CHAPTER 31

Health Assessment of Children

Elliot Simmons, 3 years old, is brought to the clinic for his annual examination. His mother states that he is very fearful and anxious about this visit.

KEY TERMS

accommodation
acrocyanosis
auscultation
body mass index (BMI)
cerumen
chief complaint
fontanel
inspection
lanugo
obligate nose breathing
palpation
PERRLA
point of maximal impulse (PMI)
stadiometer
Tanner stages
tympanometer

LEARNING OBJECTIVES

Upon completion of the chapter, the learner will be able to:

1. Demonstrate an understanding of the appropriate health history to obtain from the child and the parent or primary caregiver.
2. Individualize elements of the health history depending upon the age of the child.
3. Discuss important concepts related to health assessment in children.
4. Describe the appropriate sequence of the physical examination in the context of the child's developmental stage.
5. Perform a health assessment using approaches that relate to the age and developmental stage of the child.
6. Distinguish normal variations in the physical examination from differences that may indicate serious alterations in health status.
7. Determine the sexual maturity of females and males based upon evaluation of the secondary sex characteristics.

Wow

Growth and development is a journey, on which many children venture without a map.

Assessment of the child's health status involves many components: the health interview and history; observation of the parent–child interaction; physical examination; and the child's emotional, physiological, cognitive, and social development. The nurse's skills are vital to the success of the assessment process. The nurse must (Mandleco, 2005):

- Establish rapport and trust
- Demonstrate respect for the child and the parent or caregiver
- Communicate effectively by actively listening, demonstrating empathy, and providing feedback
- Observe systematically
- Obtain accurate data
- Validate and interpret data accurately

The focus of the assessment process depends on the purpose of the visit and the needs of the patient. Assessment is an ongoing process and is repeated to varying degrees at every encounter. Expert nurses are constantly evaluating all of those in their care, whether directly or indirectly as part of conversation and play. Indeed, some of the subtlest developmental signs may express themselves only during relaxed and casual interaction with a child. You can observe gait while watching a child run down the hall; assess fine motor skills and social adaptation while playing a board game; or observe balance and coordination when bouncing a ball. Playful activities such as tickling a child can give the nurse feedback related to upper body strength when the child attempts to push the nurse's arms away. Nurses must also learn to perform a comprehensive and thorough examination of a child in an efficient manner.

A thorough and thoughtful assessment of a child is the foundation upon which a nurse determines the needs of and plan of care for the patient. Nothing can replace it for giving the nurse a snapshot of the life and health of the child. A comprehensive history, a thorough examination, and developmental or cognitive testing as appropriate will provide practical information about the health of a child and guide the nurse's plan of care. The history and physical examination also provide a time for health education, teaching about expected growth and development, and discussing healthy lifestyle choices. The nurse uses critical thinking skills to analyze the data and establish priorities for nursing intervention or follow-up.

The health assessment may be documented using a number of formats. The information should be easily retrievable and available to all members of the child's health care team.

Health History

The health history provides the nurse with an overall picture of what the child has experienced, highlighting areas of concern such as recurrent upper respiratory infections or headaches. This not only helps the nurse to assess those specific areas more comprehensively but also provides the opportunity to ask focused questions and identify areas where education may be needed. The time used to obtain the health history also gives the nurse an opportunity to interact with the child in a nonthreatening manner, while the child watches the interactions between the nurse and the primary caregiver.

PREPARING FOR THE HEALTH HISTORY

Appropriate materials and a suitable environment are needed when performing a thorough health history. Take into account family roles and values. Consider the age and developmental stage of the child so that you can approach the child appropriately and possibly involve him or her in the health history. Observe the child–parent interaction. Determine the extent of the health history that is needed in a given situation. Being well organized and staying flexible will help ensure success.

Gathering Materials and Preparing Yourself for the Health History

Before you begin, make sure you have materials to record your history data (either a computer or chart paper and a pen), a private space with adequate lighting, chairs for adults and the nurse, and a bed or examination table for the child. The space should be safe for your patient's developmental stage and allow you uninterrupted time for your examination. Sit down for as much of the history taking as possible to demonstrate a relaxed and welcoming manner.

Approaching the Parent or Caregiver

Greet the parent or caregiver by name. While interviewing the parent, provide toys or books to occupy the child, allowing the parent to concentrate on your questions. Use open-ended questions and avoid making judgmental comments. Show respect by remaining approachable. Remember that the structure of the family and its roles and dynamics will affect how the family communicates and how they make decisions about health care. Demonstrate patience and help the parent stay on track when there are several children in the family. Throughout the interview, refer to the child by name and use the correct gen-

der when referring to the child, demonstrating interest and competence.

▶ *Take* NOTE!

Illness can cause great stress in families and individuals, so nurses must remember to protect themselves from potentially threatening behavior on the part of the family. Sit close to the door, and if you are uncomfortable with a family member, ask for assistance. You may need to keep the door open or have another nurse or security personnel present.

Approaching the Child

Show a professional demeanor while still being warm and friendly to the caregivers and child. A white examination coat or all-white uniform may be frightening to children, who may associate the uniform with painful experiences or find it too unfamiliar. The nurse can wear a variety of professional-looking outfits, whether colorful uniform tops, aprons, or smocks worn over white uniforms, or everyday clothing, depending on the setting of the nurse's practice. Make eye contact if possible and address the child by name. Use slow deliberate gestures rather than very quick or grand ones, which may be frightening to shy children.

Some young children will warm up when given time to be invisible in the room, such as hiding behind a parent before they tentatively appear. Make physical contact with the child in a nonthreatening way at first. Briefly cuddling a newborn before returning it to the caregiver, warmly shaking the hand of older children and teens, and laying your hand on the head or arm of toddlers and preschoolers will convey a gentle demeanor. A joke, a puppet, a silly story, or even a simple magic trick may coax the child into warming up. Being at the same eye level as the child can also be more reassuring than standing over the child. This may require having extra seating for the nurse at the same level as the child and parent/caregiver. Aim to be seen as a trustworthy adult who is the child's partner in feeling better and staying healthy.

Elicit the child's cooperation by allowing him or her control over the pace, the order, or anything else that the child can control while still allowing you to obtain the information you need. All of this establishes a personal relationship with the child and helps gain his or her cooperation.

Communicating With the Child During the Health History

The child should be given opportunities to actively participate in the health history and assessment process. For young children, such as toddlers and preschoolers, ask them to point to where it hurts and allow them to answer questions. Validation of the information by the parent/caregiver is essential because of the limited comprehension and language use of children at these ages. The school-aged child can be more accurate because of his or her increased language skills and maturity level.

Initially, address the child and obtain as much information from him or her as possible. School-aged children should be able to answer questions about interactions with friends and siblings and school and activities they enjoy or are involved in. Ask the parent/caregiver if any additional information or observations should be included.

Adolescents may not feel comfortable addressing health issues, answering questions, or being examined in the presence of the parent/caregiver. The nurse must establish a trusting relationship with the adolescent to provide him or her with optimal health care. Ask adolescents whether they would be more comfortable answering questions alone in the examination area or whether they prefer for their parents to be present. Either way, the parent/caregiver will have an opportunity to talk with the nurse after the health history and assessment are completed.

Demonstrate an interest in the teen by asking questions about school, work, hobbies or activities, and friendships. Begin with these topics to make the teen feel comfortable in communicating with you. Communicate honestly with the adolescent and explain the rationale for various aspects of the health history. Teens are very sensitive to nonverbal communication, so be very aware of your gestures and expressions. Once a rapport has been established, move on to more emotionally charged questions that relate to sexuality, substance use, depression, and suicide.

Always assure the teen that complete confidentiality will be maintained to the extent possible. Current state law will determine the types of information that may be withheld from parents. If the information that the nurse receives indicates that the teen may be in danger, then the nurse must inform the teen that the information will be shared with other providers and/or the parents.

▶ *Take* NOTE!

Do not try to become the adolescent's peer. Remain in the role of the health care provider while demonstrating respect and acceptance toward the teen. Clarify the meaning of jargon or slang that the teen uses, but do not use these words yourself, as the teen will simply not accept you as a peer.

Observing the Parent–Child Interaction

Observation of the parent–child interaction begins during the focused conversation of the health interview and continues throughout the physical examination. Explore the family dynamics, not only through questions but also by observing the family for behavioral clues. Does the parent make eye contact with the infant? Does the parent anticipate and respond to the infant's needs? Are the parents ineffective when dealing with a toddler's temper tantrum? The plan of care may need to be adjusted to teach appropriate responses to the infant's needs or toddler's behavior. Do the parents' comments increase the school-age child's sense of self-worth? Behavioral observations are crucial to proper assessment of the family's needs.

Does the parent seem to be coping with the health issue or does he or she appear overwhelmed? Is the parent's/caregiver's behavior appropriate? Does the child look at the parent/caregiver before answering? Does the child seem relaxed and happy with the parent/caregiver, or is the child tense? The infant will appear calm and relaxed if his or her needs are generally met. Crying may occur when the baby is ill or frightened but may also indicate discomfort with the parent or caregiver. Use a calm and comforting voice with the infant. Infants respond well to higher-pitched and soothing voices.

When observing the relationship between the adolescent and the parent/caregiver, does the parent/caregiver allow the adolescent to speak, or does he or she frequently interrupt? Does the parent/caregiver contradict what is being said? Observe the body language of the adolescent. Does the adolescent seem relaxed or tense? Since adolescents are between childhood and adulthood, they have unique needs. They are in a time of multiple physical and emotional changes, many of which they cannot control. They need to know that the nurse is interested in what they have to say. The use of open-ended questions allows the adolescent to talk. "Tell me about your. . . ." or "What have you noticed about. . . ." are comfortable phrases to use to elicit the information needed.

Be aware of your reactions to the adolescent's questions or behaviors, such as your nonverbal and facial expressions. Talk with the adolescent using accurate language that is developmentally and age-appropriate.

Determining the Type of History Needed

The purpose of the examination will determine how comprehensive the history must be. If the health care provider rarely sees the child or if the child is critically ill, a complete and detailed history is in order, no matter what the setting. The child who has received routine health care and presents with a mild illness may need only a problem-focused history. In critical situations, some of the history taking must be delayed until after the child's condition is stabilized. Evaluate the situation to determine the best timing and the extent of the history. Also, be sensitive to repetitive interviews in hospital situations, and collaborate with physicians or other members of the health care team to ensure that a family already under stress does not need to undergo prolonged or repetitive questioning.

Remember Elliot, the 3-year-old being seen for his annual examination? When you enter the room, he is hiding behind his mother's legs. Considering his age and developmental level, how will you proceed with obtaining a health history?

PERFORMING A HEALTH HISTORY

The health interview is the foundation of an accurate health assessment. Information about the child's health will come not only from a physical examination, but also from a careful conversation or interview with the child and/or the caregiver. Depending on the intent of the health assessment, many of the questions will be direct, and many will require the caregiver or child to answer simply "yes" or "no." In other than emergency situations, though, asking open-ended questions offers an excellent opportunity to learn more about the patient's life. For example, "Are you happy at school?" may elicit a brief nod of the head, whereas "Tell me what it's like on your school playground" may result in a story about the child's friends, the kind of activities they enjoy, any bullying that goes on, and so forth. These stories will provide the nurse with clues to the child's stage of physical, emotional, and moral development as well as his or her functional status.

Establish a therapeutic relationship with the child and family. Without the trust that comes from this therapeutic relationship, the family may not reveal vital information due to fear, embarrassment, or mistrust. Use therapeutic communication techniques such as active listening, open-ended questions, and eliminating barriers to communication. Establishing a "medical home" where ongoing health supervision occurs encourages the formation of trust through continuity of care and the family's continuing relationships with health care providers (see Chapter 30).

Components of the Health Interview

The structure of the health interview is determined by the nature of the visit. At an initial visit, large amounts of historical data are collected. Having the family fill out a questionnaire can save time, but a questionnaire is not a substitute for the health interview. The questionnaire may serve as a springboard to begin structured conversations between the family and the nurse. At subsequent visits the health interview can focus on the pertinent issues of that visit as well as any health issues that are being monitored.

The health history includes demographics, chief complaint and history of present illness, past health history, review of systems, family health history, developmental history, functional history, and family composition, resources, and home environment.

▶ ***Take*** *NOTE!*

Any questionnaires used in the health care setting must be appropriate to the reading level and primary language of the person filling them out.

Demographics

Questions should start with simple and nonintrusive ones; once a rapport between the nurse and patient has started, sensitive questions can be asked. First obtain data such as the child's name, nickname, birth date, and gender. Determine the child's race or ethnicity, the language the child understands, and the language the child speaks. Record the child's address and home telephone number and the parent's or caregiver's work telephone number. Identify who the historian is (the child or the parent or caregiver), and note how reliable you consider this source of information to be. Do not assume that an adult with the child is the child's parent. Establish the relationship of the adult to the child, and ask who cares for the child if that person does not. Determine the composition of the household, including other children and other family members or other persons who live there.

Chief Complaint and History of Present Illness

Next, ask about the **chief complaint** (reason for the visit). The reason may not always be apparent to you. A question such as, "What can I help you with today?" or "What did you notice in your baby/child that you wanted to have checked today?" is very welcoming. The response from the child or parent may be a functional problem, a developmental concern, or a disease.

Record the chief complaint in the child's or parent's own words.

Next address the history related to the present illness. For each concern, determine its onset, duration, characteristics and course (location, signs, symptoms, exposures, and so on), previous episodes in patient or family, previous testing or therapies, what makes it better and what makes it worse, and what the concern means to the child and family. Inquire about any exposure to infectious agents.

Past Health History

Ask about the prenatal history (any problems with pregnancy), perinatal history (any problems with labor and delivery), past illnesses, or any other health or developmental problems. Document the child's prior history of illnesses (recurrent, chronic, or serious) and any accidents or injuries in the past. Inquire about any operations or hospitalizations the child has had. Document the child's diet. Note the child's allergies to foods, medications, animals, environmental or contact agents, or latex products. Determine the child's reaction to the allergen as well as its severity. Determine the child's immunization status (refer to Chapter 30 for further information on immunizations). Record any medications the child is taking, the dosage and schedule, as well as when the last dose was given. In preadolescent and adolescent females, determine menstrual history.

Family Health History

Obtaining information about the family's health is a key part of a health interview. Perform a three-generation family health history. This information may be documented in a genogram (Fig. 31.1). Asking about the age and health status of mother, father, siblings, and other family members helps to identify trends and specific health issues. For example, do the grandparents have early-onset coronary artery disease? If they do, the child may benefit from additional health screening. Siblings may exhibit a genetic disease or carry a trait for the disease. This family health information helps to guide future health planning.

Review of Systems

Inquire about current or past history of problems related to:

- Growth and development
- Skin

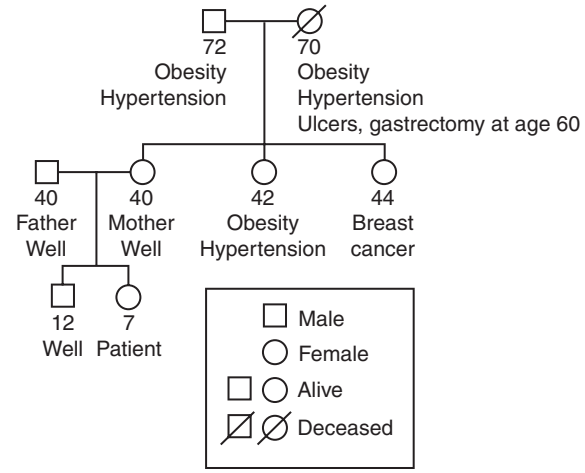

FIGURE 31.1 Genogram.

- Head and neck
- Eyes and vision
- Ears and hearing
- Mouth, teeth, and throat
- Respiratory system and breasts
- Cardiovascular system
- Gastrointestinal system
- Genitourinary system
- Musculoskeletal system
- Neurologic system
- Endocrine system
- Hematologic system

Table 31.1 provides specific questions related to each of these systems.

