

Microsurgical resection versus stereotactic guided ommaya reservoir drainage of cystic craniopharyngioma

Abstract

Background: Craniopharyngioma is often associated with cystic components. Although these tumors are histologically benign, recurrence rates up to 57% have been reported even after surgical gross total resections, due to their invasiveness.

Objective: To compare the outcome of invasive and less invasive surgeries of cystic craniopharyngioma.

Methods: This study included 20 patients diagnosed and managed in Al-azhar university hospitals and Al-Mansoura university hospital between May 2015 and April 2017. 10 patients were treated by surgical modalities, 10 Patients were treated by a less invasive maneuver by superior fenestration and insertion of ommaya reservoir. The craniopharyngioma was predominately cystic.

Results: Ommaya reservoir insertion and drainage of cystic craniopharyngiomas is safe and effective for symptom relief and might be associated with a better outcome than microsurgical treatment.

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Mohamed hasan Mansour,¹ Samer Serag²

¹Department of Neurosurgery, Al-azhar University, Egypt

²Department of Neurosurgery, Mansoura University, Egypt

Correspondence: Mohamed hasan Mansour, Department of Neurosurgery, Al-azhar University, Cairo, Egypt, Tel 1001256079
Email mohamedhasanmansour@gmail.com, islamneuro@yahoo.com

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Introduction

Craniopharyngiomas (CPs) are benign epithelial tumors that develop along the hypothalamus-hypophyseal axis and were first described by Jakob Erdheim in 1904. These tumors have represented a challenge for surgeons since the rise of modern neurosurgery.¹

These tumors are located close to the visual apparatus, hypothalamus, pituitary stalk, 3rd ventricle, and vasculature from the circle of Willis. The proximity of the tumor and its adherence to these critical structures makes complete microsurgical removal without neurological deterioration difficult.² Craniopharyngioma is often associated with cystic components.³ Although these tumors are histologically benign, recurrence rates up to 57% have been reported even after surgical gross total resections, due to their invasiveness.⁴

Microsurgical resection is usually considered the treatment of choice in these patients.⁵ Alternatively, minimally invasive cyst aspiration alone or in combination with intracavitary irradiation or chemotherapy has been advocated.⁶ In order to overcome the limitations of aspiration alone (i.e., risk of early cystic recurrences), implantation of a shunt catheter, allowing permanent "internal drainage" of the cystic contents into cerebrospinal fluid, has been recommended by some authors.⁷

So we conducted the current study. We here analyze and compare tumor control rates and outcome of cystic craniopharyngiomas treated with either open microsurgical resection or stereotactic guided ommaya reservoir drainage as a minimal invasive method.

Aim of the work

To compare the outcome of invasive and less invasive surgeries of cystic Craniopharyngioma (Table 1).

Patients and methods

This study included 20 patients diagnosed and managed in Al-azhar university hospitals and Al-Mansoura university hospital between May

2015 and April 2017. 10 patients were treated by surgical modalities (group A), 10 Patients were treated by a less invasive maneuver by superior fenestration and insertion of ommaya reservoir (group B). The craniopharyngioma was predominately cystic. Informed consent was obtained according to regulations of ethical committee.

Laboratory protocol

We did some blood tests for both groups as preoperative investigations (CBC, Liver and Kidney function, Blood sugar level and Na/K level) for both groups. For group B we analyzed the aspirated fluid.

Endocrinological Protocol

Hormonal profile was also measured Preoperatively (TSH, LH, FSH, Prolactin, GH and cortisol) to detect effect on pituitary gland and 6 weeks postoperatively.

Radiology protocol

All patient had Computed tomography (CT scan) and also had magnetic resonance imaging (MRI). CT was done early and late postoperative as a follow up method.

Ophthalmological Protocol

Ophthalmological tests included visual acuity measurements and perimetry of the visual field preoperatively and 6 weeks after treatment, evaluated by an ophthalmologist blinded to the mode of treatment.

