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Craniopharyngioma Removal Through Endoscopic Assisted Microscopic Surgery

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Abstract
One to three percent of all cerebral tumours are benign tumours called craniopharyngiomas, which come in two varieties: the childhood type, which affects children between the ages of 5 and 10, and the adult form, which affects patients between the ages of 50 and 60. The initial symptoms include visual, endocrine, hypothalamic, neurological, and neurophysiological manifestations, and they progress over time. The preferred course of action is surgery. Adjuvant therapies include included intra tumoral injection of chemotherapy medicines, gamma knife, and postoperative radiotherapy.In this study, we evaluated the role of endoscopy in assisting microscopic surgical removal of craniopharyngioma. Eleven patients underwent surgery. Using the subfrontal technique and a microscope, all procedures were carried out. After the procedure, the endoscope was used to look for any remaining tumour in the subchiasmatic and retrochiasmatic regions as well as to see the posterior portion of the tumour that the microscope couldn't see. This allowed the surgeon to determine whether the tumour was adherent to the hypothalamus and whether it should be removed.There were eleven instances in the study, four of which were craniopharyngiomas of the infancy variety and seven of the adult kind. In six cases, total removal was accomplished (five cases of adulthood type). In five patients, an oumaya reservoir was placed, while five other cases required a ventriculoperitoneal shunt. Only two of the individuals experienced persistent diabetes insipidus; the rest all experienced postoperative transient diabetes insipidus. Pituitary hypofunction was observed in three individuals before to surgery, and two more cases experienced postoperative pituitary hypofunction, both of which required hormone replacement therapy. Because of its connections to the optic nerve, hypothalamus, and vascular system produced by Willis circle and its perforating branches, the craniopharyngioma is one of the most complex and problematic tumours for neurosurgeons to treat. After the removal of the craniopharyngioma under the microscope, endoscopy plays a part in decision-making.

Keywords: *Craniopharyngiomas, Endoscopy, Microscopy, Surgery*

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I. Introduction

There are 1.3 craniopharyngiomas for every million person years. For craniopharyngioma, there are two age groups: childhood type and adult type [1]. It is a benign tumour, and despite being situated in a crucial region connected to the hypothalamus and neurovascular structures, every effort must be made to achieve thorough resection [2]. Subfrontal, interhemispheric, pterional, transcallosal transventricular, and transsphenoid approaches, as well as their various modifications, such as extended transsellar transdipharagmatic approach and transsphenoid transtuberculum sellae approach, have all been used for the resection of craniopharyngiomas. However, compared to transcranial procedures, the rate of cerebrospinal fluid leakage is much higher in transsphenoid than transcranial surgeries . The lateral growth of the tumour or the encircling of circulatory structures are the two factors that limit the transsphenoid approach [3] [4] [5]. Total excision of this tumour is challenging due to its intimate ties to the optic nerves, chiasm, and hypothalamus. The level of the hypothalamic-pituitary complex, the optic nerves, and the chiasm are typically where the anatomic challenges in

entire resection are encountered, where the resection may become limited. Unquestionably, microsurgery enhances the removal of the majority of the tumour; it has been claimed that in up to 75% of instances, entire resection is possible. The total resection rate has increased by almost 10% as a result of the addition of endoscopy to the microsurgical toolkit [1] [6]. For the treatment of craniopharyngiomas, a variety of techniques have been utilised, including surgery alone, surgery combined with the insertion of an oumya reservoir (if the cystic portion cannot be removed), surgery combined with radiotherapy, or surgery coupled with a gamma knife. Better outcomes in terms of the amount of resection and the quality of life have been attained because to technological advancements and the introduction of new equipment such endoscopes and neuro navigation [7].

Aim of the Work

We aim in this paper to study the possibility of achieving a higher rate of resection by using an additional instrument, the endoscope.

Clinical Illustration

Endocrine dysfunction and visual compromise are the most prevalent presenting symptoms, followed by hydrocephalus-related symptoms. Growth retardation is a common observation in kids with craniopharyngiomas [4].

Investigations and Diagnosis

Magnetic resonance imaging (MRI) is typically used to diagnose craniopharyngiomas [8]. Since craniopharyngiomas frequently have calcified, solid, and cystic tumour components, a computerized tomography (CT) is also performed if an MRI of the head is suggestive of a craniopharyngioma in order to look for calcifications. For the preoperative work-up, endocrine and ophthalmological exams are required.

