A quarter-century of pediatric craniopharyngioma surgery: Insights from a single center in Madrid.

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Introduction

Pediatric craniopharyngiomas (***Figure 1***) correspond to the adamantinomatous type, and their presentation is usually dominated by visual field disturbances, intracranial hypertension, hormonal deficits, and severe symptoms. They are typically complex tumors that frequently involve some degree of hypothalamic dysfunction. This series aimed to describe surgical trends regarding approach, technique, and use of radiotherapy in a large pediatric cohort from a single center. We sought to provide a real-world perspective on the management and outcomes of craniopharyngiomas over the past two decades in our institution.

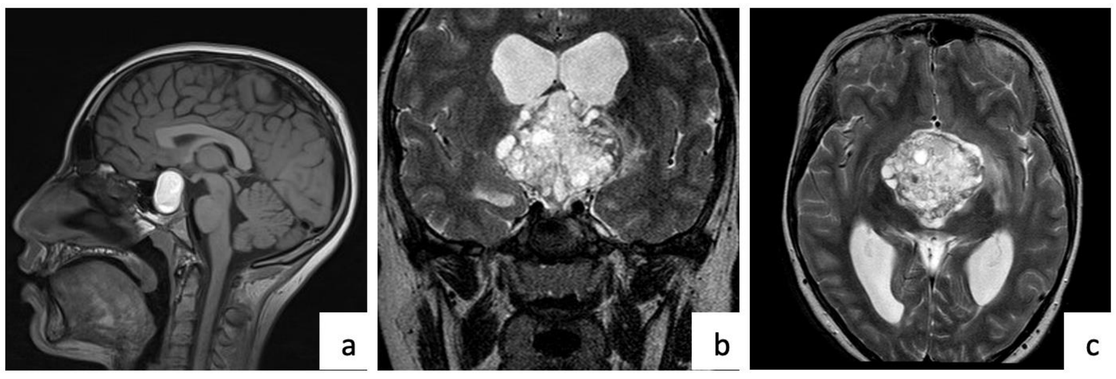


Figure 1. Representative magnetic resonance imaging (MRI) examples illustrating surgical approach selection. **(a)** Sagittal contrast-enhanced MRI demonstrating a sellar craniopharyngioma treated via an endoscopic endonasal approach. **(b, c)** Coronal and axial MRI views of a mixed solid–cystic craniopharyngioma managed using a transcranial approach.

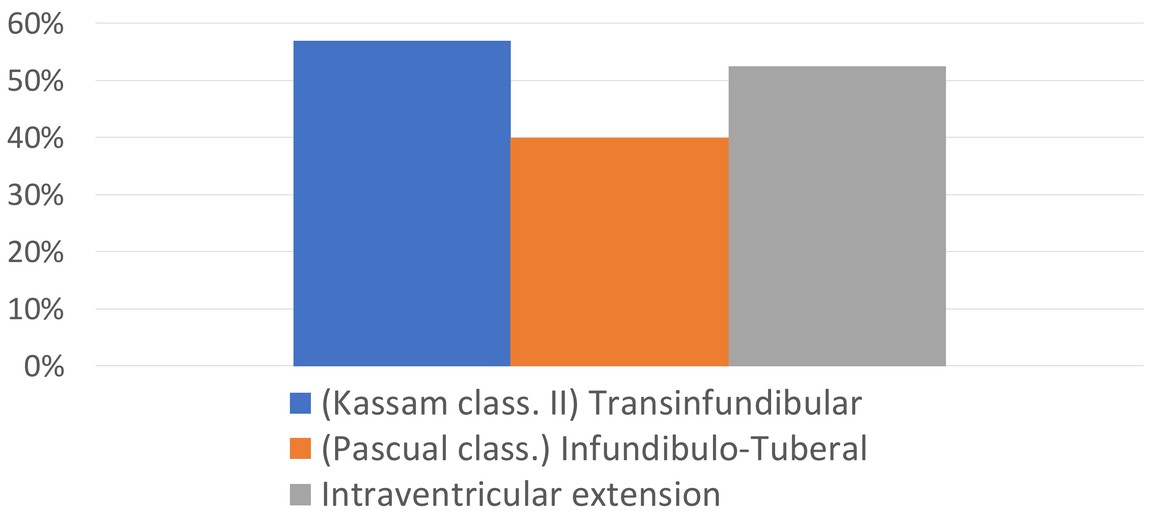
Methods and Materials

All pediatric patients (<18 years) operated at our institution between 1999 and 2025, with available clinical records and confirmed histopathological diagnosis of craniopharyngioma, were included. A descriptive study was conducted, analyzing epidemiological data, surgical management, and radiotherapy use.

