9. The priority nursing assessment of a patient with myasthenia gravis would be to:
   1. determine the degree of fatigue.
   2. assess the level of knowledge regarding the disease.
   3. monitor the adequacy of respiratory function.
   4. check the patient's swallowing, speech, and protective reflexes.

10. The nurse determines that risk for injury is the priority nursing diagnosis for a patient diagnosed with Parkinson's disease. Which nursing intervention(s) would help prevent occurrence of falls? *(Select all that apply.)*
    1. Encourage use of wheelchair.
    2. Apply leg braces.
    3. Remove loose carpets or throw rugs.
    4. Install grab bars in the shower and tub.
    5. Install low toilet seats.

Critical Thinking Activities

Scenario A

Your patient had a bout of the "flu" about a week ago. Today he noticed he was having trouble walking. When he got home from an errand, he had trouble pulling his sweater over his head. His wife brought him to the emergency department.

1. Which neurologic problem within this chapter do you think he might have?
2. What might be done to establish a diagnosis?
3. What would be a top priority in his care at this time?
4. What further problems do you think could occur?

Scenario B

Mrs. Jones seems less animated than she has been over the past several months. Her husband tells you she has fallen three times since her last office visit. You notice that she seems more stooped over and her movements are "jerky." The physician examines her and after a thorough history and physical tells the couple that he thinks Mrs. Jones has Parkinson's disease. He prescribes Sinemet for her.

1. What can you anticipate that Mr. and Mrs. Jones will need to be taught?
2. What are the potential complications of Parkinson's disease?

Scenario C

A fellow student in your clinical group confides that she has myasthenia gravis. She takes Mestinon for control of the disease.

1. What factors could cause her symptoms to worsen?
2. What might happen if she forgets to take her medication before reporting for her clinical rotation?

Scenario D

A man comes to the clinic complaining of difficulty enunciating, of having tingling and prickling in the extremities, and of having more difficulty walking. After diagnostic testing it is determined that he has amyotrophic lateral sclerosis.

1. What is the focus of interdisciplinary care?
2. What is the prognosis for the patient?

chapter 26

The Sensory System: Eye and Ear

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Objectives

Theory

1. Identify ways in which nurses can help patients preserve their sight and hearing.
2. Identify signs and symptoms of eye problems.
3. Discuss tests and examinations used to diagnose eye and ear disorders.
4. Perform nursing activities associated with assessing the eye and ear.
5. Use the nursing process for patients with disorders of the eye or ear.

Clinical Practice

1. Provide teaching for a patient who is to undergo tests for a vision problem.
2. Perform focused assessments for disorders of the eyes and ears.
3. Assist visually impaired patients to find resources to maximize their vision.
4. Instruct a spouse in ways to effectively communicate with a hearing-impaired partner.

Key Terms

cerumen (sĕ-RŪ-mĕn, p. 579)
ectropion (ĕk-TRŌ-pē-ŏn, p. 571)
entropion (ĕn-TRŌ-pē-ŏn, p. 576)
exophthalmos (ĕk-sŏf-THĂL-mŏs, p. 576)
keratitis (kĕr-ă-TĪ-tĭs, p. 571)
nystagmus (nĭs-TĂG-mŭs, p. 583)
otorrhea (ō-tō-RĒ-ă, p. 585)
photophobia (fō-tō-FŌ-bē-ă, p. 576)
presbycusis (prĕz-bē-KŪ-sĭs, p. 589)
presbyopia (prĕz-bē-Ō-pē-ă, p. 570)
ptosis (TŌ-sĭs, p. 571)
refraction (rē-FRĂK-shŭn, p. 569)
sensorineural loss (sĕn-sō-rē-NŪ-răl, p. 581)
xanthelasma (zăn-thĕ-LĂZ-mă, p. 576)

OVERVIEW OF ANATOMY AND PHYSIOLOGY OF THE EYE

WHAT ARE THE STRUCTURES OF THE EYE?

- The eyeball is spherical in shape and 2 to 3 cm in diameter (Figure 26-1).
- The sclera, which is part of the wall of the eyeball, is opaque white and covers the posterior five sixths of the eyeball.
- The transparent cornea is part of the wall of the eyeball and covers the anterior one sixth of the eyeball.
- The choroid is part of the middle layer of the eyeball. It is a highly vascular layer containing brown pigment located between the sclera and the retina.
- The ciliary body is part of the middle layer of the eyeball and contains finger-like ciliary processes that produce aqueous humor. The ciliary body helps change eye shape for near and far vision.
- The iris is the third part of the middle layer of the eyeball; it is the colored portion of the eye and is a doughnut-shaped diaphragm with the pupil as the central opening. The iris contains two groups of smooth muscles that constrict and dilate the pupil to regulate the entrance of light.
- The biconvex, transparent lens, together with the suspensory ligaments and the ciliary body, forms a partition that divides the interior of the eyeball into two chambers. The anterior chamber between the lens and the cornea is filled with aqueous humor. The posterior chamber, between the lens and the retina, contains vitreous humor.
- The suspensory ligaments connect the ciliary body to the lens.
- The retina is the inner coat of the eyeball and is found in the posterior portion of it. The retina contains several layers. The layer with rods and cones acts as the receptor for light images.
- The optic nerve carries messages from the nerve cells in the retina to the brain.
- The optic disc is formed by the axons of the ganglion cells of the retina.

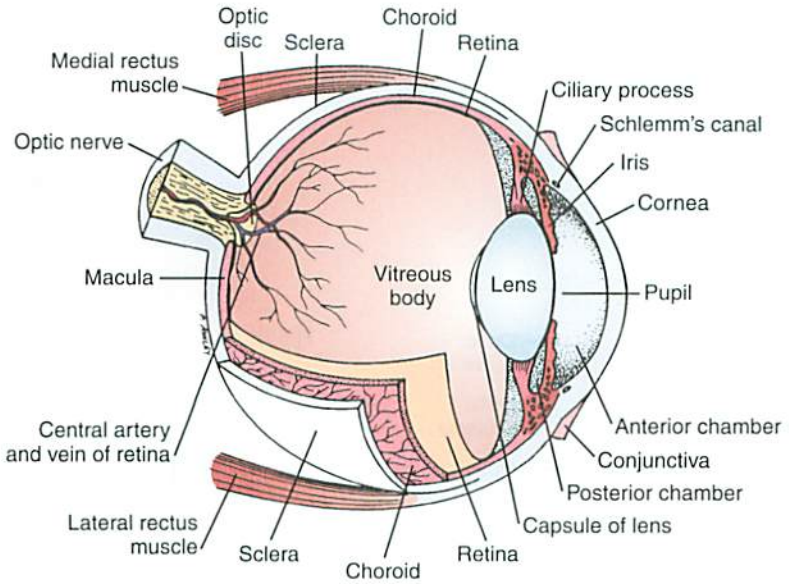

FIGURE 26-1 Structures of the eye.

- The macula lutea is a yellow spot just lateral to the optic disc that allows for visual detail.
- The fovea centralis is the area of the retina that produces the sharpest image.
- The eyelids are composed of skin, connective tissue, and conjunctiva. The conjunctiva is a thin mucous membrane that lines the eyelid and covers the anterior portion of the eyeball, except for the cornea.
- Eyelashes line the edge of the eyelid.
- Sebaceous glands are situated with the eyelashes.
- The lacrimal glands are located in the upper outer area above the eyes. The lacrimal ducts and canals carry tears from the eye to the nose.
- Six muscles attach to the eyeball and allow for movement. The muscles come from the bones of the orbit and insert on the outer layer of the eyeball.

WHAT ARE THE FUNCTIONS OF THE EYE STRUCTURES?

- The bony orbit protects the eyeball.
- The eyelashes help trap foreign particles, keeping them from landing on the eyeball.
- The eyelids protect the eyes from foreign matter and help distribute moisture on the eye surface.
- The sebaceous glands secrete an oily fluid that lubricates the lids.
- Blinking of the eyelid 6 to 30 times a minute stimulates the lacrimal glands to produce tears.
- The lacrimal gland secretes tears that moisten, lubricate, and cleanse the surface of the eye. Tears contain an enzyme that helps destroy bacteria and prevent infections.
- The transparent cornea allows light to hit the lens. It assists with the bending of light rays **(refraction),** so that the rays will hit the retina in the right location for images to be transmitted to the brain.
- The choroid's brown pigment absorbs excess light rays that could interfere with vision.
- The ciliary processes secrete aqueous humor that helps maintain the shape of the anterior chamber; it also nourishes the structures in this part of the eye. The aqueous humor assists with refraction of light onto the retina. **The amount of aqueous humor present determines the internal pressure of the eye.** The aqueous humor is reabsorbed by the blood vessels located at the junction of the sclera and the cornea.
- Muscles in the iris control dilation and constriction of the pupil.
- The suspensory ligaments connected to the ciliary body and lens allow light to focus on the lens and retina, which is necessary for close vision.
- The retina's rods and cones are photoreceptors for light and color. The nerves of the retina transmit the images perceived to the brain.
- The optic nerve conducts nerve impulses from the retina to the brain.
- Visualization of the optic disc provides information about the pressure within the eye and within the skull. When intracranial pressure gets higher, the optic disc appears "swollen" or "choked."
- Visual impulses travel along the optic nerve to the optic chiasma just anterior to the pituitary gland; at this point some of the axons cross over to the other side. Images from the medial portion of the left eye and from the lateral portion of the right eye are carried by the right optic tract. Images from the medial portion of the right eye and from the lateral portion of the left eye are carried by the left optic tract (Figure 26-2). Images are conducted to the visual cortex in the occipital lobe of the brain.
- Six muscles control movement of the eyeball. Table 26-1 lists these muscles and the nerves that control them.

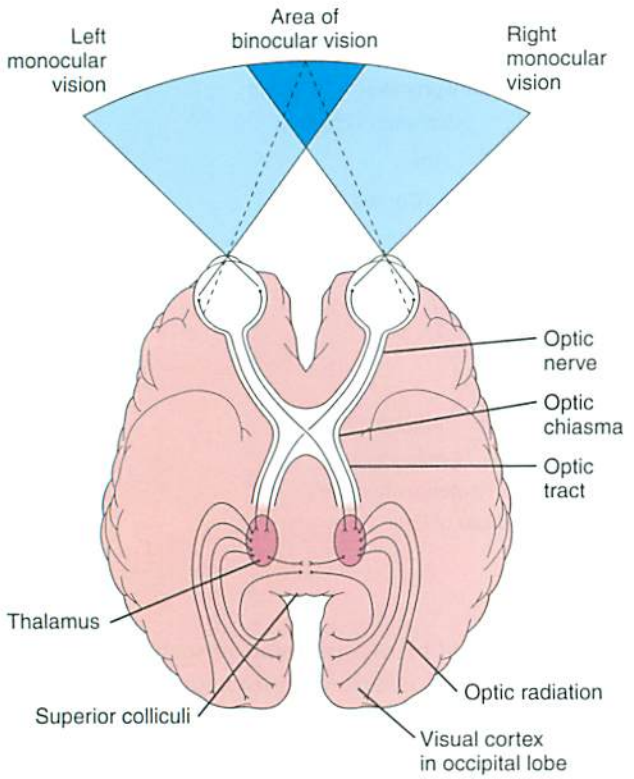

FIGURE 26-2 Visual pathway.

FIGURE 26-3 Arcus senilis, a white ring around the cornea.

WHAT CHANGES OCCUR IN THE EYE WITH AGING?

- Subcutaneous fat and tissue elasticity decrease, and the eyes appear to be sunken.
- *Arcus senilis*, an opaque ring outlining the cornea, sometimes results from the deposition of fatty globules (Figure 26-3).
- The cornea flattens and develops an irregular curvature after age 65, causing astigmatism or making an existing astigmatism worse; vision becomes blurred. Cornea transparency also decreases.
- The sclera develops a yellowish tinge due to fatty deposits; thinning of the sclera may cause a bluish tinge.
- The ability of the iris to dilate decreases, causing difficulty for the older person in going from a bright area into a darkened area.
- The lens of the eye changes after age 40, gradually losing water and becoming harder. Cataracts may form.
- The ciliary muscle has less ability to allow the eye to accommodate, a process responsible for the gradual extension of distance from the eyes at which an item to be read is held **(presbyopia).** This change begins around age 40.
- The farthest point at which an object can be identified decreases, and the older person has a narrower visual field.
- Pupil size becomes smaller, reducing the ability to see in dim light.
- Color discrimination decreases with advancing age and may cause problems.

Table 26-1 Muscles of the Eye

MUSCLE	CONTROLLING NERVE	FUNCTION
Extrinsic (Skeletal) Muscles		
Superior rectus	Oculomotor (CN III)	Elevates eye or rolls it superiorly and toward the midline.
Inferior rectus	Oculomotor (CN III)	Depresses eye or rolls it inferiorly and toward the midline.
Medial rectus	Oculomotor (CN III)	Moves eye medially, toward the midline.
Lateral rectus	Abducens (CN VI)	Moves eye laterally, away from the midline.
Superior oblique	Trochlear (CN IV)	Depresses eye and turns it laterally, away from the midline.
Inferior oblique	Oculomotor (CN III)	Elevates eye and turns it laterally, away from the midline.
Intrinsic (Smooth) Muscles		
Ciliary	Oculomotor (CN III): parasympathetic fibers	Causes suspensory ligament to relax, so lens becomes more convex for close vision.
Iris, circular muscles	Oculomotor (CN III): parasympathetic fibers	Decreases the size of the pupil to allow less light to enter the eye.
Iris, radial muscles	Sympathetic fibers from spinal nerves	Increases the size of the pupil to allow more light to enter the eye.