Patients and Methods

In this retrospective study, 11 patients with craniopharyngiomas who had been preoperatively determined to have them by radiological studies and confirmed to have them by postoperative histological analysis were included. All of these tumours had solid and cystic components, and comprehensive neurological testing and lab analyses were performed. Prior to and following surgery, MRI, visual, and endocrine tests were performed (Figure 1 & Figure 2). After surgery, MRIs were done again at three, six, and twelve months. Over the course of the follow-up period, which lasted between six months and a year. A subfrontal technique was used to remove each tumour. Our method relies on performing a small right frontal flap, a linear dura opening parallel to the base of the skull, smooth retraction of the frontal lobe, opening of the basal cisterns, and decompressing the brain by puncturing the tumour cyst and gently pulling the bulk of the tumour out of the brain. If the tumour is located in the retrochiasmatic region, the lamina terminalis is opened. The decompression is typically carried out utilizing the microsurgical approach up until the point when we determine that further resection is not risk-free. The rigid endoscopes (0˚, 30˚, and 70˚) are now used during surgery along with endoscopic micro-forceps, micro-dissectors, and bipolar coagulation.

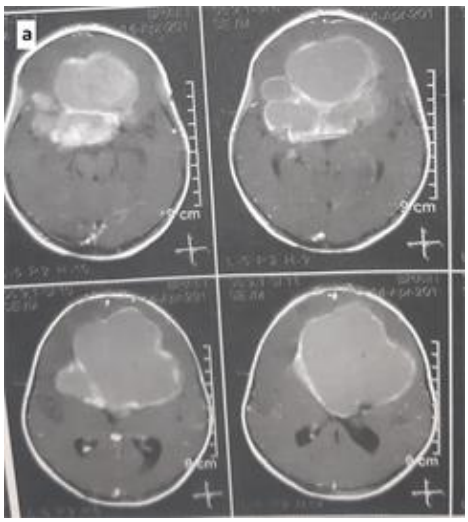
All three of the different angled endoscopes are utilised to examine the tumour site during surgical removal. The inferior surface of the optic nerves and the superior-posterior limit of the tumour attached to the hypothalamus were both examined using the 30˚ and 70˚ scopes. By dissecting and gently pulling on the tumour at these two levels with endoscopic forceps and micro dissectors, the majority of the tumour is typically removed using the 30˚ endoscope. The 70˚ endoscope provides a strange image for dissection, although it is typically used to confirm the complete resection. To confirm that entire resection had been accomplished, many endoscopes are used at various angles at the conclusion of the procedure.

II. Results

Eleven patients were included in this study, all of them underwent subfrontal operations with the introduction of an endoscope at the conclusion of the procedure for the evaluation of tumour removal and, if possible, dissection of any leftover components. Four examples of the childhood craniopharyngioma variant were found, while the rest cases were of the adult kind. There were five female patients and six male patients. In six cases, complete removal was accomplished in five adult cases. Due to adhesion to the hypothalamus and perforating arteries, subtotal resection was accomplished in five individuals, three of whom had postoperative irradiation.

Five patients required the insertion of an oumyea reservoir because the cystic portion could not be removed. In five cases, a V-P shunt was implanted. Only two of the patients who acquired diabetic insipidus (DI) permanently following surgery. Before surgery, there were two patients that had pituitary hypofunction; after surgery, there were three cases. All patients had impaired visual fields; two patients' visual fields got better following surgery, while the other two got worse. Using this method, no decline in visual acuity was noticed.

Two patients died after surgery: one from uncontrolled hypernatremia and the other from complications following an intraoperative bleed.



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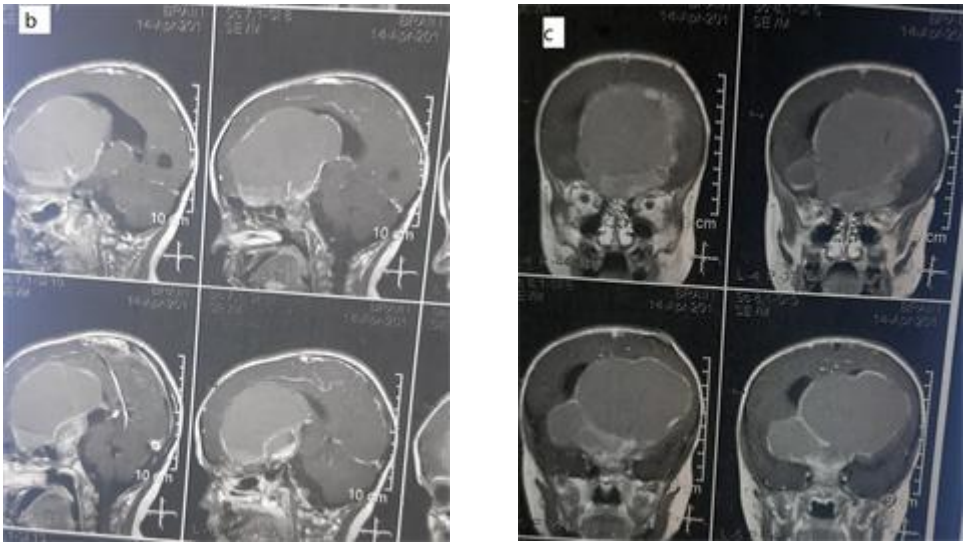

