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## Endoscopic transnasal transseptal pituitary surgery

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## **Abstract**

Pituitary surgery is performed via a transsphenoidal approach in the vast majority of cases according to various methods that have changed over the years. A microscopic transseptal approach via a sublabial mucosal incision or a nasal mucosal incision has also been extensively used. An endoscopic transnasal approach was first described in the 1990s, followed by the concept of a microscopic transseptal approach and an endoscopic strictly endonasal approach. We use an entirely endoscopic transseptal transsphenoidal approach via an incision in the nasal mucosa for both access and tumour resection. This procedure has a number of advantages: strictly midline approach to the sella turcica, large operative field, no interference between instruments and a low rate of nasal complications.

**Key-Words:** transseptal approach, endoscopy, pituitary gland.

## **Introduction**

Halstead, in 1910 [1], followed by Harvey Cushing [2], were the first to describe pituitary surgery via a sublabial transseptal approach, the historical approach to the sella turcica [3]. A sublabial vestibular incision provided access to the floor of the nasal cavities and then to the sphenoid by subperichondral and subperiosteal dissection of the nasal septum as far as the sphenoid rostrum, which was then resected in order to enter the sphenoid sinus. Following the introduction of the operating microscope, intrasellar resection was performed under microscopic control. In 1961, Gérard Guiot [4], after performing resection with an operating microscope, was the first to introduce the endoscope to control tumour resection, limited by the optical quality of the endoscopes available at the time. Roger Jankowski [5], in 1992, performed the first entirely endoscopic procedure, using a transnasal incision providing access to the sphenoidal recess and right sphenoidal ostium, with midline enlargement, endosphenoidal access to the sella turcica and resection of the pituitary adenoma. Most endoscopic surgical procedures are now performed according to this technique. We propose a combination of these two options by using the endoscopic transnasal transseptal approach followed by endoscopic exposure and intrasellar resection.

## **Technique**

- Patient installation

The patient is installed in the supine position with the head in a neutral position, slightly turned towards the operator's side, resting on a rubber ring. The patient is intubated orally and the patient's eyes are protected by tear gel and closed by adhesive tape. The surgical field comprises the upper lip and nasal pyramid. Neuronavigation can also be installed, which will be useful for endosphenoidal progression in the presence of difficult sphenoidal anatomical conditions, especially in the context of reoperation. However, neuronavigation is less useful in the sella turcica due to anatomical modifications related to brain shift induced by resection. Preparation of the nasal cavities by a vasoconstrictor pack (lidocaine plus naphazoline) is performed at the time of placement of surgical drapes. Patient positioning must also allow harvesting of abdominal fat in the event of a dural tear, by providing access to the periumbilical region.

- Instruments

The instrumentation comprises 0°, 30° and 70° endoscopes with irrigation channels. The 0° and 30° endoscopes are useful for septal and transsphenoidal progression, while the 30° endoscope is more suitable for the intrasellar phase and the 70° endoscope is useful for final control of the resection. Septoplasty instruments, a set of grasping forceps (straight Blakesley forceps, short and long 45° Blakesley forceps), straight and angled suction tubes, and Dessi bipolar coagulation forceps are necessary, together with more specific instruments for access to and resection of the pituitary adenoma:

- Sickle knife
  - Kerrison antegrade and retrograde rongeurs
  - Pituitary currettes,
  - Motor operating at 12,000 r.p.m. and protected, irrigated diamond drills with suction, 4 mm in diameter and angled at 15°
  - Classical single-layer Surgicel<sup>®</sup>,
  - X-ray detectable neurosurgical patties,
  - Fibrin sealant
- Operative technique
    - Inspection

As for any type of endoscopic endonasal surgery, the first phase consists of exploration of the nasal cavity in order to demonstrate anatomical landmarks: inferior, middle and superior turbinates, choanae, natural ostium of the sphenoid. The anatomy of the nasal septum must also be examined by identifying the number and types of deformities in order to adapt the procedure. At the end of inspection, the inferior, middle and superior turbinates are lateralised in each nasal cavity in order to enlarge the midline surgical corridor on either side of the septum. Subperichondral infiltration with lidocaine with adrenaline can be performed to facilitate subsequent detachment, but is not essential.

- Incision

The unilateral intercolumnellar incision is performed with a fine scalpel blade (No. 15) on the right side, over the caudal margin of the quadrangular cartilage and is continued laterally over the mucosa of the floor of the right nasal cavity. The caudal margin of the septal cartilage is identified and the anterior nasal spine and premaxilla are then detached.

- Endoscopic access: transnasal subperichondral approach

Bilateral subperichondral dissection of the cartilaginous septum and maxillary crest is then performed under endoscopic guidance using suction and the elevator. Extension of the incision on the floor of the right nasal cavity, dissection of the premaxilla and the use of the endoscope allow lateralisation of left and right septal mucosal flaps without needing to use a Killian retractor. The chondro-vomerine junction is then identified visually and by palpation. Using an elevator, the quadrangular cartilage is detached from the maxillary crest inferiorly, from the bony septum posteriorly, and remains attached to the superior lateral cartilages and is displaced laterally. Mucosal dissection is continued in the subperiosteal plane as far as the sphenoid rostrum on either side of the bony septum. The vomer is resected with Luc or Blakesley forceps, together with the inferior part of the perpendicular plate of the ethmoid. Mucosal dissection is continued in the anterior wall of the two sphenoidal sinuses. This complete dissection of the septal mucosa continuous with the presphenoidal mucosa allows lateralisation of two mucosal flaps, facilitated by lateralisation of the turbinates, without the need for a self-retaining Killian speculum. Any septal deformity will have been corrected at this stage of the operation. The surgical field is therefore situated between the two septal mucoperiosteal flaps, providing wide and strictly midline visualization of the sphenoid. The ostia of the sphenoid sinuses are easily identified and enlarged.