Adapted from Applegate, E.J. (2011). *The Anatomy and Physiology Learning System* (4th ed.). Philadelphia: Saunders, p. 205.
CN, cranial nerve.

FIGURE 26-4 Ectropion.

- Moisture secretion decreases during the senior years, placing the eyes at greater risk for irritation and infection. This is especially common after age 70. Repeated episodes of **keratitis** (inflammation of the cornea) may seriously compromise vision and can lead to loss of independence for an elderly person.
- Eversion of the lower lid **(ectropion)** occurs because of loss of muscle tone and elasticity (Figure 26-4).
- Decreased muscle tone and decreased elasticity may cause drooping of the upper lid to a point where it interferes with vision **(ptosis).**

THE EYE

EYE DISORDERS

There are two general kinds of patients with impaired vision: those who were born blind, and those who develop some degree of visual impairment later in life. This chapter focuses on the latter type of visually handicapped patient.

Eye disorders are caused by injury or disease, or are disorders for which there is a genetic predisposition. Diabetes mellitus and hypertension contribute greatly to visual loss in the United States. Untreated glaucoma causes blindness. Macular degeneration is another major cause of impaired vision. It is now known that smoking has a direct link to the incidence of macular degeneration. Cataracts eventually cause blindness, if they are not removed.

There are approximately 15 million visually impaired or blind people in the United States. Of those, 7.3 million are over 65 years of age (Braille Institute of America, 2010). There are many new surgical techniques and medical treatments that offer hope for eyesight preservation to increasing numbers of people. Efforts also have been made to educate the public about eye care, prevention of eye disease, and periodic examinations to detect eye disorders in their earliest and treatable stages.

Acquired immunodeficiency syndrome (AIDS) can cause blindness as a result of opportunistic infections that the AIDS patient contracts. Ocular problems of the AIDS patient are discussed in Chapter 11.

Prevention

As health care providers, nurses share responsibility for preserving vision throughout the patient's life span. Three major nursing goals to promote good vision are:

- Health education to inform the general public about basic eye care
- Prevention of accidental injury to the eye
- Prevention of visual loss

Healthy People 2020 goals contain 10 objectives related to preventing vision loss and improving vision.

BASIC EYE CARE

To prevent eye strain, rest the eye muscles periodically when working at the computer, watching television, doing needlework, or performing any activity that demands intensive visual effort. If the eyes tire easily or if there is headache or burning, itching, or redness of the eyes, the eyes should be examined. Good nutrition is important to eye health, and certain nutrients such as lutein and zeaxanthin are especially beneficial to vision.

Nutrition Considerations

Vitamins and Antioxidants Beneficial to Vision

Vitamin A protects against night blindness, slow adaptation to darkness, and glare blindness. The carotenoids are the precursors for vitamin A and are found in green leafy and yellow vegetables. Carrots, greens, spinach, orange juice, sweet potatoes, and cantaloupe are rich sources of the carotenoids (Linus Pauling Institute, 2010). Lutein and zeaxanthin, both antioxidants, may help prevent macular degeneration and cataracts. They are found in yellow fruits and vegetables, red and purple fruits, and greens. Lutein is particularly high in tomatoes, carrots, broccoli, kale, spinach, and romaine lettuce. Corn, cornmeal, kale, Japanese persimmons, and turnip greens have large quantities of zeaxanthin, with corn containing the highest amount. Many vitamin supplements have added lutein to their formulation (National Eye Institute, 2010).

Normal secretions of the conjunctiva and tear glands should be sufficient to lubricate the eye and wash away small particles of dust. **Accumulations of purulent material or excessive tearing usually indicate the need for an eye examination.** Dry eye syndrome in people younger than 60 years could be symptomatic of underlying disease.

Elder Care Points

Older persons sometimes suffer from "dry eyes." This is due to decreased production of tears and is treated by instilling "replacement tears," which are commercial preparations or prescriptions of solutions similar in composition to real tears.

Adults should have an eye examination once between ages 20 and 29, twice between ages 30 and 39,

and a baseline screening at age 40. After age 65, eyes should be examined by an eye specialist every 2 years (Eyecareamerica, 2010). It is particularly important to test for glaucoma because this disease usually is asymptomatic until damage to vision has occurred. People with a family history of glaucoma should be especially careful to have their eyes tested frequently for increased pressure within the eyeball, as this is the basic pathology of glaucoma, and the disorder tends to be hereditary.

PREVENTION OF EYE INJURY

Accidental injury to the eye is a major cause of diminished or total loss of vision. Adults should be cautioned to wear protective eyewear when engaging in sports such as racquetball and squash, in which small balls travel at high speeds. Protective eyewear should be worn when using machinery that might cause debris to fly into the eye, such as lawn mowers, weed trimmers, sanders, or power saws.

The rate of occupational accidents has gone down since the establishment and enforcement of rules for wearing goggles and other protective devices by people working in a hazardous environment. The National Institute of Occupational Safety and Health (NIOSH) in Rockville, Maryland, provides information about eye safety and hazards in the workplace.

Cosmetics for the eyelids, eyelashes, and eyebrows can be a source of infection and allergy. Eye makeup should be discarded every 6 months to help prevent infection. Most dyes used for hair on the scalp are not intended for use on the eyelashes and eyebrows.

Saliva should not be used to moisten eye pencils, eye shadow, or mascara, as it may contain organisms that can cause eye infection. Apply eye cosmetics with a steady hand to avoid accidentally scratching the cornea and eyelids. Cosmetics should never be shared, as this can transmit organisms.

Health Promotion

Danger Signals of Eye Disease

- Persistent redness of the eye. Infections and inflammations of the structures of the eye that are not treated may leave scars that can produce loss of vision.
- Continuing pain or discomfort especially following injury.
- Disturbance of vision. Although these symptoms may simply indicate a need for eyeglasses, blurred vision, loss of side vision, double vision, and sudden development of many floating spots in the field of vision may be symptomatic of more serious systemic diseases.
- Colored light flashes, or a feeling that a curtain has been pulled across the line of vision or a shade has been pulled down. This can indicate a retinal detachment and requires prompt attention.
- Crossing of the eyes, especially in children.
- Growths on the eye or eyelids or opacities visible in the normally transparent portion of the eye.
- Continuing discharge, crusting, or tearing of the eyes.
- Unequal size of the two pupils or distorted shape.

PREVENTION OF VISUAL LOSS

Diabetes mellitus and hypertension are chronic diseases that—when uncontrolled—may cause visual loss. Patients with these disorders are more susceptible to retinopathy. Nurses should encourage good control over these diseases.

Cultural Considerations

Latinos and Eye Disease

The Los Angeles Latino Eye Study found that Latinos had high rates of diabetic retinopathy and of open-angle glaucoma. The study interviewed and examined 6300 Latinos age 40 and older from the Los Angeles area. Many of those Latinos involved in the study were found to have previously undiagnosed diabetes. Almost half of the individuals in the study who had diabetes had diabetic retinopathy. Seventy-five percent of Latinos with glaucoma were undiagnosed before participating in the study (National Eye Institute, 2010).

To help prevent infections that might cause corneal scarring and loss of vision, encourage people who experience an accident causing a corneal abrasion to seek medical attention quickly. Promptly seeking medical attention when the eye is inflamed, is secreting purulent discharge, or is sore assists in treatment of infection that may cause a residual visual loss.

Think Critically

Can you identify four specific ways in which you might help prevent eye disorders among your relatives and patients?

Assessing patients for the presence of cataracts and recommending regular periodic eye examinations should be a part of every nurse's practice. Cataract removal can greatly improve vision. Screening for glaucoma reduces the incidence of blindness from that condition. Free screening clinics often are available in communities. Nurses can inform patients of when and where such screenings are available. The Tono-Pen is often used for such screenings. It is also used in the emergency department when a patient complains of symptoms that might be from increased intraocular pressure (Figure 26-5).

Nurses must be aware that there are many types of visual loss. Some may affect only one area of the field of vision in one eye, whereas others affect parts of the field of vision in both eyes. The degree of visual impairment varies greatly.

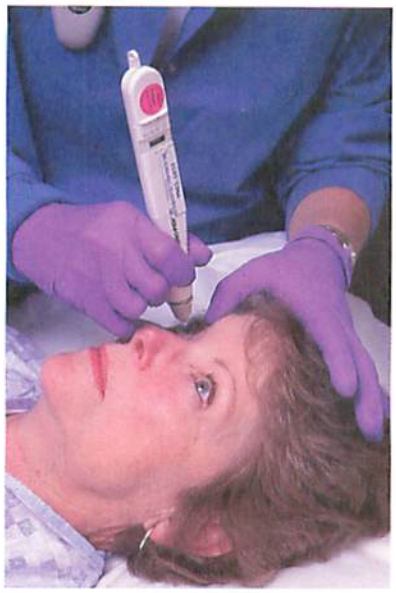

FIGURE 26-5 The Tono-Pen is used to check intraocular pressure.

DIAGNOSTIC TESTS AND EXAMINATIONS

Diagnostic tests are performed to test visual acuity, prescribe prescription lenses, inspect the interior of the eye, check intraocular pressure, and assess the health of the retinal blood vessels (Figure 26-6). Computed tomography, optical coherence tomography, and magnetic resonance imaging may also be used to diagnose eye disorders. Table 26-2 provides further information about diagnostic tests.

❖ NURSING MANAGEMENT

The nursing care of patients with severe visual handicaps demands a special awareness of the unique problems encountered by someone who has either a partial or a total loss of vision. You must be sensitive to these patients' special needs. Patient education is especially important to these patients' acceptance of their visual disorder, their participation in diagnostic and therapeutic measures, and their adjustment to their new surroundings when they are hospitalized or admitted to a long-term care facility.

FIGURE 26-6 Slit-lamp ocular examination.

■ Assessment (Data Collection)

All nurses should be able to perform a basic eye examination, inspecting the eye for signs of redness or discharge, and checking visual acuity with a Snellen eye chart. Only nurses who have had special training are qualified to conduct a complete eye assessment (Figure 26-7). Significant data can be obtained by nurses who lack specialized education, by taking an adequate history.

History Taking

Many systemic diseases, including AIDS, hypertension, and diabetes mellitus, secondarily affect the eye and its functions. In the general assessment of any patient, you should be aware of the more obvious indications of an ophthalmic pathology, whether it be primary or secondary.

A history of neurologic disorders should be noted. Neuromuscular diseases are especially likely to cause diplopia, blurred vision, or inability to move the eyes. Endocrine disorders that secondarily affect the eyes include thyroid disease and diabetes mellitus. Acute hyperglycemia can alter the shape of the lens and temporarily cause blurred vision. **Prolonged hyperglycemia can adversely affect the blood vessels of the retina, causing bleeding, and leading to loss of vision.** Liver and kidney failure can produce pathologic changes in both neural and vascular structures within the eye. Retinal changes also can be caused by hypertension and atherosclerosis.

Some drugs are capable of producing either transient or permanent ocular changes that lead to disturbances in color vision and visual acuity, and to the formation of cataracts, retinopathy, and glaucoma. Among common drugs that have possible ocular side effects are digitalis leaf, corticosteroids, indomethacin (Indocin), and sulfisoxazole (Gantrisin).

A family history of eye disorders can be significant because disorders such as strabismus, retinitis pigmentosa, glaucoma, and cataracts tend to run in families, or follow a pattern of inheritance.

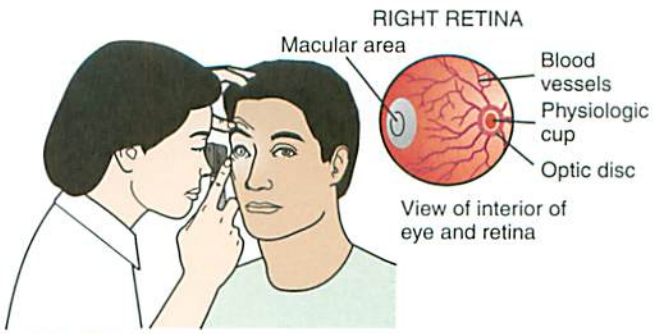

FIGURE 26-7 Examination of the eye with an ophthalmoscope.

