Management of frontal mucocele with frontal fracture

Prepared by:
Dr. Mawaheb Al Wedami
R5- ORL H&N Surgery
Frontal Sinus Fractures

- Frontal sinus fractures are rare and occur in only 5 - 12% of maxillofacial traumas.
- A study conducted at four separate level I trauma centers including 892 patients demonstrated that in patients with frontal sinus fractures:
  - the median age is 32 years and
  - 88% are male.
  - Approximately 58% of frontal sinus
Frontal Sinus Surgery

- Fractures are associated with other facial trauma, including:
  - naso-orbital-ethmoid fractures (34%),
  - Zygomaticomaxillary complex fractures (17%)
  - and orbital wall fractures (27.5%)
Fracture of Maxillary Sinus classification

- Anterior Table
  - Displaced
  - Un-displaced
- Posterior Table
  - Displaced
  - Un-displaced
- Anterior & Posterior Table
  - Displaced
  - Un-displaced
- Nasofrontal Duct
  - Involved
  - uninvolved
Frontal Sinus Fracture

1. Anterior table fracture
   a) With or without displacement
   b) With or without outflow tract injury

2. Posterior table fracture
   a) With or without displacement
   b) With or without dural injury/CSF leak
   c) With or without outflow tract injury
Frontal Sinus Fracture

- 43% of all frontal sinus fractures are isolated anterior table fractures, 7% are isolated posterior table fractures.
- 49% are combined anterior and posterior table fractures.
- MVA account for most fractures (62%)
- Assaults accounts for (12%)
- And falls (11%) also having a fairly high incidence.
Causality

- MVA: 52%
- Assault: 26%
- Recreational Accidents: 9%
- Industrial Accidents: 5%
Anterior Table Management

- Non-displaced
  - Observation

- Displaced
  - ORIF (coronal, mid-brow approach)
  - Endoscopic vs open

- Comminuted fractures
  - ORIF (mesh vs miniplates)
  - Ensure no mucosa trapped between fragments

Posterior Table Management

- Separate nasal cavity/sinus from intracranial cavity
- CSF leak
  - No spontaneous resolution → explore
- Repair dural tears
- Sinus obliteration
- Severely comminuted
  - Cranialization

Nasofrontal Duct Management

- Obliteration
- Endoscopic Lothrop procedure
- Observation
  - Minor injury in a reliable patient
  - Reimage the patient in 1 to 3 months

Frontal sinus fractures

CSF leak

No

Nasofrontal duct

No

ORIF of anterior table + Sinus preservation

Yes

ORIF of anterior table + Sinus partial obliteration

Yes

Observe 4~7 days,

Stop

Persist

Cranialization

Frontal fractures Management in literature..
Endoscopic above and below approach with frontal septotomy in a patient with frontal mucocele: a contralateral bypass drainage procedure through the frontal septum

Seok Hyun Cho, MD, Yong Seop Lee, MD, Jin Hyeok Jeong, MD, Kyung Rae Kim, MD*

Department of Otorhinolaryngology  Head and Neck Surgery, College of Medicine, Hanyang University, Seoul, South Korea
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Abstract

Frontal sinus has complex anatomy and is the most difficult sinus to dissect under the nasal endoscope. In case of difficult accessibility through the frontal recess, we can make a detour to more invasive and external procedures to treat chronic or intractable frontal sinus diseases. However, these approaches usually need advanced surgical skills and sometimes can result in minor and/or major complications. Therefore, we developed a new surgical technique to treat frontal mucocele in a patient with severe new bone formation at the frontal recess and presented our experiences with literature review.

