I was scared when we brought Latoya to the hospital. She looked helpless, afraid, and sick. The nurses and doctors took over when we got to the hospital, and I felt better because they seemed to know what to do.
—Father of Latoya, 6 months old

LEARNING OBJECTIVES

- Describe the elements of a health history for an infant or child of different ages.
- Identify communication strategies to improve the quality of historical data collected.
- Describe the strategies to gain cooperation of a young child for assessment.
- Describe the differences in sequence of the physical assessment for infants, children, and adolescents.
- Modify physical assessment techniques according to the age and developmental stage of the child.
- Determine the sexual maturity rating of males and females based upon physical signs of secondary sexual characteristics present.
- Recognize at least five important signs of a serious alteration in health condition that require urgent nursing intervention.

CD-ROM

Audio Glossary
Animations:
  - Otoscope Examination
  - Mouth and Throat Examination
  - 3D Eye
  - Movement of Joints
Skills 9-1–9-7: Growth Measurements
Skill 9-10: Blood Pressure
Skills 9-11–9-14: Body Temperature Measurements
Skills 9-18 and 9-19: Visual Acuity Screening
NCLEX–RN® Review

Companion Website

New Pediatric Blood Pressure Tables
Techniques for Assessing Selected Primitive Reflexes, with Normal Findings and Their Expected Age of Occurrence
Thinking Critically
NCLEX–RN® Review
Case Study
How do examination techniques vary by the age of the child? How does the nurse encourage infants and toddlers to cooperate with the examination? This chapter provides an overview of pediatric assessment, including history taking and examination techniques geared to the unique needs of pediatric patients. Strategies for obtaining the child’s history are presented first. The remainder of the chapter then outlines a systematic process for physical examination of the child.

ANATOMIC AND PHYSIOLOGIC CHARACTERISTICS OF INFANTS AND CHILDREN

Children and infants are not only smaller than adults, but also significantly different physiologically. Knowledge of pediatric anatomic and physiologic differences will aid in recognizing normal variations found during the physical examination. It also assists with understanding the different physiologic responses children have to illness and injury. The illustration in “As Children Grow” provides an overview of important anatomic and physiologic differences between children and adults.

OBTAINING THE CHILD’S HISTORY

COMMUNICATION STRATEGIES

The health history interview is a very personal conversation with a parent, caretaker, or adolescent during which private concerns and feelings are shared. Try to ensure that this exchange of information with the parent or the child is clearly understood by both parties and that it is an effective communication. Effective communication is difficult to accomplish because parents and children often do not correctly interpret what the nurse says, just as the nurse may not understand completely what the parent or child says. People’s interpretation of information is based on their life experiences, culture, and education.

Strategies to Build a Rapport with the Family

When beginning the history, make sure the parents understand the purpose of the interview and that the information will be used appropriately. To develop rapport, demonstrate interest in and concern for the child and family during the interview. This rapport forms the foundation for the collaborative relationship between the nurse and parent that will provide the best nursing care for the child. The following strategies help to establish rapport with the child’s family during the nursing history:

- Make a self-introduction (name, title or position, and role in caring for the child). To demonstrate respect, ask all family members present what name they prefer you to use when talking with them.
- Explain the purpose of the interview and why the nursing history is different from the information collected by other health professionals. For example, “The nurses will use this information to plan nursing care best suited for your child.”
- Provide privacy and remove as many distractions as possible during the interview. If the patient’s room does not offer privacy, attempt to find a vacant patient room or lounge. Assure the parents and the child that the information provided during the assessment is protected under the Health Insurance Portability and Accountability Act (HIPAA), a federal law that requires written consent to be provided before health information can be shared with healthcare providers outside the facility.
Direct the focus of the interview with open-ended questions. Use close-ended questions or directing statements to clarify information. Open-ended questions are useful to initiate the interview, develop a rapport, and understand the parent's perceptions of the child's problem. For example: “Tell me what problems led to Roberto's admission to the hospital.” Close-ended questions are used to obtain detailed information. For example: “How high was Tommy's fever this morning?”

Ask one question at a time so that the parent or child understands what piece of information is desired and so that it is clear which question the parent is answering. “Does any member of your family have diabetes, heart disease, or sickle cell anemia?” is a multiple question. Ask about each disease separately to ensure the most accurate response.

Children Are Not Just Small Adults

- Body surface area large for weight, making infants susceptible to hypothermia.
- Anterior fontanelle and open sutures palpable up to about 18 months. Posterior fontanelle closes between 2 and 3 months.
- Tongue large relative to small nasal and oral airway passages.
- Short, narrow trachea in children under 5 years makes them susceptible to foreign body obstruction.
- Until late school age and adolescence, cardiac output is rate dependent, not stroke volume dependent, making heart rate more rapid.
- Abdomen offers poor protection for the liver and spleen, making them susceptible to trauma.
- Until 12 to 18 months of age, kidneys do not concentrate urine effectively and do not exert optimal control over electrolyte secretion and absorption.
- Until later school age, proportion of body weight in water is larger, with more water in extracellular spaces. Daily water exchange rate is much higher.
- Blood volume is weight dependent: 80 mL/kg.

All brain cells present at birth; myelination and further development of nerve fibers occur during first year.

- Head proportionately larger, making child susceptible to head injury.
- Higher metabolic rate, higher oxygen needs, higher caloric needs.
- Until puberty, percentage of cartilage in ribs is higher, making them more flexible and compliant.
- Until about 10 years, there is a faster respiratory rate, fewer and smaller alveoli, and less lung volume. Tidal volume is proportional to weight (7 to 10 mL/kg).
- Up to about 4 or 5 years, diaphragm is primary breathing muscle. CO₂ is not effectively expired when child is distressed, making child susceptible to metabolic acidosis.
- Until puberty, bones are soft and more easily bent and fractured.
- Muscles lack tone, power, and coordination during infancy. Muscles are 25% of weight in infants versus 40% in adults.

- Anterior fontanelle and open sutures palpable up to about 18 months.
- Posterior fontanelle closes between 2 and 3 months.
- Tongue large relative to small nasal and oral airway passages.
- Short, narrow trachea in children under 5 years makes them susceptible to foreign body obstruction.
- Until late school age and adolescence, cardiac output is rate dependent, not stroke volume dependent, making heart rate more rapid.
- Abdomen offers poor protection for the liver and spleen, making them susceptible to trauma.
- Until 12 to 18 months of age, kidneys do not concentrate urine effectively and do not exert optimal control over electrolyte secretion and absorption.
- Until later school age, proportion of body weight in water is larger, with more water in extracellular spaces. Daily water exchange rate is much higher.
Observe the parent’s nonverbal behavior (posture, gestures, body movements, eye contact, and facial expression) for consistency with the words and tone of voice used. Is the parent interested in and appropriately concerned about the child’s condition? Behaviors such as sitting up straight, making eye contact, and appearing apprehensive reflect appropriate concern for the child. Physical withdrawal, failure to make eye contact, or a happy expression could be inconsistent with the child’s serious condition.

Be honest with the child when answering questions or when giving information about what will happen. Children need to learn that they can trust their nurse.

Choose the language style best understood by the parent and child. Commonly used phrases can have different meanings to persons in various regions of the country or to different ethnic groups. To improve communication, request frequent feedback from the parents or child to ensure that their interpretation of phrases is accurate.

Use an interpreter to improve communication when not fluent in the family’s primary language. To ensure confidentiality of information for parents, avoid using a family member for history taking.

**Careful Listening**

Complete attention is necessary to “hear” and accurately interpret information the parents and child give during the nursing history. Carefully listen to the information provided by the parent, as well as how it is expressed, and observe behavior during the interaction.

Does the parent hesitate or avoid answering certain questions?

Pay attention to the parent’s attitude or tone of voice when the child’s problems are discussed. Determine if it is consistent with the seriousness of the child’s problem. The tone of voice can reveal anxiety, anger, or lack of concern.

Be alert to any underlying themes. For example, the parent who talks about the child’s diagnosis, but repeatedly refers to the impact of the illness on the family’s finances or on meeting the needs of other family members, is requesting that these issues be addressed.

Observe the parent’s nonverbal behavior (posture, gestures, body movements, eye contact, and facial expression) for consistency with the words and tone of voice used. Is the parent interested in and appropriately concerned about the child’s condition? Behaviors such as sitting up straight, making eye contact, and appearing apprehensive reflect appropriate concern for the child. Physical withdrawal, failure to make eye contact, or a happy expression could be inconsistent with the child’s serious condition.

**DEVELOPING CULTURAL COMPETENCE**

**EYE CONTACT**

Eye contact with the interviewer may be avoided by many cultural groups (Asian, Native American, and Middle Eastern patients) because it is considered impolite, aggressive, or a sign of disrespect (Spector, 2000). Europeans, such as the French and Spanish, use firm eye contact and look for a response or impact regarding what has been said. Some Americans may make brief eye contact and then let the eyes wander (Seidel, Ball, Dains et al., 2003).

Subtle nonverbal and verbal cues often indicate that the parent has not provided complete information about the child’s problem. Observe for behaviors such as avoiding eye contact, change in voice pitch, or hesitation when responding to a question. Being supportive and asking clarifying questions encourage further description or the expression of information that is difficult for the parent or child to share. For example: “It sounds like that was a very difficult experience. How did Lataisha react?”

Encourage parents to share information, even if it is private or sensitive, especially when it influences nursing care planning. Often parents avoid sharing some information because they want to make a good impression, or they do not understand the value of the missing information. If parents hesitate to share information, briefly explain why the question was asked—for example, to make their child’s hospital experience more pleasant or to begin planning for the child’s discharge and home care.

In some cases the parent becomes too agitated, upset, or angry to continue responding to questions. When the information is not needed immediately, move on to another portion of the history to determine whether the parent is able to respond to other questions. Depending on the emotional status of the parent, it may be more appropriate to collect the remaining historical data later.

**DATA TO BE COLLECTED**

Collect and organize the child’s health, medical, and personal-social history to plan the child’s nursing care. This text uses a modification of the Burns Classification System as the data-collection framework selected (Burns, 1992; Byrnes, 1996). Physiologic, psychosocial, and developmental data are organized to help develop the nursing diagnoses and the nursing care plan. Be alert for nonverbal cues.

**Patient Information**

Obtain the child’s name and nickname, age, sex, and ethnic origin. The child’s birth date, race, religion, address, and phone number can be obtained from the admission form. Ask the parent for an emergency contact address and
Physiologic Data
Collect information about the child’s health problems and diseases chronologically in a format similar to the traditional medical history.

- The chief complaint is the child’s primary problem or reason for hospital admission or visit to a healthcare setting, stated in the parent’s or child’s exact words.
- The history of the present illness or injury is a detailed description of the current health problem. This includes the onset and sequence of events, characteristics of and changes in symptoms over time, influencing factors, and the current status of the problem. Each problem is described separately. Table 35–1 lists the specific data to be collected about each illness and injury.
- The past history is a more detailed description of the child’s prior health problems. It includes the birth history and all major past illnesses and injuries. A detailed and complete birth history is obtained when the child’s present problem may be related to the birth history (Table 35–2).

<table>
<thead>
<tr>
<th>TABLE 35–1 History of Present Illness or Injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>Onset</td>
</tr>
<tr>
<td>Type of symptom</td>
</tr>
<tr>
<td>Location</td>
</tr>
<tr>
<td>Duration</td>
</tr>
<tr>
<td>Severity</td>
</tr>
<tr>
<td>Influencing factors</td>
</tr>
<tr>
<td>Past evaluation for the problem</td>
</tr>
<tr>
<td>Previous and current treatment</td>
</tr>
</tbody>
</table>

Identify all major illnesses, including common communicable diseases. Identify major injuries, their cause or mechanism, and their severity. For past surgeries obtain information about the specific type and if the surgery was performed as day surgery or required at least a night of hospitalization. For all hospitalizations, record the reason and length of hospitalization. If any transfusions (blood or blood products) have been given in the past, identify the circumstances, type of transfusion, and reaction. Obtain information about each specific diagnosis, treatment, outcome, complication or residual problem, and the child’s reaction to the event.

- The current health status is a detailed description of the child’s typical health status:
  - Health maintenance—child’s primary care provider, dentist, and other healthcare providers, timing of last visit to each.
  - Medications—prescribed and over-the-counter medications taken daily, frequently, or for home management of fever, colds, coughs, cuts, and rashes.
Ask about the use of plants, herbs, teas, or other complementary therapies.

**Allergies**—to food, medication, animals, insect bites, or environmental exposure, and the type of reaction (e.g., respiratory difficulty, rash, hives, itching).

**Immunizations**—review child’s record for immunization status, vaccines and dates received, any unexpected reactions.

**Safety measures used**—car restraint system, window guards, medication storage, sports protective gear, smoke detectors, bicycle helmet, firearm storage, and others.

**Activities and exercise**—physical mobility and limitations, adaptive equipment used; play and/or sports activities.

**Nutrition**—formula-fed or breastfed, if breastfed, for how long, type and amount of daily formula intake; when solid foods were introduced, enrollment in the WIC (Women, Infants, and Children) Program; eating and snacking habits, variety of foods consumed, “junk foods” eaten, appetite.

**Sleep**—length and timing of naps and nighttime sleep; nightmares or night terrors, other sleep disturbances; where the child sleeps, and bedtime rituals.

The familial and hereditary diseases summarize the major familial and hereditary diseases in three generations of family members, including the parents, grandparents, aunts, uncles, cousins, child, and siblings. Collect information about the health status of each parent. Record information in either a pedigree or a narrative format. Specific diseases to ask about are listed in Table 35–3.

The review of systems provides a comprehensive overview of the child’s health. This is an opportunity to identify additional signs and symptoms associated with the child’s condition. Other problems may also be revealed that have no direct relationship to the child’s significant health problem but could be factors complicating nursing care or home care. For example, asking about any urinary problems may reveal that a child still wets the bed at 7 years of age, although the admission is for a femur fracture. The nurse would then need to consider how bed-wetting might cause problems with the spica cast. For each problem, obtain the treatment, outcomes, residual problems, and age at time of onset. Data-collection guidelines are given in Table 35–4.

**Psychosocial Data**

Obtain information about family composition to establish a socioeconomic and sociologic context for planning the child’s care in the hospital, community, and at home.

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**TABLE 35–3**

<table>
<thead>
<tr>
<th>Familial or Hereditary Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious diseases</td>
</tr>
<tr>
<td>Heart disease</td>
</tr>
<tr>
<td>Allergic disorders</td>
</tr>
<tr>
<td>Eye disorders</td>
</tr>
<tr>
<td>Ear disorders</td>
</tr>
<tr>
<td>Hematologic disorders</td>
</tr>
<tr>
<td>Lung disorders</td>
</tr>
<tr>
<td>Cancer</td>
</tr>
<tr>
<td>Endocrine disorders</td>
</tr>
<tr>
<td>Mental disorders</td>
</tr>
<tr>
<td>Musculoskeletal disorders</td>
</tr>
<tr>
<td>Gastrointestinal disorders</td>
</tr>
<tr>
<td>Problem pregnancies</td>
</tr>
<tr>
<td>Learning problems</td>
</tr>
</tbody>
</table>

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Family composition, including family members living in the home, their relationship to the child, marital status of parents or other family structure, and people helping to care for the child

Household members employed, family income, and financial resources or agencies used such as health insurance, food stamps, or Temporary Assistance for Needy Families (TANF)

Description of the housing and home environment (atmosphere, emotional stresses, family activities); safe play area; use of city or well water; and availability of electricity, heat, and refrigeration

School or childcare arrangements; description of the neighborhood, including playgrounds, transportation, and proximity to stores

Changes in family or lifestyle since last seen; number of times the family has moved; how the child and family members have coped with the changes
### Table 35–4  Review of Systems

<table>
<thead>
<tr>
<th>Body Systems</th>
<th>Examples of Problems to Identify</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>General growth pattern, overall health status, ability to keep up with other children or tires easily with feeding or activity, fever, sleep patterns. Allergies, type of reaction (hives, rash, respiratory difficulty, swelling, nausea), seasonal or with each exposure.</td>
</tr>
<tr>
<td>Skin and lymph</td>
<td>Rash, dry skin, itching, changes in skin color or texture, tendency for bruising, swollen or tender lymph glands.</td>
</tr>
<tr>
<td>Hair and nails</td>
<td>Hair loss, changes in color or texture, use of dye or chemicals on hair. Abnormalities of nail growth or color.</td>
</tr>
<tr>
<td>Head</td>
<td>Headaches.</td>
</tr>
<tr>
<td>Eyes</td>
<td>Vision problems, squinting, crossed eyes, lazy eye, wears glasses, eye infections, redness, tearing, burning, rubbing, swelling eyelids.</td>
</tr>
<tr>
<td>Ears</td>
<td>Ear infections, frequent discharge from ears, or tubes in ears. Hearing loss (no response to loud noises or questions, inattentiveness, was hearing test ever done?), hearing aids or cochlear implant.</td>
</tr>
<tr>
<td>Nose and sinuses</td>
<td>Nosebleeds, nasal congestion, colds with runny nose, sinus pain or infections. Nasal obstruction, difficulty breathing, snoring at night.</td>
</tr>
<tr>
<td>Mouth and throat</td>
<td>Mouth breathing, difficulty swallowing, sore throats, strep infections, mouth odor. Tooth eruption, cavities, braces. Voice change, hoarseness, speech problems.</td>
</tr>
<tr>
<td>Cardiac and hematologic</td>
<td>Heart murmur, anemia, hypertension, cyanosis, edema, rheumatic fever, chest pain.</td>
</tr>
<tr>
<td>Chest and respiratory</td>
<td>Bowel movements, frequency, color, regularity, consistency, discomfort, constipation or diarrhea, abdominal pain, bleeding from rectum, flatulence. Nausea or vomiting, appetite.</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>For pubescent children. Menses onset, amount, duration, frequency, discomfort, problems; vaginal discharge, breast development. Puberty onset, emissions, erections, pain or discharge from penis, swelling or pain in testicles. Sexual activity, use of contraception, sexually transmitted diseases.</td>
</tr>
<tr>
<td>Urinary</td>
<td>Frequency, urgency, dysuria, dribbling, strength of urinary stream. Toilet trained—age when day and night dryness attained, enuresis.</td>
</tr>
<tr>
<td>Reproductive</td>
<td>Weakness, clumsiness, poor coordination, balance, tremors, abnormal gait, painful muscles or joints, swelling or redness of joints, fractures.</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>Brain or head injuries. Seizures, fainting spells, dizziness, numbness. Learning problems, attention span, hyperactivity, memory problems.</td>
</tr>
</tbody>
</table>

Information about daily routines, psychosocial data, and other living patterns forms the basis for many nursing diagnoses as well as the nursing care plan. Collection of information should focus on issues that have an impact on the quality of daily living, even if some data seem to overlap with disease data (Table 35–5).

