Surgical management of brain arachnoid cysts (Single institute experience)

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ABSTRACT

Objectives: We report our experiences and characteristics of intracranial arachnoids cysts (IAC) over a six year period at our clinic.

Methods: We used a retrospective study design to review all IAC patients, managed in our neurosurgical clinic between 2014 and 2019. Patient files, radiological images computed tomography (CT) or magnetic resonance imaging (MRI) scans) were reviewed for patient characteristics, presentation, cyst types, site and clinical management.

Results: In total, 365 patients with IAC were included (spinal arachnoid cyst excluded). The mean age was 16 years ± 13.61 years, and 65% were male. Our data showed that 59% of patients had asymptomatic arachnoid cysts, with no further management required. However, 23% required medication for seizure control, whereas surgical intervention was required for 18% of patients.

Conclusions: Arachnoid cysts are common neurosurgical pathologies, with different clinical presentations. Variable management modalities are available, and should be guided by the clinical picture and radiological appearance. Our cohort data are comparable with international datasets.

Keywords: Intracranial arachnoid cysts, cyst management, surgical procedures, clinical outcomes.

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INTRODUCTION

Intracranial arachnoid cysts (IACs), also known as lepto-meningeal cysts, are intra-arachnoid cysts filled with a Cerebrospinal Fluid-like fluid. The first description of an IAC was by Richard Bright in 1831; he described the pathology as a “serious cyst forming in connection with the arachnoid, and apparently lying within its layers” [1-3]. However, the exact aetiology of arachnoid cysts remains unclear [4]; they may be congenital or acquired [5]. Studies have revealed that in most cases, cysts are primary in nature (i.e. developmental), but in a minority, they are secondary (i.e. traumatic, post-haemorrhagic or post-infection) [1, 5].

Histo-pathologically, the cyst wall is formed of duplicated layers of superfine, translucent fibrous connective tissue (believed to be lamellar collagen), lined by a single layer of meningothelial cells i.e. epithelial lepto-meningeal cells, either in a diffuse or focal pattern [6-9]. Secondary cysts may show signs of inflammatory changes e.g. gliosis or hemosiderin within the walls [1,7,9].

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Cysts occur at any age, but approximately 50-70% occur in children (according to our study 220 patients were below 20 years, which is equal to 60%)[10]. IAC prevalence is approximated at 1.7% [11], with a higher percentage in children (2.6%), when compared with adults (1.4%) [12].
Headache is the most common symptom, is experienced by up to 241 patients 66% of sufferers and may be caused by local mass effects, high intracranial pressure (ICP), or hydrocephalus [1,13-15], however unilateral headaches occurring in the supra orbital or temporal region may be exacerbated by physical exertion [1]. Seizures are the next common symptom [1], occurring in up to 110 patients 30% of individuals [1,13]. They can be of any type (generalised, focal, or complex-partial) [1], with no clear correlative evidence between seizure type and cyst location [1,13].

MATERIALS AND METHODS

Patients

All patients diagnosed at King Hussein Medical Centre (KHMC) for IACs between 2014 and 2019 were included. We included patients who were symptomatic, or had incidental IAC findings by CT or MRI. Ethical approval was granted by the research departmen ethical committee at the Royal Medical Services.
We reviewed 365 eligible patients with intracranial arachnoid cyst files and radiological images. Gathered patient characteristics included: age, gender, clinical presentation, management and complications. Radiological evaluations included cyst size and site identification (Galassi classification) [1-3], any associated signs of mass effects and/or hydrocephalus, and also any communications between the cyst &the subarachnoid space [16] (Figures 1–3).
We identified three management modalities: conservative, medical (headache and seizure) and surgical. Surgical management included: microscopic fenestration, endoscopic fenestration, shunt insertion and evacuation of the haematoma, either alone or in combination with cyst-peritoneal shunt. Descriptive statistics in the form of percentages, mean and standard deviation were applied.

RESULTS

Patient population

365 patients were recruited. Their ages ranged between 18 months to 78 years, with a mean age of 16 years. The male to female ratio was 2:1 (Table I). The paediatric age group was < 10 years, and comprised the majority of patients (131, 36%) (Figure 4).

Total number of patients	**365**
Age(mean± SD)	16±13.61
Gender	
Male	238(65%)
Female	127(35%)

Galassi grade (205 Sylvian locations)	
Grade 1	96 (47%)
Grade 2	56 (27%)
Grade 3	53 (26%)
Treatment modality	
Conservative	216(59%)
Medical	84(23%)
Surgical	65(18%)
Open	18(28%)
Endoscopic	23 (35%)
Shunt	24 (37%)
Surgical complications	17/65(26%)
Fenestration failure	7
Meningitis	3
Collection(mandate evacuation)	3
Cerebrospinal fluid leak	2
Pseudomeningocele	1
Hydrocephalus	1

Table I. Male-female ratio, Galassi grading ratio, modality of treatment, and percentage of surgical complications.

