Outcome of Surgical Resection of Craniopharyngioma: Single Center 12 Years' Experience

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ABSTRACT

Background

Craniopharyngiomas (CPs) are rare epithelial tumors arising from the Rathke's pouch remnant located along the path of the craniopharyngeal duct accounting for 1.2-4% of all primary intracranial brain tumors, the primary treatment of which is surgery.

Objective

Whether radical surgical resection or partial resection followed by radiotherapy is a topic of debate. We presented our 12 years single center experience on surgical resection of craniopharyngioma.

Method

This was a descriptive cross-sectional study conducted among forty-five patients who underwent transcranial resection of craniopharyngioma during a period of 12 years. Data were collected from medical record archives. Glassgow outcome score (GOS), electrolyte imbalance and visual complications were assessed as outcome measure. GOS > 3 was considered favorable while score ≤ 3 was considered unfavorable. Recurrence of tumors were analyzed.

Result

Out of 45 patients, 28 patients were male with male to female ration of 1.64. Mean age was 32.22±16.42 years. Supra-sellar craniopharyngioma were the most common location. Gross total resection was accomplished in 32 patients (71.1%) while subtotal resection among 13 patients (28.9%). Post-operative Diabetes Insipidus was developed among 35 patients (77.7%). Adamantinomatous craniopharyngioma was the most common histopathological type. Postoperative MRI with contrast was repeated to ascertain the completeness of resection. All patient with subtotal resection received radiotherapy. Follow up period ranged from 3 months to 8 years with mean of 4.2 years. Favorable outcome (GOS>3) was seen among 41 patients while unfavorable among 4 patients. Recurrence seen among 4 patients (8.9%). Overall mortality was 4 (8.8%).

Conclusion

Gross total excision of craniopharyngioma has a favorable outcome with acceptable morbidity.

KEY WORDS

Adamantinomatous, Craniopharyngioma, Pterional craniotomy, Radiation therapy

INTRODUCTION

Craniopharyngiomas (CPs) are rare epithelial tumors arising from the Rathke's pouch remnant located along the path of the craniopharyngeal duct.[1] They account for 1.2-4% of all primary intracranial neoplasms and 5-10% of all intracranial tumors in children.[2] CPs have bimodal age distribution with peaks occurring between 5 to 15 and 45 to 60 years.[3] CPs have two histological variants. Adamantinomatous craniopharyngioma (ADC) subtype is more common in the children while papillary subtype is more common among older age group.[4] The primary treatment option for CP is surgery.[5] Optimal treatment of patients with CP remain controversial with swing of pendulum between gross total resection (GTR) and subtotal resection (STR). Radical therapy is the therapy of choice at any age as it is associated with the best outcome in term of survival.[6-8] Because of aggressive nature of this benign tumor, radical surgery can also carry significant morbidity, in term of visual disturbances, hypothalamic insufficiencies, endocrine disturbances and poor quality of life.[4,8] Even with gross total resection with negative post-operative imaging, there is tendency for recurrence which has shifted the paradigm toward less aggressive surgical treatment followed by radiation therapy.

We reviewed our medical record archives and analyzed the outcome of surgical cases operated. This study aimed to assess result of surgical resection of craniopharyngioma.

METHODS

This is a descriptive cross-sectional study conducted in Upendra Devkota Memorial National institute of Neurological and allied Sciences, Bansbari, Kathmandu Nepal. Forty-five patients who underwent transcranial surgical resection of craniopharyngioma from August 2007 to August 2018 in this center were included. Operations were performed via transcranial pterional route by late Professor Upendra Prasad Devkota. Patients with sellar/suprasellar cyst who underwent reservoir placement were excluded. Preoperative imaging with contrast enhanced MRI and hormonal profile were done. Patients were operated under general anesthesia in supine position. Standard pterional craniotomy done and tumor excised from skull base corridor. Intra operative decision of extent of resection was judiciously individualized. Attempt of GTR was made if possible. Subtotal resection was considered if hypothalamus was involved by tumor, adherence to vascular structure or hard consistency of tumor due to calcification. Post-operative contrast imaging (MRI or CT) was repeated in each patient to ascertain the completeness of resection. All patient with subtotal resection received radiotherapy. Outcome of the patients were recorded. Patients were followed regularly after discharge in an outpatient department. Biannual contrast enhanced MRI was done to rule out recurrence or rule out cause of new symptoms if any.