Developmental History

Determine the age when landmarks in gross motor control were achieved, such as sitting, standing, walking, pedaling, and so on. Ask whether the child has attained fine motor skills such as grasping, releasing, pincer grasp, crayon or utensil use, and handwriting skills. Note the child's age and extent of language acquisition. Document speech problems such as a lisp or stuttering. The rate of developmental skill acquisition may vary from child to child, but the sequence of skill attainment should remain the same. Inquire about self-care ability (e.g., tying shoes, dressing, brushing teeth) and, in the younger child, how toilet training is progressing. Assess feeding skills, including how well the child drinks from a cup and uses utensils or whether the

TABLE 31.1 QUESTIONS FOR THE REVIEW OF SYSTEMS

Systems	Has the Child Experienced:
Growth and development	Weight loss or gain, appropriate energy and activity levels, fatigue, behavioral changes such as irritability, nervousness, anger, or increased crying
Skin	Easy bruising or bleeding, rash, lesion, skin disease, pruritus, birthmarks, or change in mole, pigment, hair, or nails
Head and neck	Head injury, headache, dizziness, syncope
Eyes and vision	Pain, redness, discharge, diplopia, strabismus, cataracts, vision changes, reading difficulties, need to sit close to the board at school or close to the TV at home
Ears and hearing	Earache, recurrent ear infection, tubes in eardrums, discharge, difficulty hearing, ringing, excess cerumen
Mouth, teeth, and throat	Swollen gums, pain with teething, caries, tooth loss, toothache, sores, difficulty with chewing or swallowing, hoarseness, sore throat, mouth breathing, change in voice
Respiratory system and breasts	Nasal congestion or discharge, cough, wheeze, noisy breathing, snoring, shortness of breath or other difficulty breathing, problems with or changes in breasts
Cardiovascular system	Murmur, color change (cyanosis), exertional dyspnea, activity intolerance, palpitations, extremity coldness, high blood pressure, high cholesterol
Gastrointestinal system	Nausea, vomiting, abdominal pain, cramping, diarrhea, constipation, stool-holding, anal pain or itching
Genitourinary system	Dysuria; polyuria; oliguria; narrow urine stream; dark, cloudy, or discolored urine; difficulty with toilet training; bedwetting *Boys:* undescended testicles, pain in penis or scrotum, sores or lesions, discharge, scrotal swelling when crying, changes in scrotum or penis size, addition of pubic hair *Girls:* vaginal discharge, itching rash, problems with menstruation or menstrual cycle, development of pubic hair
Musculoskeletal system	Joint or bone pain, stiffness, swelling, injury (e.g., broken bones or sprains), movement limitation, decreased strength, altered gait, changes in coordination, back pain, posture changes or spinal curvature
Neurologic system	Numbness, tingling, difficulty learning, altered mood or ability to stay alert, tremors, tics, seizures
Endocrine system	Increased thirst, excessive appetite, delayed or early pubertal changes, problems with growth
Hematologic system	Swelling of lymph nodes, pale color, excessive bruising

Data from Burns, C., Dunn, A., Brady, M., Starr, N., & Blosser, C. (2004). *Pediatric primary care: A handbook for nurse practitioners.* Philadelphia: W. B. Saunders; Jarvis, C. (2008). *Physical examination and health assessment* (5th ed.). St. Louis: Saunders; Weber, J., & Kelley, J. (2005). *Health assessment in nursing* (3rd ed.). Philadelphia: Lippincott Williams & Wilkins.

child has any special requirements. Inquire about social skills and comfort articles (e.g., blankets, stuffed animals). Note whether the child has a habit of thumb or finger sucking or using a pacifier. Document daycare attendance and preschool or school adjustment and achievements.

Functional History

The functional history should contain information about the child's daily routine. Inquire about:

- Safety measures (e.g., car seats and their placement, use of seat belts, smoke detectors, bike helmets)
- Routine health care and dental care (including dates of dental care and what was done)
- Nutrition, including a 24-hour dietary recall or week-long food diary, use of supplements and vitamins, feeding pattern and satisfaction with diet, amount of "junk food" consumed, food likes and dislikes, and the parent's perception of the child's nutrition (refer to Chapters 25 through 29 for nutritional needs at various ages)
- Physical activity and organized sports, play, and recreation
- Television and computer habits
- Sleep behavior and bedtime
- Elimination patterns and any concerns
- Hearing or vision problems (dates of last screenings and results)
- Relationships with other family members and friends, coping and temperament, discipline strategies, attention or school behavior problems
- Religious involvement and other spiritual practices
- Use of adaptive and assistive devices such as eyeglasses or contact lenses, hearing aids, walker, braces, wheelchair
- Sexual practices

Family Composition, Resources, and Home Environment

Determine the marital status of the parents. Does the child live with the parents, a stepparent, or other family member? Is the child adopted or in foster care? Are the parents the primary caretakers for the child? If not, the primary caretaker should be included in the interview process if possible. Parents may not know some of the child's routines if the child spends much of the time being cared for by someone else. Working parents may learn about a health or behavior issue only after being alerted by the child's daycare center or babysitter. It may be helpful to expand the family history to include the grandparents and their interaction with the child.

Determine the employment status of the parents and their occupations, as this could affect the child's overall well-being; for example, the parents' work schedule may not allow them to spend much time with the child. Assess family income and financial resources, including health insurance and food stamps or other governmental supplemental income. Major family changes can also affect how the parents and child interact, so evaluate for relationship problems or changes.

Ask about the family's home and its age and the home environment. Is there a safe outdoor play area? If there is a pool, are safety features in place? Determine whether the home has electricity and an indoor water supply. Also determine whether the home has heating, air conditioning, and refrigeration. What pets does the family have? How are they housed? Are there infestations of insects or rodents in the home?

Take NOTE!

Homes or apartments built prior to 1978 may contain lead-based paint, and children who live there are at an increased risk for the development of lead poisoning.

Performing a Physical Examination

After the history comes the physical examination. It should focus on the chief complaint or any of the systems that engaged the nurse's critical thinking while taking the history. The examination will reflect the nurse's general practice style, the developmental stage and age of the child, the temperament of the child and caregiver, and the health status of the child. A very ill child will not waste energy protesting the examination, so the nurse can move quickly in that situation. A healthy child, however, will express his or her normal developmental stage and will show varying degrees of resistance to the examination.

PREPARING FOR THE PHYSICAL EXAMINATION

When performing the physical examination, being prepared and organized ensures that you will obtain the needed information. The appropriate methods to use and ways to approach the child depend on the child's developmental stage.

Gathering Materials and Preparing for the Examination

The examination area should include an exam table or the child's hospital crib or bed. Appropriate lighting is necessary for adequate observation and inspection. Gather the equipment necessary for the examination such as clean gloves, stethoscope, thermometer, sphygmomanom-

eter, tape measure, reflex hammer, penlight, otoscope/ophthalmoscope, tongue depressor, and cotton ball. An infant or adult scale is needed, as well as a **stadiometer** for children capable of standing independently. Young children may be frightened by seeing a large amount of equipment, so take out one piece of equipment at a time. Some children can be very resistant to what they see as a threat or an invasion of their privacy, so it may help to have washable toys in the examination area to use as distractions during the assessment.

Children and their parents may be able to sense any frustration or anxiety on the part of the examiner, so display a confident and matter-of-fact approach. If the child is not cooperative, do not become discouraged; more time and explanation will usually do the trick.

Regardless of the child's age, if the examination room is cold, the child will be uncomfortable and possibly less cooperative. Provide appropriate covers to ensure the child's comfort, or have the child remain dressed until the time of the examination.

Approaching the Child

Approach the child according to his or her developmental age and stage. Table 31.2 outlines a general approach to the physical examination in each broad developmental category.

If several children are to be seen at the same time, begin with the child who will be most cooperative. If the other children do not see anything scary and realize that their sibling was examined without a problem, it sets the stage for better cooperation from the younger ones.

Newborns and Infants

If the infant is asleep, auscultate the heart, lungs, and abdomen first while the baby is quiet. Count the heart rate and respiratory rate before undressing the baby. Completely undress newborns and infants down to their diaper, removing it just at the end to examine the genitalia, anus, spine, and hips. It is best to examine the infant 1 to 2 hours before a feeding. Having the parent or caregiver hold the child during the examination can help to alleviate fears and anxieties (Fig. 31.2). Allow the parent or caregiver to be a nurturer rather than assisting with painful procedures, unless there are no other choices available.

Perform the assessment in a head-to-toe manner, leaving the most traumatic procedures, such as examination of the ears, nose, mouth, and throat, until last. Also delay eliciting the Moro reflex until the end of the examination, as the startling sensation may make the infant cry. Use firm, gentle handling while examining the infant. Make sure your hands and the stethoscope are warm. Perform the assessment as quickly and completely as possible. Use a soft and crooning voice, smile, and engage the infant in eye contact. If the baby is crying, a pacifier may be useful and brightly colored objects may help distract him or her.

▶ *Take* NOTE!

Many older infants demonstrate stranger anxiety as a normal part of development. If the infant is not being held by the parent, make sure the parent is within the infant's view; this will increase the baby's comfort and cooperation.

Toddlers and Preschoolers

Toddlers and preschoolers usually prefer to remove their clothing one item at a time as needed for the examination. After one area is examined, the child may feel more comfortable replacing that item of clothing before removing another one. An examination gown is usually not necessary before school age. Again, make certain the room temperature is comfortable.

When the nurse enters the room, a child of this age is often sitting or standing by the parent. Incorporate play as appropriate during the health assessment. Remember your own facial expressions and tone. Use little touch at the beginning of the encounter with the child and the caregiver.

Introduce the equipment to be used slowly, explaining briefly what is going to happen. Let the child touch and hold the equipment whenever possible, even taking a parent's temperature or putting the blood pressure cuff on a teddy bear (Fig. 31.3). The toddler will prefer to sit on the caregiver's lap. When the toddler must be supine for the abdominal examination, sit in your chair knee-to-knee with the caregiver so the toddler may lie back on the caregiver's and your laps.

Praise the child for being cooperative during the examination. "You did such a good job holding still while I listened to your chest" and similar phrases give positive feedback to the child.

If the child is uncooperative, assess as thoroughly as possible and move on to the next area to be assessed. The caregiver may need to place an arm around the toddler's body to provide restraint for invasive procedures. Use short phrases to tell the toddler what you are going to do, rather than asking if it is OK.

▶ *Take* NOTE!

Toddlers are egocentric. Telling a toddler how well another child behaved probably will not be helpful in gaining the young child's cooperation.

The preschooler may fear body invasion and mutilation and will withdraw from any procedure or assessment that is viewed as intrusive. Otherwise, the sense of initiative often leads the preschooler to be cooperative. The

TABLE 31.2 DEVELOPMENTAL CONSIDERATIONS FOR EXAMINATION

	Newborn	Infant	Toddler	Preschool	School-age	Early Teen	Late Teen
Place to perform examination	May lie on examination table or in caregiver's lap.	In caregiver's lap or on exam table with caregiver right beside infant.	Allow some freedom of movement where possible; child may stand between sitting caregiver's legs or sit on the lap.	Some may be willing to sit on exam table with caregiver standing close by with hand on the leg.	Sitting on examination table where they still have eye contact with caregiver.	Some may be willing to have their caregiver wait outside the exam room.	Explain to the caregiver that the teen needs privacy and that he or she should wait outside the exam room.
Examination direction	Keep up a running dialog with the caregiver, explaining each step as you do it.	Continue to explain each step to the caregiver; address child by name. Perform most invasive parts last.	Introduce yourself to caregiver and child; explain most steps to the child and all steps to caregiver; allow child to handle instruments. Perform most invasive parts last.	Allow child to decide the order of the examination; explain what the instruments do and let the child try them; speak to the caregiver before and after the examination.	Include the child in all parts of the examination; use head-to-toe approach with genital exam last. Speak to the caregiver before and after the examination.	Speak to the child using mature language; appeal to his or her desire for self-care. Use a head-to-toe approach, with genital exam last.	Explain confidentiality to caregiver and teen; allow time talking with them together and separately. Use a head-to-toe approach, with genital exam last.

FIGURE 31.2 The infant or toddler may feel more comfortable and secure being examined while sitting in the parent or caregiver's lap.

preschooler may be willing to undress completely, leaving just the underpants on. Use simple explanations to inform the child about each step of the examination, offering reassurance as appropriate. Allow him or her to "help" by holding the stethoscope or penlight. If choices are available, offer them to the child. Again, always compliment the child on his or her cooperation.

▶ ***Take*** NOTE!

Preschoolers like to play games. To encourage deep breathing during lung auscultation, hold up a finger or a lit penlight and instruct the child to "blow it out."

FIGURE 31.3 The preschooler enjoys listening to her mother's heart first.

School-Age Children

The school-age child's thinking is still very concrete, but he or she can be objective and realistic. Avoid using medical jargon and words that may have a double meaning to a young child. Instead of "take your temperature," "take your blood pressure," "hit your knee," or "test," say, "Let's see how warm you are," "I want to listen to you breathe," and other phrases that describe, in words the child can understand, what you are preparing to do. The school-age child may be very interested in how things work and why certain things need to be done and will be responsive to truthful and simple explanations. Instruments that are colorful or look like toys are very helpful until adolescence, when teens are put off by childish things.

Always respect a child's desire to avoid pain and insult. Allow children to wear their underpants under the examination gown to provide a sense of security until the genitalia need to be examined. Allow the child to replace his or her clothing as soon as possible. Privacy and respect for the child's feelings are important to children of this age.

▶ ***Take*** NOTE!

Describing and commenting on your findings during the physical examination is interesting to the school-age child, as children of this age like to learn about how the body works.

Adolescents

Provide privacy while the adolescent is undressing and putting on a gown. Demonstrate an attitude of respect. Perform the assessment in a head-to-toe manner, exposing only the area to be examined. Provide information about physical changes in a matter-of-fact way, such as, "the hair on your legs is what is expected at this time." This provides information related to sensitive areas that the teen may be reluctant to ask about. It also provides the adolescent with information about the sexual development that is normal and expected. Allow opportunities for the teen to ask questions without the caregiver being present. Assure the adolescent that there are no "dumb questions" about the changes being experienced. Teenage girls should remove their bra so that you can do a breast examination, teach breast self-examination, and check for scoliosis. If the nurse is a male and the patient is an adolescent female, it is appropriate for a female staff member to be present during the breast and genital examination.

Steps of the Physical Examination

The physical examination of children, just as for adults, begins with a systematic **inspection**: checking color, warmth, characteristics, and texture visually and smelling for any odor. **Palpation** follows inspection to validate your obser-

vations. Percussion is a useful tool for determining the location, size, and density of organs or masses. Tapping with the reflex hammer elicits deep tendon reflexes. The stethoscope is used to auscultate the heart, lungs, and abdomen.

Performing a Physical Examination

A complete examination includes assessment of the general appearance, vital signs, body measurements, pain assessment, as well as examination of the head, neck, eyes, ears, nose, mouth and throat, skin, thorax and lungs, breasts, heart and peripheral perfusion, abdomen, genitalia and rectum, musculoskeletal system, and neurologic system. The nurse in most settings will not be assessing the breasts, genitalia, or eyes or ears in detail. Be aware of the role of the nurse in different settings and how the nurse can facilitate the assessment process.

General Appearance

Never discount first impressions. As you become more comfortable performing physical examinations, you will develop an ability to describe what you see and hear. Does the child give an impression of being ill or well? What is the child's expression and energy level? Note lethargy, listlessness, excessive activity, or inappropriate attention span for the child's age. Observe the child's state of alertness and whether he or she is responding appropriately to the stress of the situation. Note the child's posture and positioning:

- The newborn's posture is flexed, with arms and legs tucked in.
- The older infant should have improving head and then trunk control.
- The toddler demonstrates lordosis (swayback) and bowlegs, with a relatively large head and protuberant belly.
- The preschooler is more slender and upright in appearance.
- The school-age child and adolescent should demonstrate an upright, straight, and well-balanced posture.

Note whether the child's development appears appropriate. Observing the child initially may yield a wealth of information about the child's development. Is the child active, moving about the room? Does the child's speech seem appropriate for his or her age? Notice whether the family interacts appropriately with one another and the child. Does the child appear clean and well cared for? Does the child appear well nourished or small for age or obese? Do you smell tobacco or alcohol on the family's clothing? Does the child have a toy or transitional object? Is there a baby bottle or pacifier nearby? Do the siblings appear equally well cared for? Is there tension in the room between adults or adolescents? This initial quick assessment of general appearance will serve the nurse well if it is objective; delay your interpretation of what you have assessed until you gather more data.

Measurement of Vital Signs

Measure, document, and interpret the vital signs of children using age-appropriate equipment and approaches. The child's age and size, as well as knowledge of underlying health conditions, will affect your analysis of the vital signs. Vital signs are the temperature, pulse rate, respiratory rate, and blood pressure. In terms of vital signs, there is greater fluctuation in what is considered normal in children compared to adults. Therefore, count the heart rate and respiratory rate for a full minute (this will require comforting an infant or distracting a young child). If possible, perform these measurements when the child is quiet; if the child is crying or otherwise active during the assessment, document this. Many acute care settings require continuous measurement of vital signs using specific monitoring equipment. Also assess the child's pain level when assessing the vital signs.

Temperature

Temperature is measured as it is in adults. Thermometers are available in glass, electronic, and digital types. Use the same type of equipment consistently to allow reliable comparisons to be made and to permit tracking of temperatures during the course of illness. No matter which type of thermometer is used, ensure accuracy by carefully following the manufacturer's instructions.

The routes for taking the child's temperature are tympanic, temporal, oral, axillary, and rectal. Evidence is conflicting as to which method actually correlates best with the child's core, bladder, or arterial temperature, but recent studies support the use of a tympanic temperature as the most accurate, if it is appropriately obtained (El Radhi & Patel, 2006; Nimah et al., 2006). Take the child's temperature using the least invasive method that is best accepted by the child, parent, and health care provider.