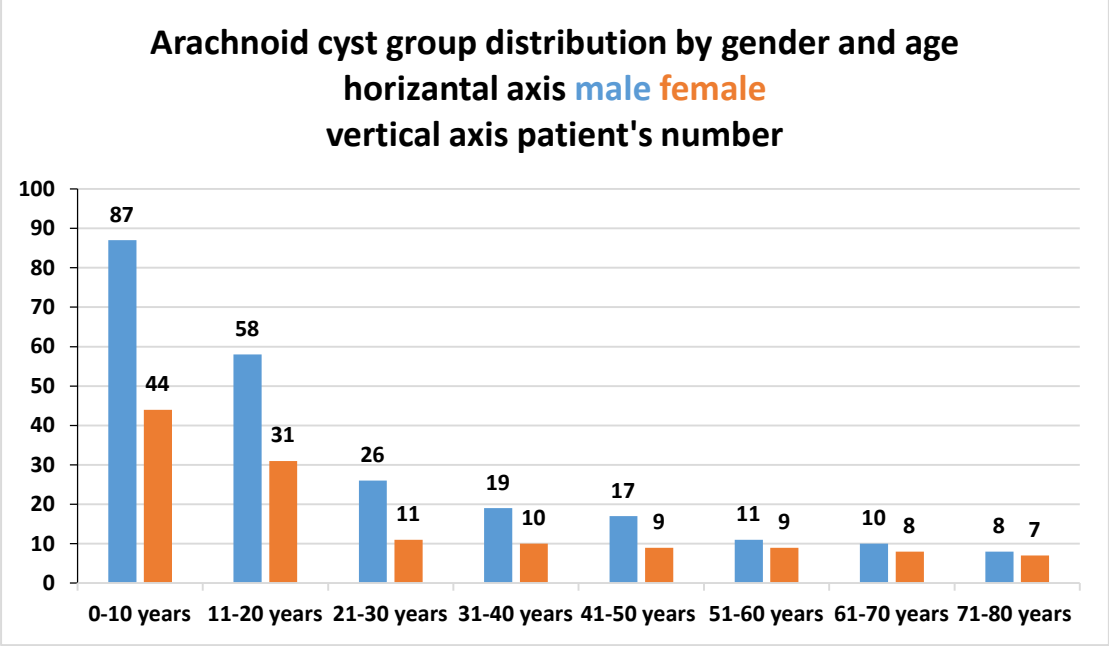

Figure 4 Arachnoid cyst group distribution by gender and age

Cyst location and grading

Galassi and associates had classified Sylvian fissure cysts, from a radiological perspective into (depending on CT scan), Type I: biconvex cyst, at the temporal lobe tip, they appear to communicate freely with the adjacent CSF spaces, producing a little mass effect & no skull deformities. Type II: triangular or rectangular cyst, occupies the proximal & intermediate segments of the fissure, less likely to communicate with adjacent subarachnoid space. Type III: they comprise up to 30% of Sylvian fissure cysts, it occupies the entire fissure, not communicating with the CSF cisterns, causing skull deformities & marked mass effect [1,11].

Arachnoid cysts location: 86% in the supra-tentorial space, and 14% in the posterior fossa, exhibited the following distributions (Table II).

Ninety-six patients (47%)with Sylvian arachnoid cyst exhibited Galassi grade 1 classification (Table I) The Sylvian fissure is the most common site of arachnoid cyst, with 205(56%) patients experiencing a left side dominance (70%).

Arachnoid cyst site	Number of patients	Percentage
Sylvian fissure	205	56%
Parasellar i.e. intrasellar and suprasellar	45	12%
Convexity and interhemispheric	35	10%
Cerebellopontine angle	29	8%
Vermian	40	11%
Clival	11	3%

Table II.Arachnoid cyst site distribution by patient number and percentage

Management &complications

Two hundred and sixteen patients were treated conservatively (59% of total patients) (Table I).Surgical management with a cyst-peritoneal shunt accounted for 37% of procedures, followed by endoscopic fenestration (35%) (Table I).Out of 65 procedures, 17 (26%) patients developed complications (Table I).

DISCUSSION

IACs are benign lesions with excellent long-term outcomes [8]. Usually, they show gender variations: the male to female ratio can range from 2:1 to 1:5 [1,6,12,14,17], but this preference is still unclear, however, it may be related to the presence of progesterone receptors in cyst wall cells [9].These ratios were similar to our data (2:1) in the pediatric age group, whereas the male to female ratio at ages> 50 years were almost equal.

IAC distribution analyses showed that Sylvian locations (56%) and the left side (70%) were the most common cyst locations, in agreement with Magnus *et al.* and other studies[1,6,13,18], and all arachnoid cysts were intra dural, except intra sellar cysts [18].Our cohort also revealed that Sylvian cysts exhibited Galassi grade 1dominancy.

