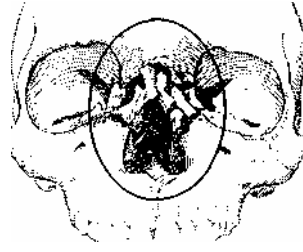


Nasoethmoidal injuries

311 MDS

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- The nasoethmoid region is an important area of the face for
 - Cosmetics
 - Facial projection

The region relies for form and strengths on a complex inter-relationship between :

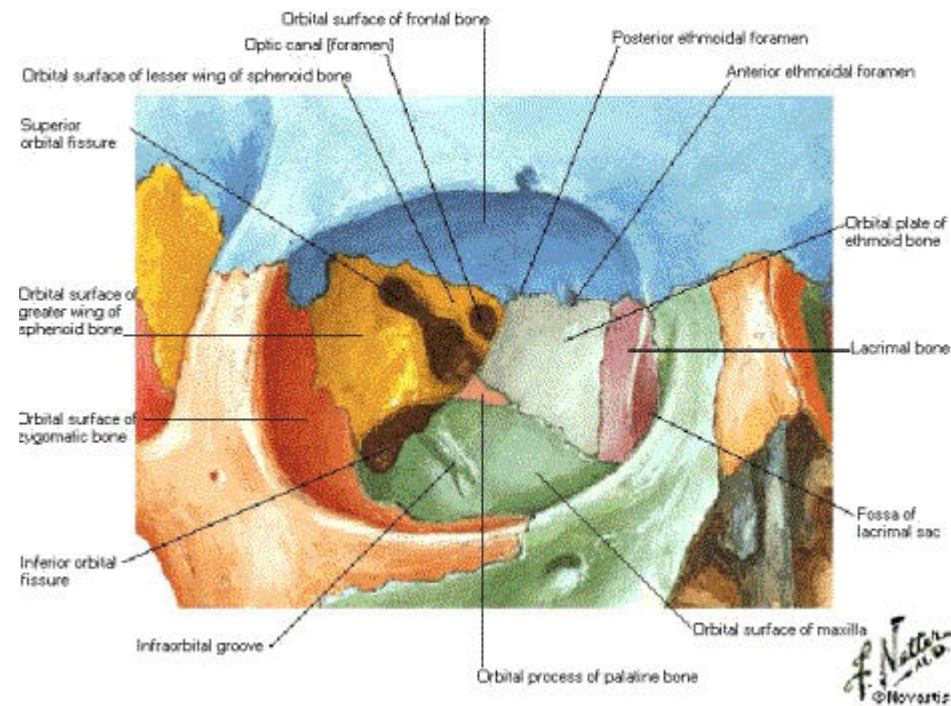
- soft tissues
- bone

The skeletal foundation of the nasoethmoidal complex consists of a strong triangular-shaped frame

- On each side the frontal process of the maxillary bone and the nasal process of the maxillary bone and the nasal process of the frontal bone are united above at the glabella by the frontal bone
- The triangle is completed inferiorly by the premaxilla
- behind the frame lies the interorbital space (between the orbits and below the cribriform plate)
- This space is situated between the medial walls of the orbit each of which is formed by the thin lacrimal plate of the ethmoid which overlies the ethmoid sinuses

Medial wall of the orbit is composed of the lacrimal bone anteriorly and the lamina papyracea of the ethmoid bone posteriorly.

Right Orbit Frontal and Slightly Lateral View

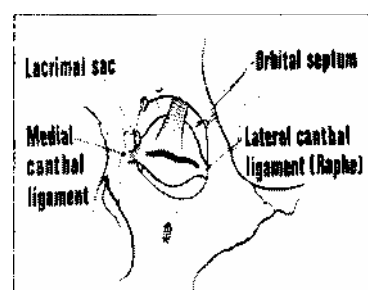


The lacrimal drainage system

- Tears secreted into conjunctival sac by lacrimal gland
- Tears circulate across the cornea and drain into the lacrimal sac through puncta in superior and inferior lids via lacrimal canaliculi
- Lacrimal sac drains into nasolacrimal duct which empties into inferior meatus of the nose

