Symptomatic Intracerebral Pediatric Arachnoids Cyst MRI - Clinical Correlation

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ABSTRACT

Background: Arachnoids cyst is a frequent finding in pediatric neuroimaging. It represents a cerebrospinal fluid-filled sac, which is located between the brain and arachnoids membrane.

Objective: To identify pediatric age group arachnoids cysts using magnetic resonance imaging, and describe the related main clinical presentation.

Methods: A cross-sectional descriptive study employed in a major pediatric care center in Baghdad, (50) patients was found to have intracranial arachnoids cysts during magnetic resonance imaging. These were divided according to age into 1-4 year (26 patients=52%), 5-8 years (10 patients=20%), 9-12 years (8 patients =16%) and 13-16 years (6 patients=12%) and according to gender into male (37 patients=74%) and female (13 patients=26%). The main clinical features were recorded.

Results: Total study sample of 50 patients with intracranial arachnoids cyst, with 27 arachnoids cysts were in middle cranial fossa, 2 in left convexity, 2 in left frontal region, 4 in midline quadrigeminal region, and15 in the posterior fosse. The main clinical presenting feature for those were headache 19 patients, seizures 11 patients, skull deformity 7 patients, developmental delay 6 patients, ataxia/gait disturbances 3 patients and increased intracranial pressure 4 patients.

Conclusions: Magnetic resonance imaging is a useful imaging tool to identify Intracranial Arachnoids cysts, being able to differentiate between different intracranial lesions and the arachnoids cysts had a significant correlation with clinical presenting features.

Keywords: Arachnoid cysts, Magnetic Resonance Imaging.

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Arachnoids cysts (AC) are benign fluid-filled malformations of the arachnoids tissue that do not communicate with the ventricular system, they can be located along the cranio-spinal axis[1], 90% of arachnoids cysts in some reports were found in supra-tentorial locations and 10% were found in the posterior fosse. The most common supra-tentorial site is the middle cranial fosse (60%)[2]. The posterior fosse is the second most common site[3]. Other sites include the quadrigeminal plate, supra sellar region; cerebral convexity and intra-ventricular arachnoids cyst have been reported in the fourth and lateral ventricles[2].

Most primary arachnoids cysts arise as developmental anomalies[4-6] nevertheless, genetic factor have been suggested as the underlying mechanisms[7].

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Arachnoids cysts are frequently discovered incidentally in asymptomatic patients undergoing radiological investigation for various other neurological symptoms, therefore, an association between the characteristic symptoms and AC has been questioned[4,8]. Nevertheless, it has been reported that symptomatic intracranial arachnoids cyst (IAC) cases represent approximately 60-80% of all cases[9,10], and may present with specific symptoms, such as sensory motor symptoms corresponding to the location of the cyst, or more often they yield unspecific symptoms (e.g. headache or dizziness, or symptoms related to suboptimal cerebral function, such as epilepsy or impaired cognition)[11-14].

Although, it is difficult to diagnose symptoms in small infants, even asymptomatic IAC may impact cerebral function significantly as this is a critical

period of brain development, in this age group[11,15-17].

Methods

A descriptive cross sectional study included the clinical features and MRI finding of 69 patients with intracranial arachnoids cyst (AC). Only 50 patients (5-16 years), of them 37 Male, 13 females were included in our study (symptomatic AC), and 19 patients excluded where they met our exclusion criteria (exclusion criteria, include asymptomatic patient with AC, and AC with additional intracranial lesions). Five patients with other additional intra cranial lesions and 14 were asymptomatic and discovered during MRI for trauma or for follow up of hematological malignancy.

The study was conducted at the Central Teaching Hospital for children in Baghdad health directorate, Iskan, during a period of 10 months from January through October 2016.

The decision to perform MRI was based on the clinical judgment of the referring pediatrician.

We enrolled patients with clinical signs and symptoms that might be related to IAC and categorized them in to six main features (Headache, seizures, skull deformity, developmental delay, ataxia and increased intracranial pressure).

Demographic information, including age and sex. Patients are divided according to age into (1-4 years,5-8 years, 9-12 years and 13-16 years). Clinical data recruited from patients' case sheet, include the clinical evaluation reports and main presenting features.

Imaging criteria was based on the identification of a homogenous extra axial cystic lesion which exerts a mass effect on the surrounding tissue, showing signal intensity similar to cerebrospinal fluid (CSF) and completely suppressed by FLAIR sequence and free diffusion sequence (DWI) (these sequences can precisely differentiates from other cerebral cysts like epidermoid cyst, porencephalic cysts and chronic subdural hematoma) with imaging characteristics, including size measurements and anatomical location.

