

## **An Overview of Functional Endoscopic Sinus Surgery (FESS): A Guide with Illustrations**

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**Abstract:** Functional Endoscopic Sinus Surgery (FESS) is a Minimally invasive procedure designed to enhance Sinus drainage and ventilation, often used to address various sinus disorders. This article offers an in-depth exploration of the fundamental concepts and techniques involved in FESS, supplemented with Illustrative examples for clarity. The discussion covers key topics such as the indications for FESS, anesthesia considerations, a detailed step-by-step procedural guide, and an overview of the essential surgical instruments. Special attention is given to Anatomical factors, Surgical methodologies, and Post-Operative care strategies to maximize success and reduce the risk of complications. This guide also highlights foundational surgical steps that are particularly useful for beginners in the field.

**Keywords:** Functional endoscopic surgery, Sinus surgery, FESS, Minimally invasive, Sinus, Illustrative, Surgical methodologies, Anatomical factors, Post-Operative

### **Introduction-**

Functional Endoscopic Sinus Surgery (FESS) has revolutionized the management of chronic sinusitis and other sino-nasal conditions. By providing direct visualization and targeted intervention, FESS allows for effective treatment while preserving sinus anatomy<sup>1,2</sup>. This article aims to elucidate the fundamental aspects of FESS, focusing on the procedural details and the anatomy crucial for successful outcomes.

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### Indications for FESS <sup>3</sup>-

FESS is primarily indicated for:

1. Chronic sinusitis refractory to medical management
2. Nasal polyps causing obstruction
3. Sinonasal tumors
4. Recurrent acute sinusitis
5. Anatomical abnormalities contributing to sinusitis

### Preoperative Assessment-

A thorough preoperative evaluation includes:

1. Detailed patient history and symptoms review
2. Nasal endoscopy to assess sinus pathology
3. Imaging studies (CT scan) to visualize sinus anatomy and disease extent
4. Assessment of comorbid conditions affecting surgery

### Surgical Anatomy-

Understanding sinus anatomy is crucial for FESS <sup>2</sup>. Key structures include:

1. Maxillary Sinus: Located in the cheek area; drainage through the middle meatus.
2. Frontal Sinus: Located above the eyes; drainage through the frontal recess.
3. Ethmoid Sinuses: Situated between the eyes; divided into anterior and posterior ethmoid sinuses.
4. Sphenoid Sinus: Located behind the nose and eyes; drainage through the sphenoethmoidal recess.

### Benefits of FESS-

1. Minimally Invasive- FESS is less invasive than traditional sinus surgery, with no need for large incisions. This results in less

postoperative pain, faster recovery, and a reduced risk of complications.

2. Precision- The use of endoscopic technology allows for precise targeting of problem areas, minimizing damage to surrounding healthy tissues.
3. Shorter Recovery Time- Patients undergoing FESS often experience quicker recovery times compared to those undergoing more invasive sinus surgeries. Many patients can return to normal activities within a week.
4. Improved Sinus Function- By restoring proper drainage, FESS can significantly improve sinus function, reducing the frequency of infections and improving quality of life.
5. Scar-Free Surgery- Since the procedure is performed through the nostrils and with Endoscope, there are no visible scars.

#### Potential Risks and Complications-

While FESS is generally safe, as with any surgical procedure, there are potential risks. These may include:

1. Bleeding- Minor bleeding is common, but significant bleeding is rare.
2. Infection- Though uncommon, infections can occur post-surgery and may require antibiotics.
3. Damage to Nearby Structures- In rare cases, FESS may result in damage to structures near the sinuses, such as the eyes or the brain. However, with modern surgical techniques and experienced surgeons, this risk is minimized.
4. Recurrence of Symptoms- In some cases, symptoms of sinusitis may recur, requiring additional treatment or surgery.

#### Procedure-

FESS surgery has evolved and has under gone many changes in the Anesthesia given and surgical approach followed. Here are the basic surgical steps described.

### Anesthesia-

General or local anesthesia is administered based on patient and surgical requirements.

