External approach to frontal sinus

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- Trephination of the frontal sinus
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- The osteoplastic flap with or without obliteration
anatomy

- The frontal sinus develops as an extension of the anterior ethmoid cells in the first 3 years of life.
- Pneumatization continues through childhood until the frontal sinus reaches its full dimensions by the second decade of life.
- 4% of frontal sinuses fail to develop entirely.
anatomy

- The average adult frontal sinus is approximately 28 mm high, 24 mm wide, and 20 mm deep. The frontal sinus is usually asymmetric.

- The diameter of the nasofrontal recess varies from 2 to 10 mm.
anatomy

- The frontal recess, an inverted funnel shaped space, not a tubular shaped duct, connects the sinus to the anterior ethmoid region and is the controlling area in frontal sinus drainage.
anatomy
Physiology

- Frontal sinus ciliary beat pattern and mucus flow is up the interfrontal sinus septum, lateral across the frontal sinus roof, and then medial over the frontal sinus floor to the ostium.

Fig. 1. Frontal sinus mucociliary flow and clearance pattern.
Pre op work up

- computed tomography (CT) is the first choice of radiologic imaging

- surgical approach to the frontal sinus, axial and coronal slices are required With additional sagittal cuts to provide the surgeon with three-dimensional (3D) orientation
Pre op work up

► If there is a need to differentiate between polyps, tumour and mucus, magnetic resonance imaging (MRI) is Indicated.

► It is recommended that in the cases of unilateral sinus disease,

► To assess intraorbital and intracranial extension
Surgical approach to frontal sinus

Box 1. The integrated approach to frontal sinus surgery

- Endoscopic frontal sinuplasty
- Endoscopic frontal sinusotony [22,23]
- Frontal sinus rescue procedure [29,30]
- Above and below approach (trephine and endoscopic) [31]
- Modified intranasal endoscopic Lothrop (without drill)
- Modified intranasal endoscopic Lothrop (with drill) [9–11]
- Above and below approach (osteoplastic flap and endoscopic) [31]
- Osteoplastic flap with frontal sinus obliteration [12]
- Frontal sinus unobliteration [32]
- Frontal sinus cranialization
Trephination of the frontal sinus

- It follows the same principles involved in drainage of an abscess found in soft tissue indicated for:

1- Acute painful frontal sinusitis unresponsive to conservative measures
2- Acute frontal sinusitis with impending complications
3- For frontal sinus exploration
4- Biopsy
5- As an adjunct to an endoscopic approach
Trephination of the frontal sinus

The procedure may be carried out under local or general anesthesia, depending on the condition of the patient and the personal preference of both the patient and surgeon.
Trephination of the frontal sinus

- 1-cm brow incision is made medial to the supraorbital nerve. The periosteum is elevated to expose the anterior wall of the frontal sinus.

- An estimate of the depth of the frontal sinus and its relationship to the orbit and anterior cranial fossa can be obtained through review of the CT scan.

- A cutting burr 0.5-cm drill is used to drill into the frontal sinus.
Trephination of the frontal sinus

- great care if a defect of the orbital roof has been seen at CT.

- sinus can be then copiously irrigated with normal saline solution containing broad-spectrum antibiotics.

- A catheter is then introduced through the trephine into the frontal sinus and brought out through the skin incision to permit irrigation of the sinus cavity postoperatively.
Trephination of the frontal sinus

- When repeated irrigation of the sinus results in free flow of the irrigating Solution through the nose, the catheter can be removed and the trephination allowed to close by secondary intention.
Trephination of the frontal sinus
Trephination of the frontal sinus
Lynch's Frontoethmoidectomy

It establishes communication between the floor of the frontal sinus and the anterior ethmoid cells.

- The Lynch procedure is associated with an unacceptably high degree of recurrence of frontal obstruction.

- May be used in patients who are not candidates for an endoscopic Draf or Lothrop.
Figure 26.3  Anatomic landmarks in the orbit. The anterior and posterior ethmoidal arterial foramina lie in the frontoethmoidal suture at the level of the anterior cranial fossa.
Lynch's Frontoethmoidectomy

- It is done with the patient under general anesthesia.
- Infiltration of 1% lidocaine with 1:100,000 epinephrine into the soft tissues from the medial extent of the eyebrow to the side of the dorsum of the nose is helpful for hemostasis.
- Decongestion and vasoconstriction of the nasal cavity are achieved with pledgets soaked in oxymetazoline 0.05%
Lynch's Frontoethmoidectomy

It similar incision for an external ethmoidectomy, except that the incision is extended superiorly over the orbital rim into the eyebrow extends straight down toward the medial canthus It is carried down to the level of the periosteum.
Lynch's Frontoethmoidectomy

- the supratrochlear bundle is preserved

The periosteum is preserved to ensure the integrity of the medial canthal ligament, trochlea, and lacrimal sac as well as to prevent herniation of the orbital fat.
Lynch's Frontoethmoidectomy

- The medial wall of the orbit is exposed, the anterior ethmoidal artery is encountered in the frontoethmoidal suture line approximately 24 mm posterior to the anterior lacrimal crest.

