

Research Paper

Recurrence and Functional Outcome Following Resection of Craniopharyngioma



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ABSTRACT

Background and Aim: Craniopharyngiomas (CP) are histologically benign tumors of the sellar-suprasellar region and are associated with significant morbidity. Due to the lack of knowledge of the factors responsible for the recurrence of CP and the challenges in surgeries for recurrent CP studies, it is necessary to determine the predictive factors for CP patients for preoperative prognosis and also for proper planning of surgery for a better functional outcome. Using “primum non nocere” or “do no harm” rule, our study tries to find out the optimum surgical strategy to have a better functional outcome as well as to reduce recurrence.

Methods and Materials/Patients: This study is a 5-year retrospective analysis of the institutes of neuropathology database and clinical and radiological data with 12 months of follow-up in such patients

Results: Out of 72 patients, 33 were men and 39 were women with a mean age of 17.34 years. A total of 11 patients underwent gross total resection (GTR) and the rest 61 patients were operated by subtotal resection (STR) followed by radiotherapy (RT). The recurrence rate in GTR and STR+radiotherapy (RT) was 1% and 24%, respectively. Eighteen cases had a poor postoperative outcome with a mortality rate of 6.98. Postoperative visual loss, obesity, neurological deficit, and diabetes insipidus (DI) were more common in the GTR group, while postoperative endocrinal dysfunction was more common in the STR+RT group. Also, older age, preoperative vision loss, hypothalamus invasion, and GTR were associated with poor postoperative outcomes.

Conclusion: Patient-tailored resection should be performed for better functional outcomes with acceptable recurrence rates. Preoperative risk factor analysis helps to make proper surgical decisions regarding the extent of resection.

Keywords:

Craniopharyngioma (CP), Skull base, Functional outcome, Recurrence

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Highlights

- Our study showed that the recurrence rate following gross total resection (GTR) is 1% compared to subtotal resection (STR) and radiotherapy, which is 24%.
- However, the favorable postoperative outcome is that STR patients are significantly higher than GTR patients.
- But GTR causes significant neurological deficit, hormonal imbalance, visual loss, and morbidity.

Plain Language Summary

Due to the lack of clarity regarding the extent of surgical resection in craniopharyngioma (CP) patients, surgeons sometimes consider gross total resection (GTR) of tumors; although it benefits the patients with a lower recurrence rate, at the same time causes significant morbidity and mortality to the patient. This study tried to show that a patient-specific surgical resection compared to gross total tumor resection has the best functional outcome for patients with CP with an acceptable recurrence rate.

1. Introduction

Craniopharyngioma (CP) is a benign tumor of the sellar suprasellar region that is critical due to its intricate close relationship with nearby vital structures and poses a significant threat to visual, endocrine, and hypothalamus dysfunction. Although the primary goal of treatment is to eliminate the compressive effect of the tumor on nearby structures, it is still unclear whether a gross total resection (GTR) or subtotal resection (STR) with adjuvant therapy confers a better prognosis. The recurrence rate following GTR is 20.2%, which is comparable to the recurrence rate of 22.1% seen in STR followed by adjuvant therapy [1]. However, postoperative morbidity in the STR group was significantly better in the form of endocrine disturbances, visual dysfunction, and neurological deficit [1]. Different factors responsible for a higher recurrence rate of CP surgery and thereby contributing to increased morbidity in patients include male gender [2], older age (>30 years) [3], neuroimaging showing large tumor [3], neurovascular encasement [4], tumor calcification, histopathological examination (HPE) showing adamantomatous variety [5], high Ki67 index of tumor [6]. However, preoperative hydrocephalus [3] or presentation with seizure has not been found to have poorer outcomes in such patients.

2. Materials and Methods

This study was conducted to study the morbidity, mortality, and 12-month recurrence rate of CP at our institute. In the course, we also want to determine the

extent of safe resection (STR/GTR) in CP surgery with acceptable morbidity and short-term recurrence rate.

