





## How I Do It

# Prelacrimal-Transmaxillary Approach to Lateral Sphenoid Recess Skull Base Defects

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## INTRODUCTION

Well-pneumatized lateral sphenoid recess lesions have been a challenge to access surgically. Various endonasal surgical techniques to the sphenoid sinus have been described including trans-ethmoid, trans-nasal, and trans-septal approaches. However, these techniques have limitations particularly in reaching/accessing the lateral limit of a well-pneumatized sphenoid sinus. Access to the lateral recess of the sphenoid sinus is usually limited inferiorly and laterally by the root of pterygoid plates and the sphenopalatine foramen. In 1999, Bolger described the endoscopic transpterygoid approach to the lateral sphenoid recess and further expanded on this technique in a series of nine patients.<sup>1</sup> This was a trans-maxillary

approach, via a wide antrostomy, to preserve the Vidian and descending V2 nerve roots. Various modifications to this technique have been described to further improve access.<sup>2–4</sup> In each modification, access to the lateral recess was achieved using various angled scopes and curved instruments through a large maxillary antrostomy. We describe a modification of this approach, the prelacrimal-transpterygoid/maxillary approach (PTMA) which allows direct access with a straight trajectory to the lateral recess of the sphenoid sinus via a direct trans-maxillary route, and the associated outcomes (Fig. 1).

## MATERIALS AND METHODS

A retrospective chart review of consecutive adult patients with pathology in the sphenoid sinus managed with PTMA was performed. This study was approved by St Vincent's Hospital Human Research Ethics Committee (2019/PID13822).

## Outcomes

The primary outcome was operative success defined as accessing the lateral recess of the sphenoid sinus and successful surgical treatment of the underlying pathology. Secondary outcomes were lateral wall integrity (or remucosalization), early surgical morbidity (<90 days), and late surgical morbidity (>90 days).

Early morbidity included infection, paraesthesia along the maxillary branch of trigeminal nerve (V2), cerebrospinal fluid (CSF) leak, bleeding, mucosal necrosis, adhesions, and skin changes. Late morbidity included recurrence requiring revision surgery, CSF rhinorrhoea, dry eye, epiphora, inferior meatal communication, stenosis, V2 paraesthesia, and cosmetic change. Raised intracranial pressure was defined as >22 cm H<sub>2</sub>O on intrathecal pressure monitoring. No patient had active lumbar drainage used in the recovery period.

## Surgical Technique

The modified prelacrimal approach (PLA) has been previously described.<sup>5</sup> In this series, a sphenoid-ethmoidectomy and

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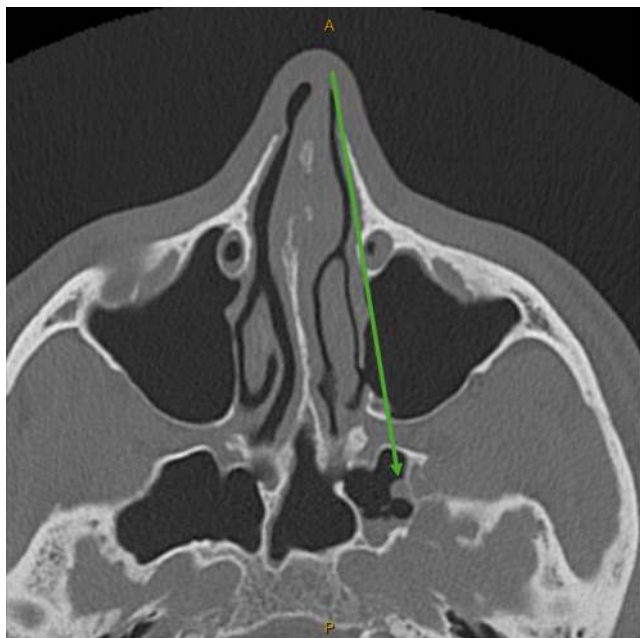


Fig. 1. Axial CT scan demonstrating straight line trajectory to the lateral sphenoid recess through a prelacrimal-transmaxillary approach. The membranous nasolacrimal duct is dissected away as demonstrated in the video. [Color figure can be viewed in the online issue, which is available at [www.laryngoscope.com](http://www.laryngoscope.com).]

maxillary antrostomy is performed prior for postoperative irrigation and surveillance. A posterior-based mucosal flap is then elevated subperiosteally commencing with a lateral nasal wall incision above the axilla of the middle turbinate near the nasal roof using needle-point diathermy coagulation, setting 12 W

