

For vision to occur, light rays must enter the eye through the cornea; travel through the pupil, lens, and vitreous body (see later); and be focused on the retina. Light rays do not travel directly to the retina. Instead, they are deflected in various directions according to the density of the ocular structures through which they pass. This process, called *refraction*, is controlled by the aqueous humor, lens, and vitreous body. The *optic disk* is the area of the retina where ophthalmic blood vessels and the optic nerve enter the eyeball.

- The structure and function of the eyeball are further influenced by the lens, aqueous humor, and vitreous body. The *lens* is an elastic, transparent structure; its function is to focus light rays to form images on the retina. It is located behind the iris and held in place by suspensory ligaments attached to the ciliary body. The *aqueous humor* is a clear fluid produced by capillaries in the ciliary body. Most of the fluid flows through the pupil into the anterior chamber (between the cornea and the lens and anterior to the iris). A small amount flows into a passage called Schlemm's canal, from which it enters the venous circulation. Under normal circumstances, production and drainage of aqueous humor are approximately equal, and normal intraocular pressure (<21 mm Hg) is maintained. Impaired drainage of aqueous humor causes increased intraocular pressure. The *vitreous body* is a transparent, jelly-like mass located in the posterior portion of the eyeball. It functions to refract light rays and maintain the normal shape of the eyeball.

DISORDERS OF THE EYE

The eye is subject to the development of many disorders that threaten its structure, function, or both. Some disorders in which ophthalmic drugs play a prominent role are discussed in the following sections.

Refractive Errors

Refractive errors include myopia (nearsightedness), hyperopia (farsightedness), presbyopia, and astigmatism. These conditions impair vision by interfering with the eye's ability to focus light rays on the retina. Ophthalmic drugs are used only in the diagnosis of the conditions; treatment involves prescription of eyeglasses or contact lenses.

Glaucoma

Glaucoma, a common preventable cause of blindness, is a group of diseases characterized by optic nerve damage and changes in visual fields. It is often characterized by increased intraocular pressure (IOP, >22 mm Hg), but may also occur with normal IOP (<21 mm Hg; average 15–16 mm Hg). Diagnostic tests for glaucoma include ophthalmoscopic exami-

nation of the optic disk, measurement of intraocular pressure (tonometry), and testing of visual fields.

The most common type of glaucoma is called primary open-angle glaucoma. Its etiology is unknown, but contributing factors may include advanced age, a family history of glaucoma and elevated IOP, diabetes mellitus, hypertension, myopia, long-term use of corticosteroid drugs, and previous eye injury, inflammation, or infection. In addition, the incidence of glaucoma in African Americans is about three times higher than in non-African Americans. Closed-angle glaucoma is usually an acute situation requiring emergency surgery. It may occur when pupils are dilated and the outflow of aqueous humor is blocked. Darkness and drugs with anticholinergic effects (eg, atropine, antihistamines, tricyclic antidepressants) may dilate the pupil, reduce outflow of aqueous humor, and precipitate acute glaucoma.

Inflammatory or Infectious Conditions

Inflammation may be caused by bacteria, viruses, allergic reactions, or irritating chemicals. Infections may result from foreign bodies, contaminated hands, contaminated eye medications, or infections in contiguous structures (eg, nose, face, sinuses). Common inflammatory and infectious disorders include the following:

- **Conjunctivitis** is a common eye disorder that may be caused by allergens (eg, airborne pollens), bacterial or viral infection, or physical or chemical irritants. Symptoms include redness, tearing, itching, edema, and burning or gritty sensations. Bacterial conjunctivitis is often caused by *Staphylococcus aureus*, *Streptococcus pneumoniae*, or *Haemophilus influenzae* and produces mucopurulent drainage. Conjunctivitis with a purulent discharge is most often caused by the gonococcus; corneal ulcers and scarring may result.
- **Blepharitis** is a chronic infection of glands and lash follicles on the margins of the eyelids characterized by burning, redness, and itching. A hordeolum (commonly called a sty) is often associated with blepharitis. The most common causes are seborrhea and staphylococcal infections.
- **Keratitis** (inflammation of the cornea) may be caused by microorganisms, trauma, allergy, ischemia, and drying of the cornea (eg, from inadequate lacrimation). The major symptom is pain, which ranges from mild to severe. Vision may not be affected initially. However, if not treated effectively, corneal ulceration, scarring, and impaired vision may result.
- Bacterial **corneal ulcers** are most often caused by pneumococci and staphylococci. Pseudomonas ulcers are less common but may rapidly progress to perforation. Fungal ulcers may follow topical corticosteroid therapy or injury with plant matter, such as a tree branch. Viral ulcers are usually caused by the herpesvirus.
- **Fungal infections** commonly occur and may often be attributed to frequent use of ophthalmic antibiotics and corticosteroids.