

EMERGENCY OPHTHALMOLOGY

A RAPID TREATMENT GUIDE

Kenneth C. Chern

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PREFACE

Prompt diagnosis and appropriate treatment are critical in ophthalmic emergencies to best preserve the integrity of the globe and vision in the eye. Prioritizing the differential diagnoses is a challenging task especially with overlapping signs and symptoms of many eye conditions. This book is designed for the practitioner to use in conjunction with the patient evaluation in the clinic or emergency room. The book highlights critical examination features and outlines initial treatment measures and follow-up guidelines for many common entities that present acutely.

The first chapter is an overview of the anatomy and structures in and around the eye. The second chapter describes the elements of the ophthalmic examination. The remainder of the book is organized by the predominant structure of the eye that is involved. Each disease is distilled into the key presenting features on clinical history and examination, treatment and follow-up outlines, and helpful ophthalmologic pearls.

KENNETH C. CHERN, MD

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With a book such as this, there are numerous authors to whom I owe a debt of gratitude for their scholarly work, excellent illustrations, and contributions to the body of ophthalmic knowledge. Many thanks to our friends and families whose continual support often goes unrecognized.

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ANATOMY

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ANATOMY OF THE EYE AND ORBIT

The eye and its associated structures (Fig. 1-1) can be divided into six separate anatomical divisions: (1) adnexa, consisting of the eyelids and lacrimal apparatus; (2) anterior segment, composed of the conjunctiva, cornea, and anterior chamber; (3) iris and lens; (4) posterior segment, consisting of the vitreous, retina, choroid, and sclera; (5) extraocular muscles; and (6) orbit. Each segment contains a number of structures that are both anatomically and functionally related.

ADENEXA

EYELIDS The eyelids serve to protect the eyes from the environmental injury and trauma and to keep the ocular surface moist by both preventing evaporative drying of the conjunctiva and cornea and helping to spread tears produced by the lacrimal glands. The eyelids consist of five layers of tissue (Fig. 1-2), from superficial to deep: the skin, a muscular layer (orbicularis oculi muscles), a layer of loose areolar connective tissue, a fibrous layer (the tarsus), and an internal mucous membrane (the

conjunctiva). When open, the elliptical space between the lid margins is referred to as the palpebral fissure and extends from the lateral canthus on the temporal side of the eye, to the medial canthus on the nasal side of eye. Adjacent to the medial canthus is the caruncle, a small yellowish structure that consists of modified sweat and sebaceous glands and the plica semilunaris, a vestigial remnant of the third eyelid formed by a folding of the conjunctiva.

Located in the margin of the eyelid between the fibrous layer and internal mucous membrane are the meibomian glands, which secrete sebum into the tear fluid. Also located along the eyelid margin are the hair follicles of the eyelashes. The sebaceous glands of Zeis and the sweat glands of Moll are adjacent to the hair follicles.

The lids receive blood from branches of both the lacrimal and ophthalmic arteries, and drain to the ophthalmic veins and the veins draining the forehead. Lymphatic drainage from the medial aspect of the lids goes to the submandibular nodes, while that from the lateral aspect drains to the preauricular and parotid nodes. The upper eyelid is innervated by CN V₁ and the lower eyelid by CN V₂.