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Two factors are generally considered important in the decision of how to treat frontal mucoceles: the patency of the ipsilateral frontal sinus outflow tract and the accessibility of the mucocele via endoscope. When these 2 factors do not allow for either a frontal sinusotomy or an above and below approach, it is usually advisable to use a more invasive or external approach, such as an endoscopic modified Lothrop procedure (EMLP) or osteoplastic flap surgery with or without obliteration. However, when the contralateral frontal recess is patent, the frontal mucocele can be drained through the intersinus septum. The following case report illustrates a novel technique to the treatment of a frontal mucocele in a patient with obstructed frontal recess due to severe new bone formation and an old blowout fracture.
2. Case report

A 67-year-old man presented to our clinic with left orbital pain and frontal headache. About 4 years ago, he was diagnosed with chronic rhinosinusitis with nasal polyposis and underwent endoscopic sinus surgery at a tertiary care center. However, he did not perceive any symptomatic improvement after surgery and postoperative medical treatment. Other rhinologic symptoms such as rhinorrea and nasal obstruction were minimal. On ophthalmic examination, there were no abnormal findings in visual acuity and eyeball movements.

Nasal endoscopic examination detected synechia formation between the middle turbinate and lateral nasal wall without polyposis. Computed tomography (CT) showed a left frontal mucocele, severe new bone formation at the frontal recess, and an old blowout fracture with orbital herniation into the ethmoid cavity (Fig. 1). On the right side, the frontal sinus was well aerated, and the previously dissected frontal recess seemed to be patent.
Fig. 1. Preoperative CT scans showing left frontal sinus mucocele.
Operative technique

- Endoscopic sinus surgery was undertaken under general anesthesia.

- First, the middle meatus and frontal recess were dissected on both sides, but we could not dissect the left frontal recess because of severe new bone formation.
Operative technique

- Synechia between the middle turbinate and lateral nasal wall was removed, and frontal recess was successfully dissected on the right side.

- After that, we made a trephination into the anterior wall of the left frontal sinus in the inferior-medial brow region, and serous discharge was expelled out.
Operative technique

- Endoscopic findings through the trephination showed minimal mucosal disease of the frontal sinus and obstruction of the frontal ostium.

- Therefore, we made another trephination in the right frontal sinus, and performed a frontal septotomy by using a curved curette and curved debrider.
Operative technique

- During the frontal septotomy, an endoscope was introduced into the right trephination, and surgical instruments were introduced into the left trephination.

- To achieve more reliable patency of the perforation made at the intersinus septum, we applied a mitomycin C (1 mL, 0.6 mg)–soaked cotton ball for 5 minutes.
Post op

- Most of the headache and left orbital pain resolved by the first postoperative day, and then he was discharged.

- By 5 months postoperatively, CT showed well-aerated frontal sinuses and a patent frontal septotomy.

- At the 1-year follow-up examination, there was no evidence of recurrence of frontal mucocele, and he did not feel any headaches or orbital pain.
Fig. 2. Postoperative CT scans showing (A) the bony defects of the anterior wall of the frontal sinuses made by bilateral frontal trephinations and (B) the well aerated sinuses and patent frontal septotomy at 3 months after surgery.
Failures of the above and below approach most commonly originate from the “below” area, that is, the frontal recess.

Possible causes of endoscopic inaccessibility to the frontal recess are as follows: complex anatomy, stenosis, severe scarring, new bone formation, and previous blowout fracture.

In these unsuitable cases, before consideration of EMLP, it is necessary to check the patency of the contralateral frontal recess.
• If the contralateral frontal recess is patent, we can avoid the EMLP.

• We can use the contralateral frontal recess as a drainage pathway for the ipsilateral frontal mucocele via frontal septotomy.
Algorithm

Fig. 3. Proposed algorithm for the management of frontal sinus mucoceles. OPF indicates osteoplastic flap surgery.
Conclusion

We believe that our modified surgical technique will be one of the important surgical options in cases of chronic or recalcitrant frontal sinus diseases, including mucoceles. More experiences will be needed to ascertain its effectiveness and long-term outcomes.
Reduction of anterior frontal sinus fracture involving the frontal outflow tract using balloon sinuplasty

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Case

- 22 yr old male sustained a right anterior table frontal sinus fracture involving the frontal sinus outflow tract after being struck by a thrown rock.
- The patient initially presented to an outside hospital where a 3-cm right lower brow/upper nasal sidewall laceration was closed.
- There was neither a bony depression nor a step-off.
**Figure 1**  Preoperative, noncontrast, coronal CT facial view of the right anterior frontal sinus fracture with involvement of the frontal sinus outflow tract.
Case (operative technique).