Table 26-2 Diagnostic Tests for Eye Problems

TEST	PURPOSE	DESCRIPTION	NURSING IMPLICATIONS
Ophthalmoscopy (retinoscopy)	To inspect the fundus (back portion) of the eyeball to detect abnormalities of the retina, macula, optic disc, and retinal vessels	The examiner uses an ophthalmoscope (see Figure 26-7) to focus light through the pupil onto the fundus.	The room is darkened before the examiner approaches the patient with the ophthalmoscope. Drops may be placed in the eye before this examination to dilate the eye and offer a wider area through which to view the fundus.
Visual acuity	To determine status of vision	The Snellen eye chart is used. It is placed 20 feet from the patient, and first one eye is occluded and then the other eye is occluded. The person begins reading lines of letters that decrease in size. Visual acuity is expressed as a fraction for each eye. The numerator (first) figure indicates the distance between the patient and the chart. The denominator (second) figure expresses the distance at which the person with 20/20 vision could read the letters in the line correctly. Visual acuity of 20/20 in each eye is normal; vision of 20/200 (with correction) is legally defined as blindness.	Explain the procedure to the patient. Have the patient hold the occluding card close to the nose so that the entire eye is covered. Start with the third line. If the patient cannot read that, progress upward; if the line is correctly read, go to the next line down; etc. Test the other eye. Record the findings.
Near vision test	To determine status of near vision	The patient is given a Jaeger's Test Type card with different sizes of type on it. One eye is occluded while the patient reads the lines of type. Determination of vision status is made on the basis of what a person with normal vision can read.	Explain that this is a simple test of vision to determine whether there are any problems that might require further testing.
Visual fields test (confrontation test)	To examine the patient's visual fields, detecting problems with peripheral vision	The examiner faces the patient and asks her to look directly into his eyes. The examiner covers his right eye, and the patient covers her left eye. Then the examiner's finger is moved from an area outside of the peripheral vision into the line of vision. The patient should detect the finger about the same time as the examiner. The test is repeated with the other eye covered.	Explain the test to the patient and remind her to keep looking directly into your eyes.
Extraocular muscle function test	To test the function of the extraocular muscles	Ask the patient to hold her head still and to move the eyes to follow a small object such as a pen to each of the six cardinal points: right; upward and right; down and right; left; upward and left; down and left.	Observe for parallel eye movements and any deviation of movement. Nystagmus is a normal finding for the far lateral gaze. Record your findings.
Color vision test	To determine if the patient has any color blindness	Use the Ishihara chart book, which shows numbers composed of dots of one color within an area of dots of a different color. Ask the patient what she sees on the page for each chart. Test each eye separately. Reading the numbers correctly indicates normal color vision.	Explain the purpose of the test. Tell the patient to tell you what number appears on the chart. Record your findings.

Refraction	To determine amount of lens correction necessary to restore person's vision to as near normal as possible with glasses	A series of glass lenses are placed in front of the patient's eyes to determine which lens provides the best vision correction. Each eye is tested separately.	A prescription for glasses will be written depending on the findings of the refraction test. The test may be performed for both near and far vision.
Intraocular pressure test	To determine the amount of pressure within the eye; aid in diagnosis of glaucoma	A tonometer is used to measure the pressure. This may be a handheld instrument, but it usually is a device that measures pressure by taking a reading while air is directed at the eye by a pneumotonometer. Another type of tonometer is the applanation tonometer. Normal intraocular pressure is 10-21 mm Hg.	Explain that this is a test to determine whether a patient might have glaucoma. More than one reading on different days is necessary to confirm a diagnosis of glaucoma. If a diagnosis of glaucoma is made, medication can be prescribed to help control the intraocular pressure and preserve vision.
Slit-lamp biomicroscopic examination	To examine the surface of the eye	A beam of light is reduced to a narrow slit that illuminates only a small section of the eye, allowing examination of a thin section of the eye structures at a time.	Explain that this device helps detect "floaters" in the vitreous humor, and abnormalities of the cornea and other structures of the eye. The eyes may be dilated with mydriatic drops for this test.
Topical dye (corneal staining)	To detect abrasions of the cornea or the presence of a foreign body on the cornea	Fluorescein dye drops are administered to the affected eye. The dye remains on the injured tissue or surrounds a foreign body. Such areas usually appear as green spots.	Explain the procedure and the rationale for the test. Warn that the drops may sting slightly for a few minutes. Give the patient a tissue to absorb the excess drops as they may stain clothing.
Fluorescein angiography (retinal angiography)	To detect tumors of the interior of the eye and to help diagnose and measure the extent of retinopathy	An IV injection of sodium fluorescein is given. A short time later, photographs of the fundus are taken with a special camera.	An IV injection is necessary. A signed consent form is required to perform the procedure.
Electroretinography	To test the functional integrity of the retina; evaluates degeneration of the photoreceptor cells	Electrodes embedded into a contact lens are placed directly on the anesthetized eye. A light stimulus is introduced. The change in electrical potential of the eye caused by the flash of light is measured.	Instruct the patient that she must fixate on the target and not move her eyes during the test.
Optical coherence tomography (OCT)	To record images of retinal structures To differentiate the anatomical layers within the retina and allow measurement of retinal thickness To detect macular holes, epiretinal membranes, cystoid macular edema, and other pathologies	Focused beams of light are directed into the eye that scan the structural features of the retina. A cross-sectional image similar to a topographic map is produced.	The patient's eyes must be dilated. Tell the patient that she will be looking into a machine. The test takes from 10-20 min.
Amsler grid test	To detect macular degeneration	Using a handheld card printed with a grid of black lines similar to graph paper, the patient fixates on a center dot and records abnormalities of the grid lines.	Test should be performed every week or two. Instruct the patient to record seeing wavy or missing lines, or distorted areas.
Ultrasonography	To evaluate the characteristics of a lesion, and its size and growth over time, or to determine the presence of a foreign body	A probe is placed directly on the eyeball. Sound waves are transmitted into the eye, bounce back off the various tissues, and are collected by a receiver and amplified on an oscilloscope screen.	Explain the procedure to the patient.

IV, intravenous.

Focused Assessment

Data Collection for Eye Disorders

The following questions should be asked when gathering history regarding an eye disorder:

- Have you noticed a change in your vision?
- Do you have any pain or discomfort in the eyes? Itching? Burning? Stinging? Excessive tearing or watering?
- Have you had any episodes of blurred vision? Double vision? A loss in the field of vision? Blind spots? Floating spots?
- Do you have difficulty with vision at night?
- Is there any pain in the eyes when you are in bright light?
- Do you have headaches in the brow area?
- Do you see halos around lights?
- Have you ever injured an eye in any way?
- Do you experience frequent reddening of the eye (conjunctivitis)?
- Do you ever experience discharge or sticky matter in the eye?
- Do you find that your lids are crusty when you awaken?
- Do your eyes feel dry? Do you frequently use eyedrops?
- Do you wear contact lenses? Use glasses?
- What medications do you take regularly?
- Is there any history of glaucoma in your family?
- Have you ever been told you have diabetes? Hypertension?
- When did you have your last eye examination?
- *For those patients who have a previous visual loss:* How do you cope with your loss of vision?

Sometimes patients are not aware of gradual changes in vision, but have noticed that they have had more minor accidents lately, seem to be more easily fatigued, or are less interested in doing things that once gave them pleasure, such as sewing or some other hobby.

Physical Examination

Observe the patient's eyes and eye area for redness of the conjunctiva, swelling of the eyelids or in the periorbital space, excessive tearing, change in visual acuity, secretions and encrustations on the eyelids, abnormal position of the eyelid, and **exophthalmos** (protrusion of the eyeball). Abnormalities of lid position are described in Table 26-3. **Xanthelasma,** or soft, raised, yellow areas, sometimes appear on the eyelid after age 50 (Figure 26-8). Signs and symptoms of selected eye diseases are listed in Table 26-4. In addition to the more obvious signs of eye disease, visual impairment also can be assessed by noting the patient's head, hand, and eye movements. Tilting the head to one side to improve vision could mean that the patient has double vision or that one eye is much stronger than the other. Squinting could mean poor vision. Shading the eyes with the hands may indicate an increased sensitivity to light **(photophobia).**

Observation of the patient's ability to move the eyebrows and eyes can be helpful in diagnosing nerve damage. Inability to raise the eyebrows indicates damage to the facial nerve. Movement of the eyeball to direct the gaze is controlled by no less than six muscles, which are themselves under the control of three cranial nerves: the oculomotor nerve (third cranial), the trochlear nerve (fourth cranial), and the abducens nerve (sixth cranial) (see Table 26-1).

Table 26-3 Abnormalities of Lid Position

ABNORMALITY	CAUSES	SYMPTOMS	TREATMENT
Entropion: Inversion of lid margin; eyelids are turned inward toward eyeball so that lashes rub against eyeball	Scarring and contraction of skin near eyelid (cicatricial entropion); or aging of skin with laxness of tissues supporting the lid and contraction of orbicularis muscle (spastic entropion)	Pain, tearing, redness, and corneal ulceration due to lid margin and eyelashes rubbing against cornea	Splinting the lid, using a pressure patch, or taping lid into everted (turned outward) position Surgical correction by tightening musculature and everting lid margin
Ectropion: Eversion or outward turning of the lower lid	Aging and laxness of skin and muscle tissues, facial paralysis, edema of conjunctiva lining the lid, or contraction of scar tissue	Irritation of palpebral conjunctiva, spilling of tears down the cheeks due to blocked outlet, irritation of skin of cheeks, symptoms of conjunctivitis	Usually responds to patching of the eye Surgical correction necessary if paralysis of orbicularis muscle is permanent or if there is severe scarring and contraction of skin near the lid
Ptosis: Drooping of the eyelid so that it partially or completely covers the cornea	Congenital weakness of the levator superioris muscle or long-term presence of foreign body; one of first signs of myasthenia gravis	Obvious drooping of eyelid If not corrected in infants, can lead to blindness because light rays cannot enter and stimulate development of the eye Patient may be observed tilting head back or raising eyebrows in an effort to see from under eyelids	Surgical correction Removal of foreign body, if that is the cause

FIGURE 26-8 Xanthelasma.

Nursing Diagnosis

Nursing diagnoses are based on the data obtained from assessment. The LPN/LVN collaborates with the RN in formulating the nursing care plan and selecting the nursing diagnoses. Some of the nursing diagnoses most frequently encountered in the care of patients with eye disease are:

- Disturbed sensory perception related to decreased visual acuity
- Risk for injury related to decreased visual field
- Fear of blindness related to consequences of diabetic retinopathy

Table 26-4 Clinical Signs and Symptoms of Selected Eye Diseases, Medical Treatment, and Nursing Interventions

DISEASE	SIGNS AND SYMPTOMS	MEDICAL TREATMENT AND NURSING INTERVENTIONS
Blepharitis: Infection of glands and lash follicles along lid margin	Itching, burning, sensitivity to light Mucus discharge and scaling; eyelids crusted, glued shut, especially on awakening Loss of eyelashes	Warm compresses to soften secretions; scrub eyelids with baby shampoo; stroke sideways to remove exudate and scales Antibiotic eyedrops; systemic and topical antibiotics if skin is infected
Chalazion: Internal stye; infection of meibomian gland	Astigmatism or distorted vision, depending on size and location of chalazion Small, hard tumor on eyelid	Chalazion may require surgical excision and antibiotics to avoid chronic state and cyst formation
Hordeolum: External stye; infected swelling near the lid margin on inside	Sharp pain that becomes dull and throbbing Rupture and drainage of pus bring relief Localized redness and swelling of lid	Hordeolum usually resolves spontaneously Warm compresses qid for 10-15 min to bring stye to a head and hasten rupture Caution patient never to squeeze swelling, as this could spread infection; poor health status can predispose a person to recurrence of styes
Conjunctivitis: Inflammation of the conjunctiva; "pink eye" is a specific type caused by chemical irritants, bacteria, or virus	Varying degrees of pain and discomfort Increased tearing and mucus production Itching; sensation of a foreign body in the eye	Depends on type of infecting organism; antibiotic eyedrops and ointments Special care when handling infective material
Keratitis: Inflammation of the cornea	Varying degrees of pain and discomfort Photophobia; blurred vision if center of cornea is affected	Depends on specific causes; could be allergy, microbes, ischemia, or decreased lacrimation. Most superficial lesions are self-healing. Antibiotic eyedrops or ointment used for bacterial infections. Steroids can reduce inflammation and discomfort; however, herpes infection can rapidly worsen keratitis unless an antiviral agent is given simultaneously Patient is encouraged to use good personal hygiene, frequent hand hygiene
Corneal abrasion or ulceration	Moderate to severe pain and discomfort aggravated by blinking History of trauma, contact lens wear	Change or discontinue use of contact lens Teach patient proper way to insert, remove, and care for contact lens Caution patient not to moisten lens with saliva

- Impaired home maintenance management related to impaired or lost vision
- Deficient diversional activity related to visual limitation
- Deficient knowledge related to proper method and schedule for instilling eyedrops

Planning

Expected outcomes for the above nursing diagnoses might be:

- Patient will compensate for decreased visual acuity and not suffer sensory deprivation.
- Patient will not experience injury.
- Patient will verbalize decreased fear as treatment begins to help condition.
- Patient will seek assistance with home maintenance within 7 days.
- Patient will explore other means of diversion than reading and watching television.
- Patient will demonstrate proper installation of eyedrops and will verbalize the schedule for the eyedrops.