The psychosocial history for adolescents should focus on critical areas in their lives that may contribute to a less than optimal environment for normal growth and development (Goldenring & Rosen, 2004). Possible screening questions are found in Table 35–6.
Infants and Toddlers

Developmental Data

Information about the child’s motor, cognitive, language, and social development will help to plan nursing care. Ask the parent about the child’s milestones and current fine and gross motor skills. Obtain the age at which the child first used words appropriately and the current words used or language ability. For children in school, ask about academic performance to assess cognitive development. Ask the parent about the child’s manner of interaction with other children, family members, and strangers. Guidelines for a nursing assessment of development can be found in Chapter 33.

DEVELOPMENTAL APPROACH TO THE EXAMINATION

The sequence and approach to the examination varies by age. Provide a comfortable atmosphere for the examination with privacy so that modesty is respected. Explain the procedures as you begin to perform them. In young children, a foot-to-head sequence is often used so that the least distressing parts of the examination are completed first. In older cooperative children, the head-to-toe approach is generally used.

Newborns and Infants under 6 Months of Age

Infants are among the easiest children to examine, as they do not resist the examination procedure. Keep the parent present to provide security to the infant. Provide physical comfort during the examination by feeding, using a pacifier, cuddling, or changing the diaper to keep the infant calm and quiet. Distraction such as rocking or clicking noises may help when the infant begins to get distressed. Keep the sequence of the examination flexible to take advantage of times the infant is quiet or asleep to auscultate the lungs, heart, and abdomen. If the infant continues to be quiet or can be quieted with a pacifier, palpate the abdomen while the muscles are relaxed. The remainder of the examination can proceed in a head-to-toe sequence. Portions of the examination that will disturb the infant, such as the examination of the hips, should be performed at the end.

Infants over 6 Months of Age

Because of developing separation and stranger anxiety, it is often best to keep the older infant with the parent. The infant and toddler can be examined on the parent’s lap and then held against the parent’s chest for some steps, such as the ear examination. The infant will not object to having clothing removed, but make sure the room is warm for the infant’s comfort. Keep the infant’s general level of activity, mood, and responsiveness to handling.

Smile and talk soothingly to the infant during the procedure. Use toys to distract the older infant. Use a pacifier or bottle to quiet the child when necessary. Because the infant may be fearful of being touched by a stranger, begin with the feet and hands before moving to the trunk. However, take advantage of opportunities presented when the infant is sleeping or quiet to auscultate the heart and lungs.

Toddlers

Toddlers may be active, curious, shy, cautious, or slow to warm up. Because of stranger anxiety, keep toddlers with their parents, often examining them on the parent’s lap. It is possible to create a flat surface for the abdominal and genital examination by sitting close to the parent with knees together. For invasive procedures (ear, eye, and mouth exam) the parent can hold the child closely to the chest with legs between the parent’s legs. The cranial nerve assessment or developmental assessment can be used as a method to gain cooperation for other procedures. Much of the neurologic and musculoskeletal assessment can be conducted by observing the child play and walk around in the examining room.

Tell the child what you will do at each step of the examination, using a confident voice that expects cooperation rather than asking. When a choice is possible, let the
### TABLE 35–6  Adolescent Psychosocial Assessment Using the HEEADSSS Screening Tool

#### Screening Questions

| **Home environment** | Who lives with you? Where do you live? Do you have your own room?  
What are relationships like at home?  
To whom are you closest at home?  
To whom can you talk at home?  
Is there anyone new at home? Has someone left recently?  
Have you ever had to live away from home? (Why?) |
|----------------------|-------------------------------------------------------------------------------------------------|
| **Employment and education** | Are you currently in school?  
What are your favorite subjects at school? Your least favorite subjects?  
How are your grades? Any recent changes? Any dramatic changes in the past?  
Have you changed schools in the past few years?  
What are your future education/employment plans/goals?  
Are you working? Where? How much?  
Tell me about your friends at school. |
| **Eating** | What do you like and not like about your body?  
Have there been any recent changes in your weight?  
Have you dieted in the last year? How? How often?  
Have you done anything else to try to manage your weight?  
How much exercise do you get in an average day? Week?  
What do you think would be a healthy diet? How does that compare with your current eating patterns? |
| **Activities** | What do you and your friends do for fun? (with whom, where, and when?)  
What do you and your family do for fun? (with whom, where, and when?)  
Do you participate in any sports or other activities?  
Do you regularly attend a church group, club, or other organized activity? |
| **Drugs (substance use)** | Do any of your friends use tobacco? Alcohol? Other drugs?  
Does anyone in your family use tobacco? Alcohol? Other drugs?  
Do you use tobacco? Alcohol? Other drugs?  
Is there any history of alcohol or drug problems in your family? Does anyone at home use tobacco? |
| **Sexuality** | Have you ever been in a romantic relationship?  
Tell me about the people that you’ve dated. OR Tell me about your sex life.  
Have any of your relationships ever been sexual relationships?  
Are your sexual activities enjoyable?  
What does the term “safer sex” mean to you?  
Are you interested in boys? Girls? Both? |
| **Suicide/depression** | Do you feel sad or down more than usual?  
Do you find yourself crying more than usual?  
Are you “bored” all the time?  
Have you thought a lot about hurting yourself or someone else? |
| **Safety (savagery)** | Have you ever been seriously injured? (How?) How about anyone else you know?  
Do you always wear a seat belt in the car?  
Have you ever ridden with a driver who was drunk or high? When? How often?  
Do you use safety equipment for sports or other physical activities (for example, helmets for biking or skateboarding)?  
Is there any violence in your home? Does the violence ever get physical?  
Is there a lot of violence at your school? In your neighborhood? Among your friends?  
Have you ever been physically or sexually abused? Have you ever been raped, on a date or at any other time? (If not asked previously) |

child have some control. For example, let the toddler choose which ear to examine first or to stand or sit for a certain part of the examination. Let the child hold a security object if it helps. Attempt to reduce the child’s anxiety by demonstrating the use of instruments on the parent or security object. Begin the examination by touching the feet and then moving gradually toward the body and head. Instruments to examine the ears, eyes, and mouth are usually viewed as the most fearful and should be used at the end of the examination.

**Preschoolers**

Assess the willingness of the child to be separated from the parent. Younger children will often prefer to be examined on the parent’s lap, while older children will be comfortable on the examining table. Most children are willing to undress, but leave the underpants on until conducting the genital examination. Most children in this age group are cooperative during the physical examination. Some children will prefer to have the head, eyes, ears, and mouth examined first while others will prefer to postpone them to the end.

Allow the child to touch and play with the equipment. Give simple explanations about the assessment procedures, and offer choice where there is one during the examination. Use distraction to gain the child’s cooperation during the examination, such as asking the child to count, name colors, or talk about a favorite activity. Give positive feedback when the child cooperates.

**School-age Children**

School-age children willingly cooperate during the examination and sit on the examining table. Anticipate the development of modesty in school-age children and offer a patient gown to cover the underwear. Let the older school age child determine if the examination will be conducted in privacy or with the parent or siblings present.

A head-to-toe sequence can be used in this age group. Demonstrate how the instruments are used and let the child handle them if they wish. During the examination, tell the child what you are doing and why. Offer as many choices as possible to help the child feel empowered. The examination is a good opportunity to teach the child about how the body works, such as letting the child listen to heart and breath sounds.

**Adolescents**

Protect the adolescent’s modesty by providing a private place to undress and put on the patient gown, and then during the examination by covering the parts of the body not being assessed. Use the head-to-toe sequence and the same procedures used for adults. Perform the examination in private without parent or siblings unless the adolescent specifically requests the parent’s presence. Provide a chaperone when the parent or accompanying adult is not present during the examination.

Adolescents often have a lot of concerns regarding their developing bodies. When appropriate, provide reassurance about the normal progression of secondary sexual characteristic development and what further changes to expect.

**GENERAL APPRAISAL**

The examination begins upon first meeting the child (Figure 35–1). Measure the infant’s weight, length, and head circumference (see Skills 9–1 through 9–7 in the accompanying CD-ROM, as well as the Clinical Skills Manual).

If the child can stand, substitute a standing height measurement for length. Plot the measurements on the appropriate growth curves. Take the child’s temperature, heart rate, respiratory rate, and blood pressure (see Skills 9–8 through 9–14).

**NURSING PRACTICE**

Following are the specific examination techniques:

- **Inspection.** Purposeful observation of the child’s physical features and behaviors. Physical feature characteristics include size, shape, color, movement, position, and location. Detection of odors is also a part of inspection.

- **Palpation.** Use of touch to identify characteristics of the skin, internal organs, and masses. Characteristics include texture, moistness, tenderness, temperature, position, shape, consistency, and mobility of masses and organs. The palmar surface of the fingers and finger pads helps determine position, size, consistency, and masses. The ulnar surface of the hand is best to detect vibrations.

- **Auscultation.** Listening to sounds produced by the airway, lungs, stomach, heart, and blood vessels to identify their characteristics. Auscultation is usually performed with a stethoscope to enhance the sounds heard.

- **Percussion.** Striking the surface of the body, either directly or indirectly, to set up vibrations that reveal the density of underlying tissues and borders of internal organs.

Observe the child’s general appearance and behavior. The child should appear well nourished and well developed. Infants and young children are often fearful and seek reassurance from their parents. The child may resist interacting with the nurse until rapport is established.

Observe the behavior and tone of voice used by the parent when he or she is talking to the child. Is the child encouraged to speak? Is the child appropriately reassured or supported by the parent? The child should feel secure with the parent and perceive permission to interact with the nurse.
Examination of the child begins from the first contact. You should be observing the behavior of the child and parent by using visual cues to make a proper assessment. Does the child appear well nourished? Does the child appear secure with the parent?

**FIGURE 35–1**

Examination of the child begins from the first contact. You should be observing the behavior of the child and parent by using visual cues to make a proper assessment. Does the child appear well nourished? Does the child appear secure with the parent?

**ASSESSING SKIN AND HAIR CHARACTERISTICS**

Examination of the skin requires good lighting to detect variations in skin color and to identify lesions. Daylight is preferred when available. Rather than inspecting the entire skin surface of the child at one time, examine the skin simultaneously with other body systems as each region of the body is exposed.

**DEVELOPING CULTURAL COMPETENCE**

SKIN TONE DIFFERENCES

The palms of the hands and soles of the feet are often lighter than the rest of the skin surface in darker-skinned children. In addition, their lips may appear slightly bluish.

**INSPECTION OF THE SKIN**

Use gloves to inspect the child’s skin for color and the presence of imperfections, elevations, or other lesions.

**Skin Color**

The color of the child’s skin usually has an even distribution. Check for color variations—such as increased or decreased pigmentation, pallor, mottling, bruises, erythema, cyanosis, or jaundice—that may be associated with local or generalized conditions. Some variations in skin color are common and normal, such as freckles found in the white population and Mongolian spots found on dark-skinned infants. See “Newborn Skin” in Chapter 27 for more information. Bruises are common on the knees, shins, and lower arms as children stumble and fall. Bruises on other parts of the body, especially in various stages of healing, should raise a suspicion of child abuse. Bruises often go through various color changes as the body reabsorbs blood over several days. The transition of color often progresses through reddish blue, brownish blue, brownish green, greenish yellow, and yellow-brown before returning to normal skin color. Note any tattoos or body piercings.

When a skin color abnormality is suspected, inspect the buccal mucosa and tongue to confirm the color change. This is especially important in darker-skinned children because the mucous membranes are usually pink, regardless of skin color. Press the gums lightly for 1 to 2 seconds. Any residual color, such as that seen in jaundice or cyanosis, is more easily detected in blanched skin. Jaundice may also be noticed in the sclerae of the eyes. Generalized cyanosis is associated with respiratory and cardiac disorders. Jaundice is associated with liver disorders.

**PALPATION OF THE SKIN**

Palpation of the skin provides a sense of its characteristics: temperature, texture, moistness, and resilience or turgor. To evaluate these characteristics, lightly touch or stroke the skin surface. Follow standard precautions by wearing gloves when palpating mucous membranes, open wounds, and lesions. The following list provides details on each of the characteristics of skin palpation.

**Temperature**

The child’s skin normally feels cool to the touch when placing the wrist or dorsum of the hand against the child’s skin. Excessively warm skin may indicate the presence of fever or inflammation, whereas abnormally cool skin may be a sign of shock or cold exposure.

**Texture**

Children have soft, smooth skin over the entire body. Identify any areas of roughness, thickening, or induration (area of extra firmness with a distinct border). Abnormalities in texture are associated with endocrine disorders, chronic irritation, and inflammation.

**Moistness**

The child’s skin is normally dry to the touch. The skin may feel slightly damp when the child has been exercising or crying. Excessive sweating without exertion is associated with a fever or with an uncorrected congenital heart defect.

**Resilience**

The child’s skin is taut, elastic, and mobile because of the balanced distribution of intracellular and extracellular fluids.
To evaluate skin turgor, pinch a small amount of skin on the abdomen between the thumb and forefinger, release the skin, and watch the speed of recoil (Figure 35–2 ). Skin with good turgor rapidly returns to its previous contour. Skin with poor turgor tents or stands up rather than resuming its previous contour. Poor skin turgor is commonly associated with dehydration.

If edema, an accumulation of excess fluid in the interstitial spaces, is present, the skin feels doughy or boggy. To test for the degree of edema present, press for 5 seconds against a bone beneath the area of puffy skin, release the pressure, and observe how rapidly the indentation disappears. If the indentation disappears rapidly, the edema is "nonpitting." Slow disappearance of the indentation indicates "pitting" edema, which is commonly associated with kidney or heart disorders.

SKIN LESIONS

Skin lesions usually indicate an abnormal skin condition. Characteristics such as location, size, type of lesion, pattern, and discharge, if present, provide clues about the cause of the condition. Inspect and palpate the isolated or generalized skin color abnormalities, elevations, lesions, or injuries to describe all characteristics present.

Primary lesions (such as macules, papules, and vesicles) are often the skin's initial response to injury or infection. Mongolian spots and freckles are normal findings also classified as primary lesions. Secondary lesions (such as scars, ulcers, and fissures) are the result of irritation, infection, and delayed healing of primary lesions (see “Pathophysiology Illustrated—Skin Lesions” in Chapter 57). The illustrations in “Pathophysiology Illustrated” on page 974 describe common primary lesions.

CAPILLARY REFILL AND SMALL-VEIN FILLING TIMES

Two techniques can determine the adequacy of tissue perfusion (oxygen circulating to the tissues). When capillary refill time or small-vein filling times suggest that tissue perfusion is inadequate, immediately assess the child for shock or a physical constriction such as a cast or bandage that is too tight. The capillary refill time is normally less than 2 seconds (Figure 35–3A and B). The small-vein filling time is normally less than 4 seconds (Figure 35–3C and D).

SKIN LESIONS

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NURSING PRACTICE

The degree of dehydration, or weight loss caused by dehydration, can be estimated from the time it takes tented skin to return to its natural contour (Seidel, Ball, Dains et al., 2003).

<table>
<thead>
<tr>
<th>Weight Loss from Dehydration</th>
<th>Time to Return to Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5%</td>
<td>&lt; 2 sec</td>
</tr>
<tr>
<td>5% to 8%</td>
<td>2 to 3 sec</td>
</tr>
<tr>
<td>9% to 10%</td>
<td>3 to 4 sec</td>
</tr>
<tr>
<td>&gt; 10%</td>
<td>&gt; 4 sec</td>
</tr>
</tbody>
</table>

INSPECTION OF THE HAIR

Inspect the scalp hair for color, distribution, and cleanliness. The hair shafts should be evenly colored, shiny, and either curly or straight. Variation in hair color not caused by bleaching can be associated with a nutritional deficiency. Normally, hair is distributed evenly over the scalp. Investigate areas of hair loss. Hair loss in a child may result from tight braids or skin lesions such as ringworm (see “Fungal Infections” in Chapter 57). Notice any unusual hair growth patterns. An unusually low hairline on the neck or forehead may be associated with a congenital disorder such as hypothyroidism.