Table 1. Clinic-radiological characteristics at presentation

Item	Measure
Tumor volume (cc)	median 14.8 *(2 -145)*
Consistency: solid	9.5%
Consistency: cystic	66.7%
Consistency: mixed	28.6%
Hydrocephalus	38.1%
Hormonal disturbances	80%
Visual symptoms	63.6%
Other symptoms	31.6%

Figure 2. Hypothalamic involvement



Results

A total of 23 patients with craniopharyngioma were included, with a median age at first surgery of 6.9 years (mean 8.3 years). The mean follow-up duration was 11 years and 7 months, and the mean number of surgeries per patient was 2.3 (range, 1–8). The three main treatments were open craniotomy (67%), endoscopic approach (27%), and Ommaya reservoir placement for cyst evacuation (6%). Radiotherapy was used in 61.9% of cases, with the last six patients undergoing proton beam therapy. Notably, 71% of endoscopic endonasal approaches were performed after 2015 (***Figure 4***). A ventriculoperitoneal shunt was required in 9.5%. Postoperative permanent diabetes insipidus occurred in 85% (prior to surgery in 50%) and pituitary dysfunction affecting at least one hormonal axis in 95% (similar to presurgical condition). According to Kassam's classification, 57% were transinfundibular type, while at least 40% were infundibulo-tuberal according to Pascual's classification. Intraventricular extension was present in 52.4% (***Figure 2***).

Figure 3. Kaplan–Meier curves of progression-free survival to first recurrence stratified by treatment strategy (GTR vs STR vs STR+SRS).

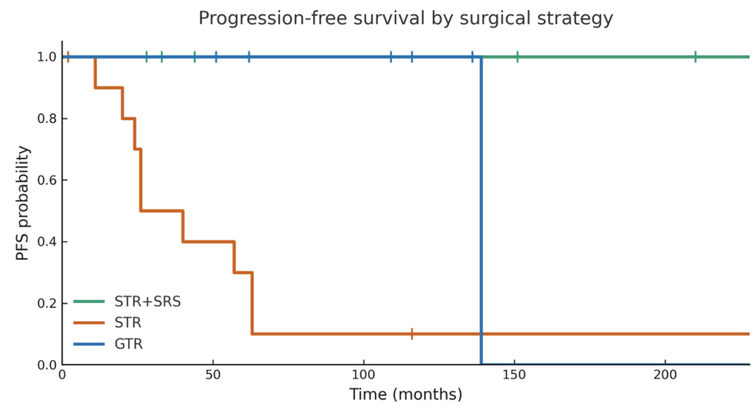
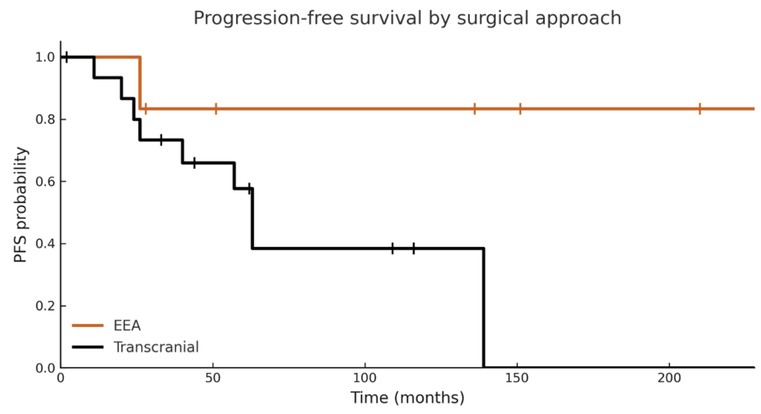


Figure 4. Kaplan–Meier curves of progression-free survival to first recurrence across surgical approaches (EEA vs TCA).



Discussion

The surgical approach was determined by tumor biology, size, and anatomy (taking into account hypothalamic and III ventricle involvement, ***Figure 2, Figure 3***) rather than surgeon preference. Transcranial surgery was essential for large, intraventricular, or high-pressure tumors, whereas the endonasal route was reserved for more favorable ventral lesions. GTR was pursued when safely feasible, but in cases of hypothalamic invasion, functional preservation through subtotal resection and radiotherapy was prioritized ***(Figure 3)***.

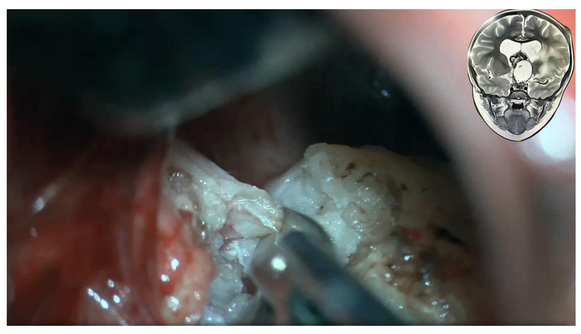


Figure 1. Transcranial approach and microsurgical resection of a giant CP (*8 y.o*).

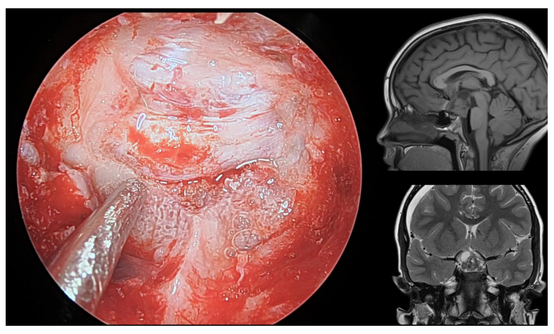


Figure 2. Endoscopic endonasal approach in a 7 y.o. boy.

Conclusions

This large pediatric series adds to the current literature, highlighting trends over the last two decades. There is a clear shift toward hypothalamic preservation during surgery, often leading to subtotal resection followed by radiotherapy. A progressive increase in the use of endoscopic approaches and non-resective strategies, such as Ommaya reservoir placement, has also been observed in recent years. Increasing use of proton beam as the favorite radiotherapy modality was noticed.

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