(0016 AM Megadyne, NJ, USA). This incision is then continued anteriorly and inferiorly to the bony pyriform aperture and then continued inferiorly to the floor of the nasal cavity and then medially to the nasal septum. The incision then extends posteriorly along the floor of the nose adjacent to the septum to the depth/level of the middle meatus. The mucosa is then elevated and the inferior turbinate bone is separated from the mucosa, in the subperiosteal plane, identifying and mobilizing the membranous nasolacrimal duct (NLD), removing the surrounding bone with a Kerrison rongeur. A “peri-lacrimal” surgical corridor is then created with a 4-mm 15° diamond burr allowing access to the maxillary sinus and posterior maxillary wall (Fig. 2).

The posterior wall of the maxillary sinus can be accessed through this peri-lacrimal corridor and mucosa from the posterior wall is marked with a diathermy and taken down. The bony back wall of the posterior maxillary sinus is then removed medial to the infra-orbital nerve with a Kerrison rongeur. The fascia over the pterygopalatine fossa contents is cauterized with bipolar electrocautery and the internal maxillary artery is dissected and either mobilized away from the field of view or ligated with medium endoscopic clips via a 5 mm laparoscopic clip applicator (Ligamax 5MM Endoscopic Multiple Clip Applier, Ethicon, NJ, USA) and divided. The periosteum over the pterygoid process is elevated and the pterygoid process is drilled with a 4-mm 15° diamond burr (IPC, Medtronic, FL, USA) lateral to the sphenopalatine foramen, Vidian canal and medial to the infra-orbital nerve. Direct access to the lateral sphenoid recess is then achieved with a 0° endoscope. The underlying pathology is then able to be addressed and multilayer reconstruction achieved through this access (Fig. 3). Our preference is to preserve the lateral recess and remove mucosa only immediately around the defect to receive a limited mucosal graft. If the lateral recess is to be obliterated then the entire mucosa is stripped, drilled, and the space obliterated with gelatin foam and the mucosal graft is used on the posterior maxillary wall.

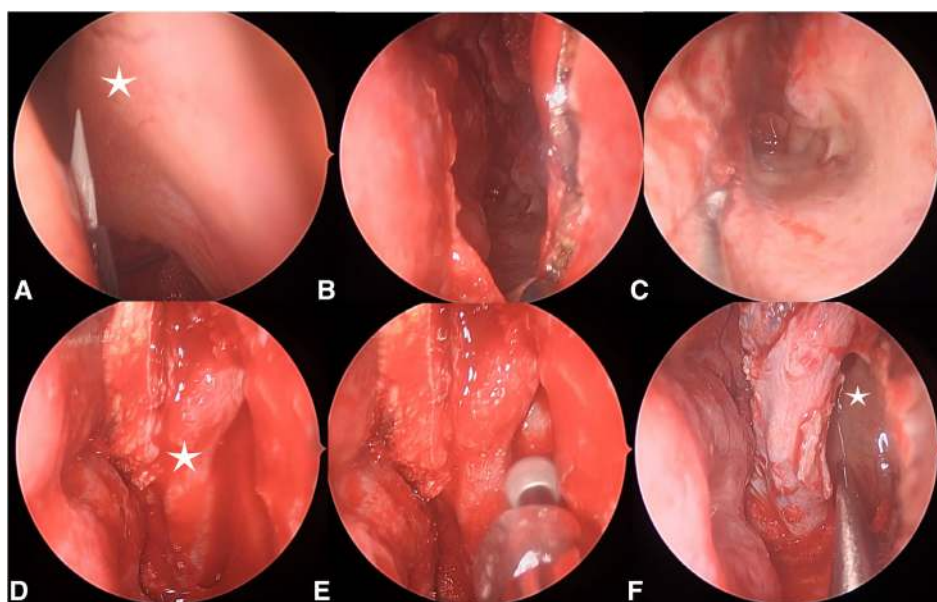


Fig. 2. Prelacrimal approach steps. Representative intraoperative endoscopic imaging of the left nasal cavity. (A) Lateral nasal wall incision high above the axilla (star) near the nasal roof. (B) The incision carries forward to the bony pyriform aperture. (C) The incision carries down to the nasal floor and medially to the nasal septum. (D) Nasolacrimal duct (star) is mobilized and preserved. (E,F) A prelacrimal window is created using a 4-mm 15° diamond burr and the posterior maxillary wall (star) is accessed using 0° endoscope. [Color figure can be viewed in the online issue, which is available at [www.laryngoscope.com](http://www.laryngoscope.com).]

