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Introduction

Persistent cerebrospinal fluid (CSF) leak continues to occur following endoscopic endonasal skull base surgery despite standardized reconstructive strategies. This poster reviews a five-year institutional experience and examines cases of persistent postoperative CSF leak encountered after algorithm-based reconstruction.

Methods and Materials

From January 2021 to September 2025, 166 patients underwent endoscopic endonasal skull base surgery with reconstruction guided by a structured, anatomy- and CSF leak grading-based algorithm (**Figure 1**). Reconstruction strategies were selected according to defect location and intraoperative CSF leak severity. Clinical outcomes and persistent postoperative CSF leaks were retrospectively reviewed.

Dural defect

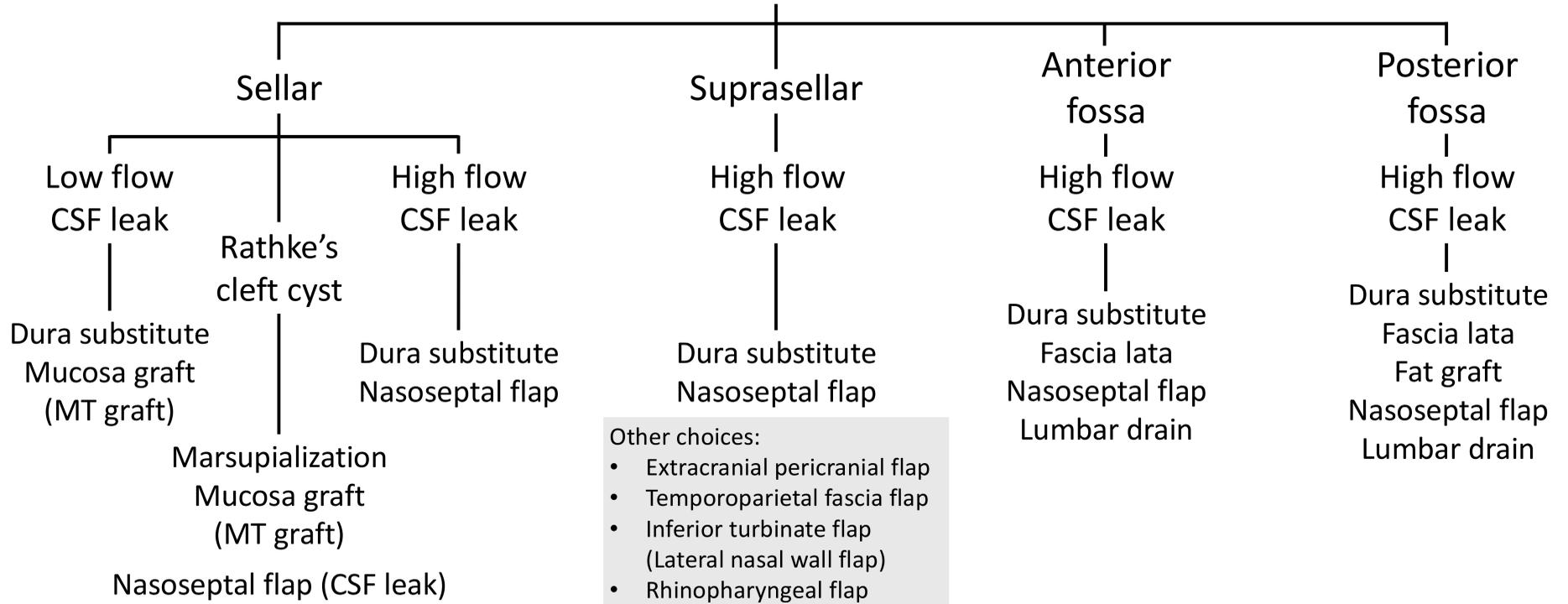


Figure 1 Algorithmic framework for skull base reconstruction based on anatomical defect location and intraoperative CSF leak grading

Results

- Total cases: 166 endoscopic endonasal skull base surgeries (2021–2025)
- Persistent postoperative CSF leak: 4 patients (2.4%), all requiring revision surgery
- Etiology: Heterogeneous failure patterns illustrated in **Figure 2**
- Revision management: All cases underwent secondary reconstruction using nasoseptal flaps
- Clinical outcome: No recurrent CSF leak or intracranial infection during follow-up

Discussion

- Although algorithm-based reconstruction can reduce overall CSF leak rates, persistent leaks in our series occurred exclusively in scenarios where protocol-driven repair was insufficient to address patient-specific or disease-related factors.
- Notably, failures were not related to reconstructive technique selection but to circumstances such as postoperative patient behavior, extreme tumor burden with secondary hematoma, impaired healing capacity, and marginal flap coverage in large dural defects (**Figure 2**).
- These findings suggest that persistent CSF leak represents a limitation of algorithmic reconstruction rather than a technical failure, reinforcing the primacy of surgeon judgment, anticipatory planning, and targeted postoperative management over further protocol refinement.

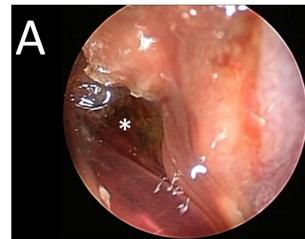
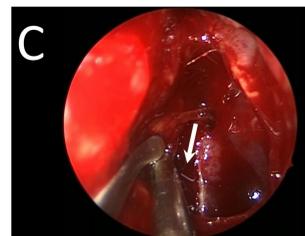


Figure 2 Representative intraoperative findings in cases of persistent postoperative CSF leak.

A. Case 1. The white asterisk indicates a postoperative tract at the reconstruction site in the left nasal cavity, associated with repeated nasal manipulation using cotton-tipped applicators.



B. Case 2. The white triangle indicates the nasoseptal flap (NSF); the white square denotes a hematoma between the NSF and tumor cavity, displacing the flap.



C. Case 3. The white arrow indicates the site of persistent CSF leakage identified at the interface between the NSF and the exposed sphenoid sinus bone, in the setting of impaired postoperative healing.



D. Case 4. The white circle indicates incomplete NSF coverage over a large suprasellar dural defect, with exposed artificial dura substitute visible beneath the flap.

Conclusions

Persistent CSF leak following endoscopic endonasal skull base surgery reflects the limitations of algorithm-based reconstruction rather than technical failure alone. Durable repair depends on surgeon judgment, anticipatory planning, and tailored postoperative management in high-risk clinical scenarios.

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