Safety and feasibility of the endoscopic endonasal approach to anterior skull base tumour resections in young children

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Dear Editor:

Tumours of the anterior skull base present unique surgical challenges due to critical neurovascular proximity and developing cranial anatomy. While open transcranial approaches (TCAs) have traditionally been used for these tumors, the endoscopic endonasal approach (EEA) is preferred due to reduced morbidity and higher gross total resection (GTR) rates [(1)]. Studies report excellent GTR rates and reconstructive outcomes with EEA in the under-18 paediatric population, with complications including cerebrospinal fluid (CSF) leak, meningitis, and stroke being relatively rare [(2-5)]. However, limitations in anatomy, including restricted sphenoid pneumatization, narrower nasal apertures, and smaller nasoseptal flaps (NSFs), contribute to hesitancy in adopting EEA for younger patients [(6,7)]. Minimal evidence focuses on outcomes in young pediatric patients in particular. This study evaluates outcomes of EEAs for anterior skull base pathologies in young paediatric patients.

We conducted a retrospective review of patients under 8 years who underwent an EEA for anterior skull base tumour resection between 2013 and 2023. Only patients undergoing definitive surgical treatment with intent for GTR were included. At our institution, all craniopharyngioma patients undergo EEA as the primary approach. TCAs are reserved for purely intraventricular tumours or those with lateral extension into the middle cranial fossa to minimise vascular injury risk. For all paediatric patients undergoing EEA, we perform bilateral maxillary antrostomies and ethmoidectomies to provide landmarks and maximise our endonasal working corridor. An NSF is raised if anticipated for reconstruction.

Patient characteristics are summarised in Table S1. Of 16 patients, craniopharyngioma was the most common pathology (81.3%), followed by chordoma (12.5%) and dermoid cyst (6.3%). Surgical outcomes are summarised in Table 1. Intraoperative CSF leaks occurred in 15 patients (93.8%), 14 of whom underwent skull base reconstruction with a vascularised NSF and fat and tensor fascia lata grafts. One did not have an available flap due to prior surgery and radiation, so a free mucosal graft was used instead. GTR was achieved in 11 cases (68.8%). Complications included a postoperative CSF leak with meningitis (6.3%), a hyponatremic seizure (6.3%), and a 13 mm thalamic perforator infarct (6.3%). One patient developed a cranial nerve III palsy (6.3%) which improved over long-term follow-up. No surgical interventions were required for sinusitis. One patient with aggressive chordoma required further treatment and died within a year.

Previous evidence supports the safety and efficacy of the EEA for anterior skull base tumours in paediatric patients under 18, showing higher GTR rates than TCAs and successful skull base reconstructions using vascularised NSFs [(2-4)]. However, data focused on younger paediatric patients, with limited anatomy, remains minimal. In our study of 16 patients under 8 years old, our GTR rate of 68.8% aligns with rates in broader paediatric EEA studies. For instance, Elliott et al.'s meta-analysis reported a 72.1% GTR rate for craniopharyngiomas in patients under 21 [(8)]. Furthermore, our GTR rate surpasses those reported for TCAs, which achieve 52.2% in paediatric craniopharyngioma cases [(9)].

Postoperative complications in our cohort, including 6.3% rates of CSF leak, meningitis, seizure, and stroke, compare favourably to broader paediatric EEA studies. Reported rates in older groups include 2-18.8% for CSF leaks, 6.3-12% for meningitis, and 2-6.3% for strokes [(2,5)]. Moreover, NSFs were accomplished for 93.8% of skull base reconstructions in our cohort, with a low postoperative CSF leak rate of 6.3%, demonstrating their feasibility in younger children [(7)].

Table 1. Operative and postoperative outcomes.

Variable	n = 16 patients
Extent of resection	
Gross Total	11 (68.8)
Subtotal	5 (31.3)
Intraoperative CSF Leak	15 (93.8)
Postoperative Complications	3 (18.8)
Postoperative CSF Leak	1 (6.3)
Seizure	1 (6.3)
Stroke	1 (6.3)
Meningitis	1 (6.3)
New Postoperative CN Deficits	1 (6.3)
EVD Placement	
Prior to Surgery	5 (31.3)
At time of Surgery	4 (25.0)
After Surgery	0 (0)
Length of Hospital Stay (days), median (IQR)	15.1 (4.5-18.0)
Length of ICU Stay (days), median (IQR)	5.5 (3.5-9.0)
Time to Follow-Up (months), median (IQR)	4.0 (2.5-22.7)
Death	1 (6.3)

All data reported as number of patients (%) unless stated otherwise. CN = cranial nerve; CSF = cerebrospinal fluid; EVD = external ventricular drain; ICU = intensive care unit; IQR = interquartile range.

Conclusion

Although limited by its single-institution, retrospective design and small sample size, our study suggests EEA is a safe and viable option for young paediatric patients. Further studies with larger cohorts are needed to bolster these findings and clarify comparisons between EEA and TCA for complex tumours in this population.

Authorship contribution

MC: data acquisition, data analysis and interpretation, drafting the article. DKL: study design, data interpretation, revising drafts of the article. SAH: data acquisition and analysis. All authors contributed to final revisions and approval.

Conflict of interest

The authors declare that there are no conflicts of interests regarding the publication of this paper.

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Abbreviations

BMI = body mass index; CN = cranial nerve; CSF = cerebrospinal fluid; EEA = endoscopic endonasal approach; EVD = external ventricular drain; ICU = intensive care unit; IQR = interquartile range; GTR = gross total resection; NSF = nasoseptal flap; SD = standard deviation; TCA = transcranial approach.

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This manuscript contains online supplementary material

SUPPLEMENTARY MATERIAL

Methods

Institutional review board approval was obtained for this study. A retrospective chart review of all endoscopic endonasal anterior skull base tumour resections in patients under the age of 8 at our institution from July 2013 through October 2023 was performed. We selected an age cut-off of under 8 years old for this study because this was the mean patient age in our previous review of outcomes for endoscopic paediatric craniopharyngioma resection [(1)]. Only cases with intent for gross total resection were included. All surgeries were performed by a multidisciplinary team consisting of both a rhinologist and a paediatric neurosurgeon. The electronic medical record was reviewed to collect data on variables including patient demographics, presenting signs and symptoms, body mass index (BMI), extent of surgical resection, pathology, method of skull base reconstruction, postoperative complications, adjuvant therapies, and morbidity. Postoperative complications were defined as postoperative CSF leak, seizure, stroke, or meningitis. Statistical analysis was performed using SPSS 29 (IBM, Armonk, NY, USA).

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Table S1. Patient demographics and preoperative characteristics.

Variable	n = 16 patients
Sex	
Male	8 (50.0)
Female	8 (50.0)
Age, yrs, mean ± SD (range)	4.8 ± 1.9 (1.8-7.9)
BMI at time of presentation, mean ± SD (range)	16.5 ± 4.0 (12.6-28.8)
Pathology	
Craniopharyngioma	13 (81.3)
Chordoma	2 (12.5)
Dermoid Cyst	1 (6.3)
Obstructive Hydrocephalus	7 (43.8)
Preoperative CN Deficits	10 (62.5)
Cavernous Extension	5 (31.3)
Suprasellar Extension	16 (100)

All data reported as number of patients (%) unless stated otherwise. BMI = body mass index; CN = cranial nerve; SD = standard deviation.