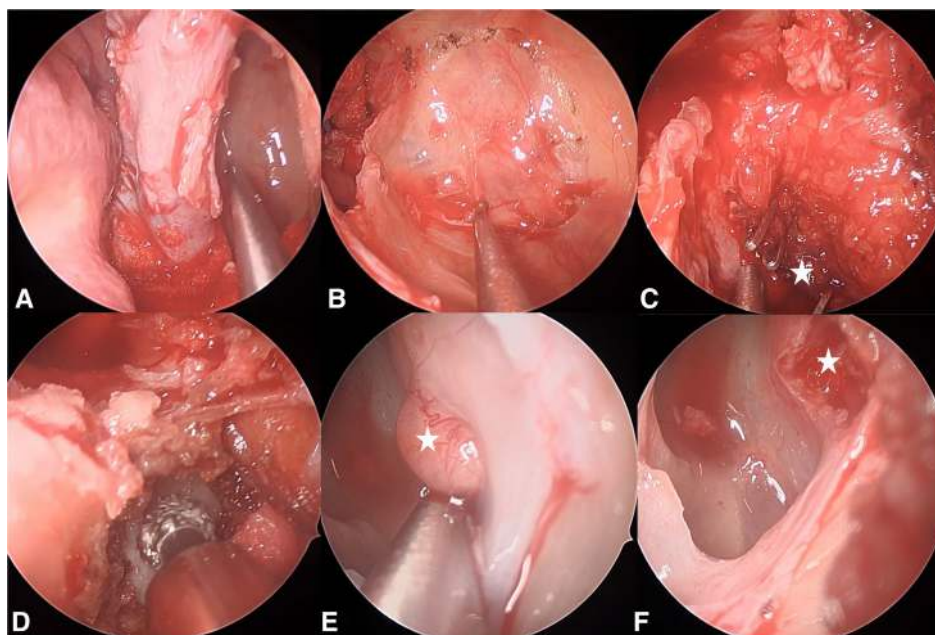


Fig. 3. Access to lateral sphenoid recess through prelacrimal window and repair of encephalocele. Representative intraoperative endoscopic imaging of the left nasal cavity. (A,B) The prelacrimal window is created and the mucosa overlying the posterior maxillary wall is demarcated with a needlepoint diathermy. (C,D) The internal maxillary artery in this case is dissected, clipped, and divided (star). A 4-mm 15° diamond burr removes the pterygoid process. (E,F) Access has now been obtained to the lateral sphenoid recess and the encephalocele is identified (star in E). The encephalocele is resected and the underlying defect (star in F) is reconstructed in a multilayer underlay fashion with DuraGen, mucosa, and bone. [Color figure can be viewed in the online issue, which is available at [www.laryngoscope.com](http://www.laryngoscope.com).]

In closure, Gelfoam (Pfizer, NY, USA) is placed in the lateral sphenoid recess and the inferior turbinate mucosa is returned with 3–4 sutures (5/0 Vicryl-Rapide, Ethicon, NJ, USA). The septum is covered with two 0.5 mm silastic sheets (Medtronic, FL, USA) secured with suture (4/0 Prolene, Ethicon, NJ, USA). The middle meatus is stented with either absorbable or nonabsorbable material. In all cases, image guidance was not used. The surgical steps are illustrated in Video 1. The entire operation is performed with a 0° endoscope and straight instruments including bipolar cautery.

### Postoperative Care

Patients were kept in hospital for neuromonitoring following surgery for 2–5 days. Amoxicillin/clavulanic acid was given for 10 days, and prednisone was given at 25 mg daily for 7–

14 days to reduce congestion and swelling. Nasal saline irrigations were commenced on discharge and delivered as 240 mL twice daily. Patients were followed up at 3 weeks postoperatively for removal of the silastic sheets and again at 3 months for review of the neo-sinus cavity.