Premedication given – Glycopyrrolate with Midazolam with Emeset

Anesthetic medications given –

- 1) Propofol 120mg iv
- 2) Atracurium 0.5 mg/kg
- 3) Hydrocortisone 100 mg with Dexamethasone 4 mg
- 4) Analgesic –Fentanyl 2ug /kg
- 5) Hypotensive Anesthesia—Inj. Dexmedetomidine (alpha 2 agonist), Inj. Esmolol SOS
- 6) Maintenance Anesthesia—Propofol Infusion 10-25 ml/hr.
- 7) Sevoflurane 0.25 – 1%
- 8) N2O: O2:: 60:40

Nasal Packing done preoperatively –

Cotton patties 4% Lignocaine with 1:2 lac Adrenaline

Injection –

2% Lignocaine with Adrenaline

Nasal Endoscopy- Rigid endoscope is inserted through the nostrils to visualize the nasal cavity and sinus openings.

Identify and Address Pathology- Depending upon disease the surgery is planned like-

Debridement is done for Removal of obstructive tissues, such as polyps.

Sinusotomy is performed for Creation of an opening to enhance sinus drainage.

Ablation methods can be Used with help of various instruments to remove diseased tissue and correct anatomical obstructions.

Surgical Techniques:

The first complication which comes to mind is bleeding in FESS. The grading system followed to see for amount of bleeding is-

Grading system for bleeding used in surgical field by P J Wormold. <sup>4</sup>

Grade 1- Cadaveric conditions with minimal suction required

Grade 2 - Minimal bleeding with infrequent suction required

Grade 3 – Brisk bleeding with frequent suction required

Grade 4 – Bleeding covers surgical field after removal of suction before surgical instrument can perform maneuver

Grade 5- Uncontrolled bleeding, bleeding out of nostril on removal of suction

The Instruments used in Surgery at our center are-

Microdebrider of Medtronic company is utilized for precise tissue removal.

For Balloon Sinuplasty, Balloon catheters are used, to dilate obstructed sinus openings.

Other cold steel instruments like Back bitter Forceps, Thru-cut forceps, Endoscopic scissors, Cautery, suction cannulas, Punches like Kerrisons, mushroom etc

In end after surgery two essential procedures done are-

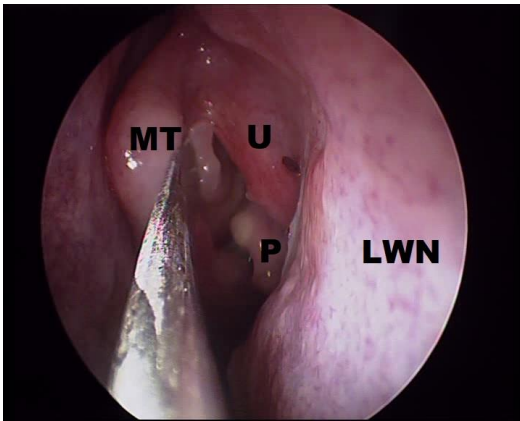
-Sinus Irrigation: Flushes out debris and ensures patent sinus pathways.

-Assessment and Closure: Final inspection of the sinuses and controlled bleeding. Nasal packing or stenting may be used to support healing.

Surgical techniques used-

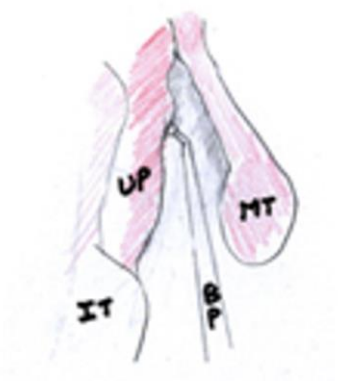
Uncinectomy –

Swing Door Technique is used as described by P.J.Wormald. Medialize the Middle turbinate for visualization of Uncinate and Maxillary Ostea.



