

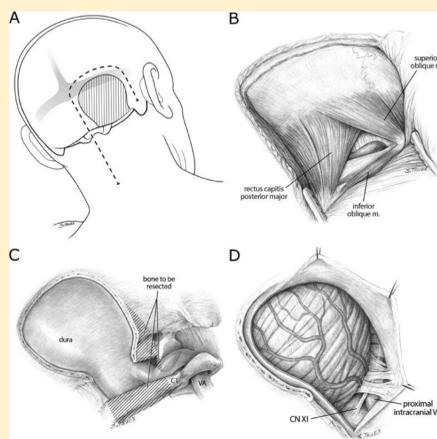
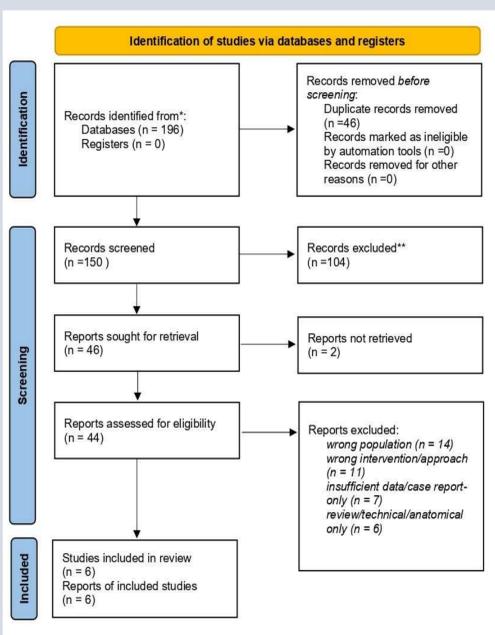
Far-lateral and extreme lateral approaches for foramen magnum meningiomas show reasonable surgical effectiveness and safety among skull base centers

Introduction

- Foramen magnum meningiomas (FMMs) are among the challenging skull base tumors due to proximity to lower cranial nerves, vertebral artery, and cervicomedullary junction.
- Far-lateral and extreme-lateral approaches were designed to improve access to ventral/ventrolateral FMMs.
- Despite widespread use, uncertainty remains regarding consistency of gross total resection (GTR), perioperative risk, and long-term control.
- We performed a systematic review and single-arm meta-analysis to synthesize surgical outcomes and complication profiles for these approaches.

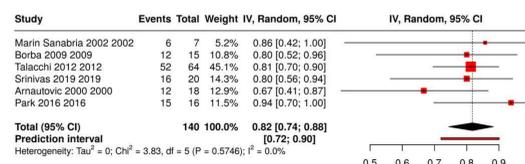
Methods

- PRISMA-guided systematic search of PubMed, Embase, and Scopus from inception to May 2025.
- Inclusion: case series/cohort studies with ≥ 5 FMM patients treated via far-lateral or extreme-lateral approaches and reporting surgical outcomes.
- Exclusion: case reports, review articles, non-FMM pathology, and series without extractable outcome data.
- Standardized extraction of demographics, tumor features, approach details, extent of resection, complications, and follow-up outcomes.
- Proportion meta-analyses using DerSimonian–Laird random-effects model and Freeman–Tukey transformation.
- Heterogeneity measured with I^2 and prediction intervals to estimate variability across future studies.

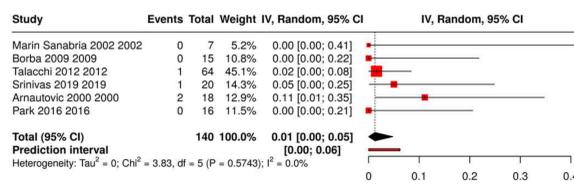


Far-lateral and extreme-lateral surgical corridor and key neurovascular anatomy at the foramen magnum. *Neurosurgical Focus*, 35(6):E12.

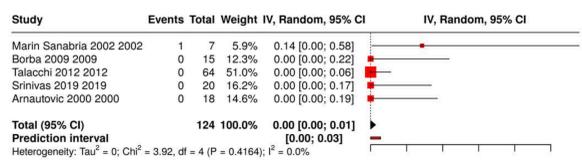
Gross total results



Recurrence results



Perioeprative mortality



Results

- 6 studies (140 patients) met inclusion criteria.
- Gross total resection: pooled 82% (95% CI 74–88%; I² = 0%) → consistent GTR rates across centers.
- Perioperative mortality: in 5 studies (124 patients), pooled 1% (95% CI 0–3%) → deaths were rare in modern series.
- Tumor recurrence: pooled 3% (95% CI 1–7%) over ~2–6 years of follow-up.
- No meaningful heterogeneity for GTR, mortality, or recurrence (all I² = 0%), indicating reproducible outcomes.

Discussion

- Far-lateral and extreme-lateral approaches achieve a high rate of GTR with reasonably low perioperative mortality for FMMs.
- Durable tumor control is observed in the vast majority of patients, with low recurrence on intermediate-term follow-up.
- Consistent low study heterogeneity suggests these results are reproducible across experienced skull base centers.
- These approaches appear to offer a favorable balance between surgical radicality and safety for ventral/ventrolateral FMMs.
- Future work should focus on prospective multicenter registries to refine patient selection, quantify neurological/functional recovery, and optimize long-term surveillance strategies.

References

- Arnautovic KI et al. Ventral foramen magnum meningiomas. *J Neurosurg.* 2000;92:71–80.
- Borba LAB et al. Surgical management of foramen magnum meningiomas. *Neurosurg Rev.* 2009;32:49–60.
- Talacchi A et al. Ventral/ventrolateral foramen magnum meningiomas. *Neurosurg Rev.* 2012;35:359–68.
- Marin Sanabria EA et al. Skull base approaches for foramen magnum meningioma. *Neurol Med Chir (Tokyo).* 2002;42:472–80.
- Srinivas D et al. “Tailored” far-lateral approach for anterior FMM. *Neurol India.* 2019;67:142.
- Park HH et al. Extreme-lateral VA transposition for anterior FMM. *World Neurosurg.* 2016;88:154–65.