Direct Endonasal Approach with Partial Upper Posterior Septectomy. A "Rescue Flap" Technique Modification

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Abstract

Objective Report a modification of the "rescue flap" technique using a direct endonasal approach with a partial superior septectomy for approaching pituitary tumors developed in our institution.

Design Prospective study.

Setting Hospital Universitario "Dr. José Eleuterio González," Universidad Autónoma de Nuevo León.

Main Outcome Measures Since April 2015, we have performed 19 cases employing a direct endonasal approach with partial superior septectomy. Results and a technical note are described below.

Results Nineteen patients were included in this report. Six patients presented transoperatory cerebrospinal fluid (CSF) leak, so a nasoseptal rescue flap was harvested. No patients developed postoperative CSF leak in this group. Two patients were submitted to a second surgical procedure. Nasoseptal flap was harvested without complications. In both patients, the size of the flap was enough to cover the dural defect and avoid CSF leak.

Conclusion Direct endonasal approach with a partial posterior septectomy allows enough exposition of the sphenoidal sinus while preserving the nasoseptal septum with the possibility of a successful rescue flap when needed.

Keywords
- endoscopy
- pituitary surgery
- partial septectomy
- rescue flap

Introduction

Pituitary surgery has evolved since the development of extended endonasal approaches.[1] For many decades, the main limitation was the high incidence of cerebrospinal fluid (CSF) leak which led these procedures to unacceptable morbidity rates. This was modified by the development of the nasoseptal flap. Vascularized flaps diminished the CSF fistulae rates to levels similar to conventional surgery.[2]

At the beginning, it was mandatory to harvest the nasoseptal flap during the initial approach, as the vascular pedicle might be damaged during the posterior septectomy. Harvest the flap in every case increases the time spent in the approach, increases manipulation of the nasal anatomic structures, and temporarily increases nasal symptoms during the postoperative period. With the evolution of pituitary surgery, some techniques were developed to avoid the necessity of harvesting the flap at the beginning allowing the

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possibility of harvesting the flap only when needed. These were called "rescue flaps."[3] In our institution, we developed an approach using a direct endonasal approach with a partial superior septectomy; this minimizes manipulation of septal mucosae and preserves the nasoseptal artery making possible to harvest a nasoseptal flap when needed. The method is described below.

Technical Note

All patients had a complete preoperative protocol including 1.5T MRI, nasal sinus CT, and endocrinological evaluation. Patients are positioned supine, no rigid fixation is employed, and head is rotated 10 degrees to the right side. One cottonoid full soaked in oximetazolin is inserted in any nostril to decongest nasal mucosae. Both middle turbinates are infiltrated with lidocaine with epinephrine at 1%. Left middle turbinate is lateralized and right middle turbinate is always resected to improve visualization. A complete nasal endoscopic exploration is performed to identify both coanas and sphenoidal sinus ostium.

Sphenoidale Rostrum Exposition and Posterior Septectomy

Using a monopolar needle a vertical incision is performed in the most posterior aspect of the nasal septum beginning at the middle portion and preserving the emergency of the nasoseptal artery. It is directed upward and allows to expose subperiosteally the ipsilateral sphenoidal rostrum and its junction with the septum (►**Fig. 1**). Dissection extends laterally to expose the sphenoidal ostium. Then, only the superior half of the septum is removed using a retrograde rongeour; septum resection extends only to have a clear visualization and can be increased as much as needed once the sphenoid sinus is exposed (►**Fig. 2a**, **b**).

Using a high-speed drill, rostrum is removed, also the superior aspect of the vomer and any remnant of the upper half of the septum are removed. If it is necessary, septal mucosa can be gently pulled down to drill the sphenovomerian junction, but most of the times there is no need to manipulate septal mucosae.

Once the sphenoidal sinus is exposed, posterior ethmoid cells are removed using a kerrison rongeour, and lateral mucosa is finally removed to increase lateral visualization.

Once the procedure has been performed, if no CSF leak happened, surgicel and gelfoam are packed in the surgical site to help hemostasis. Then a small piece of a dural substitute is placed to cover the dural defect. Finally, a fibrin glue is applied to seal the defect. No packing in the nose is performed.

Harvesting the "Rescue Flap"

This rescue flap can be harvested at the end of the procedure or in a second procedure when needed. We employ a long monopolar needle. An inferior cut is performed following the medial border of the coana and preserving the nasoseptal artery. It is directed to the ipsilateral nostril in the floor of the nasal cavity (►**Fig. 2c**).