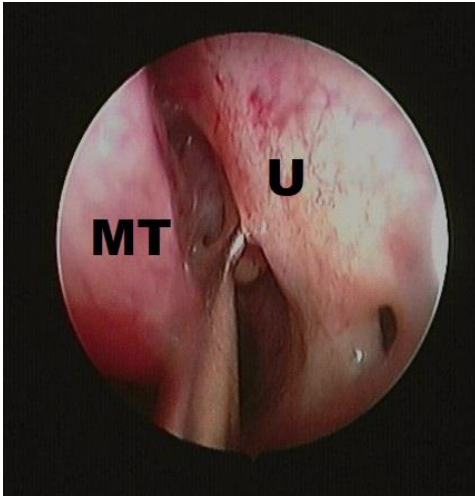
**Figure 1 Endoscopic View;** To visualize Medialization of Middle turbinate with Freer's elevator to look for Middle Meatus Left side Nose (MT-middle Turbinate, U-Uncinate, P-Polyp, LWN- Lateral wall of Nose)

Palpate free edge of Uncinate by Ball tipped Right angled probe



**Figure 2 Illustrative View;** To visualise Palpation of Uncinate process with Ball tipped angled probe Right Side Nose (UP-Uncinate process, MT-Middle turbinate, IT-Inferior turbinate, BP-Ball probe)

Tip of Sickle knife cuts Soft bone of Uncinate from posterior free edge until hard bone of Frontal process of Maxilla

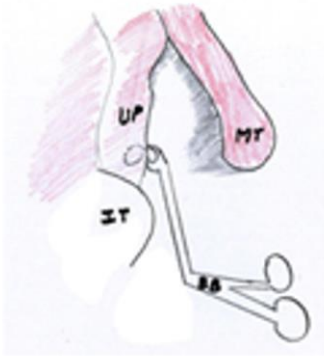


**Figure 3 Endoscopic View;** To visualize Tip of Sickle knife cutting Soft bone of Uncinate Left Side Nose (MT-Middle turbinate, U-Uncinate)

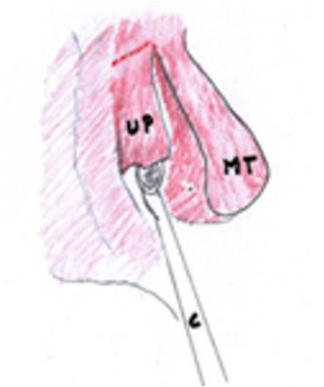


**Figure 4 Illustrative View;** To visualize Tip of Sickle knife cutting Soft bone of Uncinate Right Side Nose (UP-Uncinate process, MT- Middle turbinate, IT-Inferior turbinate, SK-Sickle knife)

Back biter engages free edge of Uncinate process. Introduce backbiter about Midway up the middle portion of Uncinate. Then slide down the free edge until it comes to rest on transition of middle and horizontal part of Uncinate. Then take Bites.

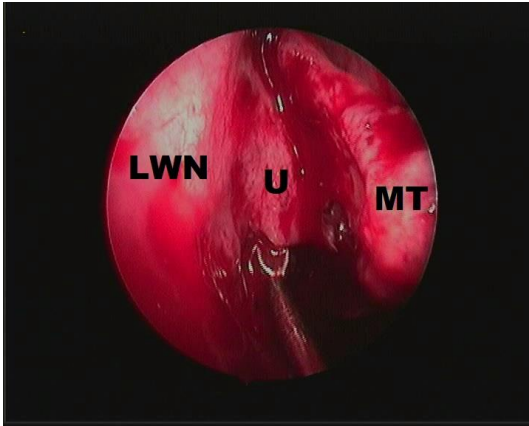


**Figure 5 Illustrative View;** To visualize Back biter engages free edge of Uncinate process Right Side Nose (UP-Uncinate process, MT- Middle turbinate, IT-Inferior turbinate, BB-Back biter)



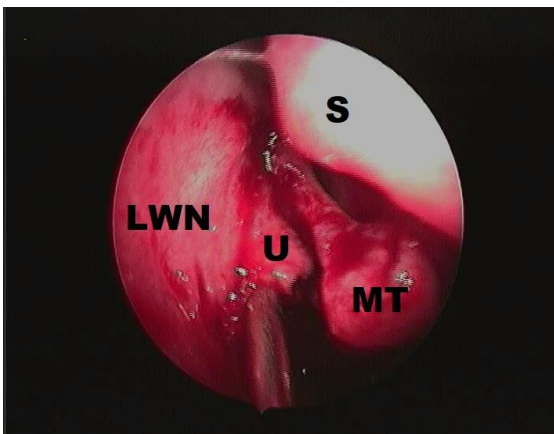
**Figure 6 Illustrative View;** Uncinate Fracture with Right Angled Curette Right Side Nose (UP-Uncinate process, MT- Middle turbinate, C-Curette)



