

# TIPS AND TRICKS IN ENDOSCOPIC ETHMOIDECTOMY – OUR EXPERIENCE

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**ABSTRACT.** Endoscopic ethmoidectomy is the surgical technique, which consists in opening the entire ethmoidal labyrinth, in order to ensure favorable drainage of all paranasal sinuses. There are several techniques for completing endoscopic ethmoidectomy. In this paper, the authors present the technique used most frequently, based on their experience of more than 4000 endoscopic ethmoidectomies. Also, the goal of this paper is to share some “tips and tricks” on endoscopic ethmoidectomy, in order to perform a complete and safe ethmoidectomy and prevent complications.

## INTRODUCTION

The ethmoid represents the keystone (Terrier, 1991) for the entire rhinosinusal pathology because of its important connections with all other paranasal sinuses. The ethmoid bone consists of two plates: the perpendicular plate (vertical) and the cribriform plate (horizontal), and two lateral masses, the right and left ethmoidal labyrinths (Casiano, 2002). On the medial surface of the ethmoidal masses there are two turbinates – the middle and superior turbinates (very rare we can find a superior turbinate), which consist of two bony lamellas covered by mucosa and are attached to the lateral nasal wall or the skull base.

The middle turbinate divides the ethmoid in two parts – the anterior ethmoidal cells and posterior ethmoidal cells. The anterior ethmoidal cells are four to ten in number, whilst the posterior ethmoidal cells are fewer, between two to four.

The endoscopic ethmoidectomy consists in opening of all ethmoidal cells, leaving in place a single cavity between the lateral nasal wall, the ethmoidal roof, the cribriform plate and the middle turbinate, with the possibility for the endoscopic approach of all other paranasal sinuses (maxillary, frontal, sphenoid).

In order to achieve a proper ethmoidectomy, the ENT endoscopic surgeon has to have the complete knowledge of the lateral nasal wall, with its landmarks.

Several types of ethmoidectomy were described in literature. The retrograde ethmoidectomy was described by Wigand (Wigand, 1990), who opened all the ethmoidal cells coming from posterior to anterior, after complete resection of the middle turbinate. This technique had a lot of complications (orbital, endocranial) and recurrences after ethmoidal inflammatory pathology were described, so in the last decades the technique described by Messerklinger was very much accepted.

In this technique the ethmoid cells are opened from anterior to posterior, passing through the basal lamella, knowing in every moment all the endoscopic landmarks.

**The Messerklinger technique** (Messerklinger, 1978 and Stammberger, 1991, 1993), also commonly used by the authors is performed with the 0° endoscope and consists of these several steps:

1. Identifying the insertion of the middle turbinate
2. Uncinectomy
3. Identifying the maxillary sinus ostium

4. Opening of the agger nasi cell and frontal recess
5. Opening of the ethmoidal bulla
6. Opening of the anterior ethmoidal cells
7. Opening of the basal lamella
8. Opening of the posterior ethmoidal cells
9. Identifying the spheno-ethmoidal recess

Our experience, consisting of more than 4000 ethmoidectomies, has established some tips and tricks for each step of the endoscopic ethmoidectomy in order to avoid complications and to achieve the gold-standard of the surgery – restoring the sinus drainage.

**The most important landmark in FESS** is the middle turbinate. During surgery, identifying the insertion of the middle turbinate, on the lateral nasal wall is the key point of surgical success, because:

- it is the exact point of local infiltration in order not to have bleeding and neurological reflexes;
- a horizontal plane that passes this landmark leaves the skull base above, so surgery performed below that plane reduces any cerebral complications.

**First step of ethmoidectomy** is uncinectomy – resection of the uncinate process (UP), which has to be performed parallel to the lamina papyracea in order not to penetrate the orbit. (**Fig.1**)

There are several types of uncinectomy:

- by sickle knife from above to below;
- by sickle knife from the inferior turbinate to the frontal recess;
- by micro-debrider;
- by cutting the uncinate process in two halves (uncinectomy by Blakesley punch).

The key points of the uncinectomy are:

- cutting the entire UP, leaving a small superior remnant part as a future landmark;
- taking out the UP not by tearing it, but by rotating its bony part;
- always have in mind that the insertion of the UP can be on the naso-lacrimal duct;
- never leave parts of the UP in the area of the infundibulum – risk of closure of the maxillary sinus.

After uncinectomy, the anterior part of the hiatus semilunaris is opened with direct view on the infundibulum and the frontal recess.

**In maxillary sinus pathology**, the ostium has to be opened. The opening can be performed with some risks of complications:

- anterior opening through the anterior fontanella can damage the naso-lacrimal duct;
- posterior opening through the posterior fontanella can cause severe bleeding from the sphenopalatine artery;

- superior opening can pass into the orbit with orbito-ocular complications.

So, as David Kennedy (Kennedy, 2001) postulated, the opening of the ostium of the maxillary sinus can be “as much as needed, as little as possible”, in order not to affect the muco-ciliary clearance.

**While opening the frontal recess**, the first step is to find the agger nasi cell, and to take down its anterior and inferior walls. Once the agger nasi cell opens, we can find the frontal recess, enlarge it, and then go to perform the endoscopic approach of the frontal sinus. (**Fig.2**)

Some tricks of the opening of the frontal recess are:

- always use angulated endoscopes (45°, 70°) and angulated powered instrumentation (drill, shaver);
- always drill the anterior wall of the agger nasi cell;
- the lateral opening of the frontal recess can lead to orbital penetration and further complications;
- the superior opening of the frontal recess can penetrate the ethmoidal roof;
- the posterior opening of the frontal recess can produce epistaxis from the anterior ethmoidal artery.