Children are frequently exposed to head lice. Inspect the individual hair shafts for small nits (lice eggs) that adhere to the hair (Figure 35–4). None should be present.
Pediatric Assessment

Capillary refill technique: A, Pinch the end of a finger until the skin is blanched. B, Quickly release the finger and watch the blood return to the veins. Count the seconds it takes for the color to return or veins to fill. Slow color return or vein filling time could be related to shock or constriction due to a tight bandage or cast. Small-vein filling time technique: C, Using the index finger, milk a vein on the dorsum of the hand or foot from proximal to distal. D, Release your pressure and color should return promptly.

Observe the distribution of body hair as other skin surfaces are exposed during examination. Fine hair covers most areas of the body. Body hair in unexpected places should be noted. For example, a tuft of hair at the base of the spine often indicates a spinal defect.

It is important to note the age at which pubic and axillary hair develops in the child. Development at an unusually young age is associated with precocious puberty.

Hypothyroidism may result in coarse, brittle hair. Part the hair in various spots over the head to inspect and palpate the scalp for crusting or other lesions. If lesions are present, describe them using the characteristics in “Pathophysiology Illustrated.”

ASSESSING THE HEAD FOR SKULL CHARACTERISTICS AND FACIAL FEATURES

What can cause a child’s head or face to be asymmetric? How does a normal fontanelle feel?

INSPECTION OF THE HEAD AND FACE

During early childhood the skull’s sutures permit expansion for brain growth. Infants and young children normally have a rounded skull with a prominent occipital area. The shape of the head changes during childhood, and the occipital area becomes less prominent. An abnormal skull shape can result from premature closure of the sutures. Children who were
CHAPTER 35

Common Primary Skin Lesions and Associated Conditions

Lesion Name: Macule
Description: Flat, nonpalpable, diameter < 1 cm (1/2 in.)
Example: Freckle, rubella, rubella, petechiae

Lesion Name: Patch
Description: Macule, diameter > 1 cm (1 in.)
Example: Vitiligo, Mongolian spot

Lesion Name: Papule
Description: Elevated, firm, diameter < 1 cm (1/2 in.)
Example: Warts, pigmented nevi

Lesion Name: Tumor
Description: Elevated, solid, diameter > 2 cm (1 in.)
Example: Neoplasm, hemangioma

Lesion Name: Vesicle
Description: Elevated, filled with fluid, diameter < 1 cm (1/2 in.)
Example: Early chicken pox, herpes simplex

Lesion Name: Nodule
Description: Elevated, firm, deeper in dermis than papule, diameter 1-2 cm (1/2 in.-1 in.)
Example: Erythema nodosum

Lesion Name: Bulla
Description: Vesicle diameter > 1 cm (1/2 in.)
Example: Burn blister

Lesion Name: Pustule
Description: Vesicle filled with purulent fluid
Example: Impetigo, acne

Lesion Name: Wheal
Description: Irregular elevated solid area of edematous skin
Example: Urticaria, insect bite
A, Inspecting for head lice with a fine-tooth comb. B, Nits on hair.

(B) Courtesy of Centers for Disease Control.

low-birth-weight infants often have a flat, elongated skull because the soft skull bones were flattened by the weight of the head early in infancy. Head flattening is also associated with the back-lying sleep positions in infants.

The head circumference of infants and young children is routinely measured until 3 years of age to ensure that adequate growth for brain development has occurred. The Clinical Skills Manual as well as the CD-ROM describes the proper technique for use of the tape measure. A larger-than-normal head is associated with hydrocephalus, and a smaller-than-normal head suggests microcephaly.

Inspect the child’s face for symmetry during several facial expressions such as resting, smiling, talking, and crying (Figure 35–5). Significant asymmetry may result from paralysis of trigeminal or facial nerves (cranial nerves V or VII), in utero positioning, and swelling from infection, allergy, or trauma.

Next inspect the face for unusual facial features such as coarseness, wide eye spacing, or disproportionate size. Tremors, tics, and twitching of facial muscles are often associated with seizures.

**PALPATION OF THE SKULL**

Palpate the skull in infants and young children to assess the sutures and fontanelles and to detect soft bones (see “As Children Grow”).

**Sutures**

Use your fingerpads to palpate each suture line. The edge of each bone in the suture line can be felt, but normally there is no separation of the two bones. If additional bone edges are felt, it may indicate a skull fracture. The suture lines of the skull are seldom palpated after 2 years of age. After that time the sutures rarely split.

**Fontanelles**

At the intersection of the sutures, palpate the anterior and posterior fontanelles. The fontanelle should feel flat and
The sutures are separations between the bones of the skull that have not yet joined. The fontanelles are formed at the intersection of these sutures where bone has not yet formed. Fontanelles are covered by tough membranous tissue that protects the brain. The posterior fontanelle closes between 2 and 3 months. The anterior fontanelle and sutures are palpable up to the age of 18 months.

A tense fontanelle, bulging above the margin of the skull, is an indication of increased intracranial pressure. A soft fontanelle, sunken below the margin of the skull, is associated with dehydration.

**Eye Size and Spacing**

Inspect the eyes and surrounding tissues simultaneously when examining facial features (Figure 35–6○). The eyes should be the same size but not unusually large or small. Observe for eye bulging, which can be identified by retracted eyelids or a sunken appearance. Bulging may be associated with a tumor, and a sunken appearance may reflect dehydration.

Next inspect the eyes to see if they are appropriately distanced from each other. Hypertelorism, or widely spaced eyes, can be a normal variation in children.

**Eyelids and Eyelashes**

Inspect the eyelids for color, size, position, mobility, and condition of the eyelashes. Eyelids should be the same color as surrounding facial skin and free of swelling or inflammation along the edges. Sebaceous glands that look like yellow striations are often present near the hair follicles. Eyelashes curl away from the eye to prevent irritation of the conjunctivae.

Inspect the conjunctivae lining the eyelids by pulling down the lower lid and then everting the upper lid. The conjunctivae should be pink and glossy. The lacrimal punctum, the opening for the lacrimal gland on each lid, is located near the medial canthus. No redness or excess tearing should be present.

When the eyes are open, inspect the level at which the upper and lower lids cross the eye. Each lid normally covers part of the iris but not any portion of the pupil. The lids

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**Assessing Eye Structures, Function, and Vision**

**Inspection of the External Eye Structures**

The function of the external and internal eye structures and related cranial nerves makes vision possible. Inspect the external eye structures, including the eyeballs, eyelids, and eye muscles. Test the function of cranial nerves II, III, IV, and VI, which innervate the eye structures. Equipment needed for this examination includes an ophthalmoscope, vision chart, penlight, small toy, and an index card or paper cup.

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**Developing Cultural Competence**

**Touching the Child’s Head**

The head is a sacred part of the body to Southeast Asians. Ask for permission before touching the infant’s head to palpate the sutures and fontanelles (Spector, 2000). When a Hispanic child is examined, however, not touching the head is considered bad luck.
should also close completely over the iris and cornea. Ptosis, drooping of the lid over the pupil, is often associated with injury to the oculomotor nerve, cranial nerve III. Sunset sign, in which the sclera is seen between the upper lid and the iris, may indicate retracted eyelids or hydrocephalus.

Inspect the eyes for the palpebral slant (Figure 35–7). The eyelids of most people open horizontally. Children of Asian descent often have an extra fold of skin, known as the epicanthal fold, covering all or part of the medial canthus of the eye. An upward or Mongolian slant is a normal finding in Asian children; however, children with Down syndrome also often have a Mongolian slant (Figure 35–8). A downward or anti-Mongolian slant is seen in some children as a normal variation.

**Eye Color**

Inspect the color of each sclera, iris, and bulbar conjunctiva. The sclera is normally white or ivory in darker-skinned children. Sclerae of another color suggest the presence of an underlying disease. For example, yellow sclerae indicate jaundice. Typically the iris is blue or light colored at birth and becomes pigmented within 6 months. Inspect the iris for the presence of Brushfield spots, white specks in a linear pattern around the iris circumference, which are often associated with Down syndrome. The bulbar conjunctivae, which cover the sclera to the edge of the cornea, are normally clear. Redness can indicate eyestrain, allergies, or irritation.

**Pupils**

Inspect the pupils for size and shape. Normally the pupils are round, clear, and equal in size. Some children have a coloboma, a keyhole-shaped pupil caused by a notch in the iris. This sign can indicate that the child has other congenital anomalies.

To test the pupillary response to light, shine a bright light into one eye. A brisk constriction of both the pupil exposed to direct light and the other pupil is a normal finding. To test pupillary response to accommodation, ask the child to look first at a near object (for example, a toy) and then at a distant object (for example, a picture on the wall). The expected response is pupil constriction with near objects and pupil dilation with distant objects. This procedure tests the optic nerve, cranial nerve II.

**INSPECTION OF THE EYE MUSCLES**

It is important to detect strabismus, or crossed eyes, because if uncorrected it can cause vision impairment. The evaluation of extraocular movements, the corneal light reflex, and the cover-uncover test are used to detect a muscle imbalance.
Begin the eye muscle examination with inspection of the extraocular movements. Have the child sit at your eye level. Hold a toy or penlight about 30 cm (12 in.) from the child’s eyes and move it through the six cardinal fields of gaze. Both eyes should move together, tracking the object. This procedure tests cranial nerves III, IV, and VI.

**Extraocular Movements**

Seat the child at eye level to evaluate the extraocular movements. Hold a toy or penlight 30 cm (12 in.) from the child’s eyes and move it through the six cardinal fields of gaze. The child’s head may need to be held still until fine motor eye movement develops. Both eyes should move together, tracking the object. This procedure tests the oculo-motor, trochlear, and abducens nerves (cranial nerves III, IV, and VI) (Figure 35–9).

**Corneal Light Reflex**

To test the corneal light reflex, shine a light on the child’s nose, midway between the eyes. Identify the location where the light is reflected on each eye. The light reflection is normally symmetric, at the same spot on each cornea (see Figure 35–6). An asymmetric corneal light reflex indicates strabismus.

**Cover-Uncover Test**

The cover-uncover test can be used to test for eye muscle weakness for older, cooperative children, usually at about 4 or 5 years. See Figure 35–10 for the technique. Because the eyes work together, no obvious movement of either eye is expected. Eye movement indicates a muscle imbalance.

**VISION ASSESSMENT**

Because vision is such an important sense for learning, assessment is essential to detect any serious problems. Vision is evaluated using an age-appropriate vision test, but no simple method exists. It is possible to assess vision in infants and children by observing their behavior in response to certain maneuvers and during play.

**Infants and Toddlers**

When the infant’s eyes are open, test the blink reflex by moving your hand quickly toward the infant’s eyes. A quick blink is the normal response. Absence of the blink reflex can indicate that the infant is blind.

To test an infant’s ability to visually track an object, hold a light or toy about 15 cm (6 in.) from the infant’s
Research has discovered that newborns have vision good enough at birth to prefer faces to other patterns and to follow a moving object. The child’s visual acuity develops during early childhood (Seidel et al., 2003).

<table>
<thead>
<tr>
<th>Age</th>
<th>Visual Acuity</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 years</td>
<td>20/40</td>
</tr>
<tr>
<td>4 years</td>
<td>20/40</td>
</tr>
<tr>
<td>5 years</td>
<td>20/30</td>
</tr>
<tr>
<td>6 years</td>
<td>20/20</td>
</tr>
</tbody>
</table>

Once an infant has developed skills to reach for and then pick up objects, observe play behavior to evaluate vision. The ability to easily find and pick up small toys is a good indicator of vision in children under 3 years of age.

**Standardized Vision Charts**

Standardized vision charts cannot be used to test vision until the child can understand directions and can cooperate, usually at about 3 or 4 years of age. The Snellen E chart, HOTV chart, and the Picture chart are used to test visual acuity of preschool-age children just as the Snellen Letter chart is used for school-age children and adolescents. Skills 9–18 through 9–19 in the Clinical Skills Manual, as well as the accompanying CD-ROM, describes the use of these charts.

**Nursing Practice**

Indications for further evaluation include visual acuity of 20/40 or less in either eye by 3 to 5 years of age, visual acuity of 20/30 or less in either eye by 6 years of age, or a difference in vision of 2 lines or more on the Snellen eye chart between the eyes, even within the passing range (American Academy of Pediatrics, 2003).

**Inspection of the Internal Eye Structures**

The funduscopic examination allows inspection of the internal eye structures—the retina, optic disc, arteries and veins, and macula (Figure 35–11). The ophthalmoscope is a complex instrument and requires practice to master. The examination is difficult to perform on uncooperative children, and most often it is performed by experienced examiners.

Darken the room so the child’s pupils dilate. Explain the procedure to the child to gain his or her cooperation. Have a picture on the wall or have the parent or assistant hold a toy for the child to stare at so that the child’s eye will not have to be held open forcibly.

**Using the Ophthalmoscope**

The ophthalmoscope has a lens-and-mirror system and a bright light for inspecting the structures of the internal eye. Turn the ophthalmoscope on and set the lens power at 0. Keep a forefinger on the disk to change the lens power as needed. Look through the lens of the ophthalmoscope, stabilizing it by resting the top against an eyebrow and the handle against a cheek. Use your right eye to examine the child’s right eye and your left eye to examine the child’s left eye. This position is best for visualizing the eye, and it reduces direct exposure to infection. Place a hand on the child’s head for stabilization.

**Red Reflex.** Shine the ophthalmoscope light at the child’s eye from a distance of 30 cm (12 in.). The first image seen is the red reflex, the red glow of the vascular retina. When the red reflex is seen, the ophthalmoscope is being used correctly and the child’s lens is clear. The red reflexes should be equal in color, intensity, and clarity (American Academy of Pediatrics Section on Ophthalmology, 2002). Black spots or opacities within the red reflex are abnormal and may indicate congenital cataracts. If a white reflex is seen rather than a red reflex, a retinoblastoma may be present. The red reflex can also be tested by shining a small flashlight into the eye.

**Visualizing the Internal Eye Structures.** Slowly move closer to the child. Deeper levels of the vitreous humor are inspected before the pink retina comes into view. The retina is a deeper pink in dark-skinned children. A blood vessel is the first retinal structure usually seen. Continue moving closer to the child’s eye and adjust the plus or minus lenses to focus on this blood vessel. Retinal arteries appear smaller and brighter red than veins. The blood vessels branch to spread and cover the retina.
Inspect and follow the branching of the blood vessels toward the nose until they merge into the optic disc. Dark areas along the blood vessels may indicate retinal hemorrhages. Carefully inspect sites where arteries and veins cross. Notches and indentations at these sites are associated with hypertension.

The optic disc margin is normally sharply defined, round, and yellow to creamy pink. Blurring of the disc margins or bulging of the optic disc is a sign of increased intracranial pressure. Use the diameter of the optic disc to identify the location of other landmarks on the retina.

The macula is located approximately 2 disc diameters lateral to the optic disc. To see the macula, ask the child to look at the light. It appears as a yellow dot surrounded by deep pink. The macula is inspected last because the bright light causes the child to blink and look away.

ASSESSING THE EAR STRUCTURES AND HEARING

Equipment needed for this examination includes an otoscope, noisemakers (bell, rattle, tissue paper), and a tuning fork 500 to 1000 Hz.

INspeCTION OF THE EXTERNAL EAR STRUCTURES

The position and characteristics of the pinna, the external ear, are inspected as a continuation of the head and eye examination. The pinna is considered “low set” when the top lies completely below an imaginary line drawn through the medial and lateral canthi of the eye toward the ear. Low-set ears are often associated with congenital renal disorders (Figure 35–12).

Inspect the pinna for any malformation. The pinna should be completely formed, with an open auditory canal. Next, inspect the tissue around the pinna for abnormalities. A pit or hole in front of the auditory canal may indicate the presence of a sinus. If the pinna protrudes outward, there may be swelling behind the ear, a sign of mastoiditis.

Inspect the external auditory canal for any discharge. A foul-smelling, purulent discharge may indicate the presence of a foreign body or an infection in the external canal. Clear fluid or a blood-tinged discharge may indicate a cerebrospinal fluid leak caused by a basilar skull fracture.

INSPECTION OF THE TYMPANIC MEMBRANE

Examination of the tympanic membrane is important in infants and young children because they are prone to otitis media, a middle ear infection. The eustachian tubes are shorter, wider, and more horizontally positioned in infants and young children than in older children and adults. This positioning enables bacteria to move up the eustachian tube from the pharynx, causing an infection. See As Children Grow: Eustachian Tube in Chapter 45.

