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Sellar and parasellar lesions – Clinical outcome in 61 children

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ABSTRACT

Objective: To evaluate clinical outcome in a 10-year consecutive series of children operated for sellar and parasellar tumors with special focus on neuropsychology and endocrinology.
Patients and methods: We analyzed 61 children (30 female) under 18 years of age (mean age 9.9, range 1 month–17 years) operated between 2000 and 2010. Medical records were evaluated retrospectively; postoperative histologic diagnoses included 20 craniopharyngiomas, 17 gliomas, 6 pituitary adenomas and 18 rare tumor entities.
Results: Of 61 patients, 58 (95%) were still alive at last follow-up. Three patients died, all due to progression of malignant rhabdoid tumors. Postoperative clinical morbidity consisted of endocrinological (66%), visual (60.7%) and other neurological deficits (55.9%) after a mean follow-up of 44 months. When compared to all other tumor entities in this series, craniopharyngiomas were associated with high rates of gross-total resection ($p = 0.008$), frequent progression of residual tumor ($p = 0.005$) scotomas ($p = 0.013$), persistent diabetes insipidus ($p < 0.001$), and panhypopituitarism ($p < 0.001$). Surgically treated gliomas showed higher rates of motor weakness ($p = 0.004$), double vision ($p < 0.001$), and milder forms of endocrinopathy (single hormone deficits, $p = 0.02$). In general, deterioration in school performance was associated with multiple surgeries ($p = 0.018$) and radiotherapy ($p = 0.021$).
Conclusion: Excellent overall survival in these patients is possible, however malignant rhabdoid tumors have a poor prognosis. Aggressive treatment is associated with significant morbidity. Children operated for craniopharyngioma showed an expected high rate of endocrine deterioration, whereas glioma patients had higher incidences of motor weakness and double vision. The treating physicians should be well aware of all these considerable postoperative deficits, especially when facing interdisciplinary management decisions, and for the informed consent discussions with the patient and the parents.

1. Introduction

Due to its complex anatomy, surgery of the sellar and especially parasellar region is challenging especially in the pediatric population. The surgical interference with the developing anterior cranial base, the unique age-dependent anatomy in children and the undeveloped venous sinuses as well as their small size is a challenge for pediatric oncologic neurosurgeons [1–4].

Numerous tumor entities arise in the sellar and parasellar region with craniopharyngiomas, gliomas of the optico-hypothalamic region, and pituitary adenomas being the most frequent ones treated by the neurosurgeon. Other tumor entities in this location such as germinomas are underrepresented in this study for neurosurgical radical resection is not the treatment of choice in these lesions.

Craniopharyngioma accounts for 5.6–15% of all intracranial tumors in children and it is the most frequent entity of the hypothalamopituitary region [5]. Approximately 3% of all pediatric brain tumors are pituitary adenomas. Of all pituitary adenomas, only 3.5–8.5% are diagnosed before the age of twenty [6,7]. The vast majority of pediatric pituitary adenomas are hormonally active. Prolactinomas represent the most frequent entity – their management is primarily medical treatment [8]. Low-grade gliomas including pilocytic astrocytomas (WHO grade 1) and fibrillary astrocytomas (WHO grade 2) are the most frequent primary brain tumors in pediatrics and make up for 18% of all brain tumors in children [6]. The most commonly regions affected by low

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grade gliomas are the cerebellum (12–18%), the cerebral hemispheres (8–20%), the hypothalamic/optic pathway (3–5%), brain stem (3–6%), and thalamus [9].

Rosemberg et al. found in a series of 1058 pediatric brain tumors, that 19% are located in the sellar region (57.7% craniopharyngiomas, 29.8% pituitary adenomas, 5.5% germinomas and 6.9% others), 4.3% are located in the hypothalamo-optic pathways (89.1% pilocytic astrocytomas, and 10% ganglionar hypothalamic hamartomas) [6]. Although tumors of the sellar and parasellar region are mostly benign, the proximity to the optic pathway, hypothalamus, and the pituitary gland accounts for the high morbidity [10–14].

Several treatment and study protocols for frequent tumors are available – for example the SIOP-LGG 2004 protocol for low-grade gliomas in children and adolescents [15] or the KRANIOPHARYNGEOM 2007 protocol for craniopharyngiomas (www.kraniopharyngeom.net/). For all, it appears tempting to follow the treatment arm of complete tumor resection as no further treatment for the child would be necessary. Clinical management including the goals of surgery are usually discussed in a multidisciplinary fashion.

With regards to craniopharyngiomas, studies on patients radically treated at our center have been published previously. Yasargil et al. described a "pure surgical series" (no postoperative radiotherapy) of 144 patients (31 children, 1967–1989), [16] and Poretti et al. described a primary surgical series on 25 children (1980–2002) with a focus on long-term outcome especially and quality of life assessment [17].

