

## Management of Subdural Hygroma in Infants and Children

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### ABSTRACT

**Aim of the work:** This is a retrospective study of the clinical outcome and complications after management for subdural hygroma in children and infants.

**Patients and Methods:** The authors reviewed 22 consecutive patients during the period from June 2017 to October 2021 with subdural hygroma. We retrospectively evaluated the causes, preoperative symptoms, and postoperative results for those patients who underwent different management plans for treatment of their hygromas at our locality.

**Result:** There were 10 boys and 12 girls whose mean age was 6.2 years (range 6 months - 12 years). The main clinical manifestations were: increased head size, epileptic fits, increased intracranial pressure, delayed developmental milestones. About 13.6 % of cases were managed conservatively, trans-fontanel tapping was used in 13.6%, burr hole drainage was applied in 23%, external drain was used in 10% and subduro-peritoneal shunts were inserted in 41% of cases.

**Conclusion:** Subduro-peritoneal shunt is an effective management of subdural hygromas and can be applied if conservation and repeated tapping fail to control symptoms.

**Keywords:** Subdural hygroma; Extraaxial fluid collection; Subdural peritoneal shunt.

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### INTRODUCTION

Various terms are used for subdural hygroma in infants and children such as subdural hygroma, subdural effusion and subdural fluid collection, according to the pre-existing condition. The initiation of the treatment for subdural hygroma should be prompt, as it may present with hemorrhage and progress into a subdural hematoma in 3~4weeks, which results in a confusing diagnosis between subdural hygroma and subdural hematoma<sup>1</sup>. Sohn et al<sup>1</sup> reported in a prospective study that in adults, incidence of traumatic subdural hygroma was 35.6 % of patients who were admitted for more than 7 days in hospital after brain trauma.

Reports for the progression rates from traumatic subdural hygroma to chronic subdural hematoma in adults are varying from 8~50%<sup>2, 3, 4, 5</sup>. It is known that subdural hygroma in infants and children is a condition which compresses the developing brain, so, relieving the pressure allows re-expansion of the brain with subsequent normal development and better outcome. Also, as this condition is markedly different from other disease entities (benign subdural collections of infancy, benign extra-axial collections of infancy, benign subarachnoid fluid collection of infancy) which resolve spontaneously without any

therapy, it is mandatory to arrive at an accurate diagnosis<sup>6, 7</sup>.

Our objective in this study was to review retrospectively our results in management of subdural hygroma in infants and children at our locality.

### PATIENTS AND METHODS

From June 2017 to October 2021, at the Neurosurgical Department of the Sohag university Hospitals, Sohag University, 22 patients with subdural hygroma (SDH) were included. Inclusion criteria were; age from 6 months up to 12 years, unilateral or bilateral SDH, not associated with intracerebral hematomas or growing skull fractures.

#### Preoperative Evaluation

All patients underwent preoperative clinical and routine laboratory evaluation. To assess the size and the communication of the hygroma, all patients underwent CT and MRI brain prior to surgery.

#### Management approaches

##### 1. Conservative Treatment

For infants presented with hygromas without progressive macrocephally, lax anterior fontanels and without compression manifestations, we observed

them both clinically and radiologically for variable periods of time unless evidence of progression of size or clinical manifestations.

2. Tapping of the hygroma

Tapping from anterior fontanel in infants with opened anterior fontanels or from burr holes in older children was the primary choice for hygromas with clinical manifestations of mass effect. Repeated tapping was done for patients with slow reaccumulation rate, less than 2 times per week.

3. Shunting of the hygroma

For patients with rapid reaccumulation of their hygromas after tapping for 2 times or more in the same week or persistent recollection over 1 month, we decided to do either:

a. External Drain

For patients without any radiological evidence of communication between the subdural and subarachnoid spaces. We used a closed sterile system of subdural drain for a period not more than 5 days to avoid infection under an umbrella of broad spectrum antibiotics. If the rate of drainage exceeded 250 ml

per day or persistent CSF drainage exceeding 5 days we shifted to permanent subduro-peritoneal shunting.

b. Subduro-peritoneal shunt

For patients with evidence of subduro-subarachnoid communication we did subduro-peritoneal shunts from the start, using medium pressure shunts and for those who failed with above lines of management we did subduro-peritoneal shunts using low or medium pressure subduro-peritoneal shunts according to the measured CSF pressure.