The superior incision begins following the superior border of the remanent posterior septum and goes in the most upper part of cartilaginous septum to the entrance of the nose. Both incisions are joined and the full flap is elevated. Once placed and covering the dural defect, fibrin glue is applied and a Foley catheter is inserted to hold the flap. It stays in the nose for 3 days and then removed.

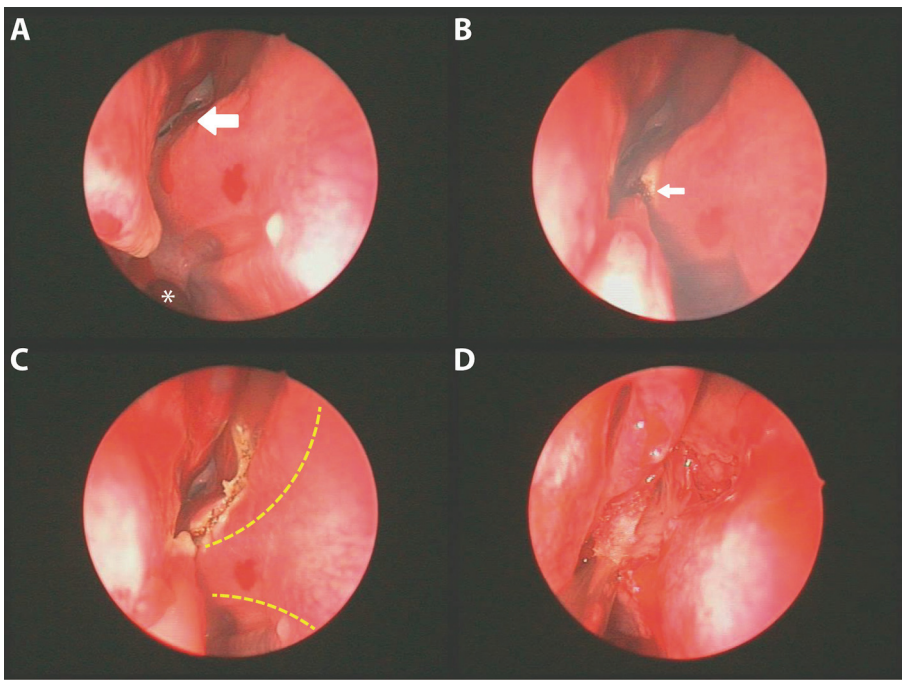

Fig. 1 (**A**) Initial endoscopic exploration of nasal cavity. Choana and sphenoidal ostium (white arrow) are identified. (**B**) A vertical cut is performed using the monopolar needle (arrow). (**C**) The incision is directed upward allowing a lateral disection to expose ipsilateral sphenoidal ostium and the sphenovomerian junction. Remotion of posterior septum can be performed preserving the protection of the nasoseptal pedicle (dotted lines).

