Chapter Six

Techniques of Functional Endoscopic Sinus Surgery

MY Mian

Function endoscopic sinus surgery is a conservative type of surgery aiming to restore the normal mucociliary flow of the paranasal sinuses. It is based on the findings (1) that anterior ethmoid sinus diseases predispose to the ethmoid infection leading to the development of maxillary and frontal sinuses, as the complex anatomical compartment (ostiomeatal complex, OMC) contains the drainage sites of maxillary ethmoid and frontal sinuses.

If adequate drainage and ventilation can be restored sinuses will be alleviated and the normal function of the sinuses is restored. On the basis of this Kennedy (2) and Stammberger (1) advocate a conservative type of surgery termed “functional endoscopic sinus surgery” popularly known as “FESS”. Surgical correction of the ostiomeatal complex obstruction, provides sinus ventilation adequate drainage by restoring the normal mucociliary flow & access to the sinuses for topical intranasal therapy.

Anaesthetic Consideration

FESS can be performed under general and local anaesthetic. Kennedy, Stammberger, and other endoscopic surgeons prefer local anaesthetic as there is less bleeding and any undue pain indicates that one is touching dura or orbital sinuses for topical intranasal therapy.

No single approach may be suitable for every case. There are two techniques of FESS one described by Messerklinger (1) and other by Wigand (3). Modification of Messerklinger technique had been adapted in several centres of Europe and North America (2). For the patient with extensive nasal polyps and Sampler’s Syndrome (triat of nasal polyps, aspirin sensitivity and asthma) are put on oral steroids prior to surgery, during surgery and after surgery to avoid the side effects of sudden surge of histamine, prostaglandin E1, E2 and slow reacting substances SRS.

The steroids also help to reduce the bleeding during surgery. For the patient with recurrent sinuses we advocate to add the appropriate antibiotics 3 days before surgery. For the patients to be operated under local anaesthetic or the patients who are undergoing FESS under general anaesthesia 0.5% oxymetazoline spray is applied to the nose about 30 minutes before surgery. The CT Scans are reviewed and are hung on the view box in the operating room so that the surgeon may refer to them intermittently (4). May I remind all the readers that no FESS is contemplated without a monitored anaesthesia care (MAC) the nose is sprayed with 4% Cocaine or 2% Xylocaine with 1:200,000 adrenaline.

Further the cotton soaked in the above solution, are applied to the nasal mucosa and middle meatus, covering the nose from the floor to the roof and extending to the nasopharynx. After 5 minutes the medial infundibular wall, uncinate process, and anterior part of the middle turbinate and ethmoidal bulla are injected with 2% Xylocaine and 1:200,000 adrenaline under endoscopic visualisation.

For the patients who are undergoing FESS under general anaesthetic 0.5% oxymetazoline spray is applied to the nose about 30 minutes before surgery. The CT Scans are reviewed and are hung on the view box in the operating room so that the surgeon may refer to them intermittently (4). May I remind all the readers that no FESS is contemplated without a coronal CT of the paranasal sinuses. The routine general anaesthesia by LMA or endotracheal is established. 4% cocaine solution or 2% lidocaine with phenylephrine is sprayed after intubation. The patient is placed in supine position with head up and face is tilted to the surgeon who stands on the right side.

A septoplasty is performed if the septum is deviated enough to interfere with the approach to the ostiomeatal complex and if a 4 mm endoscope cannot be passed between the septum and the middle turbinate before the FESS.

Before starting the surgery a thorough nasal endoscopic examination is carried out with 30-degree scope. The endoscope is dipped in an antifog solution. On the 1st pass the scope is introduced between the septum and inferior turbinate and advanced inspecting the inferior meatus and septum, till the posterior choana is reached. Eustachian tube orifice, fossa of Rosenmuller and nasopharynx is inspected, while retracting the scope the orifice of nasolacrimal duct is visualised in the inferior meatus. The 2nd pass is made along the middle turbinate and septum and rolled over to the posterior end of the middle turbinate and into the sphenoid sinus ostium. The superior turbinate and superior meatus and sphenoid sinus ostium are visualised. The 3rd pass is in the middle meatus after retracting the middle turbinate medially, the uncinate process, the hiatus semilunaris, bulla ethmoidalis and the frontal recess is inspected. Along with it any obvious pathology like paradoxical middle turbinate, conchal bulla, polyps or pus in the ostiomeatal complex is noticed.

