

INPLASY

Endoscopic endonasal approach for the treatment of clival and petroclival meningiomas: systematic review of the literature

INPLASY202670065

doi: 10.37766/inplasy2026.7.0065

Received: 17 July 2026

Published: 17 July 2026

Carretta, A; Eleuteri, A; Magnani, M; Zoli M; Mazzatenta D.

Corresponding author:

Marcello Magnani

marcello.magnani3@studio.unibo.it

Author Affiliation:

University of Bologna - IRCCS
Istituto delle Scienze Neurologiche
di Bologna.

ADMINISTRATIVE INFORMATION

Support - No support.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202670065

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 17 July 2026 and was last updated on 17 July 2026.

INTRODUCTION

Review question / Objective In patients with clival or petroclival meningiomas treated via an endoscopic endonasal (transclival) approach (EEA), what are the surgical and clinical outcomes reported in the published literature? Framed in PICOS terms:

P – patients with histologically confirmed clival or petroclival meningioma;

I – endoscopic endonasal (transclival) approach;

C – no formal comparator required (outcomes reported descriptively)

O – extent of resection (GTR/NTR/STR/PR), postoperative complications (CSF leak, meningitis, new-onset cranial nerve deficits), symptom outcome, tumour recurrence/progression, and clinical status at follow-up;

S – case reports and case series (including retrospective observational

studies). The objective is to systematically collect and descriptively pool published outcomes of the EEA for clival and petroclival meningiomas, to contextualise a single-centre institutional experience.

Rationale Clival and petroclival meningiomas are among the most demanding skull base tumours because of their deep location and close relationship with the brainstem, basilar artery, perforators and multiple cranial nerves. Historically they have been managed through lateral transcranial skull base corridors (retrosigmoid, far-lateral, anterior and posterior transpetrosal, combined petrosal), which may require brain or cerebellar retraction and often cross the cranial nerve plane along a lateral-to-medial trajectory to reach a midline lesion. The optimal surgical strategy remains controversial and no universal consensus exists. The development of extended endoscopic endonasal approaches has introduced a complementary ventral midline corridor that allows early devascularisation, internal debulking and brainstem decompression while limiting

manipulation of surrounding neurovascular structures and avoiding lateral cranial nerve crossing in most cases. The published evidence on the EEA for these specific tumours is limited and heterogeneous, largely consisting of case reports and small series with inconsistent reporting of new-onset symptomatology and follow-up. A systematic synthesis of the available literature is therefore warranted to summarise the reported feasibility, extent of resection, morbidity and outcomes of the endonasal route for clival and petroclival meningiomas, and to provide a reference framework against which single-centre experiences can be interpreted.

Condition being studied Clival and petroclival meningiomas — skull base meningiomas arising, respectively, from the clivus or from the upper two thirds of the clivus at the petroclival junction, medial to the trigeminal nerve. These tumours are characterised by a deep midline location and an intimate relationship with the brainstem, basilar artery and its perforators, and multiple cranial nerves, which they may displace or encase. They frequently present with cranial nerve deficits (trigeminal hypoaesthesia, ophthalmoplegia), gait disturbance, dysphagia/dysphonia and, in advanced cases, brainstem compression and hydrocephalus. They represent one of the most challenging entities in skull base surgery, with treatment strategies ranging from surgical resection to adjuvant radiosurgery or particle (hadron) therapy within a multidisciplinary framework.

METHODS

Search strategy MEDLINE and SCOPUS databases were queried using the string: "meningioma* AND (clivus OR clival OR petroclival OR petrocliv*) AND (endoscop* OR endonasal OR transsphenoidal OR transclival OR EEA)". Results were limited to English language and human subjects. After duplicate removal, titles and abstracts were screened; full texts of potentially eligible papers were obtained and reviewed for eligibility and data extraction. The reference lists of included articles were hand-searched to identify additional relevant studies. The last search was performed on 01 June 2026.

Participant or population Patients of any age with a histologically confirmed clival or petroclival meningioma treated through an endoscopic endonasal (transclival) route, as reported in the published literature.

Intervention Endoscopic endonasal approach (EEA) — transclival, transsphenoidal and extended endonasal variants — for resection of clival or petroclival meningiomas.

Comparator Not applicable. No formal comparator was required for eligibility; outcomes were extracted and pooled descriptively.

Study designs to be included Case reports and case series, including retrospective observational studies, reporting at least one histologically confirmed clival or petroclival meningioma treated via an endoscopic endonasal route with extractable outcome data.