▶ ***Take*** NOTE!

Glass thermometers are rarely used today due to the federal safety recommendations related to glass and mercury.

Choosing a method of measuring temperature depends on what is available at the facility and the child's age and physical condition. Tympanic thermometers measure the temperature within seconds, so this route is ideal for most children. Tympanic temperature reflects the pulmonary artery temperature. Tympanic thermometers are now available with smaller speculums, more appropriate for the infant or young child's ear canal. The accuracy of a

tympanic temperature reading depends on the user's technique (Nursing Procedure 31.1). The tympanic method is not affected by the presence of ear wax, but it may be affected by vernix in the newborn's ear.

Temporal scanning is a newer method of temperature measurement that uses infrared scanning on the skin over the temporal artery combined with a mathematical computation to determine the child's arterial temperature. The arterial temperature is considered the most accurate reflection of body temperature. Measure temperature on the exposed side of the head (not the side that has been lying on a pillow or covered by a hat). Slide the sensor tip externally in a horizontal line across the child's forehead, midway between the eyebrows and hairline and ending at the temporal artery (Fig. 31.4). Hold it there until the device registers the temperature reading, which usually requires 1 second. Accuracy may be affected by excessive sweating.

FIGURE 31.4 Temporal artery thermometers are noninvasive and well tolerated by young children. For an accurate reading, move hair to expose forehead and hairline.

Oral temperature is highly reliable if the child can cooperate. By 4 years of age, the child can hold an electronic oral thermometer in the mouth well enough to obtain a reading. Place the probe under the tongue. The child's mouth remains closed until the device registers the temperature. Have the child sit or lie quietly while the temperature is being taken. Electronic devices provide a temperature reading in as little as 4 seconds, but again the length of time varies with manufacturer. Oral intake, oxygen administration, and nebulized medications or treatments may affect oral temperature.

The axillary method works well for children who are uncooperative, neurologically impaired, or immunosuppressed or have injuries or surgery to the oral cavity. Place the tip of the electronic or digital thermometer in the axilla to obtain the reading. Make sure the tip is indeed in the axilla and not just between the arm and the child's side. Hold the thermometer parallel rather than perpendicular to the child's side to obtain the most accurate reading. Keep the child's arm pressed down to the side until the thermometer registers, which will be as little as 10 seconds with certain electronic models but 2 or 3 minutes with digital models commonly used at home.

Though long considered to reflect core temperature, the rectal route is invasive, not well accepted by children or parents, and probably unnecessary with the modern alternative methods now available. In addition to its intrusiveness, obtaining the rectal temperature runs the risks of damaging the rectal mucosa and inducing bradycardia in young infants. To take the rectal temper-

Nursing Procedure 31.1

TYMPANIC TEMPERATURE

1. Note age of child. If younger than 3 years, pull the earlobe back and down.
2. Insert the tympanic thermometer gently into the ear canal with the infrared sensor beam directed toward the center of the tympanic membrane rather than the sides of the ear canal.
3. Push the button to take the temperature and hold until a reading is obtained. The length of time required for the temperature to register varies per manufacturer but is only a few seconds at most.

ature, position the young infant supine with legs flexed. The older infant or child should be prone or side-lying. Small children may lie across the parent's lap for additional comfort. Apply a water-soluble jelly to the covered probe, insert the thermometer past the anal sphincter no more than 1 inch (2.5 cm), and hold it there until the temperature registers (as little as 15 seconds with certain electronic models but longer with digital models). See Evidence-Based Practice 31.1.

▶ *Take* NOTE!

Avoid the rectal route of temperature measurement in the neonate and the immunosuppressed child, as well as the child who has diarrhea, a bleeding disorder, or a history of rectal surgery.

Pulse

Assess the heart rate while the child is resting or sleeping. The heart rate in infants is much faster than in adults. It also varies in infants and children who are anxious, fearful, or crying. As the child grows, the heart rate slows and the range of normal values narrows. Table 31.3 lists heart rate ranges according to the child's age. The radial pulse is difficult to palpate accurately in children less than 2 years of age because the blood vessels lie close to the skin surface and are easily obliterated. For children younger than 2 years of age, auscultate the apical pulse with the stethoscope for a full minute. The **point of maximum intensity (PMI)**, the point on the chest wall where the heartbeat is heard most distinctly, is just above and outside the left nipple of the infant at the third or fourth intercostal space. The PMI moves to a more medial and slightly lower area until 7 years of age, when it is heard best at the fourth or fifth interspace at the midclavicular line (see the section below on chest examination for more information). Apical pulse rate should also be taken if the child has a cardiac problem such as an irregular heart rate or a congenital heart defect, as well as before administration of certain medications such as digoxin. During this procedure with children, allow the young child to examine or handle the stethoscope to become familiar with the equipment. In older children, palpate the radial pulse for a full minute (Fig. 31.5). Note any irregularities in strength or rhythm.

Finally, document the method used to obtain pulse measurement as well as any activity of the child during the assessment and any action taken.

▶ *Take* NOTE!

In the infant and young child, the heart rate is often quite elevated due to fear or anxiety when the stethoscope is placed on the chest initially. For an accurate heart rate, wait several seconds until the rate slows, then count for 1 full minute.

EVIDENCE-BASED PRACTICE 31.1
Pacifier Thermometers

● Study

Nurses and parents are concerned with being able to measure temperature accurately with the least invasive method possible. Research trials on pacifier thermometry in the past have been limited. The researchers utilized a convenience sample of children aged 7 days to 24 months in a prospective, cross-sectional study. Subjects were limited to those without gastrointestinal illness or contraindication to either the sublingual or rectal method of temperature measurement. Each child underwent pacifier temperature measurement with recordings at 3 and 6 minutes. The result was adjusted upward .5° F. as recommended by the thermometer manufacturer. Rectal temperature was then taken.

▲ Findings

Analysis of the pairs of recorded temperatures for each subject revealed close agreement between the rectal temperature and the adjusted 6-minute pacifier temperatures. Differences between the two were not statistically significant. Variations between measurements are certain to occur when temperature is measured at different sites, so the researcher does not recommend replacing rectal thermometers with pacifier thermometers when a rectal temperature is indicated. Rather, it is the researcher's recommendation to use the pacifier thermometer as a screening tool.

■ Nursing Implications

Pacifier thermometers are an acceptable tool for temperature screening in children 7 days to 24 months of age. Nurses must use the thermometer properly, as well as instruct parents in its appropriate use if it is to be used at home. Consistent use of one particular method is important for tracking trends in temperature management over time. The mathematical upward adjustment of .5° F. must be included in the reporting of temperatures measured by pacifier thermometry.

Braun, C. A. (2006). Accuracy of pacifier thermometers in young children. *Pediatric Nursing, 32*(5), 413–418.

TABLE 31.3 HEART RATE AND RESPIRATORY RATE RANGES BY AGE GROUP

	Infant	Toddler	Preschooler	School-age	Adolescent
Heart rate	80–150	80–140	80–130	75–120	70–100
Respiratory rate	20–40	20–40	20–30	16–22	15–20

Respiratory Rate

Assess respirations when the child is resting or sitting quietly, since respiratory rate often changes when infants or young children cry, feed, or become more active. They also tend to breathe faster when they are anxious or scared. The most accurate respiratory rate is obtained before disturbing the infant or child. This can often be done easily when the parent/caregiver is holding the child before any clothing is removed. Count the respiratory rate for a full minute to ensure accuracy. Infants' respirations are primarily diaphragmatic, so count the abdominal movements. After 1 year of age, count the thoracic movements. Table 31.3 lists ranges of respiratory rate according to the child's age. Document the rate, activity of the child, any deviations from normal, and any action taken.

▶ ***Take*** *NOTE!*

Infants normally display an uneven or irregular breathing pattern, with short pauses between some breaths. This may be accentuated when they are ill.

Measuring Oxygen Saturation

Since the incidence of respiratory dysfunction is high in children who are ill, pulse oximetry is often routinely included in the vital signs assessment. This method is reliable and noninvasive. Pulse oximetry determines the oxygen saturation (SaO_2) in blood by using a sensor that measures the absorption of light waves as they pass through highly perfused areas of the body. The pulse rate on the oximeter should coincide with the apical pulse rate to ensure that the oxygen saturation reading is accurate. Nursing Procedure 31.2 details how to use the pulse oximeter. Identify whether pulse oximetry monitoring will be continuous or intermittent (as with vital signs).

A few guidelines to follow when using pulse oximetry are as follows:

- The probe may be placed on the finger, toe, ear, or foot. Avoid placing the probe on the same extremity with a blood pressure cuff or an intravenous or other type of line.
- Use the physician's orders or health care agency guidelines to set parameters for high and low pulse rate as well as high and low oxygen saturation. Never turn off the alarm settings.
- Ensure that the probe is not applied too tightly, as this will prevent venous flow and cause inaccurate readings.

Potential sources of errors in pulse oximeter readings include abnormal hemoglobin value, hypotension, hypothermia, ambient light interference, motion artifact, and skin breakdown. Falsely low readings may be associated with a nonsecure connection (movement of child's foot or hand), cold extremities/hypothermia, and hypovolemia. Falsely high readings may be associated with carbon monoxide poisoning and anemia.

FIGURE 31.5 Assessing the radial pulse of a young child.

Blood Pressure

The National Heart, Lung, and Blood Institute (NHLBI) recommends that children over 3 years of age have their blood pressure measured at least once during every health care episode. Children under 3 years old should have blood pressure measured if they have one of the following risk factors:

- History of prematurity, very low birthweight, or other neonatal intensive care complication
- Congenital heart disease
- Recurrent urinary tract infections, hematuria, proteinuria, known renal disease or urologic malformations, family history of congenital renal disease

Nursing Procedure 31.2

PULSE OXIMETRY MONITORING

1. Explain the procedure to the child and family (use a penlight to show how the sensor "looks through the skin").
2. Attach the probe to the child and connect to the monitor.
3. Set the parameters for the alarm if monitoring pulse oximetry continuously.
4. Observe and record pulse rate and oxygen saturation.
5. Record the activity level of the child and the percentage of oxygen in use.
6. Check skin condition and rotate sensor position every few hours.

Types of probes

a. infant continuous

b. finger continuous

c. finger intermittent

- Malignancy, bone marrow transplant or solid organ transplant
- Treatment with medications that raise BP
- Systemic illnesses associated with hypertension such as neurofibromatosis and tuberous sclerosis
- Increased intracranial pressure (NHLBI, 2005)

In the hospital or outpatient setting when a child is ill or undergoing surgery or a procedure, the frequency of blood pressure measurement will depend on the child's physical status. Measurement of blood pressure can be frightening to a young child, so include an age-appropriate explanation and perform the procedure after obtaining the pulse rate and respirations (Fig. 31.6). Accuracy of blood pressure measurement depends on the cuff size, as well as the operator's skill and accurate calibration of an electronic

FIGURE 31.6 Allowing children to handle the equipment gives them some control over the situation.

device. The National Heart, Lung, and Blood Institute (NHLBI) recommends that the cuff bladder width be at least 40% of the circumference of the upper arm at its midpoint. The cuff bladder length should cover 80% to 100% of the circumference of the upper arm. Various pediatric and infant cuffs are available, as well as larger thigh cuffs that may be used on an arm in an obese adolescent.

▶ *Take* NOTE!

Using an accurate cuff size is important: a wider cuff yields a lower reading and a narrower cuff yields a higher reading.

Measure blood pressure in the upper arm, lower arm, thigh, or calf/ankle. The size of the cuff should match the extremity used. The measurement should be taken in the same limb, at the same place, and in the same position with each subsequent measurement to ensure consistency in tracking the blood pressure. To measure blood pressure using the upper arm, place the limb at the level of the heart, place the cuff around the upper arm, and auscultate at the brachial artery. When obtaining blood pressure in the lower arm, again, position the limb at the level of the heart, place the cuff above the wrist, and auscultate the radial artery. For measurement in the thigh, place the cuff above the knee and auscultate the popliteal artery. To obtain blood pressure on the calf or ankle, place the cuff above the malleoli or at the midcalf and auscultate the posterior tibial or dorsal pedal artery. Figure 31.7 shows appropriate cuff placement and auscultation points for the various sites.

The NHLBI recommends auscultation as the preferred method of obtaining blood pressure readings in children (Fig. 31.8). Systolic pressure in children is read at the moment the first Korotkoff sound is heard as the manometer pressure is lowered. The point at which the sound disappears is the diastolic pressure. The systolic blood pressure sometimes can be heard to a measurement of zero, so document the reading as systolic pressure over "P" for pulse.

Due to the small arm vessels in infants and young children, it may be very difficult to hear the Korotkoff sounds by auscultation. Alternative methods for obtaining blood pressure measurements in children include the use of Doppler or oscillometric (Dinamap) devices. The Doppler ultrasound method uses high-frequency sound waves that bounce off body parts to obtain blood pressure. Apply the gel to the Doppler end and listen with the Doppler device where you would ordinarily auscultate.

With either the Doppler method or auscultation, inflate the cuff 20 mm Hg past the point where the distal pulse disappears. Oscillometric equipment measures the mean arterial pulse and then calculates the systolic and diastolic readings. The accuracy of this method depends heavily on ongoing validation and calibration. Also, the cuff inflates to a preset value often far higher than the infant or child's blood pressure, resulting in a tight, uncomfortable cuff being in place for a longer period of time.

▶ *Take* NOTE!

If the oscillometric device yields a blood pressure greater than the 90th percentile for gender and height, repeat the reading using auscultation.

In children older than 1 year, the systolic pressure in the thigh tends to be 10 to 40 mm Hg higher than in the arm; the diastolic pressure remains the same. Refer to Appendix I for the NHLBI blood pressure levels based on gender and height. Systolic blood pressure increases

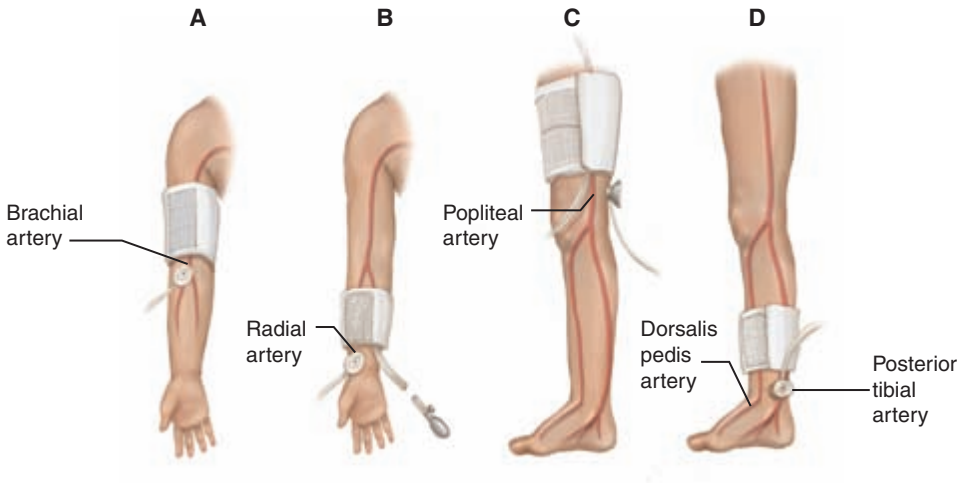

FIGURE 31.7 Various positions of cuff placement and auscultation area for obtaining blood pressure. (**A**) Upper arm. (**B**) Lower arm. (**C**) Thigh. (**D**) Calf/ankle.

FIGURE 31.8 Auscultation is the preferred method for measuring blood pressure in children.

if the child is crying or anxious, so measure the blood pressure with the child quiet and relaxed. If the reading is lower in the leg than in the arm, always consider coarctation of the aorta or interference with circulation to the lower extremities. Also pay attention to the pulse pressure (the difference between the systolic and diastolic readings): unusually wide (more than 50 mm Hg) or narrow (less than 10 mm Hg) pulse pressure readings suggest a congenital heart defect.

Infants and children presenting with cardiac complaints should have blood pressures assessed in all four extremities and also in the sitting, lying, and standing positions.

Document the method and site used, the activity of the child, any changes that may have occurred, and any actions or interventions performed.

Pain Assessment

Pain is considered to be the "fifth vital sign." Use the FLACC pain scale to measure pain in children who are too young to verbally or conceptually quantify their pain, or when there is a language barrier. The FLACC pain scale consists of a possible 10 points, with 0, 1, or 2 points given for each of five clinical signs (see Table 35.7 in Chapter 35).

Children who are older and can express that pain is worsening or improving should use the Pain Faces Scale (see Fig. 35.3 in Chapter 35). Explain that each face represents a person who is happy or sad, depending on how much or how little pain he has: 0 is for a person who is "very happy because he doesn't hurt at all"; 1 means "it hurts just a little bit"; 2, "it hurts a little more"; 3, "it hurts even more"; 4, "it hurts a whole lot"; and 5, "it hurts as much as you can imagine—but you don't have to be crying to feel this bad." Then ask the child to point to the face that best describes the amount of pain being felt.