Medial canthal ligament

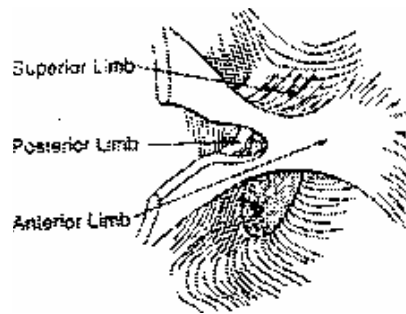
- Strong fibrous tissue band
- Acts as tendon for origin of orbicularis muscle
- has an anterior and posterior part



Insertion of the medial canthal ligament

There are three limbs

- (1) Superior limb hoods the lacrimal sac and joins the junction of the frontal process of maxilla
- (2) Posterior limb is thin attaching to the posterior aspect of the lacrimal fossa
- (3) Anterior limb attaches to the lateral surface of the nasal bone



The only other area of the facial skeleton susceptible to a fracture force similar to that of NOE area is mandibular condyle

Swearingen reported that a force of:

- 35 to 80 gm per square inch required to produce a fracture in the NOE area
- 120 to 180 gm per square inch is required for the frontal bone fracture

In nasoethmoidal fracture

- nasal bones are pushed back posteriorly and laterally into the interorbital space
- involves the frontoethmoidal Structures:
 - nasal bones
 - frontonasal processes
 - lacrimal bones
- usually the result of a high velocity injury, most often due to a road traffic accident
- This type of injury often is accompanied by:
 - frontal sinus
 - frontobasilar
 - high Le Fort fractures (Le Fort II & III)
- fractures in this region are almost invariably comminuted
- treated by open reduction
- accessed by means of a bicoronal flap which permits excellent exposure of the nasoethmoidal area
- easier but less extensive exposure of the nasoethmoidal area is using bilateral semilunar incisions over the frontal process of the maxilla

- the comminuted bones are exposed, realigned and fixed by bone plates

Classification:

1. Isolated nasoethmoid and frontal region injury without other fractures of the mid-face

- Bilateral - Central midface injury resulting from direct blow over nasal bridge.
 - Base of the nose driven backwards into interorbital space
 - nasal tip becomes upturned
- b. Unilateral- Unilateral nasal deformity.
 - Side of the nose is depressed
 - fracture of ethmoid bone

2. Combined nasoethmoid and frontal region injury with other fractures of the mid-face

- Bilateral- Nasoethmoid complex fracture combined with Le Fort II and Le Fort III fractures.
- b. Unilateral- Nasoethmoid complex injury with:
 1. Severe comminution of orbit and zygomatic complex
 2. Unilateral displacement of medial canthal ligament

Classification according to the status of the medial canthal tendon and tendon bearing bone segment (central segment)

- Type I fracture: unilateral and bilateral with a single segment NOE fracture
- Type II fracture: fractures comminute with canthal ligament attached to bony fragment can be unilateral or bilateral
- Type III fracture: comminuted unilateral or bilateral. Bone fractures extend into the bone providing canthal insertion. And canthal avulsion may be present

Diagnosis

- Most difficult midfacial fractures to diagnose
- Thorough physical examination and radiographic assessment are essential
- Pretraumatic photographs are useful to assure that an existing deformity was not present

Clinical features

1. Frontal depression/or widened interorbital space

2. Nasal deformity
3. Displaced nasal septum
4. Crepitation and mobility of the NOE complex
5. Epistaxis
6. Periorbital haematoma
7. Traumatic telecanthus
8. Cerebrospinal fluid rhinorrhoea
9. Pneumocephalus
10. Diplopia
11. Haemorrhage

Physical Examination

- visual inspection of NOE area
- localized ecchymosis and oedema
- periorbital and subconjunctival haemorrhage
- lacerations overlying the medial canthal tendon
- loss of nasal projection and height
- Flattening nasal dorsum, increase nasal width elevation of nasal tip
- Direct palpation of the medialorbital rim and perception of crepitus or movement
- Observe septal haematoma
- Bimanual examination or palpation of nasoethmoid skeleton

Bimanual examination technique

- Kelly clamp placed internally against medial orbital rim
- Index finger placed externally over medial canthal ligament insertion
- Stability is evaluated by assessing the movement of the complex

Ophthalmologic evaluation:

- assessment of visual acuity
- speed and symmetry of pupillary reaction
- visual fields
- intraocular pressure
- enophthalmos
- diplopia