When a patient is visually impaired, the nurse must plan extra time to assist with personal care, to allow the patient to perform as much self-care as possible. The instillation of preoperative eyedrops is a very time-consuming nursing task (Box 26-1). The nurse must plan for this when creating the work plan for the shift. Hands must be washed before and after instilling eyedrops. Often an eye patch must be removed, and then a new one placed, after instilling eye medication. Planning also must be done to incorporate patient teaching on the administration of medication, self-care instructions for the patient with glaucoma, and postoperative instructions.

Implementation

Many problems with the eye require eyedrops or ophthalmic ointment applied to the eye, several times a day. A new contact lens delivery system is being tested to dispense an antibiotic directly to the surface of eye in a time-release manner. The lens stays in the eye for 1 month. A prototype is in trials (Bankhead, 2009).

Nursing Interventions for the Visually Impaired Patient

Those who are deprived of optimum sight must make considerable adjustments. People who have lost their eyesight may experience hopelessness and despair. The visually impaired patient goes through stages of grief in much the same way the dying person does. A different lifestyle must be learned, but it is not necessarily less meaningful.

When communicating with these patients, remember that the person has a vision impairment; she is not deaf. Speak normally. Speak to the person and identify yourself as you enter the room, and do not touch her until after you have spoken to her—this prevents startling or frightening the patient when she may not have heard you enter the room. Be certain that she is oriented to the room and can easily locate the call bell.

Prevention of accidents is an important part of the care of a blind person. Aside from the physical effects of bumping into objects or falling over them, the visually impaired person also suffers from a loss of self-confidence and security if movement is not safe and independent. Doors should be kept closed or left completely open. They must never be left ajar. Always return things to their places when working in the room. If it is necessary to move any object in the room, ask for the patient's consent, and state the object's new location. When you leave the room, tell the visually impaired person that you are going. This will prevent her from becoming frustrated by resuming a conversation, only to find that no one is there. When ambulating with the visually impaired patient, lead with the patient holding your arm, as she follows.

Pity is neither expected nor appreciated by the visually impaired. They only want to be treated as normal

Box 26-1 Instillation of Eyedrops and Eye Ointment

Check the medication label and be certain which eye is to receive the medication. Follow the "Five Rights" of medication administration. Perform hand hygiene and apply gloves.

EYEDROPS

- Remove the cap and place it on the table on its side or upside down.
- With the patient sitting or reclining, ask the patient to look up at the ceiling and tilt the head slightly toward the eye receiving the drop.
- With a tissue beneath the fingers, retract the lower lid downward, exposing the conjunctival sac.
- Stabilize the eyedrop container above the eye and drop the designated number of drops directly into the conjunctival sac. Do not place drops on the cornea. Block the entrance to the lacrimal gland by placing a finger over it.
- Carefully replace the cap on the container without contaminating the dropper tip.
- Ask the patient to close the eyelids gently and move the eyes from side to side under the lids to distribute the medication.

EYE OINTMENT

- Remove the cap from the tube and set it down on the table upside down.
- Expose the conjunctival sac.
- Apply a thin ribbon of ointment along the entire length of the conjunctival sac.
- To end the ribbon, twist the tube with a lateral movement of the wrist without touching the eye.
- Recap the tube.
- Ask the patient to gently close the eyelids and roll the eyes around under the lids to distribute the medication.

people and would prefer to ask for your help when they need it rather than have you do everything for them. If you are assigned to the care of a visually impaired person, determine the amount of assistance the patient needs and wants, by asking. Do not assume that the person is helpless, but avoid neglect when help is needed.

When a visually impaired patient is admitted, she will require special orientation to the room and surroundings. If there is total blindness, describe the size of the room and the placement of furniture, using the bed as the focal point. An ambulatory patient can be walked around the room and to the bathroom to develop familiarity with the location of the commode, bath, and sink. As with any patient, explain how to locate and use the call system, the radio, and the telephone (if there is one at the bedside).

Most patients prefer to feed themselves, if at all possible. However, it usually is necessary to set up the meal tray of the visually impaired patient, using the "clock" method for placement of food on the plate. The patient is told what food is in which area (i.e., "The potatoes are at 2 o'clock"). Setting up the meal tray includes opening containers of milk and juice, pouring coffee or tea, and cutting meat into bite-sized pieces, unless the patient is accustomed to doing these things.

Assignment Considerations

Assisting the Visually Impaired Patient

If a certified nursing assistant (CNA) or unlicensed assistive personnel (UAP) is assigned to help feed, ambulate, or care for a visually impaired patient, be certain that the person understands what the visual impairment is and whether one or both eyes are affected. Ask that the aide announce his presence with a knock on the door and to speak before touching the patient. Review how to feed the blind patient and how to assist with ambulation. Gently remind the CNA or UAP that the patient is blind and not deaf, unless deafness is also a patient problem.

Do not give a visually impaired person a straw or drinking tube unless you are asked to, because it may be awkward to use. If you must feed the patient all of a meal, work slowly and calmly. Indicate about hot and cold foods on the tray, and alternate dishes rather than feeding all of one thing before offering another. Avoid talking too much, thus forcing the patient to either stop eating or answer you with a mouth full of food. Whenever possible, help the patient select finger foods such as sandwiches and raw fruit or vegetables from the menu. The goal is to help the patient maintain dignity and self-respect while meeting her personal needs.

If a guide dog is present, do not interfere with it or pet it as it is working. Do not feed the dog; let the patient feed at the appropriate time. Be sure the dog is near the bed on its own mat. Ask if the mat may be on the side of the bed that the staff are less likely to use.

Think Critically

Can you think of three specific ways in which you can assist a blind patient who is admitted to the hospital to maintain as much independence in this setting as possible?

Evaluation

Evaluation is based on reassessing data and determining whether expected outcomes have been met. This is an ongoing process. Some questions to be asked when gathering data for evaluation include: Is the patient compliant with the use of eye medications? Is an infection resolving? Is vision improving? If interventions have not been effective in helping the patient achieve expected outcomes, the plan of care should be altered.

COMMUNITY CARE

Nurses in all settings should be conscious of eye safety for themselves and those around them. Public education about using sunhats, visors, and dark glasses when out of doors to protect the eyes from ultraviolet A and B (UVA and UVB) rays is another function of all nurses.

Nurses working in home care often find that patients have not had eye care in many years; prescriptions have not been changed, and their quality of vision has decreased. Arrange for referral to an appropriate agency to set up an eye examination when the patient cannot afford an eye exam. Glaucoma testing should be encouraged every 2 to 3 years for all adults over age 40.

OVERVIEW OF ANATOMY AND PHYSIOLOGY OF THE EAR

WHAT ARE THE STRUCTURES OF THE EAR?

- The external ear consists of the pinna (auricle) and the canal (auditory meatus). The pinna is the fleshy part of the ear situated on the side of the head (Figure 26-9).
- The auditory meatus is a tube about 2.5 cm long extending from the pinna to the tympanic membrane.
- The meatus is lined with numerous hairs and glands that secrete a waxy substance called **cerumen** (earwax).
- The middle ear contains the auditory bones (ossicles), and opens into the eustachian tube.
- The auditory ossicles are three small bones: the malleus (hammer), the incus (anvil), and the stapes (stirrup).
- The malleus attaches to the tympanic membrane.
- The stapes attaches to the oval window.
- The incus links the malleus and the stapes.
- The tympanic membrane (eardrum) separates the middle ear from the external ear.
- The eustachian tube connects the middle ear with the throat.

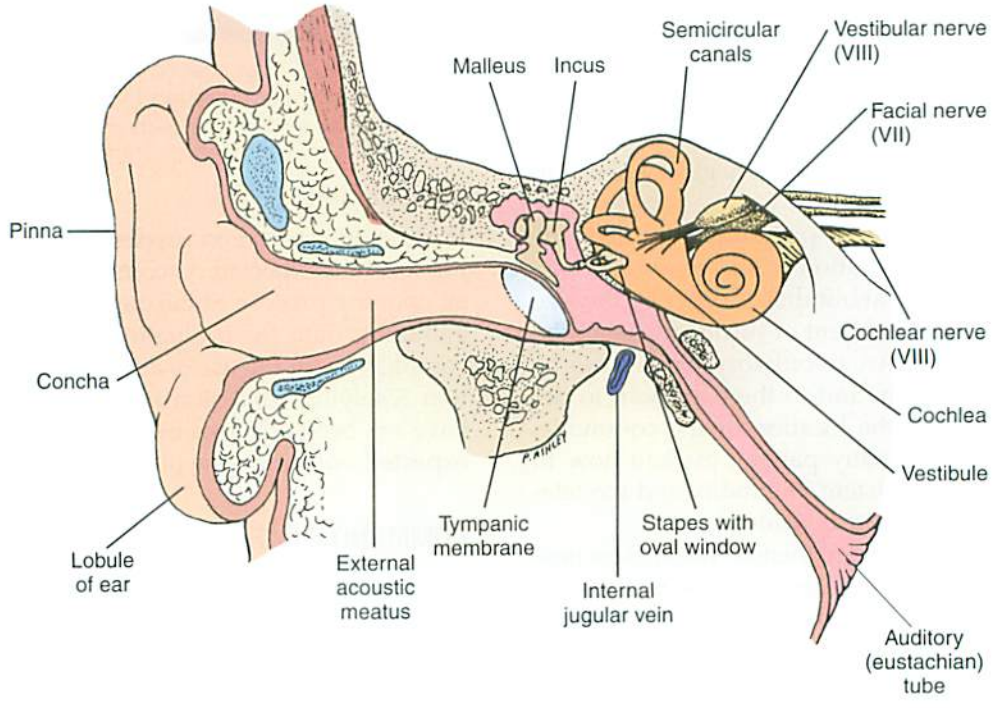

FIGURE 26-9 Structures of the ear.

- The oval window and the round window connect the middle ear to the inner ear.
- The inner ear is divided into the vestibule, the semicircular canals, and the cochlea.
- The inner ear contains a bony labyrinth with a membranous labyrinth lining; the inner ear is located in the temporal bone of the skull.
- A clear fluid, endolymph, fills the membranous labyrinth.
- The cochlea contains the organ of Corti, which is composed of sound receptors.

WHAT ARE THE FUNCTIONS OF THE EAR STRUCTURES?

- The pinna collects sound waves and channels them into the auditory meatus.
- The hairs and cerumen in the canal help prevent foreign objects from reaching the tympanic membrane.
- The tympanic membrane vibrates when sound waves hit it; the sound vibrations are conducted to the malleus.
- The bones of the middle ear transmit the sound vibrations to the inner ear. The malleus transmits them to the incus, and the incus transmits sound vibrations to the stapes. The stapes transmits the sound vibrations to the oval window, which transfers the motion to the fluid in the inner ear.
- Fluid motion in the inner ear stimulates the sound receptors in the cochlea and the organ of Corti.
- The organ of Corti transmits impulses to the cochlear branch of the vestibulocochlear nerve (cranial nerve VIII). This nerve carries the impulses to the medulla oblongata, the thalamus, and then to the temporal lobe of the brain, which contains the auditory cortex.
- The eustachian tube helps equalize pressure in the middle ear.
- Receptors responsible for equilibrium (balance) are located in the inner ear, within the bony vestibule and at the base of the semicircular canals.
- Impulses from the equilibrium receptors are transmitted to the brain via the vestibular branch of the vestibulocochlear nerve (cranial nerve VIII). The cerebellum is important in mediating the sense of equilibrium and balance.

WHAT CHANGES OCCUR IN THE EAR WITH AGING?

- Cerumen becomes harder, containing less moisture, and its buildup within the ear may contribute to a hearing loss in the low-frequency range.
- The tympanic membrane loses elasticity.
- The joints between the auditory bones become stiffer; the stiffness interferes with the transmission of sound waves, but is not clinically significant by itself.
- There is a gradual loss of the receptor cells in the organ of Corti after age 40.
- With increasing age, the number of nerve fibers in the vestibulocochlear nerve decreases, contributing to hearing loss and sometimes affecting balance and equilibrium.

THE EAR

Approximately 26 million adults in the United States have some degree of hearing loss (National Institute on Deafness and Other Communication Disorders, 2010a). The number has risen dramatically in the last three decades. About 26 million Americans between the ages of 45 and 69 have high-frequency hearing loss due to exposure to loud sounds. Social withdrawal is not unusual when hearing becomes severely impaired. The inability to hear causes difficulty with communication. Approximately 2 in 1000 babies born in the United States have some form of congenital hearing problem. After age 75, about 47% of the population has some degree of hearing loss. It is thought that the trend of playing very loud music—causing damage to the acoustic nerve—will result in considerably more hearing loss in the coming decades.

Health Promotion

Coping with Hearing Loss

The sooner the person with a hearing loss obtains and learns to use a hearing aid, the greater the hearing improvement. The brain does better at integrating the hearing aid transmissions when hearing has not been gone for a very long time. Encourage those individuals with any hearing loss to be tested and to try a hearing aid if one is recommended. The person should be told that there is an adjustment curve with new hearing aid use, and it often takes several trips back to the hearing aid center for minor adjustments to the instrument to be made. It also takes practice in using the aid to achieve better hearing.