For additional information related to pain assessment, refer to Chapter 35.

Body Measurements

Appropriate growth in children is usually an indicator of good health. A child who is not growing well may be in poor health, have inappropriate or inadequate dietary intake, or have a chronic disease. Accurate assessment of growth is a critical skill for the pediatric nurse and one that is rarely needed when caring for adults.

Determine the child's height or length, weight, and weight for length or **body mass index (BMI)**. Measure the head circumference for healthy children under age 3. Plot these measurements on a graph so they can be compared with earlier measurements and those of the child's peers. Additional anthropometric measurements used in children may include the chest circumference, mid-upper arm circumference, and skinfold measurement at the triceps, abdomen, or subscapular regions, but these are not performed routinely and are usually used only when a nutritionist consultation is necessary.

The growth chart is a screening tool for nutritional problems as well as a useful screen for chronic illness. Record each measurement in ink with a small dot at the correct location for the child's age and the date of the measurement written above it. Then use a plastic straightedge to connect the previous measurement to the most current one. Children grow at variable rates; in infancy and pre-puberty, the growth velocity is normally more rapid. The growth chart allows the nurse to compare the patient to other children of the same age and gender while allowing for normal genetic variation. When measurements fall close to the same percentiles over time, growth is normal for that child. Children whose measurements fall within the 5th and 95th percentiles are generally considered within the normal growth range.

Sudden or sustained changes in percentile may indicate a chronic disorder, emotional difficulty, or nutritional intake problem. These findings require further assessment of the physical status of the child as well as other types of evaluations such as dietary intake or serum laboratory measurements.

Appendix F provides growth charts for boys and girls, ages birth to 36 months and 2 to 20 years. Special growth charts are available for children with Down syndrome, Turner syndrome, and ethnic groups that are typically smaller in stature as adults. Children may be as much as 10% above or below the predicted measurement and still be normal. Look for a trend over time of healthy growth that is neither too fast nor too slow.

▶ ***Take*** NOTE!

The most valid and reliable growth charts are those supplied by epidemiologists at the Centers for Disease Control and Prevention.

Length or Height

Calculate the length of the infant and toddler in a lying position until the age of 24 months. Use a measuring board (Fig. 31.9) or a cloth or paper measuring tape. Stretch out the legs to get a full extension of the body. Marking the examination paper at the child's head and extended foot is an option. Make sure that the growth chart where the measurement is plotted is marked for length and not height, as the two measurements differ. Document the length in centimeters and inches.

Once the child can cooperate and stand independently, begin measuring the standing height. Using a stadiometer is best (Fig. 31.10), but a cloth or paper tape can be used. Ask the child to remove his or her shoes and check that the back, shoulders, buttocks, and heels are against the wall, with the pelvis tucked as much as possible to correct for lordosis. The chin should be parallel to the floor. Plot this measurement on a growth chart marked for height rather than length. Record the height in centimeters as well as feet and inches.

▶ ***Take*** *NOTE!*

Cloth and paper measuring tapes may stretch over time. Periodically replace or recalibrate all measuring tools.

Weight

Measure weight on a scale that is calibrated between every measurement. Just before placing the child on the electronic scale, press the "zero" or "tare" button and make sure the reading is 0. Calibrate the balance-type scale by setting the weight at zero, observing the beam balance, and making adjustments as necessary. Infants and toddlers should be weighed on a platform-type electronic or balance scale, with examination paper placed between the child and the scale surface. Calibrate the scale with the examination paper in place. Remove the infant's diaper immediately before placing him or her on the scale. Toddlers may sit on the scale with the nurse or caregiver nearby to avoid falls (Fig. 31.11). Weigh older children and adolescents on a standing scale (Fig. 31.12). They may keep their underpants on and wear a lightweight examination gown.

FIGURE 31.9 The recumbent measuring board is the most accurate method for obtaining a length measurement in infants and very young children.

FIGURE 31.10 Standing height is most accurately measured with the stadiometer.

An alternate method for obtaining weight, though much less accurate, is to weigh the caregiver initially and then weigh the caregiver holding the child. The difference between the two weights is the child's weight.

Regardless of the method used, weigh the infant to the nearest 10 g (or half-ounce) and the toddler and older child to the nearest 100 g (or quarter-pound). Record the weight in kilograms and in pounds.

Weight for Length

For children between the ages of newborn and 36 months, plot weight on the growth chart in comparison to the child's length. This allows the nurse to determine whether the child is a healthy weight for how long he or she is. Children placing less than the 5th percentile on the weight-for-length chart are considered underweight. Those placing greater than the 95th percentile are considered to be overweight.

Body Mass Index

With the recent increase in obesity in children, BMI is becoming an important measurement. BMI is a measure of

FIGURE 31.11 A nurse or caregiver should remain nearby while weighing the infant or toddler.

FIGURE 31.12 Children who can stand independently can be weighed on a regular standing balance scale.

body fat and is determined by comparing the child's height and weight. Calculate the BMI using the child's weight and height by either the English or metric method. Box 31.1 provides BMI calculation formulas. BMI is included on the charts for children ages 2 to 20 years. Plot the BMI on the growth chart according to the child's age. A child whose BMI for age plots at less than the 5th percentile is considered to be underweight. BMI between the 85th and 95th percentiles indicates risk for overweight. BMI greater than the 95th percentile indicates the child is overweight.

The growth chart can indicate when a child is not growing adequately and can also be used to predict the development of overweight and obesity.

Head Circumference

Measure head circumference at well-child visits and upon hospital admission until the third birthday. Then measure it at the annual well-child visit until 6 years old if there are problems such as microcephaly or macrocephaly present at age 3. Measure the largest point across the skull, not including the ears, with a non-stretching cloth or paper tape. Begin at the forehead just above the eyebrows and bring the tape around the head in a taut circle just above the occipital prominence at the back of the head (Fig. 31.13). Plot this measurement in relation to the child's age on the appropriate standardized growth chart (usual growth charts include head circumference only up to age 3 years).

Monitoring Equipment

Sometimes children in acute care settings require continuous monitoring of vital signs. This monitoring could be via an apnea monitor or a cardiopulmonary monitor. The apnea monitor measures abnormal or irregular breathing in infants. The cardiopulmonary monitor generally measures heart rate and respiratory rate. Additional equipment on this monitor also allows for blood pressure and temperature monitoring. Set high and low alarm limits according to the health care facility's policies. Figure 31.14 indicates the placement of electrodes for the apnea and cardiopulmonary monitors. Assess the skin where the electrodes are placed to ensure there is no skin breakdown. If the

BOX 31.1 Calculation of Body Mass Index (BMI)

English Formula:

$$\frac{\text{weight in pounds}}{(\text{height in inches}) \times (\text{height in inches})} \times 703$$

Metric Formula:

$$\frac{\text{weight in kilograms}}{(\text{height in meters}) \times (\text{height in meters})} \times 10{,}000$$

HEALTHY PEOPLE 2010

Objective	Significance
Reduce the proportion of children and adolescents who are overweight or obese.	• Screen for overweight in all children by plotting weight for length of children less than 36 months and BMI for age for children age 2–20 years. • Assess dietary intake and activity level in all children at risk for or overweight. • Provide diet and activity recommendations to attain a healthy weight or BMI. • Refer significantly overweight children to a pediatric endocrinologist.

alarm sounds, immediately check the child to ensure the leads are not disconnected or the child is not in distress.

Skin

The skin is the body's largest organ and reveals information about a child's nutrition, respiratory, cardiac, endocrine, and hydration status all at a glance. A careful skin examination provides an invaluable understanding of a child's health.

Inspection

Inspect the color of the skin. The color should be appropriate to the child's racial or ethnic background, with the nail beds, conjunctivae, soles of the feet, and palms of the hands appearing pink. Normal variations include the following:

- Blueness of the hands and feet, known as **acrocyanosis**, is normal in babies up to several days of age and results from an immature circulatory system completing the switch from fetal to extrauterine life (see Fig. 25.3 in Chapter 25).
- Cooling or warming the newborn and young infant may produce a vasomotor response that causes a mottling of the skin over the trunk and extremities (see Fig. 25.3).
- Babies of darkly pigmented Native American, African, and Asian parents will be paler than their parents for many months until the melanocytes in the epidermis begin production.
- Dark-skinned infants commonly have hyperpigmented areolas, genitals, and linea nigra.

FIGURE 31.13 Measure occipito-frontal head circumference at the largest point.

FIGURE 31.14 Placement of cardiac apnea monitor leads: white on the right upper chest, black on the left upper chest, red on the abdomen (not over bone).

Other variations related to skin color are discussed in Box 31.2.

Inspect the skin for the presence of **lanugo**. All infants display some degree of lanugo (soft, downy hair on the body, particularly the face and back). Lanugo is more

BOX 31.2 Variations in Skin Color and Their Causes

- **Pallor** (defined as decreased pinkness in light-skinned patients, ashy-gray in dark-skinned) is caused by anemia, shock, fever, or syncope.
- **Peripheral cyanosis** (blue discoloration) occurs in nails, soles, and palms and may be caused by anxiety or cold; also associated with central cyanosis.
- **Central cyanosis** (blueness of the lips, tongue, oral mucosa, trunk) is caused by hypoxia or circulatory collapse.
- Overall yellow color (**jaundice**) may be physiologic in the newborn or related to liver or hematopoietic disease in any age child.
- **Yellowing** of nose, palms, and soles may result from excess intake of yellow vegetables.
- **Redness** of the skin results from blushing, exposure to cold, hyperthermia, inflammation (localized), or alcohol ingestion.
- **Lack of color** in skin, hair, and eyes is related to albinism.

abundant in infants of Hispanic descent and in premature infants and recedes over the first few weeks of life.

Inspect the entire body for nevi and vascular and other lesions. Note their location, size, distribution, characteristics, and color. Pigmented nevi (also termed birthmarks) are indicated by a darker patch of skin and generally do not fade over time. Note the presence of hyperpigmented nevi (formerly called Mongolian spots), which appear as blue or gray, variably and irregularly shaped macules (Fig. 31.15). These are a common finding in dark-skinned infants. These nevi fade over months to years as the child's skin pigment darkens. Do not mistake hyperpigmented nevi for bruises. Inspect the skin for vascular lesions. Table 31.4 describes vascular lesions and their significance.

Rashes are common in children and are often associated with communicable diseases. Describe the rash in detail, noting types of lesions, distribution, drying, scabbing, and any drainage. The newborn and young infant may display milia (small white papules) on the forehead, chin, nose, and cheeks. These recede spontaneously. In adolescents the skin examination may reveal open or closed comedones (pimples or blackheads) across the face, chest, and back. Teens may sport tattoos, brandings, or various body piercings; inspect these areas for signs of infection such as erythema or drainage (Fig. 31.16).

Document the presence of any lacerations, abrasions, or burns. Note the distribution of the injury and whether it seems consistent with the mechanism described in the health history. Be alert to the possibility of child abuse if the type or number of burns, lacerations, or bruises seems unusual for the situation.

▶ *Take* NOTE!

Petechiae or ecchymosis may be found over areas traumatized by the birth process; these may take a few weeks to resolve. Certain cultures use "cupping" or "coining" when a child is ill, and these practices may yield bruises or mild burns.

FIGURE 31.15 Transient hyperpigmentation most often occurs in darker-skinned infants.

Palpation

Palpate the skin for temperature, moisture, texture, turgor, and edema. Use the back of your hand to assess the skin's temperature, comparing the right side of the body to the left and the upper body to the lower. The skin should feel uniformly warm. Cool extremities are associated with environmentally cool temperatures as well as impending circulatory collapse and shock. Warm skin may be associated with fever or sunburn, or locally a burn or infectious process. The skin should feel fairly dry, occasionally moister in the creases. Dry, flaking skin may occur in the young infant, particularly if born postmaturely. Overall skin dryness in the well-hydrated child may occur with excess sun exposure, poor nutrition, or

TABLE 31.4 VASCULAR LESIONS AND THEIR SIGNIFICANCE

Description	Significance
Salmon nevi: light pink macule usually on eyelids, nasal bridge, back of neck ("stork bite")	Usually fade over time, but may never go away completely. No complications.
Strawberry nevus: raised reddish papule made of blood vessels (hemangiomas)	Present at or develop after birth; recede over time, usually by age 9 years. Usually no complications.
Nevus flammeus: dark purple-red flat patch, grows with the child ("port-wine stain")	May be associated with Sturge-Weber syndrome. May be disfiguring; may be removed with laser therapy.
Ecchymosis: purplish discoloration, changing to blue, brown, black (bruise)	Common on lower extremities in young children. Should correlate with the injury.
Petechiae: pinpoint reddish purple macules that do not blanch when pressed	Broken tiny blood vessels; occur with coughing, bleeding disorders, meningococcemia
Purpura: larger purple macules	Bleeding under the skin; occur with bleeding disorders, meningococcemia

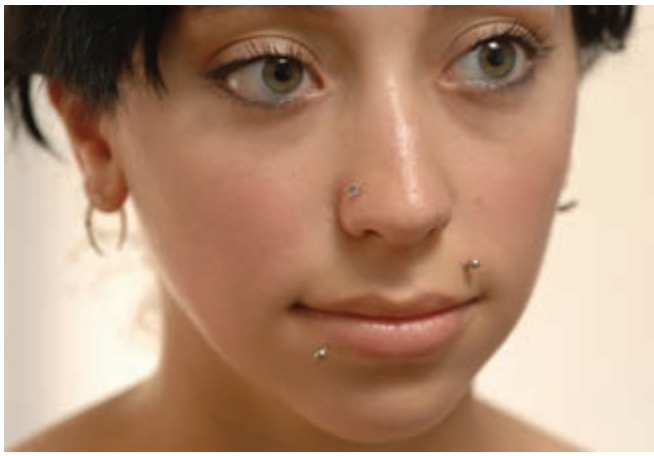

FIGURE 31.16 Adolescent with multiple piercings.

overbathing. Moist skin occurs with perspiration, fever resolution, and shock. The infant's and young child's skin is very soft ordinarily. Older children should continue to have a smooth and even skin texture. The preadolescent and adolescent may have oily-feeling skin on the face, shoulders, or back.

Assess skin turgor by elevating the skin on the abdomen in the infant or on the back of hand in the older child or teen. The "pinched-up" skin should quickly return to place. Skin that remains tented is strongly suggestive of moderate to severe dehydration. When edema is present, palpate the edematous area to determine its extent. Palpate any lumps or protrusions to determine firmness or tenderness. Palpate lesions or rashes with a gloved hand to document the size and extent of the lesions.

Hair and Nails

Inspect the hair and scalp, noting distribution of hair as well as color, texture, amount, and quality. The young infant's hair may be absent entirely or quite thick; it will be replaced by hair that is of a texture and color closer to what the child will have throughout childhood. Coarse, dry hair at any age may indicate a thyroid disorder or nutritional deficiency. Inspect the scalp thoroughly; it should be free from lesions and infestations. Note the presence of a greasy, scaly plaque on the scalp of infants; termed seborrheic dermatitis or cradle cap, it is benign and easily treated.

Inspect the nails for color, shape, and condition. Full-term infants may have long, papery fingernails that can scratch their skin if not trimmed. Children should have healthy nails. Dry, brittle nails may indicate a nutritional deficiency. Inspect the skin around the nails to ensure that it is intact and without signs of infection. Many children (especially school-age children) have a nervous habit of nail biting or hangnail biting or pulling.

Inspect the school-age child's or adolescent's toenails to ensure they are trimmed in a horizontal fashion. Self-trimming of toenails either too low or in a curved fashion places the child at risk for the development of ingrown nails. Clubbing of the nails indicates chronic hypoxemia related to respiratory or cardiac disease. Nails that curve inward or outward may be hereditary or linked with injury, infection, or iron deficiency anemia.

Head

Examining the head is critical in the newborn and infant periods but should not be overlooked in older children as an opportunity to check for diseases of the scalp and functional and developmental problems that are reflected in poor hygiene of the head and scalp. Note hair distribution and any bald or thinning areas. Use of gloves may be indicated, depending on the overall scalp cleanliness and chance of infestation by head lice (seen as small grayish specks near the base of hair shafts).

Inspection

Examine the head and face for shape and symmetry. In newborns, the head may be temporarily misshapen from uterine positioning or a long vaginal delivery. Some infants have a slight flattening of the back of the head since the recommended sleeping position is supine. Note any irregularities or asymmetry. Observe the infant's head shape by looking down on it from above. Observe whether the head appears centered on the neck or tilts to one side. After 4 months of age, the infant should have achieved enough head control to hold the head erect and in midline when placed in a vertical position. Pull the infant from the supine position into sitting to determine the extent of head lag. To determine the extent of head control in older infants and children, ask the child to turn the head in different directions, either by simple commands or by following a colorful object.

