

# External Validation of a Graded CSF Leak Repair Protocol in Expanded Endoscopic Endonasal Approaches: Retrospective Analysis of a Single Surgical Team's Experience

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## Introduction

- In recent years, endoscopic endonasal approaches (EEAs) have been adopted over open craniotomies as the preferred operative techniques for sellar and parasellar tumor resection.
- Cerebrospinal fluid (CSF) leaks remain an important concern in EEA skull-base surgeries.
- An effective graded CSF leak repair protocol for EEAs to the sellar/parasellar region has previously been described, but there is limited reporting on efficacy for more extensive approaches.
- We review our center's outcomes using this graded repair across a range of standard and extended EEAs.

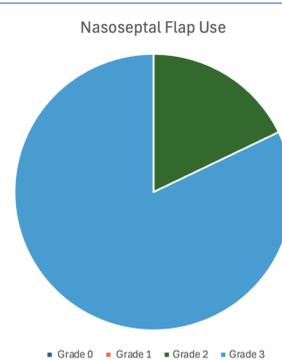
## Methods and Materials

- Patients who underwent EEAs performed by our neurosurgery and otolaryngology surgical team were retrospectively analyzed between November 2021 and June 2025.
- Intraoperative CSF leaks were graded as 0 (no leak), 1 (small leak confirmed by Valsalva), 2 (moderate leak with diaphragmatic defect), 3 (large leak).
- Repair materials used included collagen sponge, autologous fat graft, a rigid buttress of septal bone or Medpor (Stryker, Kalamazoo, USA) and occasionally a nasoseptal flap.
- Demographics, surgical approach, pathology, repair details and postoperative CSF leak occurrence at discharge and follow-up were collected.
- Descriptive statistics were used to summarize patient characteristics and outcomes.
- Primary outcome was the rate of CSF leak repair failure
- Patients undergoing transorbital neuroendoscopic approaches were excluded.

Characteristic	Value
Total no. of patients	98
Age (Years)	55.2 ± 1.7
Sex (F/M)	49/49
BMI (kg/m <sup>2</sup> )	30 ± 0.8
No. of pts w/ prior skull base surgery	25 (26%)
No. of pts w/ prior local radiation	13 (13.2%)
<b>Pathology</b>	
Benign Pituitary Neuroendocrine Tumors	52 (52%)
Nasopharyngeal Carcinoma	10 (10%)
Meningioma	9 (9%)
Encephalocele	3 (3%)
Esthesioneuroblastoma	4 (4%)
Craniopharyngioma	3 (3%)
Other	19 (36%)
<b>Total no. of procedures</b>	
Transsphenoidal	56 (56%)
Transtuberculum/Transplanum	9 (9%)
Transclival	10 (10%)
Transcribriform	10 (10%)
Transpterygoid	15 (15%)

## Results

- The study included 98 patients who underwent 100 EEA procedures
- Mean age was 55.2 ± 1.7 years with a 50/50 male/female codominance.
- The most common approach was transsphenoidal (56, 56%).
- CSF leak was appreciated intra-op in 40 (40%) procedures.
- Out of the 100 procedures, a nasoseptal flap was used in 23 (23%) cases, mostly for Grade 3 leaks (78.2%).
- Of the 40 surgeries with an intra-op grade 1 – 3 leak, a Medpore rigid buttress was used in 25 (62.5%) reconstructions
- Only one case (1%) of CSF leak repair failure was encountered. The rigid buttress was dislodged on immediate post-op imaging without evidence of a CSF leak, and the patient underwent revision surgery acutely.
- Patients were followed in clinic at 10 and 90 days. No CSF leaks were reported during clinic follow-up
- 13 patients returned to the emergency department within 30 days from discharge. Cited reasons for visit were postoperative pain/headache (30.8%), infections (30/8%), epistaxis (15.4%), seizure (7.7%), emesis (7.7%), and incidental trauma (7.7%).

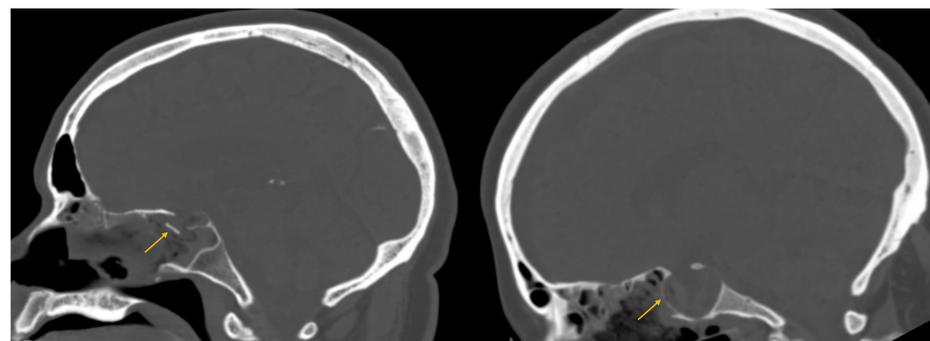
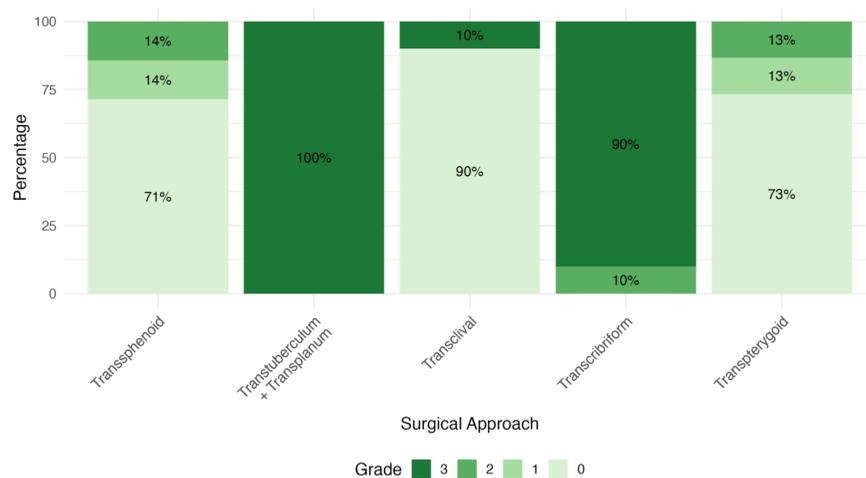


Variable	N (%), Mean ± SD
CSF Leak at Discharge	0 (0%)
Mean Duration to First Follow-Up (days)	13.5 ± 21
CSF Leak at First Clinical Follow-up (n=96)	0 (0%)
CSF Leak at 3 Month Follow-up (n=89)	0 (0%)

## Conclusion

- This established intraoperative CSF leak repair strategy is effective for extended endoscopic skull-base approaches, including in previously operated on and irradiated surgical fields
- Wedging of a rigid buttress (septal bone or Medpor) into the bony defect is crucial for success.
- Tailoring the repair based on leak grade can minimize morbidity and avoid unnecessary nasoseptal flap harvest, preserving this for future use.

Distribution of CSF Leak Grades by Approach



Sagittal Bone-Window CT Scan showing failed CSF leak repair with rigid buttress wedging

Sagittal Bone-Window CT Scan showing successful CSF leak repair with rigid buttress



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