Unfortunately, there is no class I guidance on IAC treatment [19,20,21], thus there is controversy over best management approaches (surgical versus conservative),and optimal surgical options [1.2.3]. The most critical step in selecting surgical versus conservative treatment is identifying the relationship between the cyst and the presenting symptoms/signs [1,22]. Surgical options include aspiration via a simple burr, shunting into the abdomen or a natural Cerebrospinal Fluid space, endoscopic fenestration (ventricular cystostomy or ventricular cyst-cisternostomy) and microsurgical fenestration ± marsupialisation [12,13,19]. IACs in the supra sellar and quadrigeminal regions are most amenable to neuro-endoscopy [15]. In our clinic, we adopted classical guidelines to manage IACs.

Some shunting complications include shunt revision, with incidences of up to 30% [7,12,23], shunt dependency [19], and slit-cyst syndrome (resembles slit-ventricle syndrome),but should be

considered if neuro-deterioration occurs [24]. In contrast, most authors advocate microsurgical fenestration ± marsupialisation as their first surgical preference, to achieve long-term clinical success rates approaching 75% [1].

Surgical and endoscopic fenestration has major advantages over shunting, including the avoidance of shunt insertion and associated complications .The procedure also facilitates direct cyst inspection, potentially confirming a diagnosis, avoiding or coagulating arachnoid blood vessels, and treating the flocculated cyst [7,18,23,25,26].

Surgical IAC complications may occasionally occur, and include hydrocephalous (secondary to disturbing(cerebrospinal fluid) dynamics), pseudo meningocele, CSF leak, wound related complications, infection, subdural hygroma , subdural haematoma, seizures, repeating surgery, cranial nerve palsy (due to excessive dissection of arachnoid membranes covering the nerves), and the risk of shunt dependency and its over drainage [13,25,27]. In our cohort, we reported a complication rate of 26%, which was comparable [13,25,27]

Our study had several limitations: its observational retrospective study design, limited analysed variables and confounders, and a lack of advanced statistical methods .However, our sample size was robust, and our data reporting could establish further, more comprehensive studies in our country.

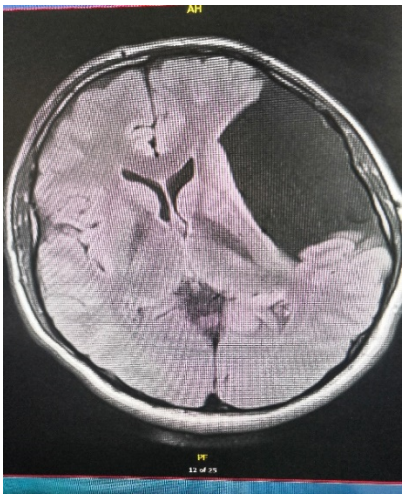

Fig. 1 T1 weighted axial MRI
Shunted left Sylvain arachnoid cyst

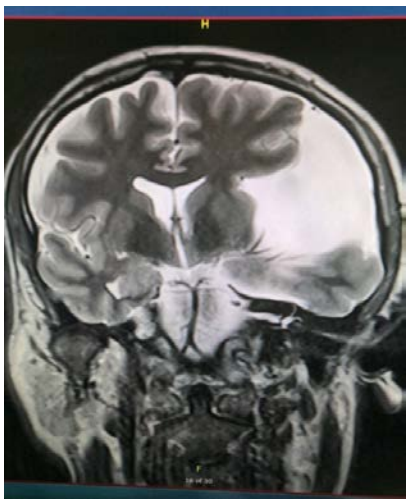

Fig. 2 .T2 weighted coronal MRI
Left Sylvain arachnoid cyst

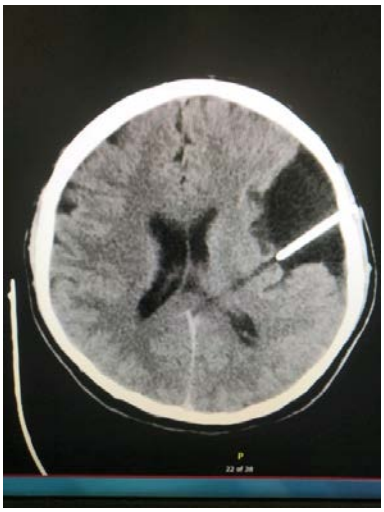

Fig. 3. Brain CT scan
Left Sylvain arachnoid cyst

CONCLUSION

IACs are common benign lesions (spinal arachnoid cysts were excluded in this study), with different clinical presentations and excellent outcomes. Variable management modalities are available, and should be guided by the clinical picture and radiological appearance. Observation is a valid management option in most cases. Importantly, our cohort data were comparable with international figures. In the future, we recommend further prospective studies investigating clinical outcomes, using different management options.

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