- Endoscopic transsphenoidal approach

The anterior walls of the left and right sphenoid sinuses (sphenoid rostrum) are completely resected with a diamond drill [Figure 1]. The intersphenoid sinus septum and the landmarks of the superior and lateral vital structures are then identified: internal carotid arteries, optic nerve and lateral opticocarotid recess, and the sella turcica and clivus [Figure 2]. The intersphenoid sinus septum is resected, except in the unusual cases in which it is very lateralised. The floor of the sella turcica is opened with a diamond drill and a Kerrison rongeur, largely exposing the sellar dura mater, which is coagulated with Dessi bipolar forceps then X-shaped opened by an X-shaped with the sickle knife.

- Endoscopic pituitary surgery [6]

Resection of the pituitary tumour does not differ from classical neurosurgical principles. A 30° endoscope is generally used at this stage, allowing superior vision of the sella turcica, especially in the presence of macroadenoma. Ring curette resection of the pituitary adenoma

starts inferiorly, then laterally and finally at the dome of the sella turcica, taking care not to damage the firm, yellow adenohypophysis and the neurohypophysis [6]. Surgical suction can be placed at the clival recess to aspirate gravitating bleeding. The diaphragma sellae progressively descends into the sella with a fine, translucent and pulsatile appearance; it must be preserved and demonstration of this diaphragm indicates completion of the resection. The sella is rinsed with normal saline at the end of procedure to verify haemostasis. The zone of resection is filled with resorbable haemostatic material (fibrinogen and thrombin sealant (Tisseel<sup>®</sup>) or gelatin: Surgiflo<sup>®</sup> (gelatin only), Floseal<sup>®</sup> (gelatin and thrombin), TachoSil<sup>®</sup>). In the case of arachnoid tear with cerebrospinal fluid leak, we use fibrin sealant and fill the sella with autologous abdominal fat anchored by fibrinogen sealant.

- Closure

The quadrangular cartilage is sutured to the nasal spine with Prolene<sup>®</sup> 3/0. The presphenoidal and septal mucosal flaps are reapplied. The right intercolumnellar incision is sutured with resorbable interrupted sutures (Vicryl<sup>®</sup> 4/0). At the end of the operation, the endoscopic endonasal anatomy is perfectly preserved with no signs of gaping of the sphenoid sinuses towards the nasal cavities. Silicone splints are left in place on either side of the septum to guide septal healing and are removed 7 to 10 days after surgery at the postoperative visit. Systematic nasal packing is not performed.

- Postoperative surveillance

Postoperative surveillance is straightforward and is partly local (verification of the absence of bleeding and CSF rhinorrhoea) and partly endocrine with determination of hourly diuresis to detect diabetes insipidus. Head CT scan is also performed on Day 1 to detect any intracranial bleeding or pneumocephalus.

## **Discussion**

The transseptal approach described here presents a number of advantages, as it is a strictly midline approach avoiding the constraints related to possible turbinate hypertrophy or deviated septum. Although initially more time-consuming than transsial approaches, this technique is nevertheless associated with a steep learning curve for ENT surgeons due to the similarities with conventional septoplasty techniques [7]. Dissection in the avascular subperichondral and subperiosteal planes is generally associated with minimal bleeding.

There is also no risk of injury to the posterior nasal artery, which is included in the flap, which decreases the risk of postoperative epistaxis. Preservation of the mucosa of the septum and anterior surfaces of the sphenoid sinuses isolates the sphenoid cavities, which theoretically decreases the risk of rhinogenic infection. Preservation of the mucosa also allows subsequent use of a nasoseptal flap pedicled on the sphenopalatine artery.

Extensive dissection, lateralisation of mucosal flaps, intraoperative retraction of the quadrangular cartilage, and drilling of all of the anterior wall of the sphenoid sinus without using a Killian speculum provide a very satisfactory range of movement of the various instruments and the endoscope. If necessary, the suction tube held by the assistant, can also be added. This procedure can therefore be performed with 3 hands or 2 hands and an endoscope holder.

In comparison, the direct transsial approach, which we use in the case of redo surgery, presents several disadvantages:

- The initially lateralised approach removes the mucosa lining the anterior wall of the right sphenoid sinus; it is medialised at the expense of perforation of the posterior part of the septum and also destroys the left presphenoidal mucosa,
- It sometimes requires preliminary septoplasty, resulting in a longer operating time,
- It sometimes requires resection of the middle and/or inferior turbinates, increasing the bleeding risk with sometimes more postoperative crusting,
- It is associated with a risk of intraoperative or secondary injury of the posterior nasal artery
- In our hands, it does not provide better exposure of endosphenoidal landmarks and the sella turcica or easier access to the intrasellar phase of the procedure.

Functional complications related to the transseptal approach are rare, due to the absence of septal perforation and turbinate resection, and endonasal anatomy is globally preserved in the vast majority of cases.

## **Conclusion**

Endoscopic transseptal subperichondral and subperiosteal surgery provides large, midline access to the sella turcica with no nasal mucosa scarring, thereby decreasing postoperative nasal morbidity. It can easily be performed by ENT surgeons due to the similarities with septoplasty.



**Conflict of interest:**

Authors declare no conflicts of interest related to this article.

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Figure 1: Endoscopic view of the surgical field after resection of the sphenoid rostrum. The intersphenoid sinus septum can be seen in the centre.

Figure 2: Internal carotid arteries (black stars), opticocarotid recess (blue stars), resected intersphenoid sinus septum (dots), sella turcica (blue circle).