There are two types of hearing loss related to problems in the ear: *sensorineural* and *conductive*. About 80% of hearing loss is due to a disorder of the hearing nerve **(sensorineural loss).** Conductive hearing loss is caused by a problem transmitting sound impulse through the auditory canal, the tympanic membrane, or the bones of the middle ear. Causes of sensorineural and conductive hearing impairment are listed in Box 26-2.

Arteriosclerosis can cause decreased blood flow to the otic nerve (eighth cranial nerve), resulting in sensorineural hearing loss. This often contributes to hearing loss in the elderly.

A loss of hearing—like a loss of sight—burdens its victims with physical, emotional, psychosocial, and financial problems. Hearing allows for communication with others in everyday conversations, in the classroom, and in business transactions. Without the ability to hear, one can be deprived of many of the joys and pleasures of life: music, drama, exchange of ideas, and the thousands of sounds in one's environment. Because hearing warns one of danger, an inability to hear can cause anxiety and fear. Adults who have a hearing deficiency might lose jobs and alienate friends because of their communication handicap. Nurses must learn ways to help prevent hearing loss, and to assist patients who already have such a loss.

Box 26-2 Common Causes of Sensorineural and Conductive Hearing Loss

CONDUCTIVE LOSS
- Obstruction by impacted cerumen
- Infection with labyrinthitis
- Otosclerosis
- Trauma and scarring of the tympanic membrane
- Congenital malformation of the outer or middle ear

SENSORINEURAL LOSS
- Presbycusis
- Heredity with congenital loss
- Ototoxic drugs
- Loud noise exposure
- Tumor (acoustic neuroma)
- Ménière's disease
- Severe infection such as measles, mumps, meningitis
- Rubella in utero

Inner ear disorders can cause problems with balance. Dizziness, vertigo, and ataxia can greatly interfere with an individual's ability to work or to perform usual activities of daily living. Accidental injury and fractures from falls may occur. To understand the problems affecting the ear, it is necessary to recall the ear's normal structure and functions.

HEARING LOSS

Causes and Prevention

A glance at the causes of hearing loss listed in Box 26-2 will help identify some of the ways the nurse can help prevent hearing loss. Not all cases of hearing disability can be prevented, but education of the general public about causes of hearing loss can reduce its incidence. *Healthy People 2020* includes many objectives to prevent hearing loss and improve hearing among the American public. Adequate treatment of severe ear infections helps preserve hearing. Loud noise is a major cause of sensorineural hearing loss, and the use of headphones or earbuds contributes considerably to hearing damage (Table 26-5) (National Institute on Deafness and Other Communication Disorders, 2010b).

Hairpins, the ends of pencils, and other assorted objects should never be used to relieve tickling or itching in the ear, or to remove cerumen. Earwax normally moves on its own out of the ear canal to the outer ear, where it can be removed without danger of damaging the delicate lining of the ear canal or the tympanic membrane (eardrum). Obstructing cerumen should be removed by using drops that dissolve it or by a physician or nurse skilled in removing impacted cerumen. Foreign objects, such as beans, peas, and other organic substances, also should be removed by

Table 26-5 Range of Sounds Audible and Hazardous to the Ear

LEVEL IN DECIBELS (dB)	EXAMPLE
0	Lowest sound audible to the human ear
30	Quiet library, soft whisper
40	Living room, quiet office, bedroom away from traffic
50	Light traffic at a distance, refrigerator, gentle breeze
60	Air conditioner at 20 feet conversation, sewing machine
70	Busy traffic, noisy restaurant; at this decibel level, noise may begin to affect hearing if exposure is constant
Hazardous Zone for Hearing Loss	
80	Subway, heavy city traffic, alarm clock at 2 feet factory noise; these noises are dangerous if exposure to them lasts for more than 8 hr
90	Truck traffic, noisy home appliances, shop tools, lawn mower; as loudness increases, the "safe" time exposure decreases; damage can occur in 8 hr
100	Chain saw, stereo headphones, pneumatic drill; even 2 hr of exposure can be dangerous at this decibel level; with each 5-dB increase, the safe time is cut in half
120	Rock band concert in front of speakers, sandblasting, thunderclap; the danger is immediate; exposure of 120 dB can injure ears
140	Gunshot blast, jet plane; any length of exposure time is dangerous; noise at this level may cause actual pain in the ear
160	Rocket launching pad; without ear protection, noise at this level causes irreversible damage; hearing loss is inevitable

Adapted from Lewis, S.L., Heitkemper, M.M., Dirksen, S.R., et al. (2011). *Medical-Surgical Nursing: Assessment and Management of Clinical Problems* (8th ed.). St. Louis: Mosby.

someone who is experienced and aware of the potential for ear damage.

Conductive hearing loss most often occurs from stiffening of the bones of the middle ear or from scarring of the tympanic membrane. Continued exposure to excessively high levels of sound can produce sensorineural loss called *noise-induced hearing impairment*. This condition is particularly likely to occur in industrial settings where machinery operation creates loud noise. The standards of the Occupational Safety and Health Administration (OSHA) require the wearing of ear protectors in such settings.

A more recent phenomenon is the potential damage to the inner ear caused by amplified music. **Sustained exposure to noise levels of 90 to 95 dB may result in hearing loss.**

Many drugs can be toxic to the inner ear. This is especially true if a very high dose of the drug is given or if it is given incorrectly. Commonly administered drugs that can be ototoxic are many of the antibiotics, nonsteroidal anti-inflammatory drugs, chemotherapy agents, and potent diuretics, such as furosemide (Lasix) (Box 26-3). Aspirin and other salicylates can produce loss of hearing of high frequencies and ringing in the ears *(tinnitus)*.

Nurses should be aware of the potential for damage to the ear by potent drugs. Nonsteroidal anti-inflammatory drugs are more toxic in the elderly, and when used at maximum dosages over an extended period of time.

Elder Care Points

The older the patient, the greater the chance of ototoxicity occurring from analgesic medications because many older patients have chronic conditions that cause chronic pain. The liver and kidneys in the elderly generally have decreased function because of aging, and so they cannot degrade and eliminate drugs as easily as they can for the younger person. For that reason drugs and drug metabolites can build up to toxic levels when medication is taken on a continuing basis.

Safety Alert

Dangers of Ototoxic Drugs

Know the toxic effects of the drugs you administer. Patients should be assessed frequently while receiving a potentially ototoxic drug. Any signs of ototoxicity, such as ringing in the ears, subtle changes in hearing ability, and difficulty in hearing, should be reported immediately. Many times ototoxicity occurs because patients are taking more than one drug that can be toxic to the ear. Teach patients who are taking daily doses of aspirin or nonsteroidal anti-inflammatory drugs for arthritis or other chronic pain conditions to immediately report the signs of ototoxicity.

Diagnostic Tests and Examinations

Visual Examination of the Ear. The two instruments most commonly used to examine the ear canal and tympanic membrane are the otoscope and the aural speculum. The otoscope is fitted with a light and a

Box 26-3 Ototoxic Drugs and Environmental Chemicals

Ototoxicity (ear poisoning) is caused by drugs or chemicals that damage the inner ear or the vestibulocochlear nerve. The vestibulocochlear nerve sends balance and hearing information from the inner ear to the brain. Ototoxicity may result in temporary or permanent disturbances of hearing, balance, or both. Environmental chemicals can be toxic from inhalation of fumes or powder residue or from skin contamination.

DRUGS THAT MAY CAUSE OTOTOXICITY

Antibiotics
- Tobramycin
- Gentamicin
- Streptomycin
- Kanamycin
- Amikacin
- Neomycin
- Netilmicin
- Dihydrostreptomycin
- Erythromycin (IV)
- Vancomycin
- Chloramphenicol
- Minocycline
- Capreomycin
- Dibekacin
- Etiomycin

Antineoplastic Drugs
- Cisplatin
- Carboplatin
- Bleomycin
- Nitrogen mustard

Loop Diuretics (IV)
- Furosemide
- Torsemide
- Bumetanide
- Ethacrynic acid

Salicylates
- Aspirin

Nonsteroidal Anti-inflammatory Drugs
- Ibuprofen
- Naproxen sodium

Quinidine Derivatives
- Quinidex
- Atabrine
- Plaquenil
- Quinine sulfate
- Mefloquine
- Chloroquine

ENVIRONMENTAL CHEMICALS
- Metals (lead, mercury, gold, arsenic)
- Aniline dyes
- Toluene
- Carbon monoxide
- Trichloroethylene
- Xylene
- Povidone-iodine
- Nicotine
- Potassium bromate

IV, intravenous.

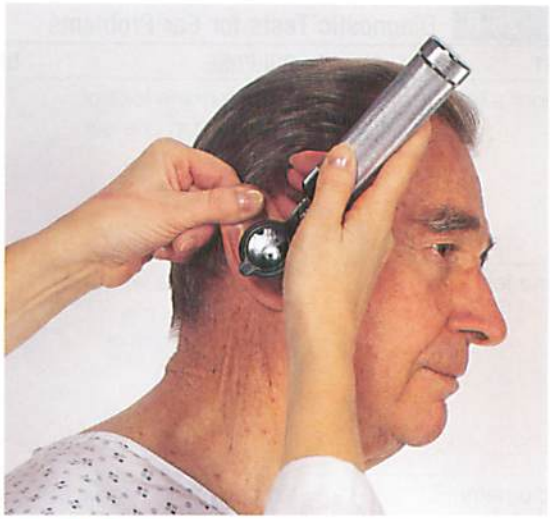

FIGURE 26-10 Examination of the ear with an otoscope.

magnifying lens to facilitate inspection (Figure 26-10). The aural speculum is used with a special circular, slightly concave head mirror that has a hole in its middle. The head mirror is positioned so that the central hole lies in front of one eye of the examiner. A source of light, such as a lamp, is placed behind the examiner so that it shines on the head mirror and is reflected into the ear.

The simple speculum can be modified by attaching a special tube and inflatable bag (pneumatic otoscope), thereby creating an airtight system. This allows the examiner to determine whether the tympanic membrane responds to positive and negative pressure. The normal eardrum moves in response to pressure. Healed perforations and scars on the eardrum can be seen when the tympanic membrane is moved.

A simple hearing test is the *whisper test*. The examiner stands behind the patient and whispers a question to the patient. If the patient hears the question, an answer is forthcoming. The examiner backs up a step and whispers another question, and so on.

Tuning Fork Tests. Tuning forks measure hearing by air conduction or by bone conduction (Weber's test and Rinne test). A tuning fork is activated by holding it by the stem and striking the tines softly on the back of your hand (Table 26-6).

Test for Nystagmus. To test for **nystagmus** (involuntary rhythmic jerking of the eyes), the nurse holds a finger directly in front of the patient at eye level. The patient is asked to follow the finger without moving the head. The nurse moves the finger slowly from the midline toward the right ear about 30 degrees. Then the finger is moved back to the midline and then slowly toward the left ear about 30 degrees.

Table 26-6 Diagnostic Tests for Ear Problems

TEST	PURPOSE	DESCRIPTION	NURSING IMPLICATIONS
Weber's test	To determine loss of hearing in one ear or both	Tuning fork is struck, and then the handle is placed on the patient's forehead. Normal hearing or equal loss in both ears is demonstrated by hearing the sound in the middle of the head.	Explain purpose and procedure to patient.
Rinne test	To determine whether hearing loss is sensorineural or conductive	Tuning fork is struck, and then the handle is placed on the mastoid bone; the fork is removed and struck again and held beside the ear. The patient is asked in which position she heard the sound better or longer.	Explain procedure to patient.
Audiometry	To determine degree of hearing loss in each ear	Earphones are placed on the patient's ears and, with the use of an audiometry machine, the audiologist channels sounds of different decibels and pitch into one ear and then the other of the patient. The patient signals when she hears the tone.	Explain procedure to patient.
Caloric test	To check for alteration in vestibular function in each ear	With patient in a seated or supine position, each ear is separately irrigated with a cold and then a warm solution to determine vestibular response. Normal response is nystagmus, vertigo, nausea, vomiting, falling; decreased response indicates abnormality.	Explain procedure to patient; tell patient she may experience nystagmus, vertigo, nausea, and vomiting, but these will indicate a normal response.
Electronystagmography (ENG)	To assess for disease of vestibular system	Electrodes are placed near the patient's eyes. Caloric test is performed; movement of the eyes is recorded on a graph. Decreased response is abnormal.	Explain procedure and equipment to patient. Tell her that nausea, vertigo, etc. indicate a normal response.
Evoked-response audiometry (ERA); auditory brainstem response (ABR)	To determine abnormality of nerve pathways between eighth cranial nerve and brainstem	Electrodes are attached to the client's head in a darkened room; similar to EEG. Auditory stimuli are directed to the patient, and a computer is used to track and separate the auditory electrical activity of the brain from other brain waves.	Explain procedure and equipment to patient. Tell her the room will be darkened.
Magnetic resonance imaging (MRI)	To detect tumor of the eighth cranial nerve, acoustic neuroma	Huge electromagnet is used to detect radiofrequency pulses from the alignment of hydrogen protons in the magnetic field. A computer translates the pulses into cross-sectional images. Provides high-contrast views of soft tissue.	Explain to patient that her head will be placed in a machine that looks like a large tube. She will need to lie very still during the test; all metal must be removed before the test.
FTA-ABS blood test	To test for syphilis	Blood is drawn and sent to the lab for determination of presence of syphilis. Syphilis can cause problems with nerve transmission from the ear.	Explain that a blood sample is needed.