Surgical procedure

Group A were selected for surgical management, trans-sphenoidal and transcranial (transcallosal and pterional) approaches were selected. For Group B which was selected for ommaya reservoir insertion, Stereotactic (by leksell frame) surgery and contrast-enhanced CT was performed under local anaesthesia. Target was selected 5mm above the lowest cut, where the cyst starts. In all

group B patients, the site of the burr hole was just in front of the coronal suture and 2 - 3 cm lateral to the midline. Ommaya catheter was inserted into the predetermined target, along the recommended trajectory to avoid any bleeding, slowly sliding the stereotactic needle to facilitate capsular fenestration and adjusting the length of ommaya catheter. The perforated part of the catheter was inserted into the cyst

cavity. The catheter was connected to the reservoir. After skin closure, slow but complete aspiration of the cyst was performed. The cystic fluid was dark brown in colour, it was full of crystals that shimmered in the light and it was sent for cytological examination. CT scan was obtained in the following 6 hours.

Table I 20 cases with cystic craniopharyngioma

Patient no.	Age(ys) /sex	Clinical	Examination	Laboratory	Imaging	Management	Outcome	Complications
Group A								
1	21/F	Headache, ↓vision, visual field defect, growth retardation, amenorrhea.	Bitemp. Hemianopia, ↓vision	↓ FSH, LH	Cystic, Enhanced, Calcified wall.	Surgical (transsphenoidal)	Improved vision	-
2	51/F	Headache, ↓vision, visual field defect.	Papilledema, left temp. H., ↓vision	N	Cystic, Enhanced	Surgical (transsphenoidal)	-	DI, DCL Death after 15 days
3	13/F	↓vision	↓vision	N	Cystic, Enhanced, Calcified wall, hydrocephalus.	Surgical (pterional)	Improved vision	DI
4	16/M	Headache, ↓vision, visual field defect, growth retardation	Stunted growth, ↓vision	N	Cystic, Enhanced.	Surgical (pterional)	Improved vision	SDH
5	50/F	Headache, ↓vision, visual field defect.	↓vision	↑ prolactin	Cystic, Enhanced.	Surgical (transsphenoidal)	Improved vision	Transient CSF rhinorrhea
6	40/M	↓vision, visual field defect, obesity, fatigability, loss of lipido, sleep disorder	Overweight, ↓vision.	↓FSH, LH,	Cystic, Enhanced, Calcified wall.	Surgical (pterional)	Improved vision	-
7	45/M	Headache, ↓vision, visual field defect.	Bitemp. Hemianopia, ↓vision	N	Cystic, Enhanced.	Surgical (pterional)	Improved vision	-
8	11/F	Headache, ↓vision, visual field defect, growth retardation, polyuria	Bitemp. Hemianopia, ↓vision	N	Cystic, Enhanced, Calcified wall.	Surgical (pterional)	Improved vision	DI
9	9/F	Headache, ↓vision, visual field defect.	↓vision	↓FSH, LH.	Cystic, Enhanced, Calcified wall, hydrocephalus.	Surgical (pterional)	-	DI, DCL Wakness, death after 5 days.
10	17/M	Headache, vomiting, ↓vision, visual field defect, obesity, fatigability, behavioral disorders, seizures.	Overweight.	↓FSH, LH.	Cystic, Enhanced, Calcified wall, hydrocephalus.	Surgical (pterional)	Improved vision	DI
Group B								
11	50/M	Headache, ↓vision, visual field defect, fatigability, loss of lipido, sleep and behavioral disorders.	Papilledema, ↓vision	↓TSH, FSH, LH,	Cystic, Enhanced, Calcified wall, hydrocephalus.	Ommaya reservoir insertion	Improved vision	Sliding of catheter end
12	8/F	Headache, vomiting, ↓vision.	Papilledema, concentric visual field, ↓vision	N	Cystic, Enhanced, Calcified wall, hydrocephalus.	Ommaya reservoir insertion	Improved vision	-
13	38/F	↓vision, visual field, galactorrhoea, loss of lipido, 2ry amenorrhoea.	left temp. H., ↓vision	↓FSH, LH. ↑Prolactin	Cystic, Enhanced.	Ommaya reservoir insertion	Improved vision	-
14	10/F	Headache, ↓vision, visual field defect.	Bitemp. Hemianopia, ↓vision	N	Cystic, Enhanced.	Ommaya reservoir insertion	Improved vision	Displaced catheter end
15	36/M	Headache, ↓vision, visual field defect.	Bitemp. Hemianopia, ↓vision	N	Cystic, Enhanced.	Ommaya reservoir insertion	Improved vision	-
16	50/F	Headache, ↓vision, visual field defect.	left temp. H., ↓vision	N	Cystic, Enhanced.	Ommaya reservoir insertion	Improved vision	-

Table Continued...