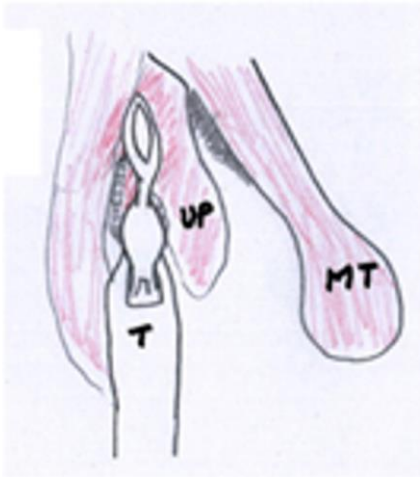


**Figure 7 Endoscopic View;** Uncinate Fracture with Right Angled Curette Right Side Nose (MT-middle Turbinate, U-Uncinate, LWN- Lateral wall of Nose)

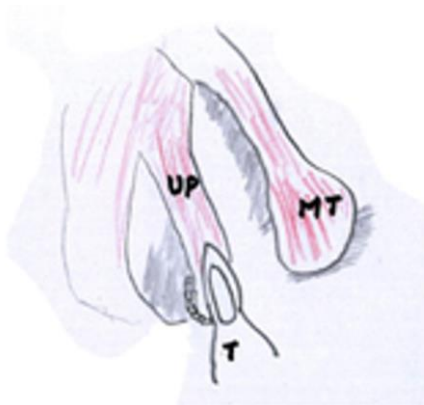
Right angled Curette slide through inferior incision and curette pulled anteriorly, Uncinate is fractured.



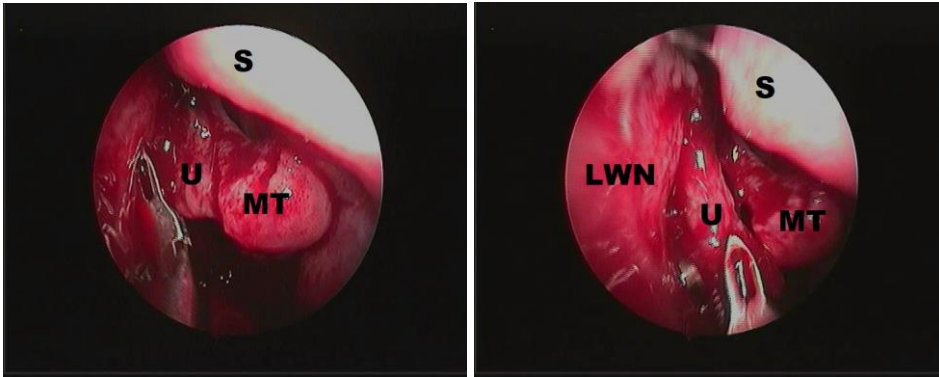
**Figure 8 Endoscopic View;** Uncinate Fracture with Right angled Curette Right side Nose (MT-middle Turbinate, U-Uncinate, S-Septum, LWN- Lateral wall of Nose)



**Figure 9 Illustrative View;** Thru-cut is used to cut the remnant part of Uncinate Right side Nose (MT-middle Turbinate, UP-Uncinate, T-Thucut)



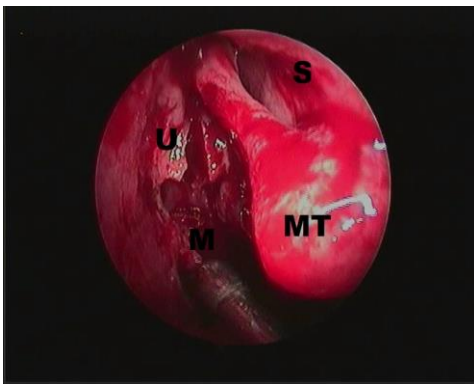
**Figure 10 Illustrative View;** Thru-cut is used to cut the remnant part of Uncinate Right Side Nose (MT-middle Turbinate, UP-Uncinate, T-Thucut)



