Original Research Article

International Journal of Neurology and Neurosurgery
Volume 10 Number 1, January - March 2018
DOI: http://dx.doi.org/10.21088/ijnns.0975.0223.10118.4

Surgical Management & Outcome Analysis of Intracranial Arachnoid Cyst: A Retrospective Study

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Abstract

Background: There are yet to simplify some aspects regarding the surgical indications and surgical procedures that are at choice for treating intracranial arachnoid cysts. The purpose of this retrospective analysis is to contribute to the continuing debate on the most suitable management.

Materials and Methods: We included in the study 66 patients, operated for intracranial arachnoid cysts during the period January 2008 to December 2017. The surgical methods were either a craniotomy or cyst shunting. The information regarding these patients was retrospectively assessed based on their clinical and imaging records. Treatment efficiency was evaluated considering postoperative clinical status, imaging appearance and postoperative complications.

Results: 84.1% of the patients reported postoperative disappearance or reduction of symptoms, while 13.6% had the same complaints as prior surgery. Only 2 patients experienced worsening of symptoms. Follow-up imaging showed cyst disappearance in 29.5% patients and cyst reduction in 61.4% patients. 9.1% had no change in cyst volume. Craniotomy correlated with a better imaging appearance (p=0.02). There was no correlation between improved clinical status and cyst fluidreduction (p=0.6). 14 patients (21.21%), all with temporal cysts, experienced postoperative complications, and 10 of them (15.1%) needed surgery. There was no severe or permanent dysfunction in any of the patients. 42.8% of the cyst shunting patients suffered postoperative complications, whereas only 10% of the craniotomy patients did.

Conclusion: Cyst decompression results in significant clinical improvement and it can be performed with little risk for severe complications. Craniotomy seems to be a better surgical treatment option than cysto-peritoneal shunt, with a better neuroimaging appearance and a lower complications rate.

Keywords: Arachnoid Cyst; Cysto-Peritoneal Shunt; Craniotomy; Marsupialization.

Introduction

Intracranial Arachnoid cysts (ACs) are benign congenital malformations, formed by the splitting or duplication of the arachnoid membrane, allowing a clear fluid resembling normal cerebrospinal fluid to fill in the space crated [1,2,3]. They are due to an increased pulsation of the cerebrospinal fluid (CSF) [4,5]. They count for approximately 1% of the intracranial pathology, being most frequently located in the middle cranial fossa (about half of the ACs) and the cerebellopontine angle (CPA) [2,3,4,6], and they appear to affect more males than females [7,8]. The clinical presentation of ACs is variable, depending on the cyst location and the importance of the mass effect exerted on the surrounding nervous structures [1,2,6,9-11]. Most of the patients present with nonspecific symptoms such as headache, dizziness or balance impairment, or symptoms of increased intracranial pressure [3,6]. The positive diagnosis is set through cerebral imaging (CT scan or MRI), and it reveals a sharply demarcated, non-enhancing, extra-axial cyst, with density/signal similar to the CSF [12,13]. The main procedures to treat arachnoid cysts are stereotactic punction, cysto-peritoneal shunting, craniotomy followed by radical resection and marsupialization of the cyst in the

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Received on 04.12.2017, **Accepted on** 18.01.2018

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subarachnoid space and neuro-endoscopic fenestration of the cyst. The surgical indications for ACs, as well as the surgical procedures elected remain a controversial subject [1,2,8,15,14-22]. Arachnoid cysts can complicate with rupture/hemorrhage, especially encountered in large cysts and mostly associated with minor head trauma in the last month [1,2,20,23,24].

Material and Methods

Patients characteristics: the study includes 66 patients, 45 male (68%) and 21 female (32%) - sex ratio M:FH - 2.14:1 - that had been operated in our department either by craniotomy or cysto-peritoneal shunting. Mean age at admission was 18.36 years (median=18.5, range 1-46). Mean follow-up period was 17.3 months (range 3-62).

Study type and database: the present study is a retrospective, observational, analytic study that includes all patients operated for an arachnoid cyst during the period January 2008 to December 2017. The patient information was extracted from the clinical and imaging records in the department's database. The patients complete medical records offered information on: demographic data, subjective complaints, clinical finding at admission and during the in hospital period, imaging aspect, dimensions and location ofthe ACs, Galassi type for sylvian fissure cysts, complications present at admission, type of surgical procedure, postoperative neuroimaging either following the first 72 hours after surgery or at follow-up, 3 months from surgery.

Criteria for surgical treatment: symptoms related to the cysts were found in 61 patients (93%), while 4 other patients were asymptomatic, but with Galassi type III ACs, exerting a significant mass effect on the adjacent brain structures. One patient had a large chronic subdural hematoma, asymptomatic, that was diagnosed during a check-up, after a history of repeated head trauma in the past month.