The study was performed with a 1.5 Tesla MEGNATOM Avanto scanner (Siemens, Germany) using head coil with the T1, T2, FLAIR and DWI sequences in required plane without contrast media.

Oral sedations or iv general anesthesia was used to achieve adequate stabilization. Parent's full explanation and agreements of purposes and procedure is achieved.

Statistical Package for Social Sciences (SPSS) version 21 was used. Descriptive statistics presented as (mean ± standard deviation) and frequencies as percentages. Kolmogorov Smirnov analysis verified the normality of the data set. Multiple contingency tables conducted and appropriate statistical tests performed, Chi-square used for categorical variables and t-test was used to compare between two-way ANOVA analysis was used to compare between more than two means. In all statistical analysis, level of significance (p value) set at ≤ 0.05 and the result presented as tables and/or graphs. Statistical analysis of the study was done by the community medicine specialist.

Results

A total of 50 patients included in this study with mean age of 5.1±4.7 years; 52% of children were in age group 1-4 years, 20% (5-8 years), 16% (9-12 years) and 12% (13-16 years). Males were more than females with male to female ratio as 2.8:1, (Table 1).

Arachnoids cyst location of studied children was observed to be the highest in the left middle cranial fossa being 23, (Table 2).

No significant differences observed between children with different arachnoids cyst (AC) locations according to their gender (p=0.2), although, middle cranial fossa AC locations was more predominant among male children while posterior fossa

cerebello-pontine angle cyst location was only present among female children.

The common presenting clinical features (as referred by pediatricians) was headache (38%), (Table 4).

There was a significant association between cyst location and clinical features (p=0.003), middle cranial fossa locations of AC were significantly associated with headache, seizure and skull deformity. Posterior fossa retro-cerebellar with ataxia/gait disturbance, (Table 5).

No significant statistical differences between distribution of AC dimension mean according to AC location (trans, antero, cranio) in all location of AC except in frontal and posterior fossa (retrocerebellar) location where there is significant differences in size between different dimensions (P value = 0.005 and 0.006), respectively, (Table 6).

No significant differences in children age according to AC clinical features (p=0.25), (Table 7).

Table 1: Age groups and gender distribution.

Variable	No.	%
Age mean ±SD (5.1±4.7 years)		
1-4 years	26	52.0
5-8 years	10	20.0
9-12 years	8	16.0
13-16 years	6	12.0
Total	50	100.0
Gender		
Male	37	74.0
Female	13	26.0
Total	50	100.0

Table 2: Intracranial arachnoids cyst locations according to sides.

Locations	Left	Right	Midline
	No.	No.	No.
Supratentorial location			
Middle cranial fosse	23	4	0
Convexity	2	0	0
Frontal	2	0	0
Quadrigeminal region	0	0	4
Infratentorial location			
Posterior fosse CPA	1	1	0
Posterior fosse retrocerebellar	5	4	1
Posterior fosse supracerebellar	0	0	2
Posterior fosse lateral cerebellar	1	0	0
Total	34	9	7

Table 3: Distribution of AC locations according children gender.

Variable	Male		Female		χ^2	P
	No.	%	No.	%		
Locations					9.6*	0.2
Middle cranial fosse	22	56.4	5	45.5		
Convexity	2	5.1	0	-		
Frontal	2	5.1	0	-		
Quadrigeminal region	3	7.7	1	9.1		
CPA	0	-	2	18.2		
Retro-cerebellar	8	20.5	2	18.2		
Supracerebellar	1	2.6	1	9.1		
Lateral cerebellar	1	2.6	0	-		

*Fishers exact test.

Table 4: Main clinical presenting features.

Variable	No.	%
Presenting clinical features		
Headache	19	38.0
Seizures	11	22.0
Skull deformity	7	14.0
Developmental delay	6	12.0
Ataxia/gait disturbances	3	6.0
Increased intracranial pressure *	4	8.0
Total	50	100.0

*increase ICP is imaging finding, include hydrocephalus, periventricular CSF leakage shows reduce signal in T1, and increase signal in T2., with normal mantle brain parenchymal thickness without brain atrophy.

Table 5: Distribution of AC locations according to main clinical presentation.