- Periorbita is protected retractor to prevent herniation of orbital fat into the field.

- Additional elevation demonstrates the posterior ethmoidal artery approximately 10 to 12 mm posterior to the anterior artery and approximately 5 mm (range 1 to 8 mm) anterior to the optic foramen.
Lynch's Frontoethmoidectomy

► The ethmoid is entered through the lamina papyracea, which is then removed circumferentially with a Kerrison rongeur.

► The frontoethmoidal suture is an important landmark because it corresponds to the level of the cribriform plate (anterior cranial fossa) and marks the location of the ethmoidal arterie
Lynch's Fronethmoidectomy

- Once the dissection is complete, Absorbable or nonabsorbable sponge packs may be left in place.
- Care should be taken to avoid the insertion of packing into the orbit or the use of excessive packthen so the intraorbital pressure increse leading to ischemia of the optic nerve or retina.
- The periosteum and subcutaneous tissues are reapproximated with 4-0 absorbable sutures and the skin is closed with 7-0 nylon.
Lynch's Frontoethmoidectomy
Lynch's Frontoethmoidectomy

**Figure 26.2** External ethmoidectomy. **A:** Incision placement. **B:** Exposure of the medial orbital wall. The lacrimal sac is displaced laterally. **C:** Entrance into the ethmoidal labyrinth.
open frontal sinus approach

1. Tumours not extending more laterally than a vertical plane through the lamina papyracea may be operated on through the nose.

2. Lesions whose point of origin or fixation is in the lower third of the posterior wall of the frontal sinus are most often an indication for the endonasal micro-endoscopic procedure. Fixation at the anterior wall of the frontal sinus is often a contraindication for this technique.

3. Intracranial extension by itself is not a contraindication to the endonasal approach rather it depends on the degree and the experience of the surgeon.
open frontal sinus approach
THE OSTEOPLASTIC BONE FLAP approach

► This approach permits an optimal view encompassing the entire frontal sinus, and allows complete microscopic removal of mucosa as well as obliteration of the frontal sinus with abdominal fat or none.
THE OSTEOPLASTIC BONE FLAP PROCEDURE

Indications are as follows:

1- failure of correctly performed type III drainage;

2- problem frontal sinus, sometimes in combination with complete endonasal ethmoidectomy;

3- type III drainage technically not possible (anterior-posterior diameter less than 8 mm);

4- laterally located mucopyocele;

5- major destruction of posterior wall;
6-inflammtory complications after trauma (e.g. aliplastic material);

7-aesthetic correction of pneumonia to sinus dilatans frontalis (mostly without obliteration);

8-major benign tumours (e.g. osteoma) without or with obliteration.
These contraindications for obliteration are:
1- missing posterior frontal sinus table bone,
2- missing orbital roof bone.
3- extensive supraorbital ethmoid cell pneumatization.
4- frontal sinus tumor.
5- allergic fungal sinus.
THE OSTEOPLASTIC BONE FLAP PROCEDURE

► Pre op perpetration:

Designed anteroposterior radiograph taken at 6 ft of distance (Caldwell's view) occipito-frontal x-ray is necessary. From this image, the contours of the frontal sinus are cut out as a template which is preserved in a disinfectant solution.

► Precise mapping of the frontal sinus may be performed with a surgical navigation Device

► Ct guided imaging
template of the frontal sinus that was excised from the occipito-frontal x-ray is carefully positioned on the root of the nose so that the borders of the frontal sinus can be marked on the periosteum.
THE OSTEOPLASTIC BONE FLAP PROCEDURE
Surgery requires general anaesthesia, with orotracheal intubation and the insertion of a pharyngeal pack to avoid aspiration.
THE OSTEOPLASTIC BONE FLAP PROCEDURE

- The anterior frontal bone can be exposed with a bicoronal incision placed above the hairline.

- A gull-wing eye brow incision is cosmetically inferior and usually divides the supraorbital nerve.
THE OSTEOPLASTIC BONE FLAP PROCEDURE
Fig. 30.3. Unilateral osteoplastastic approach with mucocele unroofed
The Osteoplastic Bone Flap Procedure

- Injection with local anaesthetic at area of incision 15 minutes before making the incision reduces bleeding. Special scalp clamps stop the remaining bleeding.