Medial canthus examination

pulling along the tarsus of the lid

Sharp angle formed at medial canthal area (Normal)

Medial canthal angle remains rounded (Unstable/Disrupted)

Intercanthal distance

>35 mm indicative of canthal spread

>40 mm diagnostic

Traumatic telecanthus

Increased intercanthal distance >35 mm (normal 32 ± 3 mm) Caused by:

1. Severance of canthi
2. Avulsion of canthi
3. Lateral displacement of medial canthal ligament whilst still attached to bone. May result in :
 - a. Narrow almond-shaped palpebral fissure
 - b. More prominent epicanthal folds
 - c. Diplopia

Radiological assessment

- Computerized Tomography (CT)
- Lateral skull radiographs
- Occipitontal views (10 and 45 degrees)
- Occlusal film (shows ethmoid disruption)
- standard trauma X-ray series

Treatment

Delayed or left undetected NOE fractures for more than 2 weeks are often difficult or impossible to correct secondarily

Necessary to accurately assess and comprehensively treatment plan as soon as possible

The aims of treatment are to restore normal anatomy and physiologic function with respect to:

- patent functioning lacrimal system
- prevent complications due to involvement of the frontal sinuses and nasolacrimal duct
- symmetrical fixation of the bones and restoration of orbital volume
- globe position
- frontonasal angle and nasal projection
- stable symmetrical fixation of the canthus in three dimensions with good apposition of the eyelids against the ocular globe

Treatment includes

- Closed reduction

The use of transnasal wires and compression plates is often unsatisfactory

- Open reduction

• Realignment of bony fragments under direct vision especially at early stages give better results

- fixation
 - direct wiring
 - miniplates
 - external fixation and cranial suspension

Sequencing surgical treatment

1. Access to give good exposure of the fracture
2. Reconstruction of the cranial base and management of the frontal sinus if necessary
3. Frontonasal buttress and orbital rim, usually these fragments are easy to locate and reduce
4. The nasal dorsum should be reconstructed and nasal projection restored
5. Medial orbit
6. Medial canthal ligament
7. Lacrimal system
8. Closure and drain
9. Nasal plaster
10. Dressings and antibiotic eye drops

Surgical approaches

- existing laceration
- H-shaped
- Bilateral 'Z' approach
- Midline vertical approach
- W-shaped approach
- Coronal approach

Immediate bone grafting may be required if there is gross comminution of key bone buttresses or the orbital walls

Rib graft

Calvarial graft

Sometimes in combination with metal orbital plates or mesh for bone grafting
Nasal bridge re-attached to frontal bone. All bone fragments must be preserved, aligned and either directly wired or plated with microplates

Orbit

- treated as for orbital injuries alone
 - 20 to 25% range of significant ocular injury in case of nasoethmoidal injuries

Lacrimal system

- damage results in chronic obstruction
- Evaluate by irrigation of the system
- Patency of the nasolacrimal system can be carried out by:
 - Jones I test (inject 2% fluorescein dye into conjunctiva! sac if no dye noted after 5 minutes .-then perform Jones test II
 - Jones II test to determine the location of the obstruction in the system

To bypass the nasolacrimal duct by anastomosing the lacrimal sac with the nasal mucosa dacryocystorhinostomy must be performed.
incidence of late lacrimal obstruction requiring OCR is about 5 to 10% following acute fracture management

Sinuses

The incidence of frontal sinus fractures is estimated to be between 6 and 15% of all cranio-maxillofacial injuries

- Complications of sinuses involvement
 - Contour irregularities
 - Chronic pain
 - Supraorbital nerve parasthesia
 - Sinusitis
 - Mucocele
 - Pyocele
 - Meningitis
 - CSF leak

most commonly used techniques for frontal sinus obliteration involve the implantation of autogenous tissue graft:

- fat
- muscle
- bone
- Cartilage
- Hydroxyapatite

A fracture in the cribriform plate may result in CSF leakage and anosmia

CSF leak

- poses surgical problem
- most settle without surgery
- admit the patient

- observe (associated head injury)
 - possible antibiotic prophylaxis (Incidence of meningitis 4 to 10%)
- Ocular injury
- Diplopia
- impairment of nasal airway function
- aesthetic complications