All patients presenting with CP at [North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences \(NEIGRIHMS\)](#) who met the inclusion criteria were included, and informed consent was obtained from all prospectively followed participants. Information about clinic -radiological presentation, hormonal status, visual charting, functional status, and extent of surgical resection is also obtained from hospital records/ departmental database/occupational therapy (OT) register and analyzed retrospectively. Treatment outcome and recurrence rate will be assessed at 0, 1-month, 6-month, and 12-month intervals using the Karnofsky performance scale (KPS). Radiological outcomes will be studied based on the comparison of preoperative and follow-up scans. Statistical analysis will be performed to determine any variables (age, sex, hypothalamus invasion, extent of resection, histopathological variant) related to better outcomes ([Figure 1](#) and [Figure 2](#)).

Inclusion criteria

The inclusion criteria included all CP-operated patients, an age group of 1-75 years, and willingness to provide informed consent.

Exclusion criteria

The exclusion criteria included patients operated elsewhere, patients <1 year and >75 years, and patients lost in follow-up.



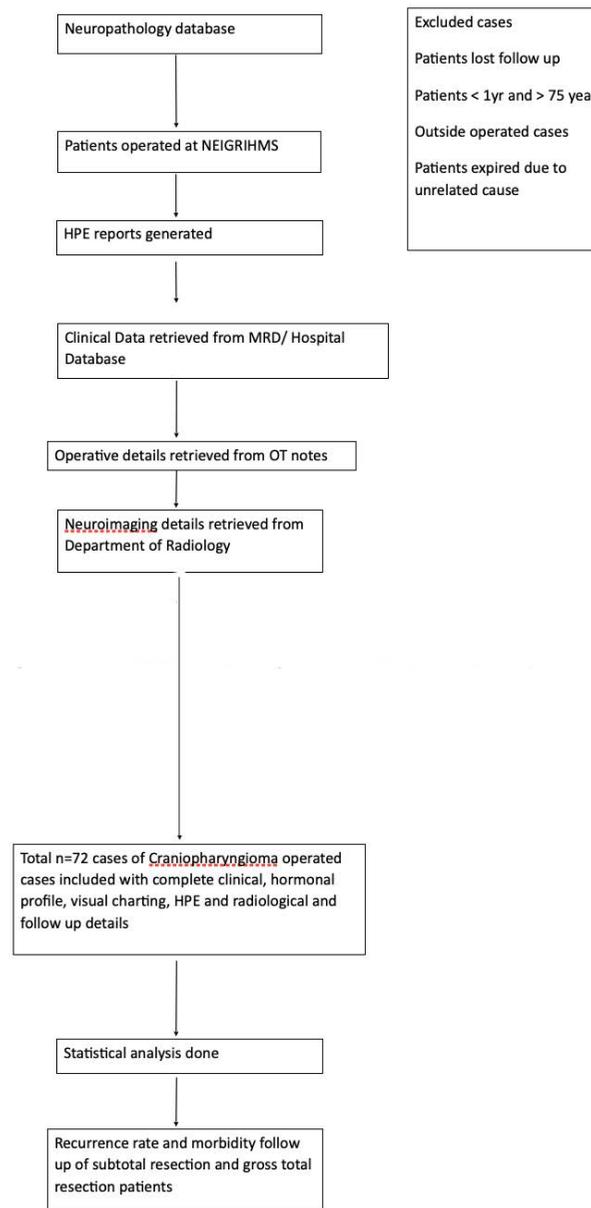


Figure 1. Methodology flow chart



3. Results

Seventy-two patients were operated at the institute between 2016 and 2021 and followed up till 2022. A total of 33 men and 39 women were in the age group of 4-45 years (mean 17.34 years). Vision loss was observed in 54 patients. Fifty-seven patients had endocrine abnormalities. Five cases of diabetes insipidus (DI) were present. Eight cases of postoperative neurological deficit were observed. Obesity was observed in 29 patients. Three cases presented with seizures (Table 1).

Based on HPE adamantomatous type was observed in 60 patients and papillary type in the rest of 12 cases. A total of 11 cases underwent GTR, while the rest 61 cases underwent STR. Eighteen cases had a Karnofsky performance scale (KPS) score of less than 80 at 1-year follow-up and 5 of them had expired. The recurrence rate following GTR is 1% (n=1), while CP recurred in 24% (n=15) in patients undergoing STR and adjuvant RT (Table 2).