EEG, electroencephalography; *FTA-ABS*, fluorescent treponemal antibody absorption.

The patient's eyes are watched for any jerking movements. Nystagmus other than at the extremes of lateral gaze is abnormal and may indicate an inner ear problem, intracranial tumor, or paralysis of an eye muscle.

Romberg Test. This is a test of equilibrium. The patient stands with the feet together, the arms out to the sides, and the eyes open. The nurse notes ability to maintain an upright posture without swaying. The patient is then asked to close the eyes and posture is observed again. If the patient loses balance, it may indicate a problem with the inner ear or the cerebellum.

❖ NURSING MANAGEMENT

▪ Assessment (Data Collection)

Patients over age 60 should always be assessed for hearing loss. If a patient has a known hearing impairment, the nurse should assess how the patient is coping with it. Hearing and balance are subjective problems and require a good history from the patient.

Focused Assessment

Data Collection for Ear Disorders

Ask the following questions:

- Have you had any pain in the ear?
- Have you had a recent temperature elevation?
- Do you suffer from allergies?
- Do you have frequent upper respiratory infections?
- Have you ever been exposed to very loud noise? Do you work in an area that is noisy? Do you listen to loud music?
- Have you ever had a head injury?
- Do you scuba dive, hunt or shoot skeet, or fly in small airplanes?
- Do you ever have ringing, buzzing, or odd sounds in the ears?
- Do you feel your hearing ability has decreased? Do people you live with think that you do not hear as well as you used to hear? Do you frequently have to ask people to repeat things that have been said to you?
- Is there a history of hearing loss in your family?
- Have you ever had a really high fever?
- What medications are you taking regularly? Are there other medications that you have taken for an extended period in the past? Do you take aspirin?
- How do you clean your ears?
- Do you ever suffer with dizziness, vertigo, or loss of balance?

Diagnosis of infection requires an otoscopic examination. It should be noted that the color, texture, and amount of cerumen varies among individuals. In whites and African Americans cerumen tends to be moist and rust-brown colored. Native Americans and Asians have cerumen that is lighter in color and drier. Normally, the top of each pinna is aligned with the corner of the eye on each side of the head. Lesions on the pinna may indicate skin cancer, particularly in the elderly patient. There should be no secretions other than cerumen from the ear. Ear pain may be referred from other parts of the head and neck and may occur from sinusitis, dental problems, or temporomandibular joint syndrome.

Focused Assessment

Physical Assessment of the Ear

- Compare the pinna from one side to the other for symmetry and placement.
- Palpate the pinna for the presence of nodules.
- Observe for the presence of lesions on the pinna.
- Check for drainage **(otorrhea)** from the ear; note color and odor.
- Observe the gait to detect any problem with balance.
- Observe for wavering when arising from a supine or seated position that might indicate dizziness or equilibrium problems.
- Observe for signs of bruising on the body from falls that may indicate problems with balance.
- Observe to see whether the person speaks in a voice louder than necessary.
- Observe to see whether facial expression indicates difficulty in understanding what is being said.
- Determine whether responses to statements are inappropriate.

Note: Someone qualified and experienced in using an otoscope should inspect the auditory meatus and the tympanic membrane.

The ears of elderly in long-term care facilities should be checked with an otoscope at regular intervals for cerumen. Many long-term care residents have a correctable hearing loss related to impacted cerumen. Cerumen can be removed by using cerumen softener drops, and then irrigating the external ear canal (Figure 26-11).

▪ Nursing Diagnosis and Planning

Nursing diagnoses are chosen based on the data provided during the assessment (Table 26-7). General goals for the patient with problems of the ear or hearing are:

- Promote knowledge to protect hearing
- Prevent infection and injury
- Promote effective communication
- Promote coping with hearing loss

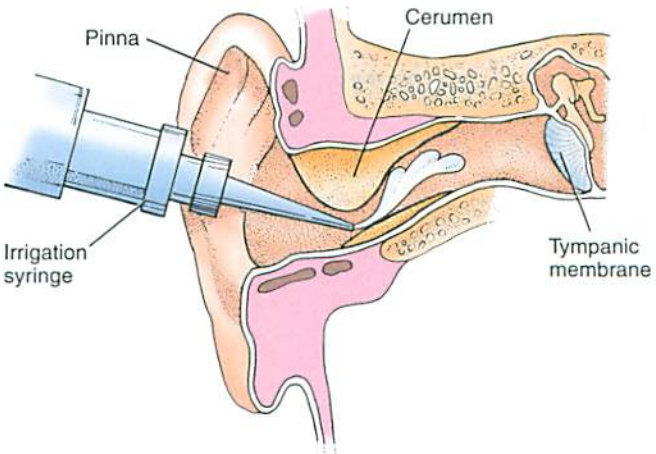

FIGURE 26-11 Irrigating the external ear canal. Warm water is used to remove cerumen and debris from the canal. Aim the stream of water above or below the impaction to allow back pressure to push it out rather than farther down the canal.

Table 26-7 Nursing Diagnoses, Expected Outcomes, and Nursing Interventions for Patients with Ear Disorders

NURSING DIAGNOSIS	GOALS/EXPECTED OUTCOMES	NURSING INTERVENTIONS
Disturbed sensory perception related to damage from infection or obstruction	Patient will verbalize ways to prevent further hearing loss. Patient will be free of ear infection within 10 days.	If cerumen is obstructing the auditory canal, irrigate as ordered; warm the irrigation solution to body temperature. If infection is present, instruct regarding antibiotic medication and encourage to take entire prescription. Instruct in use of hearing aid if one is prescribed. Advise of ways to prevent further hearing loss: avoid loud noise or wear ear protectors; seek treatment immediately for signs of ear infection.
Pain related to inflammation in the ear	Pain will be controlled with analgesia within 8 hr. Pain will be resolved within 7 days.	Administer analgesics as ordered as needed. Warm analgesic eardrops to room temperature before administration. Have patient rest head on heating pad turned on "low" setting if this seems to decrease pain.
Impaired verbal communication related to inability to receive messages or to decode and interpret them	Patient will assist in choice of methods to improve ability to communicate. Patient will try hearing aid for 2 wk if there is an indication that this device would help hearing.	Plan with patient the best way to communicate so that instructions and information are comprehended; explore tone of voice, level of volume, distance from patient when speaking, writing out communication, etc. Establish a routine procedure to confirm patient's understanding. Refer for evaluation by audiologist. Encourage daily use of hearing aid if one is prescribed. Explain that time and adjustments are necessary to obtain the optimum result. Give praise for efforts to use hearing aid.
Anxiety related to inability to hear warnings, perform at work, or communicate in social settings	Patient will explore methods of maintaining safety within 2 wk. Patient will verbalize ways in which assisted hearing devices might assist in performance in the work environment.	Encourage verbalization of fears. Utilize means to enhance communication. Advise of assisted-hearing devices, hearing aids, and availability of "hearing ear" dogs. Introduce means of learning alternative communication methods, such as sign language and speech reading. Explore methods of enhancing attention to visual cues of dangers in the environment (i.e., close attention to signal lights, or observing others at street crossings). Discuss problems of communication in social settings and explore possible solutions (i.e., masking devices for use in crowds, having interaction with only one or two people at a time, avoiding noisy restaurants, or using hearing aid).
Risk of injury related to impaired equilibrium	Patient will verbalize methods to ensure safety within 3 days. Patient will not experience a fall or injury.	Administer medication for vertigo as ordered. Encourage a low-sodium diet. Instruct to change positions very slowly. Encourage to hold on to something solid or to someone when rising from a sitting to a standing position. If vertigo is present, do not ambulate without assistance. Teach or reinforce vestibular/balance exercises as prescribed. Assist to identify any aura (presence of symptoms that precede an attack). Instruct to lie down and keep the eyes open and focused straight ahead when experiencing vertigo.
Deficient knowledge related to the nature of disability, self-care, and availability of community resources for the hearing impaired	Patient will verbalize ways to enhance safe self-care within 2 wk.	Explain nature of hearing loss or vertigo and possible causes. Describe measures to assist the hard-of-hearing person to adapt; refer to support groups and sources for information. Refer to community agencies and resources for the hearing impaired.
Social isolation related to difficulty in communicating	Patient will establish an adequate social network within 2 mo.	Assist patient to consider possibilities for social contact despite hearing problems. Help patient obtain a telephone for the hearing-impaired person. Encourage the use of computer e-mail for contact with friends and family and social interaction with others.

Expected outcomes are written for each nursing diagnosis chosen for the patient's care plan. Writing the outcomes should be done in collaboration with the patient and other health team members. In addition to the nurse and physician, an audiologist, hearing aid specialist, and speech therapist may be involved in the patient's care. Both long- and short-term goals for the patient should be considered.

When a patient is severely hearing impaired, communication with the patient for treatments and activities of daily living may take longer than with patients who hear normally. The nurse should take this into consideration when creating the daily work plan. If the patient does not have adequate aids for hearing, the nurse must devise an acceptable method of two-way communication with the patient.

Implementation

Interventions for the patient with a hearing or balance problem are geared toward patient education, treatment of infection, preoperative and postoperative care and instructions, measures for communication (Box 26-4), and referral to resources. The hearing aid must be cared for properly (Box 26-5).

Instillation of Ear Medication

Eardrops may be ordered to dissolve cerumen, relieve pain, or combat infection in the auditory meatus. The patient should be positioned in a supine lateral position so that the affected ear is uppermost. The medication should be at room temperature. Cold eardrops may cause discomfort or dizziness. For the adult, the ear canal is straightened by drawing the pinna upward and toward the back of the head (Figure 26-12). For a child under age 3, the pinna is pulled down and back. Following the "Five Rights" of medication administration, draw up the correct amount of medication. Insert the tip of the dropper into the external ear canal and instill the medication (Box 26-6). Place cotton in the external meatus to prevent the medication from escaping. Have the patient remain in the lateral position for 5 to 10 minutes.

Box 26-4 Communicating with the Hearing-Impaired Person

- If the person uses a hearing aid, encourage its use and see that it is situated, turned on, and adjusted before beginning speaking.
- Be certain you have the person's attention before beginning speaking.
- Sit facing the person with the light on your face rather than from behind you.
- Ask permission to turn down the volume or turn off the television or radio.
- The best distance for speaking to a hearing-impaired person is 2½ to 4 feet. Place yourself on eye level with the person. Do not speak directly into the person's ear as this prevents the person from obtaining visual cues while you are speaking.
- Do not smile, chew gum, or cover the mouth while speaking.
- Use short, simple sentences. If the patient does not appear to understand or responds inappropriately, state the message again using different words. Try to limit each sentence to one subject and one verb.
- Give the person time to respond to questions.
- Ask for oral or written feedback to make certain your message is understood.
- Avoid using the intercom system as it may distort sound.

Box 26-5 Caring for a Hearing Aid

When a hearing aid does not work:

- Check that the switch is "on."
- Examine the ear mold for attached wax or dirt; clean the sound hole.
- Check the battery to see that it is inserted correctly.
- Check the connection between the ear mold and the receiver.
- Replace the battery. Batteries last an average of 12 to 14 days depending on type of aid.
- Check placement of the ear mold in the ear; it should fit snugly.
- Adjust the volume.
- If all else fails, take the hearing aid to an authorized service center for repair.

To clean the hearing aid:

- Turn the hearing aid off.
- Wash the ear mold with mild soap and warm water; do not submerge in water.
- Use a pipe cleaner or toothpick to gently cleanse the opening or short tube that fits into the ear.
- Dry the mold completely before turning on the aid or before reattaching it to the hearing aid (if it is separate).

Communicating with the Hearing-Impaired Patient

The patient who is hearing impaired has unique problems of communication when in the hospital or long-term care facility. If she cannot hear well and misunderstands or misinterprets the voices and sounds in the unfamiliar surroundings, she is likely to be

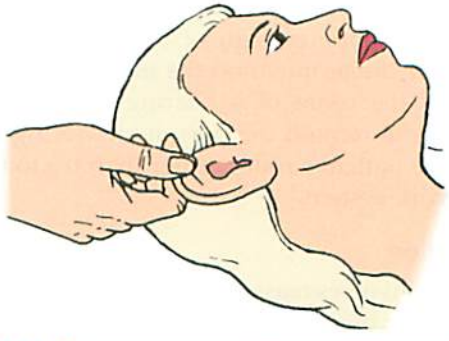

FIGURE 26-12 Straightening the ear canal to instill eardrops.