Eligibility criteria Inclusion: studies reporting at least one histologically confirmed clival or petroclival meningioma treated through an endoscopic endonasal route, with extractable data on surgical approach and postoperative outcomes; English language; human subjects. Exclusion: conference abstracts with no retrievable data; cases of secondary clival involvement by tumours primarily arising from other skull base regions (e.g., sphenoid-orbital or pre-meatal petrous meningiomas); combined (endonasal plus transcranial) approaches.

Information sources Electronic bibliographic databases: MEDLINE and SCOPUS. Supplementary source: hand-searching of the reference lists of all included articles to identify additional eligible studies.

Main outcome(s) Extent of resection, graded as gross-total resection (GTR), near-total resection (NTR), subtotal resection (STR) or partial resection (PR); and postoperative complications, specifically cerebrospinal fluid (CSF) leak, meningitis, and new-onset cranial nerve deficits. Outcomes are expressed as pooled descriptive proportions, using only patients with available data as the denominator for each variable. Extent of resection, graded as gross-total resection (GTR), near-total resection (NTR), subtotal resection (STR) or partial resection (PR); and postoperative complications, specifically cerebrospinal fluid (CSF) leak, meningitis, and new-onset cranial nerve deficits. Outcomes are expressed as pooled descriptive proportions, using only patients with available data as the denominator for each variable. Presenting symptoms; preoperative hydrocephalus; prior transcranial surgery or radiosurgery; symptom outcome at follow-up; tumour recurrence/progression; use of adjuvant radiotherapy/radiosurgery; and clinical status at last follow-up. Patient demographics (age, sex), tumour location

(clival vs petroclival) and tumour size were also extracted.

Additional outcome(s) Presenting symptoms; preoperative hydrocephalus; prior transcranial surgery or radiosurgery; symptom outcome at follow-up; tumour recurrence/progression; use of adjuvant radiotherapy/radiosurgery; and clinical status at last follow-up. Patient demographics (age, sex), tumour location (clival vs petroclival) and tumour size were also extracted.

Data management Data from the included studies were extracted into a purpose-built spreadsheet database. Extracted variables included first author, publication year, country, age, sex, side, size, presenting symptoms, type of approach, extent of resection, complications, symptom outcome, tumour recurrence/progression and clinical status at follow-up.

Quality assessment / Risk of bias analysis No formal risk-of-bias or quality-assessment tool was applied, given that the included evidence consists predominantly of case reports and small retrospective case series for which validated risk-of-bias instruments are of limited applicability. The methodological limitations and heterogeneity of the included studies are addressed narratively in the discussion.

Strategy of data synthesis A narrative and descriptive quantitative synthesis was planned. For each outcome, pooled descriptive proportions were calculated using only patients with available data as the denominator. Continuous variables (e.g., age) were summarised as weighted means with standard deviations and ranges. No formal meta-analysis was planned, given the anticipated heterogeneity and the predominance of case reports and small series. Reporting follows the PRISMA statement.

Subgroup analysis No formal subgroup analysis was planned. Where data permitted, outcomes were described separately by tumour location (purely clival vs petroclival) and tumour size category.

Sensitivity analysis No sensitivity analysis was planned, given the descriptive nature of the synthesis and the characteristics of the included evidence.

Language restriction Yes — the search was restricted to English-language publications.

Country(ies) involved Italy.

Keywords meningioma; clivus; petroclival; endoscopic endonasal approach; transclival; skull base.

Dissemination plans The findings will be disseminated through publication in a peer-reviewed neurosurgical journal.

Contributions of each author

Author 1 - Alessandro Carretta - - Conceived and designed the study;

- Defined the review question and eligibility criteria;
- Supervised study selection and data extraction;
- Interpreted the pooled data;.

Email: alessandro.carretta2@unibo.it

Author 2 - Alessandra Eleuteri - - Performed literature search;

- Independently screened titles/abstracts and full texts;

- Extracted and analyzed the data;

- Resolved discrepancies by consensus;

- Contributed to interpretation of the results and to manuscript revision.

Email: alessandra.eleuteri2@studio.unibo.it

Author 3 - Marcello Magnani - - Performed literature search;

- Independently screened titles/abstracts and full texts;

- Extracted and analyzed the data;

- Resolved discrepancies by consensus;

- Performed literature search;

- Independently screened titles/abstracts and full texts;

- Extracted the.

Email: marcello.magnani3@studio.unibo.it

Author 4 - Matteo Zoli - - Conceived and designed the study;

- Supervised study selection and data extraction;.

Email: matteo.zoli4@unibo.it

Author 5 - Diego Mazzatenta - - Conceived and designed the study;

- Conceived and designed the study;.

Email: diego.mazzatenta@unibo.it