Orbit and Contents

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Lecture Outline

• Relationships of orbits to paranasal sinuses
• Arrangement of orbital contents (fascial structures)
• Structure of eyelids & lacrimal apparatus
• Blood supply to the orbit and retina
• Cranial nerves of the orbit (CN II, III, IV, V₁, VI)
• Autonomics of the orbit (parasympathetic & sympathetic)
• Extraocular muscles (actions & innervations)
Relationships of the Orbit
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Dura mater lining the cranial cavity has two layers:
General Arrangement of Orbital Fascia & Fat

- Periostea
- Orbital septum
- Superior tarsal plate
- Inferior tarsal plate
- Periorbita (periosteum)
- Fat
- Optic canal
- Optic nerve
- Bilaminar intracranial dura
- Dura Arachnoid Pia
- Optic sheath: Arachnoid Pia

Diagram showing the arrangement of orbital structures including periorbita, fat, and tarsal plates.
**Anatomy of the Eyelids**

- **Levator palpebrae superioris**
  - (skeletal muscle innervated by CN III)

- **Superior tarsal muscle**
  - (smooth muscle innervated by sympathetics)

- **Palpebral conjunctiva**

- **Orbicularis oculi** (skeletal)

- **Tarsal plate**

- **Skin**

- **Cilia**

- **Orbital septum**

- **Bulbar conjunctiva**

- **Conjunctival vessels**

- **Conj. sac**
The **lacrimal gland** produces tears that wash across the eye from lateral to medial to moisten and aerate the cornea.

A dry eye or reduced tears can lead to corneal edema.
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The blood supply to the orbit and eye is via the ophthalmic artery, which is the first branch of internal carotid.
Internal carotid artery
Central artery of the retina
Ophthalmic artery
CNII
Optic canal
Normal retina, right eye
Ophthalmic artery
Central artery of the retina
Internal carotid artery
Clinical Correlation

Papilledema

Normal

CSF
Venous drainage from the orbit communicates with facial vein anteriorly & cavernous sinus posteriorly. These veins have no valves!
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Cranial Nerves Related to the Orbit

- Optic (II)
- Oculomotor (III)
- Trochlear (IV)
- Trigeminal (V)
  - Ophthalmic (V₁)
- Abducent (VI)
3 Cranial nerves innervate extraocular muscles:

- Oculomotor (III)
- Trochlear (IV)
- Abducent (VI)

Other cranial nerves innervate the following muscles:

- Superior oblique
- Lateral rectus
- All others
Summary of Extraocular Muscle Innervation

Handy mnemonic:
LR$_6$SO$_4$AO$_3$
(Lateral Rectus CN VI, Superior Oblique CN IV, All Others CN III)
Sensory Nerves in the Orbit

- Lacrimal
- Frontal
- Ophthalmic (V₁)
- Trigeminal ganglion
- CN V
- Long ciliary n.
- Short ciliary n.
- Nasociliary
- NFL
Ciliary ganglion (CN III)

Cornea

Long ciliary nerves

V1

Short ciliary nerves

Somatosensory pathways for blink reflex:

- Pass thru short & long ciliary nerves.
- Pass thru ophthalmic nerve.
- Cell bodies in trigeminal ganglion.
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Netter Plate 133

CN III

Brainstem

Superior cervical sympathetic ganglion

Trigeminal ganglion

Internal carotid artery

Thoracic Spinal cord

Thoracic sympathetic trunk

Netter Plate 133
Smooth Muscles of the Eye

Dilator pupillae m. (sympathetic) – dilates pupil

Ciliary muscle (parasymp) – adjusts thickness of lens (accommodation/focus)

Sphincter pupillae m. (parasympathetic) – constricts pupil
Autonomic Innervation to the Eye:

Parasympathetics to ciliary & sphincter pupillae mm.

Sympathetics to dilator pupillae muscle

- Short ciliary nerves: para/post, symp/post & SS.
- Long ciliary nerves: symp/post & SS.
*Pupillary (light) reflex (constriction of pupil in response to light shone in pupil):
- afferent limb = CN II from stimulation of retinal ganglion cells
- efferent limb = CN III (para) via ciliary nerves to pupillary sphincter
What are the signs in this patient that there is an interruption of sympathetic innervation to the head?

1. Ptosis (droopy upper eyelid) ↔ paralysis of superior tarsal muscle

2. Miosis (constricted pupil) ↔ paralysis of dilator pupillae muscle because no resistance to parasympathetically controlled pupillary sphincter

3. Vasodilation (flushed, warm skin) ↔ paralysis of smooth muscle in walls of facial vessels

4. Anhydrosis (dry skin due to lack of perspiration) ↔ sweat glands denervated
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Anatomical arrangement, innervation, & function of extraocular muscles
Extraocular Muscles

The key to learning and retaining knowledge of how the 6 extraocular muscles move the eyeball is to know/visualize each muscle’s anatomical position relative to the eyeball’s axes.

- **Vertical Axis**
  - ABduction / ADduction

- **Horizontal Axis**
  - Elevation / Depression

- **Anterior/Posterior Axis**
  - Extorsion / Intorsion
The position of each extraocular muscle can be represented by a simple line of contraction for visualizing each muscle’s action relative to an axis:

Right orbit seen from above

**Key:**
- IO = inferior oblique
- IR = inferior rectus
- LR = lateral rectus
- MR = medial rectus
- SO = superior oblique
- SR = superior rectus

**Visual gaze**
Superior Rectus Muscle: Anatomical Actions

When SR contracts relative to horizontal axis, cornea moves upward (ELEVATION).

SR passes medial to vertical axis.

When SR contracts relative to vertical axis, the cornea moves medially (ADUCTION).
Superior Oblique: Anatomical Actions

When SO contracts relative to horizontal axis, it rotates back of eye forward making cornea rotate downward (DEPRESSION).

When SO contracts relative to vertical axis, it rotates back of the eye medially causing cornea to rotate outward (ABDUCTION).

Inferior oblique & Inferior rectus schematized at end of this PPT.
**Inferior Rectus: Anatomical Actions**

When IR contracts relative to horizontal axis, it rotates cornea downward (DEPRESSION).

When IR rectus contracts relative to vertical axis, it rotates cornea medially (ADDITION).
Inferior Oblique: Anatomical Actions

When IO contracts relative to horizontal axis, it rotates back half of eyeball down causing cornea to rotate upward (ELEVATION).

When IO contracts relative to vertical axis, it rotates back of eyeball medially causing cornea to rotate laterally (ABDUCTION).
Summary Movements Relative to Vertical Axis

ADDUCTORS:
- Superior rectus
- Inferior rectus
- Medial rectus

ABDUCTORS:
- Superior oblique
- Inferior oblique
- Lateral rectus
Summary Movements Relative to Horizontal Axis

ELEVATORS:
Superior rectus
Inferior oblique

DEPRESSORS:
Superior oblique
Inferior rectus