Box 26-6 Instilling Otic Medication

- Follow the "Five Rights" of medication administration.
- Read the order carefully to determine which ear is to receive the medication.
- Position the patient supine and in the lateral position so that the affected ear is uppermost.
- Draw medication into the medicine dropper by depressing the bulb and letting it go.
- Straighten the ear canal by drawing the pinna upward and toward the back of the head. For children younger than 3 years, draw the earlobe slightly down and back.
- Insert the tip of the medicine dropper into the external ear canal and depress the bulb to dispense the medication. Withdraw the dropper.
- Place cotton in the external meatus to prevent the medication from escaping.
- Have the patient remain in the lateral position for 5 to 10 minutes.

frustrated, fearful, and anxious. Unless a special effort is made to have frequent contact with the patient, social isolation may occur.

When speaking to a hearing-impaired patient, sit at eye level facing the patient. Gain eye contact and speak slowly and enunciate clearly. When trying to communicate with a person who is hearing impaired, bear in mind that attempts to answer questions without fully understanding what is asked may occur. Past experience has taught many hearing-impaired persons that to ask for repetition of questions irritates people and causes them to think the person is stupid. **For this reason, many people who cannot hear well frequently smile and say "Yes," when such an answer is either incorrect or inappropriate.** Another problem is that the individual may fill in parts of sentences with similar-sounding words. For example, the words "Knott's Berry Farm" may be interpreted as "not very far." Some guidelines to help the hearing-impaired patient and improve the nurse's ability to communicate are given in Box 26-4.

Think Critically

What three techniques of communication with a hearing-impaired patient do you think would be the most helpful?

A piece of tape or sign of some kind should be placed over the terminal on the intercom system that designates the room of a hearing-impaired patient. This serves to remind the person answering the light to go to the patient's room rather than try to talk over the intercom system.

Evaluation

Evaluation involves reassessment to determine whether the expected outcomes are being met. Determining whether hearing has improved is the criterion by which effectiveness of treatment is evaluated. Improvement is verified by audiometry. Fading or resolution of dizziness and vertigo indicate that actions and treatments for these problems have been effective. Resolution of infection is determined by the appearance of the eardrum, absence of pain, and normal temperature.

COMMON PROBLEMS OF PATIENTS WITH EAR DISORDERS

Hearing Impairment

Hearing impairment ranges from difficulty in hearing certain ranges of tones or in understanding certain words to total deafness. Persons with sensorineural hearing loss typically have more difficulty hearing high-pitched tones than low-pitched ones; thus they frequently can understand the speech of men better than that of women. Another characteristic of sensorineural hearing loss is difficulty hearing softly spoken and poorly enunciated words. Speaking slightly louder to the person with sensorineural hearing loss may help, but it is especially important to speak slowly and clearly and to face the person when communicating with her. Because people with sensorineural hearing loss do not hear their own voices as well as a person with normal hearing, they tend to speak louder than necessary.

Assignment Considerations

Caring for the Hearing Impaired

When assigning tasks for a hearing-impaired patient to UAP and CNAs, remind the person how to effectively communicate with the patient: face the patient and obtain the patient's attention before speaking; speak slowly and enunciate clearly in a normal voice. If the patient wears a hearing aid, it should be in the ear and the patient should be reminded to turn it on before communication begins.

Hearing aids help some people with sensorineural hearing loss. Aids designed to amplify some pitches and block out others that do not need amplification are most helpful. Hearing aids are not always the answer to a problem of hearing loss, and for some people the most effective therapy is focused on rehabilitation to facilitate acceptance of the loss and learning of new ways to communicate in spite of some degree of deafness. Most hearing aid professionals and companies will offer a 30-day money-back guarantee on any hearing aid so that the patient can try it.

Clinical Cues

The earlier a hearing-impaired person who can benefit from a hearing aid obtains and uses one, the better her brain will adjust and the better the quality of hearing that can be achieved (Healthy Hearing, 2010).

Central hearing loss occurs in the brain as a result of some pathologic condition above the junction of the eighth cranial nerve and the brainstem. Central hearing loss can be due to a problem of transmission of stimuli in the brain, an inability to decode and sort signals received from one or both ears, or a failure in the transmission of sounds from one hemisphere of the brain to the other. Causes include brain tumors, vascular changes that suddenly deprive the middle ear of its blood supply, and cerebrovascular accidents.

Many people have a combination of two or more types of hearing impairment. Often there is a combination of sensorineural and conductive loss.

It should be noted that when a person is fitted with a hearing aid, it takes considerable time of working with the audiologist on adjustments to the device to obtain the best result. Too many people give up on a hearing aid because they have not taken the time to work through the adjustment process.

Think Critically

How would you go about working with a hearing-impaired patient who is a candidate for a hearing aid, but adamantly refuses to consider trying out one?

Dizziness and Vertigo

The sense of balance and equilibrium is governed by the vestibular system in the inner ear. Increases in fluid pressure in the inner ear, inflammations, and vascular disorders that interrupt blood supply to the cochlea can produce dizziness, loss of balance, and nausea and vomiting. These symptoms can range from mildly annoying to completely incapacitating and should always be assessed whenever a person has an ear disorder and loss of hearing. Ménière's disease and labyrinthitis cause vertigo.

The patient who experiences dizziness and positional vertigo should be cautioned to avoid suddenly turning her head or making other movements that aggravate the vertigo. She should be told to call for assistance whenever she needs to move from her bed or chair. When helping the patient to her feet, move slowly and give her time to stand for a moment before beginning to walk. **Typically, patients with this kind of vertigo feel that the room is spinning around during an attack, and any motion makes the sensation even worse.** While the patient is having an attack of vertigo, she should lie in bed and remain as motionless as possible. Stabilizing her head with a pillow on either side may encourage immobility. Attacks can last from a few minutes to hours.

Medications to reduce motion sickness and nausea should be given precisely as ordered. These are usually given every 3 to 4 hours or on a preventive basis *before* the patient's symptoms become severe. A series of head movements called Epley maneuvers or Brandt-Daroff exercises can be helpful.

When increased fluid pressure in the inner ear is suspected as the cause of dizziness, the physician may order a low-sodium diet and limit fluid intake. Patients with recurrent attacks of vertigo are encouraged to stop smoking if they are habitual tobacco smokers. Tobacco is vasoconstrictive and can affect the blood supply to the inner ear and nerves. **Stress may affect the frequency of attacks of vertigo in patients with inner ear disorders.** Teaching the patient effective coping mechanisms to handle stress or adding rest periods into the work schedule may be helpful.

Tinnitus

Ringing, buzzing, or other continuous noise in the ear *(tinnitus)* can be mildly annoying or so severe that it interferes with activities of daily living and prevents the patient from getting sufficient sleep and rest. Common causes of tinnitus include **presbycusis** (hearing loss associated with aging), constant exposure to loud environmental noise, inflammation and infection in the ear, otosclerosis, Ménière's disease, and labyrinthitis. Systemic disorders such as hypertension and other cardiovascular disorders, neurologic disease (including head injury), and hyperthyroidism and hypothyroidism also can cause ringing in the ears. **Tinnitus may be one of the first symptoms produced by an ototoxic drug.** Symptoms of tinnitus are subjective, and diagnosis is by patient history.

Clinical Cues

Because of the overload of sensory input to the brain, the patient with tinnitus will become more fatigued than others when in a noisy location such as a social gathering, a restaurant, or the like. Family and friends should be informed of this situation.

Medical treatment begins with efforts to determine the underlying cause and treat it. When the cause cannot be found, symptomatic relief is tried. However, some cases of intractable tinnitus resist all modes of conventional therapy. Less traditional measures that have varying degrees of success include biofeedback training and "masking." Sometimes substances that increase circulation are helpful (Niacin). The benzodiazepines, such as diazepam (Valium) or chlordiazepoxide (Librium), seem to help some people. Oral Lipoflavinoid has provided relief for many patients with tinnitus.

Biofeedback training is especially helpful in those cases in which emotional stress and anxiety are thought to be the underlying causes of tinnitus. Through visual or auditory signals, the person learns to relax and exert some degree of control over her autonomic nervous system. This can lower blood pressure and pulse rate and relax muscles that are very tense.

Masking simply provides a low-level noise to block out, or "mask," the head noise heard by the person complaining of tinnitus. Some examples include

playing soft music or a tape of sounds of nature, such as a waterfall, while the person is resting or sleeping; providing "white noise" in the working environment, using a hearing aid to amplify sound from the outside and overcome head noise; and wearing a special tinnitus instrument, which is a combination hearing aid and tinnitus masker for people who have both hearing loss and tinnitus. The therapeutic effect of masking is highly individualized. Some people find instant relief, some have partial abatement of the head noise, and some do not benefit from attempts to mask the sounds of tinnitus. Earplugs or ear protection should be worn when noise exposure cannot be avoided.

REHABILITATION FOR HEARING LOSS

Specific measures to rehabilitate a patient with hearing loss depend on the age and aptitude of the patient. Adults who have acquired the skills of speech and language before their loss of hearing occurred are better able to pick up language cues and understand what is being said to them, and therefore should have fewer problems with communication by language.

Lip-Reading (Speech Reading)

Instruction in reading lips is one mode of therapy for the hearing impaired, but it is not a remedy for all difficulties. Only about 60% of the sounds in the English language can be identified by watching the lips. Most experienced lip-readers do not catch more than half of the words spoken to them. Communication by lip-reading is enhanced by other nonverbal clues, such as facial expressions and hand gestures. Learning to lip-read is difficult. It requires at least average intelligence, exceptional language skills, excellent eyesight, and much persistence and patience.

Sign Language

Many deaf people learn to communicate with sign language. American Sign Language (ASL) is the third most commonly used language in the United States. There are online dictionaries for ASL and several websites that provide tutorials (see Online Resources). Most major hospitals have someone on staff who can act as an interpreter for ASL.

Hearing Aids

An evaluation by a reputable audiologist provides a prescription for a hearing aid designed to provide the best possible improvement of hearing. Hearing aids can improve hearing for a variety of types of hearing loss. For the person who does not have a defect in the middle ear, a hearing aid can transmit amplified sound from the receiver through the eardrum to the inner ear. This is accomplished by amplifying sound waves transmitted by air conduction and bone conduction. There are many types of hearing aids on the market. Newer digital types can amplify the tones needed while masking other levels of noise. It takes time to adapt to the use of a hearing aid, and the audiologist must make repeated adjustments to the device to achieve optimum function.

The design of a hearing aid varies. Some are worn in the ear, others behind the ear, and still others are built into the frame of eyeglasses. Persons with binaural hearing loss (both ears are affected) must wear a hearing aid in each ear. Regardless of the type of hearing aid, it will have a microphone, an amplifier, a receiver, and a battery (Figure 26-13).

The hearing aid should not be handled roughly or dropped. The ear mold can be cleaned with soap and water, but the other parts of the aid should not get wet (see Box 26-5). Hair spray can damage the microphone of a hearing aid. Regular servicing by a dealer can keep the aid in good working order. When an incapacitated patient has a hearing aid, the nurse is responsible for the security of the hearing aid.

Cochlear Implant

Cochlear implants are now available for some patients who have no hearing at all. The device is a small computer that changes spoken words into electrical impulses that are transmitted via an implanted coil to the nerve endings in the cochlea. Success with the

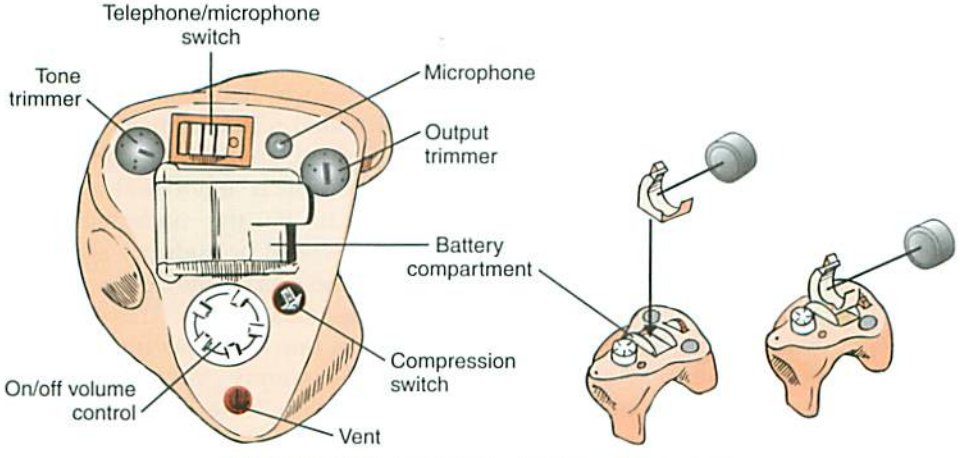

FIGURE 26-13 Parts of a typical in-the-ear hearing aid.

