms usually of nonendocrine etiology.
   2. If sudden onset, suggest diabetes mellitus or insipidus.
   3. May be present with hyperparathyroidism or hyperaldosteronism.
✦ H. Noticeable mental changes.
   1. Though often subtle, may be indicative of underlying endocrine disorder.
      a. Nervousness and excitability may indicate hyperthyroidism.
      b. Mental confusion may indicate hypopituitarism, Addison's disease, or myxedema.
   2. Mental deterioration is observed in untreated hypoparathyroidism and hypothyroidism.
   3. Mental retardation is present in some endocrine gland disorders.

System Implementation

A. Give medications on schedule to maintain accurate blood level.
B. Instruct the child and parent on signs and symptoms and side effects of medications.
C. Instruct the child and parent on methods to decrease infection.
D. Provide appropriate nutrition and education.

THYROID GLAND DISORDERS

Hypothyroidism

✦ *Definition*: Hypothyroidism is a condition caused by low production of thyroid hormones. It can be congenital or acquired, acute or chronic. Screening is routinely done on neonates. Beyond the first 2 years of life, primary hypothyroidism can be caused by many defects, and the effects are generally less severe than the congenital form.

Assessment

✦ A. Assess for severe retardation of physical development, resulting in decelerated growth, sexual development retardation.
✦ B. Evaluate severe mental retardation, apathy in older children.
✦ C. Assess for dry skin; coarse, dry, sparse brittle hair; puffiness around eyes (myxedematous skin changes).
D. Evaluate constipation.
E. Assess teething pattern (usually slow).
F. Assess for poor appetite.
G. Examine tongue (usually large).
H. Check for pot belly with umbilical hernia.
I. Assess for sensitivity to cold.
J. Evaluate laboratory values to confirm diagnosis.
   1. T_4 levels decreased, elevated TSH.
   2. Elevated serum cholesterol.

Implementation

✦ A. Monitor administration of drugs; must be started immediately in infants to avoid mental deficiencies.
   1. Synthroid (levothyroxine).
   2. Dosage is based on age, weight, and response to treatment.

B. Involve older children in treatment plan.
C. Support and education of family and child; make appropriate referrals.

Hyperthyroidism (Graves' Disease)

Definition: The oversecretion of thyroid hormone, occurring more commonly in adolescents. The etiology is unknown, but the disease is more common in girls and has familial tendencies.

Assessment

A. Obtain family history.
B. Assist with diagnostic evaluation.
   1. Increased levels of T_3 and T_4.
   2. Decreased levels of TSH.
✦ C. Weight loss with excellent appetite.
✦ D. Nervousness; irritability, difficulty sleeping, heat intolerance, excessive sweating, tachycardia.
E. Characteristic exophthalmos.
F. Vomiting/diarrhea.
G. Occasionally palpable goiter.
H. Heat intolerance.
I. Warm, moist skin.

Implementation

✦ A. Oral administration of propylthiouracil (antithyroid medicine), iodine (to shrink the size of the thyroid gland), followed by either radioactive iodine or surgery to remove the gland. A beta blocker, e.g., Inderal (propranolol), is used to block the stimulating effects of the hyperactive thyroid gland (e.g., tremors).
   1. Teaching about medications and side effects.
   2. Administer iodine preoperatively as ordered.
B. Most common treatment is ingestion of Iodotope (radioactive iodine) as ablative therapy.
C. Surgery may be necessary (thyroidectomy).
✦ D. Monitor for thyroid storm—teach child and parents signs of and management.
E. Support child and family—discharge teaching.

PITUITARY GLAND DISORDERS

Hypopituitarism (Growth Hormone Deficiency)

Definition: Hyposecretion of growth hormone (growth hormone deficiency—GHD) by the anterior pituitary. Growth is symmetrical but decreased. Most causes are idiopathic, but may be related to previous trauma to pituitary area (infection, tumor, radiation therapy).

Assessment

✦ A. Assess for retarded linear physical growth with normal weight; review family history.
✦ B. Assess for delay of body-aging processes, delay in appearance of permanent teeth, delayed sexual development.
C. May have premature aging.
D. Examine pale, dry, smooth skin; thin hair.
E. Assess for poor development of secondary sex characteristics and external genitalia.
F. Assess for slow intellectual development.

Implementation

✦ A. Assist with diagnostic studies (x-rays, blood tests, CT scan, MRI) and support child and family.
B. Monitor administration of human growth hormone (HGH) injections; if the imbalance is diagnosed and treated in early stage, 80% of children respond to growth hormone and increase their growth.
C. Monitor response to medication; plotting growth chart and evaluating development of secondary sex characteristics.
D. Support family and refer to social services if condition continues.
E. Support and teaching to client and family (most children responding to HGH will reach adult height but puberty may be delayed). Teach families to give injections, monitor for complications.

Pituitary Hyperfunction

Definition: Hypersecretion of growth hormone by the anterior pituitary (termed *acromegaly* if occurring after epiphyseal plates close), which occurs in childhood prior to closure of the epiphyses of the long bones.

Assessment

✦ A. Evaluate growth trends—patterns of height and weight overgrowth. Assess for symmetrical overgrowth of the long bones, increased development of muscles and viscera.
✦ B. Assess for increased height in early adulthood (may reach height of 8 feet [243.8 cm] or more).
C. Evaluate deterioration of mental and physical processes, which may occur in early adulthood if condition untreated.
D. Early diagnosis and intervention is essential.

Implementation

A. Care for client as irradiation or surgical intervention of pituitary program is instituted.
B. Administer care for hypophysectomy.
C. Provide emotional support to child and family.

Phenylketonuria

✦ *Definition*: An inborn error of metabolism, inheritance is via autosomal recessive transmission with an absence of

the enzyme that converts phenylalanine to tyrosine. By-products accumulate and are toxic to the CNS. Phenylalanine is present in most protein-rich foods, cow's milk, and breast milk.

Assessment

✦ A. Neonatal screening done on all newborns before leaving hospital. If the infant is less than 48 hours old, the test may not be valid, as it is dependent on sufficient intake of phenylalanine from milk (breast or formula).
   1. Phenylalanine levels greater than 20 mg/dL confirms the diagnosis.
   2. Questionable results may be rescreened or child is given phenylalanine challenge.

B. Infant/child generally is fair skinned, with light hair and eyes (decreased melanin production from inability to generate melanin precursor, tyrosine).

Implementation

✦ A. Treatment is dietary, restricting phenylalanine intake.
   1. Keep phenylalanine serum levels 2–6 mg/dL.
   2. Use low-phenylalanine formula (Lofenalac) formula for infants. Breastfeeding is contraindicated.
   3. Monitor serum phenylalanine; significant brain damage occurs when levels are 10–15 mg/dL.
   4. As the child grows, a phenylalanine-free protein supplement is provided in place of meat, dairy, fish, eggs, legumes, etc. (all protein foods). Staples are fruits, vegetables, and starches.

B. Family and child need comprehensive multidisciplinary teaching program about diet and nutrition.

Diabetes Mellitus

Definition: A total or partial deficiency of insulin. The most common childhood endocrine disorder, incidence peaks in adolescence. (See Diabetes Mellitus in Chapter 8, Endocrine System section.)

Characteristics

A. Until the 1990s, more than 95% of children with diabetes had type 1, usually from genetic predispositions and environmental triggers.
   1. The number of children, especially adolescents, with type 2 diabetes has increased dramatically.
   2. Between 10 and 50% of newly diagnosed children with diabetes have type 2.

B. Rates are highest in Native Americans, blacks, and Hispanics.

C. Family history and obesity are major contributors.

Classification

A. Type 1. An absolute deficiency of insulin and clients are insulin dependent. Often diagnosed in early childhood or adolescence. Requires replacement of insulin.

B. Type 2. The body fails to use insulin properly and may also have deficient insulin levels. Type 2 diabetes has increased dramatically in children.

Assessment

A. Type 1. Obvious symptoms develop quickly in type 1, usually over 2–3 weeks or less.
   1. High blood glucose levels cause the child to urinate excessively, causing an increase in thirst and desire to consume fluids.
   2. Some become dehydrated, resulting in weakness, lethargy, and tachycardia.
   3. Diabetic ketoacidosis occurs at onset of the disease and is diagnosed in about one-third of children with type 1 diabetes.
      a. Ketoacidosis causes nausea, vomiting, fatigue, and abdominal pain.
      b. Acetone-smelling (fruity) breath, Kussmaul respirations, headaches, and changes in LOC may be present; in extreme cases, condition progresses to coma or death.
      c. The blood glucose level with this presentation is > 300 mg/dL with ketones in the serum and in urine.

B. Type 2. Symptoms are milder in children with type 2 diabetes than those with type 1 and develop more slowly—over weeks or even a few months.
   1. Parents may notice a mild or moderate increase in child's thirst and urination or only vague symptoms, such as fatigue.
   2. Usually children with type 2 diabetes do not develop ketoacidosis or severe dehydration.

C. As with adults; random blood glucose levels > 200 mg/dL or fasting glucose level > 125 mg/dL.

D. Clinical signs: polyphagia, polyuria, polydipsia, weight loss, enuresis, decreased attention span, glycosuria and ketonuria.

Implementation

A. When type 1 diabetes is initially diagnosed, children are usually hospitalized, and those with diabetic ketoacidosis are usually managed in a pediatric intensive care unit (PICU) and given fluids (to treat dehydration) and insulin (often intravenously) for a brief time.
   1. Those without ketoacidosis typically receive two or more daily injections of insulin or continuously by a small infusion pump.
   2. Frequent blood glucose monitoring is necessary.

B. Children with type 2 diabetes do not usually need to receive treatment in the hospital.
   1. They do require treatment with drugs to lower blood sugar levels (antihyperglycemic drugs, usually Glucophage), which are taken by mouth.
   2. Drugs used for adults with type 2 diabetes are also used in children; some of the side effects (diarrhea) cause more problems in children.
   3. Occasionally some children with type 2 diabetes need insulin.
   4. Children who lose weight, improve their diet, and exercise regularly can be tapered off drugs.

C. Nutritional management and education are important for all children with diabetes.
   1. Parents and older children are taught how to gauge carbohydrate content of food and adjust what children eat to maintain a consistent daily intake of carbohydrates.
   2. Children of all ages may find it difficult to consistently follow a properly balanced meal plan (consumed at regular intervals) and avoid high-sugar snacks.

D. Infants and preschool-aged children are difficult to manage because of the need to support growth and avoid hypoglycemia.

E. Adolescents may have particular problems controlling glucose levels.
   ✦ 1. Hormonal changes during puberty affect how the body responds to insulin, and higher doses are usually required.
   2. Adolescent lifestyle: peer pressure, increased activities, erratic schedules, body image, or eating disorders may interfere with prescribed treatment regimen, especially meal plan compliance.
   3. Alcohol, cigarettes, and illicit drug use—experimentation with these substances may cause adolescents to neglect their treatment regimen.
   4. Conflicts with parents and other authority figures impact compliance and interfere with management.
   5. Adolescents need adults to recognize issues and give them the opportunity to discuss problems with a healthcare practitioner and participate in a group setting with other adolescent diabetics.
      a. The focus should remain on keeping their blood sugar levels under control.
      b. Adolescents also need to check their blood sugar levels frequently.

PEDIATRIC ONCOLOGY

The signs and symptoms of pediatric malignancy may be subtle and not easily recognized. In addition, the causal factors associated with cancer in children are not clearly defined. Current research supports the theory of a genetic cause, allowing the uncontrolled proliferation of abnormal cells from previously normal ones. Current treatment focuses on chemotherapy and radiation therapy; combinations of the two; and surgical intervention. The specialty area of pediatric oncology is becoming more prominent as the incidence increases and the etiology remains somewhat a mystery.

TREATMENT MODALITIES

Chemotherapy

✦ **Characteristics**

A. Chemotherapeutic agents work on rapidly dividing cells.
B. Tumor's location and cell type affect choice of drugs.
C. Most antineoplastic drugs are metabolized in the liver and excreted by the kidneys so they must be adequately functioning to prevent toxicity.

Assessment

A. Assess if more than one chemotherapeutic agent is being administered.
B. Identify potential side effects of medications (specific to medications used).
   1. GI disturbance.
   2. Loss of hair.
   3. Bone marrow suppression.
C. Assess for fluid and electrolyte imbalances associated with drug therapy.
D. Assess for adequate urine output.
E. Monitor laboratory values.
F. Assess oral cavity for irritation and bleeding gums.

✦ **Implementation**

A. Establish baseline data.
   1. Nutritional status.
   2. Oral condition.
   3. Skin condition.
   4. Degree of mobility.
   5. Psychological status.
   6. Neurological condition.
B. Observe for side effects of cell breakdown.
   ✦ 1. Signs of acute tumor lysis syndrome (ATLS): Tumor degradation rapidly releases intracellular components causing rapid rise in uric acid, phosphate, and potassium. Kidneys are unable to clear substances quickly enough and renal failure may develop.
      a. Monitor for increasing serum potassium, phosphates, BUN and creatinine, and uric acid with corresponding decreasing serum calcium.
      b. Anticipate use of Zyloprim (allopurinol) to decrease uric acid, IV fluids with sodium bicarbonate to alkalinize the urine before chemotherapy starts.
      c. Parenteral urate oxidase, a recombinant enzyme, is able to oxidize uric acid into water-soluble product so that it can be excreted.
   ✦ 2. Stone formation in urinary tract, cystitis.
C. Maintain chemotherapy flow sheet, per institutional protocols.
D. Observe for side effects on rapidly dividing cells.
   ✦ 1. Gastrointestinal mucosa: diarrhea, nausea, vomiting.
      a. Administer antiemetics 1 hour prior to chemotherapy.
      b. Provide mouth care with prescribed product. Use soft toothbrush.
      c. Provide frequent cold, high-calorie beverages.
   2. Hair follicles: loss of hair.
      a. Prepare client for loss (i.e., suggest wig, hats, scarves).
      b. Reassure client that hair will begin to grow back 6–8 weeks after chemotherapy ends.
✦ E. Monitor administration of common drugs according to protocol.
   ✦ 1. Corticosteroids: Deltasone used most frequently.
      a. Monitor side effects, which may include ravenous appetite, change in fat distribution, retention of fluid, hirsutism, occasional hypertension, growth disturbances, and psychological disturbance.
      b. Monitor serum blood glucose levels.
      c. Monitor tapering of medication if prolonged use.

✦ CARDINAL SYMPTOMS OF MALIGNANCY

- Unusual mass or swelling.
- Unexplained paleness, weakness.
- Sudden tendency to bruise.
- Persistent, localized pain or limp.
- Prolonged, unexplained fever.
- Frequent headaches, often with vomiting.
- Sudden eye or vision changes.
- Excessive, rapid weight loss.

✦ 2. Purinethol (mercaptopurine; 6MP): interrupts the synthesis of purines essential to the structure and function of nucleic acids.
   a. Monitor side effects: anorexia, dermatitis, stomatitis; very little toxicity in children but the kidneys must excrete increased amount of uric acid—may be hepatotoxic.
   b. Observe kidney function and possible increase in fluid intake.

✦ 3. Trexall: folic acid antagonist (antimetabolite) that suppresses the growth of abnormal cells enough to permit regeneration of normal cells.
   a. Monitor side effects: ulceration of oral mucosa and nausea, vomiting, diarrhea, and abdominal pain.
   b. Toxic effects: hepatitis, nephropathy, pneumonitis, osteoporosis.
   c. Observe for ulcerations. Discontinue drug temporarily at the appearance of ulcers.
   d. Observe renal function (e.g., drug is excreted through kidneys).
   e. High-dose Trexall often followed with citrovorum factor (leucovorin) rescue.

✦ 4. Cytoxan (cyclophosphamide), Ifex (ifosfamide): alkylating agents that suppress cellular proliferation; have greater effect on abnormal than normal cells.
   a. Monitor side effects: hemorrhagic cystitis, severe immunosuppression.
   b. Provide large quantities of fluids preceding and immediately following drug administration to help prevent side effects (usually three times normal maintenance).

✦ 5. Oncovin (vincristine): alkylating agent used to rapidly induce remissions.
   a. Monitor side effects: insomnia, severe constipation, peripheral neuritis or weaknesses, or syndrome of inappropriate antidiuretic hormone (SIADH).
   b. Once disease is in remission, maintain client on another less toxic drug as ordered.

F. Observe for tumor mass effects.
   1. Leukostasis (peripheral WBC > 100,000).
      a. High number blast cells causes capillary obstruction, microinfarction, and end-organ dysfunction (primary lungs and brain).
      b. Thorough and frequent CNS and respiratory assessment necessary.
   2. Superior vena cava syndrome (obstruction to venous return from upper body due to tumor or enlarged lymph nodes).
      a. Assess swelling or discoloration of face, tachypnea, wheezing, lethargy, headache, or visual disturbances.
      b. Assist with diagnostic procedures: x-ray, CT scan, MRI.
      c. Maintain patent airway; support ventilation and oxygenation, CNS status, and cardiac output until tumor can be reduced.
   3. Spinal cord compression—arising from primary tumor or metastases.
      a. Assess motor weakness, back pain, sensory loss, respiratory compromise (high lesion).
      b. Assist with diagnosis (usually MRI).
      c. Provide pain relief, measures to assist with bowel or bladder dysfunction, ROM if motor impairment.

Radiation

Characteristics

A. Radiation affects all cells but is particularly lethal to rapidly developing cells.
B. Radiation is often utilized in conjunction with chemotherapy and surgery, or as primary therapy.
C. Radiation may be used to eradicate or shrink tumors or to relieve pressure.
D. Total body irradiation used in preparation for bone marrow transplant.
E. Side effects usually dependent on irradiated area.

Assessment

A. Assess for easy fatigability.
B. Assess fluid and electrolyte imbalances due to vomiting, diarrhea, and urinary frequency associated with radiation therapy.
C. Monitor hemoglobin and hematocrit for anemia.
D. Assess skin condition in radiated area.
E. Assess for dental caries, gum disease, and ulcerations.
F. Assess condition of hair.

Implementation

A. Treat radiation sickness.
   1. Monitor symptoms: nausea, vomiting, malaise.
   2. Offer frequent high-calorie feedings (milkshakes with extra protein and vitamins).
   3. Make food trays attractive and palatable.
B. Observe side effects of cell breakdown: signs of tumor lysis syndrome and renal compromise, rising potassium, phosphate, creatinine, and BUN; accumulation of uric acid; and stone formation in urinary tract.
C. Treat side effects of cell breakdown.
   1. Increase fluid intake if adequate renal function.
   2. Monitor intake and output.

D. Treat skin breakdown.
   1. Check client regularly for any redness or irritation at radiation site.
   2. Notify physician immediately.
   3. Apply lotion to area following termination of radiation therapy.
   4. Avoid any irritation to area from clothing, soap, or weather extremes.

E. Treat bone marrow depression.
   1. Watch lab values carefully.
   2. Isolate client if absolute neutrophil count dangerously low (< 1500).
   3. Avoid injections (low platelets), bruising.
   4. Administer antibiotics.
   5. Meticulous hand washing, limit contacts, keep those with any illness away from client.
   6. Remove fresh fruits and vegetables and fresh plants from the client's room.

Surgery

A. Goal is to remove all traces of the malignancy and restore normal functioning. May be palliative or curative (if tumor is encapsulated and localized—and detected early).
B. Current trend is toward more conservative excision (e.g., resections rather than complete amputations).
C. Surgery is generally combined with chemotherapy and/or radiation in treatment of many pediatric cancers.

✦ Biologic Response Modifiers

A. Change in reaction to tumor cells—most agents are monoclonal antibodies.
B. Influence the immune response by affecting numerous cellular activities.
C. Particularly useful in T cell suppression in antirejection therapy for transplant recipients—Neoral, Orthoclone OKT3 (muromonab-CD3), etc.
D. Also used to deplete T cells to reduce graft versus host disease in bone marrow transplant.
E. Some BRMs have direct antitumor effects.
F. Major categories include interferons, interleukins, and colony-stimulating factors.