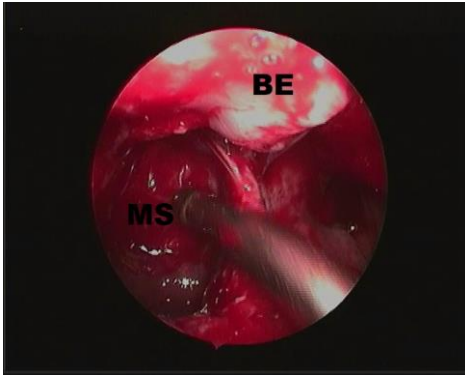
**Figure 11,12 Endoscopic View;** Thru-cut is used to cut the remnant part of Uncinate Right Side Nose (MT-middle Turbinate, U-Uncinate, S-Septum, LWN- Lateral wall of Nose)

Thru-cut is used to cut the remnant part of Uncinate.  
Maxillary Sinusotomy-

Right angled ball probe or Olive Tip Suction is used to fracture the horizontal part of Uncinate. Microdebrider Straight blade can be used to remove the mucosa.



**Figure 13 Endoscopic View;** Right angled ball probe or Olive tip Suction is used to fracture the horizontal part of Uncinate Right side Nose (MT-middle Turbinate, U-Uncinate, S-Septum)

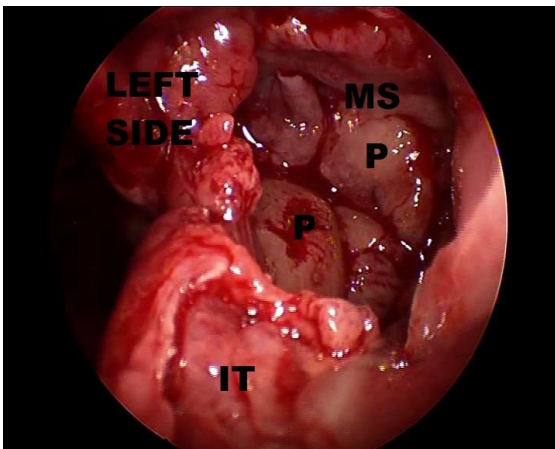


**Figure 14 Endoscopic View;** Suction done in Maxillary Sinus Right Side Nose (MS-Maxillary Sinus, BE-Bulla Ethmoidalis)

Then 40 degree blade is used to widen the Ostium.

30 and 45 degree Endoscopes are used to visualize the Maxillary Sinus

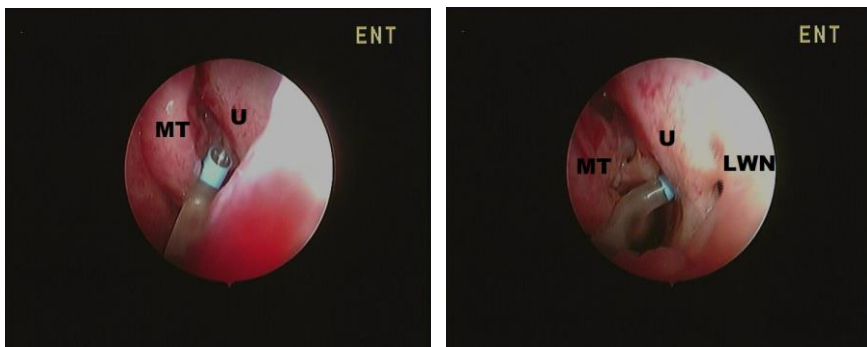
For removing the Polyps from the Maxillary Sinus 60, 90, 120 Degree Tricut debrider blades are used.



**Figure 15 Endoscopic View;** Left side Nose Endoscopic View with 30 degree Endoscope (MS-Maxillary Sinus, P-Polyp, IT-Inferior Turbinate)

Balloon Sinuplasty <sup>5</sup> is a procedure designed to enlarge the sinus ostia (openings) to enhance mucus drainage and airflow. Unlike traditional sinus surgery, which may involve removing bone or tissue to open up the sinuses, balloon sinuplasty uses a balloon-tipped catheter to gently expand the sinus passages. Using an endoscope visualizes the sinus passages. A small balloon catheter is inserted into the narrowed sinus opening.