The lateral wall of the nose is infiltrated with 2% Xylocaine with 1:200,000 adrenaline. The infiltration is done at various parts on the medial infundibular wall, uncinate process, anterior part of the middle turbinate and bulla ethmoidalis. Blanching of the mucosa will occur. Sublabial infiltration may be done if one plain to perform canine fossa puncture for maxillary sinus sinuscopy.

Using 0-degree telescope the uncinate process and bulla ethmoidalis are exposed by retracting the middle turbinate medially. An incision is made on the uncinate process, starting at the level of middle turbinate and going downwards following the curve of the uncinate process till just above the inferior turbinate (Fig 1-4).
The uncinate process is fractured medially and then grasped with Blakesley-Wilde forceps and removed with medial twisting movement, uncappping the infundibulum. This exposes the base of the infundibulum, anterior ethmoid sinus, bullae ethmoidalis and maxillary sinus ostium. If the maxillary sinus ostium is not visible it is palpated with double ended maxillary sinus ostium seeker or olive tipped curved Eicken cannula (Fig 5).

We prefer to identify the maxillary sinus ostium after uncinectomy due to its close relation to the orbit (5). This serves as a window for the visualisation & identification of the lamina papyracea & the floor of the orbit. Thus reducing the likelihood of entering the orbit. More over establishing the maxillary sinus patency is essential to the success of ostiomeatal complex surgery. Once the ostium is identical it is widened by punching out its bony walls by reverse cutting Ostrum's forceps (Fig 6-7).

It is better to enlarge the ostium in the anterior direction but one should stop short of nasolacrimal duct. The presence of
dense bone anteriorly in the area of lacrimal duct is the anterior limit of the dissection in the area of maxillary sinus ostium. If further enlargement of the maxillary sinus ostium is necessary the posterior edge should be enlarged to the posterior fontanelle. A 10-15 mm diameter opening is adequate. If the uncinate process consists of very hard bone, retrograde uncinotomy may be performed with a reverse cutting Ostrum punch forcep.

The ethmoid infundibulum is opened and the anterior ethmoid cells are removed anterior and superior to the bullae ethmoidalis. I keep the anterosuperior wall of the bullae ethmoidalis intact as it marks the junction between the roof of anterior ethmoid cells and nasofrontal recess. A 30-degree scope and upward biting forceps are necessary to remove the agar nasi cells which may be seen as making a bulge in the lateral nasal wall just anterior to the anterior attachment of the middle turbinate. These cells are opened and frontonasal recess is exposed and unblocked by removing the disease mucosa. In a sagittal section the transition from the infundibulum of the frontal sinus to the frontal recess has an hour-glass shape, the narrowest portion representing the frontal sinus ostium. The size and shape of the frontal recess may be significantly influenced by the agar nasi cells, ethmoidal bulla, uncinate process and infundibular cells (Fig 8-12).

Fig 8: Opening the suprabullar recess
Fig 9: Opened suprabullar recess

Fig 10: Opening the frontal recess
Fig 11: Opened frontal recess

Fig 12: Enlarged frontal recess and opening of the frontal ostium

To avoid injury to the lacrimal sac, the orbit and anterior cranial fossa during the exenteration of agar nasi cells the surgeon must keep the tip of 45 degree upward cutting Blakesley-Wild forceps in vertical position rather than directing medially or laterally, keeping in mind the various relations the uncinate process makes to this area. The uncinate process insertion is used as a guide to enter the frontal recess & should be carefully studied by CT. After removing the polypoidal tissue the frontal sinus and infundibulum can be enlarged by circular cutting Stammberger punch forcep. The frontal sinus may be entered with 3mm long olive tipped curved Eicken antrum cannula or with the curved curtte.

The safest way to enter the bulla ethmoidalis is to penetrate the inferomedial wall with straight Blakesley-Wild ethmoid forceps using the 0-degree scope. The contents of the bulla ethmoidalis and the middle ethmoid cells are removed, the basal lamella may be identified as a bluish grey thin sloping bony septum between the bulla ethmoidalis and posterior ethmoid cells that lie superior and posterior to bulla ethmoidalis (Fig 13-17).
Superiorly the dissection must stop on reaching the ethmoid roof where sometimes the anterior ethmoid artery can be identified and mark the superior limits of the dissection. The roof of the ethmoid is formed by the frontal bone that curves upward as it goes laterally. Medially it is thin and dips down sharply to join the cribriform plate. While removing the diseased cell in this area, the tip of the Blakesley-Wild forceps should be directed laterally to avoid accidental perforation of the cribiform plate. The middle turbinate attachment to the skull base is useful land mark to remember & one should not violate this. The lamina papyracea forms the lateral limits of the dissection and can be recognised by slightly yellowish tinge because of orbital fat. The cells in this area are removed by the cutting edge of the forceps. The basal lamella makes the posterior limit of the dissection if the CT shows no disease in the posterior ethmoid sinus or sphenoid sinus.