4. Discussion

GTR was associated with a significantly low recurrence rate (1%) compared to STR+RT (24%). Recent studies





Figure 2. Contrast magnetic resonance imaging showing craniopharyngioma encasing left internal carotid



Table 1. Number of patients in GTR and subtotal resection+radiotherapy group (STR+RT) according to postoperative complications

| Complications | No. (%) | |
|-----------------------|---------|--------|
| | GTR | STR+RT |
| Vision loss | 9(82) | 45(73) |
| Endocrine dysfunction | 8(72) | 49(80) |
| DI | 5(45) | 0 |
| Neurological deficit | 6(54) | 2(3.2) |
| Obesity | 9(82) | 20(32) |

Abbreviations: GTR: Gross total resection; STR: Subtotal resection; RT: Radiotherapy; DI: Diabetes insipidus.



Table 2. Number of patients with favorable and unfavorable outcomes according to different independent variables

| Variables | Favorable Outcome (n=54) | Unfavorable Outcome (n=18) | P |
|-----------------------|--------------------------|----------------------------|-------|
| Hydrocephalus | 21 | 8 | 0.784 |
| Age (>30 y) | 0 | 9 | 0.001 |
| Sex | F=31 M=23 | F=8 M=10 | 0.416 |
| Hypothalamus invasion | 2 | 8 | 0.001 |
| Vision loss | 44 | 13 | 0.001 |
| Hormonal imbalance | 44 | 5 | 0.50 |
| HPE | A=44 P=10 | A=16 P=2 | 0.717 |
| Resection | STR=54 GTR=3 | STR=7 GTR=8 | 0.001 |
| Calcification | 16 | 10 | 804 |

Abbreviations: HPE: Histopathology examination; A: Adamantomatous; P: Papillary; GTR: Gross total resection; STR: Subtotal resection; F: Female; M: Male.



have found that the CP recurrence rate following GTR is as low as 0%-1% [7, 8]. If we compare the recurrence rate following STR+RT, our study shows a comparatively lower recurrence rate compared to 50%-100% in different studies [4, 9], which may be attributed to the short 1-year follow-up. However, as described in another study, a low recurrence rate following GTR comes at the cost of raising postoperative morbidity and mortality compared to STR+RT. The mortality rate in our study was 6.94, which is comparable to Western studies with a mortality rate between 2.88 and 9.28 [10]. In our study, most postoperative morbidity is due to endocrine abnormalities, such as panhypopituitarism and vision loss, which is similar to other studies, such as Clark et al and Park et al [11, 12]. Compared to other studies [13, 14], an increased rate of postoperative visual loss and endocrinopathies in the STR+RT group was shown. This may be attributed to the added complications following radiation therapy. A significant relationship was observed between older age, hypothalamus invasion, and GTR with unfavourable outcomes following surgery, which is consistent with other available studies in the literature [15, 16]. It was also found that preoperative vision loss is significantly associated with poor postoperative outcomes; although no direct association is reported between preoperative vision status and outcome of surgery. Several studies suggest that large tumor size >3 cm is associated with poor outcomes [16, 17].

5. Conclusion

Due to the lack of clarity regarding the extent of surgical resection of CP, significant morbidity is observed in the form of hypothalamic injury, hormonal imbalance requiring lifelong hormonal supplementation, visual deficit, infarction, and even death. Thus patient-specific tailored resection of CP is an urgent need for the patient to reduce morbidity and mortality due to tumor resection, but at the same time provides an acceptable recurrence rate.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Institutes Ethical Committee (IEC) of NEIGRIHMS Hospital (Code: NEIGR/IEC/M6/F11/2022 dated 13th, August 2022). Written informed consent was obtained from all patients.

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Authors' contributions

Conceptualization, study design and data collection: Tamajyoti Ghosh and Binoy Singh; Data analysis, data interpretation, writing original draft: Tamajyoti Ghosh; Critically revising the article: Aishik Mukherjee and Binoy Singh; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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