

**Chapter 29: Related Ophthalmology**

**Anatomy**

1. The orbit forms a quadrilateral pyramid: floor, roof, medial wall, and lateral wall.

Roof: orbital process of the frontal bone; lesser wing of the sphenoid.

Floor: orbital plate of maxilla; orbital surface of zygoma; orbital process of palatine bone.

Medially: frontal process of maxilla; lacrimal bone; sphenoid bone; lamina papyracea of the ethmoid bone.

Laterally: lesser and greater wings of the sphenoid; zygoma.

2. The trochlea, a pulley through which runs the tendon of the superior oblique muscle, is located between the roof and the medial wall. A displaced trochlea will give diplopia on downward gaze.

3. The inferior orbital fissure is in the floor of the orbit. It is bound by the greater wing of the sphenoid, orbital surface of the maxilla, and orbital process of the palatine bone. It transmits the infraorbital nerve, infraorbital vessels, zygomatic nerve, twigs from the sphenopalatine ganglion to the lacrimal gland, and ophthalmic vein branch.

4. The anterior and posterior ethmoid foramina are situated at the junction between the frontal and ethmoid bone (but they are on the frontal bone per se).

5. The superior orbital fissure lies between the roof and the lateral wall of the nose. It is a gap between the lesser and the greater wings of the sphenoid. It transmits cranial nerves III, IV, VI, V1, the superior orbital vein, ophthalmic vein, orbital branch of middle meningeal artery, and recurrent branch of lacrimal artery.

6. The optic canal runs from the middle cranial fossa into the apex of the orbit. It is formed by the two roofs of the lesser of the lesser wing of the sphenoid. It transmits the optic nerve and the ophthalmic artery.

7. The upper lid contains:

a. Orbicularis oculi.

b. Levator palpebrae superioris.

c. Sweat glands.

d. Meibomian glands.

e. Wolfring's glands.

f. Tarsal plate.

8. The lower lid contains:

a. Tarsal plate.

b. Orbicularis oculi.

c. Sweat glands.

d. Meibomian glands.

e. Wolfring's glands.

9. The lateral ends of the tarsi unite to form the lateral palpebral ligament which fixes onto the orbital surface of the zygomatic bone. A displaced lateral canthal ligament may give an inferiorly displaced canthus or slight ptosis.

10. The medial ends join to form the medial palpebral ligament which is attached to the frontal process of the maxilla immediately in front of the lacrimal fossa. Displacement of the medial palpebral ligament gives rise to a rounding of the medial canthus or pseudohypertelorism. The medial palpebral ligament sends a few fibers to be attached to the posterior lacrimal crest. This is believed to keep Horner's muscle in place which in turn maintains the lacrimal puncta against the globe. Hence, displacement of Horner's muscle may lead to epiphora.

11. The septum orbitale is the orbital periosteum which extends into the lid to attach to the tarsal plates. It separates the orbital contents from the lacrimal apparatus. Medially, it is fused with the palpebral ligament leading toward the posterior lacrimal crest.

12. The suspensory ligament of Lockwood is a continuous band of fibrous tissue slung beneath the eyeball from side to side. The ends of the suspensory ligament blend with the check ligaments and with the medial and lateral horns of the aponeurosis of the levator palpebrae superioris.

### **Control of Eye Movement**

1. The six extraocular muscles and their functions are:

Lateral rectus	to abduct
Medial rectus	to adduct
Superior rectus	to elevate (and intort)
Inferior rectus	to depress (and extort)
Superior oblique	to intort (and depress)
Inferior oblique	to extort (and elevate).

2. LR6(SO4), the rest by III.

The lateral rectus is innervated by the VI nerve.

The superior oblique is innervated by the IV nerve.

The rest of the extraocular muscles are innervated by the III nerve.