RESULTS

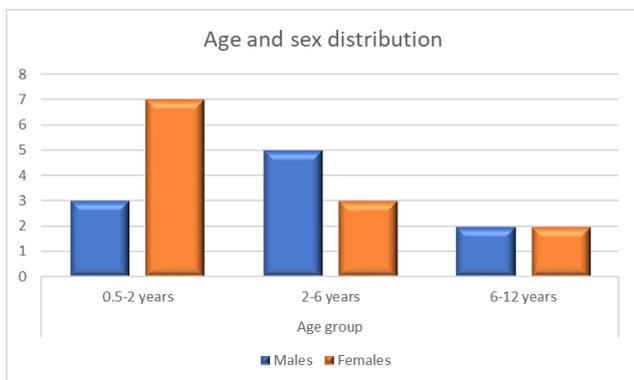
Twenty-two consecutive patients during the period from June 2017 to October 2021 with subdural hygromas were included.

Age and sex incidence:

Out of 22 cases: 12 were females (55%) and 10 were males (45 %). Age varies from 6 months to 12 years with a mean of 6.2 years.

	Total number	Sex		Total	P value
		Males	Females		
Age	Mean±SD	10(45%)	12(55%)	22	-
	Median(range)	4.95±3.86	3.83±3.34	4.34±3.54	0.632
Age group	0.5-2 years	5(0.5-12)	2(1.5-11)	3.5(0.5-12)	0.619
	2-6 years	3	7	10	
	6-12 years	5	3	8	
		2	2	4	

Table 1: Age and sex incidence

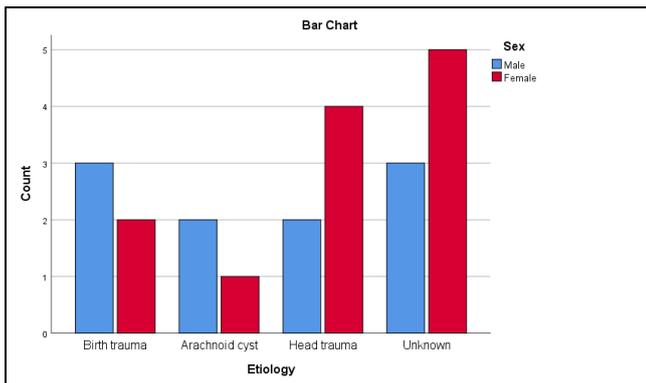
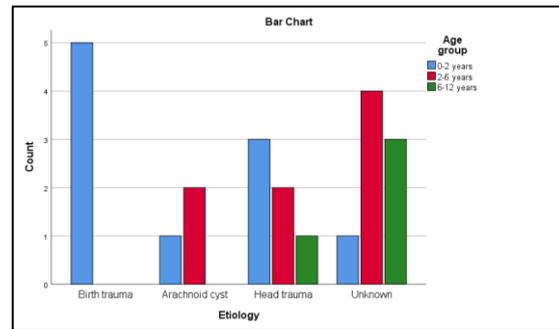
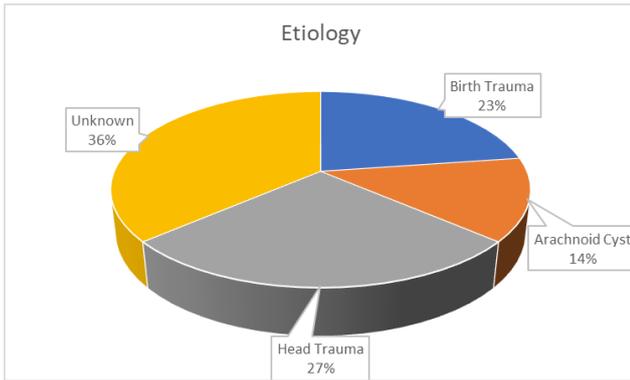


Etiology:

While history of birth and head trauma was evident in most cases, some of cases were with unknown cause. Rupture arachnoid cyst due to mild head injury was found in 3 cases

