Frontal Sinus Fractures

Peter Aquilina

MBBS(Hons) MS(Head & Neck) BDS(Hons) FRACDS(OMS)
Consultant Maxillofacial Surgeon
Westmead & Royal Children's Hospitals
Senior Lecturer University of Sydney

www.maxillofacialsurgeons.org
Anatomy & Embryology

- Absent at birth
- Doesn’t begin development until about 2 years of age
- Radiographically evident at about 8 years
- Adult size at about 12 years, but pneumatization continues slowly until about 40 years
- Consists of one or more compartments
- Irregular shape & asymmetric
- Lined by respiratory epithelium
- Intimate relation with cranial
Anatomy

- Volume approx 5 mls
- Anterior wall thicker/stronger than posterior wall
- Dura adheres to deep surface of posterior table
- Mucosal lining contiguous with ethmoidal air cells & nasofrontal ducts
- Foramina of Breschet → venous drainage of mucosa are site of potential intracranial spread of infection
- Mucosa deeply invaginates foramina
Anatomical Variation

- 10% unilateral
- 5% rudimentary
- 4% absent
- 20% of people “abnormal” frontal sinus anatomy
Nasofrontal Duct

- Drains frontal sinus
- Located posteromedial floor of sinus
- Very variable course
- True duct is absent in 85% people
  - FS drains indirectly via ethmoidal air cells to middle meatus
Examination

- Full assessment as per ATLS
- Lacerations
- Depression
- CSF leak
Investigations

• CT imaging modality of choice
  – Request axial and coronal slices
• Beta Transferrin $\rightarrow$ CSF
• Other investigations as required
Associated injuries

• Neurological
  – Closed head injury
  – Pneumocephalus
  – Cerebral contusions
  – Haematomas
  – Open brain
Associated injuries

• Ophthalmological
  – Up to 25%
  – Full ophthalmological examination mandatory
Associated injuries

- Maxillofacial injuries
  - NOE
  - ZMC
  - Le Fort fractures
  - Panfacial fractures
Classification of Frontal Sinus Fractures

- Many classification systems
- Can get very detailed classification, however not useful clinically
Clinical Classification

- **Anterior Table**
  - Displaced
  - Un-displaced
- **Posterior Table**
  - Displaced
  - Un-displaced
- **Anterior & Posterior Table**
  - Displaced
  - Un-displaced
- **Nasofrontal Duct**
  - Involved
  - uninvolved
Simplified Clinical Classification

1. Fracture of anterior table
2. Fracture with disruption of posterior wall
3. Fracture involving floor of sinus
Surgical Management

Goal = “Safe Sinus”
Anterior Table Fractures

- Non surgical
  - Undisplaced
  - Minimal displacement with no cosmetic defect

- Surgical Intervention
  - Displaced fractures
Anterior Table Fractures
Surgical Access

- Coronal flap preferable
- Generally avoid using lacerations or local incisions
- Avoid “Gull Wing” & “Open Sky” approaches
- Anatomically reduce fragments & hold in place with 1.3mm hardware
Anterior Table with Bone Loss
Frontal Sinus with Orbital Roof
Fractures with Disruption of the Posterior Table

• Non-Surgical management
  – Undisplaced fractures

• Surgical Management
  – Displaced fractures
    • Displacement more than thickness of posterior table
  – Clinical findings suggestive of significant dural tear
    • Encephalocele
    • Persistent CSF leak
Surgical Management of Posterior Table Fractures

Cranialization
Vs
Obliteration
Obliteration

- Frontonasal ducts obliterated, mucosal lining removed and sinus “packed”
- Various materials advocated
  - Fat
  - Muscle
  - Bone
  - Hydroxyapatite
Cranialization

- Frontal craniotomy
- Dural repair
- Removal of posterior wall
- Removal of mucosal lining
- Plugging of nasofrontal ducts
- Galeal flap placed
Fracture of the Floor of the Frontal Sinus

- Unusual in isolation
- Usually associated with NOE fractures
- Treat isolated floor fracture to prevent mucocoele formation
- If isolated floor fracture & sinus clinically draining satisfactorily may opt to leave alone
- Accurate reduction of fractures can expect NFD function to resume (Gruss)
Management of the Nasofrontal Duct

• Role of drainage via nasofrontal duct may be overstated in trauma compared to infective sinusitis (Evans)
• Avoid trying to reestablish a frontonasal duct prone to failure
• If radiological evidence of NFD disruption, explore and treat on merits
• NFD function most likely to return to normal with accurate anatomical fracture reduction.
CSF LEAK

- Management controversial
- Surgical or non-surgical
- Prophylactic antibiotics?
Prophylactic Antibiotics

- Incidence of meningitis between 3-50%
- Mortality about 10%
- Usually pneumococcus spp.
Prophylactic Antibiotics

• EBM
  – Prophylactic antibiotics not recommended
  – Prophylactic antibiotics may increase incidence of meningitis by changing the pathogenicity of the nasopharyngeal flora
Managing CSF leak

• Fracture reduction often stops leak
• Most traumatic leaks close spontaneously
• Leak > 72 hrs → lumbar drain
• Surgical repair
  – Endoscopic
  – intracranial