The otoscope, an instrument with a magnifying lens, bright light, and speculum, is used to examine the internal auditory canal and tympanic membrane. Infants and young children often resist having their ears inspected with the otoscope because of past painful experiences. For that reason it may be wise to delay the otoscopic examination until portions of the assessment requiring cooperation are completed. Use simple explanations to prepare the child. Let the child play with the otoscope or demonstrate how it is used on the parent or a doll. Figure 35–13 illustrates one method for restraining an uncooperative child. See also Skill 7–3 in the Clinical Skills Manual.

Using the Otoscope

To begin the otoscopic examination, hold the handle of the otoscope in the palm with the thumb pointed toward the base of the handle. If using a pneumatic squeeze bulb, hold...
To straighten the auditory canal, pull the pinna back and up for children over 3 years of age. Pull the pinna down and back for children under 3 years of age.

**FIGURE 35–13**

To restrain an uncooperative child, place the child prone on the examining table. Have an assistant hold the child's arms next to the head to restrain the child's head movements. Restrain the child's body movements by lying across the child's body. Keep your hands free to hold the otoscope and position the external ear.

**FIGURE 35–14**

To straighten the auditory canal, pull the pinna back and up for children over 3 years of age. Pull the pinna down and back for children under 3 years of age.

Slowly insert the speculum into the auditory canal, inspecting the walls for signs of irritation, discharge, or a foreign body. The walls of the auditory canal are normally pink, and some cerumen is present. Children often put beads, peas, or other small objects into their ears. If the auditory canal is obstructed by cerumen or a foreign body, warm water irrigation can be used to clean the canal.

**NURSING PRACTICE**

Never irrigate the ear canal if any discharge is present, the tympanic membrane may be ruptured. Water could enter the middle ear and potentially worsen the infection.

The tympanic membrane, which separates the outer ear from the middle ear, is usually pearly gray and translucent. It reflects light, and the bones (ossicles) in the middle ear are normally visible (Figure 35–15 ). When the pneumatic attachment is squeezed, the tympanic membrane normally moves in and out in response to the positive and negative pressure applied. Table 35–7 lists the abnormal findings of a tympanic membrane examination and their associated conditions.

**HEARING ASSESSMENT**

Hearing evaluation is important in children of all ages because hearing is essential for normal speech development and learning. Often hearing must be evaluated by inspection of the child's responses to various auditory stimuli. Hearing loss may occur at any time during early childhood as the result of birth trauma, frequent otitis media, meningitis, or antibiotics that damage cranial nerve VIII. Hearing loss may also be associated with congenital anomalies and genetic syndromes.

Use hearing and speech articulation milestones as an initial hearing screen. Select an age-appropriate method to screen hearing. When a hearing deficiency is suspected as a result of screening, refer the child for audiometry, tympanometry, or evoked response to obtain the most accurate evaluation of hearing. See Skills 9–20 and 9–21 in the Clinical Skills Manual.

**GROWTH AND DEVELOPMENT**

Indicators of hearing loss in an infant:
- No startle reaction to loud noises
- Does not turn toward sounds by 4 months of age
- Babbles as a young infant but does not keep babbling or develop speech sounds after 6 months of age

Indicators of hearing loss in a young child:
- No speech by 2 years of age
- Speech sounds are not distinct at appropriate ages
Infants and Toddlers
Select noisemakers with different frequencies, such as a rattle, bell, and tissue paper, that will attract the young child's attention. Ask the parent or an assistant to entertain the infant with a quiet toy, such as a teddy bear. Stand behind the infant, about 2 feet (60 cm) away from the infant's ear but outside the infant's field of vision, and make a soft sound with the noisemaker. Have the parent or assistant observe the child for any of the following responses when the noisemaker is used: widening the eyes, briefly stopping all activity to listen, or turning the head toward the sound. Repeat the test in the other ear and with the other noisemakers.

Preschool and Older Children
Use whispered words to evaluate the hearing of children over 3 years of age. Position your head about 12 inches (30 cm) away from the child's ear, but out of the range of vision so the child cannot read your lips. Use words easily recognized by the child, such as Mickey Mouse, hot dog, and Popsicle, and ask the child to repeat the words. Repeat the

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**TABLE 35-7** Unexpected Findings on Examination of the Tympanic Membrane and Their Associated Conditions

<table>
<thead>
<tr>
<th>Characteristics of Tympanic Membrane</th>
<th>Unexpected Findings</th>
<th>Associated Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Redness</td>
<td>Infection in middle ear</td>
</tr>
<tr>
<td></td>
<td>Slight redness</td>
<td>Prolonged crying</td>
</tr>
<tr>
<td></td>
<td>Amber</td>
<td>Serous fluid in middle ear</td>
</tr>
<tr>
<td></td>
<td>Deep red or blue</td>
<td>Blood in middle ear</td>
</tr>
<tr>
<td>Light reflex</td>
<td>Absent</td>
<td>Bulging tympanic membrane, infection in middle ear</td>
</tr>
<tr>
<td></td>
<td>Distorted, loss of triangular shape</td>
<td>Retracted tympanic membrane, serous fluid in middle ear</td>
</tr>
<tr>
<td>Bony landmarks</td>
<td>Extra prominent</td>
<td>Retracted tympanic membrane, serous fluid in middle ear</td>
</tr>
<tr>
<td>Movement</td>
<td>No motility</td>
<td>Infection or fluid in middle ear</td>
</tr>
<tr>
<td></td>
<td>Excess motility</td>
<td>Healed perforation</td>
</tr>
</tbody>
</table>
test with different words in the opposite ear. The child should correctly repeat the whispered words.

**NURSING PRACTICE**

An alternative procedure is used to assess hearing when the child will not cooperate by repeating whispered words. In a whisper, direct the child to point to different parts of the body or objects, for example, “Show me your eyes” and “Point to your mouth.” Children should point to the correct body part each time.

**Bone and Air Conduction of Sound**

Use a tuning fork to evaluate the hearing of school-age children who can follow directions. Stroke the tines of the tuning fork to begin the vibration. Avoid touching the vibrating tines, which will dampen the sound. Test bone conduction by placing the handle of the tuning fork on the child’s skull. Test air conduction by holding the vibrating tines close to the child’s ear (Figure 35–16)

To perform the *Weber test*, place the vibrating tuning fork on top of the child’s skull in the midline. Ask the child to say where the sound is heard best, either in both ears equally or in one ear. The sound should be heard equally in both ears.

To perform the *Rinne test*, place the vibrating tuning fork handle on the mastoid process behind an ear. Ask the child to say when the sound is no longer heard. Immediately move the tuning fork, holding the vibrating tines about 2.5 to 5 cm (1 to 2 in.) from the same ear. Again, ask the child to indicate when the sound is no longer heard. The child normally hears the air-conducted sound twice as long as the bone-conducted sound. Repeat the Rinne test on the other ear. Table 35–8 provides an interpretation of the Weber and Rinne tests.

<table>
<thead>
<tr>
<th>Test and Result</th>
<th>Associated Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Weber Test</em></td>
<td></td>
</tr>
<tr>
<td>Sound heard equally in both ears</td>
<td>No hearing loss</td>
</tr>
<tr>
<td>Sound heard better in one ear</td>
<td>Conductive hearing loss if sound</td>
</tr>
<tr>
<td>(lateralized)</td>
<td>lateralized to deaf ear</td>
</tr>
<tr>
<td><em>Rinne Test</em></td>
<td></td>
</tr>
<tr>
<td>Sound heard by air conduction</td>
<td>No hearing loss</td>
</tr>
<tr>
<td>twice as long as bone conduction</td>
<td></td>
</tr>
<tr>
<td>Sound heard longer by bone</td>
<td>Conductive hearing loss in affected ear</td>
</tr>
<tr>
<td>conduction than air conduction</td>
<td></td>
</tr>
<tr>
<td>Sound heard longer by air</td>
<td>Sensorineural hearing loss in</td>
</tr>
<tr>
<td>conduction than bone conduction</td>
<td>affected ear</td>
</tr>
<tr>
<td>but less than twice as long</td>
<td></td>
</tr>
</tbody>
</table>

**ASSESSING THE NOSE AND SINUSES FOR AIRWAY PATENCY AND DISCHARGE**

An otoscope with a nasal speculum or a penlight is needed for this examination.

**INSPECTION OF THE EXTERNAL NOSE**

Examine the external nose characteristics and placement on the face simultaneously with the facial features. Inspect the external nose for size, shape, symmetry, and midline placement on the face. The nose should be proportional in
size to other facial features and positioned in the middle of the face. A flattened nasal bridge is the expected finding in Asian and black children.

The nasolabial folds are normally symmetric. Asymmetry of the nasolabial folds may be associated with injury to the facial nerve (cranial nerve VII). A saddle-shaped nose is associated with congenital defects such as cleft palate.

Inspect the external nose for unusual characteristics. For example, a crease across the nose between the cartilage and bone is often caused by the allergic child’s wiping an itchy nose upward with a hand.

**PALPATION OF THE EXTERNAL NOSE**
When a deformity is noted, gently palpate the nose to detect any pain or break in contour. No tenderness or masses are expected. Pain and a contour deviation are usually the result of trauma.

**Nasal Patency**
The child’s airway must be patent to ensure adequate oxygenation. To test for nasal patency, occlude one nostril and observe the child’s effort to breathe through the open nostril with the mouth closed. Repeat the procedure with the other nostril. Breathing should be noiseless and effortless. **Nasal flaring**, an effort the child makes to widen the airway, is a sign of respiratory distress and should not be present.

**INSPECTION OF THE INTERNAL NOSE**
Inspect the internal nose for color of the mucous membranes and the presence of any discharge, swelling, lesions, or other abnormalities. Use a bright light, such as an otoscope light or penlight. For infants and young children, push the tip of the nose upward and shine the light at the end of the nose. The nasal speculum of the otoscope can be used in older children (Figure 35–17). Avoid touching the septum of the nose with the speculum. Injury to the septum can cause a nosebleed.

**Mucous Membranes and Nasal Septum**
The mucous membranes should be dark pink and glistening. A film of clear discharge may also be present. Turbinates, if visible, should be the same color as the mucous membranes and have a firm consistency. When the turbinates are pale or bluish gray, the child may have allergies. A polyp, a rounded mass projecting from the turbinate, is also associated with allergies. The nasal septum should be straight without perforations, bleeding, or crusting. Crusting will be noted over the site of a nosebleed.

**Discharge**
Observe for the presence of nasal discharge, noting if the drainage is from one or both nares. Nasal discharge is not a normal finding unless the child is crying. Discharge may be watery, mucoid, purulent, or bloody, depending on the condition present. A foul-smelling discharge in only one nostril is often associated with a foreign body. Table 35–9 lists conditions associated with nasal discharge.
INSPECTION OF THE SINUSES

The illustration in “As Children Grow” shows how the maxillary and ethmoid sinuses develop during early childhood. Sinus infections can occasionally occur in young children. Suspect a sinus problem when the child has a headache or pain and swelling around one or both eyes.

Inspect the face for any puffiness and swelling around one or both eyes. Puffiness and swelling are not normally present. To palpate over the maxillary sinuses, press up under both zygomatic arches with the thumbs. To palpate the ethmoid sinuses, press up against the bone above both eyes with the thumbs. No swelling or tenderness is expected. Tenderness may indicate sinusitis.

TABLE 35-9  Nasal Discharge Characteristics and Associated Conditions

<table>
<thead>
<tr>
<th>Discharge Description</th>
<th>Associated Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watery</td>
<td>Allergy</td>
</tr>
<tr>
<td>Clear, bilateral</td>
<td>Spinal fluid from fracture of cribriform plate</td>
</tr>
<tr>
<td>Serous, unilateral</td>
<td></td>
</tr>
<tr>
<td>Mucoid or purulent</td>
<td>Upper respiratory infection</td>
</tr>
<tr>
<td>Bilateral</td>
<td>Foreign body</td>
</tr>
<tr>
<td>Unilateral</td>
<td></td>
</tr>
<tr>
<td>Bloody</td>
<td>Nose bleed, trauma</td>
</tr>
</tbody>
</table>

ASSESSING THE MOUTH AND THROAT FOR COLOR, FUNCTION, AND SIGNS OF ABNORMAL CONDITIONS

Equipment needed to examine the mouth and throat includes a tongue blade and penlight.

INSPECTION OF THE MOUTH

Young children often need coaxing and simple explanations before they will cooperate with the mouth and throat examination. Most children readily show their teeth. If the child resists by clenching the teeth, they can be gently separated with a tongue blade. Wear gloves when examining the mouth (Figure 35–18 ).

AS CHILDREN GROW

Growth and Development of Sinuses

Sinuses grow and develop during childhood. Maxillary sinuses can be identified in 1-year-old children. Ethmoid sinuses have developed in children by 6 years of age. Sinus problems under 7 years occur infrequently.
CHAPTER 35

The structures of the mouth.

**FIGURE 35–18**

- Hard palate
- Soft palate
- Palatoglossal arch
- Palatopharyngeal arch
- Uvula
- Oropharynx
- Palatine tonsil
- Tongue

Mouth Odors

During inspection of the teeth, be alert to any abnormal odors that may indicate problems such as diabetic ketoacidosis, infection, or poor hygiene. Be alert for alcohol odors in older children that could signal substance abuse.

Gums

Inspect the gums for color and adherence to the teeth. The gums are normally pink, with a stippled or dotted appearance. Use a tongue blade to help visualize the gums around the upper and lower molars. No raised or receding gum areas should be apparent around the teeth. When inflammation, swelling, or bleeding is observed, palpate the gums to detect tenderness. Inflammation and tenderness are associated with infection and poor nutrition.

Buccal Mucosa

Inspect the mucous membrane lining the cheeks for color and moisture. The mucous membrane is usually pink, but patches of hyperpigmentation are commonly seen in darker-skinned children. The Stensen duct, the parotid gland opening, is opposite the upper second molar bilaterally. Normally pink, the duct opening becomes red when the child is infected with mumps. Small pink sucking pads can be present in infants. No areas of redness, swelling, or ulcerative lesions should be present.

Tongue

Inspect the tongue for color, moistness, size, tremors, and lesions. The child's tongue is normally pink and moist, without a coating, and it fits easily into the mouth. A pattern of gray, irregular borders that form a design (geographic tongue) is often normal, but it may be associated with fever, allergies, or drug reactions. Tremors are abnormal. A white adherent coating on an infant’s tongue may be caused by thrush, a *Candida* infection.

Observe the mobility of the tongue. Ask the child to touch the gums above the upper teeth with the tongue. This tongue movement is adequate to enunciate all speech sounds clearly. Ask the child to stick out the tongue and lift it so the underside of the tongue and the floor of the mouth can be inspected for distended veins.

Palate

Inspect the hard and soft palate to detect any clefts or masses or an unusually high arch. The palate is normally pink, with a dome-shaped arch and no cleft. The uvula hangs freely from the soft palate. Newborns often have Ep-
stein pearls, white papules in the midline of the palate that disappear in a few weeks. A high-arched palate can be associated with sucking difficulties in young infants.

**PALPATION OF THE MOUTH STRUCTURES**

Palpate any masses seen in the mouth to determine their characteristics, such as size, shape, firmness, and tenderness. No masses should be found.

**Tongue**

To assess the tongue’s strength, while simultaneously testing the hypoglossal nerve (cranial nerve XII), place the index finger against the child’s cheek and ask the child to push against your finger with the tongue. Some pressure against the finger is normally felt.

**Palate**

To palpate the palate, insert the little finger, with the fingerpad upward, into the mouth. While the infant sucks against your finger, palpate the entire palate. This procedure also tests the strength of the sucking reflex, innervated by the hypoglossal nerve (cranial nerve XII). No clefts should be palpated.

**INSPECTION OF THE THROAT**

Inspect the throat for color, swelling, lesions, and the condition of the tonsils. Ask the child to open the mouth wide and stick out the tongue. Illuminate the throat with a flashlight. Use a tongue blade, if needed, to visualize the posterior pharynx. Moistening the tongue blade may decrease the child’s tendency to gag. The throat is normally pink without lesions, drainage, or swelling. Swelling or bulging in the posterior pharynx may be associated with a peritonsillar abscess.

**Tonsils**

During childhood the tonsils are large in proportion to the size of the pharynx because lymphoid tissue grows fastest in early childhood. The tonsils should be pink without exudate, but crypts (fissures) may be present as a result of prior infections. The size of the tonsils can be graded as indicated in the “Pathophysiology Illustrated” diagram.
Gag Reflex

Use a tongue blade when you are unable to see the posterior pharynx or need to test the gag reflex. Do this at the end of the examination because children dislike the gagging sensation. Prepare the child for what will happen. Ask the child to say “Ah.” A symmetric rising movement of the uvula is observed. If the uvula does not rise or rises to one side, cranial nerves IX and X may be paralyzed. The epiglottis lies behind the tongue and is normally pink like the rest of the buccal mucosa.

ASSESSING THE NECK FOR CHARACTERISTICS, RANGE OF MOTION, AND LYMPH NODES

INSPECTION OF THE NECK

Inspect the neck for size, symmetry, swelling, and any abnormalities. A short neck with skin folds is normal for infants. The neck is normally symmetric. No swelling should be present. Swelling may be caused by local infections such as mumps or a congenital defect. The neck lengthens between 3 and 4 years of age.

Inspect the child’s neck for webbing, an extra skin fold on each side of the neck. Webbing is commonly associated with Turner syndrome. See “Turner Syndrome” in Chapter 56.