For the extensive disease involving the posterior ethmoid and sphenoid sinuses, the posterior ethmoid sinus is entered by gently penetrating the basal lamella by straight Blakesley-Wild forceps (Fig 18-19).
The posterior ethmoid cells are carefully removed until the anterior wall of the sphenoid sinus. Kerrison forceps are safer to remove the posterior ethmoidal cells. It should be noted that lateral wall of ethmoid sinus curves inward and the posterior ethmoid cells are intricately related to the orbital apex and optic nerve laterally. Also the effort is made to stay away from the superior attachment of the middle turbinate, as the bone is paper thin and vulnerable to penetration, resulting in the CSF leak. The surgeon must be on his guard by continually checking of the depth of his surgical field (Fig 20).

Fig 20: Checking the depth of the surgical field

The sphenoid sinus is entered inferiromedially by perforating the posterior wall of posterior ethmoid with straight Blakesley-Wild forceps using 0 degree scope. The anterior wall of sphenoid sinus is identified by locating the posterior attachment of the middle turbinate and the arch of the posterior choana. It is about 1.5cm above the posterior choana and 7.1 cm from the anterior nasal spine on average. Sphenoid sinus wall & ostium should be palpated and identified in this area before entering the sinus (Fig.21-22). Sphenoid has postero-inferior and medial relation to posterior ethmoid sinus, therefore the forceps should point inferiomedially while entering the sphenoid sinus via the posterior ethmoid.

Fig 21. Palpating the Sphenoid Sinus
Fig 22. Ostium of the Sphenoid Sinus

Extreme caution is necessary while removing the disease like polyps and fungus from the sphenoidal sinus. They should always be removed under direct vision. Fungal concretion can be extracted by irrigation and mobilisation with Eichen antrum cannula. The superior portion of the lateral wall of the sphenoid sinus is dealt with extreme caution due to the close proximity of the optic nerve and internal carotid artery. The optic canal may be dehiscent in about 4% of the cases in the superolateral wall of the sphenoid sinus.

For the extensive disease of maxillary sinus, which cannot be dealt with enlarged natural ostium, an inferior meatus antrostomy can be performed. 30 degree scope is introduced to inspect various part of the maxillary sinus through the natural ostium and the disease can be removed from the various parts of the maxillary sinus through the inferior meatal antrostomy.

Direct visualisation of maxillary sinus can also be achieved by canine fossa puncture with a Trocar and Canula. The sublabial sulcus is injected with 2% Xylocaine and 1:200,000 adrenaline. The upper lip is lifted with Hijeck retractor and the infraorbital notch is palpated to avoid injury to the infraorbital nerve. The tip of the Trocar is placed in the suprolateral part of the canine fossa and with a screwing movement the sinus is entered. Care must be taken not to injure the posterior sinus wall with a forceful entry. A 30-degree scope can be introduced to inspect various parts of the maxillary sinus. To deal with extensive disease the scope is held in through the Trocar and the instruments are introduced through the middle meatus antrostomy.

We pack the nose with merocel soaked in naseptin ointment after checking the allergy to pea nuts. The rapid rhino packs are useful alternate. In the post operative period the patient is given a course of broad spectrum antibiotic if necessary, saline nasal or sinus rinse douching, decongestant drops and steam inhalation with regular visit to the clinic for the nasal toilets are helpful tools for speedy healing.
Indication for external approaches to frontal sinus

1. The case in which annoying symptoms are present which have resisted all the available conservative measures.
2. The release of pus under pressure in severe cases with threatening complication.
3. The removal of cells and growths within the sinus which are encroaching in the ostium.
4. The treatment of malignant growths, osteomas and inflammatory conditions with bone involvement.
5. The endonasal approach to the frontal sinus surgery under the telescope may be difficult.

Two reasons may exist:

1. Frontal sinusitis is not as frequent as ethmoid and maxillary sinuses, hence lack of operative experience.
2. Frontothmoidal transition varies greatly in anatomy.

References