Patient no.	Age(ys) /sex	Clinical	Examination	Laboratory	Imaging	Management	Outcome	Complications
17	5/F	Headache, ↓vision, visual field defect, polyuria	Underweight, ↓vision	N	Cystic, Enhanced. Calcified wall, hydrocephalus.	Ommaya reservoir insertion	Improved vision	-
18	7/M	Headache, vomiting, ↓vision, visual field defect, growth retardation.	↓vision	N	Cystic, Enhanced. Calcified wall, hydrocephalus.	Ommaya reservoir insertion	Improved vision	Disconnected catheter end
19	8/M	Headache, ↓vision, visual field defect.	Bitemp. Hemianopia, ↓vision	N	Cystic.	Ommaya reservoir insertion	Improved vision	-
20	32/F	Headache, ↓vision, visual field defect, galactorrhea, obesity, fatigability, 2ry amenorrhoea, sleep and behavioral disorders, polyuria.	Left 6th palsy, overweight, ↓vision	↓FSH, LH. ↑Prolactin	Cystic, Enhanced. Calcified wall, hydrocephalus.	Ommaya reservoir insertion	-	DI, DCL.

Results

Population

8 males (40%) and 12 females (60%) were the overall patients included in this study, the peak incidence of our patients were in the 1st decade of life (30%), and (55%) of our patients were younger than 30 years, ages ranging between 5 and 51 years, with a mean age of 25.85 years.

Clinical presentation

The most common clinical presentation was decrease visual acuity, in 20 cases (100%) followed by visual field defect in 18 cases (90%) and Headache in 17 cases (85%).

Hormonal profile

7 cases showed decreased TSH and LH level (35%), 3 cases showed increase prolactin level (15%).

Radiological findings

All cases were cystic (100%) and 19 cases were enhanced (95%), 11 cases were calcified wall (55%), 8 cases presented radiologically by hydrocephalus (40%).

Surgical approaches

All group A patients were managed surgically by different approaches, 2 cases transsphenoidal (10%), 7 cases pterional (35%), 1 case transcallosal (5%). All group B patients were managed by ommaya reservoir insertion

Outcome

In group A patients 8 of 10 patients reported improved visual acuity postoperative. In group B patient 9 of 10 patients reported improved visual acuity (Figure 1).

Complications

In group A, the most common complication was diabetes insipidus in 5 cases, disturbed conscious level in 2 cases, death in 2 cases one after 15 days postoperative and another one 5 days postoperative, subdural hematoma in 1 case and transient CSF rhinorrhoea in 1 case (Figure 2).



Figure 1 Outcome in both groups.

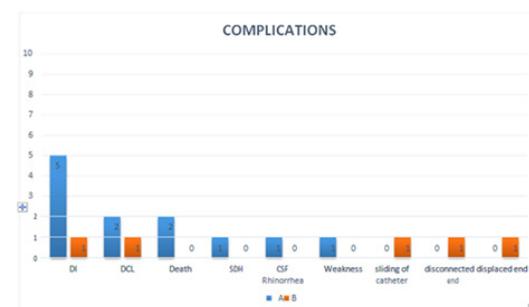


Figure 2 Complications in both groups.

In group B, the most common complication was sliding of the catheter end in 1 case (Figure 3), diabetes insipidus in 1 case, disturbed conscious level in 1 case, disconnected catheter end in 1 case (Figure 4) and displaced catheter end in 1 case (Figure 5).

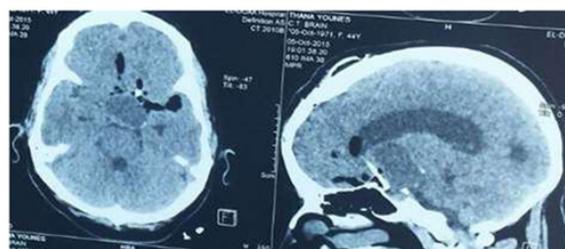


Figure 3 Sliding of the distal catheter end anterior to the cyst due to its calcified wall and was corrected by introducing the needle first to open the calcified wall then the stylet.