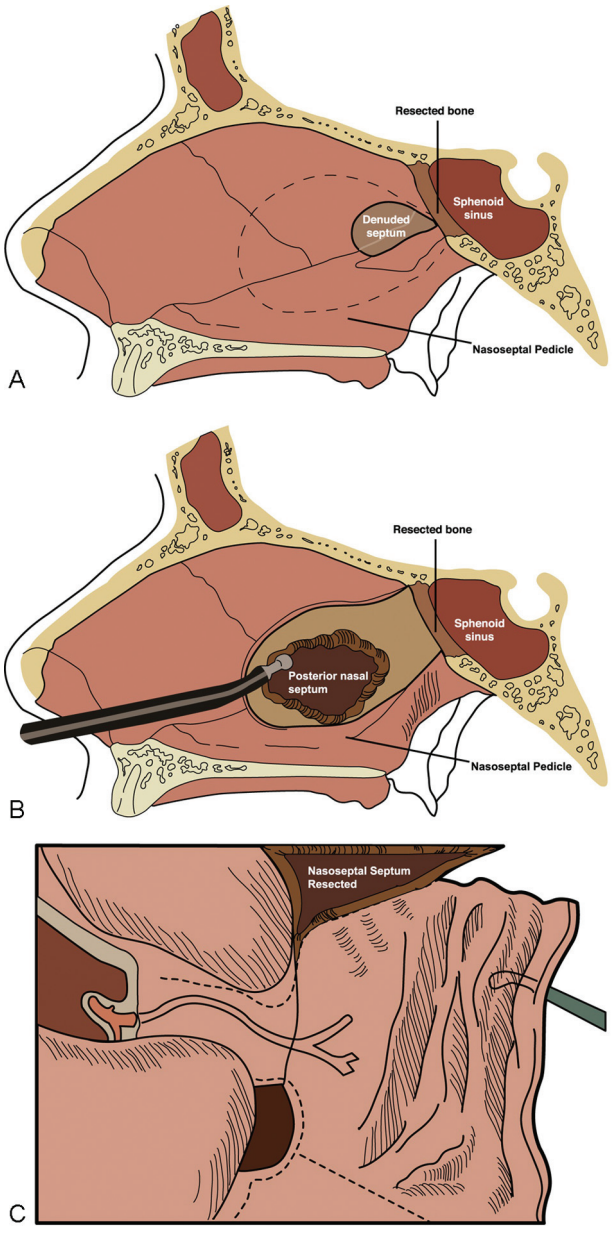

Fig. 2 (**A**) Once sphenovomerian junction is exposed, posterior upper septum can be fractured and (**B**) posterior upper septum can be resected as much as needed. The pedicle of the nasoseptal flap is preserved. (**C**) When needed, flap can be harvested.

Results

A total of 19 patients were included in this report. Characteristics of patients are described in ►**Table 1**,18 cases of patients with diagnosis of a pituitary adenoma and one case with diagnosis of craniopharyngioma. Pituitary adenomas were classified according to the Hardy-Vezina system. Their characteristics are shown in ►**Table 2**.

As a result of the procedure, six patients presented transoperatory CSF leak, so a nasoseptal rescue flap was harvested. None of the patients developed postoperative CSF leak in this group (►**Fig. 3**).

Table 1 Characteristics of patients included in this study

Table 1	Group characteristics
Age	40 years
Gender	50% female
Diagnosis	
Pituitary adenoma	18
Functioning	2
Nonfunctioning	16
Craniopharyngioma	1

Two patients were submitted to a second surgical procedure. One patient was misdiagnosed as a pituitary adenoma and turned into a craniopharyngioma. The patient developed a cyst with fast growth and visual deterioration. Nasoseptal flap was performed as part of the initial approach in the second procedure. The second case was because of a regrowth with visual deterioration. Nasoseptal flap was harvested without complications. In both the patients, the size of the flap was enough to cover the dural defect and avoid CSF leak (►**Fig. 4**).

Discussion

With the development of the nasoseptal flap, CSF leak dramatically diminished in endoscopic endonasal surgery to rates similar to classic open approaches. At the beginning, nasoseptal flap was harvested during the approach to avoid laceration of the nasoseptal artery and necrosis of the pediculated flap. With the evolution of the nasal endoscopic surgery, new techniques were developed to shorten the length of the surgical procedure and avoid modification of nasal anatomy.[3] The "gasket seal closure" was described,[4] and then the "rescue flap" techniques with several variations were adopted depending on the surgeon's preferences and training.[5,6] Finally, when the septum was not an option for harvesting a flap, new techniques like the inferior turbinate flap were developed making it possible to obtain a vascularized flap to repair the dural defect.[7] Although most publications found that nasoseptal flap doesn't produce long-term effects in nasal function if it is adequately performed,[8] there are recent publications that relate the nasoseptal flap to olfactory dysfunction and a low possibility of nasal deformation.[9] Anyway, it is always better to reduce manipulation or destruction of normal structures. The

Table 2 Classification of patients with diagnosis of pituitary adenomas according to the Hardy-Vezina classification