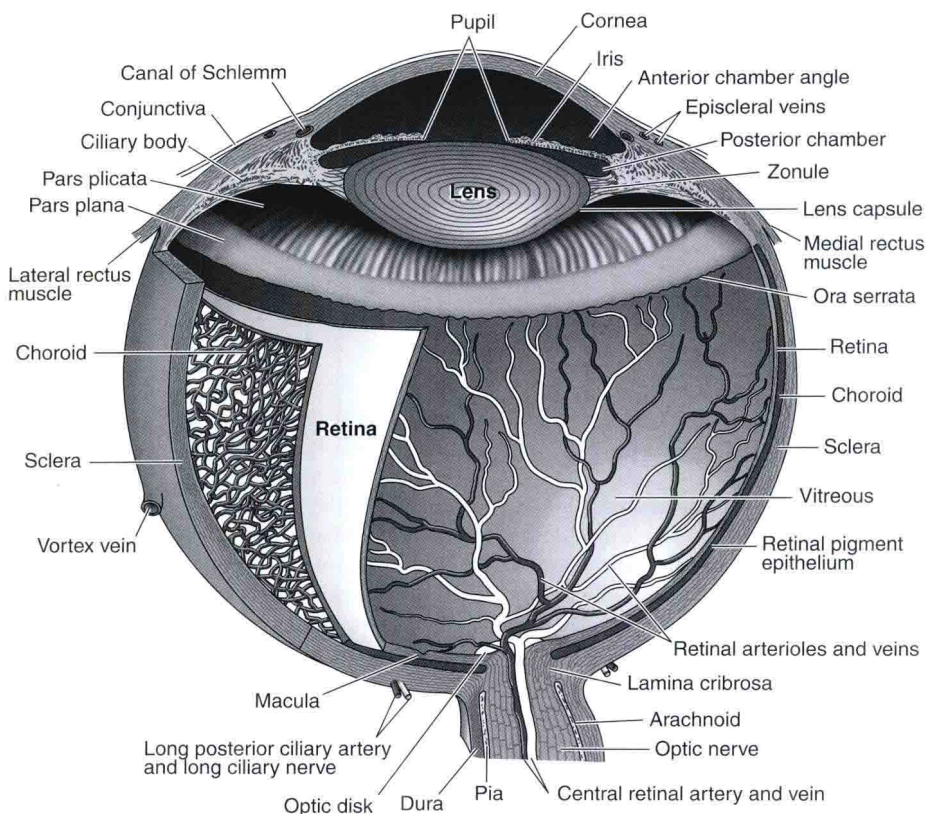


Figure 1-1 *Internal structures of the human eye.* (Redrawn from an original drawing by Paul Peck from: *The Anatomy of the Eye*. Courtesy of Lederle Laboratories. Used by permission from Vaughan D, Asbury T, Riordan-Eva P. *General Ophthalmology*, 15th ed. Stamford, CT: Appleton & Lange, 1999.)

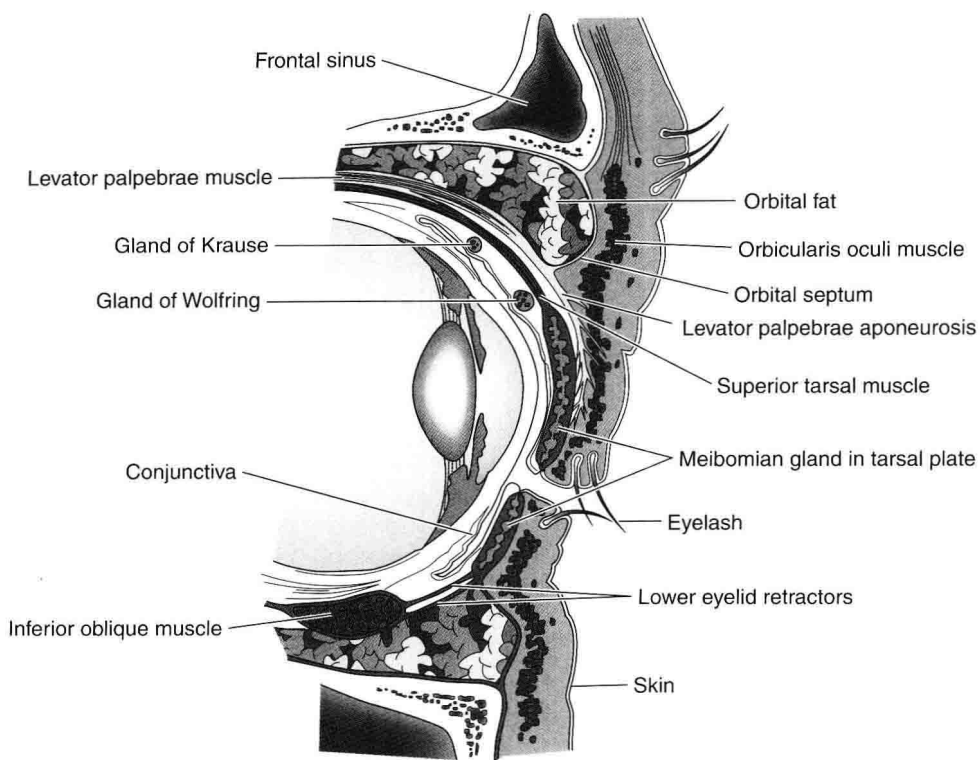


Figure 1-2 *Cross section of the eyelids.*

(Courtesy of C Beard. Used by permission from Vaughan D, Asbury T, Riordan-Eva P. *General Ophthalmology*, 15th ed. Stamford, CT: Appleton & Lange, 1999.)

LACRIMAL APPARATUS The lacrimal apparatus (Fig. 1-3) consists of the lacrimal glands located in the anterior superior temporal segment of the orbit, punctae, canaliculi, lacrimal sac, and nasolacrimal duct, all located in the medial canthus. Tears are produced in the palpebral and orbital portions of the lacrimal gland and secreted onto the conjunctiva via ten secretory ducts. The tears are spread and distributed by capillary action and the blinking motion of the eyelids. Tears drain to the superior and inferior puncta. These two small openings are located on their respective eyelid margin on the lateral border of the medial canthus. Fluid entering the punctae drains through the inferior and superior canaliculi to the common canaliculus, lacrimal sac, and finally, through the nasolacrimal duct into the inferior meatus of the nose.

Tear fluid forms a layer that ranges from 4 to 9 μm thick and serves to protect and lubricate the surface of the cornea, to provide nutrition

and oxygenation to the cornea, and to flatten any minor irregularities in the surface of the cornea, providing a uniform optical surface. The tear fluid consists of a lipid layer secreted from the meibomian glands of the eyelids, an aqueous layer produced by the lacrimal apparatus, and a mucous layer produced by the conjunctival goblet cells. Tear fluid has a pH between 7.1 and 8.6 and also contains small quantities of albumin, lysozyme, IgG, IgA, urea, inorganic salts, lactate, and cellular debris.