The incision goes down as far as the periosteum. Using partly blunt, partly sharp dissection extending to the supraorbital ridge and over the root of the nose, the scalp flap is pulled caudally on both sides, leaving behind the periosteum and the bone, thus preserving the supraorbital and supratrochlear vascular nerve bundles.
THE OSTEOPLASTIC BONE FLAP PROCEDURE
Then, the osteotomy is made in the bone, from which the periosteum has been elevated, a few millimetres inside the marked line. The oscillating saw is angled at 30° towards the frontal sinus, allowing a surface that is as wide as possible to be created for the later replacement of the bony lid.

The bony incision reaches the supraorbital ridge on both sides.
Figure 118.14 Technique of the osteoplastic frontal sinus operation. (a) The x-ray template is placed and the periostial incision is marked; the supraorbital nerves are preserved after scalping flap elevation. (b) Formation of the bone flap with a saw corresponding to the limits of the frontal sinus. The periosteum is elevated from the area of bone incision. (c) An oblique incision through the bone enlarges the area for replacement of the bony flap. (d) Then the anterior wall of the frontal sinus is elevated with two broad chisels. This ends in a fracture of the frontal sinus floor just posteriorly of the supraorbital ridge (continued over).
THE OSTEOPLASTIC BONE FLAP PROCEDURE

► When opening the frontal sinus bilaterally, the intersinus septum must be separated from the anterior frontal sinus wall with an angled chisel.

► The diseased tissue is then removed according to the pathological-anatomical findings.
THE OSTEOPLASTIC BONE FLAP PROCEDURE
it must be decided whether the mucosa around the infundibulum is sufficiently healthy to preserve the frontal sinus or whether obliteration should be carried out. Where the sinus is preserved, a type III median drainage can be performed easily from above with optimum exposure.
abdominal fat is harvested then abdominal fat is temporarily placed in isotonic Saline solution and then placed into the frontal sinus with pieces held together by fibrin glue, until the sinus cavity is completely filled.
pinna conchal cartilage can be used. Cartilage can be tightly sealed with fascia held with fibrin glue. Through this three-layered closure, the frontal sinus is securely isolated from the nasal cavity, and growth of mucosa into the sinus with The associated risk of mucocoele formation.
(1) Elevated galea-periosteum; (2) pathological red mucosa frontal sinus; (3) drill holes; (4) bony flap inged on periosteum (anterior wall of the frontal sinus); (5) preserved fascia; (6) cartilage; (7) transplanted fat with fibrin glue; (8) fibrin glue; (9) resorbable sponge; (10) rubber finger packs.
The bone flap (from which the mucosa has been removed) is returned to its anatomic site. Fixation of the flap is then undertaken with either fine wire or silk or with adaptation plates. The incision is closed in layers with a suction drain left in place and compression dressing is applied.
Postoperative Management

- Compressive dressing is maintained for 48 to 72 hours postoperatively. Administration of antibiotics for longer than 24 hours is unnecessary unless acute infection was encountered during surgery. The drain is removed 24 to 48 hours after surgery.
Complication of osteoplastic approach

The most frequent intraoperative complications were:

- exposure of orbital fat (19.5 %),
- unintentional fracture of the anterior wall (19.5 %)
- incorrect placement of the anterior wall (17 %)
- dural injury (9.8 %).
- Persistent changes of the frontal contour (emboossment, depression)
- periorbital edema and ecchymosis develops in virtually all patients
- Mucocoeles due to incomplete excision of mucosa (0.2 %)
- the aesthetic result was unfavourable in 5 %
Complication of osteoplastastic approach

- The primary symptom of frontal obliteration failure is persistent, unremitting hard frontal pain. Not every patient with chronic frontal pain has a frontal sinus mucocele, and not every patient with a frontal sinus mucocele has pain.
Complication of osteoplastic approach

- Massive mucocele involving the frontal sinus and the left supraorbital ethmoid cell, which had eroded the entire left orbital roof.
Complication of osteoplastic approach

► When all conservative methods have failed to account for or to control the pain, it is often necessary to re-explore the sinus.

► Many author recommend unobliteration try endoscopic approach ?
Above and below (osteoplastic and endoscopic)

- This procedure provides access to the frontal recess:
- It is the procedure of choice for frontal sinus tumors, such as inverting papilloma
- also the procedure of choice for unobliteration
- Frontal sinus stents in this case commonly are left in place for 6 to 12 months
Frontal sinus cranialization

- Removing the posterior wall of the sinus
- It is performed commonly by neurosurgeons or plastic surgeons who have little understanding of the ramifications associated with leaving sinus mucus membrane
- The problem is the possibility of intracranial regeneration of mucus membrane producing an intracranial mucocele
Frontal sinus cranialization

If there truly is no possible way to salvage the posterior frontal sinus table, an otorhinolaryngologist should be involved in drilling away the last vestiges of the mucus membrane.
Thank you

► Any Questions ?