	Hardy		Vezina
I	2	A	2
II	1	B	10
III	7	C	6
IV	8	D	0

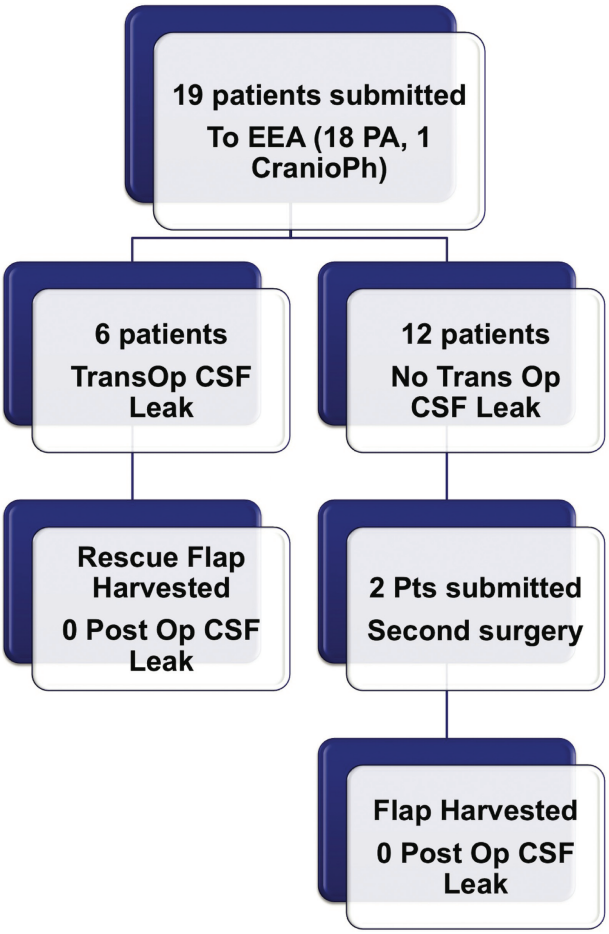

Fig. 3 Rescue flap could be harvested at the end of the surgical procedure or at a second surgery. The rescue flap was useful for repairing the dural defect in all patients.

rescue flaps allow to minimize mucosa and septal manipulation while keeping the possibility of harvesting a flap when needed.

Olfactory dysfunction is the most common symptom related to a nasoseptal flap[10]; with "rescue flaps," this is avoided in most of the patients, although we did not perform an evaluation of the olfactory function for this paper; the less manipulation we perform in our approaches, it decreases the risk of olfactory dysfunction.

The initial "rescue flap technique" involved performing the superior incision and retracting downward the mucosae to allow posterior septectomy.[3] There is a modified "sigmoid" incision that allows in the same way to retract a small portion of the mucosa exposing bony structures of the septum.[6] We consider our approach a modification that means even less manipulation. We only expose rostrum and bony structures and remove the upper half of the posterior septum. It does not require manipulation of mucosae but only removes the bone and mucosae needed. This might seem to narrow the lowest part of the flap carrying the risk of an insufficient pedicle or a narrow flap not wide enough to cover the dural defect. We found no failure in our group of patients. There was no evidence of necrosis of the flap, or a flap too small to cover the sellar defect.

The first part of the flap is usually rested over the floor of the sphenoidal sinus or middle clivus in its road to the sella, so when it gets to the sellar defect we have a fully wide flap to reconstruct the defect. So, we consider removing the upper half of the posterior septum including bone, and mucosa does not affect the structure of the flap or increase in any way the risk of failure of the procedure.

The main limitation of this approach is the impossibility to visualize the floor of the sphenoidal sinus. Most of pituitary adenomas do not require exposing the floor of the sinus, but in certain tumors that involve extensive invasion of the sinus or when drilling the middle clivus is needed, this approach may be inappropriate.

Conclusion

Direct endonasal approach with a partial posterior septectomy allows enough exposition of the sphenoidal sinus while preserving the nasoseptal septum with the possibility of a successful rescue flap when needed.

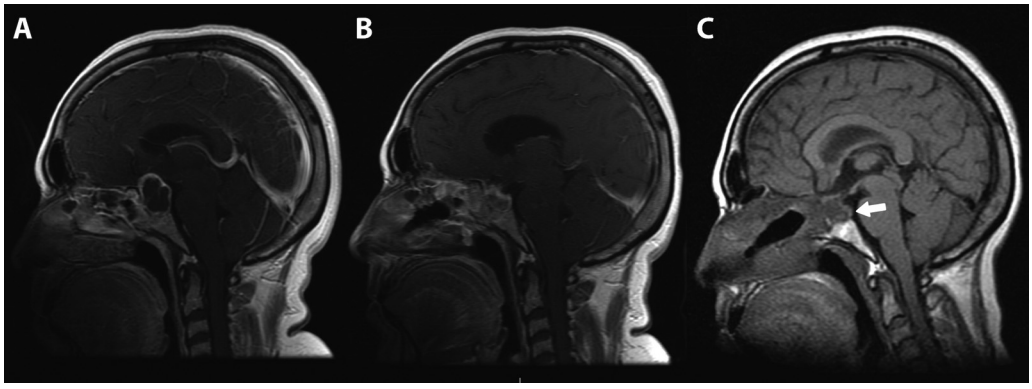

Fig. 4 Patient with diagnosis of a craniopharyngioma. It was submitted to a second surgical procedure. (**a**) Shows a sagittal plane contrast enhanced image, previous to the second surgery. Nasal cavity shows postoperative changes. (**b**) Immediate postoperative MRI after the second surgery. Nasal cavity shows postoperative changes. Residual tumor is observed in the sella. Patient did not develop CSF leak. (**c**) Three months later, T1 noncontrast sagittal plane image. Adequate adhesion of the nasoseptal flap to the sella and anterior cranial fossa is observed.

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