Etiology		Sex		Total	P value	
		Males	Females			
Etiology	Birth trauma	3(30%)	2(16.7%)	5(22.7%)	0.327	
	Arachnoid cyst	2(20%)	1(8.3%)	3(13.6%)		
	Head trauma	2(20%)	4(33.3%)	6(27.3%)		
	Unknown	3(20%)	5(41.7%)	8(36.4%)		
Etiology		Age groups			P value	
		0-2 years	2-6 year	6-12 years		
	Birth trauma	5(50%)	0	0		0.006
	Arachnoid cyst	1(10%)	2(25%)	0		
	Head trauma	3(30%)	2(25%)	1(25%)		
Unknown	1(10%)	4(50%)	3(75%)			

Table 2: Etiology

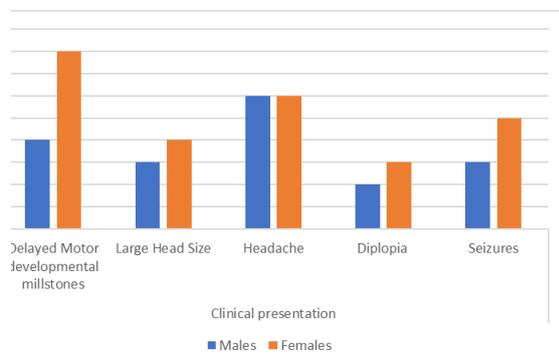
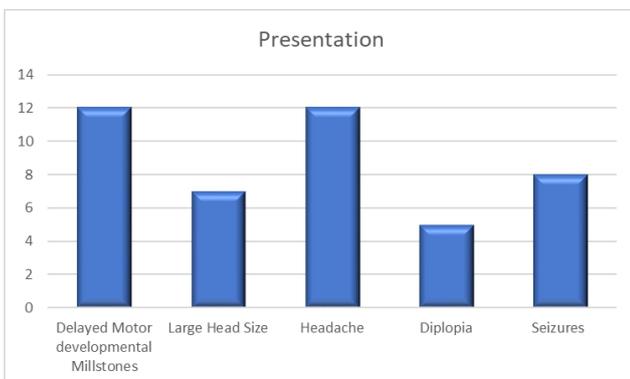


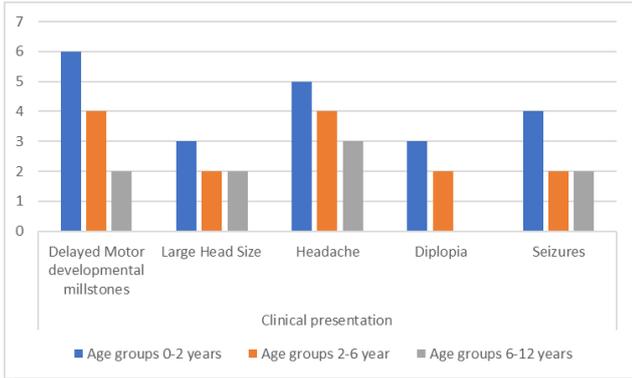
**Clinical symptoms and signs:**

Delayed motor milestones and large head size were the main presentations in infants while manifestations of intracranial hypertension predominated in older children.

Clinical presentation	Delayed Motor developmental millstones	Sex		Total	P value
		Males	Females		
		4(40%)	8(66.7%)	12(54.5%)	0.391
	Large Head Size	3(30%)	4(33.3%)	7	1.000
	Headache	6(60%)	6(50%)	12	0.691
	Diplopia	2(20%)	3(25%)	5	1.000
	Seizures	3(30%)	5(41.7%)	8	0.675
		Age groups		P value	
		0-2 years	2-6 year	6-12 years	
		6(60%)	4(50%)	2(50%)	0.685
	Large Head Size	3(30%)	2(25%)	2(50%)	0.588
	Headache	5(50%)	4(50%)	3(75%)	0.478
	Diplopia	3(30%)	2(25%)	0	0.278
	Seizures	4(40%)	2(25%)	2(50%)	0.916