Figure 4 Disconnected catheter end of ommaya reservoir and was corrected.

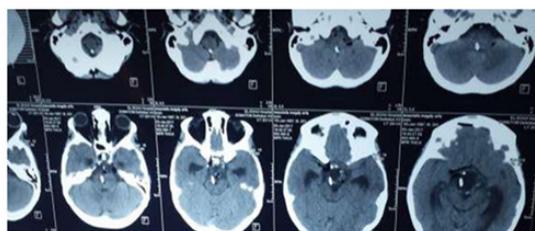


Figure 5 Displaced the distal catheter end passing through the pons till below the foramen magnum at the 4th ventricle and was corrected.

Discussion

DO NO HARM TO YOUR PATIENTS, this is one of the ten Hippocratic medical principles, beside the religious instructions regarding respectation of the human beings. So in this study we are trying to find the best strategy for managing cystic craniopharyngioma.

In our study, the peak incidence of our patients were in the 1st decade of life (30%). In our study, The most common clinical presentation was decrease visual acuity. In Moussa et al.⁸ raised intracranial pressure and visual changes were the main presenting symptoms and hormonal changes were observed in some patients. All cases were of cystic type, some cases were enhanced, some of calcified wall, some cases presented radiologically by hydrocephalus which needed VP shunt.

In group A patients 8 of 10 patients reported improved visual acuity postoperative. In group B patient 9 of 10 patients reported improved visual acuity. There is two patients died at group B. All group A patients were managed surgically by different approaches, many different complications were occurred, diabetes insipidus, death, CSF Rhinorrhea and weakness.

Group B patients were managed by by ommaya reservoir insertion, complications were diabetes insipidus in one case only, another case was complicated by sliding of the distal catheter end and crossed the brainstem till reaching the 4th ventricle (Figure 5) but after follow up CT the patient was reoperated and correction of the length of catheter was done to be placed in the cyst. Another case was complicated by disconnection of the catheter (Figure 4) from reservoir and when we decided aspiration from reservoir, no fluid came, so we reoperated and the complication was corrected. Another case was complicated by sliding of the distal catheter end anterior to the cyst due to its calcified wall (Figure 3) and it was corrected introducing the needle first to open the calcified wall then the stylet of the stereotactic system.

So, Complications occurred during microsurgical treatment (group A) were severe sometimes like death and weakness and diabetes

insipidus and also irreversible but Complications occurred during ommaya reservoir insertion were less severe and mostly reversible.

In Rachinger et al.⁹ Stereotactic bidirectional drainage of cystic craniopharyngiomas is effective and provides a better endocrinological outcome than conventional microsurgery. For stereotactic drainage, a catheter was implanted, allowing both permanent upstream (into ventricular spaces) and downstream (into prepontine cistern) drainage. We recommend ommaya as an optional management in de novo cases but strongly recommended in recurrent cases due to the presence of adhesions so incidence of complications is high.

Ommaya reservoir insertion is not a final treatment as it is not only for cystic fenestration and aspiration but acts like a stent for repeated aspiration if needed and follow up of tumor activity by measuring levels of LDH and CAE of the aspirated cystic fluid, to advise radiotherapy or not. The Ommaya itself could catheter by act as a stent, creating a tract allowing gradual drainage of cyst fluid and stabilization without necessitating any further interventions in selected cases.^{4,10}

In Moussa et al.⁸ 73% patients did not develop any recollection of the cyst and showed significant clinical improvement. The only possible explanation is that the part of the catheter of the ommaya reservoir system, with holes in, has established communication between the cyst and the CSF spaces around it after the collapse of the cyst with no adverse effect on the patient at any time. Ten (19%) patients needed reaspiration every 6 months and four (8%) patients showed rapid recollection of cystic fluid and were treated with intracystic bleomycin.

Conclusion

Ommaya reservoir insertion and drainage of cystic craniopharyngiomas is safe and effective for symptom relief and might be associated with a better outcome than microsurgical treatment.

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Conflicts of interest

None.

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