Ethical Clearance was taken from Institutional review committee (IRC) of Upendra Devkota Memorial National Institute of Neurological and Allied Sciences, Bansbari, Kathmandu, Nepal.

Data were retrieved from medical record archives. Variables considered were demography, clinical presentation, hormone profile, extent of resection, histopathological diagnosis and postoperative complications. Glasgow outcome score (GOS), visual symptoms and electrolyte imbalance were assessed as outcome measures. GOS > 3 was considered favorable while score GOS ≤3 was considered unfavorable. Recurrence of tumor was analyzed.

Data entry was completed in patient proforma sheet. Telephone enquiry was made when necessary. Data analysis was done with IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corporation. Proportion and Mean were deduced for categorical data and continuous variables respectively.

RESULTS

During 12 years period from August 2007 to August 2018, 45 patients were operated. Twenty-eight patients (62.2%) were male and 17 patients were female (37.8%) with male to female ration of 1.64. Mean age was 32.22±16.42 (fig. 1). Bimodal peak was observed at 10-20 years and 51-60 years group. Headache was predominant presenting feature in 33 (73.3%) patients followed by visual symptoms in 33 patients (73.3%). Hormonal dysfunction was observed in 16 (35.5%) patients. Symptoms duration ranged from one month to 5 years (Table 1).

Table 1. Demographic and clinical profile

Variables	Total (n=45) %
Age in years	
≤ 20	12 (26.6%)
> 20	33 (73.4%)
Sex	
Female	17(38%)
Male	28(62%)
Symptomatology	
Visual problem	31 (68.8%)
Headache	33 (73.3%)
Hormonal dysfunction	16 (35.5%)

Supra-sellar craniopharyngioma were the most common location, 33 (73.5%) while 5 were purely sellar (11%) and 4 were purely intraventriular accounting 9% with few occurrences in pre-chiasmatic and retro-chiasmatic location (fig. 2).

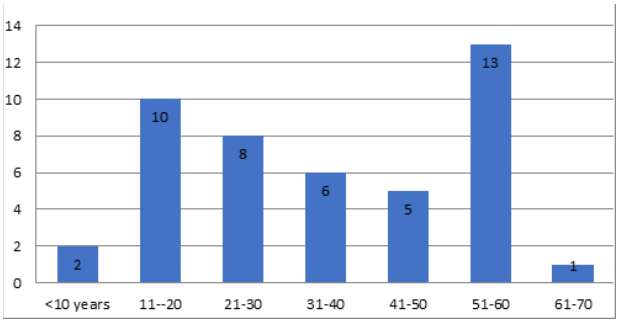

Figure 1. Age distribution of patients in years

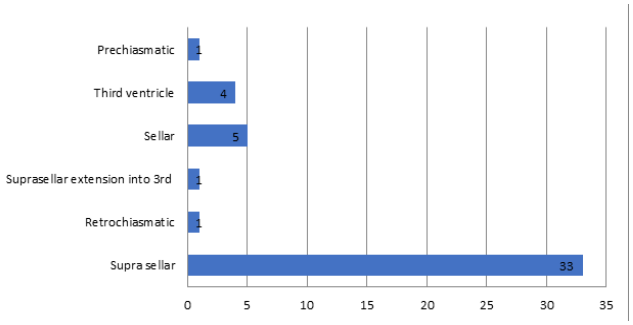

Figure 2. Location of craniopharyngiomas

Decision as to the degree of resection was made intraoperatively considering the relationship of tumor with surrounding neurovascular structures including hypothalamus and also the degree of calcification. Gross total resection was accomplished in 32 patients (72%) while subtotal resection among 13 patients (28%) (Table 2).

Table 2. Result showing extent of resection and histopathology

Variables	Total (n=45) %
Extent of surgical resection	
Gross total resection	32 (71.1%)
Subtotal resection followed by XRT	13 (28.9%)
Histopathological report	
Adamantinomatous	40 (89%)
Papillary	3 (7%)
Hybrid	2 (4%)

MRI with contrast was repeated post-operatively within the next 48 hours to ascertain the completeness of resection. Adjuvant radiotherapy was instituted only in cases of subtotal resection. Post-operative DI developed among 35 patients (77.7%), however none progressed to permanent DI. None of our patients had visual deterioration if not better than preoperative status (Table 3)

ADC was the most common histopathological type in our study. Forty patients (89%) belonged to this type while only 3 (7%) cases were papillary variant. Interestingly 2 (4%) patient had hybrid type of histology (Table 2) (fig. 4).