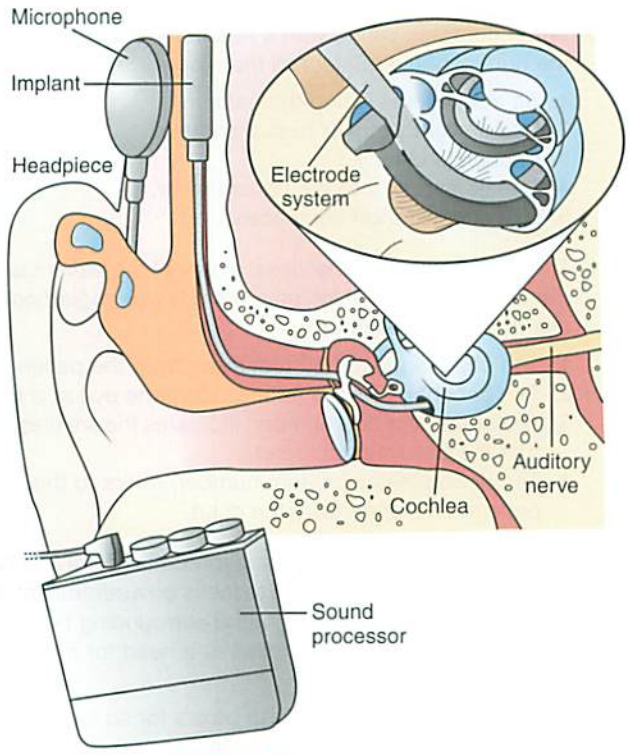

FIGURE 26-14 Cochlear implant.

surgical implant varies considerably from one person to the next (Figure 26-14). Bone hearing devices and semi-implanted devices are under development. A speech therapist works with the patient once the cochlear implant is in place.

Hearing-Assistive Devices

Many devices on the market use hearing aid technology. These devices assist people to hear telephone conversations, television, and sound systems, such as those in church or the theater. A telecommunication device for the deaf (TDD) is available. It is a combination typewriter and telephone and can be used to communicate with someone else who has a TDD, or can be used to call a relay center that then communicates the message to the intended person. There are alarm clocks that activate a flashing light, smoke detectors that flash light, and doorbells and telephones that flash a light when a sound is produced. "Hearing ear" dogs are trained to alert their owners to particular sounds and to keep their owners safe when around traffic.

COMMUNITY CARE

Public education about the dangers of loud noise and music could do much to prevent thousands of people from becoming hearing impaired. Teaching people to seek medical attention for symptoms of otitis media quickly prevents damage to the tympanic membrane and preserves hearing ability.

Encouraging those with hearing impairment to have a thorough evaluation and to try a hearing aid could do much to improve the quality of their lives. There is little economic reason for refusing to *try* a hearing aid. Veterans should be told that the Veteran's Administration Health Clinics will perform hearing tests and supply a hearing aid. The Office of Vocational Rehabilitation may provide this service as well. Nurses in home care and in long-term care settings should frequently assess the function of the patient's hearing aid.

The elderly person with arthritis or poor vision may have difficulty properly inserting the battery into a hearing aid. If the aid is not working, it may be that the battery simply is not inserted correctly.

Get Ready for the NCLEX® Examination!

Key Points

- Eye disorders are caused by injury, disease, or genetic predisposition.
- Everyone older than age 40 should have a complete eye examination.
- After age 65, an eye examination is recommended every 2 years.
- Control of diabetes mellitus and hypertension can help preserve vision.
- Obtaining a good history is important to data collection regarding vision.
- The tympanic membrane must be able to vibrate when sound is received in order for the sound waves to be transmitted to the middle ear.
- The bones of the middle ear transmit the sound waves to the inner ear.
- Sound is transmitted from the inner ear to cranial nerve VIII.
- Changes in the ear structures with aging may cause hearing impairment.
- Exposure to loud noise causes sensorineural hearing loss.
- A variety of drugs are ototoxic (see Box 26-3).
- There are several diagnostic tests and examinations for problems of the ear (see Table 26-6).
- Learning to communicate with the hearing-impaired person is important for nurses (see Box 26-4).
- Labyrinthitis and Ménière's disease cause dizziness and vertigo.
- Decreasing stress often decreases dizziness and vertigo.
- Tinnitus is common with a variety of ear disorders.
- A variety of treatments are available to help the patient with tinnitus; biofeedback and masking help many people.

- Lip-reading or speech reading is helpful to the hearing-impaired person but is difficult to learn.
- Various types of hearing aids are available, but using one takes practice.
- Cochlear implants are available for the patient who is totally deaf.
- Nurses should actively educate in the community about ways to prevent hearing loss.

Additional Learning Resources

SG Go to your Study Guide for additional learning activities to help you master this chapter content.

Evolve Go to your Evolve website (http://evolve.elsevier.com/deWit/medsurg) for the following FREE learning resources:

- Animations, audio, and video
- Answers and rationales for questions and activities
- Concept Map Creator
- Glossary with pronunciations in English and Spanish
- Interactive Review Questions and Exercises and more!

Online Resources

- American Foundation for the Blind, www.afb.org
- American Sign Language, www.lifeprint.com/asl101/.com; www.ddeafworld.com
- American Speech-Language-Hearing Association, www.asha.org
- Association for Education and Rehabilitation of the Blind and Visually Impaired, www.aerbvi.org
- Bookshare, www.bookshare.org
- Exercises for vertigo, http://ivertigo.net/vertigo/vertherapy2.html
- Guide Dogs for the Blind, Inc., www.guidedogs.com
- Hearing Loss Association of America, www.shhh.org
- International Hearing Dog, Inc., www.ihdi.org
- National Association of the Deaf, www.nad.org
- National Braille Association, www.nationalbraille.org
- National Institute on Deafness and Other Communication Disorders, www.nidcd.nih.gov

Review Questions for the NCLEX® Examination

1. When a patient is receiving Lasix for a problem with edema, which assessment relative to this drug is important to the patient's health?
   1. Measuring the blood pressure
   2. Determining if the patient is nauseated
   3. Inquiring about constipation
   4. Checking for hearing loss

2. When administering eardrops to an adult, the nurse would:
   1. draw the pinna upward and toward the front of the head.
   2. draw the pinna upward and toward the back of the head.
   3. pull the pinna downward and toward the front of the head.
   4. pull the pinna downward and toward the back of the head.

3. When communicating with a hearing-impaired patient, the nurse should: *(Select all that apply.)*
   1. Sit at eye level facing the patient.
   2. Use a slightly higher tone than usual.
   3. Enunciate clearly.
   4. Speak directly into the patient's ear.
   5. Use simple, short sentences.

4. The nurse evaluates the visual acuity of the patient using the Snellen chart. Which statement is true regarding the use of the Snellen chart?
   1. The chart is placed 40 feet away from the patient.
   2. The patient reads the letters using one eye at a time.
   3. The numerator (top number) indicates the smallest line that the patient could read.
   4. The denominator (bottom number) refers to the patient's distance from the chart.

5. While looking at a card with a geometric grid of identical squares, the patient is asked to focus on a central dot and to describe any distortions of the surrounding boxes. Which patient statement indicates a need for further diagnostic testing?
   1. "I get dizzy staring at these boxes for so long."
   2. "I am beginning to see color differences in the squares."
   3. "I can see all the boxes surrounding the dot."
   4. "There are wavy lines around the central dot."

6. During a physician visit, a 65-year-old man complains of pain in his right eye associated with excessive tearing. The nurse notes that the eye is red with lashes rubbing against the cornea. A likely condition would be:
   1. ptosis.
   2. ectropion.
   3. hordeolum.
   4. entropion.

7. The nurse applies a vibrating tuning fork to the middle of the patient's forehead. The patient reports hearing the sound in the middle of the head. The patient's response indicates:
   1. sensorineural hearing loss.
   2. conduction hearing loss.
   3. normal hearing.
   4. inconclusive findings.

8. The nurse observes another nurse administering eye ointment. Which action indicates a need for further instructions about technique? The nurse administering the ointment:
   1. places the cap from the tube upside down on the table after removal.
   2. applies the ointment to the lower part of the eyeball.
   3. twists the tube slightly to end the ribbon of ointment.
   4. closes the eye and has the patient move the eyes side to side to distribute the medication.

9. While ambulating, the patient with Ménière's disease complains of dizziness and vertigo. An immediate nursing action would be to:
   1. provide oxygen.
   2. assist patient to supine position.
   3. administer nausea medication.
   4. notify the physician.

10. Which nursing action(s) demonstrate(s) appropriate care of a visually impaired patient? *(Select all that apply.)*
    1. Introduce self before touching.
    2. Speak slowly with a loud voice.
    3. Keep the door ajar.
    4. Ensure ready access to the call button for assistance.
    5. Assist with feeding using the clock method.

Critical Thinking Activities

Scenario A

Mr. Hartman comes to the ambulatory clinic because he "got something in my eye" while using the weed trimmer.

1. What type of examinations would you expect the health care provider to perform?
2. What would you teach Mr. Hartman about eye safety before he leaves?
3. What questions would you ask him about basic eye care while you are interviewing him before the physician sees him?

Scenario B

Mrs. Como is admitted to the hospital for management of her hypertension. She has had sensorineural deafness for several years, and it is much worse in her left ear than in her right. Her inability to hear well causes additional stress for Mrs. Como, and she is especially anxious about being in the hospital among strangers. Mrs. Como also suffers from tinnitus, which adds to her stress and inability to relax and rest. Tinnitus and the stress of not being able to hear adversely affect Mrs. Como's hypertension.

1. What evidence would you expect to find that would indicate that Mrs. Como has a hearing impairment?
2. What can the nurses do to improve communication with Mrs. Como and help allay her anxiety about being in the hospital?
3. Why could her hearing problem make her blood pressure rise?

Scenario C

Mrs. Martinez is scheduled for a cochlear implant and states that she "really doesn't understand" how the device works.

1. What should she be told?
2. What should she expect she will need to do after the cochlear implant surgery?

chapter

27 Care of Patients with Disorders of the Eyes and Ears

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Objectives

Theory

1. Discuss errors of refraction and their treatment.
2. Devise nursing care for the patient who is undergoing a corneal transplant.
3. Compare measures used to provide assistance after a chemical eye burn with measures for an eye injury with a foreign object.
4. Describe the signs and symptoms of selected disorders of the eye and appropriate medical treatment and nursing interventions for each.
5. Choose nursing interventions for the patient having a scleral buckle or a cataract extraction.
6. Identify aids and resources for people with vision loss.
7. Explore the impact of hearing or vision loss on an individual and his family.
8. List the signs and symptoms of selected disorders of the ear, appropriate medical or surgical treatment, and nursing interventions for each.
9. Teach the patient with tinnitus or vertigo measures that may decrease the symptoms.
10. Research aids and resources for people with impaired hearing or tinnitus.

Clinical Practice

1. Provide appropriate care for a patient who is preoperative for eye surgery.
2. Properly administer eye medications.
3. Teach a patient to properly administer ear medication.
4. Provide appropriate care for a postoperative ear surgery patient.
5. Assist a patient to find resources for low-vision assistance.

Key Terms

accommodation (ă-kŏm-ō-DĀ-shŭn, p. 594)
astigmatism (ă-STĬG-mă-tĭsm, p. 594)
drusen (drū-zĕn, p. 609)
enucleation (ē-nū-klē-Ā-shŭn, p. 597)
exophthalmos (ĕk-sŏf-THĂL-mŏs, p. 595)
hyperopia (hī-pĕr-Ō-pē-ă, p. 594)
myopia (mī-Ō-pē-ă, p. 594)
nystagmus (nĭs-TĂG-mŭs, p. 613)
photodynamic therapy (fō-tō-dī-NĂM-ĭk, p. 609)
photophobia (fō-tō-FŌ-bē-ă, p. 598)
presbyopia (prĕz-bē-Ō-pē-ă, p. 594)
tympanoplasty (tĭm-pă-nō-PLĂS-tē, p. 613)

COMMON DISORDERS OF THE EYE

ERRORS OF REFRACTION

The most common visual defects are those of refraction. This means that light rays entering the eye are not "refracted," or bent, at the correct angle (Figure 27-1, *A*) and therefore do not focus on the retina. Errors of refraction may be caused by a number of structural defects within the eyeball itself. For example, if the distance between the lens and retina is too short, the light rays focus behind the retina. This causes difficulty in seeing objects close at hand and is called *farsightedness* **(hyperopia)** (Figure 27-1, *B*).

If the opposite is true, and the eyeball is too elongated, the light rays will converge and focus in front of the retina. The individual then has difficulty seeing objects at a distance and is referred to as being nearsighted. *Nearsightedness* is called **myopia** (Figure 27-1, *C*).

Light rays from distant objects do not enter the eye at the same angle as light rays from near objects. When looking off into the distance and then quickly looking down at a book, the eyes must make an adjustment to the difference in the light rays entering the eye. This adjustment, which is called **accommodation,** is accomplished by ciliary muscles and ligaments that change the shape of the lens, making it more rounded or flatter, thereby allowing light rays to fall on the retina (Figure 27-2).

With age, the ciliary muscles become less elastic and cannot readily accommodate the needs of distant and near vision. Hardening of the ciliary muscles occurs in many people over 40 years of age and is known as **presbyopia.** Bifocal glasses are usually prescribed for this condition because they allow for two sets of lenses in one pair of glasses, one for viewing distant objects and one for seeing close objects.

Astigmatism is a visual defect resulting from a warped lens or an irregular curvature of the cornea; either condition will prevent the horizontal and vertical rays from focusing at the same point on the retina. Actually, very