Infants develop head control by 2 months of age. By this age an infant can lift the head up and look around when lying on the stomach. A lack of head control can result from neurologic injury, such as an anoxic episode.

PALPATION OF THE NECK

Face the child and use your fingerpads to simultaneously palpate both sides of the neck for lymph nodes, as well as the trachea and thyroid.
Lymph Nodes
To palpate the lymph nodes, slide your fingerpads gently over the lymph node chains in the head and neck. The sequence for lymph node palpation is as follows: around the ears, under the jaw, the occipital area, and the cervical chain in the neck (Figure 35–20). Firm, clearly defined, non-tender, movable lymph nodes up to 1 cm (1/2 in.) in diameter are common in young children. Enlarged, firm, warm, tender lymph nodes indicate a local infection.

Trachea
Palpate the trachea to determine its position and to detect the presence of any masses. The trachea is normally in the midline of the neck. It is difficult to palpate in children less than 3 years of age because of their short necks. To palpate the trachea, place your thumb and forefinger on each side of the child’s trachea near the chin and slowly slide them down the trachea. Any shift to the right or left of midline may indicate a tumor or a collapsed lung.

Thyroid
As the fingers slide over the trachea in the lower neck, attempt to feel the isthmus of the thyroid, a band of glandular tissue crossing over the trachea. The lobes of the thyroid wrap behind the trachea and are normally covered by the sternocleidomastoid muscle. Because of the anatomic position of the thyroid, its lobes are not usually palpable in the child unless they are enlarged.

RANGE OF MOTION ASSESSMENT
To test the neck’s range of motion, ask the child to touch the chin to each shoulder and to the chest and then to look at the ceiling. Move a light or toy in all four directions when assessing infants. Children should freely move the neck and head in all four directions without pain.

When the child is unable to move the head voluntarily in all directions, passively move the child’s neck through the expected range of motion. Limited horizontal range of motion may be a sign of torticollis, persistent head tilting. Torticollis results from a birth injury to the sternocleidomastoid muscle or from unilateral vision or hearing impairment. Pain with flexion of the neck toward the chest (Brudzinski’s sign) may indicate meningitis. See “meningitis” in Chapter 53.

ASSESSING THE CHEST FOR SHAPE, MOVEMENT, RESPIRATORY EFFORT, AND LUNG FUNCTION
What terms describe the location of specific sounds heard when auscultating the chest? What are retractions and what do they indicate? How can normal and adventitious breath sounds be distinguished when auscultating the lungs?

Examination of the chest includes the following procedures: inspecting the size and shape of the chest, palpating chest movement that occurs during respiration, observing
the effort of breathing, and auscultating breath sounds. A stethoscope is needed.

**TOPOGRAPHIC LANDMARKS OF THE CHEST**

The chest skeleton provides most of the landmarks used to describe the location of findings during examination of the chest, lungs, and heart. The intercostal spaces are the horizontal markers. The sternum and spine are the vertical landmarks. When both a horizontal and a vertical landmark are used, the location of findings can be precisely described on the right or left side of the patient’s chest (Figures 35–21 and 35–22).

**INSPECTION OF THE CHEST**

Position the child on the parent’s lap or on the examining table with all clothing above the waist removed to inspect the chest. The thoracic muscles and subcutaneous tissue are less developed in children than in adults, so the chest wall is thinner. As a result the rib cage is more prominent.

**Size and Shape of the Chest**

Inspect the chest for any irregularities in shape. A chest is considered rounded when the anteroposterior diameter is approximately equal to the lateral diameter. If a child over 2 years of age has a rounded chest, a chronic obstructive lung condition such as asthma or cystic fibrosis may be present.

**GROWTH AND DEVELOPMENT**

In infants the chest is rounded with the anteroposterior diameter approximately equal to the lateral diameter. The chest becomes more oval with growth. By 2 years of age the lateral diameter is greater than the anteroposterior diameter.

An abnormal chest shape results from two different structural deformities (Figure 35–23). If the sternum protrudes, increasing the anteroposterior diameter, pigeon chest (pectus carinatum) may be present. If the

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**FIGURE 35–21**

Intercostal spaces and ribs are numbered to describe the location of findings. **A**, To determine the rib number on the anterior chest, palpate down from the top of the sternum until a horizontal ridge, the angle of Louis, is felt. Directly to the right and left of that ridge is the second rib. The second intercostal space is immediately below the second rib. Ribs 3–12 and the corresponding intercostal spaces can be counted as the fingers move toward the abdomen. **B**, To determine the rib number on the posterior chest, find the protruding spinal process of the seventh cervical vertebra at the shoulder level. The next spinal process belongs to the first thoracic vertebra, which attaches to the first rib.
lower portion of the sternum is depressed, decreasing the anteroposterior diameter, funnel chest (pectus excavatum) may be present. Scoliosis, curvature of the spine, causes a lateral deviation of the chest. See “Scoliosis” in Chapter 55.

**Chest Movement and Respiratory Effort**

Inspect for simultaneous chest expansion and abdominal rise. Chest movement is normally symmetric bilaterally, rising with inspiration and falling with expiration. The chest movement of infants and young children is less pronounced than the abdominal movement. The diaphragm is the primary breathing muscle in infants and children under 6 years old. The thoracic muscles are less developed and serve as accessory muscles in cases of respiratory distress. As the thoracic muscles develop, they become primarily responsible for ventilation. On inspiration the chest and abdomen should rise simultaneously. Asymmetric chest rise is associated with a collapsed lung. **Retractions,** depression of sections of the chest wall with each inspiration, are seen when the accessory muscles are used for breathing in cases of respiratory distress.
Respiratory Rate

Because young children use the diaphragm as the primary breathing muscle, observe or feel the rise and fall of the abdomen to count the respiratory rate in children under age 6 years (see Skill 9–9 in the Clinical Skills Manual). Table 35–10 gives the normal respiratory rates for each age group. Make every effort to count the respiratory rate when the child is quiet. The respiratory rate rises in response to excitement, fear, respiratory distress, fever, and other conditions that increase oxygen needs.

TABLE 35–10 Normal Respiratory Rate Ranges for Each Age Group

<table>
<thead>
<tr>
<th>Age</th>
<th>Respiratory Rate per Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>30–60</td>
</tr>
<tr>
<td>1 year</td>
<td>20–40</td>
</tr>
<tr>
<td>3 years</td>
<td>20–30</td>
</tr>
<tr>
<td>6 years</td>
<td>16–22</td>
</tr>
<tr>
<td>10 years</td>
<td>16–20</td>
</tr>
<tr>
<td>17 years</td>
<td>12–20</td>
</tr>
</tbody>
</table>

A sustained respiratory rate greater than 60 breaths per minute is an important sign in respiratory distress. At that rate, children develop hypoxemia if treatment is not started. The child’s airway is very narrow, resulting in higher airway resistance than occurs in adults. When the respiratory rate exceeds 60 breaths per minute, inspired oxygen does not reach the alveoli for gas exchange because air moves no farther than the upper airway (Eichelberger, Ball, Pratsch et al., 1998).

PALPATION OF THE CHEST

Use palpation to evaluate chest movement, respiratory effort, deformities of the chest wall, and tactile fremitus.

Chest Wall

To palpate the chest motion with respiration, place your palms and outspread fingers on each side of the child’s chest. Confirm the bilateral symmetry of chest motion. Use your fingerpads to palpate any depressions, bulges, or unusual chest wall shape that might indicate abnormal findings such as tenderness, cysts, other growths, crepitus, or fractures. None should be found. Crepitus, a crinkly sensation palpated on the chest surface, is caused by air escaping into the subcutaneous tissues. It often indicates a serious injury to the upper or lower airway. Crepitus may also be felt near a fracture.

Tactile Fremitus

Crying and talking produce vibrations, known as tactile fremitus, that can be palpated on the chest. Place the palms of your hands on each side of the chest to evaluate the quality and distribution of these vibrations. Ask the child to repeat a series of words or numbers, such as Mickey Mouse or ice cream. As the child repeats the words, move your hands systematically over the anterior and posterior chest, comparing the quality of findings side to side. The vibration or tingling sensation is normally palpated over the entire chest. Decreased sensations indicate that air is trapped in the lungs, as occurs with asthma. Increased sensations indicate lung consolidation, as occurs with pneumonia.

AUSCULTATION OF THE CHEST

Auscultate the chest with a stethoscope to assess the quality and characteristics of breath sounds, to identify abnormal breath sounds, and to evaluate vocal resonance. Use an infant or pediatric stethoscope when available to help localize any unexpected breath sounds. Use the stethoscope diaphragm because it transmits the high-pitched breath sounds better.

Breath Sounds

Evaluate the quality and characteristics of breath sounds over the entire chest, comparing sounds between the sides. Select a routine sequence for auscultating the entire chest so assessment of all lobes of the lungs will be consistently performed. Figure 35–24 shows one suggested chest auscultation sequence. Listen to an entire inspiratory and expiratory phase at each spot on the chest before moving to the next site.
Three types of normal breath sounds are usually heard when the chest is auscultated. *Vesicular breath sounds* are low-pitched, swishing, soft, short expiratory sounds. They are usually heard in older children but not in infants and young children. *Bronchovesicular breath sounds* are medium-pitched, hollow, blowing sounds heard equally on inspiration and expiration in all age groups. The location of these sounds on the chest is related to the child’s developmental status. *Bronchial/tracheal breath sounds* are hollow and higher pitched than vesicular breath sounds.

Breath sounds normally have equal intensity, pitch, and rhythm bilaterally. Absent or diminished breath sounds generally indicate a partial or total obstruction, such as from a foreign body or mucus, that does not permit airflow.

**Vocal Resonance**

Auscultate the chest to evaluate how well voice sounds are transmitted. Have the child repeat a series of words, either the same as or different from those used for evaluating tactile fremitus. Use the stethoscope to auscultate the chest, comparing the quality of sounds from side to side and over the entire chest. Voice sounds, with words and syllables muffled and indistinct, are normally heard throughout the chest.

If voice sounds are absent or more muffled than usual, an airway obstruction condition such as asthma may be present. When a lung consolidation condition such as pneumonia is
present, the vocal resonance quality changes in characteristic ways. These abnormal characteristics are called whispered pectoriloquy, bronchophony, and egophony. Whispered pectoriloquy is present when syllables are heard distinctly in a whisper. Bronchophony is the increased intensity and clarity of sounds while the words remain indistinct. Egophony is the transmission of the “eee” sound as a nasal “ay” sound.

Abnormal Breath Sounds
Abnormal breath sounds, also called adventitious sounds, generally indicate disease. Examples of abnormal breath sounds are crackles, rhonchi, and friction rubs. To further assess abnormal breath sounds, the examiner determines their location, the respiratory phase in which they are present, and whether they change or disappear when the child coughs or shifts position. To routinely identify these adventitious sounds takes practice. Table 35–11 describes adventitious sounds.

Abnormal Voice Sounds
Observing the quality of the voice and other audible sounds is also important during an examination of the lungs. Examples of these sounds are hoarseness, stridor, and cough. Stridor is a noise resulting from air moving through a narrowed trachea and larynx; it is associated with croup. Wheezing is a noise resulting from the passage of air through mucus or fluids in a narrowed lower airway; it is associated with asthma. A cough is a reflexive clearing of the airway associated with a respiratory infection. Hoarseness is associated with inflammation of the larynx.

PERCUSSION OF THE CHEST
Percussion is a method sometimes used to assess the resonance of the lungs and the density of underlying organs, such as the heart and liver. Today there is less reliance on percussion to evaluate the lungs because of the frequent use of radiologic examination.

When percussing the anterior and posterior chest, choose a sequence that covers the entire chest and permits comparison bilaterally. The same sequence as that used for auscultation is effective. To perform indirect percussion, lay your middle finger of the nondominant hand on the child’s chest at an intercostal space. Keep your other fingers off the chest. With a springlike motion, use the fingertip of the other hand to tap the finger in contact with the chest (Figure 35–25A). Direct percussion is a technique effective for infants. Tap the chest at an intercostal space with a fingertip to elicit the quality of resonance (Figure 35–25B).

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine crackles</td>
<td>High-pitched, discrete, noncontinuous sound heard at end of inspiration</td>
<td>Air passing through watery secretions in the smaller airways (alveoli and bronchioles)</td>
</tr>
<tr>
<td>(Rub pieces of hair together beside your ear to duplicate the sound.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sibilant rhonchi</td>
<td>Musical, squeaking, or hissing noise heard during inspiration or expiration</td>
<td>Bronchospasm or an anatomic narrowing of the trachea, bronchi, or bronchioles</td>
</tr>
<tr>
<td>Sonorous rhonchi</td>
<td>Coarse, low-pitched sound like a snore, heard during inspiration or expiration; may clear with coughing</td>
<td>Air passing through thick secretions that partially obstruct the larger bronchi and trachea</td>
</tr>
</tbody>
</table>
Characteristic patterns of percussion resonance are expected (Figure 35–26). Characteristic descriptions of sounds heard with percussion of the chest include tympany, flatness, dullness, resonance, and hyperresonance.

**ASSESSING THE BREASTS**

**INSPECTION OF THE BREASTS**

The nipples of prepubertal boys and girls are symmetrically located near the midclavicular line at the fourth to sixth ribs. The areola is normally round and more darkly pigmented than the surrounding skin. Inspect the anterior chest for other dark spots that may indicate supernumerary nipples, which are small, undeveloped nipples and areola that may be mistaken for moles. Their presence may be associated with congenital renal or cardiac anomalies.

See page 1008 for pubertal development.

**PALPATION OF THEbreasts**

Palpate the developing breasts of adolescent females for abnormal masses or hard nodules while the child is supine. Use a concentric pattern covering all quadrants of each breast, including the axilla, all around the areola, and then around the nipple. Breast tissue normally feels dense, firm, and elastic.

The majority of boys have unilateral or bilateral breast enlargement during adolescence called gynecomastia. It is often most noticeable around 14 years of age and commonly disappears by the time of full sexual maturity. Palpate the tissue to differentiate actual breast tissue from fatty tissue in the pectoral area, and to detect any masses.

**ASSESSING THE HEART FOR HEART SOUNDS AND FUNCTION**

A stethoscope and sphygmomanometer is needed to assess the heart.

**INSPECTION OF THE PRECORDIUM**

Begin the heart examination by inspecting the precordium, or anterior chest. Place the child in a reclining or semi-Fowler’s position, either on the parent’s lap or on the examining table. Inspect the shape and symmetry of the anterior chest from the front and side views. The rib cage is normally symmetric. Bulging of the left side of the chest wall may indicate an enlarged heart.

Observe for any chest movement associated with the heart’s contraction. The apical impulse, sometimes called the point of maximum intensity, is located where the left ventricle taps the chest wall during contraction. The apical impulse can normally be seen in thin children. A heave, an obvious lifting of the chest wall during contraction, may indicate an enlarged heart.

**PALPATION OF THE PRECORDIUM**

Place the entire palmar surface of your fingers together on the chest wall to palpate the precordium. Systematically palpate the entire precordium to detect any pulsations,
The location of the apical impulse changes as the child’s rib cage grows. In children under 7 years old, it is located in the fourth intercostal space just medial to the left midclavicular line. In children over 7 years old, it is located in the fifth intercostal space at the left midclavicular line.

**Abnormal Sensations**

A lift is the sensation of the heart lifting up against the chest wall. It may be associated with an enlarged heart or a heart contracting with extra force. A thrill is a rushing vibration that feels like a cat’s purr. It is caused by turbulent blood flow from a defective heart valve and a heart murmur. If present, the thrill is palpated in the right or left second intercostal space. To describe a thrill’s location, use the topographic landmarks of the chest (see Figures 35–21 and 35–22) and estimate the diameter of the thrill palpated.

**GROWTH AND DEVELOPMENT**

The child’s heart rate varies with age, decreasing as the child grows older. The heart rate also increases in response to exercise, excitement, anxiety, and fever. Such stresses increase the child’s metabolic rate, creating a simultaneous need for more oxygen. Children respond to the need for more oxygen by increasing their heart rate, a response called sinus tachycardia. They cannot increase their cardiac stroke volume to deliver more oxygen to the tissues as adults do.

**PERCUSSION OF THE HEART BORDERS**

Percussion of the heart borders is rarely performed during physical examination. The borders of the heart are better identified by radiologic examination.

**AUSCULTATION OF THE HEART**

Auscultation is used to count the apical pulse, to assess the characteristics of the heart sounds, and to detect abnormal heart sounds. Use the bell of the stethoscope to detect these lower pitched sounds.

To assess heart sounds completely, auscultate the heart with the child in both sitting and reclining positions. Differences in heart sounds caused by a change in the child’s position or by a change in the position of the heart near the chest wall can then be detected. If differences in heart sounds are detected with a position change, place the child in the left lateral recumbent position and auscultate again.

**Heart Rate and Rhythm**

The apical heart rate can be counted at the site of the apical impulse (Skill 9–8) either by palpation or by auscultation. Count the apical rate for 1 minute in infants and in children who have an irregular rhythm. The brachial or radial pulse rate should be the same as the auscultated apical heart rate. Table 35–12 gives normal heart rates in children of different ages.