✦ Bone Marrow Transplantation

A. For cancers that do not respond to conventional therapy, but is high-risk and expensive.
B. May be considered earlier in treatment in children with acute myeloblastic leukemia (AML).
C. Marrow may be retrieved from living relative or unrelated with histocompatibility.
D. High-dose chemotherapy and total-body irradiation are given first in attempt to destroy all malignant cells, and transplanted marrow should then produce normally functioning cells.
E. Posttransplant care involves prolonged stay in protected environment to monitor marrow function and protect from infection.
F. Most serious complication is graft-versus-host disease (GVHD).
G. Child and family require *extensive* multidisciplinary support throughout process.

MALIGNANT DISEASES

Leukemia

Definition: The most common childhood cancer. A potentially fatal malignant disease caused by the unrestricted proliferation of leukocytes and their precursors.

Characteristics

A. Average life expectancy was 3–4 years in the 1940s, but new therapies have extended life expectancy and long-term disease-free survival rates.
B. Types include acute lymphocytic leukemia, which is responsible for about 80% of all childhood cases, and chronic myelocytic leukemia (CML), which affects young adults.
C. Long-term survival in all types treated at major research centers is now around 80%, and the majority are cured.
D. The annual incidence is around 4–5 per 100,000 in Caucasian children less than 15 years old and less in black children under age 15.

Assessment

A. Obtain complete history of symptoms, previous illnesses, cancers, or therapies.
✦ B. Assess for early manifestations, usually vague, nonspecific complaints.
   1. Bone and abdominal pain.
   2. Fever.
   3. Bruising, epistaxis.
   4. Lethargy, pallor, anorexia, or malaise.
   5. Lymph node enlargement.
   6. Night sweats.
   7. Lingering illness (usually a cold or "flu").

C. Assess for late manifestations.
   1. Oral and rectal ulcers.
   2. Hemorrhage.
   3. Infection, overwhelming sepsis.
   4. Increased intracranial pressure, ventricular enlargement.
   5. Invasion of bone, weakened periosteum.
   6. Muscle wasting, weight loss.

Treatment

✦ A. Clinical course.
   1. Untreated: rapid deterioration and death.
   2. Treated: with chemotherapy, 90% of those treated experience at least an initial remission.

B. Initial remission usually occurs following the commencement of induction therapy, the chemotherapy lasting 4–6 weeks. The goal is complete eradication of leukemic cells.

C. Induction is followed by CNS prophylactic therapy and maintenance/intensification therapy.

✦ D. Drugs most commonly used for induction and maintenance of remissions in acute lymphocytic leukemia.
   1. Corticosteroids: Deltasone and Decadron (dexamethasone).
   2. Elspar (L-asparaginase).
   3. Adriamycin (doxorubicin).
   4. Oncovin.
   5. Trexall.

E. Trexall, Cortef (hydrocortisone), and Ara C (cytarabine) administered by intrathecal injection soon after start of remission to prevent central nervous system involvement in high-risk children or those with CNS involvement.

F. Induction therapies differ with AML and CML.

G. Maintenance therapy begins after induction is completed.

Implementation

A. Counsel parents, child, and siblings.
   1. Prepare for diagnostic procedures (bone marrow aspiration, biopsy, LP, and MRI).
   2. Provide support and education throughout therapy: reinforcement of medical information, preparation for procedures.
   3. During periods of remission, encourage normal activity, support growth and development.
   4. Provide support for occurrence of complications or recurrences.
   5. Refer to parents' support group.
   6. Provide for continuing follow-up of family.

✦ B. Prevent infection.
   1. Meticulous hand hygiene in all contacts.
   2. Avoid contact with communicable diseases.
   3. Do not give live virus immunizations while in treatment.
   4. Provide oral hygiene and frequent peri-care.
   5. Prevent and/or treat *Candida* oral infections.
   6. Change intravenous tubing daily, as institutional protocol; monitor IV site closely.
   7. If absolute neutrophil count is very low (< 15,000), implement "reverse isolation."
   8. Monitor fever, CBC, and vital signs closely for early signs of infection.

✦ C. Prevent hemorrhage.
   1. Handle infants carefully.
   2. Pad beds: head, feet, and sides.
   3. Follow platelet count closely, other clotting studies.
   4. Avoid all unnecessary intramuscular and intravenous injections.
   5. Gentle tooth cleaning and oral care.
   6. Monitor for GI bleeding; avoid rectal temps.
   7. Platelet transfusions if actively bleeding.

✦ D. Promote nutrition.
   1. Administer antiemetic 30 minutes before meals (Zofran [ondansetron] most effective) and as needed.
   2. Use anesthetic mouthwash before meals.
   3. Use only soft toothbrushes or soft swabs.
   4. Offer cold liquids high in calories (Popsicles, ice cream, milkshakes), frequently and in small amounts, or any food child will eat.

E. Monitor renal status.
   1. Observe for hemorrhagic cystitis (related to Cytoxan).
   2. Monitor for acute tubular disease.
   3. Meticulous I&O daily weights.

F. Provide ongoing education and support as therapy progresses.
   1. Management of complications.
   2. Alopecia.
   3. Mood changes.
   4. Altered body image.

Wilms' Tumor (Nephroblastoma)

Definition: A cancerous unilateral tumor of the kidney. The most common type of renal cancer in children; peak age of occurrence is 3 years. Multimodal therapy can give 90% cure in localized tumors (stage I or II).

Assessment

A. Evaluate family history, previous symptoms and illnesses, usual voiding patterns.

✦ B. Carefully assess child's abdomen (see Implementation B).

C. Assess for presence of fever or abdominal pains.

D. Assist with diagnostic evaluation; ultrasound, CT scan, blood studies, urine evaluation, bone marrow, aspiration if metastases are suspected.

E. Evaluate abdominal girth, anemia, hypertension.

F. Assess for other congenital abnormalities of genitourinary system.

Implementation

✦ A. Avoid palpation of the tumor preoperatively. (Although tumor is generally well encapsulated, seeding is possible. If a mass is present, defer palpation of abdomen to physicians ONLY.)

B. Treatment is surgical removal of affected kidney and adrenal gland, combined with chemotherapy and possible radiation.
   1. Chemotherapy is indicated for all stages of tumor, usually Oncovin, Dactinomycin (actinomycin D), Adriamycin, and Cytoxan from 6–15 months.
   2. Radiation may be added if tumor is large, not completely resectable, or with metastasis or recurrence.

C. Provide appropriate nursing care aimed at routine postabdominal surgery management, minimizing complications of chemotherapy and radiation therapy (as previously discussed).

D. Support growth and development of child, provide family support and appropriate referrals.

Hodgkin's Disease

✦ *Definition*: A malignancy of the lymph system characterized by painless enlargement of lymph nodes—large, primitive, reticulum-like, malignant cell. Prognosis is greatly improved due to recent staging and treatment protocols. The long-term survival rates are as high as 90% in early-stage disease; 65–75% in advanced stages.

Assessment

A. Assess age. Symptoms usually peak between 15 and 29 years of age.

B. Evaluate enlarged, painless lymph nodes (i.e., nodes are firm and movable).

C. Assess for frequent infections.

✦ D. Assess for stage of disease (CBC, liver function tests; UA, ESR; CT scan of chest, liver, and spleen; bone scans all useful in staging).
   1. Stage I: Disease is restricted to single anatomic site or is localized in a group of lymph nodes; asymptomatic.
   2. Stage II(a): Two or three adjacent lymph nodes in the area on the same side of the diaphragm are affected.
   3. Stage II(b): Symptoms appear.
   4. Stage III: Disease is widely disseminated into the lymph areas and one or more extralymphatic sites (spleen, liver, bone marrow, or lungs).

Implementation

A. Provide symptomatic relief of the side effects of radiation and chemotherapy.

✦ 1. Radiation and chemotherapy used in combination is usual treatment of choice.
   a. Combination drugs commonly used: Adriamycin, Blenoxane (bleomycin), Velban (vinblastine), DTIC (dacarbazine) (ABVD) regimen or Blenoxane, Etopophos (etoposide), Adriamycin, Cytoxan, Oncovin, Matulane (procarbazine), and Deltasone (prednisone) (BEACOPP).
   b. Extensive follow-up is mandatory.

✦ 2. Radiation is used for stages I, II, and III in an effort to eradicate the disease. May be used in involved areas only or to include adjacent nodes.

B. Counsel client and family.
   1. Enlist participation of client and family in treatment plan.
   2. Provide reinforcement of medical teaching, make appropriate multidisciplinary referrals.
   3. Encourage independence where possible.

C. Observe for pressure from enlargement of the lymph glands on vital organs, particularly for respiratory problems from the compression of the airway. Observe for other complications of therapy.

D. Appropriate discharge planning and teaching.

Brain Tumors

✦ *Definition*: The second most common childhood cancer. Two-thirds of brain tumors arise in the infratentorial region of the brain compared with those in adults, which are usually supratentorial. The most common types are cerebellar astrocytoma, medulloblastoma, and brain stem glioma.

Characteristics

A. Stereotactic surgery and procedures using lasers and brain mapping have greatly increased the numbers of tumors that can be resected. Many childhood brain tumors, however, are impossible to remove, or are so situated as to cause damage if completely removed.

B. Tumors occur most frequently in the 5–7 age group.

✦ C. Location: Most tumors occur in the posterior fossa.

✦ D. Types most frequently seen in children:

✦ 1. Astrocytoma (most common pediatric brain tumor—20% of pediatric brain tumors).
   a. Located in the cerebellum.
   b. Insidious onset and slowly progressive course.
   c. Surgical removal usually possible.

✦ 2. Medulloblastoma (about 18% of pediatric brain tumors).
   a. Located in the cerebellum.
   b. Highly malignant, fast growing.
   c. Prognosis poor.

✦ 3. Brain stem gliomas (about 10% of pediatric brain tumors).
   a. Surgical excision difficult. Poor long-term prognosis.
   b. Develops slowly with initial symptoms of cranial nerve palsies.

4. Ependymoma (6% of pediatric brain tumors).
   a. Usually, a ventricular blockage, which leads to signs of increased intracranial pressure.
   b. Treated with incomplete internal compression and radiation therapy.
5. Neuroblastoma.
   a. A malignant, solid tumor primarily occurring in infants and young children.
   b. The tumor generally arises in the adrenal gland, but may originate in any part of the sympathetic chain. First symptom may be abdominal mass.
   c. Growth is by extension and invasion; prognosis is guarded.
   d. Chemotherapy (Oncovin and Cytoxan) can be successful, especially under 1 year of age. Also, autologous stem cell transplantation after high-dose chemotherapy has improved survival rates. Administering the biologic modifier 13-cis-retinoic acid (Accutane) has further increased survival rates.

Assessment

✦ A. Assess for increased intracranial pressure.
   1. Vomiting without nausea, or projectile.
   2. Headache (especially one that awakens from sleep).
   3. Irritability/lethargy (changes in LOC).
   4. Seizures.

B. Measure OFC in children under 3 years old.

✦ C. Neuromuscular changes (motor weakness, clumsiness, poor fine-motor control).

D. Vital signs indicative of Cushing's triad.

E. Papilledema, cranial nerve neuropathy.

Implementation

A. Control and relieve symptoms.

✦ B. Institute seizure precautions.

C. Frequent, thorough neurological assessment—report any changes promptly.

✦ D. Administer postoperative care—prevent postoperative complications.
   1. Maintain child flat in bed on unaffected side if infratentorial procedure. Elevate head of bed with supratentorial procedure.
   2. Logroll for change of position.
   3. Control fever with hypothermia mattress.
   4. Frequently observe vital signs until stable, every 15–30 minutes, with neurological checks. Be alert to signs of CNS infection.
   5. Reinforce a wet dressing with sterile gauze.
   6. Notify physician of increased wetness of dressing and test for possible cerebral spinal fluid leakage.
   7. Minimize increases in ICP: Prevent vomiting, coughing, straining with stool, keep lights dim and noise to minimum, limiting suctioning.
   8. Child may have ventricular drain in place postoperatively; handle as ordered and with aseptic technique.

✦ E. Surgery may be followed by chemotherapy and/or radiation therapy.
   1. Radiation therapy is detrimental to brain growth and development in children less than 3 years old.
   2. Chemotherapy may be used after surgery in children under age 3, and radiation postponed.
   3. Many clinical trials are currently under way.

F. Educate and counsel family.
   1. Counsel family and child through the stages of acceptance of the disease.
   2. Instruct on the use of medications and dosage.
   3. Alert family to signs of increased intracranial pressure.
   4. Suggest the use of a wig, a hat, or a scarf to cover the child's shaved head.
   5. Encourage return of the independence of the child.

BONE TUMORS

Osteogenic Sarcoma

✦ *Definition*: The most common malignant bone tumor in children, originating from osteoblasts (bone-forming cells). Occurs twice as frequently in boys as in girls, most occurring between 4 and 25 years of age. The usual location is in the metaphysis of long bones, near growth plates, especially in lower extremities.

Assessment

✦ A. Assess for tumor. Usually located at the end of the long bones (metaphysis). Most frequently seen at the distal end of the femur or the proximal end of the tibia or humerus. Other sites include the pelvis, jaw, or phalanges.

B. Assist with diagnostic procedures; CT scan, biopsy, bone scan.

✦ C. Assess for pain at site, swelling, and limitation of movement. Tumors are usually painless—pain indicative of metastasis from other cancer, or noncancer trauma.

D. Evaluate lungs, kidneys, thyroid; common sites of metastasis.

Implementation

✦ A. Therapy is aimed at salvaging the limb whenever possible, limb-sparing tumor resection, followed by adjuvant irradiation and/or chemotherapy.

B. Provide postoperative care and pain relief appropriate to procedure.
C. Assist with irradiation and chemotherapy as needed.
✦ D. Administer and monitor frequently used chemotherapy.
1. Adriamycin (antibiotics).
2. High-dose Trexall (antimetabolite) with citrovorum factor rescue.
3. Ifex (alkylating agents).
4. Oncovin (plant alkaloid).
5. Platinol (cisplatin) (synthetic agent).
6. Etopophos (cell cycle–specific mitotic inhibitor).
E. Monitor and manage side effects of chemotherapy and irradiation.
F. Provide education and support to child and family. Involve child immediately with plan of care, therapeutic regimen, and decision making. Make appropriate referrals to community agencies, other healthcare professionals, and support groups. Educate child and family about long-term activities/prognosis and signs of treatment complications and side effects. Support growth and development.

Ewing's Sarcoma

✦ *Definition*: A malignant tumor of the bone originating from myeloblasts with early metastases to lung, lymph nodes, and other bones. Occurs predominantly in individuals 4–25 years old.

Assessment

A. Assist in obtaining history of tumor development.
✦ B. Palpate tumor. Usually located on the shaft of the long bones. Femur, tibia, and humerus are common sites. Lesions at distal ends of extremities have highest cure rate.
✦ C. Assess for swelling and tenderness.
✦ D. Check elevation in temperature, other signs of metastases (enlarged lymph nodes, cough, CNS symptoms).
E. Assess for side effects of therapy.

Implementation

A. Assist with diagnostic procedures; MRI, x-rays, CT scans, biopsy.
✦ B. Treatment is generally limb-sparing surgery with adjuvant irradiation and/or chemotherapy.
C. Rarely, amputation may be necessary.
D. Encourage inclusion of child in discussions of treatment, options, risks, and prognosis.
E. Monitor for side effects of radiation.
✦ F. Administer chemotherapy to treat tumor and prevent metastases.
1. Adriamycin, Blenoxane.
2. Cytoxan; alternate with Ifex and Etopophos.
3. Oncovin.
G. Treat the side effects of chemotherapy and radiation, relieve pain.
H. Listen to parents, child, and siblings as they work through denial, anger, acceptance; allow them their grieving process.
I. Promote age-appropriate activities and group discussions with peers.
J. Assist parents in avoiding overprotection, promoting normal growth and development, encouraging safe activities, interactions with friends and family.

SPECIAL TOPICS IN PEDIATRIC NURSING

Special topics in pediatric nursing include a broad category of subjects relevant to pediatrics, but which do not fit in the system format. This section encompasses venereal diseases, the mentally retarded child, accidents, the battered child syndrome, and, finally, death and children.

THE CHILD WITH INTELLECTUAL/ COGNITIVE IMPAIRMENT

General Concepts

✦ A. Intellectual impairment is used to describe a significant limitation in both intellectual and functional capacity. Intellectual impairment has replaced the term *mental retardation* to describe people with below-average intellectual functioning. This means that the condition manifests in measured intelligence (IQ) and also in adaptive behavior assessed as language skills, cognition, academic ability, self-help skills, social behaviors, and motor performance). (See **Table 13-10**.)

B. Intellectual impairment may result from
1. Genetic conditions: inborn errors of metabolism, chromosomal abnormalities (Down syndrome).
2. Fetal or birth-related factors: fetal alcohol syndrome, maternal infections, asphyxia, prematurity, hyperbilirubinemia.
3. Familial factors: low parental intelligence or environmental deprivation.
4. Acquired conditions: CNS infections, lead poisoning, hydrocephalus (untreated), tumors or posttraumatic injury.

Caring for Children with Intellectual/ Cognitive Impairment

✦ A. Treat the child according to developmental age rather than chronological age.

✦ B. Give the child as much stimulation and love as a child with normal cognitive abilities.

C. Behavioral modification therapy works well with children.

✦ D. Support parents' reaction to the birth of a child with intellectual impairment.
1. Birth presents a threat to the parents' marital relationship and family dynamics.
2. Stages of reactions.
   a. Denial: initial reaction of defense, which protects the parents from admitting that this child, this extension of themselves, is not normal.
   b. Self-awareness: recognition of difference between their child and other children.
   c. Recognition of problem: active search for information on their child's problem and for professional advice.

✦ E. Assess developmental delay—may be first indication of impairment (almost 75% have no physical abnormality).

F. Diagnosis is difficult and should be done by skilled team to ensure no child is mislabeled.

Down Syndrome

Etiology

✦ A. Caused by the presence of an extra chromosome, number 21.

B. Usually the result of nondisjunction in division of gametes. Incidence increases dramatically with increasing maternal age. The incidence of Down syndrome is 1 in 400 births if the mother is 35 years old and 1 in 100 births if the mother is 40 years old.

Assessment

✦ A. Assess facial characteristics: almond-shaped eyes, round face, protruding tongue, flattened posterior and anterior surfaces of the skull, epicanthal folds, and flat nose.

✦ B. Assess musculoskeletal system: Muscles are flaccid and joints are loose.

✦ Table 13-10 CLASSIFICATION OF INTELLECTUAL/COGNITIVE IMPAIRMENT

Type I	Type II	IQ	Description
Mild	Educable	50–75	Can develop social and sensorimotor skills. Can be self-supporting with vocational skills.
Moderate	Trainable—delays in motor development	35–50–55	Can communicate. Minimal learning ability. Poor social interaction skills, but can be independent with supervision.
Severe	Minimally trainable—marked delay in motor development	20–35–40	Poor communicative, social, and sensorimotor skills. Needs supervision and protective environment. Can benefit from habit training.
Profound	Custodial	Below 20–25	Gross retardation. Minimal capacity to function. Requires custodial care.

✦ C. Assess extremities: broad hands, abnormal palmar crease, in-curved fifth finger, first and second toe widely spaced.
D. Assess mental capacity: ranges from moderate to severe intellectual impairment.
E. The condition is apparent at birth with observable features. Down syndrome can be identified prenatally by amniocentesis, chorionic villi sampling, and with maternal blood tests at 20–22 weeks' gestation.

Implementation

A. Refer parents for genetic counseling.
B. Following discharge from hospital, provide follow-up for the family for counseling and child guidance.
C. Refer to the community health agency for follow-up.
D. Alert the parents to the child's increased susceptibility to infections and the need for extra precautions to prevent illness.
E. Assist the parents in developing a program for the child by identifying for them signs of neurological development in the child that indicates readiness for developmental tasks such as sitting, self-feeding, and crawling.