### RESULTS

Six patients ( $41.5 \pm 9$  years, 50% female) were assessed (Table I). Follow-up was  $50.1 \pm 25.2$  months. All patients had defects lateral to the V2 nerve and were successfully treated using the PTMA without need for

TABLE I.  
Baseline Characteristics of Prelacrimal Transpterygoid/Maxillary Approach. Continuous Data is Presented as Mean  $\pm$  Standard Deviation.

	Prelacrimal Transpterygoid/Maxillary Approach
<i>n</i>	6
Gender, <i>n</i> (% female)	50%
Age (years)	$41.5 \pm 9.0$
Prior Surgery, <i>n</i> (%)	33%
Diagnosis, <i>n</i> (%)	
Encephalocele	50%
Meningocele	33%
Meningo-encephalocele	17%
Side, <i>n</i> (%left)	83%
Idiopathic Intracranial Hypertension, <i>n</i> (%)	67%

N = number; SD = standard deviation.



Video 1. A prelacrimal transpterygoid/maxillary approach to an encephalocele in the lateral sphenoid sinus in a 59-year-old male with underlying idiopathic intracranial hypertension. Video content can be viewed at <https://onlinelibrary.wiley.com/doi/10.1002/lary.31653>

TABLE II.  
Early and Late Morbidities of Prelacrimal Transpterygoid/Maxillary Approach.

Prelacrimal-Transpterygoid/Maxillary Approach (n = 6)	
Early (<90 days)	
Infection (requiring additional antibiotics), n (%)	0%
Temporary V2 paraesthesia, n (%)	33.3% [1.1–2.2]
CSF leak, n (%)	0% [2.0–2.0]
Bleeding, n (%)	0% [2.0–2.0]
Necrosis of mucosa, n (%)	0% [2.0–2.0]
Adhesions, n (%)	0% [2.0–2.0]
Skin changes, n (%)	
Late (>90 days)	
Recurrence requiring revision surgery, n (%)	0% [2.0–2.0]
CSF rhinorrhoea, n (%)	0% [2.0–2.0]
Dry eyes, n (%)	0% [2.0–2.0]
Epiphora, n (%)	0% [2.0–2.0]
Inferior-meatal communication, n (%)	0% [2.0–2.0]
V2 paraesthesia, n (%)	0% [2.0–2.0]
Cosmetic change, n (%)	0% [2.0–2.0]

Proportions are presented as Percentage and 95%CI.  
CSF = cerebrospinal fluid; N = number; V2 = maxillary branch of trigeminal nerve.

revision surgery. Five out of six patients had left sided pathology. Two patients (33%) had previous surgery at another institution and presented with ongoing CSF rhinorrhoea; one was revision surgery for ongoing CSF rhinorrhoea with a defect in the lateral sphenoid recess and one patient had a left sided encephalocele in the lateral sphenoid recess. No patient had a lumbar drain inserted during the recovery period.

Two patients (33%) reported temporary paraesthesia along/in the V2 distribution which resolved after 90 days. No other early or late morbidities were seen (Table II).

## DISCUSSION

In 1999, Bolger described the endoscopic transpterygoid approach to the lateral sphenoid recess for a large encephalocele in the sphenoid sinus and later expanded on this approach with nine patients.<sup>1</sup> This was especially useful for lesions lateral to the Vidian canal and foramen rotundum (second division of the trigeminal nerve). This method necessitated a medial to lateral approach from a maxillary antrostomy to the lateral sphenoid recess requiring a multitude of curved instruments and angled endoscopes making manipulation and dissection more challenging. In a large series of 39 patients, Bozkurt and colleagues<sup>2</sup> reported modifications to this technique with a two-surgeon, four-instrument approach through both nostrils with a 45 degree endoscope and double curved instruments to facilitate dissection.<sup>2</sup> The large posterior septectomy assisted with the angulation required to reach the lateral recess. Similarly, Sreenath and colleagues<sup>3</sup> described a two-surgeon, uni-nostril approach to access the lateral sphenoid recess through a large maxillary antrostomy using a 30 degree endoscope. In both studies, the authors were required to work “around corners” as a straight line trajectory was not possible.<sup>3</sup>