Observe the infant's face when crying, smiling, or babbling for symmetry of muscle movement. In children who are old enough to follow directions, a game of "Simon Says" is a playful way to determine facial symmetry and strength; ask them to puff out their cheeks, make kisses, look surprised, stick out their tongue, and so on (effectively testing function of cranial nerve VII [facial]).

▶ ***Take*** NOTE!

When you note a flattened occiput in an infant, encourage the parent or caregiver to allow the infant "tummy time" while awake and observed and to change the infant's head position frequently when upright in an infant seat.

Palpation

Gently palpate the anterior and posterior **fontanels** (Fig. 31.17), which remain open in infancy to allow for rapid brain growth in the first months of life. Note the size of the fontanels. The anterior fontanel is about the

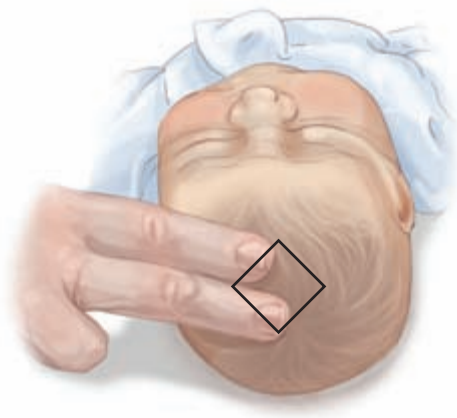

FIGURE 31.17 Note location and size of the fontanels. The anterior fontanel is diamond-shaped and closes between the ages of 9 and 18 months.

size of a quarter at birth and slowly gets smaller until it can no longer be felt when it is closed by the age of 9 to 18 months. The posterior fontanel is much smaller and may close any time between shortly after birth and approximately 2 months of age. The fontanel should be neither depressed nor taut and bulging, though it is not uncommon to see it pulsate or briefly bulge if the baby cries. In an acutely ill infant, assess the fontanels while obtaining the vital signs. Dehydration can cause the fontanels to be sunken; increased intracranial pressure and overhydration can cause them to bulge. Palpate the skull for asymmetry, overriding or open sutures, and lumps or other deformities. Palpate the jaw joints as the child bites down to assess cranial nerve V (trigeminal). Use the fingertips to palpate for occipital, postauricular, preauricular, submental, and submandibular lymph nodes, noting their size, mobility, and consistency (Fig. 31.18).

▶ **Take** NOTE!

Large fontanels may be associated with Down syndrome or congenital hypothyroidism. A fontanel that becomes larger over time rather than smaller may indicate the development of hydrocephalus, especially if accompanied by an accelerated increase in head circumference.

Neck

Inspect the neck for symmetry. The infant's neck is short, but by 4 years of age the child's neck should be similar in appearance to the adult's. Webbing or excessive neck skin folds may be associated with Turner syndrome, and lax neck skin may occur with Down syndrome. Assess the flexibility of the neck through a full range of motion. Take younger children through a passive range of motion. Older

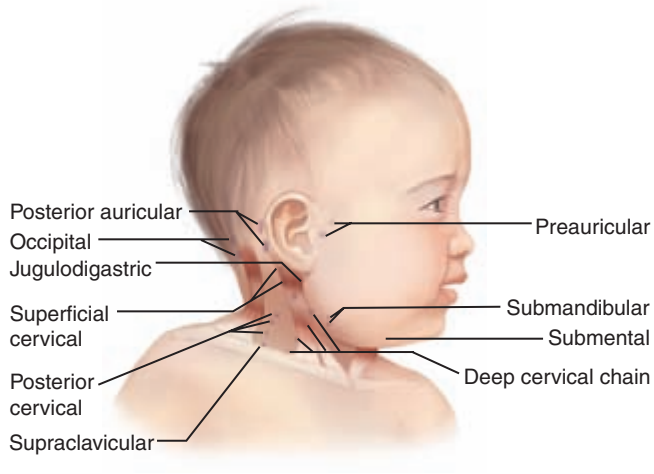

FIGURE 31.18 Location of lymph nodes.

children will be able to look in all directions on command and stretch their chins to the chests themselves. Test cranial nerve XI (accessory) in the older child by having the child attempt to turn the head against resistance. Assessment of neck mobility is particularly important when infections of the central nervous system are suspected. Pain or resistance to range of motion may indicate meningeal irritation. Do not assess neck mobility in the trauma victim.

Palpate the neck for masses and lymph nodes. Palpate the cervical and clavicular lymph nodes with the distal part of the fingers using gentle but firm pressure in a circular motion. Tilt the child's head upward slightly to allow better access. Assess the lymph nodes for swelling, mobility, temperature, and tenderness. In healthy infants and adolescents, the cervical lymph nodes are usually not palpable, whereas they are often found to be small, nontender, and mobile in healthy children from the ages of 1 year through 11 years (see Fig. 31.18 for locations of lymph nodes). Enlarged cervical lymph nodes frequently occur in association with upper respiratory infections and otitis media. Significant enlargement should be reported to the physician or nurse practitioner. Palpate the trachea; the thyroid is usually palpable only in older children.

▶ **Take** NOTE!

The infant or child who has experienced trauma should have the cervical spine maintained completely immobile until a radiologist has determined that the spinal cord is not damaged.

Eyes

Assessment of the eyes includes evaluation of the external and internal structures as well as screening for visual acuity. Any nurse caring for a child should be adept at examining the external structures. Assessment of the internal

structures will also be covered below but is usually performed only by the advanced practitioner. Refer to Chapter 30 for information on vision screening. Determination of visual acuity tests the function of cranial nerve II (optic).

External Structures

Observe the eyes for symmetry and spacing, even distribution of eyelashes and eyelids, and presence of epicanthal folds. Note the child's ability to blink, reporting inability to do so. The eyes should look symmetrical and both should be facing forward in the midline when the child is looking directly ahead. The iris should be perfectly round and the sclerae should be clear. The cornea should be uniformly transparent. Inspect the corners of the eye (medial and lateral canthus) and the conjunctiva (lining of the eyelids). They should be free of discharge, inflammation, or swelling. Epicanthal folds may be present in children of Asian descent, children with genetic abnormalities, or those with fetal alcohol spectrum disorder. Using a small penlight or ophthalmoscope, inspect the function and clarity of the pupil by putting your non-dominant hand on the child's forehead and moving the light toward and away from each eye. This will elicit the blink reflex. Next observe whether the pupil contracts with the light and expands when the light is removed. Make the same motion with a small toy or object and direct the child to look at it. The eyes demonstrate **accommodation**, or focusing at different distances, if the pupil constricts as the object moves closer. If normal findings are present, report **PERRLA** (pupils are equal, round, reactive to light and accommodation) (Fig. 31.19). This is a particularly important assessment in head and eye injuries, as well as when other neurologic concerns are present. Absence of pupillary reflexive action after age 3 weeks may indicate blindness.

▶ ***Take*** *NOTE!*

The normal infant may exhibit intermittent strabismus (crossing of the eyes) until about 3 months of age. However, persistent strabismus at any age or intermittent strabismus after 3 months of age should be evaluated by a pediatric ophthalmologist.

Check extraocular muscle motility and function of cranial nerves III and IV (oculomotor and abducens) by instructing the child to follow the light through the six cardinal positions of gaze. Infants and very young children will follow an interesting object. This tests cranial nerve III (oculomotor). Instruct the older child to look downward and inward (testing cranial nerve IV [trochlear]). Assess eye muscle strength using two tests. Using the Hirschberg test, bring the penlight to the middle of your face and direct the child to look at it. The small dot of reflected light seen in the iris should be symmetrically placed in each eye

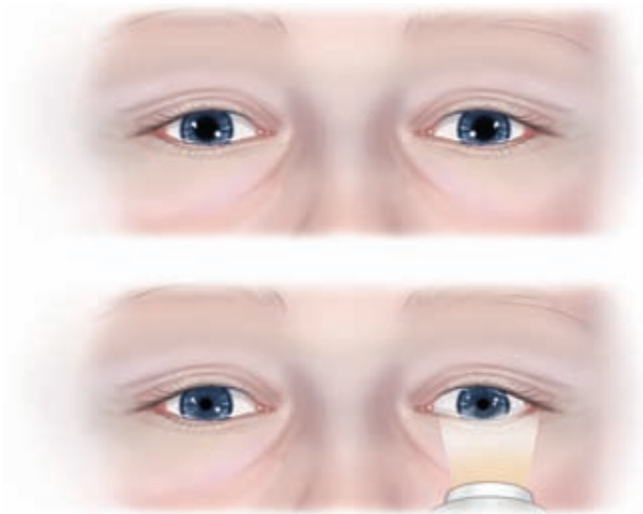

FIGURE 31.19 The pupils should be equal, round and reactive to light and accommodation (PERRLA).

(Fig. 31.20). The cover test also assesses eye muscle strength. Cover one of the child's eyes and instruct the child to focus on an interesting object. The eye should not waver. While the child is still focusing with the first eye, remove the cover from the second. Observe the uncovered eye for movement. Report any movement or drift.

To test peripheral vision, have the child focus on a specific point or object directly in front. Bring a finger or a small object from beyond the range of vision into the area of the peripheral vision. When the child sees the ob-

FIGURE 31.20 Note reflected light falling symmetrically on each pupil with the Hirschberg test.

ject from the side, while still focusing on the object or point in front, the child should say "stop." This also tests cranial nerve II (optic).

Internal Structures

Assessment of the internal structures of the eye is best accomplished by an advanced practitioner with experience in this type of assessment. An adequate assessment requires that the child cooperate. Restraint for eye examination does not usually prove fruitful, as movement and tearing of the eyes interfere with the accuracy of the examination. Use the ophthalmoscope to inspect the internal eye structures. Observe the glow of the pupil, which appears red (creamy-colored in children with very dark eye color). Inspect the optic disk, macula, fovea, and blood vessels. Refer any child with blurring or bulging of the optic disk or hemorrhage of vessels to a pediatric ophthalmologist for further evaluation.

▶ *Take* NOTE!

Immediately report absence of the red reflex in one or both eyes, as this may indicate the presence of cataracts.

Ears

Assessment of the ears includes evaluation of the external and internal structures as well as screening for hearing. Any nurse caring for a child should be adept at examining the external structures. Assessment of the internal structures will also be covered below but is usually performed only by the advanced practitioner. Refer to Chapter 30 for information on hearing screening. Testing of hearing also tests the function of cranial nerve VIII (acoustic).

External Structures

Assess the placement of the external ears on the head. They should be symmetrical and placed no lower than the eyes. The pinna should deviate no more than 10 degrees from an imaginary line that is perpendicular to a line drawn between the outer canthus of the eye and the top of the ear. Low-set ears may be associated with genetic abnormalities or syndromes (Fig. 31.21). Note protrusion or flattening of the ears, which may be normal for that child or may indicate inflammation (protrusion) or persistent side-lying (flattening). Note the presence of pits or skin tags in the preauricular area. Observe the exterior ear canal. A waxy **cerumen** that is soft and an orangish-brown color is normally found lubricating and protecting the external ear canal and should be left in place or washed gently away when bathing. Note drainage from the ear canal, which is always considered abnormal. Pull on the auricle and palpate the mastoid process, neither of which should result in pain in the healthy child.

FIGURE 31.21 Low-set ears may be associated with chromosomal or other genetic anomalies.

▶ *Take* NOTE!

Impacted and dry cerumen can be softened with a few drops of mineral or cooking oil and then gently irrigated from the canal with an ear syringe and warm water.

Internal Structures

Use a **tympanometer** to assess the mobility of the eardrum (tympanic membrane). Gently pull down on the earlobe of infants and toddlers and up on the outer edge of the pinna in older children to straighten the ear canal, and press the tip of the tympanometer over the external canal. A reading of air pressure is recorded by the instrument, and this is useful to assess middle ear disease. Many tympanometers record a wave pattern that may be printed to include in the child's chart.

A nurse practitioner or physician generally performs inspection of the ear canal and tympanic membrane with an otoscope (Fig. 31.22). The otoscopic examina-

FIGURE 31.22 Otoscopic examination allows visualization of the internal structures of the ear.

tion is usually performed near the end of the physical assessment for infants and young children, as they are often quite resistant to this intrusive procedure. The infant or toddler may require restraint in the parent's lap for the otoscopic evaluation. The preschooler may cooperate if the nurse uses a game such as looking for pretend puppies or potatoes in the child's ear. As with the tympanometer, gently pull down on the earlobe of the infant or toddler and up on the outer edge of the pinna in older children to straighten the ear canal. Use an otoscopic speculum appropriate to the size of the child's ear canal. Insert the speculum into the ear canal to visualize the canal and the tympanic membrane. The canal should be pink, should have tiny hairs, and should be free from scratches, drainage, foreign bodies, and edema. The tympanic membrane should appear pearly pink or gray and should be translucent, allowing visualization of the bony landmarks. It may be red if the child has been crying recently. Compress the pneumatic insufflator bulb to provide a puff of air; this causes motion of the tympanic membrane when the middle ear is healthy. Note abnormalities such as a fluid level, bubble or pus behind the tympanic membrane, tympanic membrane immobility, holes or perforations in the tympanic membrane, and the presence of tympanostomy tubes, scarring, or vesicles.

▶ ***Take*** NOTE!

Never attempt to flush a foreign object out with water until it has been identified, because small pieces of sponge, clay, or vegetative material like peas or beans swell with water, further obstructing the ear canal.

Nose and Sinuses

The nose, as with all facial features in a child, should be symmetrical, but it can be displaced temporarily by birth trauma in newborns. Children of Asian or African descent often display a flattened nasal bridge as a normal variation. Ensure that the nares provide unobstructed airflow by alternately occluding one nostril at a time and observing for air movement through the other nostril. If the child is breathing comfortably, there should be little nostril movement visible. Adolescents may have pierced their nose or nasal septum; ensure that the site is free from infection or loose jewelry that could migrate into the sinuses. Ideally the nose should not be draining, though clear mucus may be present if the child has been crying. Assess the amount, color, thickness, and presence of any odor if drainage is present. Inspect the interior of the nose by tilting the child's head backward and pushing the tip of the nose upward. Direct the beam of a penlight in the nostril. The nasal mucosa should be uniformly firm, pink, and free from edema, excoriation, or masses. Test the older child's sense of smell by having the child close the eyes and identify a familiar scent such as peppermint or coffee (cranial nerve I [olfactory]). Palpate the sinuses for tenderness.

▶ ***Take*** NOTE!

Infants up to 3 to 6 months of age have traditionally been thought to be ***obligate nose breathers*** *because of their long soft palate and relatively large tongue, which allows for swallowing without aspiration during breast or artificial nipple feeding. This lessens with age and as the infant becomes better able to breathe through the mouth when necessary.*

Mouth and Throat

Wear a powder-free glove to examine the mouth, teeth, and throat. Inspection of the exterior of the mouth may be done at any point in the examination. Infants and young children may find assessment of the mouth and particularly the pharynx and uvula to be quite intrusive, so delay that part of the assessment until the end of the examination, after otoscopic evaluation. Assess the character and quality of the child's voice and the infant's cry. It should be neither too hoarse nor too shrill.

Inspection of the Mouth

Observe the lips for color, symmetry, and absence of inflammation or edema. Salivation in infants begins at about 3 months of age; drooling occurs because the infant does not learn to swallow saliva until several months later. Next, inspect the interior of the mouth. The mouth

is the first part of the digestive system, and a pink, moist, healthy mucosal lining is indicative of a healthy gastrointestinal tract. In infants, the tongue should lie within the mouth at rest and should be capable of extending over the lower gum line to help the baby feed. The tongue extrusion reflex is normal in infants up until the age of 6 months and allows the infant to suckle easily from birth. Observe movement of the tongue when the infant or young child babbles or cries. Ask the older child to touch the tongue to the roof of the mouth and then stick out the tongue and move it from side to side (testing cranial nerve XII [hypoglossal]). Full movement should be present and the tongue should be free from lesions or exudate. Visualize the hard and soft palate (which should be intact) or palpate with the gloved finger.

Most infants have no teeth before the fifth to sixth month. When the teeth begin to erupt, they usually erupt symmetrically at the rate of about one a month, until toddlers have 20 teeth by 30 months of age. The infant may drool for several months before teething. During teething the gums will be swollen at the location of the impending tooth. In older children, the secondary teeth replace the primary teeth much more slowly and with little discomfort from the 5th to the 20th year. Figure 31.23 shows the usual permanent tooth eruption pattern.

Look for dental caries or alignment problems and inspect the gums for signs of infection. Test cranial nerve IX (glossopharyngeal) by having the child identify taste with the posterior portion of the tongue.

Take NOTE!

Natal (present at birth) or neonatal (erupting by 30 days of age) teeth should be evaluated by a pediatric dentist for potential extraction, as they may pose an aspiration risk.