**Table 3: Clinical presentation**



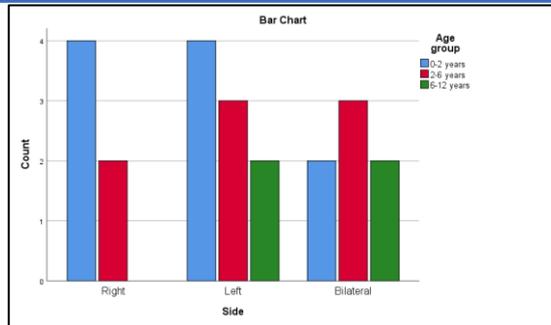
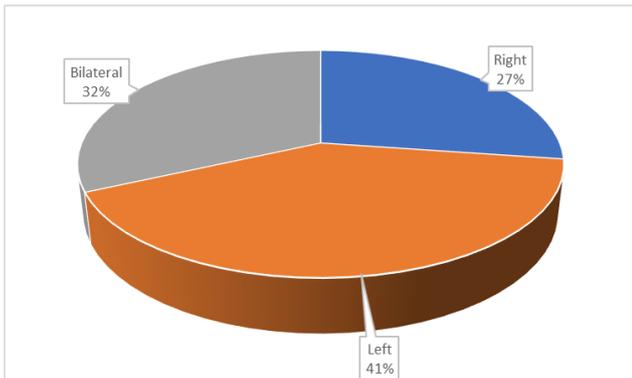


**Radiological Findings:**

Bilateral hygromas were found in 7 cases and temporal arachnoid cysts were found in 3 cases.

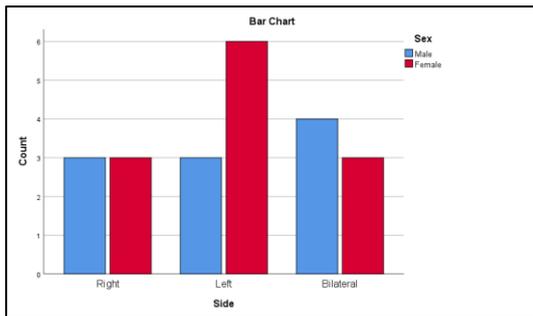
Side of hygroma		Sex		Total	P value
		Males	Females		
Side of hygroma	Right	3(30%)	3(25%)	6(27.3%)	0.766
	Left	3(30%)	6(50%)	9(40.9%)	
	Bilateral	4(40%)	3(25%)	7(31.8%)	
Side of hygroma		Age groups			P value
		0-2 years	2-6 year	6-12 years	
Side of hygroma	Right	4(40%)	2(25%)	0	0.122
	Left	4(40%)	3(37.5%)	2(50%)	
	Bilateral	2(20%)	3(37.5%)	2(50%)	

**Table 4: Radiological findings**



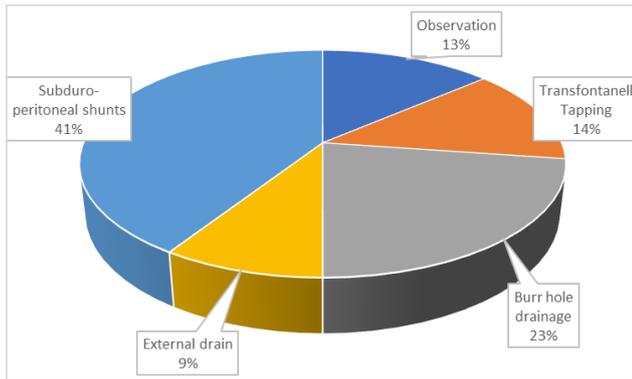
**Treatment results:**

Subduro-peritoneal shunts were the most common surgical method (41 %) while external drains were used in 2 cases only (9%).