IMMUNIZATIONS

A. Refer to schedule (Appendix 13-2).
B. The schedule format shows
   1. One schedule for persons aged 0–18 years for routine recommendations.
   2. A different schedule for catch-up for persons 0–18 years.
   3. Special populations are represented with bars.
C. The rotavirus vaccine (Rota) is recommended in a three-dose schedule at ages 2, 4, and 6 months. If the Rotarix product is used, then administer it at 2 and 4 months only.
   1. The first dose should be administered at ages 6 weeks through 12 weeks with subsequent doses administered at 4- to 10-week intervals.
   2. Rotavirus vaccination should not be initiated for infants aged > 12 weeks and should not be administered after age 32 weeks.
D. The influenza vaccine is recommended for all children beginning at age 6 months using the inactivated product as an intramuscular injection. The live virus influenza may be given to persons 2–49 years in good health.
E. The human papillomavirus vaccine (HPV) is recommended in a three-dose schedule, with the second and third doses administered at 2 and 6 months after the first dose.
   1. Routine vaccination with HPV is recommended for girls and boys aged 11–12 years. HPV4 may be given to boys and girls. HPV2 may only be given to girls.
   2. Vaccination series can be started as young as age 9 years.
   3. Catch-up vaccination is recommended for boys and girls aged 13–18 who have not been vaccinated previously or who have not completed the full vaccine series.
F. Educating parents.
   1. Need for immunizations.
   2. Minimizing pain and psychological trauma—most well-child visits at 12 scheduled dates will still include at least three injections (or as many as five, if no combination vaccines are used).
   3. Although many studies have found no link between vaccines and autism, recent developments from CDC in 2014 have disclosed there is a link between MMR vaccine and autism with African American boys being the most affected. (but to this day, it remains a controversial issue).
   4. Thimerosal (ethylmercury) has been essentially eliminated from pediatric vaccines. Studies have not demonstrated any cognitive and behavioral problems in babies who might have received these thimerosal-containing vaccines in the past.
   5. If doses of vaccines are switched to combination vaccines, there are no additive adverse effects and immunity is equal to receiving the doses separately.
   6. Educate parents about possible side effects (fever, fussiness, local reaction) to immunizations—and management (Tylenol/Advil to manage fever and pain, massage and warm compresses to local reactions).

POISONING

Definition: Ingestion of toxic substances, which may result in death or severe illness.

Characteristics

✦ A. The most common age group affected is 2-year-olds because of their exploration of the environment through tasting.
✦ B. The major cause of poisoning is improper storage of toxic agents.
   1. Legislation has mandated childproof tops on prescription drugs, but many children can still remove the tops.
   2. Some new forms of drugs, such as transdermal patches or lozenges, are packaged so that they present a danger.
✦ C. Interventions for poisoning.
   ✦ 1. Identify the toxic substance and retrieve the poison and its container.

✦ 2. Consult local poison control telephone number and inform them of the toxic substance.
3. Reverse the effect of the poison.
✦ 4. Vomiting is contraindicated with some substances.

D. Poison control center should always be consulted before treatment is initiated.
E. As of 2008, syrup of ipecac is no longer recommended or available.

Types of Poisoning

✦ A. Tylenol (acetaminophen) poisoning (a substance commonly ingested by children).
1. Toxic dose uncertain, seriousness of ingestion determined by amount ingested and length of time before intervention, and if toxicity is acute or cumulative. Start treatment if single dose is > 150 mg/kg or 7.5 g by history.
2. Symptoms: diaphoresis; nausea and vomiting; lethargy; weakness, pallor, decreased urine output, liver failure.
3. Intervention: Call poison control center and follow directions; lavage with activated charcoal; antidote—Mucomyst (acetylcysteine) binds with acetaminophen.

✦ B. Aspirin (salicylate) poisoning.
1. Moderate toxicity is 300–500 mg/kg; severe toxicity is > 500 mg/kg.
2. Symptoms: hyperventilation (from severe acidosis); nausea and vomiting; delirium; dizziness; confusion; bleeding, diaphoresis, fever (hyperexia), tinnitus (chronic toxicity).
3. Intervention: Induce vomiting; lavage with activated charcoal; IV fluids; dialysis in severe cases; vitamin K if bleeding present.

✦ C. Chemical poisoning.
1. Toxic dose: Any corrosive chemical is toxic.
2. Symptoms: respiratory problems, burns.
3. Interventions: Avoid emesis, which could cause further damage; dilute with water if ordered; maintain patent airway; give steroids if ordered.

Lead Poisoning

✦ *Definition*: An environmental disease caused by the ingestion of lead-based materials, such as paint.

Characteristics

The effects of lead exposure to young children and pregnant women are as follows.

A. By inhalation or ingestion.
1. Fatigue, poor attention span, irritability, hyperactivity.
2. Decreased IQ scores, poor school performance, behavior problems, perceptual-motor difficulties.
3. Anemia.
4. GI: poor appetite, nausea and vomiting (N&V), constipation, lead line in gums.
5. Renal: glycosuria, proteinuria, renal failure.

B. Lead crosses the placenta.
1. Increased risk of miscarriage.
2. Fetal malformations.
3. Low birth weight.
4. Pregnancy-induced hypertension (PIH).

Assessment

A. Standard blood levels indicating toxicity have been lowered from < 25 mg/dL to < 5 mg/dL. This level aids in early detection and treatment, before severe symptoms appear. CDC has recommended that public health actions be initiated for children ages 1-5 with blood lead levels above 5 micrograms per deciliter (μg/dL) (retrieved from CDC on November 23, 2014: http://www.cdc.gov/nceh/lead/)
1. Children with serum lead levels > 20–25 mg/dL should be removed from the lead source.
2. Children with lead levels between 5 and 15 mg/dL should be monitored frequently.
3. Children with lead levels > 35 mg/dL should begin chelation treatment (see Implementation).

B. Obtain serum lead levels for children ages 12–36 months annually if enrolled in child health screening in government programs and if lead questionnaire indicates possible exposure. Children typically do not have observable symptoms indicative of elevated lead levels.

✦ C. Assess gastrointestinal symptoms.
1. Unexplained, repeated vomiting; loss of weight.
2. Vague chronic abdominal pain.
3. Pallor, listlessness, fatigue due to anemia caused by interference with the biosynthesis of heme.

✦ D. Assess central nervous system symptoms.
1. Irritability.
2. Drowsiness.
3. Ataxia.
4. Convulsive seizures.

Implementation

✦ A. Institute preventive measures.
1. Inspect structures built before 1978 (especially before 1955) in which lead-based paint was used.
2. Change old lead pipes that have corroded.
3. Cover areas painted with lead paint with plywood or linoleum or hire specially trained persons to remove lead-based paint.

4. Educate parents to have children wash hands before eating, and to provide a diet high in iron, calcium, and vitamin C, which will prevent the absorption of lead if ingested.
5. Educate parents to avoid the use of lead-containing ceramic dishes as storage containers for food. Avoid lead in candy. Do not buy toys or jewelry that contain lead. Avoid home remedies that contain lead.
6. Remove clothing and wash after hobbies or activities that involve lead (for example, mining, stained glass, ceramics, auto repair).

✦ B. Treat condition.
- ✦ 1. Medications that aid in removal of lead are Endrate or EDTA (calcium disodium edetate) and BAL (dimercaprol)—given IM only.
- ✦ 2. Method: IV preferable because IM injections are very painful.
  - ✦ a. With EDTA observe for signs of hypocalcemia: tetany and convulsions.
  - b. Provide for seizure precautions.
  - c. Record accurate intake and output to evaluate kidney response to chelating agents.

Treatment of Poisoning at Home

A. See Poisoning section, page 731–733.
B. At a well-child visit, give parent the telephone number of the American Association of Poison Control Centers Poison Help Line (1-800-222-1222).
✦ C. Keep poison control telephone number immediately available.
✦ D. Instructions to the family.
1. When poisoning occurs, telephone the control number. Be sure to know the brand name of the poison and the approximate amount ingested.
2. Institute the program suggested by poison control.
3. If no telephone number is available, call a physician and take the child to the emergency room; bring the bottle of poison and have a neighbor or a friend drive.

E. Diagnostic information the physician will need.
1. What child ingested.
2. The amount ingested.
3. Odor on breath.
4. Pupil changes.
5. Presence of abdominal pain, nausea, or vomiting.
6. Convulsions.

ACCIDENTAL INJURY

Definition: Unexpected events that lead to recognizable injury or metabolic changes.

General Categories of Injuries

A. Incidence: Unintentional injuries are the leading cause of death from 1 to 19 years of age.
B. Each year, 20–25% of all children sustain an injury severe enough to require medical attention and missed school.
1. For every childhood death from injury, there are 34 hospitalizations and 1000 ER visits.
2. Lower socioeconomic status and male sex have higher incidence of accidental death.

C. The top three causes of death by age group (CDC 2012 statistics).
1. 0–1 years.
   a. Developmental and genetic conditions that were present at birth (neonatal cause of death).
   b. Unintended injuries—suffocation, motor vehicle accident (MVA), drowning, and burns. From 1 month to 12 months of age LEADING cause of death.
   c. Sudden infant death syndrome (SIDS).
   d. All conditions associated with prematurity and low birth weight.
2. 1–4 years.
   a. Unintended injuries—MVA, drowning, fire/burns, suffocation, pedestrian, falls.
   b. Cancer.
   c. Heart disease.
   d. Homicide.
3. 5–9 years.
   a. Unintended injuries—MVA, fires/burns, drowning, suffocation, other land transport (bicycles, skateboards, etc.), pedestrian, firearms.
   b. Cancer.
   c. Influenza and pneumonia.
   d. Homicide.
4. 10–19 years.
   a. Unintended injuries—MVA, drownings, fires/burns, other land transport, suffocation, poisoning, firearms.
   b. Suicide.
   c. Cancer.
   d. Homicide.

D. There are almost twice as many deaths in the first year of life as there are in the next 13 years total (due to congenital defects and SIDS).
1. The death rate rises rapidly following puberty due to the large number of deadly accidents (MVAs), homicides, and suicides in the 15- to 24-year age group.
2. The top three causes of death in teens should all be preventable.
3. Other top causes of accidental death are drowning, fire, falls, and poisoning.

Accident Prevention

A. Control of agent when possible.
✦ 1. Education of parents as to what substances are hazardous and how to "safety-proof" a home.
✦ 2. Use of car seats and seat belts, use of bicycle helmets.
3. Smoke detectors in home.
4. Decrease temperature on hot water heater to 120°F or 48.89°C.
✦ 5. Safe storage of poisons and prescriptions (with safety caps).
6. Pools should have 5-foot-tall circumferential fence, vigilant observation of children around water.
7. Firearms kept unloaded and with trigger locks and locked up where child cannot obtain access.
B. Recognition of risk.
1. Provide accident prevention education appropriate to the age of the child.
2. For children with a history of accidents, take special care to make the environment safe.
3. Encourage parents and siblings to take CPR course.
C. Control of the environment; during crisis periods in families, suggest help for child care and supervision.
D. Encourage families to make "disaster plans."

Car Restraints

A. Educate parents about car seats.
1. After even a minor accident, replace car seat.
2. Car seat faces rear until child is 2 years old.
3. At 40 pounds, use a booster seat and be sure seat belt is positioned correctly.
B. Do not place child in front of air bag because child could be thrown into air bag after braking.
C. All children under 12 are safest in back seat because of air bags.
D. Children should be in protected car or booster seats until adult belt fits them properly.

BEHAVIORAL AND MENTAL HEALTH PROBLEMS

Failure to Thrive

✦ *Definition*: A syndrome characterized by an infant's failure to grow and develop. Etiology is nonspecific. May be organic or nonorganic.

Assessment

✦ A. Assess history of infant: feeding problems, vomiting, sleep disturbance, irritability, sucking ability, aversion to formula, and irregularity in daily activities.
B. Assess general physical–physiological status to assist in ruling out organic (physiological) cause of disorder.
✦ C. Assess usual nutritional intake to help determine if cause is related to deficient intake, malabsorption, or poor assimilation.
1. Assess number of calories, quality of calories, and feeding patterns.
2. Check weight daily and observe reaction to nutritional program.
D. Assess nature of mother–child relationship.
1. Relationship patterns.
2. Ability of mother to perceive infant's needs.

Implementation

✦ A. Priority—provide sufficient nutrients so that infant will grow.
1. Develop a structured feeding routine.
2. Weigh daily to assess weight gain.
3. Foster parent–infant attachment.
4. Consult with dietician, occupational therapist, and physical therapist.
✦ B. Provide nurturing to infant.
1. Ensure a warm, loving environment through holding, cuddling, and physical contact.
2. Limit number of persons interacting with infant; primary nursing preferred.
3. Spend time talking to infant and building a trusting relationship.
4. Maintain as much eye-to-eye contact as possible.
C. Provide a positive, quiet, nonstimulating environment to promote psychosocial growth.
D. Assist parents to develop a positive relationship with infant.
1. Do not be judgmental in evaluating parent–infant relationship.
2. Support parent as she/he attempts to cope with situation.
3. Encourage parent to express feelings.
4. Include parent in plan of care.
5. Evaluate continuing parent–infant relationship.
E. Document feeding behaviors and evaluate infant progress.
F. Coordinate referral services for family when infant discharged.

Child Abuse

✦ *Definition*: Child maltreatment is any nonaccidental physical abuse resulting from an absence of reasonable standards of care by the parents or the child's caretaker.

Epidemiology

✦ A. Incidence.
1. In 2010, approximately 695,000 children were identified as victims of substantiated physical,

sexual, or emotional abuse or neglect. The national rate of victimization is 12.4 per 1000 children.

✦ 2. In 2010, 78% suffered neglect, 18% were physically abused, and 9% experienced sexual abuse. Approximately 1560 children died from maltreatment in 2010. Eighty percent of children killed were younger than 4 years of age.

✦ 3. In the hospital emergency room it is estimated that 10% of the injuries seen in children under 5 are actually caused by parents or are the result of negligence.

B. Victims.

✦ 1. Premature infants have a three times greater risk of becoming battered children than full-term infants.

2. Stepchildren have an increased risk.

3. Often are physically or developmentally delayed.

4. Have behavior that makes the child seem demanding or "difficult."

C. Environment.

✦ 1. Abuse usually occurs on the same day as a crisis or stressful event.

2. Abuse may occur during periods of economic hardship.

3. Abuse usually occurs in anger after the parent (or perpetrator) is provoked.

Clinical Indications of Abuse

(Focus is on physical abuse.)

A. History of the problem.

✦ 1. The cause given for the condition is implausible, e.g., punishment is inappropriate for the age of the child.

✦ 2. There are discrepancies in the history from neighbors or various members of the family.

✦ 3. There is a delay in seeking medical help for the child.

✦ B. Physical examination and indications for diagnosis.

1. Bruises, welts, and scars in multiple stages of healing, in unusual locations.

2. Fingermark pattern of bruises.

3. Bite, rope, or choke marks.

4. Cigarette and/or hot water burns.

5. Eye damage, subdural hematoma, failure to thrive, and/or intra-abdominal injuries.

6. Radiographic findings of multiple bone injuries at different stages of healing.

7. Passive, noncommunicative, and/or withdrawn child.

8. Shaken baby syndrome, now called *abusive head trauma*, has been documented in children up to 5 years of age.

Characteristics of Perpetrators

A. Majority of perpetrators of physical abuse are direct relatives (81% were parents with mothers more likely than fathers); approximately only 2% are caregivers.

✦ B. Parents were usually abused as children.

✦ C. Abusers are unable to utilize outside help (neighbors, friends, or professionals) when angry at their child; isolated from community and social groups.

D. Spouse of abuser frequently does not know how to prevent the occurrence or recurrence of the abuse.

✦ E. Abusive parents frequently have unreasonable expectations of their children—they expect a baby to meet their needs, cannot cope with demands of infant (or protracted crying).

F. Characteristics of the abusive family.

1. Intense competition for emotional resources within the family for affection, attention, nurturing.

2. Unpredictable and unstable family environment.

3. Conflict resolution generally achieved through aggression or power struggle between family members.

4. Communication characterized by mixed or double messages, threats, or a focus on nonverbal communication rather than direct verbalization.

5. Frequent domination by a single family member who maintains control through manipulation, intimidation, deceit, and aggression.

Legal Responsibility

✦ A. Both nurse and doctor are legally responsible to report a suspected battered child to the proper authorities.

B. The designated community authorities are responsible for determining placement of the abused child.

C. Support prevention educational programs.

✦ Attention Deficit–Hyperactivity Disorder

✦ *Definition*: A developmental disorder that involves a group of behavioral symptoms with difficulty in attention and concentration, impulse control, and hyperactivity.

Characteristics

A. The prevalence of attention deficit–hyperactivity disorder (ADHD) in children ages 4–17 in the United States was approximately 9.5% (in 2010). The male to female ratio was 2:1.

B. Symptoms may become apparent as early as age 3 or 4 years, but medication is not started until the child is in a structured school setting.

C. ADHD is more common in first-degree biologic relatives, which suggests a genetic predisposition for the disorder.
D. There are several theories about the cause of ADHD including central nervous system abnormalities, prenatal substance abuse, complications related to labor and delivery, chaotic and abusive home environments.

Assessment

✦ A. Identify child with this disorder by assessing presence of diagnostic criteria. Behavior must be inconsistent with developmental level, persist for at least 6 months, and demonstrate at least six of the following behaviors for diagnosis of ADHD.
  ✦ 1. Inattention.
    a. Does not complete things, often loses things, is forgetful in daily activities.
    b. Fails to give close attention to details or makes careless mistakes.
    c. Demonstrates difficulty in concentrating.
    d. Easily distractible by external stimuli, has difficulty organizing tasks.
    e. Cannot stick to a play activity.
  ✦ 2. Impulsivity.
    a. Often acts before thinking.
    b. Moves rapidly from one activity to another.
    c. Cannot organize work effectively.
    d. Requires close supervision.
    e. Interrupts in class.
    f. Cannot wait to take turns; has difficulty in group activities.
  ✦ 3. Hyperactivity.
    a. Runs around, jumps, and climbs constantly, excessively.
    b. Cannot sit still or stay seated for very long, interrupts, blurts out answers in school, has difficulty waiting turn and staying in seat.
    c. Moves around during sleep.
    d. Seems to be always active, fidgets or squirms.
  4. Onset before 7 years of age.
  5. Cause is not identified as schizophrenia, affective disorder, mental retardation, or other disorder.
  6. Must be present in two or more locations (home, school, or other social situation—church, recreation).

B. Observe for additional traits.
  1. Negativistic.
  2. Emotional lability.
  3. Easily frustrated.
  4. Nonlocalizing neurological signs, learning disabilities, and abnormal electroencephalogram (EEG) may or may not be present.

Implementation

A. Coordinate treatment plan with physician, family, and educational counselor.
  1. Behavioral therapy with medications is preferred.
  2. Behavior therapy alone has lesser results.

✦ B. Provide safe environment with minimal stimulation.
  1. Decrease number of stimuli; reduce extraneous stimuli.
  2. Set limits on behavior.
  3. Structure activities.
  4. Provide for energy outlets: Allow large muscle movements.
  5. Provide for quiet area and time.

C. Establish primary relationship, if possible, with short contact times.

✦ D. May establish behavior modification program; encourage positive behavior. Assist to build self-esteem, which is usually low.

E. Assist client to establish own controls and behavior.

F. The consensus is that it is NOT necessary to limit sugar, additives, and artificial colors. It may be helpful to add sugar, additives and, or artificial coloring and determine if the child's behavior changes.

G. Stimulant medications cause the child to have a poor appetite. Plan ways to be sure that the child has adequate intake of healthy foods throughout the day.

H. Administer medication
  1. Ritalin (methylphenidate) and its newer timed-release forms (Concerta, Ritalin LA, Metadate ER).
  2. Dexedrine (dextroamphetamine) or Adderall (amphetamine/dextroamphetamine) and long-acting form (Adderall XR).
  3. Strattera (atomoxetine), a nonstimulant medication.

I. Obtain observations of the child from several settings using standardized questionnaires such as the Conners' Teacher Rating Scale in order to titrate medication dosage for best effects.

Learning Disorders

Definition: Described as the inability to acquire, retain, or broadly use specific skills or information, which affects how a person understands, remembers and responds to new information.