The aim of this current study is to present the clinical outcome of children with sellar and parasellar lesions (not only craniopharyngiomas), with a focus on endocrinological and neuropsychological aspects.

2. Patients and methods

Between January 2000 and December 2010, 61 consecutive patients (30 girls and 31 boys) diagnosed with lesions of the sellar and parasellar region underwent surgery at the Department of Neurosurgery of the University Hospital of Zurich, Switzerland. Mean age at the time of surgery was 9 years and 11 months (SD 4.8 years, range 1 month–17 years). The procedures were performed by four different surgeons – their policy of resection was extensive in almost all cases. For one patient, long-term clinical data is missing due to death of a progressive malignant rhabdoid tumor only 3.5 months after initial surgery at the age of 6 months. Three patients were lost to follow up due to going abroad – we suspect that one of them, a patient with the rare case of histologically malignant craniopharyngioma may have deceased meanwhile. Medical records were reviewed retrospectively and operative notes were analyzed to assess treatment modality including surgical approach and intraoperative complications. Mean follow-up of all patients after surgery was 3 years and 8 months (SD 3 years and one month; range 1.5 months–10.8 years).

Approval to perform the study and to link study data to clinical data has been obtained from the Institutional Review Board.

All statistics were performed using commercially available software, SPSS (Version 19, IBM Company, USA). Hypothesis testing using categorical data was done using the Chi-squared test and Fisher's exact test, where appropriate. Two-tailed p values < 0.05 were considered statistically significant.

3. Results

Postoperative histological diagnoses included 20 craniopharyngiomas (32.8%), 17 gliomas (27.9%), 6 pituitary adenomas (9.8%) and 18 rare tumor entities (29.5%) (Table 1). Surgical approaches included 46 frontal craniotomies (75.4%) and 15 transsphenoidal approaches (24.6%), 26 patients had multiple surgeries (42.6%), ranging from 2 to 5 sessions.

Table 1
Frequency of tumor entities.

Type of tumor	Frequency	Percentage (%)
Craniopharyngioma	20	32.8
Gliomas	17	27.9
- Pilocytic astrocytoma	10	
- Pilomyxoid astrocytoma	1	
- Optic nerve glioma	3	
- Ganglioglioma	2	
- Low grade glioma WHO 2	1	
Pituitary adenoma	6	9.8
- ACTH-producing pituitary-microadenoma	3	
- GH-producing pituitary adenoma	1	
- Prolactinoma	2	
Rare lesions	18	29.5
- Arachnoid cyst	1	
- Atypical meningeoma	2	
- Cavernous hemangioma	1	
- Embryonal rhabdomyosarcoma	2	
- Epidermoid	1	
- Ewing sarcoma	1	
- Glioneuronal heterotopia	1	
- Juvenile trabecular ossifying fibroma	2	
- Meningeoma (NF type 2)	1	
- Osteoblastoma	1	
- Papillary rhabdoid meningeoma	1	
- Rathke's cyst	2	
- Teratoma	2	

Gross-total resection (GTR; 100% tumor removal as judged by early postoperative imaging) was intended in most cases and achieved in 25 cases (41%). In 13 patients we observed residual tumor growth after partial resection (36.1%) whereas in 7 cases recurrence after GTR was seen (28.0%) – this difference was not statistically significant (Chi-square test, $p = 0.507$). As for craniopharyngiomas, GTR was achieved in 13 of 20 cases (65%) – this is more common as compared to all other tumor entities (GTR 12/41, 29.3%) (Chi-square test, $p = 0.008$). Only the small subgroup of pituitary adenomas showed a higher GTR rate (6/8, 75%). Within the group of partially resected craniopharyngiomas, residual tumor growth was more frequent (6/7, 85.7%) than in all other tumor entities (7/29, 24.1%) (Fischer's exact test, $p = 0.005$).

Following surgery, 12 children (6 craniopharyngioma, 1 glioma, 5 rare tumors) underwent radiotherapy (19.7%), 5 (all gliomas) received chemotherapy (8.2%) and 4 patients (2 gliomas, 2 rare tumors) had combined radio-chemotherapy (6.6%).

Intraoperative complications included 9 cases of acute central diabetes insipidus (14.8%), 8 cases of hemorrhagic complications (13.1%) with one patient being hemodynamically unstable and one case with transient anisocoria due to oculomotor nerve irritation.

Postoperative complications included 4 cases of hydrocephalus malresorptivus (6.6%, two were treated with a shunt), 10 cases of CSF-leaks (16.4%) – 7 were treated with a lumbar drainage, and 6 children developed meningitis (9.8%). The relationship between CSF-leaks and meningitis is shown in Table 2.

3.1. Neurologic outcome

Postoperative neurological complications included 7 transient postoperative seizures (11.7%), 4 children with permanent seizures