Variable	Headache		Seizures		Skull deformity		Develop. Delay		Ataxia/ Gait dis.		Increased ICP.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Locations												
Middle cranial fossa	12	63.1	7	63.6	5	71.4	3	50.0	0	-	0	-
Convexity	0	-	1	9.1	1	14.3	0	-	0	-	0	-
Frontal	0	-	2	18.2	0	-	0	-	0	-	0	-
Quadrigeminal region	1	5.3	0	-	1	14.3	0	-	0	-	2	50.0
Posterior fossa CPA	0	-	0	-	0	-	0	-	1	33.3	1	25.0
Posterior fossa retrocerebellar	5	26.3	1	9.1	0	-	2	33.3	2	66.7	0	-
Posterior fossa supracerebellar	0	-	0	-	0	-	1	16.7	0	-	1	25.0
Posterior fossa lateral cerebellar	1	5.3	0	-	0	-	0	-	0	-	0	-

P=0.003.

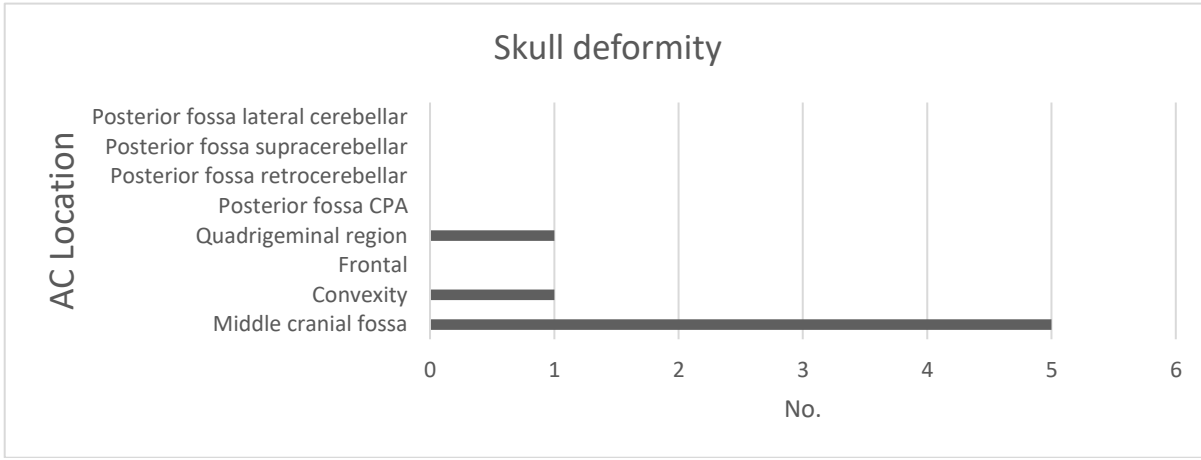

Figure 1: Arachnoids cyst association with skull deformity (asymmetry of occipital bone due to posterior fosse AC).

Table 6: Distribution of AC dimension means according to AC locations.

Locations	Trans. (mm)	Antero. (mm)	Cranio. (mm)	P V
	Mean ±SD	Mean ±SD	Mean ±SD	
Middle cranial fosse	26.6±11.7	29.7±12.1	30±15.2	0.47
Convexity	46.5±9.7	49.7±5.3	50±12.3	0.9
Frontal	14.4±2.2	14.2±1.7	28.6±0.9	0.005
Quadrigeminal region	18.4±3.6	20.4±1.3	20±1.5	0.48
Posterior fosse CPA	28.7±5.9	16.5±2.1	25.3±0.7	0.09
Posterior fosse retrocerebellar	14.4±5	16.2±4.6	23.4±8	0.006
Posterior fosse supracerebellar	15.3±0.9	18.3±4.7	21.8±5.4	0.41
Posterior fosse lateral cerebellar	16±1.7	15±0.8	18±1.4	NONE

*ANOVA

Table 7: Distribution of children age groups according to main clinical presenting feature.

