Orbital and Optic Nerve Decompression

**APPLIED ANATOMY**

- **Orbit is surrounded on 3 sides by paranasal sinuses. From 11’oclock to 6’oclock position**
- **Orbit relations**:
  - **Superiorly**: Anterior cranial fossa
  - **Medially**: Ethmoidal labyrinth and nasal cavity
  - ** Inferiorly**: Maxillary sinus and occasionally infraorbital ethmoidal cells.
  - ** Laterally**: Infratemporal fossa and middle cranial fossa
- Apex of orbit lies directly in middle cranial fossa.
- Average volume is 30 ml. (4ml rise – proptosis of 6mm)
- **MEDIAL WALL (4 bones)** ➔ frontal process of maxilla, lacrimal bone, lamina papyracea of ethmoid, body of sphenoid
- Anteromedial is fossa for lacrimal sac, demarcated by anterior and posterior lacrimal crests.
- Rule of 24-12-6mm i.e. distance from lacrimal crest to anterior ethmoidal foramina, from ant to posterior ethmoidal foram and from post to optic canal.
- **ETHMOIDAL foramina has also been taken as indicator for level of Cribriform plate.**
- **Medial wall extremely thin and thus provides less resistance to infection**
- **INFERIOR WALL (3 bones)** ➔ Orbital plates of maxilla, zygomatic and orbital process of palatine bone.
- **Infraorbital foramen lying halfway along the inferior rim is vertically in line with the superior orbital notch and is continuous with infraorbital canal.**
- **Anterior alveolar nerve** joins the **Infraorbital Nerve** in the foramen and thus damage can lead to denervation of upper dentition.
- **Inferior oblique is the only muscle to take origin from anterior part of orbit.**
- **Floor commonest site for blow out fractures as it is thin. (0.5 to 1mm)**
- **SUPERIOR WALL (2 bones)** ➔ Roof is triangular and consists of orbital plate of the frontal bone and lesser wing of sphenoid.
- Bone thin (<3mm) except in sphenoid region.
- Supraorbital foramen = supraorbital notch
LATERAL WALL (3 BONES)

- Greater wing of sphenoid, orbital surface of zygoma, and zygomatic process of frontal bone.
- Superior orbital fissure lies between the greater and lesser wings of sphenoid. 3,4,5,6 (Ophthalmic division of 5th nerve) and superior ophthalmic vein passes through it.
- Orbit Lined by periosteeum which acts as a protective coat and called periorbita.
- Medial canthal ligament comprises the preseptal and pretarsal heads of orbicularis oculi muscle and each of these has superficial and deep component
- Fascia bulbi (TENON’s capsule) covers globe from cornea till optic nerve.
- Inferiorly thickened to form suspensory ligament of Lockwood.

ORBITAL DECOMPRESSION

DEFINITION

- Refers to expansion of orbital volume through removal all or part of the individual orbital walls.
- The finite capacity of the bony orbit means that increase in the tissue volume usually results in anterior displacement of the orbital contents.

INDICATIONS

1. Thyroid eye disease
2. Vasculitis
3. Large myopic globes.
4. Sphenoid wing meningioma with compressive optic neuropathy
5. Acute orbital haemorrhage with proptosis
6. Drainage of orbital subperiosteal abscess

PREOPERATIVE ASSESMENT

- CT scan of orbit and sinuses.
- Axial cuts demonstrate hypertrophy of Extraocular muscles and orbital fat and associated axial proptosis (COCA COLA bottle sign as The belly of the muscle enlarges with sparing of the tendinous insertion, giving the appearance of the traditional coca-cola bottle. Usually seen in thyroid eye disease)
- Coronal scans for planning an endoscopic approach.
- Thyroid profile and cause assessment

SURGICAL TECHNIQUES:

MEDIAL WALL

- External Ethmoidectomy
- Trans nasal approach
- Trans antral approach

**LATERAL WALL**

- Lateral Canthotomy approach

**INFERIOR WALL**

- Transconjunctival approach
- Transantral approach
- Transnasal approach

**ENDOSCOPIC ORBITAL DECOMPRESSION**

- Kennedy et al first described endoscopic orbital decompression during the early 1990's.
- In this procedure the whole medial wall of orbit along with the medial portion of the orbital floor is removed.
- **PROCEDURE:**
  - GA ➔ Decongest nasal mucosa ➔ Uncinectomy ➔ visualization of the maxillary sinus ostium ➔ ostium is opened widely up to the floor of the orbit superiorly, the wall of the maxillary sinus posteriorly, and the inferior turbinate inferiorly. Care is taken not to extend the maxillary sinus ostium anteriorly beyond the frontal process of maxilla to prevent injury to the nasolacrimal duct ➔ A 30 degree endoscope is used to visualize the infra orbital nerve through the maxillary sinus ostium as the nerve courses along the floor of the orbit. ➔ Now **endoscopic sphenoidotomy** is performed. After this process the **anterior and posterior ethmoidal arteries** can be identified as it courses through the skull base ➔ The middle turbinate is removed to enable optimal visualization of the medial orbital wall ➔ After complete exposure of the medial orbital wall, a curette is used to penetrate the thin bone of lamina papyracea. The thin bone is carefully elevated exposing the underlying periorbita ➔ **Bone removal is proceeded superiorly towards the roof of ethmoid, inferiorly up to the orbital floor and anteriorly up to the maxillary line** ➔ **Bone over the frontal recess area is left intact, this is done to prevent prolapsing orbital fat from obstructing frontal sinus drainage** ➔ Only that portion of the floor of the orbit medial to the infraorbital nerve is removed ➔ A sickle knife may be used to open up the periorbita. The periorbital incision is started at the posterior limit of decompression and brought Anteriorly in order to prevent orbital fat from obscuring the vision ➔ Parallel incisions are made along the ethmoid roof and orbital floor. To reduce the risk of diplopia post operatively a sling of fascia overlying the medial rectus may be preserved. On completion of this procedure fat could be seen prolapsing into the nose and maxillary sinus. ➔ Nasal packing should be avoided to enable maximum decompression.
- Average amount of retrogression with the removal of medial wall and floor is 5mm.
- If a greater amount of decompression or globe retrogression is required then posterior half of orbital floor can be removed
- Even further entails approach to anterior orbital floor and lateral orbital wall through subciliary incision.
- After incising the conjunctiva, orbital rim identified ➔ orbital periosteum elevated ➔ floor removed
  - lateral and medial to infraorbital nerve

**LATERAL CANTHOTOMY AND CANTHOLYSIS**

- Local Anaesthetic in lateral canthal region ➔ Horizontal incision through skin and soft tissues in lateral junction of eyelids on the bone of orbital rim ➔ tendon identified and cut.
- Intraorbital pressure relieved and allows reperfusion of optic nerve and retina
- Insufficient and used only to buy time for formal orbital decompression.
- Tendon can be sutured to orbital periosteum after 24 to 48 hrs.

  - Only medial wall ➔ 1.75mm
  - Medial plus floor ➔ 5.75mm
  - Three wall decompression ➔ 6.5 mm

**POST OPERATIVE CARE :**

- Iv Steroids (8-12mg dexamethasone duing procedure, 4-8mg every 8hrs thereafter till in hospital and then tapered)
- Sutures removed 5-7days after surgery.
- Intranasal splints removed after 1 week
- Saline spray to prevent crusting
- Mucosalisation complete by 2 months
- Counselling about diplopia
- Observed for atleast 6months before consideration for extraocular or eyelid surgery.

**COMPLICATONS**

- CSF leak
- Retro orbital haematoma
- Optic nerve and carotid artery damage
- Subcutaneous emphysema
- Injury to infraorbital nerve
- Injury to medial and lateral rectus muscles
- Ecchymosis of periorbital tissues
- Diplopia
- Damage to nasolacrimal apparatus and Epiphora
- Bacterial Sinusitis
- Mucocele
OPTIC NERVE DECOMPRESSSION

INDICATIONS

- Traumatic optic neuropathy
- Thyroid eye disease
- Neoplastic decompression eg meningioma
- Fibrosis due to chronic inflammation eg Wegners granulomatosis.

Medical Management of Traumatic optic neuropathy includes Systemic steroids.

ENDOSCOPIC OPTIC NERVE DECOMPRESSSION:

- The most common indication for optic nerve decompression is traumatic optic neuropathy.

PATIENT SELECTION

- Patients with traumatic optic neuropathy include:
  - Afferent Pupillary defect
  - Monocular or binocular involvement
  - Impairment of colour vision
  - Visual field defects
  - Loss of visual acuity
  - Delayed development of optic atrophy

ANATOMY OF OPTIC NERVE:

- The optic nerve per se can be divided into three segments: Intraorbital, intracanalicualar, and intracranial. The main goal of optic nerve decompression is to relieve the compressive forces within the intracanalicualar portion of the nerve.
- The optic nerve canal is formed by two struts of the lesser wing of sphenoid. This canal carries the optic nerve and ophthalmic artery.
- Within the optic canal the nerve is ensheathed by three meningeal layers. At the **orbital apex is the fibrous annulus of Zinn**. This thick fibrous layer is the least expandable portion of the fibrous tissue around the optic nerve. This area has been postulated to be the most susceptible site for pathologic compression of the optic nerve.

PROCEDURE:

- **GA**  →  Decongestion  →  Sphenoidectomy  →  The anterior face of the sphenoid is opened widely, and the bulge of the **optic nerve canal is identified along the lateral wall of the sphenoid sinus**  →  After complete sphenoethmoidectomy, a spoon curette is used to fracture the lamina papyracea approximately 1 cm anterior to the optic canal  →  The lamina is removed carefully in a posterior direction to expose the annulus of Zinn  →  When the optic canal is reached the thin lamina is replaced
by thick bone of the lesser wing of sphenoid ➔ This bone must be thinned with a diamond burr before removal.

- It is recommended that the optic sheath is also incised to enable better decompression.