

# Reconstruction and CSF Leak After Endoscopic Endonasal Approach of Clival Chordomas: A Systematic Review and Meta-analysis

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## Introduction

Clival chordomas are surgically complex and associated with significant postoperative morbidity. The endoscopic endonasal approach (EEA) offers a minimally invasive route, but carries risks of cerebrospinal fluid (CSF) leak, meningitis, and hydrocephalus. Reconstructive technique selection considers intraoperative findings, which is critical to reducing complications.

## Objective

To determine the postoperative CSF leak rate after EEA for clival chordomas and the associated infectious complications and hydrocephalus.

## Methods

Systematic searches of PubMed, Embase, Scopus, and Web of Science were conducted from inception to July 2025.

Studies reporting patients with clival chordomas treated via EEA, including reconstructive details and postoperative CSF leak data, were included.

Studies published in languages other than English, Spanish, or Portuguese, case series with fewer than five patients, and secondary evidence were excluded.

The full protocol was registered in PROSPERO (CRD420251155767).

## Results

Seventeen observational studies comprising 1,123 procedures were included.

Autologous fat graft was the most frequently used material for skull base reconstruction (88%), followed by fascia lata (82%) and nasoseptal or middle turbinate flaps (71%).

Multilayer reconstruction was employed in 71% of the studies.

Lumbar drainage was used in 21.4% of patients, usually with prophylactic intent and maintained for 3 to 5 days.

Suspected CSF leaks were most often managed with lumbar drainage or external ventricular drainage.

The pooled CSF leak rate was 11.70% (95% CI: 6.82–16.59;  $I^2 = 62%$ ,  $p = 0.0003$ ).

The pooled meningitis rate was 9.81% (95% CI: 4.99–14.63;  $I^2 = 68%$ ,  $p = 0.0009$ ).

The pooled hydrocephalus rate was 0.82% (95% CI: 0.06–2.15;  $I^2 = 40%$ ,  $p = 0.14$ ).

Figure 1. (A) Forest plot, (B) Baujat plot and (C) leave-one-out analysis of CSF leak

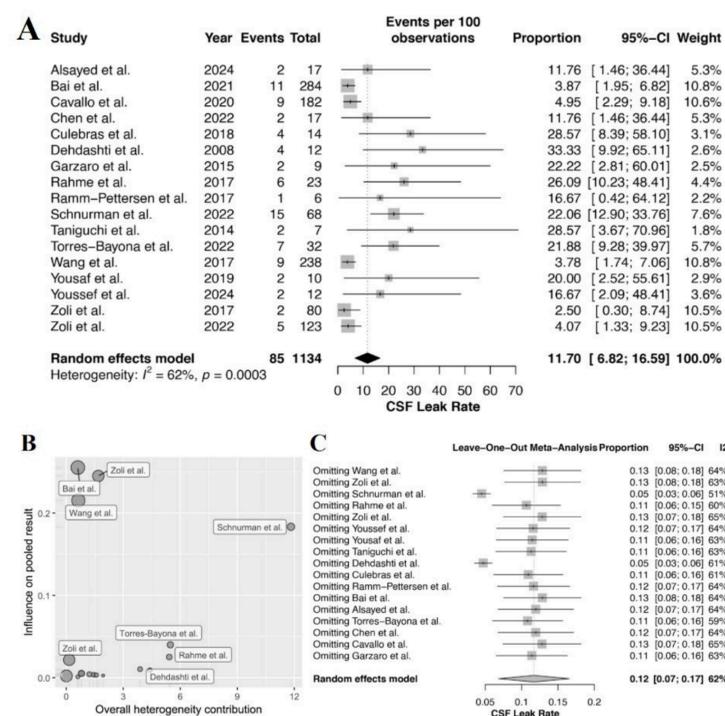


Figure 2. Forest plot of meningitis

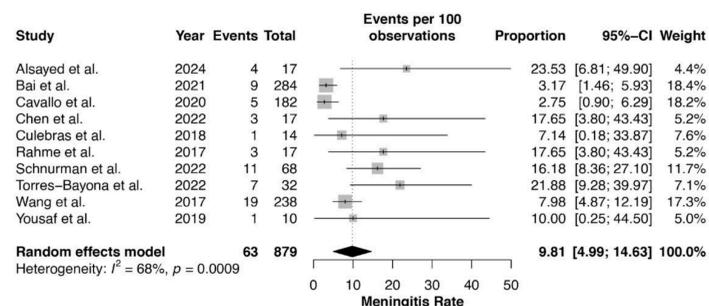
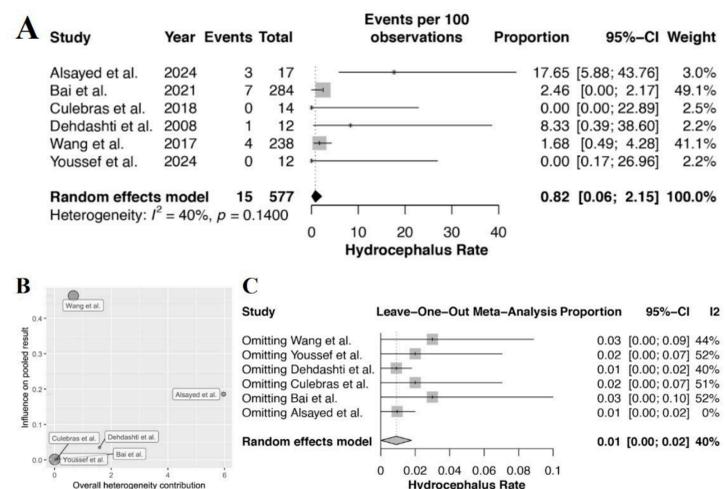


Figure 3. (A) Forest plot, (B) Baujat plot and (C) leave-one-out analysis of hydrocephalus



## Conclusion

- These data underscore the need for aggressive reconstruction strategies and targeted leak-prevention pathways in high-risk scenarios.
- Future comparative analyses should clarify the roles of lumbar drainage, buttress or gasket-seal adjuncts, and tumor topography in mitigating CSF-related morbidity.