Variable		Headache	Seizure	Skull deformity	Developmental delay	Ataxia	Increase ICP
Age group (year)	N						
1- 4	26	7	6	3	5	3	2
5- 8	10	5	3	0	1	0	1
9- 12	8	5	2	1	0	0	0
13-16	6	2	0	3	0	0	1
Total	50	19	11	7	6	3	4

*ANOVA

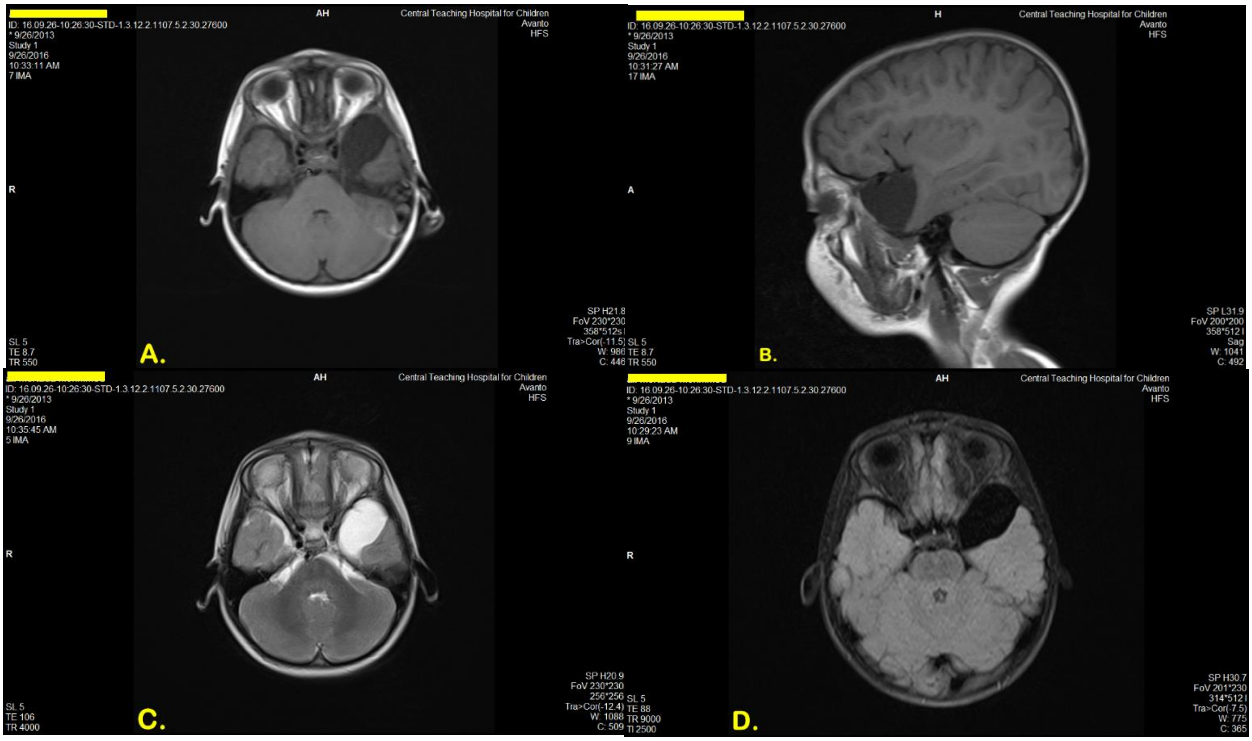

Figure 2: Left sided temporal arachnoids cyst in a 3-year child presenting with headache (A: axial T1, B: sagital T1, C: axial T2, D: Axial FLAIR).

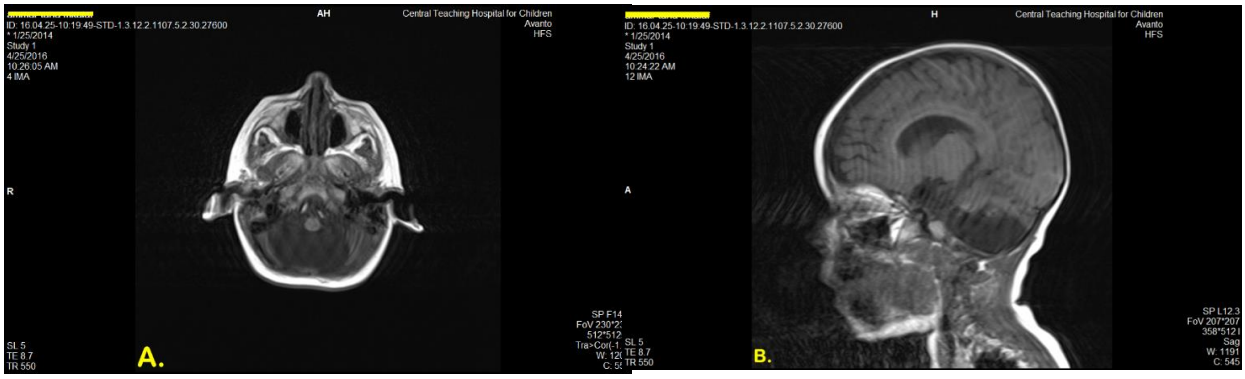

Figure 3: Posterior fosse arachnoids' cyst in 3 years old male presented with ataxia.