Inspection of the Throat

Inspect the tonsils, uvula, and oropharynx. Assess the infant's throat during a yawn or cry, as any forcible attempt to depress the tongue with a tongue depressor produces a strong reflex elevation of the base of the tongue that completely blocks the view of the pharynx. The young child will require restraint so that the nurse can depress the tongue and visualize the back of the mouth without injuring the child (Fig. 31.24). Asking the older child to open wide, stick out the tongue, and say "aaaah" simultaneously will allow for a quick look at the tonsils and pharynx without the need to use a tongue depressor, but the nurse must be very quick because the tongue rises rapidly after those maneuvers are performed.

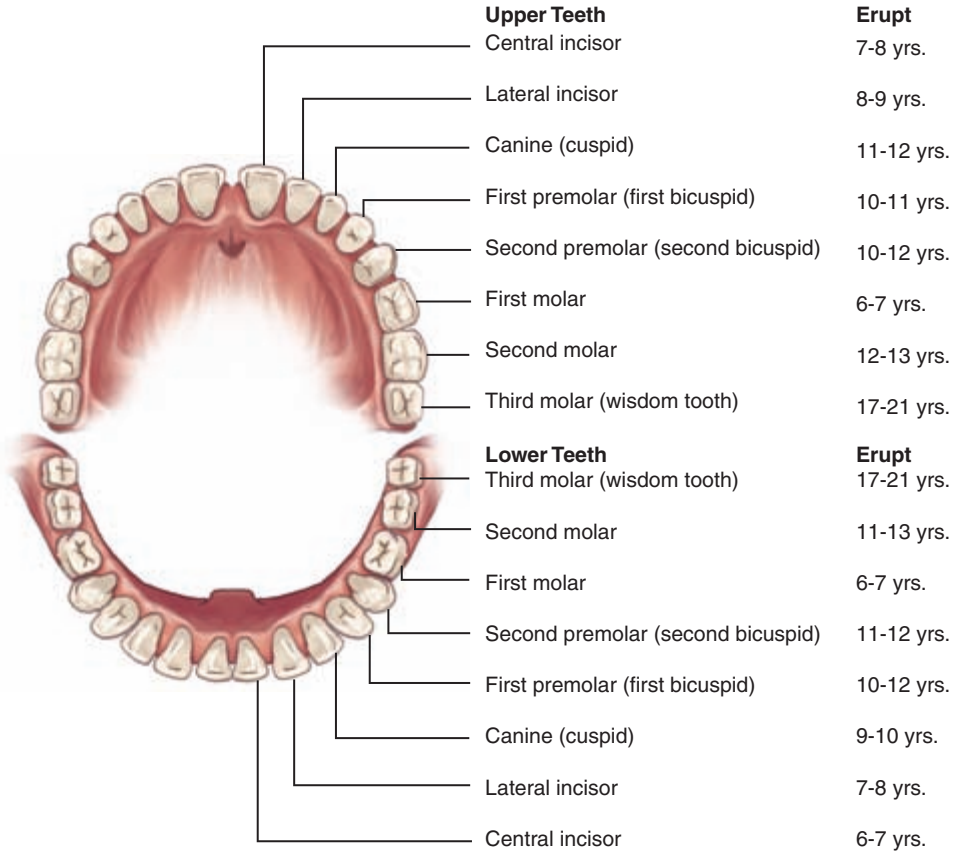

FIGURE 31.23 Usual sequence of permanent tooth eruption.

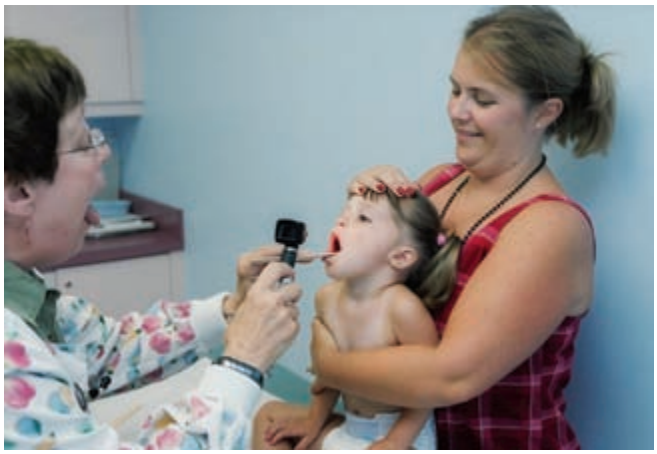

FIGURE 31.24 The young child may need to be restrained so that the throat examination can be done safely.

Tonsils usually cannot be seen in the infant. As the child becomes a toddler, the tonsils become dramatically larger and then begin to decrease in size again by the ninth year. The tonsils should be pink and often have crypts on their surfaces, which are sometimes filled with debris. Is the uvula at midline? Does it rise if the gag reflex is elicited (cranial nerve X [vagus])? Inspect the oropharynx, which should be pink and free from exudate.

▶ ***Take*** NOTE!

If a gag reflex is inadvertently elicited in the very ill child, the airway may become compromised. Therefore, the pharynx should be examined by asking the child to say "aaah" rather than by depressing the tongue with a tongue depressor.

Thorax and Lungs

Assessment of the thorax and lungs begins by observing the shape and contour of the thorax and determining work of breathing. Accurate auscultation of the lungs is essential, since children often have respiratory infections and disorders and may exhibit alterations in respiratory effort and breath sounds. Note the child's color, which should be pink; cyanosis indicates hypoxia. Listen for audible stridor (inspiratory high-pitched sound), expiratory grunting or snoring, audible wheezing (heard with the naked ear), or cough. Document type and extent of cough. Observe the nail beds for clubbing, which occurs with diseases inducing chronic hypoxic states.

Thorax

Examine the chest with the head in a midline position to determine size and shape as well as symmetry, movement, and bony landmarks. The newborn's chest should be smooth and round, with the transverse diameter nearly equal to the anterior-posterior diameter. The shape of the chest progresses to that of the adult by age 5 to 6 years. At that time the anterior-posterior diameter is about half the transverse diameter (Fig. 31.25). At the point where the xiphoid process and the right and left costal margins meet, the costal angle should measure 90 degrees or less. Inspect for structural deformity such as pectus excavatum (depressed sternum) or pectus carinatum (protuberant sternum) (Fig. 31.26). Note symmetric movement of the chest wall with respiration. Infants and younger children are primarily diaphragmatic breathers, so the abdomen and chest will rise and fall together. Older children, particularly adolescent females, demonstrate thoracic breathing, yet the abdomen and chest should continue to rise and fall together. Asymmetry of chest wall movement is an abnormal finding.

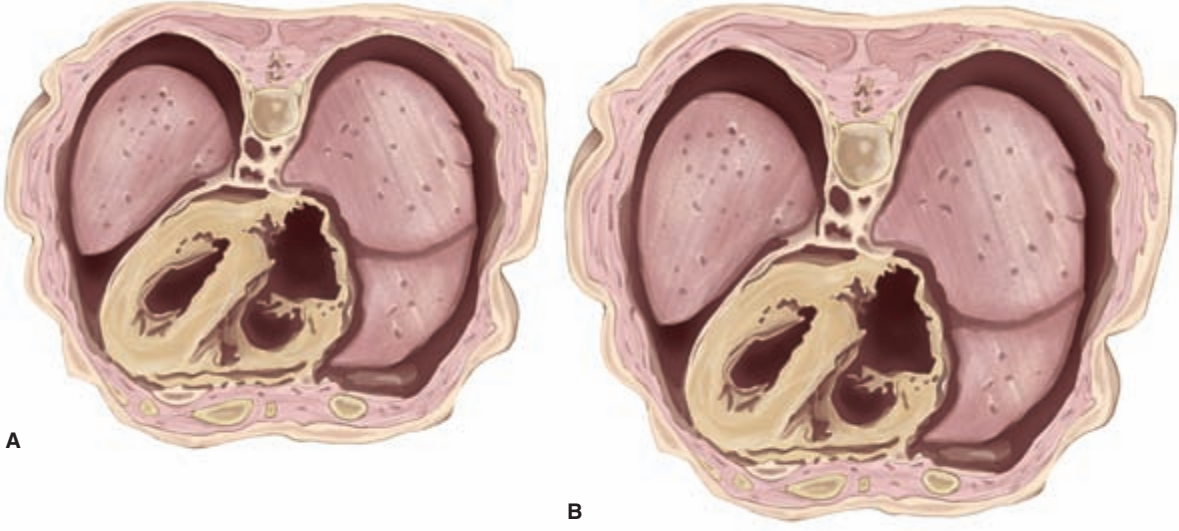

FIGURE 31.25 (**A**) The newborn's chest is round. (**B**) The adult chest has an anterior-posterior diameter about twice the transverse diameter.

FIGURE 31.26 Pectus excavatum: note depression in xiphoid area.

Observe the depth and regularity of respirations, noting the length of the inspiratory and expiratory phases in relation to each other. The newborn and young infant demonstrate an irregular respiratory pattern. Older infants and children should have a more regular respiratory pattern.

Assess the child's respiratory effort by first observing for nasal flaring, which indicates labored breathing. Observe the chest wall and shoulders for accessory muscle use, which normally is not present. If retractions are present, note their location and severity. Typical locations for retraction include the intercostal, subcostal, substernal, suprasternal, and clavicular regions (Fig. 31.27). Pay attention to the position the child naturally assumes to breathe comfortably: children in respiratory distress often sit forward and are uncomfortable lying down or talking.

Lungs

Experienced examiners may palpate and percuss the lungs before using **auscultation** to evaluate the breath sounds. Palpate for symmetric respiratory excursion by placing the thumbs and fingers together along the costal margin on the chest or back. Movement should be symmetric with each breath. Palpate for the normal presence of tactile fremitus with the palms or fingertips while the infant is crying or the older child says "99." Indirectly percuss the lungs of older children, noting resonance over lung fields. Hyperresonance may be present in conditions resulting in hyperaeration of the lungs, such as asthma.

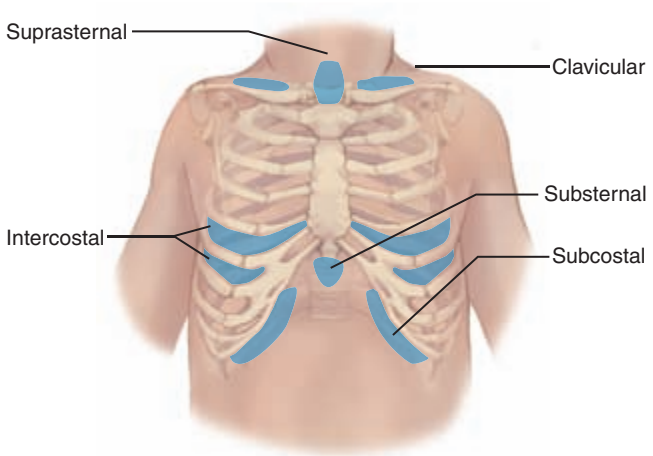

FIGURE 31.27 Location of retractions.

Auscultation

Use the bell of the stethoscope or switch to a small diaphragm to auscultate lung sounds in the infant or child. The adult-sized diaphragm may be used for the adolescent. Auscultate the lung fields with the infant or child in a sitting position, even if that requires propping the infant in a parent's lap. Infants and young children have loud breath sounds because of their thin chest walls. Breath sounds should be clear with adequate aeration throughout all lung fields. Listen to a full inspiration and expiration at the apices of the lungs as well as symmetrically across the entire lung field, systematically comparing the right to the left side. Listen on the anterior chest, posterior chest, and in the axillary regions.

Playing games may encourage younger children to cooperate with deep breathing during lung assessment. The child can blow a cotton ball up in the air, blow a pinwheel, or "blow out" the light of the penlight. Older children are capable of deep breathing when instructed to do so.

The child who has a respiratory disorder or who is experiencing respiratory distress may exhibit diminished breath sounds, most often in the lung bases. Diminished breath sounds are softer and quieter than lung sounds demonstrating adequate aeration. In the healthy infant or child, no adventitious sounds should be heard. If noisy breath sounds are heard in the infant or young child, particularly over all lung fields, compare the sound to the noises heard over the trachea or within the nose. Infants and young children with secretions in the nasopharyngeal area may have those sounds transmitted over the lung fields. These sounds usually clear with coughing or airway suctioning; they are not true adventitious sounds. Note adventitious breath sounds such as wheezes or crackles, documenting their location and whether they are present on inspiration, expiration, or both. It is most important to describe the abnormal breath sounds being heard rather than attempting to classify the sounds. Adventitious lung sounds are associated with a variety of disorders, and extensive experience is required to appropriately classify lung sounds. Adventitious breath sounds should be reported for further evaluation.

Breasts

Assess the breasts of children of all ages and both genders. Note the size of the breasts in relation to the age of the child. Palpate the axillary lymph nodes during the breast assessment.

Inspection

Observe the breasts for position, shape, size, symmetry, and color. Newborns of both genders may have swollen nipples from the influence of maternal estrogen, but by several weeks of age the nipples should be flat and should continue to be so in all prepubertal children. In children the nipples are located lateral to the midclavicular line, usually between the fourth and fifth rib. The areola becomes darker in color as the child approaches puberty. Overweight children may appear to have enlarged breasts due to adipose tissue. Note the location of additional (supernumerary) nipples if present (usually located along the mammary ridge); they may appear as darkly pigmented elevated or nipple-like spots. These are usually of no concern as they do not change over time, but they may be associated with renal disorders.

Inspect the breasts for the current stage of development: widening of the areola, elevation of the nipple, and increase in breast size. Female breast development may begin as early as age 8 but starts by age 13 in most girls. Breast development then continues in a characteristic pattern but usually is asymmetric, with one breast larger than the other throughout the lifespan. The sexual maturity rating scale developed by Tanner in 1962 is used to describe breast development (**Tanner stages**; Fig. 31.28). Adolescent boys may develop gynecomastia (enlargement of the breast tissue) due to hormonal pubertal changes. When the hormone levels stabilize, male adolescents then have flat nipples. Occasionally gynecomastia is caused by marijuana use, anabolic steroids, or hormonal dysfunction.

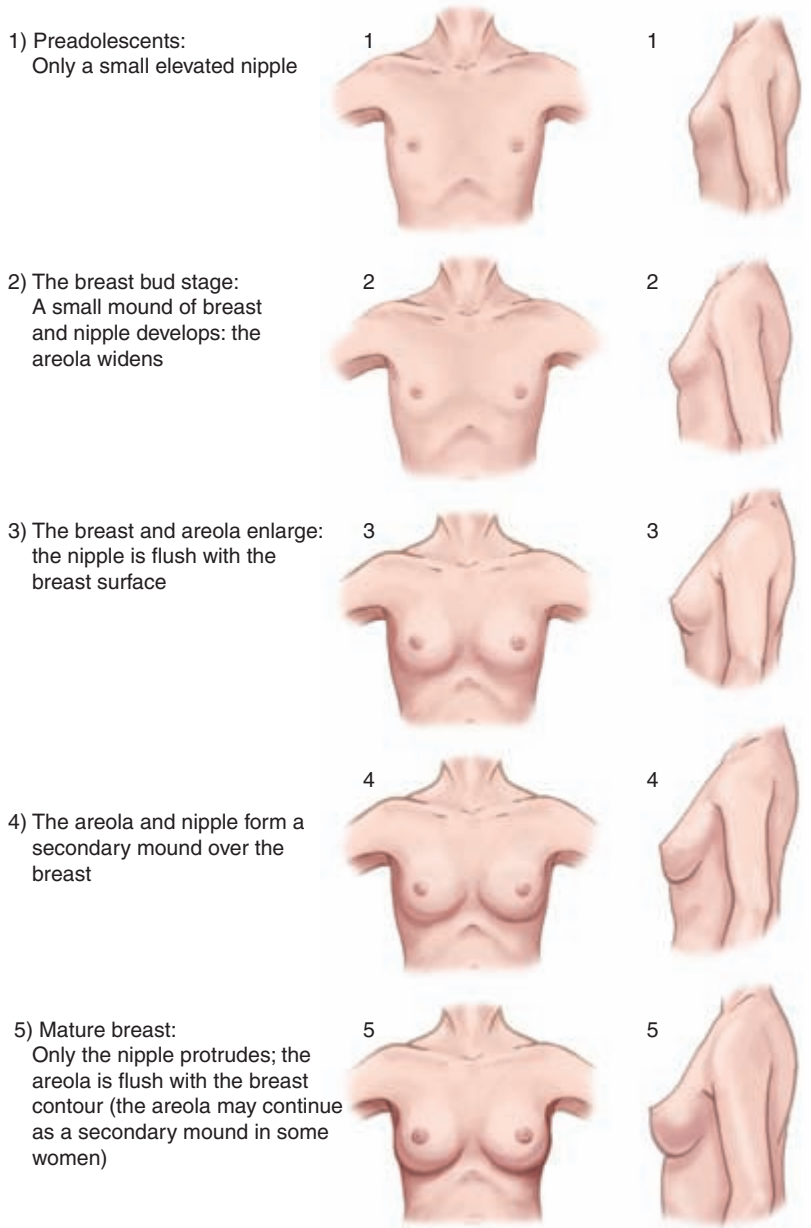

FIGURE 31.28 Tanner sexual maturity rating for breast development.