The blood supply of the lacrimal glands is from a branch of the lacrimal artery and drains into the ophthalmic vein. Lymphatic drainage travels to the preauricular nodes. The lacrimal gland receives sensory innervation from the lacrimal branch of CN V₁, parasympathetic secretory innervation from the superior salivary nucleus via the greater superficial petrosal nerve, and sympathetic innervation from nerve fibers traveling with the lacrimal artery and nerve.

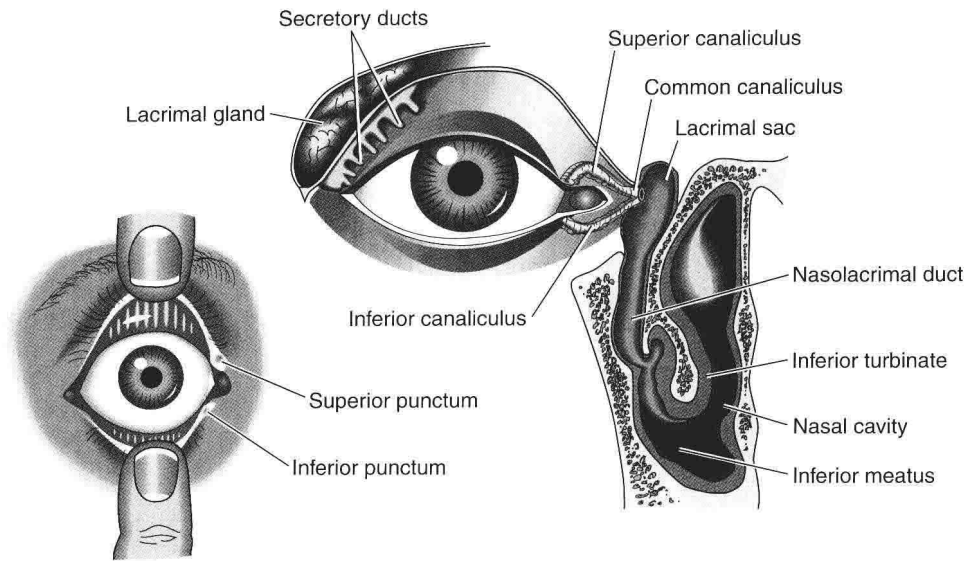


Figure 1-3 *The lacrimal drainage system.*

(Redrawn with modifications from Thompson J, Elstrom ER: Radiography of the nasolacrimal passageways. *Med Radiogr Photogr* 1949;25[3]:66. Used by permission from Vaughan D, Asbury T, Riordan-Eva P. *General Ophthalmology*, 15th ed. Stamford, CT: Appleton & Lange, 1999.)

ANTERIOR SEGMENT

CONJUNCTIVA The conjunctiva is a thin mucous membrane that covers the posterior surface of the eyelids and the anterior surface of the eyeball itself. The palpebral conjunctiva begins at the eyelid margins and covers the entire surface of the inner eyelid to the fornix, where it is firmly attached to the underlying fibrous tissue, before being reflected back to cover the globe as the bulbar conjunctiva. At the point at which the conjunctiva is reflected back over sclera, the conjunctiva has numerous folds that allow the eye to move freely.

CORNEA The cornea is a thin, clear, avascular structure that makes up the anterior wall of the globe and functions to refract light toward the pupil and lens. The transition from the cornea to the sclera is the limbus and contains the epithelial stem cells that are the source of the corneal epithelium. The cornea is normally completely avascular. The cornea derives its nourishment from the diffusion of nutrients from the tear fluid anteriorly and aqueous humor posteriorly. Additionally, the superficial layers of the cornea can obtain oxygen from

the atmosphere by direct diffusion. The cornea is richly innervated from branches of CN V₁ and even the smallest abrasion results in significant pain.

The cornea itself is divided into five layers (Fig. 1-4): the epithelium, Bowman's layer, the stroma, Descemet's membrane, and the endothelium. The epithelium is a stratified squamous cell layer that is approximately five cells thick and continuous with the conjunctiva. The epithelium is rapidly proliferating, with actively mitotic cells located at the limbus. Full turnover of the epithelium occurs every seven days. Adjacent to the basement membrane of the epithelium is Bowman's layer, which primarily consists of a layer of compacted collagen fibrils. Underneath Bowman's layer is the stroma, composed of parallel lamellae of collagen fibers held together by a mucopolysaccharide matrix. The stroma forms the bulk of the cornea. Descemet's membrane, located beneath the stroma, is tightly associated with the underlying endothelium. The endothelium is one cell thick and lacks any substantial proliferative capacity. The endothelium functions to remove fluid from the stroma to help maintain corneal clarity.