Discussion

Arachnoids cysts are benign (fluid-filled) malformations of the arachnoid tissue which do not show communication with the ventricular system.

An apparent increase in frequency and a shift in age distribution toward the first years of life have been described in recent years, likely reflecting the increasing use of intracranial imaging, especially MR imaging[18-22] and over 75% are now detected at the first two decades of life[10,21] and most of the patients who develop symptoms, manifest during childhood or by the second decade of life[3].

Regarding age groups of our study we found increase in prevalence (52%) at (1-4 years) group and the lowest (12%) at the (13-16) group.

It comes inconsistent with Al-Holou et al[4] which state that “There was no significant difference in arachnoids” cyst prevalence over the pediatric age range, this may result from the small sample in our study.

In our study we found the middle cranial fosse was the most common location (54%) with the left side being predominant (85.2%).

This is in agreement with many others studies[14,19,23-26], a left-sided predominance for middle fosse cysts has also been noted in some studies[1,19].

We identified a significant greater prevalence of arachnoids' cysts in males (74%) compared to (36%) in female, which fits with many authors who have identified a greater prevalence of arachnoids' cysts in males[1,4].

We observed no significant differences between location and gender (p=0.2), although, middle cranial fosse AC location was more predominant among male children while posterior fosse CPA AC location was only present among female children, this comes in accordance Holou et al[4] and Helland CW Ester K et al[16].

We found no significant differences between children with different age groups and size measurements.

This is possibly due to existence of many causes for AC development and different theory about how it expands[5].

Although arachnoids' cysts have increasingly been identified on MR imaging, the natural history and clinical relevance of these lesions is not well understood, and despite it is known that arachnoids' cyst is frequently discovered incidentally in asymptomatic patients, others have been reported that symptomatic IAC cases represent approximately 60-80% of all cases[8,27].

Some authors proposed that arachnoids' cysts are frequently symptomatic and argue that any impairment of mental function is likely to be improved following surgery. Others suggest offering surgery only when imaging criteria are convincing that a cyst is symptomatic[4].

The cause-effect relationship and clinical judgment is sometimes difficult when symptoms are common and nonspecific such as headaches, attention-deficit disorder, and aphasia[27,3]. We acknowledge that this point will remain controversial.

The most direct link of cause- effect relationship is found in situations, such as obstructive hydrocephalus, in which the cyst is found to cause obstruction and there will be symptomatic relieve after surgery[3].

In the present study, we found a significant correlation between AC location and clinical presenting feature, which could be attributed to many factsheets. There was a significant association AC location and AC clinical features (P = 0.003), middle cranial fossa location of AC was significantly associated with headache and seizure and skull deformity, posterior fossa retro-cerebellar with ataxia/gait disturbance and to lesser extent the quadrigemeninal region AC with increase ICP and MCF with developmental delay, this partially in accordance with Al-Holou et al[4] which state that (middle cranial fossa and quadrigemeninal plate cysts were positively correlated with the presence of development of symptoms (P = 0.004 and 0.006 respectively and surgical treatment (P =0.0001 and P = 0.03, respectively).

In our study the common presenting clinical features of AC were headache (38%), seizures (22%), skull deformity (14%), developmental delay (12%), increased intracranial pressure ICP (8%) and ataxia/gait disturbances (6%), this in accordance to Helland C Wester K et al[16] state that "headache is the most common complaint in cyst patient".

This in accordance with many retrospective studies which state that Intracranial arachnoids' cysts may cause headaches[16,27,28] seizures[14,15,23] cranial deformities or increasing head size[23,28,29] hydrocephalus[15,29] cognitive symptoms[1,15,16,23] or other focal neurological deficits such as hemi paresis and cerebellar symptoms[29].

This in accordance with many other studies [11-14] and Al-Holouetal[4] who state that "initial cyst size and intracranial location correlated with ether presence or development of symptoms and surgical treatment".

In conclusion; MRI is a useful imaging tool to identify intracranial arachnoids cysts, being able to differentiate between different intracranial lesions, with a significant correlation between clinical features and cyst location.

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