Characteristics

A. Result from deficiencies in attention, memory, or reasoning and can cause difficulty in listening or paying attention, speaking, reading or writing, and in math performance.
B. Include disorders such as dyslexia, dysgraphia, dyscalculia, dyspraxia, and information-processing disorders.

Assessment (Warning Signs)

A. Delays in language development: Children are unable to put sentences together by age 2½.
B. Speech difficulty: Parents and others cannot understand what children say more than half of the time at age 3 years.
C. Coordination difficulty: Children are unable to tie shoes, button, hop, and cut by around age 5.
D. Short attention span: Between 3 and 5 years old, children are unable to sit still while being read a short story. (Attention span should increase with age during this period.)
E. Eye, ear, speech, and psychological evaluations are helpful; early diagnosis is critical.

Implementation

A. No evidence that special diets, vitamins, or visual programs provide quick fixes.
B. Children need individualized approach, specific to identified learning disability, and help in developing lifelong strategies to accommodate the disorder.

✦ Autism

Definition: A disorder where a young child cannot develop normal social relationships, has language delays or uses abnormal language, may fail to develop normal intelligence, and engages in ritualistic or compulsive behavior. Also referred to as pervasive developmental disorder syndrome (PDDS).

Characteristics

A. Signs usually appear before age 3 years.
B. Previously occurred in about 5 out of 10,000 children.
C. As of 2014, Centers for Disease Control and Prevention (CDC) estimates that 1 in 68 children (or 14.7 per 1000 eight-year-olds) in multiple communities in the United States has been identified with autism spectrum disorder (ASD). Retrieved November 23, 2014, from: http://www.cdc.gov/media/releases/2014/p0327-autism-spectrum-disorder.html

Assessment

A. Abnormal development seen in language (about 50% may never speak). Echolalia or reverse pronouns, unusual pitch and rhythm are common, and children rarely are able to carry an interactive dialogue.
B. Social relationships abnormal.
   1. Infants avoid eye contact, do not cuddle, lack of attachment to parents, prefer to play alone rather than with other children; older children are unable to interpret expressions or moods of others.
   2. Behavior involves repetitive movements (such as hand flapping, rocking, or self-injury), excessive attachment to particular inanimate objects.
C. Majority have intellectual delays.
   1. Unpredictable performance on IQ tests.
   2. Some have ability to perform complex mental or musical skills, but are unable to use the skills in a socially productive or interactive manner.
D. Diagnosis: made by close observation and standardized tests. Metabolic, chromosomal, or genetic abnormalities must be ruled out before diagnosis is made.

Implementation

A. Prognosis influenced by language skills at age 7, and those with severe intelligence deficits may require institutional care.
B. Behavioral modification and special education including physical, occupational, and speech therapy may be helpful.
C. Drug therapy ineffective for underlying disorder, but may help reduce ritualistic behaviors. Antipsychotics may alleviate self-injurious behavior.
D. Special diets, immunologic therapies, and GI therapies are still unproven.

See Pervasive Development Disorders in Chapter 14, Psychiatric Nursing, page 803.

POSSIBLE RED FLAGS FOR AUTISM SPECTRUM DISORDERS

Children with an autism spectrum disorder might

- Not play "pretend" games (pretend to "feed" a doll).
- Not point at objects to show interest (point at an airplane flying over).
- Not look at objects when another person points at them.
- Have trouble relating to others or not have an interest in other people at all.
- Avoid eye contact and want to be alone.
- Prefer not to be held or cuddled or might cuddle only when they want to.
- Appear to be unaware when other people talk to them but respond to other sounds.
- Repeat or echo words or phrases said to them, or repeat words or phrases in place of normal language (echolalia).
- Have trouble expressing their needs using typical words or motions.
- Repeat actions over and over again.
- Have trouble adapting to changes in routine.
- Have unusual reactions to the way things smell, taste, look, feel, or sound.
- Lose skills they once had (for instance, stop saying words they were once using).

Asperger's Syndrome (Pervasive Developmental Disorder-Not Otherwise Specified)

Definition: Children have impaired social interactions and repetitive behaviors similar to children with autism. Language skills and IQ are normal or above average.

Characteristics

A. Children tend to function at higher levels than children with autism, and may be able to function independently.
B. Psychotherapy may also be helpful.

Depression

Definition: Intense sadness, often following a recent loss or sad event, but persists and becomes out of proportion to the event.

Characteristics

A. May affect a small percentage of children and around 14% of adolescents; familial tendencies are noted.
B. Physiological causes must be investigated.
C. Other behavioral/psychiatric problems, such as schizophrenia, must also be ruled out.
D. History from parents and teachers, and structured questionnaires aid in diagnosis.
E. Risk factors.
    1. Stressful life events (death, divorce).
    2. Head injury.
    3. Substance abuse.
    4. Child abuse, neglect.
    5. Family history of depression.
    6. Unstable relationships with friends, unstable caregiving.
    7. Chronic illness.

Assessment

A. Signs include irritability, angry outbursts, loss of enjoyment in usual activities, faltering school performance, relationship problems with friends and family, sleep disturbances (excessive sleeping or difficulty), concentration or memory problems, decreased energy, change in eating habits, preoccupation with death or suicidal ideation/threats.
B. Any talk of suicide should be taken seriously.

Implementation

A. Rule out physical causes (e.g., thyroid disorder), bipolar disorder, schizophrenia, or other psychiatric disorders.
B. Combination psychotherapy and antidepressant therapy is needed.
C. Selective serotonin reuptake inhibitor (SSRI) medications can cause some "activation" of suicidal thoughts. Current research indicates that SSRIs are NOT prohibited in children and adolescents. However, the decision whether to use a particular SSRI should be based on its potential for a therapeutic effect.
D. Cognitive-behavioral therapy to increase coping skills and social skills to provide skills to manage stress.

Sexual Abuse

Characteristics

A. The perpetrator is more likely to be a family friend or neighbor (75.9%) compared with a parent (2.7%).
B. Perpetrators are most often males who have mental issues, rationalizing behaviors, social skills/empathy deficits, and decreased coping skills.
C. Many perpetrators were abused as children themselves.

Assessment (Behaviors, Parent Clues, Outcomes)

A. The child may exhibit
    1. Difficulty walking or sitting.
    2. Pain on urination or in the genital area.
    3. Previously toilet-trained child may have urinary accidents.
    4. Bruising or laceration of perineal tissue (vaginal or rectal).
    5. Nightmares or other sleep disturbances.
    6. Decreased appetite.
    7. Sudden refusal to participate in gym or other physical activities.
    8. Overt aggression.
    9. Sexual language and innuendo that is not appropriate for age.
    10. Adolescents might be sexually promiscuous.
B. The parent may be:
    1. Overly protective.
    2. Isolating the child from others.
    3. Overly controlling.
C. The child may or may not report the sexual abuse even with direct questioning; some report years later; may keep secrets, accept blame for the situation, may disassociate during the abuse to avoid the pain and feelings.

RISK FACTORS FOR CHILD AND ADOLESCENT SUICIDE

- Preoccupation with morbid themes.
- Poor hygiene and self-care (if an abrupt change).
- Access to firearms and prescription drugs.
- Alcohol or drug abuse.
- Family history of suicide.
- Dramatic changes in mood, peer contact, grades.
- Depressed mood or appetite, or sleep disturbance.
- Previous attempt at suicide.

DEATH AND CHILDREN

Assessment

A. Assess child's understanding of death.
✦ 1. Young child's concerns.
   a. Views death as temporary separation from parents, sometimes viewed synonymously with sleep.
   b. May express fear of pain and wish to avoid it.
   c. Child's awareness is lessened by physical symptoms if death comes suddenly.
   d. Gradual terminal illness may simulate the adult process: depression, withdrawal, fearfulness, and anxiety.
✦ 2. Older children's concerns.
   a. May identify death as a "person" to be avoided.
   b. May ask directly if they are going to die.
   c. Concerns center around fear of pain, fear of being left alone, and leaving parents and friends.
3. Adolescent concerns.
   a. Recognize death as irreversible and inevitable.
   b. Often avoids talking about impending death and staff may enter into this "conspiracy of silence."
   c. Adolescents have more understanding of death than adults tend to realize.
B. Assess impact of death on child.
C. Assess parent's ability to cope with death of child.

Implementation

✦ A. Always elicit child's understanding of death before discussing it with him or her.
✦ B. Before discussing death with child, discuss it with child's parents.
C. Parental reactions include the continuum of grief process and stages of dying.
   1. Reactions depend on previous loss experience.
   2. Reactions also depend on relationship with the child and circumstances of illness or injury.
   3. Reactions depend on degree of parental guilt.
D. Assist parents in expressing their fears, concerns, and grief so that they may be more supportive of the child.
E. Assist parents in understanding siblings' possible reactions to a terminally ill child.
   1. Guilt: belief that they caused the problem or illness.
   2. Jealousy: desire for equal attention from parents.
   3. Anger: feelings of being left behind.
F. Enlist multidisciplinary support.

Sudden Infant Death Syndrome

✦ *Definition*: The sudden, unexplainable death of an infant during sleep, with the exact cause unknown despite a thorough investigation that includes a complete autopsy, examination of the death scene, and review of the clinical history.

Characteristics

A. SIDS was the second leading cause of death in infants from 1–12 months of age in 2009.
✦ B. Peak incidence from 2–4 months of age. Uncommon after age 6 months.
✦ C. Higher incidence in winter, June and July, and low-income groups.
D. On autopsy results vary; inflammation of upper respiratory tract and pulmonary edema have been found.
E. Maternal factors: lower socioeconomic status.
✦ F. Infant factors: SIDS more common in premature and small-for-gestational-age infants; male gender, prenatal exposure to cigarette smoke or alcohol, under age 6 months.
G. Sleep: Most deaths are unobserved; death during sleep is common.
H. Extrinsic modifiable risk factors: prone sleeping position, bed sharing, use of soft bedclothes or soft mattresses, putting the infant to sleep on upholstered furniture or adult mattresses, and exposure to cigarette smoke.
I. Familial recurrence: genetic predisposition among American Indian and African American ethnic groups.
J. Etiology unknown. Current research accepts that SIDS is the result of an interaction among nonmodifiable (intrinsic) and modifiable (extrinsic) risk factors.

Assessment

A. Assess age of infant and remaining epidemiologic findings.
B. Assess for prematurity/low-birth-weight infant.
C. Check for respiratory pauses, sleep apnea.
D. Check for gastroesophageal reflux/apnea associated with regurgitation after feeding, or tiring during feeding
E. Assess for past history of oxygen administration. (C, D, E specific to an apparent life-threatening event [ALTE.])

Implementation

✦ A. Recent research has shown that there is a correlation between SIDS and infants sleeping on abdomen. Incidence of SIDS in the United States has decreased more than 70% since the original "Back-to-Sleep" program in 1994. Teach mothers

to place infant on back for sleep, to place the infant on a firm surface in a bassinet or crib in the parents' room for sleeping.

✦ B. Apneic episode discovered: infant responds when stimulated (referred to as ALTE). Instruct parents in care.
   1. Shake/stimulate infant. If no response, immediately begin rescue breathing and CPR.
   2. Take infant to physician or nearest emergency room.
      a. Record accurate history from parents: time of discovery of infant, color of infant, skin temperature, spontaneous respirations after stimulation.
      b. Ask relevant questions: Was CPR begun? How long after? How long was it continued? Did infant respond? Did there appear to be regurgitation of formula when infant was discovered? When did infant last eat?
   3. Assist physician in a complete neurological, developmental, and physical exam of infant, including lab work.
   4. Teach parents CPR.
   5. Instruct parents about care of a child on a home monitor (controversial).
   6. Give parents phone numbers for respite care and support groups.

C. Infant dies; upon autopsy, SIDS is diagnosed.
   1. Support parents through loss and grieving process. Reassure parents that they did everything right for the child. Emphasize blamelessness of parents and siblings.
   2. Inform parents of result of autopsy as soon as possible so grieving process may begin.
   3. Refer parents to National Foundation for SIDS, other local support groups.

✦ Appendix 13-1. DENTAL DEVELOPMENT

Part 1. Dentition Principles

A. Age at eruption of deciduous teeth is variable. Generally lower central incisors erupt first at approximately 6–10 months, followed by upper central incisors between 8 and 12 months, then lower lateral incisors at 10–16 months and upper lateral incisors between 9 and 13 months.
B. First molars: generally appear between 13 and 19 months (upper and lower)—somewhat earlier in males.
C. Second molars usually erupt between 23 and 33 months, sometimes slightly earlier in males.
D. Eruption of teeth often accompanied by drooling, irritability, biting, and decreased sucking, and sometimes low-grade temperature and sleep disturbances.
E. Parents need reassurance and teaching. Cold objects (frozen teething rings), topical gels, or Tylenol (acetaminophen) in proper doses may be helpful.
F. Loss of deciduous teeth and eruption of permanent teeth is usually in the same order as eruption, usually starting at 6–7 years old.
G. At age 6–7, the first permanent molars erupt.
H. By age 11–12, children have 28 of 32 permanent teeth.
I. Anticipatory guidance.
   1. Regular brushing of deciduous teeth from eruption of first tooth.
   2. Children up to 8–9 years old need help flossing.
   3. Fluoride supplements may be given, considering fluoridation of water supply.
   4. Regular visits to a dentist start early. Schedule varies depending on the child's general health and compliance with dental health practices.

Part 2. Dental Development Stages

	Age at Eruption		Age at Shedding	
Deciduous Teeth	**Maxillary**	**Mandibular**	**Maxillary**	**Mandibular**
Central incisors	6–8 months	5–7 months	7–8 years	6–7 years
Lateral incisors	8–11	7–10	8–9	7–8
Cuspids	16–20	16–20	11–12	9–11
First molars	10–16	10–16	10–11	10–12
Second molars	20–30	20–30	10–12	11–13

	Age at Eruption	
Permanent Teeth	**Maxillary**	**Mandibular**
Central incisors	7–8 years	6–7 years
Lateral incisors	8–9	7–8
Cuspids	11–12	9–11
First molars	6–7	6–7
Second molars	12–13	12–13
First premolars	10–11	10–11
Second premolars	10–12	11–13
Third molars	17–22	17–22

✦ Appendix 13-2. RECOMMENDED IMMUNIZATION SCHEDULES FOR PERSONS AGED 0 THROUGH 18 YEARS–UNITED STATES, 2014

This schedule includes recommendations in effect as of January 1, 2014. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967).

The Recommended Immunization Schedules for Persons Aged 0 Through 18 Years are approved by the Advisory Committee on Immunization Practices (http://www.cdc.gov/vaccines/acip), American Academy of Pediatrics (http://www.aap.org), American Academy of Family Physicians (http://www.aafp.org), and American College of Obstetricians and Gynecologists(http://www.acog.org).

Source: U.S. Department of Health and Human Services Centers for Disease Control and Prevention

(*Continues*)

Figure 1 RECOMMENDED IMMUNIZATION SCHEDULE FOR PERSONS AGED 0 THROUGH 18 YEARS–UNITED STATES, 2014 (*Continued*)

[FOR THOSE WHO FALL BEHIND OR START LATE, SEE THE CATCH-UP SCHEDULE (FIGURE 2).]

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19–23 mos	2–3 yrs	4–6 yrs	7–10 yrs	11–12 yrs	13–15 yrs	16–18 yrs
Hepatitis B[1] (HepB)	1st dose	◄- 2nd dose -►			◄---------- 3rd dose ----------►											
Rotavirus[2] (RV) RV1 (2-dose series); RV5 (3-dose series)			1st dose	2nd dose	See footnote 2											
Diphtheria, tetanus, & acellular pertussis[3] (DTaP: < 7 yrs)			1st dose	2nd dose	3rd dose			◄--- 4th dose ---►				5th dose				
Tetanus, diphtheria, & acellular pertussis[4] (Tdap: ≥ 7 yrs)														(Tdap)		
Haemophilus influenzae type b[5] (Hib)			1st dose	2nd dose	See footnote 5		◄--- 3rd or 4th dose, See footnote 5 ---►									
Pneumococcal conjugate[6] (PCV13)			1st dose	2nd dose	3rd dose		◄--- 4th dose ---►									
Pneumococcal polysaccharide[6] (PPSV23)																
Inactivated poliovirus[7] (IPV) (< 18 yrs)			1st dose	2nd dose	◄---------- 3rd dose ----------►							4th dose				
Influenza[8] (IIV; LAIV) 2 doses for some: See footnote 8					Annual vaccination (IIV only)						Annual vaccination (IIV or LAIV)					
Measles, mumps, rubella[9] (MMR)							◄--- 1st dose ---►					2nd dose				
Varicella[10] (VAR)							◄--- 1st dose ---►					2nd dose				
Hepatitis A[11] (HepA)							◄---- 2-dose series, See footnote 11 ----►									
Human papillomavirus[12] (HPV2: females only; HPV4: males and females)														(3-dose series)		
Meningococcal[13] (Hib-Men- CY ≥ 6 weeks; MenACWY-D ≥ 9 mos; MenACWY-CRM ≥ 2 mos)			See footnote 13											1st dose		Booster

Range of recommended ages for all children	Range of recommended ages for catch-up immunization	Range of recommended ages for certain high-risk groups	Range of recommended ages during which catch-up is encouraged and for certain high-risk groups	Not routinely recommended

This schedule includes recommendations in effect as of January 1, 2014. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967). Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines/recs/vac-admin/contraindications.htm) or by telephone (800-CDC-INFO [800-232-4636]).

This schedule is approved by the Advisory Committee on Immunization Practices (http//www.cdc.gov/vaccines/acip), the American Academy of Pediatrics (http://www.aap.org), the American Academy of Family Physicians (http://www.aafp.org), and the American College of Obstetricians and Gynecologists (http://www.acog.org).

Figure 2 CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGED 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND—UNITED STATES, 2014

The figure below provides catch-up schedules and minimum intervals between doses for children whose vaccinations have been delayed. A vaccine series does not need to be restarted, regardless of the time that has elapsed between doses. Use the section appropriate for the child's age. Always use this table in conjunction with Figure 1 and the footnotes that follow.

Persons aged 4 months through 6 years					
Vaccine	**Minimum Age for Dose 1**	**Minimum Interval Between Doses**			
		Dose 1 to dose 2	**Dose 2 to dose 3**	**Dose 3 to dose 4**	**Dose 4 to dose 5**
Hepatitis B[1]	Birth	4 weeks	8 weeks and at least 16 weeks after first dose; minimum age for the final dose is 24 weeks		
Rotavirus[2]	6 weeks	4 weeks	4 weeks[2]		
Diphtheria, tetanus, & acellular pertussis [3]	6 weeks	4 weeks	4 weeks	6 months	6 months[3]
Haemophilus influenzae type b[5]	6 weeks	4 weeks if first dose administered at younger than age 12 months 8 weeks (as final dose) if first dose administered at age 12 through 14 months No further doses needed if first dose administered at age 15 months or older	4 weeks[5] if current age is younger than 12 months and first dose administered at < 7 months old 8 weeks and age 12 months through 59 months (as final dose)[5] if current age is younger than 12 months and first dose administered between 7 and 11 months (regardless of Hib vaccine [PRP-T or PRP-OMP] used for first dose); OR if current age is 12 through 59 months and first dose administered at younger than age 12 months; OR first 2 doses were PRP-OMP and administered at younger than 12 months. No further doses needed if previous dose administered at age 15 months or older	8 weeks (as final dose) This dose only necessary for children aged 12 through 59 months who received 3 (PRP-T) doses before age 12 months and started the primary series before age 7 months	
Pneumococcal[6]	6 weeks	4 weeks if first dose administered at younger than age 12 months 8 weeks (as final dose for healthy children) if first dose administered at age 12 months or older No further doses needed for healthy children if first dose administered at age 24 months or older	4 weeks if current age is younger than 12 months 8 weeks (as final dose for healthy children) if current age is 12 months or older No further doses needed for healthy children if previous dose administered at age 24 months or older	8 weeks (as final dose) This dose only necessary for children aged 12 through 59 months who received 3 doses before age 12 months or for children at high risk who received 3 doses at any age	

(*Continues*)

Figure 2 CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGED 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND—UNITED STATES, 2014 (*Continued*)

Inactivated poliovirus[7]	6 weeks	4 weeks[7]	4 weeks[7]	6 months[7] minimum age 4 years for final dose	
Meningococcal[13]	6 weeks	8 weeks[13]	See footnote 13	See footnote 13	
Measles, mumps, rubella[9]	12 months	4 weeks			
Varicella[10]	12 months	3 months			
Hepatitis A[11]	12 months	6 months			
Persons aged 7 through 18 years					
Tetanus, diphtheria; tetanus, diphtheria, and acellular pertussis[4]	7 years[4]	4 weeks	4 weeks if first dose of DTaP/DT administered at younger than age 12 months 6 months if first dose of DTaP/DT administered at age 12 months or older and then no further doses needed for catch-up	6 months if first dose of DTaP/DT administered at younger than age 12 months	
Human papillomavirus[12]	9 years		Routine dosing intervals are recommended[12]		
Hepatitis A[11]	12 months	6 months			
Hepatitis B[1]	Birth	4 weeks	8 weeks (and at least 16 weeks after first dose)		
Inactivated poliovirus[7]	6 weeks	4 weeks	4 weeks[7]	6 months[7]	
Meningococcal[13]	6 weeks	8 weeks[13]			
Measles, mumps, rubella[9]	12 months	4 weeks			
Varicella[10]	12 months	3 months if person is younger than age 13 years 4 weeks if person is aged 13 years or older			

Footnotes—Recommended immunization schedule for persons aged 0 through 18 years—United States, 2014

For further guidance on the use of the vaccines mentioned on the following pages, see: http://www.cdc.gov/vaccines/hcp/acip-recs/index.html. For vaccine recommendations for persons 19 years of age and older, see the adult immunization schedule.