- Under general anesthesia, the Acclarent Balloon Sinuplasty system (Acclarent, Inc. Menlo Park, CA) was utilized to internally reduce the fracture.

- Using endoscopic guidance, a Relieva sinus guide catheter (Acclarent, Inc., Menlo Park, CA) was placed in the right nasofrontal recess.

- The Relieva sinus guidewire was then passed into the right nasofrontal tract into the frontal sinus under fluoroscopic guidance.
Operative technique
Operative technique

Relieva Ultirra®
Sinus Balloon Catheter

- EASY PROCEDURAL IRRIGATION
- ENHANCED BALLOON CATHETER PERFORMANCE
Operative technique

- The Relieva sinus balloon catheter was deployed over the wire, positioned at the superior extent of the internally displaced fracture fragment, and was inflated to 14 atm.
- The balloon was deflated and, after repositioning it more proximally in the nasofrontaloutflow tract, was once again inflated to a pressure of 14 atm.
Operative technique

- Fluoroscopy suggested that the largest fracture fragment was reduced and that the frontal sinus outflow tract was enlarged.
- After deflation, the balloon catheter was removed.
- A syringe of MeroGel Injectable (Medtronic Xomed, Jacksonville, FL) was then attached to the sinus guide catheter and injected into the frontal sinus outflow tract.
Post Op

- The total surgery time was 53 minutes.
- The patient was admitted for 23-hour observation.
- Post op Ct scan obtained
- Post Abx for 4 wks.
Discussion

- The treatment of an (AFSF) involving the (FSOT) is at the epicenter of the debate.
- Smith reported his institution’s experience with a group of patients with AFSF involving the FSOT.
- 7 pts were followed up.
• **Prospectively** after treatment with open reduction/ internal fixation of the AFSF without obliteration.

• Antibiotics were given postoperatively.

• A CT scan was obtained eight weeks post-injury.
  ◦ Five patients experienced normal FSOT ventilation.
  ◦ Two patients had persistent FSOT obstruction with frontal sinusitis.
  ◦ Both underwent successful endoscopic management.
  ◦ For one, an extended frontal sinusotomy was performed and in the other, a modified Lothrop procedure was utilized.
• At a mean follow-up of 17.8 months, no major complications had resulted:
  ◦ no mucoceles or frontal sinusitis had been reported.
• For the two patients who underwent surgery, :
  ◦ 21-month and 25-month follow-up showed patent FSOT (10 mm)
  ◦ and no symptoms of frontal sinusitis.
Discussion

- This is the first known report of utilizing balloon sinuplasty to internally reduce an AFSF with FSOT involvement.

- This approach follows the management protocol used by Smith.

- Among the reasons cited for developing this protocol included the risk in obliterating a traumatized sinus and the increasing facility of endoscopic sinus surgery to successfully manage the frontal recess and sinus.
In this protocol, initial management addresses the displaced anterior frontal sinus fracture.

Similarly, this was accomplished in our patient but without fracture exposure and without internal fixation.

For our patient, antibiotics were also given postoperatively and the FSOT was also managed expectantly.

To date, the patient is without evidence of complication.
Conclusion

• We have shown that balloon sinuplasty has the ability to internally reduce an anterior frontal sinus fracture.

• It may be considered in the treatment of
  ◦ carefully selected internally displaced anterior table frontal sinus fractures involving the FSOT in compliant patients likely to follow up.