Management		Sex		Total	P value
		Males	Females		
Management	Observation	1(10%)	2(16.7%)	3(13.6%)	0.776
	Transfontanell tapping	1(10%)	2(16.7%)	3(13.6%)	
	Burr hole drainage	3(30%)	2(16.7%)	5(22.7%)	
	External drain	1(10%)	1(8.3%)	2(9.1%)	
	Subduro-peritoneal shunt	4(40%)	5(41.7%)	9(40.9%)	
Management		Age groups			P value
		0-2 years	2-6 year	6-12 years	
Management	Observation	2(20%)	1(12.5%)	0	0.705
	Transfontanell tapping	1(10%)	1(12.5%)	1(25%)	
	Burr hole drainage	2(20%)	2(25%)	1(25%)	
	External drain	1(10%)	1(12.5%)	0	
	Subduro-peritoneal shunt	4(40%)	3(37.5%)	2(50%)	

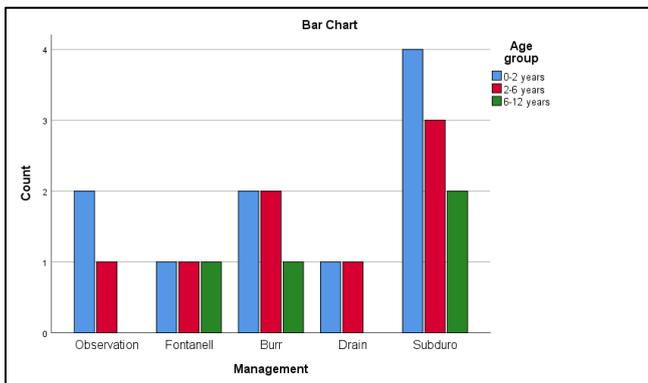
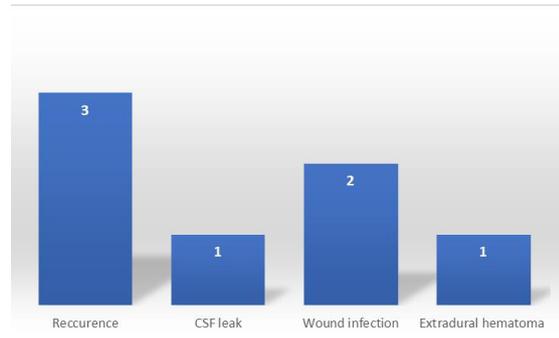
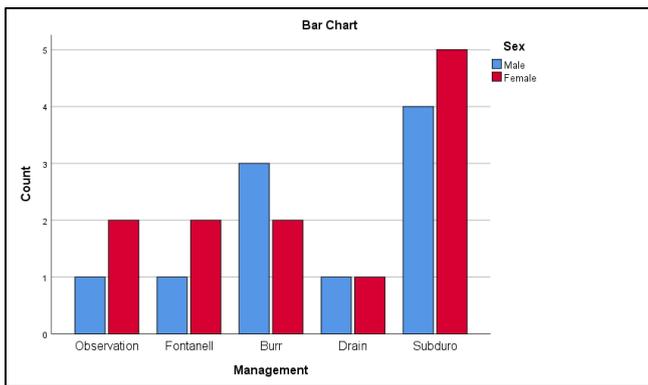
**Table 5: Treatment**



evacuation with a craniotomy flap and insertion of a subduro-peritoneal shunt in the same session. There was no CNS infection or operative mortality in this series.

Complication	No of Cases
Reccurence	3
CSF leak	1
Wound infection	2
Extradural hematoma	1

**Table 6:** Postoperative complications



**Complications:**

All cases with hygroma recurrence after tapping were managed by a subduro-peritoneal shunt. CSF leak occurred in one patient who was treated by burr hole drainage, and leak was minimal and stopped spontaneously after 3 days of conservative treatment. In two cases, superficial wound infection was controlled by broad spectrum antibiotics.

In one case, after insertion of a subdural drain, extradural hematoma developed causing deterioration of conscious level after initial clinical improvement in 5 years old boy having a left sided ruptured temporal arachnoid cyst. It was managed by

Case presentations:

Case 1

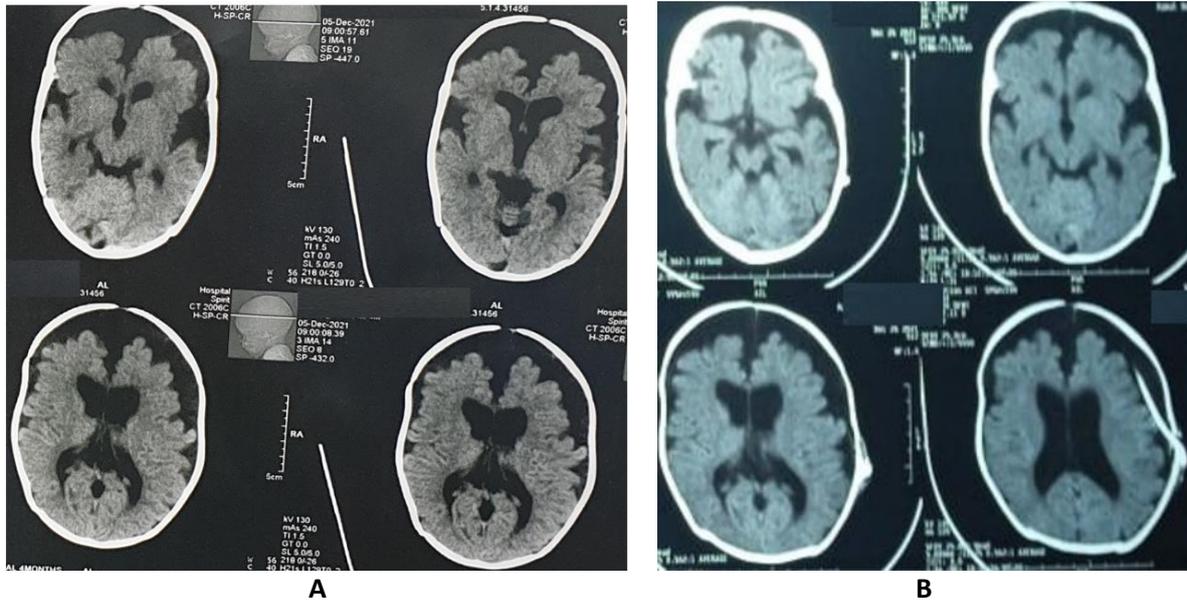


Fig. 1: Preoperative (A) and Postoperative (B) CT scans of an 8-months old boy with bilateral subdural hygroma.