Figure 2 CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGED 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND—UNITED STATES, 2014

Additional information (*Continued*)

- For contraindications and precautions to use of a vaccine and for additional information regarding that vaccine, vaccination providers should consult the relevant ACIP statement available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html.
- For purposes of calculating intervals between doses, 4 weeks = 28 days. Intervals of 4 months or greater are determined by calendar months.
- Vaccine doses administered 4 days or less before the minimum interval are considered valid. Doses of any vaccine administered ≥5 days earlier than the minimum interval or minimum age should not be counted as valid doses and should be repeated as age-appropriate. The repeat dose should be spaced after the invalid dose by the recommended minimum interval. For further details, see *MMWR, General Recommendations on Immunization and Reports* / Vol. 60 / No. 2; Table 1. *Recommended and minimum ages and intervals between vaccine doses* available online at http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf.
- Information on travel vaccine requirements and recommendations is available at http://wwwnc.cdc.gov/travel/destinations/list.
- For vaccination of persons with primary and secondary immunodeficiencies, see Table 13, "*Vaccination of persons with primary and secondary immunodeficiencies*," in General Recommendations on Immunization (ACIP), available at http://www.cdc.gov/mmwr/pdf/rr/rr6002.pdf; and American Academy of Pediatrics. Immunization in Special Clinical Circumstances, in Pickering, L. K., Baker, C. J., Kimberlin, D.W., & Long, S.S. (eds.) *Red book: 2012 report of the Committee on Infectious Diseases*. (29th Ed). Elk Grove Village, IL: American Academy of Pediatrics.

1. **Hepatitis B (HepB) vaccine. (Minimum age: birth) Routine vaccination:**

   At birth:
   - Administer monovalent HepB vaccine to all newborns before hospital discharge.
   - For infants born to hepatitis B surface antigen (HBsAg)-positive mothers, administer HepB vaccine and 0.5 mL of hepatitis B immune globulin (HBIG) within 12 hours of birth. These infants should be tested for HBsAg and antibody to HBsAg (anti-HBs) 1 to 2 months after completion of the HepB series, at age 9 through 18 months (preferably at the next well-child visit).
   - If mother's HBsAg status is unknown, within 12 hours of birth administer HepB vaccine regardless of birth weight. For infants weighing less than 2000 grams, administer HBIG in addition to HepB vaccine within 12 hours of birth. Determine mother's HBsAg status as soon as possible and, if mother is HBsAg-positive, also administer HBIG for infants weighing 2000 grams or more as soon as possible, but no later than age 7 days.

   Doses following the birth dose:
   - The second dose should be administered at age 1 or 2 months. Monovalent HepB vaccine should be used for doses administered before age 6 weeks.
   - Infants who did not receive a birth dose should receive 3 doses of a HepB-containing vaccine on a schedule of 0, 1 to 2 months, and 6 months starting as soon as feasible. See Figure 2.
   - Administer the second dose 1 to 2 months after the first dose (minimum interval of 4 weeks), administer the third dose at least 8 weeks after the second dose AND at least 16 weeks after the **first** dose. The final (third or fourth) dose in the HepB vaccine series should be administered *no earlier than age 24 weeks*.
   - Administration of a total of 4 doses of HepB vaccine is permitted when a combination vaccine containing HepB is administered after the birth dose.

   Catch-up vaccination:
   - Unvaccinated persons should complete a 3-dose series.
   - A 2-dose series (doses separated by at least 4 months) of adult formulation Recombivax HB is licensed for use in children aged 11 through 15 years.
   - For other catch-up guidance, see Figure 2.

2. **Rotavirus (RV) vaccines. (Minimum age: 6 weeks for both RV1 [Rotarix] and RV5 [RotaTeq])**

   Routine vaccination:

   Administer a series of RV vaccine to all infants as follows:
   1. If Rotarix is used, administer a 2-dose series at 2 and 4 months of age.
   2. If RotaTeq is used, administer a 3-dose series at ages 2, 4, and 6 months.
   3. If any dose in the series was RotaTeq or vaccine product is unknown for any dose in the series, a total of 3 doses of RV vaccine should be administered.

   Catch-up vaccination:
   - The maximum age for the first dose in the series is 14 weeks, 6 days; vaccination should not be initiated for infants aged 15 weeks, 0 days or older.
   - The maximum age for the final dose in the series is 8 months, 0 days.
   - For other catch-up guidance, see Figure 2.

3. **Diphtheria and tetanus toxoids and acellular pertussis (DTaP) vaccine. (Minimum age: 6 weeks.** Exception: DTaP-IPV [Kinrix]: 4 years)

   Routine vaccination:
   - Administer a 5-dose series of DTaP vaccine at ages 2, 4, 6, 15 through 18 months, and 4 through 6 years. The fourth dose may be administered as early as age 12 months, provided at least 6 months have elapsed since the third dose.

   Catch-up vaccination:
   - The fifth dose of DTaP vaccine is not necessary if the fourth dose was administered at age 4 years or older.
   - For other catch-up guidance, see Figure 2.

4. **Tetanus and diphtheria toxoids and acellular pertussis (Tdap) vaccine. (Minimum age: 10 years for** Boostrix, 11 years for Adacel)

   Routine vaccination:
   - Administer 1 dose of Tdap vaccine to all adolescents aged 11 through 12 years.
   - Tdap may be administered regardless of the interval since the last tetanus and diphtheria toxoid-containing vaccine.
   - Administer 1 dose of Tdap vaccine to pregnant adolescents during each pregnancy (preferred during 27 through 36 weeks' gestation) regardless of time since prior Td or Tdap vaccination.

   Catch-up vaccination:
   - Persons aged 7 years and older who are not fully immunized with DTaP vaccine should receive Tdap vaccine as 1 (preferably the first) dose in the catch-up series; if additional doses are needed, use Td vaccine. For children 7 through 10 years who receive a dose of Tdap as part of the catch-up series, an adolescent Tdap vaccine dose at age 11 through 12 years should NOT be administered. Td should be administered instead 10 years after the Tdap dose.
   - Persons aged 11 through 18 years who have not received Tdap vaccine should receive a dose followed by tetanus and diphtheria toxoids (Td) booster doses every 10 years thereafter.
   - Inadvertent doses of DTaP vaccine:

(*Continues*)

Figure 2 CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGED 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND—UNITED STATES, 2014 (*Continued*)

Additional information (*Continued*)

- If administered inadvertently to a child aged 7 through 10 years may count as part of the catch-up series. This dose may count as the adolescent Tdap dose, or the child can later receive a Tdap booster dose at age 11 through 12 years.
- If administered inadvertently to an adolescent aged 11 through 18 years, the dose should be counted as the adolescent Tdap booster.
- For other catch-up guidance, see Figure 2.

5. ***Haemophilus influenzae* type b (Hib) conjugate vaccine. [Minimum age: 6 weeks for PRP-T (ACTHIB, DTaP-IPV/Hib [Pentacel] and Hib-MenCY [MenHibrix]), PRP-OMP (PedvaxHIB or COMVAX), 12 months for PRP-T (Hiberix)]**

Routine vaccination:

- Administer a 2- or 3-dose Hib vaccine primary series and a booster dose (dose 3 or 4 depending on vaccine used in primary series) at age 12 through 15 months to complete a full Hib vaccine series.
- The primary series with ActHIB, MenHibrix, or Pentacel consists of 3 doses and should be administered at 2, 4, and 6 months of age. The primary series with PedvaxHib or COMVAX consists of 2 doses and should be administered at 2 and 4 months of age; a dose at age 6 months is not indicated.
- One booster dose (dose 3 or 4 depending on vaccine used in primary series) of any Hib vaccine should be administered at age 12 through 15 months. An exception is Hiberix vaccine. Hiberix should only be used for the booster (final) dose in children aged 12 months through 4 years who have received at least 1 prior dose of Hib-containing vaccine.
- For recommendations on the use of MenHibrix in clients at increased risk for meningococcal disease, please refer to the meningococcal vaccine footnotes and also to *MMWR* March 22, 2013; 62(RR02);1-22, available at http://www.cdc.gov/mmwr/pdf/rr/rr6202.pdf.

Catch-up vaccination:

- If dose 1 was administered at ages 12 through 14 months, administer a second (final) dose at least 8 weeks after dose 1, regardless of Hib vaccine used in the primary series.
- If the first 2 doses were PRP-OMP (PedvaxHIB or COMVAX), and were administered at age 11 months or younger, the third (and final) dose should be administered at age 12 through 15 months and at least 8 weeks after the second dose.
- If the first dose was administered at age 7 through 11 months, administer the second dose at least 4 weeks later and a third (and final) dose at age 12 through 15 months or 8 weeks after second dose, whichever is later, regardless of Hib vaccine used for first dose.
- If first dose is administered at younger than 12 months of age and second dose is given between 12 and 14 months of age, a third (and final) dose should be given 8 weeks later.
- For unvaccinated children aged 15 months or older, administer only 1 dose.
- For other catch-up guidance, see Figure 2. For catch-up guidance related to MenHibrix, please see the meningococcal vaccine footnotes and also *MMWR* March 22, 2013; 62(RR02);1-22, available at http://www.cdc.gov/mmwr/pdf/rr/rr6202.pdf.

Vaccination of persons with high-risk conditions:

- Children aged 12 through 59 months who are at increased risk for Hib disease, including chemotherapy recipients and those with anatomic or functional asplenia (including sickle cell disease), human immunodeficiency virus (HIV) infection, immunoglobulin deficiency, or early component complement deficiency, who have received either no doses or only 1 dose of Hib vaccine before 12 months of age, should receive 2 additional doses of Hib vaccine 8 weeks apart; children who received 2 or more doses of Hib vaccine before 12 months of age should receive 1 additional dose.
- For clients younger than 5 years of age undergoing chemotherapy or radiation treatment who received an Hib vaccine dose(s) within 14 days of starting therapy or during therapy, repeat the dose(s) at least 3 months following therapy completion.
- Recipients of hematopoietic stem cell transplant (HSCT) should be revaccinated with a 3-dose regimen of Hib vaccine starting 6 to 12 months after successful transplant, regardless of vaccination history; doses should be administered at least 4 weeks apart.
- A single dose of any Hib-containing vaccine should be administered to unimmunized* children and adolescents 15 months of age and older undergoing an elective splenectomy; if possible, vaccine should be administered at least 14 days before procedure.
- Hib vaccine is not routinely recommended for clients 5 years or older. However, 1 dose of Hib vaccine should be administered to unimmunized* persons aged 5 years or older who have anatomic or functional asplenia (including sickle cell disease) and unvaccinated persons 5 through 18 years of age with human immunodeficiency virus (HIV) infection.

* *Clients who have not received a primary series and booster dose or at least 1 dose of Hib vaccine after 14 months of age are considered unimmunized.*

6. **Pneumococcal vaccines. (Minimum age: 6 weeks for PCV13, 2 years for PPSV23)**

Routine vaccination with PCV13:

- Administer a 4-dose series of PCV13 vaccine at ages 2, 4, and 6 months and at age 12 through 15 months.
- For children aged 14 through 59 months who have received an age-appropriate series of 7-valent PCV (PCV7), administer a single supplemental dose of 13-valent PCV (PCV13).

Catch-up vaccination with PCV13:

- Administer 1 dose of PCV13 to all healthy children aged 24 through 59 months who are not completely vaccinated for their age.
- For other catch-up guidance, see Figure 2.

Vaccination of persons with high-risk conditions with PCV13 and PPSV23:

- All recommended PCV13 doses should be administered prior to PPSV23 vaccination if possible.
- For children 2 through 5 years of age with any of the following conditions: chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure); chronic lung disease (including asthma if treated with high-dose oral corticosteroid therapy); diabetes mellitus; cerebrospinal fluid leak; cochlear implant; sickle cell disease and other hemoglobinopathies; anatomic or functional asplenia; HIV infection; chronic renal failure; nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; solid organ transplantation; or congenital immunodeficiency:
  1. Administer 1 dose of PCV13 if 3 doses of PCV (PCV7 and/or PCV13) were received previously.
  2. Administer 2 doses of PCV13 at least 8 weeks apart if fewer than 3 doses of PCV (PCV7 and/or PCV13) were received previously.
  3. Administer 1 supplemental dose of PCV13 if 4 doses of PCV7 or other age-appropriate complete PCV7 series was received previously.
  4. The minimum interval between doses of PCV (PCV7 or PCV13) is 8 weeks.
  5. For children with no history of PPSV23 vaccination, administer PPSV23 at least 8 weeks after the most recent dose of PCV13.

Figure 2 CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGED 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND—UNITED STATES, 2014

- For children aged 6 through 18 years who have cerebrospinal fluid leak; cochlear implant; sickle cell disease and other hemoglobinopathies; anatomic or functional asplenia; congenital or acquired immunodeficiencies; HIV infection; chronic renal failure; nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; generalized malignancy; solid organ transplantation; or multiple myeloma:
  1. If neither PCV13 nor PPSV23 has been received previously, administer 1 dose of PCV13 now and 1 dose of PPSV23 at least 8 weeks later.
  2. If PCV13 has been received previously but PPSV23 has not, administer 1 dose of PPSV23 at least 8 weeks after the most recent dose of PCV13.
  3. If PPSV23 has been received but PCV13 has not, administer 1 dose of PCV13 at least 8 weeks after the most recent dose of PPSV23.
- For children aged 6 through 18 years with chronic heart disease (particularly cyanotic congenital heart disease and cardiac failure), chronic lung disease (including asthma if treated with high-dose oral corticosteroid therapy), diabetes mellitus, alcoholism, or chronic liver disease, who have not received PPSV23, administer 1 dose of PPSV23. If PCV13 has been received previously, then PPSV23 should be administered at least 8 weeks after any prior PCV13 dose.
- A single revaccination with PPSV23 should be administered 5 years after the first dose to children with sickle cell disease or other hemoglobinopathies; anatomic or functional asplenia; congenital or acquired immunodeficiencies; HIV infection; chronic renal failure; nephrotic syndrome; diseases associated with treatment with immunosuppressive drugs or radiation therapy, including malignant neoplasms, leukemias, lymphomas, and Hodgkin disease; generalized malignancy; solid organ transplantation; or multiple myeloma.

7. **Inactivated poliovirus vaccine (IPV). (Minimum age: 6 weeks)**
   Routine vaccination:
   - Administer a 4-dose series of IPV at ages 2, 4, 6 through 18 months, and 4 through 6 years. The final dose in the series should be administered on or after the fourth birthday and at least 6 months after the previous dose.

   Catch-up vaccination:
   - In the first 6 months of life, minimum age and minimum intervals are only recommended if the person is at risk for imminent exposure to circulating poliovirus (i.e., travel to a polio-endemic region or during an outbreak).
   - If 4 or more doses are administered before age 4 years, an additional dose should be administered at age 4 through 6 years and at least 6 months after the previous dose.
   - A fourth dose is not necessary if the third dose was administered at age 4 years or older and at least 6 months after the previous dose.
   - If both OPV and IPV were administered as part of a series, a total of 4 doses should be administered, regardless of the child's current age. IPV is not routinely recommended for U.S. residents aged 18 years or older.
   - For other catch-up guidance, see Figure 2.
8. **Influenza vaccines. (Minimum age: 6 months for inactivated influenza vaccine [IIV], 2 years for live, attenuated influenza vaccine [LAIV])**
   Routine vaccination:
   - Administer influenza vaccine annually to all children beginning at age 6 months. For most healthy, nonpregnant persons aged 2 through 49 years, either LAIV or IIV may be used. However, LAIV should NOT be administered to some persons, including 1) those with asthma, 2) children 2 through 4 years who had wheezing in the past 12 months, or 3) those who have any other underlying medical conditions that predispose them to influenza complications. For all other contraindications to use of LAIV, see *MMWR* 2013; 62 (No. RR-7): 1-43, available at http://www.cdc.gov/mmwr/pdf/rr/rr6207.pdf.

   For children aged 6 months through 8 years:
   - For the 2013–14 season, administer 2 doses (separated by at least 4 weeks) to children who are receiving influenza vaccine for the first time. Some children in this age group who have been vaccinated previously will also need 2 doses. For additional guidance, follow dosing guidelines in the 2013-14 ACIP influenza vaccine recommendations, *MMWR* 2013; 62 (No. RR-7): 1-43, available at http://www.cdc.gov/mmwr/pdf/rr/rr6207.pdf.
   - For the 2014–15 season, follow dosing guidelines in the 2014 ACIP influenza vaccine recommendations.

   For persons aged 9 years and older:
   - Administer 1 dose
9. **Measles, mumps, and rubella (MMR) vaccine. (Minimum age: 12 months for routine vaccination) Routine vaccination:**
   - Administer a 2-dose series of MMR vaccine at ages 12 through 15 months and 4 through 6 years. The second dose may be administered before age 4 years, provided at least 4 weeks have elapsed since the first dose.
   - Administer 1 dose of MMR vaccine to infants aged 6 through 11 months before departure from the United States for international travel. These children should be revaccinated with 2 doses of MMR vaccine, the first at age 12 through 15 months (12 months if the child remains in an area where disease risk is high), and the second dose at least 4 weeks later.
   - Administer 2 doses of MMR vaccine to children aged 12 months and older before departure from the United States for international travel. The first dose should be administered on or after age 12 months and the second dose at least 4 weeks later.

   Catch-up vaccination:
   - Ensure that all school-aged children and adolescents have had 2 doses of MMR vaccine; the minimum interval between the 2 doses is 4 weeks.
10. **Varicella (VAR) vaccine. (Minimum age: 12 months)**
    Routine vaccination:
    - Administer a 2-dose series of VAR vaccine at ages 12 through 15 months and 4 through 6 years. The second dose may be administered before age 4 years, provided at least 3 months have elapsed since the first dose. If the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid.

    Catch-up vaccination:
    - Ensure that all persons aged 7 through 18 years without evidence of immunity (see *MMWR* 2007; 56 [No. RR-4], available at http://www.cdc.gov/mmwr/pdf/rr/rr5604.pdf) have 2 doses of varicella vaccine. For children aged 7 through 12 years, the recommended minimum interval between doses is 3 months (if the second dose was administered at least 4 weeks after the first dose, it can be accepted as valid); for persons aged 13 years and older, the minimum interval between doses is 4 weeks.
11. **Hepatitis A (HepA) vaccine. (Minimum age: 12 months)**
    Routine vaccination:
    - Initiate the 2-dose HepA vaccine series at 12 through 23 months; separate the 2 doses by 6 to 18 months.
    - Children who have received 1 dose of HepA vaccine before age 24 months should receive a second dose 6 to 18 months after the first dose.