**The opening of the ethmoidal bulla** is the next step of the anterior ethmoidectomy. The ethmoidal bulla is the most frequent pneumatized ethmoidal cell and can be opened through its anterior wall, as medially and inferiorly possible.

In order to avoid complications while opening the ethmoidal bulla:

- always have in mind that the lateral wall of the bulla is lamina papyracea, and by penetrating this thin bony wall, it is possible to damage the medial rectus muscle.
- while opening the posterior wall of the ethmoidal bulla (which can be sometimes the basal lamella), we have in mind the proximity of the sphenopalatine foramen and the possibility of damaging the sphenopalatine artery.

**The anterior ethmoidectomy** is completed by opening the retro- and supra-bullar cells. Usually, these two cells have complete bony walls, but when there is no wall between these two cells, when can describe the sinus lateralis (the space between the ethmoidal bulla and the basal lamella).

The risks in this area are:

- penetration of the orbit by destroying the lamina papyracea;
- important epistaxis from the anterior ethmoidal artery (with retro-bulbar hematoma);
- endocranial complications by damaging the ethmoidal roof (with CSF leaks).

**The basal (ground) lamella** divides the ethmoidal cells into anterior and posterior cells. In order to reach the posterior ethmoid pathology, we have to open this lamella. It has two parts – horizontal and oblique. The opening of the ground lamella is performed in its oblique part, as medial and inferior possible. **(Fig.3)**

In order to see the oblique part of the basal lamella, the middle turbinate is pushed gently near the septum (medialized). Sometimes the middle turbinate is attached to the ethmoidal roof, or the cribriform plate and while medializing it, we can produce a skull base injury with CSF leak.

**Posterior ethmoidectomy** consists in the opening of the posterior ethmoidal cells (two to four). There are some important tricks during posterior ethmoidectomy:

- it is very important to identify the superior turbinate;
- the most important landmark is the lamina papyracea from anterior ethmoid to posterior part of the orbit (optic nerve);
- always remember that the ethmoidal roof goes down in posterior ethmoid, so the risk of skull base injury is very high;
- while opening the posterior ethmoidal cells, anterior to the superior turbinate, always have in mind the anatomical position of the posterior ethmoid artery;
- sometimes it is possible to find the optic nerve canal on the lateral wall of sphenoid-ethmoidal cell (in this case, we are talking about the Onodi cell) with a high risk of nerve injury and blindness. **(Fig.4)**

**The sphenoid recess** is the landmark to find while performing the endoscopic approach of the sphenoid sinus.

There are also some tips and tricks in approaching this region :

- it is better to resect the superior turbinate in order to get much more surgical field in this posterior part;
- always remember that the superior turbinate is attached to the ethmoidal roof;
- identify the sphenoid ostium but do not enlarge it laterally (risk of damage to the optic nerve), inferiorly (risk of bleeding from the sphenopalatine artery) or superiorly (risk of endocranial complications).

Experience has taught us how to avoid complications during ethmoidectomy and has established some rules for reaching the surgical success:

- identifying the endoscopic anatomic landmarks

- no endoscopic ethmoidectomy without a CT-scan investigation pre-op
- precise endoscopic surgical technique
- correct postoperative care and follow-up.

In conclusion we can say that what Mosher postulated in 1929, describing intranasal ethmoidectomy as “one of the easiest operations with which to kill a patient” is now far history due to the development of the endoscopic instruments and technique and the continuous accuracy of the imaging and endoscopic investigations.

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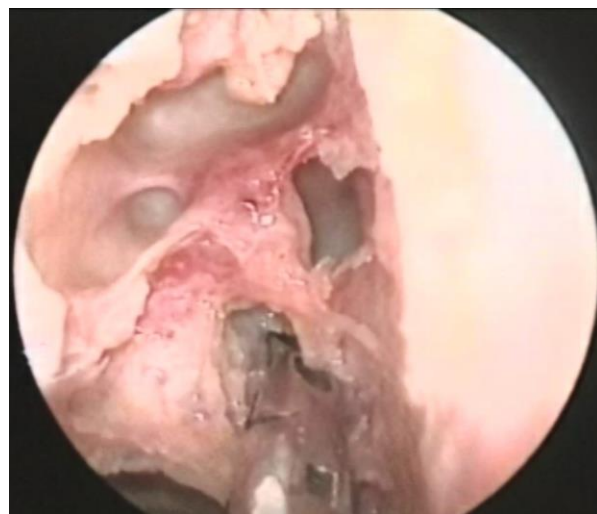
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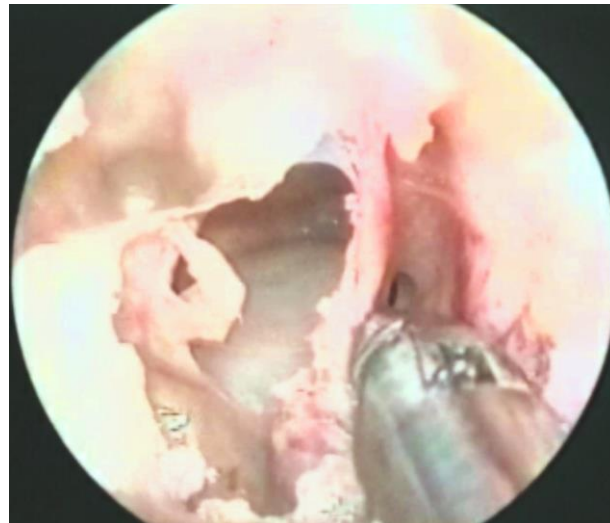
**Fig.1 Uncinate process and bulla ethmoidalis**



**Fig.3 Opening of the basal lamella**



**Fig.2 Opening of the frontal recess**



**Fig.4 Onodi cell and ostium of the sphenoid sinus**