The balloon is gently inflated to widen the passageway. Once the desired dilation is achieved, the balloon is deflated and removed. The process may be repeated in multiple sinuses during the same session.



**Figure 16, 17 Endoscopic View;** Balloon Sinuplasty Catheter used to enlarge Left Side Nose Maxillary sinus ostia (MT-middle Turbinate, U-Uncinate, LWN- Lateral wall of Nose)

#### Partial Resection of Concha Bullosa-

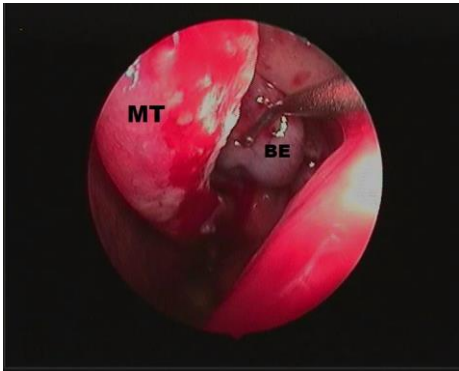
The Ball tip probe is used to palpate the Middle Turbinate. Freers Elevator is push in the Concha at Inferior and Lateral part to make an opening in the Concha. Microdebrider Straight blade is used to debride the Lateral wall of Concha. It can also be cut with Scissors and the lateral bony wall removed. Some part should be left at the superior end to keep the Middle turbinate medialised.

#### Partial Resection of Bulla Ethmoidalis –

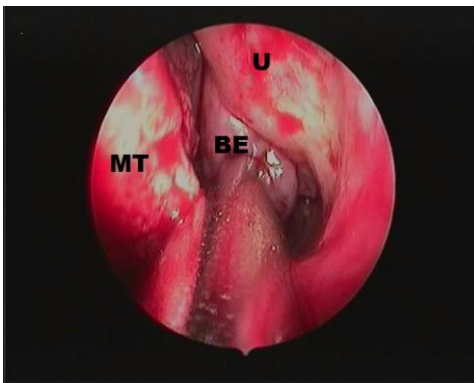
Natural Ostium is found on its Posteromedial aspect in Retrobullar recess. Probe is passed Medial to Bulla between Bulla and Middle Turbinate. Tip

is rotated laterally. Retrobullar recess is probed until the tip falls into Natural Ostium. Probe is pulled forward, Medial and anterior walls are fractured.

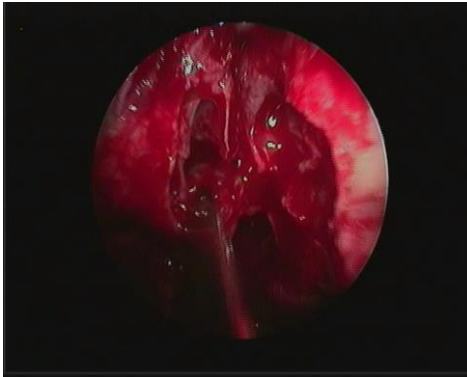
Microdebrider straight Blade is placed in fractured area and Medial and anterior wall of bulla is removed.



**Figure 18 Endoscopic View;** Probe is passed Medial to Bulla between Bulla and Middle Turbinate Left Side Nose (MT-Middle Turbinate, BE-Bulla Ethmoidalis)



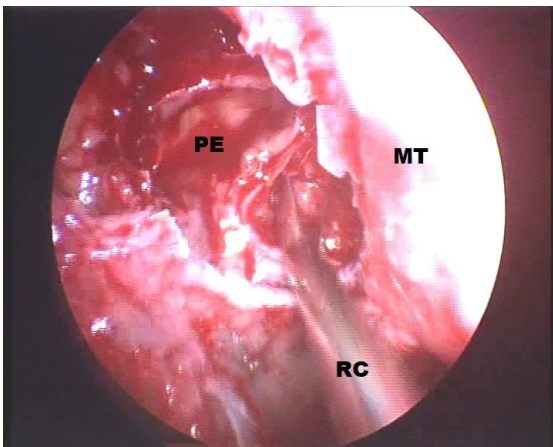
**Figure 19 Endoscopic View;** Bulla palpated with Suction Tip Left Side Nose (MT-Middle Turbinate, U-Uncinate, BE-Bulla Ethmoidalis)



**Figure 20 Endoscopic View;** Medial wall of Bulla removed with Forceps Right Side Nose

Posterior Ethmoidectomy—

At place where Horizontal ground lamella turns Vertically, Probe is used to open the Posterior Ethmoids. Ring Curette is used to break the septa. Microdebrider is used to debride the Polyp with Straight blade.