(*Continues*)

Figure 2 CATCH-UP IMMUNIZATION SCHEDULE FOR PERSONS AGED 4 MONTHS THROUGH 18 YEARS WHO START LATE OR WHO ARE MORE THAN 1 MONTH BEHIND—UNITED STATES, 2014 (*Continued*)

Additional information (*Continued*)

- For any person aged 2 years and older who has not already received the HepA vaccine series, 2 doses of HepA vaccine separated by 6 to 18 months may be administered if immunity against hepatitis A virus infection is desired.

Catch-up vaccination:

- The minimum interval between the two doses is 6 months.

Special populations:

- Administer 2 doses of HepA vaccine at least 6 months apart to previously unvaccinated persons who live in areas where vaccination programs target older children, or who are at increased risk for infection. This includes persons traveling to or working in countries that have high or intermediate endemicity of infection; men having sex with men; users of injection and non-injection illicit drugs; persons who work with HAV-infected primates or with HAV in a research laboratory; persons with clotting-factor disorders; persons with chronic liver disease; and persons who anticipate close, personal contact (e.g., household or regular babysitting) with an international adoptee during the first 60 days after arrival in the United States from a country with high or intermediate endemicity. The first dose should be administered as soon as the adoption is planned, ideally 2 or more weeks before the arrival of the adoptee.

12. **Human papillomavirus (HPV) vaccines. (Minimum age: 9 years for HPV2 [Cervarix] and HPV_4 [Gardasil])**

Routine vaccination:

- Administer a 3-dose series of HPV vaccine on a schedule of 0, 1-2, and 6 months to all adolescents aged 11 through 12 years. Either HPV4 or HPV2 may be used for females, and only HPV4 may be used for males.
- The vaccine series may be started at age 9 years.
- Administer the second dose 1 to 2 months after the first dose (minimum interval of 4 weeks), administer the third dose 24 weeks after the first dose and 16 weeks after the second dose (minimum interval of 12 weeks).

Catch-up vaccination:

- Administer the vaccine series to females (either HPV2 or HPV4) and males (HPV4) at age 13 through 18 years if not previously vaccinated.
- Use recommended routine dosing intervals (see chart in Figure 2) for vaccine series catch-up.

13. **Meningococcal conjugate vaccines. (Minimum age: 6 weeks for Hib-MenCY [MenHibrix], 9 months for MenACWY-D [Menactra], 2 months for MenACWY-CRM [Menveo])**

Routine vaccination:

- Administer a single dose of Menactra or Menveo vaccine at age 11 through 12 years, with a booster dose at age 16 years.
- Adolescents aged 11 through 18 years with human immunodeficiency virus (HIV) infection should receive a 2-dose primary series of Menactra or Menveo with at least 8 weeks between doses.
- For children aged 2 months through 18 years with high-risk conditions, see below.

Catch-up vaccination:

- Administer Menactra or Menveo vaccine at age 13 through 18 years if not previously vaccinated.
- If the first dose is administered at age 13 through 15 years, a booster dose should be administered at age 16 through 18 years with a minimum interval of at least 8 weeks between doses.
- If the first dose is administered at age 16 years or older, a booster dose is not needed.
- For other catch-up guidance, see Figure 2.

Vaccination of persons with high-risk conditions and other persons at increased risk of disease:

- Children with anatomic or functional asplenia (including sickle cell disease):
  1. For children younger than 19 months of age, administer a 4-dose infant series of MenHibrix or Menveo at 2, 4, 6, and 12 through 15 months of age.
  2. For children aged 19 through 23 months who have not completed a series of MenHibrix or Menveo, administer 2 primary doses of Menveo at least 3 months apart.
  3. For children aged 24 months and older who have not received a complete series of MenHibrix or Menveo or Menactra, administer 2 primary doses of either Menactra or Menveo at least 2 months apart. If Menactra is administered to a child with asplenia (including sickle cell disease), do not administer Menactra until 2 years of age and at least 4 weeks after the completion of all PCV13 doses.
- Children with persistent complement component deficiency:
  1. For children younger than 19 months of age, administer a 4-dose infant series of either MenHibrix or Menveo at 2, 4, 6, and 12 through 15 months of age.
  2. For children 7 through 23 months who have not initiated vaccination, two options exist depending on age and vaccine brand:
     a. For children who initiate vaccination with Menveo at 7 months through 23 months of age, a 2-dose series should be administered with the second dose after 12 months of age and at least 3 months after the first dose.
     b. For children who initiate vaccination with Menactra at 9 months through 23 months of age, a 2-dose series of Menactra should be administered at least 3 months apart.
     c. For children aged 24 months and older who have not received a complete series of MenHibrix, Menveo, or Menactra, administer 2 primary doses of either Menactra or Menveo at least 2 months apart.
- For children who travel to or reside in countries in which meningococcal disease is hyperendemic or epidemic, including countries in the African meningitis belt or the Hajj, administer an age-appropriate formulation and series of Menactra or Menveo for protection against serogroups A and W meningococcal disease. Prior receipt of MenHibrix is not sufficient for children traveling to the meningitis belt or the Hajj because it does not contain serogroups A or W.
- For children at risk during a community outbreak attributable to a vaccine serogroup, administer or complete an age- and formulation-appropriate series of MenHibrix, Menactra, or Menveo.
- For booster doses among persons with high-risk conditions, refer to *MMWR* 2013; 62(RR02);1-22, available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm.

Catch-up recommendations for persons with high-risk conditions:

1. If MenHibrix is administered to achieve protection against meningococcal disease, a complete age-appropriate series of MenHibrix should be administered.

- If the first dose of MenHibrix is given at or after 12 months of age, a total of 2 doses should be given at least 8 weeks apart to ensure protection against serogroups C and Y meningococcal disease.

2. For children who initiate vaccination with Menveo at 7 months through 9 months of age, a 2-dose series should be administered with the second dose after 12 months of age and at least 3 months after the first dose.
3. For other catch-up recommendations for these persons, refer to *MMWR* 2013; 62(RR02);1-22, available at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6202a1.htm.

For complete information on use of meningococcal vaccines, including guidance related to vaccination of persons at increased risk of infection, see *MMWR* March 22, 2013; 62(RR02);1-22, available at http://www.cdc.gov/mmwr/pdf/rr/rr6202.pdf.

Appendix 13-3. DRUG ADMINISTRATION FOR CHILDREN

A. Clark's weight rule

$$\text{child's dose} = \frac{\text{child's weight in pounds}}{150} \times \text{adult dose}$$

Convert from kilograms to pounds: Multiply by 2.2 (1 kg = 2.2 lb).

B. Majority of drugs are calculated on a per-kilogram (or BSA) basis.
C. Intravenous microdrip has 60 drops/mL. ALL pediatric IV therapy should be infused using reliable infusion pumps.
D. Conversion of administration units:
   1 tsp = 5 mL
   1 tbl = 15 mL
   1 gm = 1000 mg
   1 oz = 30 mL

✦ Appendix 13-4. FLUID REQUIREMENTS IN CHILDREN

Part 1. Calculation of Maintenance Fluid Requirements in Children

0–10 kg (body weight):	100 mL/kg/24 hr
11–20 kg:	1000 mL + 50 mL/kg/24 hr
21–40 kg:	1500 mL + 20 mL/kg/24 hr

Divide total fluid requirement by 24 to obtain hourly fluid rate.

Part 2. Oral Rehydration Therapy for Mild-Moderate Dehydration

A. Fluids available: Pedialyte, Infalyte and Rehydrate.
B. Rehydration: 40–50 mL/kg of rehydration fluid over 4 hours (rehydration fluids should contain 75–90 mEq of sodium per liter).
C. Maintenance: Fluids should contain 40–60 mEq/L sodium. Examples: breast milk, lactose-free formulas, or half-strength lactose-containing fluids.
D. Approx. 10 mL/kg replacement with rehydrating solution should be used for each diarrheal stool after rehydration therapy is complete.

✦ Appendix 13-5. PEDIATRIC INFECTIOUS AND COMMUNICABLE DISEASES

Disease	Characteristics	Transmission	Nursing Care
Diphtheria	Local and systemic manifestations Malaise, fever, cough with stridor Toxin has affinity for renal, nervous, and cardiac tissue Adherent white or gray pharyngeal membrane Incubation: 2–6 days or longer	Spread by droplets from respiratory tract or carrier	Maintain strict isolation in hospitalized children Antitoxin and antibiotic therapy to kill toxin Strict bed rest, prevent exertion Liquid or soft diet Observe for myocarditis and neuritis Monitor carefully for respiratory depression or obstruction Suctioning, humidified oxygen, and emergency tracheotomy may be necessary Assure child is fully vaccinated to prevent
Erythema Infectiosum (fifth disease)	Rash in 3 stages: I—Facial erythema ("slapped cheek" appearance) Lasts 1–4 days II—Symmetrically distributed maculopapular red spots on upper and lower extremities Progresses from proximal to distal locations, may last > 7 days III—Rash subsides but can reappear Caused by human parvovirus B19 (HPV) Incubation: usually 4–14 days, can be up to 21 days	Unknown Possibly respiratory secretions and/or blood	Standard precautions Isolation of hospitalized child only necessary if immunosuppressed or if in aplastic crisis May precipitate aplastic crisis in clients with chronic hemolytic disorders
Lyme disease	First sign generally a ring-shaped rash (erythema migrans), fever, headache, red eyes, arthralgia, lymphadenopathy, and general malaise Complications: meningitis, facial palsy, pericarditis Incubation: between 3 and 30 days	Caused by *Borrelia burgdorferi*, transmitted by infected ticks	Oral antibiotic administered (tetracycline) in early localized infection—educate parents Promote rest and fluid intake Anticipatory guidance to families in areas known to have ticks (bug repellant use, clothing covering legs)

(*Continues*)

✦ Appendix 13-5. PEDIATRIC INFECTIOUS AND COMMUNICABLE DISEASES (*Continued*)

Disease	Characteristics	Transmission	Nursing Care
Mumps	Acute viral disease, characterized by fever, swelling, and tenderness of one or more parotid glands Caused by paramyxovirus Potential complications including meningoencephalitis Complications: deafness, orchitis, arthritis, hepatitis Incubation: 14–21 days	Spread by droplet and direct and indirect contact with saliva of infected person Most infectious 48 hours prior to swelling	Prevent by vaccination (MMR) Isolate (respiratory precautions) in hospital Treat symptoms Warm or cool compresses to neck Encourage fluids and soft, bland food Fever and pain control Watch for symptoms of neurological involvement, fever, headache, vomiting, stiff neck
Pertussis (whooping cough)	Dry cough occurring in paroxysms Dyspnea and fever may be present Lymphocytosis Incubation: 5–21 days	Direct contact or droplet from infected person Infants at risk until DPT series is complete	Child is symptomatic: rest, keep warm, humidify air Bed rest until afebrile Antimicrobial therapy (erythromycin) Maintain nutritional status, encourage fluids Protect from secondary infections May be devastating to young infants who may not be fully immunized
Rubella (German measles)	Viral infection Slight fever, mild coryza, and headache Discrete pink-red maculopapules that last about 3 days Incubation: 14–21 days	Spread by direct and indirect contact with droplets Fetus may contract measles in utero if mother has the disease	Basically a benign disease unless contracted by pregnant female (highly associated with congenital anomalies in fetus) Symptomatic: bed rest until fever subsides Preventable by vaccine (MMR)
Rubeola (measles)	Acute viral disease, characterized by conjunctivitis, bronchitis, Koplik's spots on buccal mucosa Dusky red and splotchy rash 3–4 days Usually photophobia Complications can be severe in respiratory tract, eye, ear, and nervous system Incubation: 10–12 days	Spread by droplet or direct contact	Symptomatic: bed rest until cough and fever subside; force fluids, dim lights in room; tepid baths and lotion to relieve itching Cool mist humidifier Observe for signs of neurological involvement Preventable by vaccine (MMR)
Scarlet fever	Usually seen in children age 6–12 Manifested by sore throat, headache, abrupt, high fever, vomiting, then "beefy red" tonsils and "strawberry tongue." Sandpaper-like erythematous rash, spreads from chest and arms to abdomen, groin, and buttocks Complications: sinusitis, arthritis, glomerulonephritis, retropharyngeal or peritonsillar abscess Incubation: 1–7 days	Caused by *Streptococcus pyogenes* (group A-hemolytic streptococci—GAS) Transmitted by droplets, direct contact with infected person, or indirectly by contact with contaminated articles or food	Treat fever, sore throat Administer antibiotics (penicillin) Respiratory precautions until 24 hours of antibiotics completed Encourage fluids
Tetanus	Acute or gradual onset Muscle rigidity and spasms, headache, fever, and convulsions Death may result from aspiration, pneumonia, or exhaustion Incubation: 3–21 days	Organisms in soil Enter body through wound Not communicable through person-to-person contact	Toxins must be neutralized Bed rest during illness in quiet, darkened room Avoid stimulation, which can cause spasms Observe for complications of laryngospasm and respiratory failure Assure child is fully vaccinated to prevent
Varicella (chickenpox)	Acute viral disease; onset is sudden with high fever; maculopapular rash and vesicular scabs in multiple stages of healing Incubation: 10–21 days	Spread by droplet or airborne secretions; scabs not infectious	Isolate Treat symptoms: fluids for fever, acetaminophen Prevent scratching Observe for signs of complications, which can be fatal in immunocompromised children Preventable by varicella vaccine

✦ Appendix 13-6. NUTRITIONAL GUIDELINES FOR INFANTS AND CHILDREN

Nutrition for the Infant

A. Caloric requirements
   1. Birth–6 months
   2. Infants require 100–108 kcal/kg/day and 2.2 g/kg/day protein.
B. Fluids.
   1. First 6 months—120–150 mL/kg/24 hours.
   2. Requirements increase in hot weather.
C. Number of feedings per 24 hours.
   1. First week—6 to 10 per day.
   2. 1 week to 1 month—six to eight times per day (4–5 oz/feeding).
   3. 1 to 3 months—five to six per day (5–7 oz/feeding).
   4. 3 to 6 months—four to five per day (6–7 oz/feeding).
   5. 6 to 12 months—three per day (6–8 oz/feeding).
D. Vitamins.
   1. Breastfed infants—if mother's source adequate, infant adequate.
   2. Formula-fed infants—vitamin supplements depend on type of formula and what vitamins are already included in it.
   3. Mixing cereal with vitamin-C–containing juices will aid iron absorption.
   4. Vitamin supplements: may be added at 3–6 months if advised by healthcare provider.
   5. Teaching.
      a. No cow or goat milk until 12 months old.
      b. Never prop bottles—feed infant in upright position.
      c. Don't put infant to bed with a bottle (development of dental caries).
      d. No cereal should be routinely added to bottles (unless prescribed for GERD).
E. Solid foods—introduce solid foods at 4 to 6 months of age.
   1. Cereal—infants are least allergic to rice; fortified cereal is a good source of iron and should be given until 18 months.
   2. Fruits and vegetables.
      a. Introduce new foods once a day in small amounts until the child becomes accustomed to them.
      b. Introduce only one new food per week.
      c. Bananas and applesauce are well tolerated.
      d. Orange juice is usually not well tolerated, initially. It can be introduced, diluted with water, when the child is 6 months old.
      e. Green and yellow vegetables can be introduced at about 4 months of age.
   3. Eggs.
      a. Introduce yolks after child is 6 months old.
      b. Usually yolks are well tolerated, but sometimes there are allergic reactions to egg whites; introduction of whites should be delayed until 12 months.
   4. Meat.
      a. May be introduced at 6 months.
      b. Usually more palatable if mixed with fruits or vegetables.
   5. Starchy foods.
      a. May be introduced during the second 6 months.
      b. Should not be given in place of green vegetables or fruit.
      c. Chief value is caloric.
      d. Zwieback and other crackers are good for the teething infant.
   6. Whole milk should not be given until after 1 year of age.
F. Diarrhea—temporary.
   1. Usually caused by viral infection or incorrect formula preparation.
   2. Review feeding preparation and storage of formula with caretaker.
   3. Usually corrected with oral rehydration therapy (ORT).
      a. Solution containing 75–90 mEq Na^+/L.
      b. Give 40–50 mL/kg over 4 hours.
      c. Reevaluate need for further therapy.
   4. Avoid intake of fluids high in carbohydrates and osmolality and low in electrolytes.
   5. BRAT (bananas, rice, applesauce and toast) diet is NOT recommended.
G. Constipation.
   1. Increase fluid intake.
   2. In child 3 months old or older, increase cereal, fruit, and vegetable intake.
   3. On occasion, prune juice (half an ounce) may be given.
H. Avoid honey until at least 1 year old (risk of infantile botulism).

Nutrition for the Second Year

A. Rate of growth is slowing down; thus there is a decreased caloric need.
B. Self-selection. Children usually, over a period of several days, select a diet that is balanced.
   1. Serve small amount of food so child can finish it.
   2. Don't mix food on plate.
C. Child should be feeding himself or herself, with some assistance.
D. Assess food intake by associated findings.
   1. Weight, growth normal for age.
   2. Level of activity.
   3. Assess condition of skin, eyes, hair.
   4. Assess elimination problems.
   5. Assess emotional state: Is child happy and content, fussy, or unhappy?
E. Avoid baby bottle syndrome or "sippy" cup: juice, formula, or milk bottle at night leads to dental caries.

Nutrition for the Preschooler

A. Child begins to imitate family's likes and dislikes.
B. Finger foods are popular.
C. Single foods are preferable to a combination.
D. Counsel mothers—they express concerns about poor eating habits, which are common at this age.

(*Continues*)

✦ Appendix 13-6. NUTRITIONAL GUIDELINES FOR INFANTS AND CHILDREN (*Continued*)

Nutrition for the School-Age Child

A. Patterns of good eating habits are established at this time.
B. Avoid snacks–except fruits.
C. Appetite increases due to increased calorie needs for growth.
D. Child's appetite at a meal is influenced by the day's activity level.
E. Boys require more calories than girls.
F. Both boys and girls need more iron in prepuberty than in 7- to 10-year-old age group.
G. Tendency toward obesity at this age.
H. Every child needs daily exercise.

Adolescent Eating Patterns

A. Period of rapid growth and appetite increases.
B. Adolescents frequently gain weight easily and use fad diets.
C. Girls adapt themselves to fashionable weight goals, which may be unhealthy.
D. There is social eating of non-nutritious foods.
E. One form of rebellion against parents is to refuse to eat "healthy" foods.
F. Adolescent girls are often deficient in iron, calcium, vitamins C and A.
G. Important teaching for adolescents is that they must not just fill stomachs with food, but nutritious food necessary for growth.

Malnutrition Disorders

A. Kwashiorkor—caused by a lack of protein; frequently seen in ages 1 to 3, when high protein intake is necessary.
B. Nutritional marasmus—a disease caused by a deficiency of food intake. It is a form of starvation.
C. Vitamin A deficiency—night blindness may progress to xerophthalmia and, finally, keratomalacia.
D. Vitamin C deficiency: scurvy—symptoms begin with muscle tenderness as walls of capillaries become fragile. Hemorrhage of vessels results.
E. Vitamin D deficiency: rickets—caused because vitamin D is necessary for adequate calcium absorption by the bones.
F. Thiamine deficiency: beriberi—primarily a disease of rice-eating people; symptoms include numbness in extremities and exhaustion.
G. Niacin deficiency: pellagra—symptoms include dermatitis, diarrhea, dementia, and, finally, death.
H. Iodine deficiency—leads to hyperplasia of the thyroid gland, or goiter.

BIBLIOGRAPHY

American Academy of Pediatrics (AAP). (2011). AAP Updates Recommendation on Car Seats. Retrieved from: http://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/AAP-Updates-Recommendation-on-Car-Seats.aspx

Amin, A., Oragui, E., Khan, W., Puri, A. (2010). Psychosocial consideration in perioperative care in children, with a focus on effective management strategies. *Journal of Perioperative Practice*, *20*(6):198–202.