In the PTMA, direct access can be achieved with a 0° endoscope and straight instruments through a perilacrimal corridor and then direct “trans-maxillary” through the posterolateral maxillary sinus wall. With wide access through this corridor, multilayer closure of the defect can be achieved using underlay cartilage, bone, mucosa, and synthetic materials such as DuraGen (Integra Lifesciences, NJ, USA). Furthermore, modifications such as posterior septectomy and contralateral sphenoidectomy are not required even for the most lateral aspect of the lateral sphenoid recess. Even meningoceles protruding via a “lateral” directed defect was still accessible (Fig. 4). The prelacrimal-transmaxillary approach is favored for when the lateral recess is truly lateral rather than any inferior or superior location. For defects that are directly behind the descending root of CNV2 they may be approached through a wide sphenoidectomy and angled instrumentation. However, once the defect is lateral to CNV2, foramen rotundum,

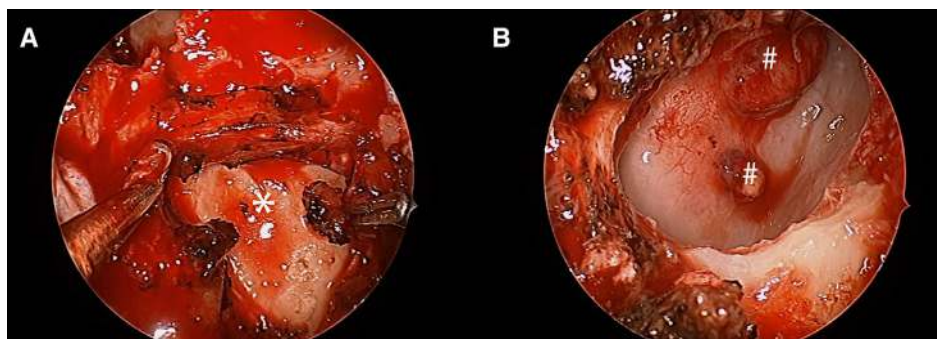


Fig. 4. Skull base defects in lateral recess of sphenoid sinus lateral to V2. The left anterior wall of the sphenoid bone (\*) can be seen after ligation of the maxillary artery branches (A). Skull base defect seen in the lateral pneumatized recess of the sphenoid sinus (#). Both are lateral to V2 and facing lateral in their opening, an orientation that makes any angled instrument approach difficult to visualize, but is seen here with a 0 degree endoscope. [Color figure can be viewed in the online issue, which is available at [www.laryngoscope.com](http://www.laryngoscope.com).]

TABLE III.  
Summary of Success of Closure and V2 Paraesthesia in Published Studies on the Transpterygoid Approach to the Lateral Recess of the Sphenoid Sinus.

Author	Year	Number of Patients	Complete Removal/Success	Complications
Ahmadzada (Current)	2023	6	100%	33.3%
Bolger <sup>1</sup>	2005	9	100%	22%
Bozkurt <sup>2</sup>	2020	39	100%	23%
Sreenath <sup>3</sup>	2021	33	100%	15%
Huang <sup>4</sup>	2021	31	100%	29%
Overall		118	99% [95%CI; 96–100%]	23.6% [95% CI: 16.6 to 31.5%]

Overall data is a meta-analysis of proportional data from the studies listed with a random effect model.

and the descending root of CNV2 then we approach these via a prelacrima-transmaxillary window.

Temporary paraesthesia of the maxillary division of the trigeminal from this technique were similar compared with the traditional transpterygoid approach (Table III).

The modified PLA with a large lateral wall flap preserves the lacrimal system including valve function, allows rapid remucosalization, and does not affect cosmesis.<sup>5</sup> The anterior superior alveolar nerve is at risk during bone removal and can cause dysesthesia if injured and the risk has been previously described.<sup>5</sup> The PTMA also preserves the Vidian neurovascular bundle, the descending root of V2, and the pterygopalatine ganglion. Huang and colleagues<sup>4</sup> described a similar prelacrima approach to the lateral recess of the sphenoid sinus and found a significantly lower rate of Vidian nerve injury when compared to the trans-ptyerygoid approach. The internal maxillary artery is routinely taken as the terminal sphenopalatine branches are located anterior to the pterygoid process of the sphenoid bone. The prelacrima window may limit introduction of more than two instruments at a time, which may preclude a two-surgeon approach. However, in this series, adequate access for visualization and instrument maneuverability could be

achieved through this window as this narrow point is located in the corridor and not at the point of dissection.

## CONCLUSION

The prelacrima trans-maxillary approach is a robust approach with direct and wide access to the pneumatized lateral sphenoid recess with a 0° endoscope. This approach allows both treatment of underlying pathologies in this region as well as multilayer reconstruction of the skull base.

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