Patients followed up in neurosurgery OPD were assessed for GOS. Mean duration of follow up was of 4.2 years which ranged from 3 months to 8 years. Favorable outcome was seen among 41 patients (91.1%) while unfavorable among 4 patients (8.9%). Four patients (8.9%) had recurrence out of which, 3 were from gross total resection group versus one from subtotal resection group (Table 3).

Mortality in our study was 4 (8.8%). One died due to pontine myelinolysis resulting from severe hyponatremia in the postoperative period, other patient died due to remote cerebellar hemorrhage.[9] Other patient died at the verge of discharge due to pulmonary embolism from deep vein thrombosis of lower limb. Whereas other died at home after 3 months (Table 3).

Table 3. Outcome following surgical resection

Variables	Total (n=45) %
Visual Deterioration	None
Post Op DI	35 (77.7)
GOS:	
> 3	41 (91.1)
≤ 3	4(8.9)
Mortality:	
Operative	2 (4.4)
Delayed death	2 (4.4)
Overall	4 (8.8)
Recurrence	4 (8.8)

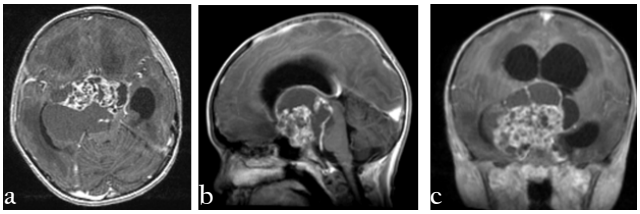

Figure 3. A. Contrast enhanced T1W axial section shows multilobulated solid cystic suprasellar mass with heterogeneous enhancement of anterior solid portion. Mass is encroaching into the third ventricle with dilatation of the temporal horns with CSF seepage. B. T1W contrast enhanced mid sagittal images showing mass displacing the mammillary body superiorly and lesion obstructing third ventricle causing hydrocephalus C. Contrast enhanced coronal images showing enhancing sellar/ suprasellar lesion with enhancement of the cyst wall.

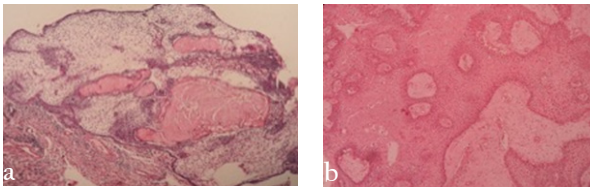

Figure 4. Types of histopathology of craniopharyngioma. A. Adamantinomatous type: multistratified epithelium with basal palisades and central loosening (stellate reticulum) and lobules of eosinophilic wet keratin seen under medium power (x100) B. Papillary type of craniopharyngioma: anastomosing lobules of non-keratinizing squamous epithelium punctuated regularly by fibrovascular cores seen under medium power (X100)

DISCUSSION

CPs are the rare embryonic epithelial benign tumor arising from Rathke's pouch remnants. It is locally aggressive benign tumor. Surgery of CP bears an anatomical challenge by virtue

of its relation to surrounding important neurovascular structure viz. visual apparatus, hypothalamus and circle of Willis, hence, carries increased surgical risk. Thus, optimal therapeutic management of craniopharyngioma is controversial. Whether radical surgical resection or partial resection followed by radiotherapy is a topic of debate.

Demography

This study included 45 histologically proven craniopharyngioma operated in a single center over the duration of 12 years. Among them 28 patients (62.2%) were male and 17 patients (37.8%) were female different to the systematic review of 377 patients done by Clark et al. which showed the distribution of female in 55% and male in 45%.[3] We observed wide distribution of CP among age groups, ranging from 7 years to 65 years. Mean age in our study was 32.22±16.42 with bimodal distribution among age group 11-20 years and 51-60 years. Similar observation was made by Hofmann et al. and Mortini et al. where the mean age was 35.1 and 33.3±1.8 years respectively.[10,11]

