**How I Do It**

**Reverse Harvesting Sequence of Nasoseptal Flaps During Endoscopic Skull Base Surgery: Technical Modification to Deal With The Severe Septal Spur**

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**INTRODUCTION**

In 2006, a vascularized posteriorly based pedicled nasoseptal flap (NSF) (Hadad-Bassagaisteguy flap) was described as a technique for reconstructing the skull base after endonasal skull base surgery. This flap was shown to markedly reduce the incidence of postoperative cerebrospinal fluid (CSF) leaks in this group of patients. This flap has great utility in reconstructing a wide variety of skull base defects, and is versatile enough to be taken down and re-used (recycled) in revision situations. A subsequent reverse rotation flap from the contralateral side was described to reconstruct the denuded anterior septum left after the harvest of the NSF. This allows for more rapid remucosalization of the remaining septum and reduces the nasal morbidity of these surgeries.

In cases of midline pathology, either the left or right NSF can be used to reconstruct the skull base, with the contralateral anterior based septal reverse flap rotated to reconstruct the anterior denuded donor septum. However, in lateralized pathologies where internal carotid artery (ICA) exposure is desirable, it is necessary to utilize the contralateral (to the desired ICA exposure) nasoseptal flap to reconstruct the skull base, with the ipsilateral (to the desired ICA exposure) reverse rotation flap used to reconstruct the septum. The rationale for this asymmetric dissection required to identify the vidian neurovascular complex to expose the ICA. Therefore, in these atypical cases, the dissection of the ipsilateral ICA mandates that the flap must be raised from the contralateral side to protect the pedicle (nasoseptal artery), Figure 1.

The challenge arises when dissection of a specific ICA is needed requiring the NSF to be raised contralaterally in the presence of a sharp bony spur that risks perforation.

**Conventional Technique/Order**

The typical intraoperative sequence involves first elevating the NSF from anterior to posterior, leaving it based on the nasoseptal artery posteriorly (even though the posterior cuts are often initiated first the flap is raised from anterior to posterior). The posterior nasal bony septum is then removed, taking care to preserve the contralateral mucoperiosteum and perichondrium. Finally, the reverse rotation flap is detached posteriorly, superiorly, and inferiorly, and rotated around the posterior limit of the septum to the contralateral side, Figure 2. In the vast majority of cases, this sequence of flap elevation and septal resection represents the optimum flap elevation protocol.

There is a situation, however, where elevation of the flap in this sequence may represent a technical challenge: if there is a severe bony septal spur, on the side of the NSF. This is analogous to a septoplasty operation, in which a large and acutely angulated bony septal spur will frequently result in perforation of the overlying mucosa during elevation of the mucoperichondrial flap.
A unilateral tear in the septal mucosa during septoplasty only infrequently results in a septal perforation, as it can often heal spontaneously. When the nasoseptal flap is being used for skull base reconstruction, on the other hand, a large tear or perforation in the flap can have significant deleterious consequences, as it could result in an inadequate closure of the skull base defect. This would have the potential to increase the risk of CSF leak and intracranial complications after skull base surgery.

**Modified Technique**

We report a modification of the flap elevation sequence that allows its elevation without mucosal tearing in patients with severe septal spurs ipsilateral to the side of the NSF. If a severe septal spur is identified, the anteriorly based reverse rotation flap can be elevated first. The posterior limits of this flap can be delineated, and electrocautery used to incise the mucosa of the reverse flap posteriorly, superiorly, and inferiorly. Elevation of the mucoperiosteum and mucoperichondrium can be undertaken in a posterior to anterior direction, allowing dissection of the septal mucosa overlying the concave side of the septal deflection first.

**MATERIALS AND METHODS**

This modification to the typical flap harvest sequence is illustrated in this case report. An 18-year-old male presented to our service with a large, predominantly right-sided trigeminal nerve schwannoma (Fig. 3). The tumor was asymmetric to the right and required a right Meckel’s cave approach with skeletonization of the right ICA. This precluded the option of raising the NSF from the right side; thus, dictating that it should be raised from the left.

Given the extensive size of the tumor, a two-staged expanded endonasal resection with a left-sided NSF was planned. Computed tomography of the sinuses and initial endoscopic assessment of the nose revealed a large, sharply angulated posterior left-sided bony septal spur (Fig. 4). As described above, it was felt that elevation of the NSF from anterior to posterior would result in perforation of the flap in the area overlying the septal spur, with possible risk to the blood supply of the flap and its capacity for skull base coverage.

**RESULTS**

The above-mentioned sequence of intraoperative maneuvers allowed us to remove the septal bony spur from the right side after elevation of the right-sided anteriorly based reverse rotation flap; this allowed elevation of the left-sided NSF without trauma or perforation. This flap was used to reconstruct the skull base after the first stage of the procedure, and seemed to be intact and with a robust blood supply at the second stage of the procedure, 2 weeks later.
DISCUSSION

A significant technical difference with this modification is that the reverse flap is completely separated and raised from the entire nasal septum, including the most anterior cartilaginous portion. In fact, the reverse flap is completely mobilized and pulled out of the naris to allow for unencumbered access to the concave side of the spur. This concave side is not at increased risk for perforation, and even if inadvertent mucosal injury results, it is the less important reverse rotation flap that is at risk. Once the anteriorly based reverse rotation flap is elevated and left pedicled anteriorly, a Cottle elevator is used to break through the bony-cartilaginous junction. This then allows for gentle manipulation of the septal bone, removing it by pulling the bony fragments toward the nasal side contralateral to the spur. Essentially, this allows for a retrograde septoplasty to be performed from the contralateral side of where the actual NSF will be harvested.

This maneuver allows for removal of that bone without perforating the overlying ipsilateral mucosa. Once the bone spur is removed (along with the remainder of the posterior septum), it is a simple matter to detach the NSF anteriorly, inferiorly, and superiorly, and elevate the flap back to its nasoseptal artery blood supply. The reverse rotation flap can then be rotated into place to reconstruct the denuded anterior septum on both sides.

In essence, both flaps are still raised in the same fashion with same pedicle points, that is, NSF posteriorly based and the reverse anteriorly based. Then only difference is that the reverse flap is raised first and the nasal septal spur is removed from the subsequent defect in a retrograde fashion contralateral to the site of the eventual NSF. This prevents risking a perforation from the NSF. Once the spur is removed, the NSF is raised easily with little threat and reversed flap positioned to cover the donor site.

CONCLUSION

This technical note describes a modification (reverse sequence) to the elevation of the NSF and reverse rotation nasoseptal flaps during expanded endoscopic endonasal skull base surgery, which can facilitate elevation of these flaps when there is a severe septal bony spur on the nasal side ipsilateral to the Hadad-Bassagasteguy flap. This may prevent perforation of the flap, and thus maintain the benefits of vascularized reconstruction of the skull base during these procedures.

BIBLIOGRAPHY