Augustyn, M. C., Zuckerman, B. S., & Caronna, E. B. (2010). *The Zuckerman Parker handbook of developmental and behavioral pediatrics: A handbook for primary care* (3rd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Ball, J. W., Binder, C., & Cowen, K. J. (2009). *Child health nursing: Partnering with children and families* (2nd ed.). Upper Saddle River, NJ: Prentice Hall Health.

Ball, J. W., Binder, C., & Cowen, K. J. (2011). *Principles of pediatric nursing: Caring for children* (5th ed.). Upper Saddle River, NJ: Prentice Hall Health.

Bowde, V. R., & Greenberg, C. S. (2011). *Pediatric nursing procedures* (3rd ed.). Philadelphia: Lippincott Williams & Wilkins.

Cangialose, A., & Allen, P. J. (2014). Screening for autism spectrum disorders in infants before 18 months of age. *Pediatric Nurse*, *40*(1):33–37.

Castro-Rodriguez, J. A. (2010). The asthma predictive index: A very useful tool for predicting asthma in young children. *Journal of Allergy and Clinical Immunology*, *126*:212–216.

Centers for Disease Control and Prevention. (2014). Birth–18 Years & "Catch-Up" Immunization Schedules—United States. Retrieved from http://www.cdc.gov/vaccines/schedules/hcp/child-adolescent.html

Centers for Disease Control and Prevention. (2014). Blood Pressure Tables for Children and Adolescents. Retrieved from http://www.nhlbi.nih.gov/guidelines/hypertension/child_tbl.htm

Centers for Disease Control and Prevention. (2014). Clinical Growth Charts. Retrieved from http://www.cdc.gov/growthcharts/clinical_charts.htm

Center for Disease Control and Prevention. (2014). HIV Among Pregnant Women, Infants, and Children. Retrieved from http://www.cdc.gov/hiv/risk/gender/pregnantwomen/facts/index.html

Centers for Disease Control and Prevention. (2014). Lead. Retrieved from http://www.cdc.gov/nceh/lead/

Centers for Disease Control and Prevention. (2014). Systematic Evidence Reviews and Clinical Practice Guidelines. Retrieved from http://www.nhlbi.nih.gov/guidelines/index.htm

Centers for Disease Control and Prevention. (2014). Ten Leading Causes of Death by Age Group, United States–2012. Retrieved from: http://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_death_by_age_group_2012-a.pdf

Chiocca, E. M. (2011). Epiglottitis. *Nursing*, *41*(3):72. doi: 10.1097/01.NURSE.0000394118.67586.23.

Czaikowski, B. L., Liang, H., & Stewart, C. T. (2014). A pediatric FOUR score coma scale: Interrater reliability and predictive validity. *Journal of Neuroscience Nursing*. *46*(2):79–87. doi: 10.1097/JNN.0000000000000041.

Hagan, J. F., & Duncan, P. M. (Eds.). (2008). *Bright futures: Guidelines for health supervision of infants, children, and adolescents* (3rd ed.). Elk Grove Village, IL: American Academy of Pediatrics.

Hockenberry, M. J., & Wilson, D. (2011). *Wong's nursing care of infants and children* (9th ed.). St. Louis, MO: Mosby.

Hockenberry, M. J., & Wilson, D. (2012). *Wong's essentials of pediatric nursing* (9th ed.). St. Louis, MO: Mosby.

Hooke, M. C., Garwick, A. W., & Neglia, J. P. Assessment of physical performance using the 6-minute walk test in children receiving treatment for cancer. *Cancer Nursing*, *36*(5):E9–E16. doi: 10.1097/NCC.0b013e31829f5510.

Hornor, G. (2014). Child neglect: Assessment and intervention. *Journal of Pediatric Health Care*, *28*(2):186–92. doi: 10.1016/j.pedhc.2013.10.002.

Johnstone, L., Spence, D., & Koziol-McClain, J. (2010). Oral hygiene care in the pediatric intensive care unit: Practice recommendations. *Pediatric Nurse*, *36*(2):85–96.

Kliegman, R., Stanton, B., & Behrman, R. (2011). *Nelson textbook of pediatrics*. Philadelphia, PA: Elsevier.

Kyle, T. (2011). *Essentials of pediatric nursing* (2nd ed.). New York, NY: Lippincott Williams & Wilkins.

Kyle, T. (Ed.). (2012). *Essentials of pediatric nursing*. Philadelphia, PA: Wolters Kluwer Health.

Lewis, S. L., Dirksen, S. R., Heitkemper, M. M., & Bucher, L. (2014). *Medical surgical nursing: Assessment and management of clinical problems* (9th ed.). St. Louis, MO: Mosby.

Lilley, L. L., Rainsforth Collins, S., Harrington, S., & Snyder, J. S. (2014). *Pharmacology and the nursing process* (8th ed.). St. Louis, MO: Mosby Elsevier.

McKinney, E. S., James, S. R., Murray, S. S., Nelson, K., & Ashwill, J. (2013). *Maternal-child nursing* (4th ed.). St. Louis, MO: Mosby Elsevier.

Nettina, S. (2013). *Lippincott manual of nursing practice*. Philadelphia, PA: Lippincott Williams & Wilkins.

Potts, N. L., & Mandleco, B. L. (2011). *Pediatric nursing: Caring for children and their families* (3rd ed.). Independence, KY: Thomson Delmar Learning.

Rudd, K., & Kocisko, D. (2014). *Pediatric nursing: The critical components of nursing care*. Philadelphia, PA: F. A. Davis Company.

Taketomo, C. K., Hodding, J. H., & Kraus, D. M. (2013). *Pediatric & neonatal dosage handbook*. Philadelphia, PA: Wolters Kluwer Health-Lexicomp.

Tanski, S., Garfunkel, L. C., Duncan, P. M., & Weitzman, M. (Eds). (2010). *Performing preventive services: A bright futures handbook*. Elk Grove Village, IL: American Academy of Pediatrics.

PEDIATRIC NURSING REVIEW QUESTIONS

1. The nurse determines that a 7-month-old infant is developmentally delayed when the infant

1. Is unable to sit unsupported for brief periods.
2. Is unable to crawl to get a toy.
3. Frequently rolls from back to stomach.
4. Grasps a the bottle and brings it to his mouth.

2. In the emergency room, the nurse notes many bruises on the child. The nurse asks the mother and the mother's boyfriend how the bruises occurred. The mother replies that the child often falls down and hurts himself. The next action the nurse should take is to

1. Report this suspected child abuse case to the authorities.
2. Explore the circumstances of how the child was injured.
3. Provide family counseling for the mother, her boyfriend, and the child.
4. Bring her boyfriend into the room for a conference.

3. The nurse is instructing the parents how to manage care for their 8-year-old child who has been recently diagnosed with type 1 diabetes. Considering Erikson's developmental theory, the nurse plans to teach the parents how to

1. Recognize the difference between abnormal blood glucose levels and temper tantrums.
2. Reassure the child that insulin injections are not punishment for bad behavior.
3. Allow the child to gradually assume responsibility for insulin injections.
4. Deal with the child's desire to do everything that his/her peers are doing.

4. A 1-month-old infant, who had a meningomyelocele repaired at birth, is on the pediatric unit for observation. The priority nursing assessment would be to

1. Measure head circumference daily.
2. Monitor for contractures.
3. Measure the weight daily.
4. Obtain strict intake and output.

5. A 5-year-old child with suspected epiglottitis has just been admitted to the emergency room. The child has a temperature is 102°F or 38.8°C, difficulty swallowing, and inspiratory stridor. The most important immediate intervention is to

1. Check the mouth for a gag reflex.
2. Sit the child in an upright position.
3. Monitor vital signs.
4. Give the child sips of ice water.

6. The healthcare provider sets a goal of 50 mL/kg/ hour of oral replacement solution for a dehydrated infant who weighs 8 kg. The mother reports that the infant had taken two 8-ounce bottles of Pedialyte in the last hour. The nurse's next action is to

1. Ask the provider for a prescription (order) for intravenous fluids.
2. Assure the parent that the provider's goal is being met.
3. Encourage the infant to drink more than two bottles of Pedialyte in the next hour.
4. Weigh each diaper to obtain an accurate output.

7. The most accurate location to obtain the heart rate of an infant is at the

1. Carotid artery.
2. Apex of the heart.
3. Brachial artery.
4. Radial artery.

8. An 8-year-old child is admitted with a diagnosis of seizure disorder. A priority in protecting the child against injury during a seizure is to

1. Restrain the child's arms.
2. Insert a padded tongue blade in the mouth.
3. Decrease environmental stimulation.
4. Place the child in a lateral position.

9. A 6-month-old infant is admitted with a diagnosis of severe diarrhea. The priority nursing assessment is the

1. Severity of fluid loss.
2. Number of the diarrhea stools.
3. Stool culture results.
4. Electrolyte lab results.

10. A young child is receiving total parenteral nutrition (TPN) via a peripherally inserted central catheter

(PICC). A complication related to infusion of TPN through the PICC line that the nurse will assess for is

1. Plugging or dislodging of the catheter.
2. Air embolism.
3. Insertion in the superior vena cava.
4. Bleeding at the site of insertion.

11. When providing nursing care for a child with an infected wound in contact isolation, the nurse should understand that

1. Any articles brought into the room should be disinfected or discarded.
2. Children in contact isolation should not receive fresh flowers or fresh fruit.
3. Protective gear for healthcare personnel includes mask, gown, and gloves.
4. The parents do not need to follow the same precautions as healthcare personnel.

12. A 15-year-old client with Hodgkin's disease will begin chemotherapy. Considering the side effects of chemotherapy that may occur, the nurse will anticipate a significant issue is the client's

1. Identity crisis.
2. Body image changes.
3. Feelings of abandonment.
4. Loss of privacy.

13. The nurse determines that the parent of an infant with eczema needs further education when the parent states, "I will

1. Delay immunizations since they may cause skin rashes."
2. Avoid the use of scented soaps and laundry detergents."
3. Apply moisturizing creams immediately following bathing."
4. Gradually introduce new foods to see if there is a reaction."

14. The nurse anticipates the following therapeutic approach for a 12-year-old client with juvenile idiopathic arthritis:

1. Prolonged periods of complete joint immobilization.
2. Application of moist hot pack and night splints to the affected joint.
3. Passive range of motion exercises in the initial phases of the disease.
4. Unlimited nonsteroidal anti-inflammatory drugs (NSAIDs) as needed for pain.

15. Considering the toddler's developmental stage, the most effective method to encourage adequate nutritional intake following an acute illness is to offer a variety of

1. Semisoft foods at designated meal times.
2. Finger foods at frequent intervals.
3. Pureed foods made in the blender.
4. The child's favorite foods four times a day.

16. A 2-year-old toddler was diagnosed with iron deficiency anemia. The nurse recognizes that the most common anemias in childhood

1. Have signs and symptoms directly related to the decrease in the oxygen-carrying capacity of the blood.
2. Are caused by deficiencies of vitamins, which interfere with the production of red blood cells.
3. Can be easily identified by observation of pallor and shortness of breath at rest.
4. Are potentially serious and often terminal.

17. A child is brought to the emergency room with a leg fracture involving the epiphyseal plate. Fractures of this type are serious in children because

1. The blood supply to the bone is disrupted.
2. Normal bone growth can be affected.
3. Bone marrow can be lost through the fracture.
4. Healing in this area is very difficult.

18. The nurse determines that a child has Down syndrome characteristics when the following are present: *(Select all that may apply.)*

1. Abnormal palmar creases.
2. Protruding tongue.
3. Low-set ears.
4. Loose joints and flaccid muscles.
5. Almond-shaped eyes.
6. Low birth weight.

19. The nurse plans to offer a special formula relatively early after birth to prevent or limit intellectual impairment related to

1. Cretinism.
2. Down syndrome.
3. Phenylketonuria (PKU).
4. Tay–Sachs disease.

20. A mother with an almost 6-month-old breastfed infant is present at the well-baby clinic. The nurse advises the mother to offer iron-fortified rice cereal as the first "solid" food because

1. Cereals are more readily accepted by infants than pureed fruits and vegetables.

2. The infant requires extra iron to grow during the second half of the first year.
3. The infant's iron source from the mother in utero has been depleted.
4. The infant will be ingesting less breast milk, which has been a rich source of iron.

21. The nurse assesses a 1-month-old child with poor feeding and lethargy who has been admitted to the pediatric unit. The nurse is concerned about a central nervous system infection when the nurse observes

1. Separation of cranial sutures.
2. Depressed anterior fontanelle.
3. Oliguria.
4. A crying infant, comforted by the mother.

22. During a routine physical examination, the nurse reports to the physician the presence of the following reflex in a 9-month-old child:

1. Parachute reflex.
2. Neck righting reflex.
3. Rooting and sucking reflex.
4. Moro reflex.

23. A 3-month-old has a diagnosis of gastroesophageal reflux disease (GERD). The nurse explains to the parent the current recommendation for infants with GERD is to place the infant

1. In a prone position while sleeping.
2. In a supine position while sleeping.
3. In an infant seat with the head slightly elevated.
4. On the left side while awake or sleeping.

24. During the hospitalization of a 14-month-old toddler, the parents have spent time at the bedside. When the parents returned home, the toddler begins screaming and throwing things out of the crib. In this situation, the most effective nursing action is to

1. Turn on a child's program on the TV as a distractor.
2. Ignore the crying and wait until the child wears himself out.
3. Stay in the room, talking and trying to comfort the toddler.
4. Call the parents and ask them to return to the hospital.

25. What anatomic condition must be present for an infant with complete transposition of the great vessels to survive at birth?

1. Coarctation of the aorta.
2. Large septal defect.
3. Pulmonic stenosis.
4. Mitral stenosis.

26. The nurse's main objective in providing care for a child following a tonsillectomy is early recognition of

1. Pain levels.
2. Bleeding.
3. Infection.
4. Dehydration.

27. A pediatric staff nurse is caring for a child who develops chicken pox after being admitted for an elective surgery. The nurse places the child in

1. Contact precautions.
2. Droplet precautions.
3. Airborne precautions.
4. Airborne and contact precautions.

28. A child is placed on maintenance intravenous fluids by the physician. The child weighs 10 kg. The nurse will set the IV infusion pump at _____ mL/hour.

29. The nurse would expect an infant with a patent ductus arteriosus (PDA) to exhibit which of the following symptoms?

1. Improved perfusion in a knee-chest position.
2. Becoming cyanotic with a long feeding session.
3. Being acyanotic but having diaphoresis while feeding.
4. Clubbing of fingers and an oxygen saturation of 90%.

30. A 4-week-old infant is admitted for surgical correction of pyloric stenosis. The nurse does not expect to assess

1. A palpable mass in the upper right quadrant.
2. Visible peristaltic waves with feedings.
3. Projectile vomiting after each feeding.
4. Bounding pulses and peripheral edema.

31. The nurse suspects a possible renal disorder in a 2-week neonate with

1. Low-set ears, periorbital edema, hypertension, palpable abdominal mass.
2. Tachycardia, urine specific gravity of 1.005, polyuria.
3. Hypotension, dyspnea, dependent edema.
4. Lethargy, depressed fontanelles, mongolian spots.

32. The nurse is caring for a hospitalized 2-year-old who was toilet trained at home. During the hospital stay, the toddler wets his pants. The nurse's best response is,

1. "It's okay; try not to wet your pants next time."
2. "That's okay; now let's get you cleaned up."
3. "I know you understand how to use the toilet; what happened?"
4. "Your mom told me you don't wet anymore; what's wrong?"

33. Which action should the nurse teach the parent of a child with hemophilia to do first if the child has an injury that causes bleeding into a joint?

1. Give the child Tylenol.
2. Elevate and immobilize the joint.
3. Apply warm compresses to the joint.
4. Administer the missing clotting factor per home protocol.

34. The nurse realizes that the behavior is typical of a developmentally normal 18-month-old child during the first few hours of hospitalization is:

1. Crying loudly when the parents leave.
2. Readily accepting the nurse caring for him/her.
3. Showing considerable interest in new toys.
4. Sitting quietly in the corner of the crib, showing little interest in surroundings.

35. The nurse advises the mother of a 4-month-old infant who has been spitting up his feedings to

1. Feed the infant a larger amount of formula less frequently.
2. Reduce the amount of formula given at one time.
3. Burp the infant less frequently.
4. Feed the infant with a high caloric formula.

36. When obtaining an infant's respiratory rate, the nurse counts his respirations for 1 full minute because

1. Young infants are abdominal breathers.
2. Infants do not expand their lungs fully with each respiration.
3. Activity will increase the respiratory rate.
4. The rhythm of the respiratory rate is irregular in infants.

37. An 8-year-old child with an acute asthma attack is admitted to the hospital after several albuterol treatments. On admission, the nurse is likely to document

1. Stridor on inspiration.
2. Wheezing on expiration.
3. End-inspiratory crackles.
4. A hoarse voice.

38. The parents ask if it is necessary to make their child with cystic fibrosis take pancreatic enzyme capsules with every meal. The nurse replies, "The pancreatic enzymes are necessary to

1. Prevent the development of diabetes, which is common in clients with cystic fibrosis."
2. Replace pancreatic enzymes that are blocked by thick mucus in the digestive tract."
3. Thin the thick mucus that has been swallowed so that it can be excreted."
4. Promote intestinal peristalsis and prevent constipation."

39. The nurse understands that a definitive diagnosis of bacterial meningitis is based on

1. Clinical manifestations and history of exposure.
2. Blood cultures.
3. Cerebrospinal fluid cultures.
4. White blood cell count.

40. The nurse teaches the mother that the best method to prevent childhood poisoning is to

1. Keep her purse out of the child's reach.
2. Never refer to medicines as candy.
3. Keep all cabinets locked at all times.
4. Store medicine only in high cupboards.

41. The nurse anticipates that a preschool child with frequent respiratory infections will have which test to diagnose cystic fibrosis?

1. Sweat chloride test.
2. Blood glucose analysis.
3. Sputum culture.
4. Stool analysis for fat content.

42. The nurse is providing discharge teaching to the parents of a child who has had surgical correction of pulmonic stenosis. The nurse stresses the importance of preventing infectious endocarditis by

1. Supplementing the child's diet with multivitamins.
2. Obtaining the Synagis (palivizumab) vaccine.
3. Avoiding people with upper respiratory infections.
4. Administering antibiotics prior to dental procedures.

43. The nurse understands that the earliest recognizable clinical manifestation of cystic fibrosis is:

1. Meconium ileus.
2. History of poor intestinal absorption.
3. Foul-smelling, frothy, greasy stools.
4. Recurrent pneumonia and lung infections.

44. The nurse explains to a mother that her 10-month-old daughter is more likely to have otitis media than her 6-year old brother because the baby's

1. Contaminated hands transmit diseases when she crawls on the floor.
2. Immune system is less effective during teething at this age.

3. Eustachian tube is shorter and more horizontal than her brother's Eustachian tube.
4. Tympanic membrane is thinner than her brother's tympanic membrane.

45. The nurse determines that the mother of a male newborn needs further teaching when she states: "I will prevent sudden infant death syndrome (SIDS) by

1. Placing my baby on his back when sleeping."
2. Offering a pacifier, if he wants it, when falling asleep."
3. Sleeping with my baby to keep a close eye on him."
4. Asking family members who visit to avoid smoking."

46. The nurse is caring for a child with thalassemia who is receiving the first chelation therapy. The parent shows understanding of the procedure when she states, "Chelation therapy

1. Decreases the risk of bleeding."
2. Eliminates excess iron in the blood."
3. Prevents sickling of red blood cells."
4. Replaces damaged red blood cells."

47. A mother of a 3-month-old infant asks the nurse if she can offer solid food now so the infant can sleep through the night. The nurse correctly responds by saying,

1. "Infants obtain all the nutrients they need from the formula and they really can't digest foods well at that early age."
2. "Infants at age 3 months do not usually sleep through the night, so solid food probably will not help this problem."
3. "It would be best to give the baby her bath at night to relax her and then she might sleep through the night."
4. "It sounds like she's not getting enough food to satisfy her, so it is probably a good idea to start introducing solid food."

48. The nurse expects that the 1-month-old infant will be able to

1. Actively follow movements of familiar persons with the eyes.
2. Respond to "No, No."
3. Turn the head toward a familiar noise.
4. Discriminate between family and strangers.