Clinical presentation

In our study, 33 patients presented with headache (73.3%) and 31 patients presented with visual symptoms (68.8%) similar to study done by Hoffman et al. in which headache (68%) was the most common symptoms followed by visual dysfunction (58%).[12] In this study duration of symptoms ranged from 1-month to 5 years, with a mean of 12.44±18.36 months. Hoffman et al. reported symptoms duration ranged from 2 weeks to 4 years with a mean of 37.8 weeks.[12] This wide difference in mean duration of symptoms at presentation could be due to poor access to the health facility owing to difficult geography and poor referral system of our country. A part of delay might be attributed to the subtle visual symptoms which go unnoticed by patients early in the course of disease. Preoperative hormonal dysfunction was observed in 16 patients (35.5%). Similar to the study done by KC et al. and Gardner et al. in which they found hormonal dysfunction among 10 patients (40%) and 5 patients (31.25%) respectively.[8,13]

Surgical resection

In this study, all tumors were removed via transcranial approach. Gross total resection was accomplished in 32 patients (72%) while subtotal resection among 13 patients (28%). Reason for subtotal resection was lack of plane of cleavage from hypothalamus, adherence to vascular structure and hard stone like consistency due to calcification. Variable extent of resection was claimed in past (Table 4). Our study was comparable to study done by Hoffman et al. and martini et al. while Yasargil et al. and Kim et al. claimed to have offered GTR among 90% and 100% of their patients respectively.[10,11,14,15]

Table 4. Comparison of our study with other studies.

Study	N	Post op CT/MRI	GTR (%)	STR (%)	PR (%)
Bishokarma et al.[9]	45	CT±MRI	71.1	28.8	0
Yasargil et al.[14]	144	CT±MRI	90	10	0
Kim et al.[15]	36	CT±MRI	100	0	0
Hofmann et al.[10]	73	MRI	83	6	11
Mortini et al.[11]	134	MRI	72	25.5	2.5

GTR: Gross total resection; STR: Subtotal Resection; PR: Partial Resection

Histopathology

ADC was the most common histopathological type in our study. Forty patients (89%) belonged to this type while 3 cases were papillary variant (7%). Interestingly 2 patients (4%) had hybrid type of histology. Similarly ADC was common (92.9%) subtype followed by papillary (7.1%) among 104 tumor as studied by Mortini et al.[11]

Post-operative complications

Thirt five patients (77.7%) developed DI post operatively and improved over few weeks and gradually weaned off Vasopressin. Fortunately, none progressed to permanent DI. Yasargil et al. observed DI among 90%.[14] While Hoffman et al. observed among 93% and Kim et al. observed among 94%.[12,15] In a study done by Zhang et al. among 202 patients with 39.6% GTR and 51.5% STR and 9.8% partial resection, incidence of DI was 81%.[16] We didn't see any significance difference in DI with extent of surgical resection. None of our patients had visual deterioration as reported by Maira et al.[17] Favorable outcome was seen among 41 patients (91.1%) with mortality among 4 (8.9%) in our study. In a study done by Zhang et al. had 5.4% major morbidity among 201 patients.[16] Yasargil et al. did a GTR among 112 patients had good results among 76.8% with 13.4% morbidity and 9.8% overall mortality.[14] Similarly, Hofmann et al. study revealed surgical mortality of 2% among 50 patients operated trans cranially.[12]

Recurrence

Tumor recurrence was seen in 4 patients (8.9%). Low figure of recurrence may be because of poor follow up system. Three patients recurred from gross total resection group while one was from STR with radiotherapy group. Recurrence among GTR group could be due to microscopic residual which gradually increases with time. Post-operative radiotherapy in this subgroup would have been beneficial. Kim et al. did GTR among 50 patients revealed 36% recurrence during a follow up period of 31.4 months while Mortini et al. revealed 24% recurrence among 134 patients operated for craniopharyngioma.[11,15]

However, this study bears the innate limitation of retrospective study. Due to drop out, not all patient could be followed for longer period. The response of treatment following adjuvant radiotherapy could not be followed up in all patients.

CONCLUSION

Among 45 patients, 32 underwent GTR of craniopharyngioma and 13 patients underwent STR and adjuvant radiotherapy. Perioperative complications like DI was seen in 77.7% patient. Favorable outcome was seen in 91.1% patients with operative moratility of 4.4% and overall operative mortality of 8.9%. Tumor recurrence was seen in 8.9%. We conclude favorable outcome following GTR of craniopharyngioma provided judicious intraoperative patients selection for degree of resection. Benefit of radiotherapy following GTR need to be explored by future prospective studies.

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