Palpation

Palpate the breasts in a systematic fashion. A tender nodule palpated just under the nipple confirms pubertal changes. This change may be difficult to assess in girls with excessive adipose tissue. Normal breast tissue should feel smooth, firm, and elastic. Note masses or nodules if present. Palpate for axillary lymph nodes with the child's arms relaxed at the side but slightly abducted. Note size and texture of nodes if present.

Heart and Peripheral Perfusion

The examination of the heart in children is identical to that of adults except for the focus of the examiner's attention. Congenital heart defects are the most common cause of heart problems in children, and children with these defects present differently than adults with heart disease.

▶ ***Take*** *NOTE!*

The younger the child, the more responsive the heart rate is to activity changes. It increases with fever, fear, crying, or anxiety and decreases with sleep, sedation, or vagal stimulation.

Inspection

Observe the child's posture. Note the presence of pallor, cyanosis, mottling, or edema, which may indicate a cardiovascular problem. Inspect the anterior chest from the side or at an angle, noting symmetry in shape as well as movement. Observe for the apical impulse, which is visible in about half of children. It occurs at the PMI, which is located at the fourth intercostal space just medial of the child's left midclavicular line until age 4 years, at the fourth intercostal space at the left midclavicular line in children ages 4 to 6 years, and then lateral to the left midclavicular line at the fifth intercostal space in children ages 7 years and older (Fig. 31.29). Note clubbing of the fingertips or distention of neck veins, both of which may be associated with congenital heart disease.

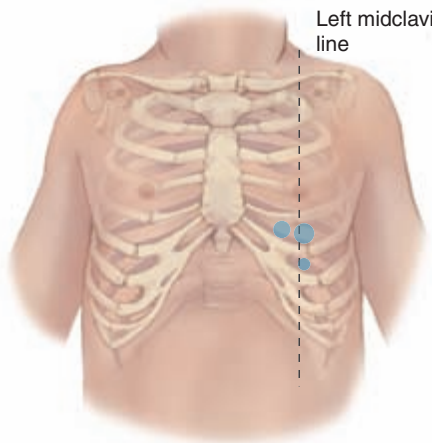

FIGURE 31.29 The point of maximal intensity (PMI) or apical impulse.

FIGURE 31.30 It is important to assess brachial and femoral pulses simultaneously to determine equality or differences in strength and intensity.

Palpation

Using the fingertips, palpate the chest for lifts and heaves or thrills, which are not normal. Palpate the apical pulse in the area of the PMI (see Fig. 31.29). Check the pulses and compare the upper body to lower body pulses, as well as left versus right, noting strength and quality (Fig. 31.30). The pedal, brachial, and femoral pulses are usually easily palpated. The radial pulse is very difficult to palpate in children less than 2 years of age. Note warmth of the distal extremities. To assess capillary refill time, place slight pressure on the nail beds and quickly release it. Observe the length of time required for refill and return to original color. Compare capillary refill time of the fingers to the toes. A capillary refill time of less than 3 seconds indicates adequacy of perfusion.

Auscultation

Perform auscultation of the heart with the child in two different positions, upright and reclined (Fig. 31.31).

FIGURE 31.31 Auscultating the child's heart.

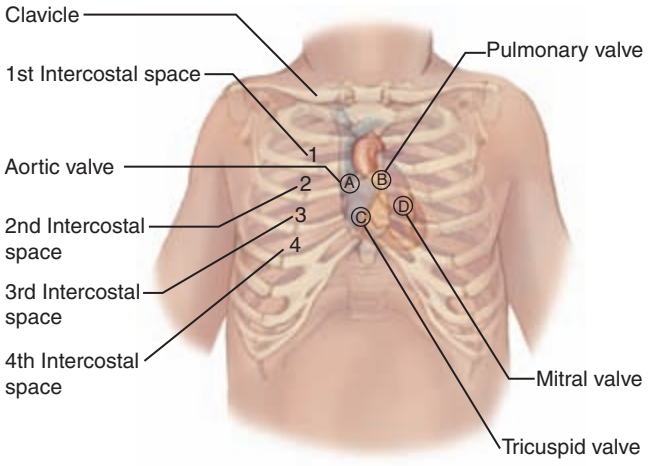

FIGURE 31.32 Areas where the sounds of heart valves radiate. A: Aortic valve—second intercostal space, just right of sternum. P: Pulmonic valve—second intercostal space, just left of sternum. T: Tricuspid valve—fourth intercostal space, just right of sternum. M: Mitral valve—fourth intercostal space at left midclavicular line.

Auscultate the heart rate in the area of the PMI (see Fig. 31.29). As you begin auscultation, listen first for respirations and note their timing so as not to confuse the heart sounds with the lung sounds. A crying infant may help by briefly holding his or her breath between cries. Once you are confident that you are listening to the heart, be sure to listen for 1 to 3 minutes because of the irregularity of rhythms in some children. Count the heart rate, which should be consistent with the palpated pulse (either radial or brachial).

Develop a systematic approach to auscultation of the heart. Listen over all four valvular areas anteriorly (Fig. 31.32). In the infant or younger child, also auscultate the heart in the axillary region and posteriorly (certain murmurs radiate to these areas). Note S1, S2, extra heart sounds, or murmurs. S1 is usually loudest at the mitral and tricuspid areas and increases in intensity with fever, exercise, and anemia. S2 is usually most intense at the aortic and pulmonic areas. A split S2 heard at the apex occurs in many infants and young children. S3 may be heard in many healthy children and is considered normal, though the child with a chronic cardiac condition may develop an S3 when congestive heart failure is present. S4 is usually considered abnormal, most often occurring with cardiac disease.

Sinus arrhythmia is a common and normal finding in children and adolescents. It results in an irregular heart rhythm: the heart rate increases with inhalation and decreases with exhalation. If the child holds his or her breath, the rhythm becomes regular.

▶ ***Take NOTE!***

S1 should not vary in intensity at a particular point. If it does, this may indicate a cardiac arrhythmia and the child should be referred for further evaluation.

Auscultate for murmurs. Note the location (where it is heard best or loudest) and timing of the murmur. A systolic murmur occurs in association with S1 (closure of the atrioventricular valves), a diastolic murmur in association with S2 (closure of the semilunar valves). Also note the duration of murmur. Does it occur early or late in diastole or systole? Does it occur all the way across systole (holosystolic)? Note the intensity of the murmur. Table 31.5 discusses grading of murmur intensity.

Innocent murmurs occur frequently in children because of the child's more dynamic circulation, thin chest wall, and angulated vessels. An innocent murmur is most often heard at the second or fourth intercostal space, and its timing is systolic. The innocent murmur is usually medium-pitched and musical. Often an innocent murmur disappears when the child changes position. A venous hum that is heard in the supraclavicular area and possibly radiating down the chest is considered an innocent murmur. Refer any child with a murmur to an experienced practitioner for further evaluation.

TABLE 31.5 GRADING HEART MURMURS IN CHILDREN

Grade	Sound
1	Barely audible; sometimes heard, sometimes not. Usually heard only with intense concentration
2	Quiet, soft; heard each time the chest is auscultated
3	Audible, intermediate intensity
4	Audible, with a palpable thrill
5	Loud, audible with edge of the stethoscope lifted off the chest
6	Very loud, audible with the stethoscope placed near but not touching the chest

Abdomen

The abdomen contains organs related to the genitourinary and lymphatic systems, in addition to the gastrointestinal system. These structures lie within the abdomen in approximately the same location as they do in adults. Dividing the abdomen into quadrants simplifies the description of normal organ location and the reporting of abnormalities. Draw an imaginary vertical line from the xiphoid process to the symphysis pubis. Cross this with an imaginary perpendicular line through the umbilicus. The sequence of physical examination is altered for the abdominal assessment: auscultation is done before percussion and palpation because manipulation of the lower abdomen may affect the bowel sounds.

Inspection

Inspect the abdomen for size, shape, and symmetry. The abdomen in the infant and toddler is rounded and protuberant until the abdominal musculature becomes well developed. Though rounded, the abdomen should not be distended (at any age). By adolescence, the stature is more erect and the abdomen begins to appear flat when standing and concave when supine. The thin skin of a young child may allow the visualization of superficial venous circulation across the abdomen. Inspect the abdomen for movement. At eye level with the abdomen, note abdomen and thorax movement occurring simultaneously. Visible peristaltic waves are abnormal and should be reported immediately.

Inspect the newborn's umbilicus for color, bleeding, odor, and drainage. The umbilical stump should slowly dry, become black and hard, and fall away from the cutaneous navel by the end of the second week of life. Note drainage or granulation at the umbilical site indicating delayed drying of the umbilical stump. Inspect the umbilicus in older infants and young children for the presence of umbilical hernia. Because the umbilicus divides the rectus abdominis muscle, it is not uncommon to see an umbilical hernia protrude through and become larger when the infant or toddler strains or cries. This is a benign finding and will usually disappear as the abdomen becomes stronger. Adolescents may have jewelry piercing the umbilicus.

Auscultation

Auscultate the abdomen using the diaphragm or the bell of the stethoscope pressed firmly against the abdomen. Count the bowel sounds in each of the four quadrants for a full minute. Bowel sounds should be present by a few hours after birth and should remain active throughout life. Note whether bowel sounds are normally active, hyperactive, hypoactive, or absent. Normal bowel sounds can be described as growls, gurgles and clicking sounds. Hypoactive bowel sounds may occur postoperatively. Hyperactive bowels sounds are common with diarrhea. Classify bowel sounds as absent after listening for 5 full minutes in each area. Absent bowel sounds may indicate ileus or peritonitis.

Percussion

Indirectly percuss all areas of the abdomen. Normal findings include dullness along the costal margins and tympany over the remainder of the abdomen. A full bladder may yield dullness to percussion.

Palpation

Palpate the abdomen with the child in a supine position. If the child's legs are small enough, the knees may be brought up with the nondominant hand to flex the hips and relax the abdomen. Palpate all four quadrants of the abdomen in a systematic fashion, first lightly and then deeply. Apply light pressure with the fingertips to perform light palpation, assessing for tenderness and muscle tone (Fig. 31.33). Note skin turgor by gently elevating a piece of skin and allowing it to fall back into place. Perform deep palpation to assess the organs and any masses. Place one hand on top of the other and palpate from the lower quadrants to the upper (see Fig. 31.33). The edge of the liver may be felt at the right costal margin, and the tip of the spleen can be felt at the left costal margin. The descending colon may be felt in the left lower quadrant as a small column and the blad-

FIGURE 31.33 (**A**) Light and (**B**) deep palpation of the abdomen.

der as a soft balloon below the umbilicus. The kidneys are rarely palpable. The abdomen should be soft and nontender to palpation. Report firmness, tenderness, or masses. Palpate the inguinal area for the presence of hernia or enlarged lymph nodes.

▶ *Take* NOTE!

To decrease ticklishness with abdominal palpation, place a flat, warm, still hand on the abdomen while distracting the child before palpation begins. An alternate technique is to first palpate with the child's hand under the examiner's hand.

Genitalia and Anus

Examination of the genitals should immediately follow the abdominal assessment in the younger child and should be reserved for the end of the assessment in the adolescent. Though the anus is part of the gastrointestinal tract, it is best assessed during the genital examination. Ensure privacy for the older child and adolescent. Keep the child covered as much as possible. Use a casual, matter-of-fact approach to place the child or teen at ease. During the genital examination, teach the child or adolescent about normal variations and changes with puberty, as well as issues related to health promotion.

Male

Inspect the penis and scrotum for size, color, skin integrity, and obvious masses. The obese boy's penis may appear small because of additional skin folds. Penis size should correlate with pubertal stage (Fig. 31.34). The penis may have a foreskin that covers the glans, protecting and lubricating it. If present, do not forcibly retract the foreskin. In circumcised males the urinary meatus is exposed and should be at the tip of the glans. Assess the meatus for absence of discharge. If possible, observe the stream of urine for strength of flow and patency of the urethral orifice. Skin lesions may indicate sexually transmitted infection. A foreskin that cannot be retracted in a boy over 3 years of age may indicate phimosis. Report abnormal findings.

▶ *Take* NOTE!

When you first remove a male infant's diaper, this is the ideal time to assess the force of the urine stream and the erection reflex, as the cool air may make the infant void and briefly experience an erection.

FIGURE 31.34 Tanner male sexual maturity rating for genitalia and pubic hair.

Assess the presence and distribution of pubic hair. Inspect the scrotum for size, slight asymmetry, color, and absence of edema. The scrotum may initially be swollen from birth trauma or maternal hormones, but this swelling should decrease in the first few days of life. The scrotum is ordinarily more deeply pigmented than the rest of the boy's skin. Figure 31.34 illustrates scrotal changes that occur with puberty. Assess the testicles by placing one finger over the inguinal canal and palpating the scrotum with the other. This prevents the retractile testes in a young child from slipping back up the inguinal canal. The testicles should be smooth, of similar sizes, and freely move-

FIGURE 31.35 Placing a digit over the inguinal canal during testicular palpation prevents retraction of the testis into the canal.

able. The infant's testicles may be palpated in the scrotum or in the inguinal canal, where they can be easily moved into the scrotum with gentle pressure from the examiner's nondominant hand (Fig. 31.35). Beyond infancy, allow the boy to sit cross-legged to reduce the cremasteric reflex that retracts the testicles during palpation. An adolescent boy may need to stand for the nurse to fully palpate the scrotum. Document the presence of both testicles in the scrotal sac, if they are retractile, or if they are absent. Report undescended testicle or other abnormal findings.

Female

In most cases, the female genitalia examination is limited to assessment of the external genitalia. Internal examination is not routinely performed before maturity unless the adolescent anticipates becoming or is sexually active or requests birth control or if pathology is suspected. If an internal examination is needed, refer the child or adolescent to the appropriate advanced practitioner or physician.

Position the infant in the parent's lap or on the examination table or crib. The toddler or preschooler should be examined in the parent's lap, in a frog-legged position. The school-age or adolescent girl should lie on the examination table or bed. Provide for privacy by keeping the genital area covered until it is time for the examination.

Perform the assessment of the external genitalia in a systematic fashion. First, determine the presence and distribution of pubic hair. Infants and young girls (particular those of dark-skinned races) may have a small amount of downy pubic hair. Otherwise, the appearance of pubic hair indicates the onset of pubertal changes, sometimes prior to breast changes. Pubic hair generally begins to appear by age 11 years, with age 13 being the latest. Figure 31.36 illustrates the development of pubic hair through puberty in girls.

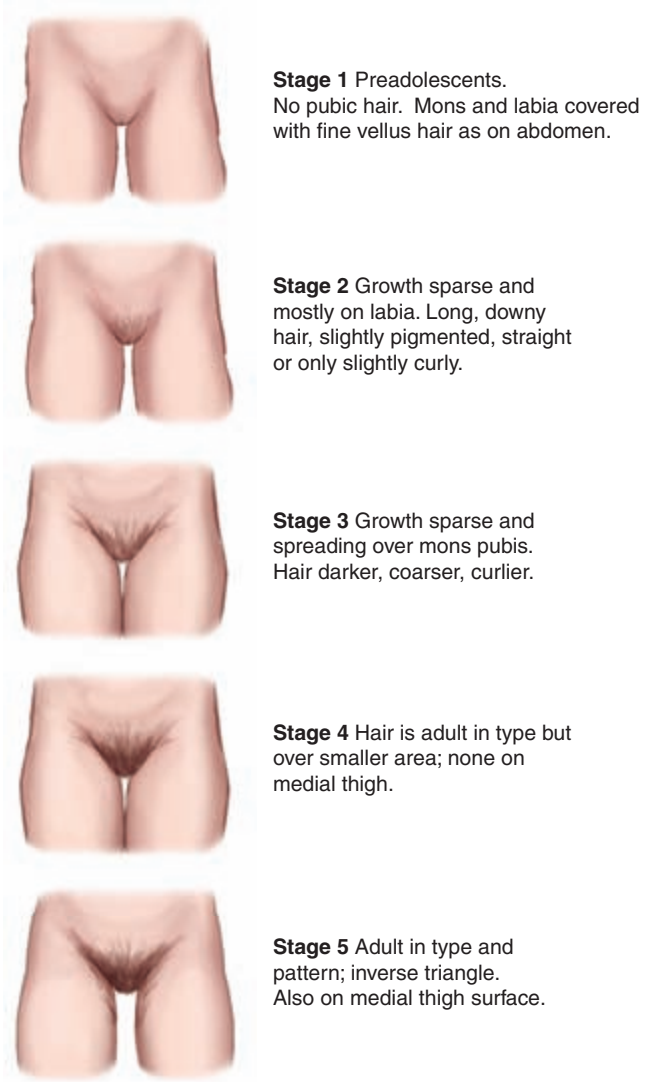

FIGURE 31.36 Tanner female sexual maturity rating for pubic hair.