**TABLE 35–12**

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart Rate Range (beats/min)</th>
<th>Average Heart Rate (beats/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborns</td>
<td>100–170</td>
<td>120</td>
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<tr>
<td>Infants to 2 years</td>
<td>80–130</td>
<td>110</td>
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<tr>
<td>2–6 years</td>
<td>70–120</td>
<td>100</td>
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<tr>
<td>6–10 years</td>
<td>70–110</td>
<td>90</td>
</tr>
<tr>
<td>10–16 years</td>
<td>60–100</td>
<td>85</td>
</tr>
</tbody>
</table>

Listen carefully to the heart rate rhythm. Children often have a normal cycle of irregular rhythm associated with respiration called sinus arrhythmia. With sinus arrhythmia the child’s heart rate is faster on inspiration and slower on expiration. When any rhythm irregularity is detected, ask the child to take a breath and hold it while you listen to the heart rate. The rhythm should become regular during inspiration and expiration. Other rhythm irregularities are abnormal.

**Differentiation of Heart Sounds**

Heart sounds are due to the closure of the valves and vibration or turbulence of blood produced by that valve closure. Two primary sounds, S₁ and S₂, are heard when the chest is auscultated.

S₁, the first heart sound, is produced by closure of the tricuspid and mitral valves when the ventricular contraction begins. The two valves close almost simultaneously, so only one sound is normally heard.

S₂, the second heart sound, is produced by the closure of the aortic and pulmonic valves. Once blood has reached the pulmonic and aortic arteries, the valves close to prevent leakage back into the ventricles during diastole. The timing...
of the valve closure varies with respirations. Sometimes $S_2$ is heard as a single sound and at other times as a split sound, that is, two sounds heard a fraction of a second apart.

Sound is easily transmitted in liquid, and it travels best in the direction of blood flow. Auscultate heart sounds at specific areas on the chest wall in the direction of blood flow, just beyond the valve (Figure 35–27). The sounds produced by the heart valves or blood turbulence are heard throughout the chest in thin infants and children. Both $S_1$ and $S_2$ can be heard in all listening areas.

Auscultate heart sounds for quality (distinct versus muffled) and intensity (loud versus weak). First, distinguish between $S_1$ and $S_2$ in each listening area. Heart sounds are usually distinct and crisp in children because of their thin chest wall. Muffling or indistinct sounds may indicate a heart defect or congestive heart failure. Document the area where heart sounds are heard the best. Table 35–13 and Figure 35–27 review the location where each sound is normally best heard for assessment of quality and intensity. If the child has a potential murmur, auscultate the heart in the sitting, reclining, and standing positions to see if differences are noted by position change.

### Third Heart Sound

A third heart sound, $S_3$, is occasionally heard in children as a normal finding. $S_3$ is caused when blood rushes through the

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**NURSING PRACTICE**

Palpate the carotid pulse when auscultating the heart to distinguish between the two heart sounds. The heart sound heard simultaneously with the pulsation is $S_1$.

**TABLE 35–13**

<table>
<thead>
<tr>
<th>Heart Sound</th>
<th>Locations Best Heard</th>
<th>Where Heard Softly</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_1$</td>
<td>Apex of the heart</td>
<td>Base of the heart</td>
</tr>
<tr>
<td></td>
<td>Tricuspid area</td>
<td>Aortic area</td>
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<tr>
<td></td>
<td>Mitral area</td>
<td>Pulmonic area</td>
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<tr>
<td>$S_2$</td>
<td>Base of the heart</td>
<td>Apex of the heart</td>
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<tr>
<td></td>
<td>Aortic area</td>
<td>Tricuspid area</td>
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<td></td>
<td>Pulmonic area</td>
<td>Mitral area</td>
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<tr>
<td>Physiologic splitting</td>
<td>Pulmonic area</td>
<td></td>
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<tr>
<td>$S_3$</td>
<td>Mitral area</td>
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</tbody>
</table>
mitral valve and splashes into the left ventricle. It is heard in diastole, just after S₂. It is distinguished from a split S₂ because it is louder in the mitral area than in the pulmonic area.

Murmurs
Occasionally abnormal heart sounds are auscultated. These sounds are produced by blood passing through a defective valve, great vessel, or other heart structure.

To hear murmurs in children takes practice. Often, murmurs must be very loud to be detected. For softer murmurs, normal heart sounds must be distinguished before an extra sound is recognized. Once a murmur is detected, define the characteristics of the extra sound.

Murmurs are classified by the following characteristics:

- **Intensity.** How loud is it? Can a thrill also be palpated?
- **Location.** Where is the murmur the loudest? Identify the listening area and precise topographic landmarks. Is the child sitting or lying down?
- **Radiation.** Is the sound transmitted over a larger area of the chest, to the axilla, or to the back?
- **Timing.** Is the murmur heard best after S₁ or S₂? Is it heard during the entire phase between S₁ and S₂?
- **Quality.** Describe what the murmur sounds like—for example, machinelike, musical, or blowing.

**Blood Pressure**
Assessment of blood pressure is important to detect conditions of hypertension or hypovolemic shock. The child should be seated and quiet for 3 to 5 minutes before the blood pressure is taken. See Skill 9–10 for the technique for obtaining the blood pressure in children in the Clinical Skills Manual, as well as the CD-ROM accompanying this text.

Compare the systolic and diastolic readings with the standard blood pressure values by age, sex, and height in Table 35–14a & b. Use the child’s height percentile for age and sex from the standard growth curves. A blood pressure value at the 50th percentile for the child’s age, sex, and height percentile is considered the midpoint of the normal range. A reading above the 95th percentile indicates hypertension.

**Palpation of the Pulses**
Palpate the characteristics of the pulses in the extremities to assess the circulation. The technique and sites for palpating the pulse are the same as those used for adults. Evaluate the pulsation for rate, regularity of rhythm, and strength in each extremity and compare your findings bilaterally. The femoral and brachial pulses are the most important pulses to evaluate.

Palpate the femoral arteries and compare their strength with the strength of the brachial pulsations. The femoral pulsations are usually stronger than or as strong as the brachial pulsations. A weaker femoral pulse is associated with coarctation of the aorta.

**Other Signs**
To assess the heart and tissue perfusion, consider other signs, including skin color, capillary refill, and respiratory distress. The mucous membranes are usually pink. Cyanosis is most commonly associated with a congenital heart defect in children. Capillary refill is normally less than 2 seconds, indicating good circulation and perfusion of the tissues. Signs of...
### TABLE 35–14(a) Systolic and Diastolic Blood Pressure Values for Children of Different Ages by Sex and Selected Height Percentiles

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>BP Percentile</th>
<th>Systolic BP (mm Hg)</th>
<th>Diastolic BP (mm Hg)</th>
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(continued)
respiratory distress, such as tachypnea, flaring, and retrac-
tions, may be associated with the child’s attempts to com-
penstate for hypoxemia caused by a congenital heart defect.

ASSESSING THE ABDOMEN FOR SHAPE, BOWEL SOUNDS, AND UNDERLYING ORGANS

TOPOGRAPHIC LANDMARKS OF THE ABDOMEN

The location of underlying organs and structures of the ab-
domen must be considered when the abdomen is exam-
ined. The abdomen is commonly divided by imaginary lines into quadrants for the purpose of identifying underlying structures (Figure 35–28 on page 1003).

INSPECTION OF THE ABDOMEN

Begin the examination of the abdomen by inspecting the shape and contour, condition of the umbilicus and rectus muscle, and abdominal movement. Inspect the child’s ab-
domen from the front and side with good lighting. Perform inspection and auscultation before palpation and percus-
sion because touching the abdomen may change the character-
istics of bowel sounds.

TABLE 35–14(a) Systolic and Diastolic Blood Pressure Values for Children of Different Ages by Sex and Selected Height Percentiles—continued

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>BP Percentile</th>
<th>Systolic BP (mm Hg)</th>
<th>Diastolic BP (mm Hg)</th>
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</table>

BP, blood pressure
*The 90th percentile is 1.28 SD, 95th percentile is 1.645 SD, and the 99th percentile is 2.326 SD over the mean.


THINKING CRITICALLY

ASSESSING A CHILD WITH BRONCHIOLITIS

Latoya, 6 months old, is brought by her mother and father to the emer-
gency room. She is an emergency admission from the local pediatri-
cian’s office with a diagnosis of bronchiolitis. As Latoya’s nurse, you
are responsible for assessing her condition after she arrives on the
pediatric nursing unit.

What historical information do you collect, and what approach
do you take to examine Latoya? What procedures are used to perform
a physical examination on a 6-month-old? Identify all the compo-
nents of the physical assessment used to detect signs of respiratory
difficulty and inadequate tissue perfusion. How do you organize your
findings to make sense of them to plan nursing care?
# TABLE 35–14(b) Systolic and Diastolic Blood Pressure Values for Children of Different Ages by Sex and Selected Height Percentiles

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>BP Percentile</th>
<th>Systolic BP (mm Hg)</th>
<th>Diastolic BP (mm Hg)</th>
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(continued)
Shape
Inspect the shape of the abdomen to identify an abnormal contour. The child’s abdomen is normally symmetric and rounded or flat when the child is supine. A scaphoid or sunken abdomen is abnormal and may indicate dehydration.

Umbilicus
Observe the newborn’s umbilical stump for color, bleeding, odor, and drainage. See Chapter 27 for more information. After the stump falls off, inspect the umbilicus for continued drainage which may indicate an infection or a granuloma. Inspect the umbilicus in older infants and toddlers. Children in these age groups often have an umbilical hernia, a protrusion of abdominal contents through an open umbilical muscle ring.

Rectus Muscle
Inspect the abdominal wall for any depression or bulging at midline above or below the umbilicus, indicating separation of the rectus abdominis muscles. The depression may be up to 5 cm (2 in.) wide. Measure the width of the separation to monitor change over time. As abdominal muscle strength develops, the separation usually becomes less prominent. However, the splitting may persist if congenital muscle weakness is present.

Abdominal Movement
Infants and children up to 6 years of age breathe with the diaphragm. The abdomen rises with inspiration and falls with expiration, simultaneously with the chest rise and fall. When the abdomen does not rise as expected, peritonitis may be present.

Other abdominal movements such as peristaltic waves are abnormal. Peristaltic waves are visible rhythmic contractions of the intestinal wall smooth muscle, which move food through the digestive tract. Their presence generally indicates an intestinal obstruction, such as pyloric stenosis.
AUSCULTATION OF THE ABDOMEN

To evaluate bowel sounds, auscultate the abdomen with the diaphragm of the stethoscope. Bowel sounds normally occur every 10 to 30 seconds. They have a high-pitched, tinkling, metallic quality. Loud gurgling (borborygmi) is heard when the child is hungry. Listen in each quadrant long enough to hear at least one bowel sound. Before determining that bowel sounds are absent, auscultate at least 5 minutes in each quadrant. Absence of bowel sounds may indicate peritonitis or a paralytic ileus. Hyperactive bowel sounds may indicate gastroenteritis or a bowel obstruction.

Next auscultate over the abdominal aorta and the renal arteries for a vascular hum or murmur. No murmur should be heard. A murmur may indicate a narrowed or defective artery.

PERCUSSION OF THE ABDOMEN

Use indirect percussion to evaluate borders and sizes of abdominal organs and masses. Percussion is performed with the child supine. Choose a sequence to systematically percuss the entire abdomen (Figure 35–29). Different tones are expected when the abdomen is percussed, depending on the underlying structures. Dullness is found over the liver, spleen, and full bladder. Tympany is found over the stomach or the intestines when an obstruction is present. Tympany may be found over areas beyond the stomach in infants because of air swallowing. A resonant tone may be heard over other areas. Organ size can be identified by listening for a percussion tone change at the border of an organ. For example, when the examiner percusses down the chest, the upper

![Figure 35–28](image1.png)

Topographic landmarks of the abdomen. The abdomen is commonly divided by imaginary lines into quadrants for the purpose of identifying underlying structures.

![Figure 35–29](image2.png)

Sequence for indirect percussion of the abdomen.
edge of the liver is usually detected by a tone change from resonant to dull near the fifth intercostal space at the right midclavicular line. The lower liver edge is usually detected 2 to 3 cm (about 1 in.) below the right costal margin in infants and toddlers, but closer to the costal margin in older children.

PALPATION OF THE ABDOMEN

Both light and deep palpation are used to examine the abdomen’s organs and to detect any masses. Light palpation evaluates the tenseness of the abdomen (how soft or hard it is), the liver, the presence of any tenderness or masses, and any defects in the abdominal wall. Deep palpation detects masses, defines their shape and consistency, and identifies tenderness in the abdomen.

To make the most accurate interpretation, perform the abdominal examination when the child is calm and cooperative. Organs and other masses are more easily palpated when the abdominal wall is relaxed. Infants and toddlers often feel more secure lying supine across both the parent’s and the examiner’s laps. A bottle, pacifier, or toy may distract the child and improve cooperation for the examination.

To begin palpation, position the child supine with knees flexed. Stand beside the child and place warmed fingertips across the child’s abdomen. Palpate with the edge of your fingers, not just your fingerpads, and palpate in a sequence to examine the entire abdomen. Watch the child’s face during palpation for a grimace or constriction of the pupils, which indicates pain.

Light Palpation

For light palpation, use a superficial, gentle touch that slightly depresses the abdomen. Usually the abdomen feels soft and no tenderness is detected. Palpate any bulging along the abdominal wall, especially along the rectus muscle and umbilical ring, which could indicate a hernia. Measure the diameter of the muscle ring, rather than the protrusion, to monitor change over time. The muscle ring normally becomes smaller and closes by 4 years of age. An umbilical hernia that persists beyond this age may need surgical repair.

Liver. Locate and lightly palpate the lower liver edge. Place the fingers in the right midclavicular line at the level of the umbilicus and gently move them toward the costal margin during expiration. As the liver edge descends with inspiration, a flat, narrow ridge is usually felt. Measure the distance of the liver edge from the right costal margin at the right midclavicular line. The liver edge is normally palpated 2 to 3 cm (1 in.) below the right costal margin in infants and toddlers. It may not be palpable in older children. The liver is enlarged when the edge is more than 3 cm (1 in.) below the right costal margin. An enlarged liver may be associated with congestive heart failure or hepatic disease.

Deep Palpation

To perform deep palpation, press the fingers of one hand (for small children) or two hands (for older children) more deeply into the abdomen. Because the abdominal muscles are most relaxed when the child takes a deep breath, ask the child to take regular deep breaths when palpating each area of the abdomen.

Spleen. Palpate for the spleen at the left costal margin in the midclavicular line. The spleen tip may be felt when the child takes a deep breath. The spleen is enlarged when it can be easily palpated below the left costal margin.

Kidneys. Palpate for the kidneys deep in the abdomen along each side of the spinal column. The kidneys are difficult to palpate in all children, except newborns, because of the deep layer of abdominal muscles and intestines. If a kidney is actually palpated, an abnormal mass may be present.

Other Masses. Occasionally other masses, both normal and abnormal, can be palpated in the abdomen. A tubular mass commonly palpated in the lower left or right quadrant is often an intestine filled with feces. A distended bladder is often palpated as a firm, central, dome-shaped mass above the symphysis pubis in young children. Any fixed mass that moves laterally, pulsates, or is located along the vertebral column may be a neoplasm.
ASSESSMENT OF THE INGUINAL AREA

The inguinal area is inspected and palpated during the abdominal examination to detect enlarged lymph nodes or masses. The femoral pulse, a part of the heart examination, may be assessed simultaneously with the abdominal examination.

**Inspection**

Inspect the inguinal area for any change in contour, comparing sides. A small bulging noted over the femoral canal in girls may be associated with a femoral hernia. A bulging in the inguinal area in boys may be associated with an inguinal hernia.

**Palpation**

Palpate the inguinal area for lymph nodes and other masses. Small lymph nodes, less than 1 cm (1/2 in.) in diameter, are often present in the inguinal area because of minor injuries on the legs. Any tenderness, heat, or inflammation in these palpated lymph nodes could be associated with a local infection.

ASSESSING THE GENITAL AND PERINEAL AREAS FOR EXTERNAL STRUCTURAL ABNORMALITIES

What can a vaginal discharge indicate in a preadolescent girl? Is swelling in a newborn’s scrotum normal? Where is the proper location of the urethral meatus on the penis?

PREPARATION OF CHILDREN FOR THE EXAMINATION

Examination of the genitalia and perineal area can cause stress in children because they sense their privacy has been invaded. To make young children feel more secure, position them on the parent’s lap with their legs spread apart. Children can also be positioned on the examining table with their knees flexed and the legs spread apart like a frog.

In younger children the genital and perineal examination is performed immediately after assessment of the abdomen. The genitals and perineum may be examined last in older children and adolescents. Equipment needed for this examination includes gloves, lubricant, and a penlight.

GROWTH AND DEVELOPMENT

Preschool-age children are often taught that strangers are not permitted to touch their “private parts.” When a child this age actively resists examination of the genital area, ask the parent to tell the child you have permission to look at and touch these parts of the body. Some children develop modesty during the preschool period. Briefly explain what you need to examine and why. Then calmly and efficiently examine the child.