49. In order to manage symptoms of mild persistent asthma, the nurse reinforces teaching to the child's family about prescribed

1. Short-acting inhaled bronchodilators as monotherapy, used as needed.
2. Inhaled corticosteroids, used daily.
3. Long-acting inhaled bronchodilators as monotherapy, used daily.
4. Low-dose oral corticosteroids, used daily.

50. While a 10-month-old infant is hospitalized with bronchiolitis, the nurse provides a developmentally appropriate toy such as a

1. Pop-up toy.
2. 15-piece puzzle.
3. Mobile hanging from the crib.
4. Noise-making rattle.

PEDIATRIC NURSING ANSWERS WITH RATIONALE

1. (1) At 7 months, an infant should be sitting with minimal support. The ability to sit is one of the most important milestones in development. The other options are either already mastered at an earlier age or are expected at an older age: Crawling is not expected until 8–9 months; rolling in both directions should have been mastered between 4 and 6 months; grasping a bottle to feed is evident by 6 months.

   NP:A; CN:H; CL:A

2. (2) The nurse does not have enough data or information to report this case as child abuse, so the nurse should continue the assessment. When there is sufficient data to suspect child abuse, the nurse will notify the designated authorities. The nurse is legally responsible to report any suspected case of child abuse. Family counseling might occur *after* abuse has been reported; bringing in the boyfriend for a conference might occur after the mother has described the circumstances of the injuries—the nurse first needs to determine if the mother's explanation is plausible before involving others in the household.

   NP:I; CN:H; CL:AN

3. (3) Allowing the child to gradually assume self-management of the insulin injections builds on Erikson's stage of industry in which children want to accomplish tasks successfully. The autonomy vs. shame stage relates toddlers' temper tantrums or to preschool children who regress. Preschool children in the stage of initiative vs. guilt are most likely to be preoccupied with inappropriate guilt. Although school-age children may regress to this stage, the best intervention is still allowing opportunities for "industry." Wanting to "fit in" with the peer group by following what the group is doing is most applicable to the adolescent whose main task is identity vs. role confusion

   NP:P; CN:H/PH; CL:AN (multilogical thinking)

4. (1) While all of the assessments would be done, the most important is to measure head circumference daily. An increase in size would indicate a neurological condition developing (hydrocephalus is a frequent complication). Daily weights (3) will provide information about nutritional status, which is important at this young age, but not as important as impending increased intracranial pressure. (4) An imbalance in intake and output would suggest possible urological complications. Daily weights also provide information about fluid status. Contractures (2) could be prevented through proper positioning and would not be the priority assessment.

   NP:A; CN:PH; CL:AN (priority question)

5. (2) The most important intervention is to keep the child upright—a supine position could occlude the airway and cause respiratory arrest. The nurse would never check the gag reflex (1) because it could cause further spasms of the epiglottis. The child should be NPO and the hydration status frequently monitored. Vital signs (3) are important, but positioning to facilitate breathing takes precedence.

   NP:I; CN:PH; CL:A

6. (2) The provider's goal has been met: 16 ounces total in the two bottles equals 480 mL (16 ounces × 30 mL/ounce). The child weighs 8 kg so 8 kg × 50 mL/kg equals 400 mL/kg for the hour. Therefore IV fluids are not needed (1) and more bottles per hour are not needed (3). Assessing the output by weighing diapers or by inserting an indwelling catheter might be done to assess output, but this does not answer the question of sufficient intake of oral rehydration solution therapy.

   NP:E/I (is the goal met and then the action related to the evaluation); CN:PH; CL:AN

7. (2) The apical pulse at the apex of the heart, using a stethoscope, is the most reliable way to obtain a heart rate in an infant by auscultation. The apical impulse can also be palpated. The brachial artery (3) can be used in palpating the pulse of an infant but is difficult to auscultate and to count the beats by palpation. The (4) radial artery is difficult to palpate and to

Coding for Questions/Answers Abbreviations: Nursing Process: NP, Assessment: A, Analysis: AN, Planning: P, Implementation: I, Evaluation: E; Client Needs: CN, Safe, Effective Care Environment: S, Health Promotion and Maintenance: H, Psychosocial Integrity: PS, Physiological Integrity: PH; Clinical Area: CA, Medical Nursing: M, Surgical Nursing: S, Maternal/Newborn Nursing: MA, Pediatric Nursing: P, Psychiatric Nursing: PS; Cognitive Level: CL, Knowledge: K, Comprehension: C, Application: A, Analysis: AN.

auscultate and is generally used only for adults. The carotid arteries (1) are difficult to locate in the neck of an infant for both palpation and auscultation.

NP:A; CN:H (assessment that has developmental variations); CL:A

8. (4) The major goal in protecting the seizing child against injury is to always maintain an adequate airway. Placing the child on the side assists in preventing aspiration. Current treatment of seizures no longer advocates the use of a padded tongue blade (2) during a seizure because of possible injury to teeth. Restraints (1) may also cause injury. Decreasing environmental stimulation is used to decrease intracranial pressure, but not relevant to seizure management.

NP:I; CN:S; CL:A

9. (1) All objectives are important, but assessing for degree/severity of fluid loss (dehydration) is the most critical (priority) because this condition can be life-threatening as hypovolemic shock. The degree of fluid loss is assessed by the percentage of change in weight (if known), clinical manifestations of skin turgor, capillary refill, alertness, moistness of oral mucosa, recent intake and output including number of stools, and vital signs indicative of shock. The number of stools (2) does not provide sufficient information alone. Stool culture results will dictate if antibiotic treatment is indicated, but not the first priority as fluid resuscitation is the first treatment measure. Electrolyte results are the second most important priority, so that the healthcare provider can determine intravenous prescriptions (orders) after the initial fluid boluses: with electrolyte results, acidosis can be determined from the serum CO_2 and contributes to the understanding of the severity of the fluid loss. Sodium levels will determine if the loss is isotonic, hypotonic, or hypertonic.

NP:A; CN:S/PH; CL:AN

10. (1) If the catheter becomes plugged or dislodged, it is a complication. (2) Air embolism can occur during tubing changes, not during infusion. (3) The PICC line should be located in the superior vena cava. (4) Bleeding at the site of insertion is unlikely, rather more commonly blood clots can occur in the PICC line and may need to be dissolved with anticlotting medications such as tissue plasminogen activator (tPA).

NP:A; CN:S; CL:A

11. (1) Things that go into the room will have to be disinfected when they are removed, so they should be washable. Fresh flowers and fresh fruit are avoided for neutropenic precautions only (2). Contact precautions do not require a mask (3); healthcare personnel and parents need to observe the same precautions (4).

NP:P; CN:SY; CL:C

12. (2) A change in body image is the most likely problem with chemotherapy because of loss of hair. Also, consider Hodgkin's disease is often curable. Identity crisis occurs in adolescence, but will probably not be related directly to the chemotherapy. Some aspects of care may create some privacy problems, depending on the sensitivity of the healthcare personnel; however, a changed body image will cause more difficulty. A sense of abandonment is not relevant to this scenario, but perhaps social isolation.

NP:A; CN:PS; CL:A

13. (1) Routine immunizations are given per the usual schedule for children with eczema. The only exception would be if the child were given high dose systemic steroids for a long period of time or if an unusual circumstance required the smallpox vaccine which is contraindicated in eczema. Children with eczema usually use topical steroids. All other responses by the parent are correct actions for eczema.

NP:E; CN:PH; CL:A

14. (2) Moist hot packs will help relieve the pain, and night splints prevent further swelling and immobility. (1) Affected joints should not be immobilized for extended periods of time. Passive range of motion (3) should not be done in the initial phases of the disease or during periods of acute inflammation. Unlimited NSAIDs (4) could be dangerous to the child with side/toxic effects of stomach ulcers and bleeding and kidney damage. If NSAIDs are not effective in one month, other categories of drugs are used such as Trexall (methotrexate) or DMARDS.

NP:P; CN:PH; CL:C

15. (2) The developmental stage for toddlers is the autonomy stage. The child wants to do things for himself and will respond well to finger foods offered frequently, not just at designated mealtimes (1). If the child will eat a variety of nutritious finger foods, the nutritional status will be reestablished more effectively. Blenderized (3) foods may or may not be accepted. Offering any foods that the child desires at meals may not meet the nutritional requirements (4). Also, frequent feeding of nutritional foods throughout the day works best for toddlers' erratic eating habits.

NP:P; CN:PH; CL:A

16. (1) Clinical manifestations of iron deficiency anemia are fatigability, dyspnea on exertion, anorexia, weakness, and tachycardia; the severity of these symptoms is related to the decrease of the oxygen-carrying capacity of the red blood cells and are likely to be obvious with hemoglobin values less than 10–12 mg/dL. Anemias in children are seldom caused by vitamin B_{12} and folic acid deficiency—the most common form of anemia in childhood is iron deficiency anemia and is easily treated with iron rich foods and iron supplementation (not terminal) (4).

    NP:A; CN:PH; CL:K

17. (2) The epiphysis is the child's growth plate, and fractures here can cause growth disturbances. Bone marrow (3) is not affected, but healing (4) is generally rapid in children because they are still growing. The medical and surgical management of epiphyseal fractures is different from fractures of the bone shaft.

    NP:AN; CN:PH; CL:C

18. (3) The answer is *1 2 4 5*. Although low-set ears are a sign of congenital defects, they are usually associated with a kidney problem. Low birth weight is not a characteristic of Down syndrome. The other characteristics will be present with Down syndrome.

    NP:A; CN:H; CL:A

19. (3) A strictly controlled diet, eliminating protein because the infant cannot metabolize the amino acid phenylalanine, will prevent or limit mental retardation. A special formula is used for the infant, and a special diet must be followed (at least) until adulthood depending on phenylalanine levels.

    NP:P; CN:PH; CL:A

20. (3) Between 4 and 6 months of age, full term infants have used up the iron provided by the mother and require further supplementation in the form of iron supplementation or iron rich foods, not because *extra* iron is needed for growth (2). Breast milk is not a rich source of iron (4), though the iron it does have is well absorbed—consequently iron rich foods must be introduced at 4–6 months of age for the breastfed infant. The food more readily accepted by infants is fruits (1).

    NP:P; CN:PH; CL:A

21. (1) Meningitis is a common CNS infection of infancy and early childhood. Increased intracranial pressure, which can accompany meningitis, accounts for *separation* of the cranial sutures, bulging (not depressed) fontanelles, and/or projectile vomiting. Oliguria (3) is not a symptom common to CNS infection initially (later on, possibly, with continued intracranial pressure secondary to SIADH [syndrome of inappropriate secretion of ADH]). (4) An infant who cannot be consoled is more likely to correlate to CNS infection.

    NP:A/I; CN:PH; CL:C

22. (4) The Moro (startle) reflex begins to fade at approximately the fourth month. Thus, if found in a 9-month-old child, would be abnormal and needs to be reported. The remaining reflexes illustrate normal development.

    NP:E/I; CN:H; CL:A

23. (2) Current recommendations are to place all infants in the supine position when sleeping, even with a history of GERD, to reduce the incidence of SIDS. Even a side-lying position for sleep is not recommended. The use of an infant seat is discouraged because the slumping posture allows reflux to occur.

    NP:I; CN:PH; CL:A

24. (4) The most effective action is to call the parents to return, if possible. Currently, parents are encouraged to stay with the child around the clock. No one can take the place of the parents with acute separation anxiety of this child (most acute between 9 and 18 months of age). The second choice is for the nurse to try to comfort the child. While the nurse cannot take the place of his parents, the nurse can be comforting. The more time the nurse is with the child, the more trust develops.

    NP:I; CN:PS; CL:A

25. (2) Because complete transposition results in two closed blood systems, the child can survive only if a large septal defect is present.

    NP:(NONE); CN:PH; CL:K

26. (2) Recognition of bleeding leading to shock is the most important complication in postoperative care of the tonsillectomy client as manifested by frequent swallowing, pallor, and vital signs indicative of shock. Infection, dehydration, and pain are also potential complications but not the priority issue for the postoperative tonsillectomy client.

    NP:P; CN:PH; CL:A

27. (4) The child should be placed in contact and airborne isolation because weeping lesions of chicken pox spread the disease and prodromal symptoms are spread by small droplets suspended in the air (airborne).

    NP:I; CN:S; CL:A

28. The answer is *41.7 mL/hour*. Maintenance intravenous fluids are 100 mL/kg for the first 10 kg. In this case, the child would receive 10 kg × 100 mL/kg, which is equal to 1000 mL then divided by 24 hr = 41.7 mL/hr

    NP:I; CN:PH; CL:A

29. (3) PDA is acyanotic initially with diaphoresis with feeding. If the ductus is large and much blood is shunted into the pulmonary circulation, there may be eventual left to right shunting. Improved perfusion with a knee-chest position (1) occurs with cyanotic disorders. Similarly, clubbing and a lower oxygen saturation occurs with cyanotic cardiac lesion, and cyanosis with increased exertion (e.g., with a long feeding session).

    NP:A; CN:PH; CL:C

30. (4) Pyloric stenosis presents in early infancy with projectile vomiting after feeding. Dehydration and electrolyte imbalances are possible complications if therapy is not performed; thus fluid overload is not a symptom often seen as bounding pulses and peripheral edema.

    NP:A; CN:PH; CL:C

31. (1) Embryologically, the ears and kidneys are formed at the same time; therefore, if a child presents with low-set ears or any defect in the ears, renal disease is also suspected. In addition, certain syndromes are characterized by both renal and ear malformations. Periorbital edema is seen in neonates with renal and/or cardiac disease. A palpable abdominal mass in a neonate could indicate Wilms' tumor, a malignant tumor. The other distractors are not indicative of renal disorders.

    NP:A; CN:PH; CL:A

32. (2) The nurse knows that children tend to regress when under the stress of hospitalization, so it is important not to make a judgment or imply that the child should know better. The best approach: Be matter-of-fact, not blaming.

    NP:I; CN:H; CL:A

33. (4) All other actions are indicated but the missing factor is the first intervention since it provides clotting factors to stop bleeding physiologically more than elevating and immobilizing the joint (2). Currently, children with hemophilia have access to the missing synthetic factor at home. Tylenol may be sufficient to control the pain, not the bleeding. Cold, not heat, should be applied (3).

    NP:I; CN:PH; CL:AN (priority)

34. (1) When a toddler is hospitalized, he or she may suffer from separation anxiety syndrome. The behavior that would indicate the first stage, protest, would be loud crying or even throwing a tantrum when the parent leaves. Answer (4) would indicate the final stage, denial. Answers (2) and (3) would not occur when the toddler is in a strange new environment.

    NP:A; CN:PS; CL:C

35. (2) Regurgitation or spitting up can be caused by feeding too much formula at one time, or the need for more burping (3). It usually diminishes by the age of 5 or 6 months. A formula with higher caloric density is not used unless there is a growth disturbance noted and it must be ordered by the healthcare provider. Most causes of spitting up do not cause growth problems (GER vs. GERD).

    NP:I; CN:H; CL:A

36. (4) Infants breathe in an irregular pattern with varying depth and rate so that a 1-minute count is appropriate. Answers (1), (2), and (3) are true statements, but not the rationale for the question.

    NP:A; CN:H; CL:C

37. (2) The hallmark of asthma is wheezing. Wheezing with an asthma exacerbation is often heard best as a prolonged expiratory sound. Asthma is not a condition of the upper respiratory tract, so inspiratory stridor is unlikely (1). End-inspiratory crackles alone (3) indicates atelectasis or pneumonia; however, crackles *with* wheezes may occur. A hoarse voice is unlikely because there is no vocal cord involvement with asthma. Asthma is a lower respiratory tract condition involving the bronchioles.

    NP:A; CN:PH; CL:A

38. (2) Pancreatic enzymes are given as supplements to replace the pancreatic enzymes that are blocked and/or no longer being produced; they are needed each time the child eats. (1) Pancreatic enzymes do not prevent the destruction of the pancreas and the development of diabetes. (3) The enzymes are replacements and do not change the mucous. (4) Pancreatic enzymes do not prevent constipation, though they do affect the amount of fat in the stools.

    NP:I; CN:PH; CL:A

39. (3) Examination of the cerebrospinal fluid is the only definitive way to verify bacterial meningitis.

    NP:A; CN:PH; CL:C

40. (3) The other answers are also necessary information but keeping *all* cabinets *locked* is critical. It is not enough to keep medicine only in high cupboards (4) because other products, such as cleaning materials, can be poison.

    NP:I; CN:H; CL:A

41. (1) Children with cystic fibrosis produce abnormally high levels of sodium chloride in their sweat. Although answers (3) and (4) might be used during the diagnostic work-up, they do not definitively diagnose the disease.

    NP:A; CN:PH; CL:C

42. (4) Antibiotics are used to prevent infections from bacteria spread by an invasive procedure that attach to the rough surfaces on the heart's surface (recommended with valve placement). (1) optimizes nutrition but is not specific to preventing a bacterial infection. (2) prevents respiratory synticial virus (RSV) infection only. (3) Avoiding ill people prevents respiratory illness but not infective endocarditis.

    NP:I; CN:PH; CL:A

43. (1) The earliest clinical manifestation of CF is a meconium ileus, which is found in about 10% of children with CF. Clinical manifestations include abdominal distention, vomiting, failure to pass stools, and rapid development of dehydration. All the other distractors are later clinical manifestations.

    NP:A; CN:PH; CL:C

44. (3) is correct because the shorter, more horizontal Eustachian tube allows bacteria to travel from the pharynx to the middle ear when there has been pooling of secretions or pressure changes. (1), (2), and (4) are simply not true statements.

    NP:I; CN:H; CL:A

45. (3) The American Academy of Pediatrics (AAP) recommends the following to prevent SIDS in infants: Place infants on their backs to sleep, use mattresses with a firm sleeping surface; avoid exposing the infant to second-hand smoke, and offering a pacifier for sleep. In addition, bed sharing is not recommended, and parents are advised to put the infant in a crib in the parent's room for sleeping. Overheating the infant is to be avoided.

    NP:E; CN:PH; CL:A

46. (2) Chelation therapy removes excess iron that has accumulated in repeated blood transfusions given previously to replace abnormal red blood cells. Thalassemia is the result of a genetic disease in which abnormal fragile red blood cells are produced in the bone marrow, which are taken out of circulation, and lead to anemia. There is no sickling of red blood cells (3) and no problem with clotting (1). Chelation therapy is not a blood transfusion of red blood cells (4).

    NP:E; CN:PH; CL:A

47. (1) Studies have indicated that breast milk or formula will provide sufficient nutrition to infants up to 6 months and even 1 year. The American Academy of Pediatrics recommends introduction of solid food at about 6 months of age, as infants cannot easily digest food before this time. Sleeping patterns for infants vary on an individual basis (some infants sleep all night at 3 months of age) and the introduction of solid food does not ensure a full night's sleep.

    NP:I; CN:H; CL:A

48. (1) Actively following movements with the eyes occurs at 1 month. Responding to "No" (2) and turning the head in response to a noise (3) begins at 4 months, and discrimination between family and strangers (4) appears at 5–6 months of age.

    NP:A; CN:H; CL:C

49. (2) In order to manage symptoms of mild persistent asthma, daily use of inhaled corticosteroids are recommended. Short-acting inhaled bronchodilators are also used only as needed. Both mediations must be prescribed for mild persistent asthma.
    (3) Long-acting inhaled bronchodilators are never used alone for asthma. (4) Low-dose oral corticosteroids may be used in *short bursts* for exacerbations of mild persistent asthma or for severe persistent asthma on a daily basis.

    NP:I; CN:PH; CL:A

50. (1) The pop-up toy, such as a jack-in-the-box, or pop-up shapes that appear when the child presses a button will engage the 10-month-old infant. The 10-month-old is conquering object permanence (here it is, now it's gone) according to Piaget's cognitive theory. (2) The puzzle requires dexterity for an older child, the (4) rattle is most interesting to the 4–6 month-old who is learning to grasp objects, and the (3) mobile is interesting in the first few months of life when the head and eyes turn to follow objects.

    NP:I; CN:H; CL:AN