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ACUTE BACTERIAL MENINGITIS IN PATIENTS ADMITTED TO THE CHILDREN HOSPITAL IN DAMASCUS, SYRIA

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ABSTRACT

Objective: This study aimed to determine the most common age, presentation (symptoms and signs) of acute bacterial meningitis (ABM) for each age group, the most common pathogens responsible for it and the cerebrospinal fluid (CSF) analysis of ABM cases. **Methods:** This is a retrospective study composed of all children (newborns until 12 years old); who reviewed the Children University Hospital Between 1/1/2015 and 20/11/2017 and were diagnosed with acute bacterial meningitis. **Results:** This study included 55 patients. Most of the participants were boys between (1 month -6 months) old. The most common results of CSF culture in our study were sterile (23 cases of all patients). In addition, the most common pathogen was Streptococcus pneumoniae (13 cases of all patients). The most common symptom-sign for each age group (<month, 1 month-6 months, 6 months- 1 year, 1 year- 6 years and 6 years- 12 years) was (poor breastfeeding-hyperreflexia, poor breastfeeding and convulsion equally-bulging fontanelle, fever- bulging fontanelle, fever- positive Neck Stiffness, upper Brudzinski, lower Brudzinski, Kernig equally and fever-neck stiffness, upper Brudzinski equally), respectively. CSF analysis revealed 23.6% of all patients had a WBC count (more than 100 cell/mm3), 18.1% had polymorph nuclear neutrophils dominance and 38.2% had low glucose levels in the CSF. All of the following opposes the diagnosis of bacterial meningitis and suggests different causes of meningitis. This could be related to incomplete or incorrect previous antibiotic therapy. **Conclusion:** We found that acute bacterial meningitis (ABM) is most common in boys between (1 month- 6 months) old. The most common pathogen causing ABM is streptococcus pneumoniae while the most common culture result was sterile. The mortality rate in our study was 21.8% (12 patients).

KEYWORDS: Acute bacterial meningitis (ABM); Children Hospital; ABM pathogens; CSF analysis

INTRODUCTION

Meningitis is an inflammation of the three anatomical layers (meninges) that covers the brain and spinal cord. It is a medical emergency and if left untreated, its morbidity and mortality rate might reach 100%. It should be noticed that even with advanced medications and intensive care units (ICU) worldwide, the morbidity rate of meningitis is about 10%/[1-2] This could even be higher in developing countries, in wars and in immunocompromised patients (tuberculosis and HIVs).[1-2] Acute bacterial meningitis (ABM) is a very common form of meningitis, and even children who recover from it might complain of long-term complications.[3] There is no single clinical feature that is sufficiently distinctive to make a firm diagnosis of meningitis; but a history of fever, seizures and altered consciousness with the presence of meningeal signs are indicative features of it.[4] The gold standard diagnosis of meningitis is pathogen culture in the cerebrospinal fluid (CSF); however, in countries with limited resources, alternatives could be used such as CSF cytology and biochemistry.

This study aimed to determine the most common age, presentation (symptoms and signs) of ABM for each age group, the most common pathogens responsible for ABM and the CSF analysis of ABM cases. Up to our knowledge, this is the first study of its kind in Syria.

MATERIALS AND METHODS

This is a retrospective study composed of all children (newborns until 12 years old) who reviewed the children's university hospital between 1/1/2015 and 20/11/2017, and were diagnosed with ABM. It should be noted that the children's university hospital, Damascus, Syria has become the main pediatric hospital in Syria during the crisis and receives patients from all over the country.

This study included 55 patients diagnosed with ABM. We excluded meningitis caused by viral, tuberculous and parasitic meningitis. We also excluded immunocompromised children and those with CSF shunts due to differences in inflammatory response and pathological agents in both groups, respectively.

The criteria used for the diagnose ABM included one or both of the following: 1-presence of bacteria in CSF culture. 2-CSF examination revealed high predominance polymorph nuclear

cell count (WBC more than 100 cell/mm3), protein level more than 50mg/100ml, and low sugar level less than 40mg/100ml.

The patient's information was obtained from the hospital's data including (age-sex-symptoms- blood sample-meningeal signs – CSF profile –CSF culture-prior antibiotic treatment- history of head trauma –complications- sequelae – death).

Meningeal signs included neck stiffness, positive kerning sign, upper and lower Brudzinski sign, bulging fontanelle- Hyperreflexia)

Statistical analysis was done using SPSS 23.0.

RESULTS

Total number of participants was 55 and most of the participants were boys between (1 month -6 months) old. (Table 1). All values in our tables are from 55 total cases. All missing or less than total data are due to missing data from the records.

Table 1: Demographic variables of our study.

Variable		Frequency	percent	total
Age	<month	4	7.3	55
	1 month-6 months	21	38.2	
	6 months- 1 year	7	12.7	
	1 year- 6 years	10	18.2	
	6 years- 12 years	13	23.6	
Gender	Male	34	61.8	55
	Female	21	38.2	

We had 9 posttraumatic cases (16.4% of all samples). We had 8 cases with complication like subdural effusion and brain atrophy (14.5% of all sample) and 1 patient has a sequel (hearing loss) (1.8% of all sample). The mortality rate in our study was 21.8 %(12 cases). (Table 2).