Case 2

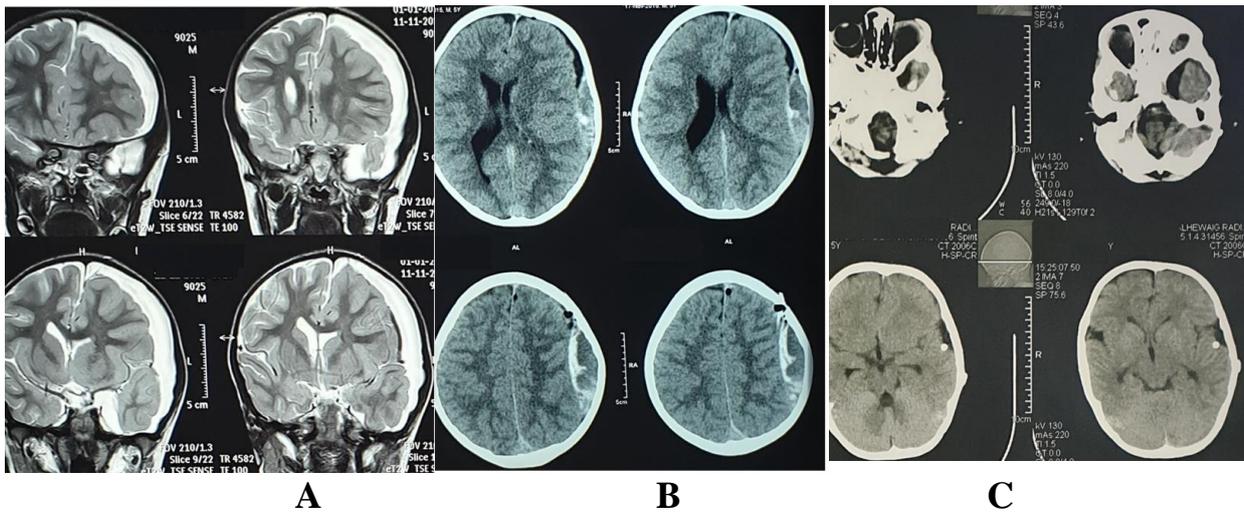
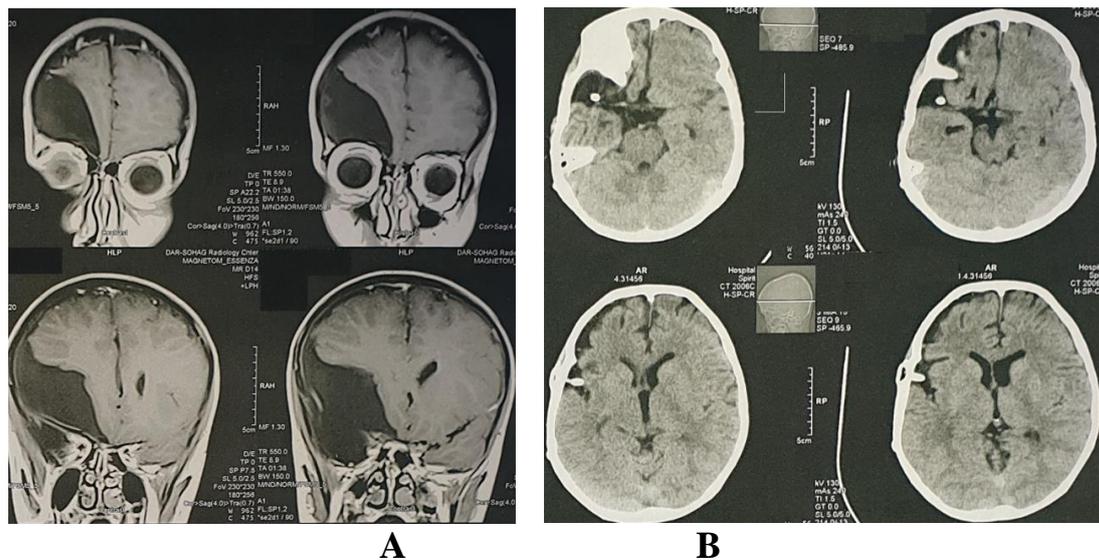


Fig. 2: Preoperative MRI (A) and Postoperative CT scans (B showing extradural hematoma after subdural external drain and C after subduroperitoneal shunt and evacuation of extradural hematoma) of a 5-years old boy with Lt sided subdural hygroma secondary to rupture of Lt temporal arachnoid cyst.

## Case 3



**Fig. 3:** Preoperative MRI (A), and Postoperative (B) CT scan of a 12-years old boy with Rt sided subdural hygroma secondary to rupture of Rt temporal arachnoid cyst.

### DISCUSSION

There is no accurate report on the incidence of subdural hygroma in infants, but it has been suggested that subdural hematomas occur every 21 per 100,000 infant populations<sup>8</sup>.

The mechanisms for formation of subdural hygroma are known to be idiopathic or secondary after brain damage. In idiopathic cases; cells in the granulation tissue of the arachnoid membrane does not develop adequately, which then interferes with the normal cerebrospinal fluid absorption process. Ultimately, subdural hygroma develops when the outer arachnoid membrane breaks up or when the cap cells of arachnoid membrane proliferates. But it is well known that subdural hygroma improves when the cerebrospinal fluid is absorbed normally as time goes on<sup>9, 10</sup>. Unfortunately, if the subdural hygroma grows too large while waiting for spontaneous resolution, it may influence brain development and may also further develop in to a subdural hematoma, and needs surgical intervention<sup>11</sup>.

When the etiology is secondary, it has been demonstrated that when treatment consisted of subdural drainage or subduroperitoneal shunt, the success rate is high due to the brain expansion in the developmental age. All subdural hygromas in infants and children should be treated taking into consideration the size of the hygroma and the presence or absence of symptoms<sup>12</sup>.

Arachnoid cysts are common childhood developmental anomalies, but their association with spontaneous subdural hygroma is rare. They are benign lesions and may be associated with complications such as subdural hematoma, subdural hygroma, and intracystic hemorrhage. Minor head injury is known to result in subdural hygroma or hematoma due to rupture of arachnoid cyst; however

spontaneous rupture of arachnoid cyst may occur rarely<sup>6, 9</sup>.