Decompression method: most of the patients (68%) were performed a craniotomy under general anesthesia, cyst membrane excision in the parts where it wasn't adherent to the brain matter. The large bridging veins that presented the risk of rupture and hemorrhagic complications postoperatively were coagulated. The normal CSF flow was reestablished by fenestrations that create communications with the posterior cranial fossa and the basal cisterns [Figure 1 a,b&c]. The rest of the patients included in the study (32%) had a cysto-peritoneal shunt, which drained the fluid in the cyst into the peritoneal cavity, thus relieving the pressure inside the cyst. This procedure was also performed under general anesthesia.

Treatment evaluation: the efficiency of the surgical treatment performed on each patient was evaluated considering 3 parameters - the clinical presentation postoperative (quantified by the clinical outcome status = COS scale), the neuroimaging aspect at the 3 months postoperative examination (evaluated by the imaging outcome aspect = IOA scale), and the presence of postoperative complications or reoperation due to complications or failure of the primary intervention. The COS and IOA categories are detailed in [Table 1].

Statistical analysis: the statistical data was analyzed with Office 2007 Excel and CDCs Epi Info 7 for Windows. The contingency tables statistical significance was analyzed with Persons chi square test and Fisher exact (p level was 0.05, confidence interval – CI=95%).

Results

Cyst location: inside the patients group included in our study, most of the patients (82%) had a sylvian

Table 1: Clinical outcome status = COS scale & Imaging outcome aspect = IOA scale

COS	COS1: no or minor postoperative symptoms
	COS2: relief of the symptoms presented preoperatively
	COS3: no change in the clinical presentation postoperatively
	COS4: more complaints postoperatively
IOA	IOA1: cyst no longer visible
	IOA2: decreased cyst volume
	IOA3: no change in cyst volume

Table 2: Intracranial Arachnoid Cyst location

Location	Side	Number of Patients	Percentage of Patients
Temporal	Left	30	45.45%
	Right	24	36.36%
Frontal	Left	5	6.82%
	Right	3	4.54%
	Bilateral	1	2.27%
CPA	Left	3	4.54%

CPA= Cerebellopontine angle

Table 3: Main clinical symptoms by cyst location

Location *Symptom*	Sylvianfissure	Frontallobe	CPA	Total
Headache	54 (81.8%)	3 (4.54%)	3 (4.54%)	60 (90.9%)
Epilepsy	15 (22.73%)	5 (6.82%)	0	20 (30.3%)
Dizziness/balance Impairment	12 (18.18%)	2 (3.03%)	3 (4.54%)	17 (25.75%)
Personalitychanges	2 (3.03%)	1 (1.5%)	0	3 (4.54%)
Hemiplegia	2 (3.03%)	0	0	2 (3.03%)

Table 4: Postoperative complications/reoperation due to complications or treatment failure

Complication	Cyst shunting patients	Craniotomy patients	Overall
Infectious	2 (9.5%)	2 (4.4%)	4 (6.3%)
Subdural hematoma	0	2 (4.4%)	2 (3.03%)
Epidural hematoma	0	1 (3.3%)	1 (1.5%)
Revision of shunt	6 (28.6%)	0	6 (9.1%)
New shunt^	1 (4.76%)	0	1 (1.5%)
Reoperation*	7 (33.3%)	3 (6.6%)	10 (15.1%)
All complications	9 (42, 8%)	5 (10%)	14 (21.21%)

^One of the patients developed secondary hydrocephalus and needed an additional ventricular shunt
*not all complications required surgical treatment