Inspect the labia majora and minora for size, color, and skin integrity. The newborn's labia minora are swollen from the effects of maternal estrogen but will decrease in size and be hidden by the labia majora within the first weeks of life. Redness or swelling of the labia may occur with infection, sexual abuse, or masturbation. Lesions on the external genitalia may indicate sexually transmitted infection. Gently spread the labia to inspect the clitoris, urethral meatus, and vaginal opening. Some girls may prefer to spread the labia themselves. The urinary meatus and vaginal orifice should be visible and not occluded by the hymen. It is not uncommon to see a hymenal tag. Note clitoral size. Inspect the urinary meatus and vaginal opening for edema or redness, which should not be present. Observe for any vaginal discharge. A small amount of blood-tinged or mucoid discharge may be noted in the first few weeks of life as a result of maternal hormone exposure. A small amount of clear mucus-like dis-

charge is normal in all females. If present, document labial adhesion or other abnormal findings.

Anus

Inspect the anal area for fissures, rash, hemorrhoids, prolapse, or skin tags. Examine the infant's anal area while examining the genitalia. The younger child may lie back in the parent's lap and flex the knees to the chest. The older child or adolescent may be prone or in a side-lying position. If the adolescent boy is already standing for the scrotal assessment, have him bend forward so that you can assess the anal area. The anus should appear moist and hairless. Gently stroke the anal area to elicit the anal reflex (quick contraction). If indicated, inspect anal sphincter tone by inserting a gloved finger lubricated with water-soluble jelly just inside the anal sphincter.

Musculoskeletal

Assessment of the musculoskeletal system includes examination of the clavicles and shoulders, spine, extremities, joints, and hips. Determining the child's ability to move all extremities through the full range of motion is also important.

Clavicles and Shoulders

Palpate the clavicles. In the newborn, tenderness or crepitus reveals a fracture sustained at birth. In the older infant or child, a bump indicates callus formation with clavicle fracture. Test shoulder strength and the function of cranial nerve XI in the older child by requesting that the child shrug the shoulders while you apply downward pressure.

Spine

Observe the child's resting posture and alignment of the trunk. The newborn's position will look like the position the baby preferred *in utero* and is one of general flexion. The older infant moves more and can sit unassisted in the second half of the first year. Toddlers stand with a wide-based gait, a slightly swayed back, and the abdomen slightly protruding. The posture straightens in the preschool and school-age years. Adolescents often demonstrate kyphosis as the skeleton and muscles are both growing rapidly (Fig. 31.37).

Inspect the child's spine. The newborn's spine has a single C-shaped curve and remains rounded for the first 3 months of life. The cervical curve begins to develop around 3 to 4 months of age as the baby gains head control. By 12 to 18 months of age, the lumbar curve develops, which corresponds to the onset of walking. The S-shaped spine in older children and adolescents is similar to that of the adult's. The spine should be flexible, with good muscle tone and no rigidity. Assess the back, and hip and shoulder heights for symmetry.

Examine the preadolescent and adolescent for the development of scoliosis. Refer to Chapter 44 for information about scoliosis screening. Scoliosis screening is generally performed during well-child examinations by the physician or nurse practitioner or by the middle or high school nurse on a particular day of the school year.

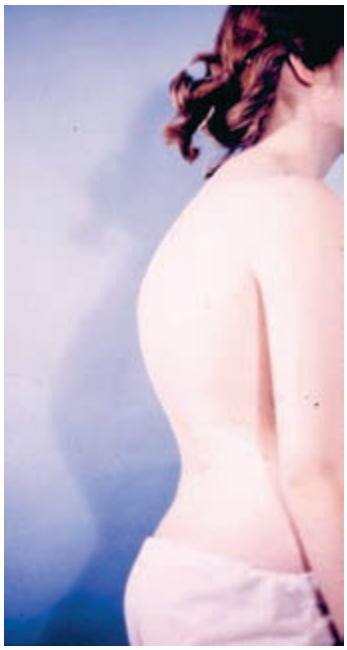

FIGURE 31.37 The teen's posture often demonstrates kyphosis.

Note mobility of the vertebral column by having the child bend forward and side to side. Flex the neck and move it from side to side. No resistance or pain should occur. Inspect the back for discoloration, tufts of hair, or dimples. A normal pilonidal dimple is sometimes seen at the base of the spine, but there should be no tuft of hair or nevi along the spine. Document and report abnormal findings.

Extremities

All children, even newborns, should be able to move all extremities spontaneously. Screen the infant younger than 6 months of age for developmental dysplasia of the hip by performing the Ortolani and Barlow maneuvers (refer to Chapter 44 for additional information). These maneuvers are usually best performed by a proficient examiner. Inspect and palpate the child's upper and lower extremities. Assess for symmetry in size, contour, movement, warmth, and color of the extremities. The infant's feet and legs appear bowed secondary to *in utero* positioning but can be straightened through passive range of motion. Observe the child in a standing position. Bowing of the lower legs (internal tibial torsion) lessens as the toddler begins to bear weight and usually resolves in the second or third year of life as the strength of the muscles and bones increases. When it persists past that time, it is termed genu varum (bow legs). Genu valgum (knock knee) is usually present until the child is 7 years old. Observe the child walking, noting any difficulty with leg position or balance.

If the child is reluctant to walk, use play as a way to elicit the behavior. The school-age child should have gait and leg appearance similar to that of the adult.

Note the normal flat foot in the toddler and young child. The arch develops as the child grows and the muscles become less lax, though some children may continue with flexible flat feet; this is considered a normal variation.

Perform passive range of motion of the young infant's extremities. Inability to straighten the foot to midline may indicate clubfoot. Count the fingers and toes, noting abnormalities such as polydactyly (increased number of digits) or syndactyly (webbing of the digits). Palpate the joints for warmth or tenderness. Check the mobility of the joints of the upper and lower extremities by performing range of motion. Determine lower extremity muscle strength by having the child push against the examiner's hands with the soles of the forefoot. Assess upper extremity strength by having the child squeeze the examiner's crossed fingers and/or push up or down against the examiner's outstretched hands.

▶ ***Take*** *NOTE!*

Slight tremors may be noticed in the infant's extremities in the first month of life.

Neurologic

The neurologic examination should include level of consciousness, balance and coordination, sensory function, and reflexes. Motor function is assessed within the musculoskeletal section. Cranial nerve function is generally tested within other portions of the physical assessment as it applies to that section.

Level of Consciousness

Note the state of alertness and attentiveness to parents and the environment in the newborn and infant. Older infants become interactive with other people, as do toddlers and preschoolers. Younger children demonstrate orientation by positive interaction with family members and by crying or fussing when they feel threatened. By school age, the child should be oriented to name and place and a few years later should be able to state the date as well (even if only the day of the week).

Balance and Coordination

Balance and coordination are controlled by the cerebellum. Observe the child's gait to assess balance and coordination. Observe toddlers and older children rising and walking from a seated and supine position. They should be able to stand and balance without straining or holding on to objects. Continue to test cerebellar function by having the younger child skip or hop and requesting that the older child or adolescent walk heel to toe. Further tests of cerebellar function responsible for balance and coordination are discussed in Box 31.3. Demonstrate each test and make sure the child understands your instructions.

Sensory Testing

Portions of sensory testing related to most of the cranial nerves, vision, hearing, taste, and smell have already been incorporated into other sections as appropriate within the physical assessment. Test cranial nerve V (trigeminal) by lightly touching the child's cheek with a cotton ball. The young infant will root toward the side that is touched. With the child's eyes closed, ask the child to identify other locations where he or she is lightly touched (several different ones) to assess sensation. Ask the child to tell you when he or she is touched. Make a game of this activity to encourage cooperation in younger children. In the older child who knows the definition of sharp and dull, test for these sensations with the child's eyes closed. Use the rounded end of a tongue blade for dull and the broken edge of a tongue blade for the sharp sensation. The child should be able to discriminate the sensations of sharp and dull.

BOX 31.3 Cerebellar Function Testing

- **Romberg:** Ask the school-age or older child to stand still with eyes closed and arms down by the sides. Observe the child for leaning (stand close in case this does occur). This is considered a positive Romberg test, indicating cerebellar dysfunction.

For the following tests, the child should demonstrate accuracy and smoothness:

- **Heel-to-shin:** Have the child lie in a supine position, place one heel on the opposite knee, and run it down the shin.
- **Rapid alternating movements:** The child pats the thighs with the hands, lifts them, turns them over, pats the thighs with the back of the hands, and repeats the process multiple times. An alternate test is for the child to touch the thumb to each finger of the same hand starting at the index finger, then reverse the direction and repeat.
- **Finger-to-finger:** The child's eyes are open. The child touches the examiner's outstretched finger with the index finger, then touches his or her own nose. The examiner moves the finger to a different spot and the child repeats this process several times.
- **Finger-to-nose:** The child's eyes are closed. The child stretches the arm with the index finger extended, then touches his or her nose with that finger, keeping the eyes closed.

Reflexes

Assess the infant's primitive and protective reflexes. The primitive reflexes involve a whole-body response and are subcortical in nature. Selected primitive reflexes present at birth include Moro, root, suck, asymmetric tonic neck, plantar and palmar grasp, step, and Babinski. Most of the primitive reflexes diminish over the first few months of life, giving way to protective or postural reflexes. Protective reflexes are motor responses related to maintenance of equilibrium. They are necessary for appropriate motor development and remain throughout life once they are established. The protective reflexes include the righting and parachute reactions.

Place one finger in each of the infant's hands to elicit the palmar grasp reflex (usually disappears by age 3 to 4 months). Touch the thumb to the ball of the infant's foot to elicit the plantar grasp reflex. The infant's toes will curl down (this reflex disappears by 8 to 10 months). Refer to Table 25.2 and Figures 25.1 through 25.6 in Chapter 25 for additional explanation of the other reflexes. Appropriate presence and disappearance of primitive reflexes, as well as development of protective reflexes, is indicative of a healthy neurologic system. Primitive reflexes that persist beyond the usual age of disappearance may indicate an abnormality of the neurologic system and should be further investigated.

Assess deep tendon reflexes in all infants and children. Appropriate responses indicate that the reflex arc is intact. Use the reflex hammer in all ages or the curved tips of the two first fingers to elicit the responses in infants. The limb must be relaxed and the muscle partly stretched. Use a snapping motion of the wrist to tap with the fingertips or the reflex hammer. Test the biceps, triceps, patellar, and Achilles reflexes as you would in the adult. It may help to place a finger under the infant's knee to encourage relaxation. Young children who tense up when their reflexes are being tested may relax the area if you have them focus on another area, so have the child clasp the hands while testing the Achilles and patellar reflexes. As the child focuses on the hands, the lower extremities relax. Distraction may also be helpful.

Grade the strength of the response using the standard scale from 0 to 4+:

- 0: no response
- 1+: diminished or sluggish
- 2+: average
- 3+: brisker than average
- 4+: very brisk, may involve clonus

The newborn's deep tendon reflexes are normally brisk (3+). They decrease to average (2+), usually by 4 months of age. Healthy children should have reflexes of 2+ if the reflex has been elicited properly. Absent, sluggish, or hyperreactive responses usually indicate disease.

Refer back to Elliot, the 3-year-old from the beginning of the chapter. What are some important considerations when performing his physical examination?

Key Concepts

- The health history in children includes more than just the chief complaint, history of present illness, and past medical history; it is important to include the perinatal history and developmental milestones.
- Allow the chief complaint to determine which parts of the history require more in-depth investigation.
- The developmental history will warrant more attention in the younger child, while school performance and adjustment will be more important in the school-age child and adolescent.
- Though the parent will provide most of the health history for the infant and young child, allow the young verbal child to answer questions during the health history as appropriate.
- Direct health history questions to the school-age child and adolescent, seeking clarification from the parents as needed.
- Provide confidentiality and privacy for the adolescent during the health history.
- Weight and length or height should be assessed at each well-child visit to determine adequacy of growth.
- Measure head circumference until age 3 years to monitor brain growth.
- Perform hearing and vision screenings for children of all ages.
- BMI can be used to identify children who are overweight or at risk for being overweight.
- The normal range of vital signs varies based on the child's age.
- The sequence of the physical examination in children should be based on the child's developmental age, his or her level of cooperation, and the severity of the illness.
- Obtain heart rate and respiratory rate and auscultate the heart and lungs while the infant or young child is quiet.
- Perform intrusive procedures such as examination of the ears, mouth, and throat last in the infant or young child.
- Perform the health assessment in a head-to-toe fashion in the school-age child or adolescent, reserving the genitalia and anus examination for last.
- Plan the health assessment in such a way as to minimize trauma to the child or adolescent.
- Use age-appropriate measurement tools to assess pain in children.
- Allow the infant or young child to remain in the parent's lap for as much of the assessment as possible so that the child feels secure.

- Use age-appropriate games during the health assessment to gain cooperation in the younger child.
- Having the young boy sit cross-legged for a testicular examination may reduce the cremasteric reflex.
- The newborn may exhibit a wide variety of normal skin variations.
- The infant's fontanels should be soft and flat; report a bulging fontanel immediately.
- Jaundice (outside of the newborn period), pallor, cyanosis, and poor skin turgor indicate illness and may need immediate intervention.
- Heart murmurs should be assessed for intensity, location, and duration. They may be innocent or may indicate a congenital heart defect.
- The infant's chest wall is relatively thin, allowing upper airway sounds to be transmitted throughout the lung fields.
- Substernal or xiphoid retractions indicate that the child is laboring to breathe, whereas a fixed, depressed sternum (pectus excavatum) is a structural abnormality.
- The Tanner stages of sexual maturity provide a basis for assessing pubertal development in boys and girls. Use the breast and pubic hair charts for girls and the pubic hair and penis and scrotum size chart for boys.

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Kids' Health for Kids—Nemours Foundation: kidshealth.org/kid
Maternal and Child Health Bureau: mchb.hrsa.gov
Agency for Healthcare Research and Quality, Child and Adolescent Health: www.ahrq.gov/child
Bright Futures at Georgetown University: www.brightfutures.org
Centers for Disease Control: www.cdc.gov/
Child Trends Data Bank: www.childtrendsdatabank.org
U.S. Food and Drug Administration's Kids' Home Page: www.fda.gov/oc/opacom/kids/default.htm
Healthy People 2010: www.healthypeople.gov
HHS for Kids (U.S. Department of Health and Human Services): www.hhs.gov/kids
National Association of Pediatric Nurse Practitioners: www.napnap.org
Society of Pediatric Nurses: www.pedsnurses.org

CHAPTER WORKSHEET

MULTIPLE CHOICE QUESTIONS

1. A 5-year-old boy visits the physician's office with an upper respiratory infection. Which approach would give the nurse the most information about the child's developmental level?
   a. Playing a game with the child.
   b. Talking with the child about the teddy bear next to him.
   c. Using a screening tool during a follow-up office visit.
   d. Asking the 10-year-old sibling about the child.
2. Which statement indicates the best sequence for the nurse to conduct an assessment in a non-emergency situation?
   a. Introduce yourself, ask about any problems, take a history, do the physical examination.
   b. Perform the physical examination and then ask the family if there are any problems in the child's life.
   c. Do the physical examination while at the same time asking about the child's previous illnesses; then talk about the family's concerns.
   d. Get a complete history of the family's health beliefs and practices, then assess the child.
3. What approach by the nurse would most likely encourage a child to cooperate with an assessment of physical and developmental health?
   a. Explain to the child what's going to happen when the child asks questions.
   b. Explain what is going to happen in words the child can understand.
   c. Force them to cooperate by having a parent hold them down.
   d. Give the child a sticker before beginning the examination.
4. A sleeping 5-month-old girl is being held by the mother when the nurse comes in to do a physical examination. What assessment should be done initially?
   a. Listening to the bowel sounds.
   b. Counting the heart rate.
   c. Checking the temperature.
   d. Looking in the ears.
5. Which assessment finding is considered normal in children?
   a. Irregular respiratory rate and rhythm.
   b. Split S2 and sinus arrhythmia.
   c. Decreased heart rate with crying.
   d. Genu varum past the age of 5 years.

CRITICAL THINKING EXERCISES

1. A soft and muffled heart murmur is heard in a 4-year-old patient. The mother states that she has never heard that the child has a murmur. What should the nurse do?
2. A nurse is helping a new mother breastfeed her 4-day-old baby. The mother notices that the baby has a bluish cast to the skin on his hands and that sometimes the infant has a tremor. She asks the nurse if the baby is cold, though the baby is swaddled and comfortably resting against the mother's skin. How might the nurse help teach this mother?
3. Devise a plan for encouraging cooperation of the toddler or preschooler during various parts of the physical examination.

STUDY ACTIVITIES

1. In the clinical setting, obtain a health history on an infant, child, or adolescent.
2. In the clinical setting, compare the approach you use for the physical examination of a toddler versus a school-aged child or adolescent.
3. No matter how thoughtfully and appropriately you plan your assessment, odds are good that you will have difficulty assessing a 2-year-old. Discuss with your classmates the strategies that you have used for success and brainstorm with them about their ideas for assessing a crying or resistant young child.