The idiopathic cause is most common in patients under the age 1, and especially at 3-5 months. When and how often infants or children develop subdural hygromas is not yet accurately known, but progression to subdural hematoma usually develops 3~4 weeks after the appearance of subdural hygroma<sup>12</sup>. In this study about 36% of cases were with unknown cause and head and birth trauma predominated the causes while 3 cases had ruptured arachnoid cyst after minor head injury.

According to Caldarelli et al<sup>13</sup>, which studied 85 cases of infantile subdural hygroma, the main symptoms were increased intracranial pressure, macrocrania, mental retardation, hemiparesis, seizure, and decreased consciousness, in decreasing order of frequency. However, our study showed that delayed developmental milestones, increased intracranial pressure, seizures, large sized head, and lastly diplopia was the most common symptoms, in descending order of frequency.

Radiological characteristics of subdural hygroma in CT and MRI can be distinguished from external hydrocephalus. As subdural hygroma shows expansion of the subdural space and not the subarachnoid space due to accumulation of CSF in the subdural space. So, the enhanced vessels by contrast media are compressed to adhere to the brain<sup>14, 15</sup>. When a subdural hygroma appears on the inside of a cerebral cortical vessel, it should be differentiated from external hydrocephalus. If the patient is under age of 1 month, it should also be differentiated from other transient diseases, such as benign perisylvian fluid collection and benign familial subdural fluid collection. Of course the subarachnoid membrane can be seen without enhancement on the MRI, and therefore it can be certain that the location of the hygroma is not in the subarachnoid space, but in the subdural space<sup>16</sup>. Mri

brain was done for all cases in this series and carefully studied by radiologist and us to differentiate subdural hygroma from other possibilities.

Many authors tried subdural aspiration first in infantile patients with subdural hygroma, and then subdural drainage. This is a still used surgical procedure, but subdural aspiration may be of benefit for some cases<sup>12</sup>. In this study, subdural aspiration (tapping from anterior fontanelle) was performed in 3 cases by transfontanell aspiration. The other 5 cases were done by burr hole drainage in older children. Among the 8 cases, 6 cases improved and 2 cases needed subduroperitoneal shunts.

Subdural drainage through subdural catheter as an external drain may be tried for subdural hygromas, but it is most effective when a subdural hematoma develops, and a success rate of 60~70% had been reported<sup>13, 17, 18, 19, 20, 21, 22</sup>. In this study subdural drain was successfully used in 2 patients. One case developed extradural hematoma after a subdural external drain causing deterioration of conscious level after initial clinical improvement in a 5 years old boy having a left sided ruptured temporal arachnoid cyst and managed by evacuation and insertion of subduroperitoneal shunt in same site at same session.

In spite of the fact that the success rate is higher after subduroperitoneal shunt compared to subdural drainage, it is not the more preferred mode of treatment for subdural hygroma. This is because of the complication of the abdomen due to the abdominal operation, though infection rate is similar to that of subdural drainage while obstruction is frequent, which does not occur with subdural drainage, and finally the shunt catheter needs to be removed after recovery<sup>22</sup>. In addition, subduroperitoneal shunt cannot be performed in the presence of subdural hemorrhage because of the high risk of obstruction<sup>22</sup>.

Nevertheless, the reason why the use subduroperitoneal shunt is being widely reported is that it may be performed when subdural drainage is ineffective, and its success rate is as high as 70~90%. With regard to the choice of unilateral or bilateral subduroperitoneal shunt in bilateral subdural hygroma, Aoki<sup>23</sup> reported that the course of subdural hygromas was improved after unilateral subduroperitoneal shunt only<sup>24</sup>. In this series 9 cases (41%) were treated by unilateral subduroperitoneal shunts with no incidence of complications. Success rate more than 90% in comparison to previous studies.

### CONCLUSION

Subdural hygroma is not uncommon disease in our community. Early diagnosis and proper management is essential for better outcome. Subduro-peritoneal shunt is an effective management of subdural hygromas and can be applied if conservation and repeated tapping fail to control symptoms.

### Limitation

Small number of patients and short term follow up.

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