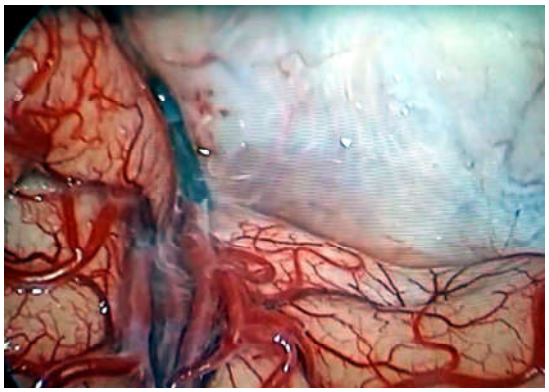

Fig. 1a: Intact temporal arachnoid cyst after craniotomy and dural opening

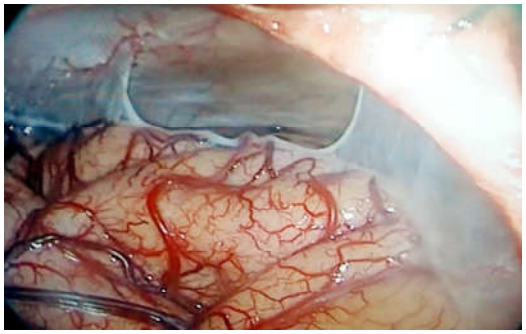

Fig. 1b: Opening of arachnoid cyst wall

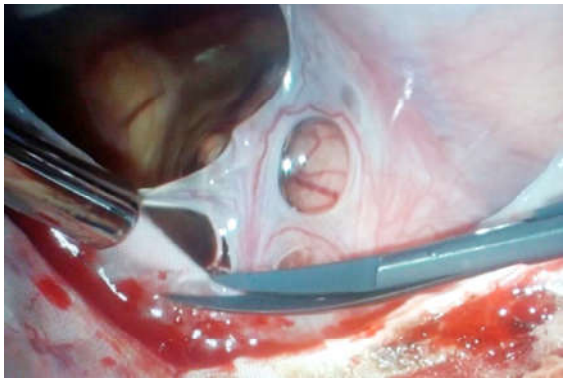

Fig.1c: excision of Arachnoid cyst wall

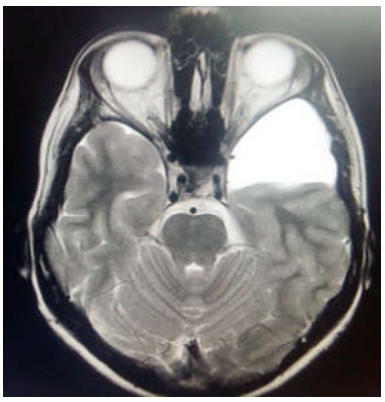

Fig.2: MRI brain showing left temporal arachnoid cyst

fissure cyst [Figure 2], followed by frontal arachnoid cysts (14%) and CPA arachnoid cysts (4%). Details on cyst locations are presented in [Table 2]. No other cyst locations presented criteria for surgery.

Main clinical symptoms: with the exception of 3 patients, all patients presented with symptoms related to the cyst. The most frequently encountered symptoms were headache (90.9%), epilepsy (29.55%) and dizziness/balance impairment (29.3%). One patient presented with motor deficiency in the right side of the body, and two patients complained of personality changes. [Table 3] summarizes the frequency of symptoms categorized by cyst location.

Intracranial hemorrhage in patients with arachnoid cysts: 24 patients (31.8%) presented a hemorrhagic complication at admission (21 of them had a subdural hematoma and 3 presented with hemorrhage into the cyst. Minor head trauma in the last month was a common finding among them (81.25%). Data statistical analysis showed that a history of minor head trauma in the past month is a risk factor for hemorrhagic complications of ACs–odds ratio (OR)=56.33, p=0.000004, CI=(6.72, 636.86).

Clinical outcome status: 56 patients (84.1%) either no/minor complaints or the relief of symptoms postoperatively (a COS1 or COS2). 13.6% of the patients had no change in the clinical status after surgery (COS3), while only two patient complained of worse clinical status postoperatively (a COS4). The patient with the COS4 was one of the asymptomatic patients, with a compressive type III cyst and complained of headache/dizziness (the symptoms were no longer present 1 month later, at check-up). There is no significant statistical evidence that any of the two procedures results in a better clinical outcome (COS1/2) p=0.8.

Imaging outcome aspect: 90.9% of the patients (60/66) showed either cyst disappearance (IOA1) or cyst reduction (IOA2) at the 3 month neuroimaging examinations, while 9.1% (6/66) showed no change in cysts dimensions (IOA3). All the IOA3 subgroup patients where operated by cysto-peritoneal shunting. Craniotomy appears to result in a better neuroimaging aspect at 3 months (p=0.02). There is no correlation between a good clinical outcome and cyst reduction/disappearance in imaging examination (p=0.6).

Postoperative complications/reoperation due to complications or treatment failure: 42.8% of the patients treated by cysto-peritoneal drainage presented complications/re-interventions due to failure of primary treatment, whereas only 10% of the patients where a craniotomy was performed presented with postoperative complications. The type of complications for each of the two surgical procedures is detailed in [Table 4]. However, the overall complications/reoperations due to failure of primary treatment rate of 21.2% and the lack of any severe or permanent postop deficiencies prove that surgery is an appropriate treatment for arachnoid cysts. Statistical analysis of the data proved that craniotomy is a risk factor for postoperative complications/reoperations – RR=4.3 (relative risk), RD=32.8% (risk difference), p=0.019.

Discussion

Our study results regarding the sex distribution, cyst location and symptoms frequency is similar to the data cited in the international specialized literature [1-11]. There was a high percentage of patients that presented with hemorrhagic complications, the numbers rising the question whether or not ACs diagnosed in children should be operated on even though they are not symptomatic, considering the risk of bleeding associated with a history of head trauma and large arachnoid cysts [23,24].

The majority of patients that underwent surgical treatment had a good clinical and neuroimaging outcome and most of the patients had no complications and/or reoperations. Plus, none of the complications implies any severe/permanent dysfunction in any of the patients operated. Failure of treatment is associated more with cyst shunting than craniotomy, mostly because of the under-shunting complications/reoperations that appear in most of the shunt dependent patients.

Conclusions

We obviously established that a history of minor head trauma in the past month represents a risk factor for hemorrhage into cyst. Another conclusion is that surgical management of intracranial arachnoid cysts improves patient's clinical outcome, with little risk of severe postoperative complications, proving that surgery is an appropriate modality to improve patient's quality of life, without causing damage. Also, craniotomy has a better neuroimaging outcome and a lower risk of complications than cyst shunting, making it the best procedure of the two. The high rate of reoperations associated with cyst shunting indicates that shunt dependence is a problem that we should avoid whenever possible.

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