FIGURE 1: Preoperative axial (a), sagittal **(b)** and coronal **(c)** MRI showing huge sellar suprasellar craniopharyngioma.

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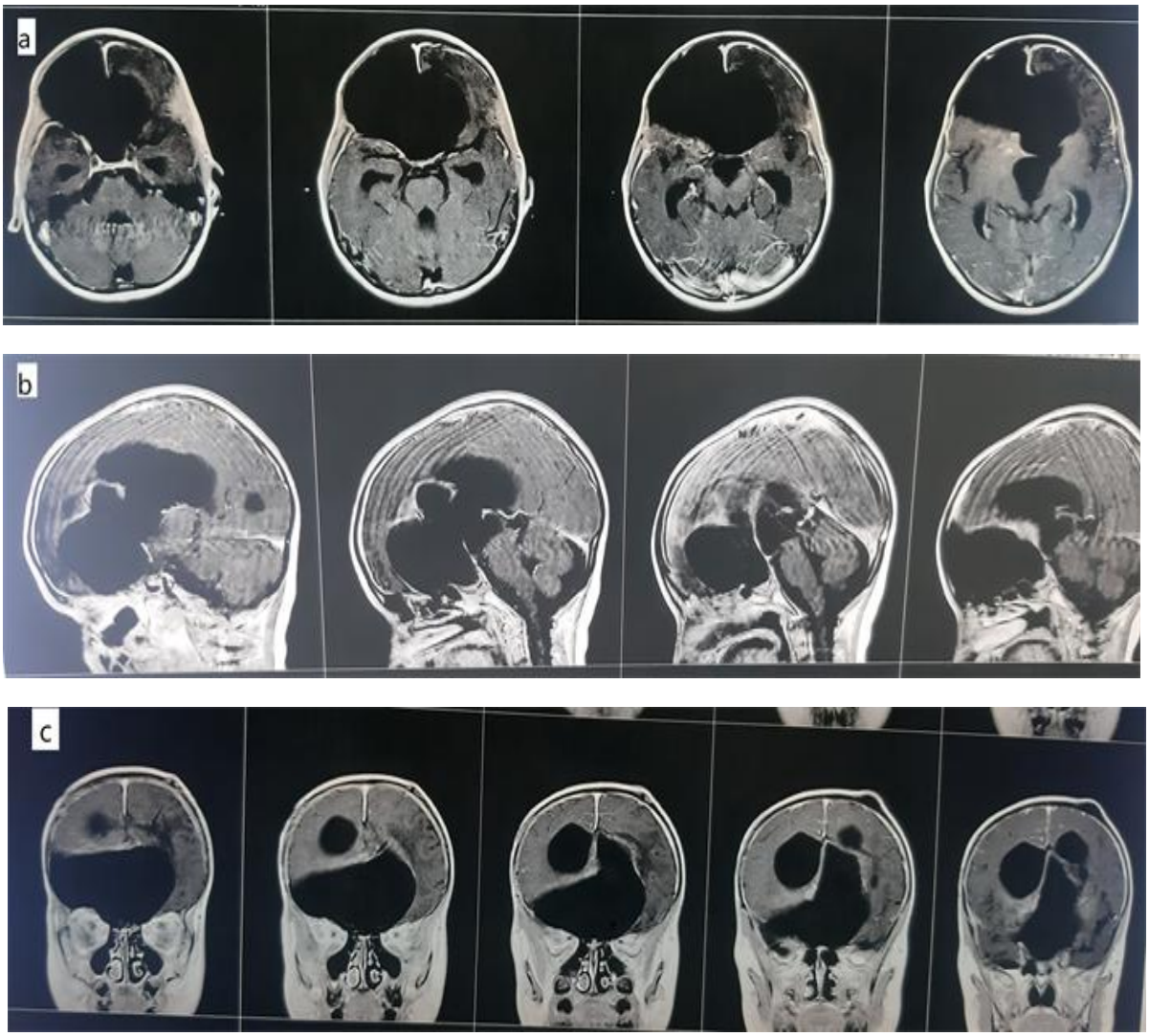

FIGURE 2 : Postoperative axial (a), sagittal **(b)** and coronal **(c)** MRI showing complete removal of the tumor (6 months after surgery).