3. The inferior rectus muscle is the most commonly trapped muscle in a blow-out fracture, the second being the inferior oblique. When these muscles are trapped, the patient may experience difficulty looking upward. This condition is not due to paralysis but rather to the trapping of the two muscles mentioned above. To differentiate paralysis of the elevators from trapping of the inferior rectus and the inferior oblique muscles, the "forced duction test" is performed under local or general anaesthesia. The forced duction test consists of grasping the globe adjacent to the limbus with small forceps and rotating it up, down, in, and out. If the globe moves freely, there is no entrapment of these muscles.

4. There are six cardinal directions of gaze, each controlled by a set of two muscles:

Eyes to right: right lateral rectus and left medial rectus.

Eyes to left: right medial rectus and left lateral rectus.

Eyes up and right: right superior rectus and left inferior oblique.

Eyes down and right: right inferior rectus and left superior oblique.

Eyes up and left: right inferior oblique and left superior rectus.

Eyes down and left: right superior oblique and inferior rectus.

When diplopia occurs it may exist in more than one direction. The muscles suspected of being involved are those controlling the direction of gaze in which the images of the diplopia are farthest apart. It is usually obvious as to which eye is involved. However, when such is not the case, each eye should be covered in turn and tested. The eye that sees the peripheral image is the one injured.

### **Lacrimal System**

1. The lacrimal gland (a serous gland predominantly) is located in a fossa within the zygomatic process of the frontal bone. The lacrimal sac lies in a fossa bound by the lacrimal bone, the frontal process of the maxilla, and by the nasal process of the frontal bone.

2. The lacrimal gland secretes tears through 17-20 openings. Although the gland is developed, secretion of tears does not take place until 2 weeks after birth.

3. When cannulating the inferior and superior canaliculi, it is important to remember that each canaliculus has a vertical portion (about 2 mm) and a longer horizontal portion (about 8 mm). The lacrimal sac is about 12 mm long and the duct about 17 mm in length. The nasolacrimal duct empties into the anterior portion of the inferior meatus. This area is to be avoided when creating a nasoantral window. The most common site of obstruction in the lacrimal system is the upper portion of the nasolacrimal duct giving rise to dacrocystitis, the symptoms of which are epiphora and pain.

4. A lacerated canaliculus should be sutured together if possible. If not, a silk string or polyethylene tube should be passed from one canaliculus to the other.

5. A lacerated nasolacrimal duct can be sutured primarily over a polyethylene stent passing from the canaliculus to the nose. If the lacerated ends cannot be identified, then a polyethylene tube passing from the canaliculus into the nose can be left in place for 2-3 weeks.

### **Malignant Exophthalmos**

1. Malignant exophthalmos is caused by an endocrine disorder. One of the causes is an oversecretion of "exophthalmos factor" by the anterior pituitary. The factor is possibly linked to TSH. The more severe form of exophthalmos is caused by excessive orbital edema giving rise to an increase in bulk of the extraocular muscles and adipose tissues. These adipose tissues are found at such time to contain a greater amount of mucopolysaccharides than normally.

2. The exophthalmos is not only undesirable but can lead to:

a. Corneal abrasions (due to an inability to properly close the eye).

b. Chemosis secondary to venous stasis.

c. Fixation of the extraocular muscles causing ophthalmoplegia. The earliest limitation noted is in the upward gaze.

d. Retinal venous congestion leading to blindness.

3. Since the consequences of malignant exophthalmos are grave, many surgical corrections have been devised.

a. Kronlein's procedure removes the lateral orbital wall to allow the orbital contents to expand into the zygomatic area.

b. Naffziger's procedure removes the roof of the orbital cavity to allow expansion of the orbital contents into the anterior cranial fossa. It does not expose any of the paranasal sinuses and it preserves the superior orbital rim. Postoperatively, the cerebral pulsations may be noticed in the orbit.

c. Sewell's procedure consists of an ethmoidectomy and removal of the floor of the frontal sinus for expansion.

d. Hirsch's procedure removes the orbital floor to allow decompression into the maxillary sinus. A ridge of bone around the intraorbital nerve is preserved to support the nerve.

e. Ogura has described a method in which the floor and the medial wall of the orbit are removed to allow expansion into the ethmoid and maxillary sinus. As complete an ethmoidectomy as possible is performed.