INSPECTION OF THE FEMALE GENITALIA

Inspect the external genitalia of girls for color, size, and symmetry of the mons pubis, labia, urethra, and vaginal opening (Figure 35–30). At that time, determine the stage of pubertal maturation. Simultaneously look for any abnormal findings such as swelling, inflammation, masses, lacerations, or discharge.

**Mons Pubis**

Inspect themons pubis for pubic hair and its characteristics. See page 1008 for guidelines to assess the stage of pubic hair development.

**Labia**

The labia minora are usually thin and pale in preadolescent girls but become dark pink and moist after puberty. In young infants the labia minora may be fused and cover the structures in the vestibule. These adhesions may need to be separated. See Chapter 27 for more information.

**Hymen**

Use the thumb and forefinger of one gloved hand to separate the labia minora for viewing structures in the vestibule. The hymen is just inside the vaginal opening. In preadolescents it is usually a thin membrane with a crescent-shaped opening. The vaginal opening is usually about 1 cm (1/2 in.) in adolescents when the hymen is intact. Sexually active adolescents may have a vaginal opening with irregular edges.

**FIGURE 35–30**

Anatomic structures of the female genital and perineal area.
**Urethral and Vaginal Openings**

Inspect the vestibule for lesions. No lesions or signs of inflammation are expected around the urethral or vaginal opening. Redness and excoriation are often associated with an irritant such as bubble bath.

**Vaginal Discharge**

Preadolescent girls do not normally have a vaginal discharge. Adolescents often have a clear discharge without a foul odor. Menses generally begin approximately 2 years after breast bud development. A foul-smelling discharge in preschool-age children may be associated with a foreign body. Various organisms may cause a vaginal infection in older children.

An internal vaginal examination is indicated when abnormal findings such as a vaginal discharge or trauma to the external structures is noted. Only an experienced examiner should perform the vaginal examination of the child.

**PALPATION OF THE FEMALE GENITALIA**

Palpate the vaginal opening with a finger of your free, gloved hand. The Bartholin and Skene glands are not usually palpable. Palpation of these glands in preadolescent children indicates enlargement because of an infection such as gonorrhea.

**INSPECTION OF THE MALE GENITALIA**

Inspect the male genitalia for the structural and pubertal development of the penis, scrotum, and testicles. Place boys in tailor position, seated with their legs crossed in front of them. This position puts pressure on the abdominal wall to push the testicles into the scrotum. See page 1009 for guidelines to assess the staging of pubic hair and external genital development.

**Penis**

Inspect the penis for size, foreskin, hygiene, and position of the urethral meatus. The length of the nonerect penis in the newborn is normally 2 to 3 cm (1 in.). The penis enlarges in length and breadth during puberty. The penis is normally straight. A downward bowing of the penis may be caused by a chordee, a fibrous band of tissue associated with hypospadias.

When the penis is circumcised, the glans penis is exposed. To inspect the glans penis of an uncircumcised boy, ask the child or parent to pull the foreskin back. Alternatively, the examiner may retract the foreskin. The foreskin of children over 6 years of age normally retracts past the corona easily. If the foreskin is tight and cannot be retracted, phimosis is present.

The foreskin is usually not completely separated from the glans at birth. Separation is normally completed by 3 to 6 years of age. A foreskin opening large enough for a good urinary stream is normal, even when the foreskin does not fully retract.

A round, pinpoint urethral meatus may indicate meatal stenosis. Location of the urethral meatus at another site on the penis is abnormal, indicating hypospadias or epispadias. Inspect the urinary stream. The stream is normally strong without dribbling. Erythema and edema of the glans (balanitis) may result from infection or trauma. In the uncircumcised penis, purulent discharge and an edematous foreskin may be seen.

**Scrotum**

Inspect the scrotum for size, symmetry, presence of the testicles, and any abnormalities. The scrotum is normally loose and pendulous with rugae, or wrinkles. The scrotum of infants often appears large in comparison to the penis. A small, undeveloped scrotum that has no rugae indicates that the testicles are undescended. Enlargement or swelling of the scrotum is abnormal. It may indicate an inguinal hernia, hydrocele, torsion of the spermatic cord, or testicular inflammation. A deep cleft in the scrotum may indicate ambiguous genitalia.

**PALPATION OF THE MALE GENITALIA**

**Penis**

Palpate the shaft of the penis for nodules and masses. None should be present.
Testicles

Palpate the scrotum for the presence of the testicles. Make sure your hands are warm to avoid stimulating the cremasteric reflex that causes the testicles to retract. Place your index finger and thumb over both inguinal canals on each side of the penis. This keeps the testicles from retracting into the abdomen (Figure 35–31).

Gently palpate each testicle with only enough pressure to identify the shape and size. The testicles are normally smooth and equal in size. They are approximately 1 to 1.5 cm (1/2 in) in diameter until puberty, when they increase in size. A hard, enlarged, painless testicle may indicate a tumor.

If a testicle is not palpated in the scrotum, the examiner palpates the inguinal canal for a soft mass. When the testicle is found in the inguinal canal, try to move it to the scrotum to palpate the size and shape. The testicle is descendable when it can be moved into the scrotum. An undescended testicle is one that does not descend into the scrotum or cannot be palpated in the inguinal canal.

Spermatic Cord

Palpate the length of the spermatic cord between the thumb and forefinger from the testicle to the inguinal canal. It normally feels solid and smooth. No tenderness is expected.

Enlarged Scrotum

When bulging or swelling of the scrotum is present, palpate the scrotum to identify the characteristics of the mass. Try to determine whether the mass is unilateral or bilateral and attempt to reduce the mass by pushing it back through the external inguinal ring. A mass that decreases may indicate an inguinal hernia. A mass that does not decrease may indicate a hydrocele or an incarcerated hernia. To distinguish between a hydrocele and an incarcerated hernia, place a bright penlight under the scrotum and look for a red glow or transillumination through the scrotum. A hydrocele transilluminates; a hernia does not.

Inguinal Canal

Attempt to insert the little finger into the external inguinal canal to determine whether the external inguinal ring is dilated. The inguinal ring is normally too small for the finger to pass into the canal. If the finger passes into the inguinal canal, ask the child to cough. A sensation of abdominal contents coming down to touch the fingertip may indicate an inguinal hernia.

Cremasteric Reflex

Stroke the inner thigh of each leg to stimulate the cremasteric reflex. The testicle and scrotum normally rise on the stroked side. This response indicates intact function of the spinal cord at the T12, L1, and L2 levels.

Inspection of the Anus and Rectum

Inspect the anus for sphincter control and any abnormal findings such as inflammation, fissures, or lesions. The external sphincter is usually closed. Inflammation and scratch marks around the anus may be associated with pinworms. A protrusion from the rectum may be associated with a rectal wall prolapse or a hemorrhoid.

Palpation of the Anus and Rectum

Lightly touching the anal opening should stimulate an anal contraction or “wink.” Absence of a contraction may indicate the presence of a lower spinal cord lesion.

Patency of the Anus

Passage of meconium by newborns indicates a patent anus. When passage of meconium is delayed, a lubricated catheter can be inserted 1 cm (1/2 in.) into the anus. Resistance in passage of the catheter may indicate an obstruction.

Rectal Examination

A rectal examination is not routinely performed on children. It is indicated for symptoms of intra-abdominal, rectal, bowel, or stool abnormalities. Only an experienced examiner should perform a rectal examination.
ASSESSMENT OF PUBERTAL DEVELOPMENT AND SEXUAL MATURATION

The age of onset of secondary sexual characteristics can vary with race and ethnicity, environmental conditions, geographic location, and nutrition. For example, sexual maturity begins earlier in taller and heavier girls. Black girls have an earlier onset of breast and pubic hair development than whites (Herman-Giddens, Slora, Wasserman et al., 1997).

**FEMALES**

Inspect the child’s breasts while the child is sitting. Breast development in girls usually precedes other pubertal changes. Figure 35–32 shows the Tanner stages of breast development. Breast budding, the first stage of pubertal development in girls, normally occurs between 9 and 14 years of age. The mean age for breast development in African-American girls is 8.87 years, and for Caucasian girls it is 9.96 years (Herman-Giddens et al., 1997). Breast development before 6 years of age in African Americans and 7 years of age in Caucasians is abnormal (Herman-Giddens et al., 1997; Kaplowitz, Oberfield, and the Drug and Therapeutics and Executive Committees of the Lawson Wilkins Pediatric Endocrine Society, 1999). A girl’s breasts may develop at different rates and appear asymmetric.

The presence, amount, and distribution of pubic hair indicates the sexual maturation stage in the girl. Preadolescent girls have no pubic hair. Initial pubic hair is lightly pigmented, sparse, and straight. Pubic hair develops in consistent stages for all girls, but the timing of pubic hair stages is individually determined (Tanner, 1962). Figure 35–33 illustrates the normal stages of female pubic hair development. Breast development usually precedes pubic hair development. The presence of pubic hair before 8 years of age is unusual.

**FIGURE 35–32**

Normal stages of breast development.


**FIGURE 35–33**

The stages of female pubic hair development with sexual maturation. Soft downy hair along the labia majora is an indication that sexual maturation is beginning. Hair grows progressively coarse and curly as development proceeds.

Initial signs of pubertal development in males are enlargement of the testicles and thinning of the scrotum. Straight, downy pubic hair first appears at the base of the penis 6 months later. The hair becomes darker, dense, and curly, extending over the pubic area in a diamond pattern by the completion of puberty. The presence of pubic hair before 9 years of age is uncommon, and delayed onset of testicular enlargement after 14 years of age needs evaluation. Penile enlargement generally follows testicular enlargement about one year later in genitalia Tanner stage 3. Stages of pubic hair development follow a standard pattern, as seen in Figure 35–34.

SEXUAL MATURITY RATING

The sexual maturity rating (SMR) is an average of the breast and pubic hair Tanner stages in females and of the genital and pubic hair Tanner stages in males. The rating is a number between 2 and 5, as stage 1 is prepubertal. The SMR is then related to other physiologic events that happen during puberty. Compare the stage of the child’s secondary sexual characteristics with information in Figure 35–35.

In females, menarche generally occurs in SMR 4 or breast stage 3 to 4. The peak height velocity usually occurs before menarche at a mean age of 11.5 years. In males, ejaculation usually occurs at SMR 3, with semen noted between SMR 3 and 4. The peak height velocity usually occurs in SMR 4 or genital stage 4 to 5, at about 13.5 years of age.

ASSESSING THE MUSCULOSKELETAL SYSTEM FOR BONE AND JOINT STRUCTURE, MOVEMENT, AND MUSCLE STRENGTH

INSPECTION OF THE BONES, MUSCLES, AND JOINTS

Inspect and compare the arms and then the legs for differences in alignment, contour, skin folds, length, and...
deformities. The extremities normally have equal length, circumference, and numbers of skin folds bilaterally. Extra skin folds and a larger circumference may indicate a shorter extremity.

Inspect and compare the joints bilaterally for size, discoloration, and ease of voluntary movement. Joints are normally the same color as surrounding skin, with no sign of swelling. Children should voluntarily flex and extend joints during normal activities without pain. Redness, swelling, and pain with movement may indicate injury or infection.

**PALPATION OF THE BONES, MUSCLES, AND JOINTS**

Palpate the bones and muscles in each extremity for muscle tone, masses, or tenderness. Muscles normally feel firm, and bony masses are not normally present. Dohyg muscles may indicate poor muscle tone. Rigid muscles, or hypertonia, may be associated with an active seizure or cerebral palsy. A mass over a long bone may indicate a recent fracture or a bone tumor.

Palpate each joint and surrounding muscles to detect any swelling, masses, heat, or tenderness. None is expected when the joint is palpated. Tenderness, heat, swelling, and redness can result from injury or a chronic joint inflammation such as juvenile rheumatoid arthritis.

**GROWTH AND DEVELOPMENT**

Palpate the clavicles of the newborn from the sternum to the shoulder. These bones are often fractured during the birth process. A mass and crepitus may indicate a fracture.

**RANGE OF MOTION AND MUSCLE STRENGTH ASSESSMENT**

**Active Range of Motion**

Observe the child during typical play activities, such as reaching for objects, climbing, and walking, to assess range of motion of all major joints. Children spontaneously move their joints through the full normal range of motion with play activities when no pain is present. Limited range of motion may indicate injury, inflammation of a joint, or a muscle abnormality.

**Passive Range of Motion**

When a joint is suspected of having limited active range of motion, perform passive range of motion. Flex and extend, abduct and adduct, or rotate the affected joint cautiously to avoid causing extra pain. Full range of motion without pain is normal. Limitations in movement may indicate injury, inflammation, or malformation. Increased passive range of motion may indicate muscle weakness.

**Muscle Strength**

Observe the child’s ability to climb onto an examining table, throw a ball, clap the hands, or move around on the bed. The child’s ability to perform age-appropriate play activities indicates good muscle tone and strength. Attainment of age-appropriate motor development is another indicator of good muscle strength (Table 35–15).

To assess the strength of specific muscles in the extremities, engage the child in some games. Compare muscle strength bilaterally to identify muscle weakness. For example, the child squeezes the examiner’s fingers tightly with each hand; pushes against and pulls the examiner’s hands with his or her hands, lower legs, and feet; and resists extension of a flexed elbow or knee. Children normally have good muscle strength bilaterally. Unilateral muscle weakness may be associated with a nerve injury. Bilateral muscle weakness may result from hypoxemia or a congenital disorder such as Down syndrome. Asymmetric weakness may be associated with conditions such as cerebral palsy.

When generalized muscle weakness is suspected in a preschool- or school-age child, ask the child to stand up from the supine position. Children are normally able to rise to a standing position without using their arms as levers. Children who push their body upright using the arms and hands may have generalized muscle weakness, known as a positive Gowers’ sign. This may indicate muscular dystrophy (see Chapter 55).
POSTURE AND SPINAL ALIGNMENT

Posture
Inspect the child’s posture when standing from a front, side, and back view. The shoulders and hips are normally level. The head is held erect without a tilt, and the shoulder contour is symmetric. After beginning to walk, young children often have a pot-bellied stance because of lumbar lordosis. The spine has normal thoracic convex and lumbar concave curves after 6 years of age. Table 35–16 shows normal posture and spinal curvature development.

Spinal Alignment
Assess the school-age child and adolescent for scoliosis, a lateral spine curvature. Stand behind the child, observing the height of the shoulders and hips (Figure 35–36). Ask the child to bend forward slowly at the waist, with arms extended toward the floor. No lateral curve should be present in either position. The ribs normally stay flat bilaterally. The lumbar concave curve should flatten with forward flexion (Figure 35–37). A lateral curve to the spine or a one-sided rib hump is an indication of scoliosis (see Chapter 55).

INSPECTION OF THE UPPER EXTREMITIES

Arms
The alignment of the arms is normally straight, with a minimal angle at the elbows, where the bones articulate.

Hands
Count the fingers. Extra finger digits (polydactyly) or webbed fingers (syndactyly) are abnormal. Inspect the creases on the palmar surface of each hand. Multiple creases across the palm are normal. A single crease that crosses the entire palm of the hand, a simian crease, is associated with Down syndrome (Figure 35–38).

Nails
Inspect the nails for size, shape, and color. Nails are normally convex, smooth, and pink. Clubbing, widening of the nailbed with an increased angle between the proximal nail fold and nail, is abnormal (see Figure 48–46 in Chapter 48).

TABLE 35–16 Normal Development of Posture and Spinal Curves

<table>
<thead>
<tr>
<th>Age</th>
<th>Posture and Spinal Curves</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–3 months</td>
<td>Holds head erect when held upright; thoracic kyphosis when sitting.</td>
</tr>
<tr>
<td>6–8 months</td>
<td>Sits without support; spine is straight.</td>
</tr>
<tr>
<td>10–15 months</td>
<td>Walks independently; straight spine.</td>
</tr>
<tr>
<td>Toddler</td>
<td>Protruding abdomen; lumbar lordosis.</td>
</tr>
<tr>
<td>School-age child</td>
<td>Height of shoulders and hips is level; balanced thoracic convex and lumbar concave curves.</td>
</tr>
</tbody>
</table>
Clubbing is associated with chronic respiratory and cardiac conditions.

**INSPECTION OF THE LOWER EXTREMITIES**

**Hips**

Assess the hips of newborns and young infants for dislocation or subluxation. First inspect the skin folds on the upper legs. The same number of skin folds should be present on each leg. Uneven skin folds may indicate a hip dislocation or difference in leg length (Allis’ sign). Then check for a difference in knee height symmetry (Figure 35–39). The Ortolani-Barlow maneuver is used to assess an infant’s hips for dislocation or subluxation. See Chapter 27.

Ask the child to stand on one leg and then the other. The iliac crests should stay level. If the iliac crest opposite the weight-bearing leg appears lower, the hip bearing weight may be dislocated.

**Legs**

Inspect the alignment of the legs. After a child is 4 years of age, the alignment of the long bones is straight, with minimal angle at the knees and feet where the bones articulate. Assess alignment of the lower extremities in infants and toddlers to ensure that normal changes are occurring. To evaluate the toddler with bowlegs, have the child stand on a firm surface. Measure the distance between the knees when the child’s ankles are together. No more than 1.5 in (3.5 cm) between the knees is normal. See Figure 35–40 for assessment of knock-knees.