**Figure 21 Endoscopic View;** Ring Curette is used to break the septa Posterior Ethmoids Right Side Nose (MT-Middle Turbinate, PE-Posterior Ethmoids, RC-Ring Curette)

**Sphenoidotomy-**

Sphenoid sinus is located medial to superior turbinate.

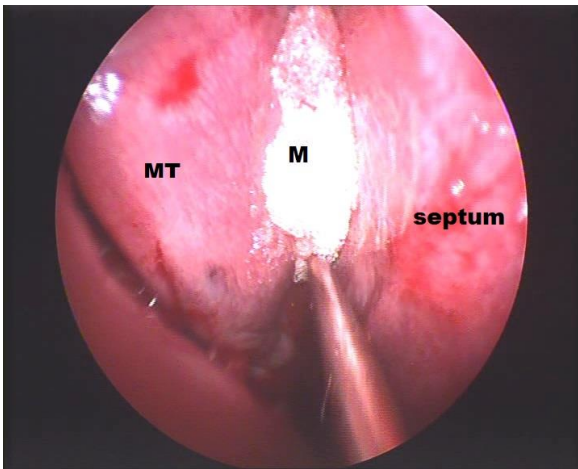
When no disease sphenoid sinus ostea is visible medial to Middle turbinate.

If there is disease then its better to go through Posterior Ethmoids to prevent destabilization of middle turbinate.

Lower One third to Half of Superior Turbinate is removed with Microdebrider.

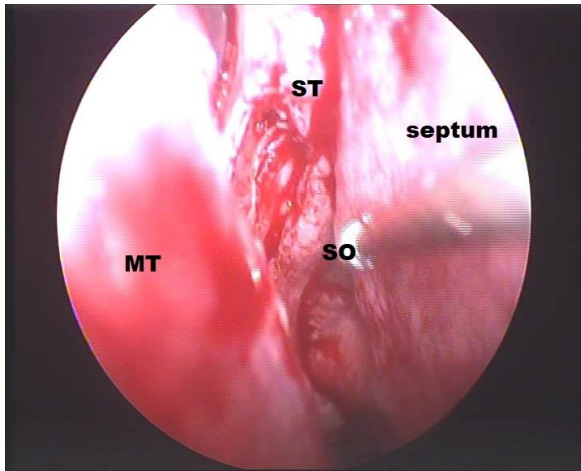
Sphenoid opening is palpated by probe or Straight suction.

The Sphenoid sinus is widened medially and Inferiorly.



**Figure 22 Endoscopic View;** Merocel piece used to decongest Right side Sphenoid sinus Ostia (MT-Middle Turbinate, S-Septum, M-Merocel)





**Figure 23 Endoscopic View;** Sphenoid sinus ostea visualized Right side Nose (MT-Middle Turbinate, ST-Superior Turbinate, SO-Sphenoid Ostea,S-Septum)

### **Postoperative Care**

Postoperative management involves:

Nasal saline irrigation to promote healing and maintain sinus patency. Use of nasal steroids is done to reduce inflammation. Monitoring is done for potential complications, such as infection or bleeding on regular visits. Follow-up appointments for endoscopic examination and assessment of sinus function is done.

### **Conclusion-**

FESS offers significant benefits for patients with chronic sinus conditions by addressing underlying anatomical and pathological issues. A detailed understanding of sinus anatomy and precise surgical techniques are essential for successful outcomes. Continuous advancements in endoscopic

technology and surgical methods further enhance the efficacy and safety of FESS.

It is a key intervention in managing chronic sinus conditions. Through careful planning, precise technique, and comprehensive post-operative care, FESS can greatly improve patient quality of life. This article provides a foundational understanding of the procedure, supported by illustrative examples to aid in clinical practice and education.

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### **Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understand that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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Nil.

### **Conflicts of interest**

There are no conflicts of interest.