III. Discussion

Nearly 14% of CNS tumours are benign growths called craniopharyngiomas, which are found at the base of the skull [9]. The entire resection of the craniopharyngioma is a significant challenge for neurosurgeons due to the anatomic intricacy of this region and the nearby tissues that may cause endocrine, autonomic, and behavioural issues [10]. The rate of recurrence is substantially higher in patients with partial or complete resection, and every effort must be made to accomplish entire resection in the first operation, according to Matson and Crigler's research on childhood craniopharyngiomas in 1969 [3]. The aim of the surgeon must be complete surgical resection of the craniopharyngioma because the survival and recurrence rates are correlated with the amount of resection, but this cannot be done at the expense of the patient's quality of life, such as by causing additional hypothalamic manifestations [11]. There are some restrictions that must be taken into account before surgery, such as childhood obesity, which may be a predictor of severe postoperative hypothalamic dysfunction, and older patients with morbidities. There is debate over whether craniopharyngioma excision should be partial or complete before radiation. Following subtotal excision and radiation, the Pittsburgh group's rate of tumour control was 89.1% after a 10-year follow-up [12].

The malignancies in the Oxford series that underwent complete resection and radiation did not return. Adherence of the tumour to the hypothalamus is one of the limits to total resection. To prevent serious hypothalamic affection, grabbing attempts to remove a tumour that cannot be sucked should be avoided. The other restriction is the tumor's adhesion to the arteries and perforators without a cleavage plane between them [13]. Of all the patients in Fischer's study, a total resection rate of 27% was recorded [14]. Other writers claim that this incidence is substantially higher, ranging from 60 to 76 percent depending on the surgeon's surgical skill and the surgical methods employed.

Yasargil et al1990 .'s study included 144 patients, of which 51 (35.1%) were adults. He used the pterional method, with a total removal rate of 90 percent, a death rate of 9 percent, and a recurrence rate of 7 percent without the use of radiotherapy [15]. Fahlbusch et al. conducted a study in 1999 that comprised 168 individuals, 80 of which were adults (47.6%). He used three approaches, primarily pterional, transsphenoid, and bifrontal. Shi et al. conducted a study in 2006 with 284 patients, 80 of whom (28.1%) were adults. They used both the pterioneal and the bifrontal approaches, but primarily the pterional technique. Mortality was 4.2 percent, total removal was achieved in 84 percent of cases, and the recurrence rate was 14 percent [16]. In a previous study by H. Kadri and A.A. Mawlade [1], 69 patients under the age of 17 were operated on for a craniopharyngioma, with a total resection rate of 62.4 percent using only the microsurgical approach. Eight out of the eleven patients in this group (72.3%) had a total resection, which means that adding the endoscope to the instrumentation increased the total resection rate by almost 10 percent. In this current group, we operated on eleven cases of craniopharyngioma using microsurgical techniques assisted by endoscopy. Despite the fact that these rates are not statistically significant ($p > 0.05$), we discovered that this procedure improves and makes the complete removal of the tumour safer even if radical excision of these tumours has a higher incidence of problems.

The enormous tumour volume is frequently the cause of difficulties, which are typically of a hormonal or visual origin. These complications are due to the intricate anatomical relationships between the tumour, the visual track, and the hypothalamus. No appreciable variations in the frequency of hormonal and/or visual problems were found between our patient group and the control group. After tumour de-bulking using our method, the visual field was improved in two patients while it deteriorated in another two. All patients experienced diabetes insipidus following surgery, however only two of them developed a persistent condition. After total resection, recurrence is said to occur between 11% and 31% of the time. According to many writers, partial resection carries a higher risk of recurrence, which can range from 22% to 100%. Our mortality rate was 7%, with two patients dying as a result of long-term hypernatraemia and inadvertent intraoperative bleeding, respectively.

IV. Conclusion

The best surgical method for treating a craniopharyngioma is still total excision. In our experience, endoscopy appears to facilitate the safe excision of the craniopharyngioma using microsurgery.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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