**GROWTH AND DEVELOPMENT**

Infants are often born with a twisting of the tibia caused by positioning in utero (tibial torsion). The infant’s toes turn in as a result of the tibial torsion. Toddlers go through a skeletal alignment sequence of bowlegs (genu varum) and knock-knees (genu valgum) before the legs assume a straight alignment.

**Feet**

Inspect the feet for alignment, the presence of all toes, and any deformities. The weight-bearing line of the feet is usually in alignment with the legs. Many newborns...
To evaluate the child with knock-knees, have the child stand on a firm surface. Measure the distance between the ankles when the child stands with the knees together. The normal distance is not more than 2 in. (5 cm) between the ankles.

have a flexible forefoot inversion (metatarsus adductus) that results from uterine positioning. Any fixed deformity is abnormal.

Inspect the feet for the presence of an arch when the child is standing. Children up to 3 years of age normally have a fat pad over the arch, giving the appearance of flat feet. Older children normally have a longitudinal arch. The arch is usually seen when the child stands on tiptoe or is sitting. Inspect the nails of the feet as for the hands.

ASSESSING THE NERVOUS SYSTEM FOR COGNITIVE FUNCTION, BALANCE, COORDINATION, CRANIAL NERVE FUNCTION, SENSATION, AND REFLEXES

Equipment needed for this examination includes a reflex hammer, cotton balls, a penlight, and tongue blades.

COGNITIVE FUNCTION

Observe the child’s behavior, facial expressions, gestures, communication skills, activity level, and level of consciousness to assess cognitive functioning. Match the neurologic examination to the child’s stage of development. For example, cognitive function is evaluated much differently in infants than in older children because infants cannot use words to communicate.

Table 35–17: Expected Language Development for Age

<table>
<thead>
<tr>
<th>Language Milestones</th>
<th>Age Attained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understands Mama and Dada</td>
<td>10 months</td>
</tr>
<tr>
<td>Says Mama, Dada, 2 other words; imitates animal sounds</td>
<td>12 months</td>
</tr>
<tr>
<td>4–6 word vocabulary, points to desired objects</td>
<td>13–15 months</td>
</tr>
<tr>
<td>7–20 word vocabulary, points to 5 body parts</td>
<td>18 months</td>
</tr>
<tr>
<td>2-word combinations</td>
<td>20 months</td>
</tr>
<tr>
<td>3-word sentences, plurals</td>
<td>36 months</td>
</tr>
</tbody>
</table>


Behavior

The behavior of infants and children during the assessment indicates their alertness. Infants and toddlers are curious but seek the security of the parent, either by clinging or by making frequent eye contact. Older children are often anxious and watch all of the examiner’s actions. Lack of interest in assessment or treatment procedures may indicate a serious illness. Excessive activity or an unusually short attention span may be associated with an attention deficit hyperactivity disorder.

Communication Skills

Speech, language development, and social skills provide good clues to cognitive functioning. Listen to speech articulation and words used, comparing the child’s performance with standards of social development and speech articulation for the child’s age (Table 35–17). Toddlers can normally follow simple directions such as “Show me your mouth.” By 3 years of age, the child’s speech should be easily understood. Delay in language and social skill development may be associated with mental retardation.
Memory
Immediate, recent, and remote memory can be tested in children starting at approximately 4 years of age. To evaluate recent memory, ask the child to remember a special name or object. Then 5 to 10 minutes later during the examination, have the child recall the name or object. To evaluate remote memory, ask the child to repeat his or her address or birth date or a nursery rhyme. By 5 or 6 years of age, children are normally able to recall this information without difficulty.

Level of Consciousness
When approaching the infant or child, observe his or her level of consciousness and activity, including facial expressions, gestures, and interaction. Children are normally alert, and sleeping children arouse easily. The child who cannot be awakened is unconscious. A lowered level of consciousness may be associated with a number of neurologic conditions such as a head injury, seizure, infection, or brain tumor.

CEREBELLAR FUNCTION
Observe the young child at play to assess coordination and balance. Development of fine motor skills in infants and preschool children provides clues to cerebellar function.

Balance
Observe the child’s balance during play activities such as walking, standing on one foot, and hopping (Table 35–18). The Romberg procedure can also be used to test balance in children over 3 years of age (Figure 35–41 ). Once balance and other motor skills are attained, children do not normally stumble or fall when tested. Poor balance may indicate cerebellar dysfunction or an inner ear disturbance.

Coordination
Tests of coordination assess the smoothness and accuracy of movement. Development of fine motor skills can be used to assess coordination in young children (Table 35–19). After 6 years of age, the tests for adults (finger-to-nose, finger-to-finger, heel-to-shin, and alternating motion) can be used (Figure 35–42 ). The child usually responds enthusiastically when these tests are presented as games. Jerky movements or inaccurate pointing (past pointing) indicate poor coordination, which can be associated with delayed development or a cerebellar lesion.

Gait
A normal gait requires intact bones and joints, muscle strength, coordination, and balance. Inspect the child when

TABLE 35–18 Expected Balance Development for Age

<table>
<thead>
<tr>
<th>Balance Milestones</th>
<th>Age Attained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stands without support briefly</td>
<td>12 months</td>
</tr>
<tr>
<td>Walks alone well</td>
<td>15 months</td>
</tr>
<tr>
<td>Walks backwards</td>
<td>2 years</td>
</tr>
<tr>
<td>Balances on 1 foot for 5 seconds</td>
<td>4 years</td>
</tr>
<tr>
<td>Hops on 1 foot, heel-toe walking</td>
<td>5 years</td>
</tr>
<tr>
<td>Heel-toe walking backwards</td>
<td>6 years</td>
</tr>
</tbody>
</table>

Romberg procedure. Ask the child to stand with feet together and eyes closed. Protect the child from falling by standing close. Preschool–age children may extend their arms to maintain balance, but older children can normally stand with their arms at their sides. Leaning or falling to one side is abnormal and indicates poor balance.
Pediatric Assessment

Expected Fine Motor Development for Age

<table>
<thead>
<tr>
<th>Fine Motor Milestones</th>
<th>Age Attained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfers objects between hands</td>
<td>7 months</td>
</tr>
<tr>
<td>Picks up small objects</td>
<td>10 months</td>
</tr>
<tr>
<td>Feeds self with cup and spoon</td>
<td>12 months</td>
</tr>
<tr>
<td>Scribbles with crayon or pencil</td>
<td>18 months</td>
</tr>
<tr>
<td>Builds 2-block tower</td>
<td>24 months</td>
</tr>
<tr>
<td>Builds 4-block tower</td>
<td>30 months</td>
</tr>
<tr>
<td>Unfastens front buttons</td>
<td>36 months</td>
</tr>
</tbody>
</table>


GROWTH AND DEVELOPMENT

Walking from both a front and a rear view. The iliac crests are normally level during walking, and no limp is expected. A limp may indicate injury or joint disease. Staggering or falling may indicate cerebellar ataxia. Scissoring, in which the thighs tend to cross forward over each other with each step, may be associated with cerebral palsy or other spastic conditions.

CRANIAL NERVE FUNCTION

To assess the cranial nerves in infants and young children, modify the procedures used to assess school-age children and adults (Table 35–20). Abnormalities of cranial nerves

Tests of coordination. **A**, Finger-to-nose test. Ask the child to close the eyes and touch his or her nose, alternating the index fingers of the hands. **B**, Finger-to-finger test. Ask the child to alternately touch his or her nose and your index finger with his or her index finger. Move your hand to several positions within the child’s reach to test pointing accuracy. Repeat the test with the child’s other hand. **C**, Heel-to-shin test. Ask the child to rub his or her leg from the knee to the ankle with the heel of the other foot. Repeat the test with the other foot. This test is normally performed without hesitation or inappropriate placement of the foot. **D**, Rapid alternating motion test. Ask the child to rapidly rotate his or her wrist so the palm and dorsum of the hand alternately pat the thigh. Repeat the test with the other hand. Hesitating movements are abnormal. Mirroring movements of the hand not being tested indicate a delay in coordination skill refinement.
may be associated with compression of an individual nerve, head injury, or infections.

**SENSORY FUNCTION**

To assess sensory function, compare the responses of the body to various types of stimulation. Bilateral equal responses are normal. Loss of sensation may indicate a brain or spinal cord lesion. Withdrawal responses to painful procedures indicate normal sensory function in an infant.

**Superficial Tactile Sensation**

Stroke the skin on the lower leg or arm with a cotton ball or a finger while the child's eyes are closed. Cooperative children over 2 years of age can normally point to the location touched.

**Superficial Pain Sensation**

Break a tongue blade to get a sharp point. After asking the child to close the eyes, touch the child in various places on each arm and leg, alternating the sharp and dull ends of the tongue blade. A paper clip may also be used. Children over 4 years of age can normally distinguish between a sharp and dull sensation each time. To improve the child's accuracy with the test, let the child practice describing the difference between the sharp and dull stimulation.

An inability to identify superficial touch and pain sensation may indicate sensory loss. Identify the extent of sensory loss, such as all areas below the knee. Other sensory function tests (temperature, vibratory, deep pressure pain, and position sense) are performed when sensory loss is found. Refer to other texts for a description of these procedures.
INFANT PRIMITIVE REFLEXES
Evaluate the movement and posture of newborns and young infants by the Moro, palmar grasp, plantar grasp, placing, stepping, and tonic neck primitive reflexes. These reflexes appear and disappear at expected intervals in the first few months of life as the central nervous system develops. Movements are normally equal bilaterally. An asymmetric response may indicate a serious neurologic problem on the less responsive side. See “Newborn Primitive Reflexes” in Chapter 27 for more information.

SUPERFICIAL AND DEEP TENDON REFLEXES
Evaluate the superficial and deep tendon reflexes to assess the function of specific segments of the spine.

Superficial Reflexes
Assess superficial reflexes by stroking a specific area of the body. The plantar reflex, testing spine levels L4 to S2, is routinely evaluated in children (Figure 35–43). Assess the cremasteric reflex in boys (see page 1007).

To assess the plantar reflex, stroke the bottom of the infant’s or child’s foot in the direction of the arrow. Watch the toes for plantar flexion or the Babinski response, fanning and dorsiflexion of the big toe. The Babinski response is normal in children under 2 years of age. Plantar flexion of the toes is the normal response in older children. A Babinski response in children over 2 years of age can indicate neurologic disease.

Deep Tendon Reflexes
To assess the deep tendon reflexes, tap a tendon near specific joints with a reflex hammer (or with the index finger for infants), comparing responses bilaterally. The biceps, triceps, brachioradialis, patellar, and Achilles tendons are usually evaluated in children. Inspect for movement in the associated joint and palpate the strength of the expected muscle contraction (Table 35–21). The numeric scoring of deep tendon reflexes is as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Response Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No response</td>
</tr>
<tr>
<td>1+</td>
<td>Slow, minimal response</td>
</tr>
<tr>
<td>2+</td>
<td>Expected response, active</td>
</tr>
<tr>
<td>3+</td>
<td>More active or pronounced than expected</td>
</tr>
<tr>
<td>4+</td>
<td>Hyperactive, clonus may be present</td>
</tr>
</tbody>
</table>

Responses are normally symmetric bilaterally. The absence of a response is associated with decreased muscle tone and strength. Hyperactive responses are associated with muscle spasticity.

ANALYZING DATA FROM THE PHYSICAL EXAMINATION
Once the physical examination has been completed, group any abnormal findings for each system with those of other systems. Use clinical judgment to identify common patterns of physiologic responses associated with health conditions. Individual abnormal physiologic responses are also the basis of many nursing diagnoses. Be sure to record all findings from the physical assessment legibly, in detail, and in the format approved by your institution.
### TABLE 35–21 Assessment of Deep Tendon Reflexes and the Spinal Segment Tested with Each

<table>
<thead>
<tr>
<th>Deep Tendon Reflex</th>
<th>Technique and Normal Findings*</th>
<th>Spine Segment Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biceps</strong></td>
<td>Flex the child’s arm at the elbow, and place your thumb over the biceps tendon in the antecubital fossa. Tap your thumb. <em>Elbow flexes as the biceps muscle contracts.</em></td>
<td>C5 and C6</td>
</tr>
<tr>
<td><strong>Triceps</strong></td>
<td>With the child’s arm flexed, tap the triceps tendon above the elbow. <em>Elbow extends as the triceps muscle contracts.</em></td>
<td>C6, C7, and C8</td>
</tr>
<tr>
<td><strong>Brachioradialis</strong></td>
<td>Lay the child’s arm with the thumb upright over your arm. Tap the brachioradial tendon 2.5 cm (1 in) above the wrist. <em>Forearm pronates (palm facing downward) and elbow flexes.</em></td>
<td>C5 and C6</td>
</tr>
</tbody>
</table>
Deep Tendon Reflex Technique and Normal Findings & Spine Segment Tested with Each—continued

<table>
<thead>
<tr>
<th>Deep Tendon Reflex</th>
<th>Technique and Normal Findings &amp; Spine Segment Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patellar</strong></td>
<td>Flex the child’s knees, and when the legs are relaxed, tap the patellar tendon just below the knee. Knee extends (knee jerk) as the quadriceps muscle contracts.</td>
</tr>
<tr>
<td><strong>Achilles</strong></td>
<td>While the child’s legs are flexed, support the foot and tap the Achilles’ tendon. Plantar flexion (ankle jerk) as the gastrocnemius muscle contracts.</td>
</tr>
</tbody>
</table>

*italics indicate normal findings.

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**Critical Concept Review**

**LEARNING OBJECTIVES**

Describe the elements of a health history for an infant or child of different ages.

**CONCEPTS**

Historical data to collect includes:

1. Chief complaint.
2. History of the present illness or injury.
3. Past history.
5. Review of systems.
6. Family history.
7. Psychosocial data.
8. Developmental data.

(continued)
Describe strategies to gain cooperation of a young child for assessment.

1. Allow the young child to stay in caretaker's lap for most of the examination.
2. Allow the young child to hold and examine any equipment before it is used on the child.
3. Avoid the use of any quick, jerky movements when performing assessments.

Describe the differences in sequence of the physical assessment for infants, children, and adolescents.

1. Any painful or frightening procedures (examination of throat and ears) should be delayed until the end of the physical assessment of the infant and young child.
2. Physical examination of the school-age child should proceed in a head-to-toe fashion, with the exception of the genitalia examination (should be done last).
3. The physical examination of the adolescent may be completed without the presence of the parent, especially the examination of the genitalia.

Modify physical assessment techniques according to the age and developmental stage of the child.

Infants and toddlers:
1. Head circumference is required until age 3.
2. Palpate fontanels until closure.
3. Assess vision and hearing response with the use of toys and familiar objects.
4. Perform the abdominal examination with the infant and toddler on the lap of the caregiver and use distraction.
5. Use direct percussion of the chest to evaluate resonance.

Preschooler:
1. Ask young child to show teeth to begin assessment of the mouth and throat.
2. Gently pry teeth apart with a tongue depressor if teeth remain clenched.
3. Use familiar objects and words easily recognized to assess vision and hearing.
4. Males should sit “tailor fashion” to assess genitalia.

Adolescent:
1. Assess breast development in both males and females.

Determine the sexual maturity rating of males and females based upon physical signs of secondary sexual characteristics present.

The sexual maturity rating (SMR) for:
1. Females: Average of breast development and pubic hair (Tanner stages).
2. Males: Average of genital development and pubic hair (Tanner stages).

Recognize at least five important signs of a serious alteration in health condition that require urgent nursing intervention.

1. Altered level of consciousness.
2. Bradycardia.
3. Tachypnea (greater than 60 breaths per minute).
5. Signs of dehydration (no tears, dry mucous membranes, doughy skin turgor, sunken fontanelle, increased urine concentration).
7. Retractions.
8. Cyanosis.
CRITICAL THINKING IN ACTION

View the Critical Thinking in Action video in Chapter 35 of the CD-ROM. Then, answer the questions that follow.

It is a relatively calm night in the Children’s hospital emergency room when a 6–month–old infant named Colby is brought in by emergency personnel from an automobile accident. Colby was in his infant, rear–facing, car seat, riding with his parents when another car rear–ended them. The parents were not hurt and did not need to go to the hospital. The father immediately called 911 on his cell phone after the accident. When the ambulance arrived at the emergency room, you were given the report from the EMT. He stated that Colby was alert and quiet in his father’s arms when they arrived on the scene and he did not have any obvious signs of trauma. He is being brought to the hospital to make sure he did not sustain any injuries from the accident. His vital signs are as follows: temperature—98.9 degrees fahrenheit, respirations—40, pulse—110 and blood pressure is 95/55.

1. The fontanelles are an extremely important body part to examine in children. In the scenario with Colby, it can give an indication if there is increased intracranial pressure related to a head injury. How can you describe the placement of the fontanelles, and when should they close and become unpalpable? Also, describe why the head would be more likely to sustain injury in an infant like Colby versus an adult.

2. After reviewing the scenario, what can you tell the parents about Colby’s vital signs and stability at this time? What is the difference between adult vital signs and Colby’s vital signs?

3. Describe what structures in the chest and abdominal area of Colby’s body would be of concern with the type of accident he sustained.

4. If a heart murmur were to be found on examination of Colby, what would be the five ways to describe it?

REFERENCES