Table 2: frequency of different variables and the mortality rate in our study

Variable		Frequency	percent	total
Posttraumatic	No	46	83.6	55
	Yes	9	16.4	
Had complications	No	47	85.5	55
	Yes	8	14.5	
Had sequels	No	54	98.2	55
	Yes	1	1.8	
Mortality rate		12	21.8	55

The most common symptom-sign for each age group (<month, 1 month-6 months, 6 months-1 year, 1 year- 6 years and 6 years- 12 years) was (poor breastfeeding-hyperreflexia, poor breastfeeding and convulsion equally-bulging fontanelle, fever- bulging fontanelle, fever-positive Neck Stiffness, upper Brudzinski, lower Brudzinski, Kernig equally and fever-neck stiffness, upper Brudzinski equally), respectively. Table (3-4).

Table 3: Frequency of symptoms in each age group.

Age	N of cases	Symptoms								
		Frequency of symptom in each age group								
		Fever	Poor breastfeeding	Convulsion	Vomiting	Headache	Altered sensation	Respiratory distress	Diarrhea	Pain
<month	4	2	3	-	2	-	-	1	-	-
1 month-6 months	21	7	10	10	-	-	-	1	1	-
6 months- 1 year	7	6	2	3	3	1	1	-	1	-
1 year- 6 years	10	8	-	4	7	1	1	-	-	-
6 years- 12 years	13	11	-	2	11	9	1	-	-	1

Table 4: Frequency of signs in each age group:

Age	Number of cases	Clinical Signs					
		Frequency of signs in each age group					
		Neck Stiffness	Upper Brudzinski	Lower Brudzinski	Kernig	Bulging Fontanelle	Hyperreflexia
<month	4	-	-	-	-	1	5
1 month - <6 months	21	-	-	-	-	1	-
6 months- < 1 year	7	-	-	-	-	2	1
1 year-< 6 years	10	3	3	3	3	-	2
6 years- 12 years	13	10	10	8	8	-	-

The most common results of CSF culture in our study were sterile (23 cases of all patients). In addition, the most common pathogen was Streptococcus pneumoniae (13 cases of all patients). (Table 5).

Table 5: pathogens causing bacterial meningitis in our study.

	All patients	
Variable	**frequency**	**percent**
Sterile	23	41.8%
Staphylococcus	2	3.6%
Streptococcus pneumoniae	13	23.6%
Streptococcus type b	1	1.8%
Haemophilus Influenzae type b	3	5.6%
Multiple organisms	1	1.8%
Pseudomonas	1	1.8%
Missing	11	20%
Total	55	100%

Table 6 shows the CSF analysis results of all cases.

Table 6: CSF analysis in our study.

		Total N of all sample	Total % of all sample
CSF analysis	WBC less than 100	39	70.9%
	WBC more than100	13	23.6%
	Lymphocytes ↑	45	81.8%
	Neutrophils ↑	10	18.1%
	Glucose < 40	21	38.2%
	Glucose > 40	23	41.8%
	Protein ↑	41	74.5%
	Protein ↓	11	20%

DISCUSSION

Acute bacterial meningitis (ABM) is a frightening diagnosis among both parents and practitioners; therefore, a rapid diagnosis is needed in order to prevent serious outcomes that could reach death especially when left untreated. Unfortunately, there is no single clinical feature that is sufficient to make a certain diagnosis, Nevertheless, in developing countries, the clinical features of ABM were sickness, lethargy, poor feeding, neck stiffness and bulging fontanelle.[4-5]

Bacterial meningitis is most common in children younger than 4 years old and its highest incidence is in those between 3-8 months old.[6] In our study, the peak incidence was in those between 1-6 months old (38.2% of all patients). (Table 1).

We recorded 9 cases of posttraumatic meningitis, but they had no significant correlation with other variables. (Table 2).

Many studies have determined early neurologic complications and long-term sequelae of childhood bacterial meningitis, especially in developing countries. These include subdural effusion, which is the most common complication.[7] In our study, we found 7 cases out of 8 cases with complications (12.7% of all sample) with subdural effusion, followed by 2 cases out of 8 cases with complications (3.63%) with brain atrophy. Both of which were confirmed by CT scan.

Sensorineural hearing loss or vestibular dysfunction are the most frequent sequelae, mainly during the earliest stages of meningitis.[8] We reported one case that developed sensorineural

hearing loss. The mortality rate in our study was (21.8%) compared to 34% globally.[8] (Table 2).

Most of the ABM cases usually occurs during winter and autumn.[9] In our study most of the cases occurred during winter and spring.

Clinical presentation of fever, seizures and alerted consciousness accompanied by meningeal signs are common features of meningitis in infants more than 2 months old.[4] In our study, these symptoms were positive in infants of same age group. In addition, the symptoms in infants less than one-month old were poor feeding, vomiting and respiratory distress, which are nonspecific indicators.[10]

Although Streptococcus pneumoniae is widely known as the most common pathogen in ABM.[7] In this study, sterile cultures were the most common of all CSF culture results. This could be due to is undetectable cultures (bacterial meningitis of unknown etiology) or poor culturing techniques especially when the CSF profile and clinical presentation suggest bacterial meningitis. The second most common culture result was streptococcus pneumoniae, especially in ages (1 month- 6 months). Other culture results included haemophilus influenzae type b (3 cases), staphylococcus (2 cases), streptococcus (1 case), pseudomonas (1 case) and multiple organisms (1 case). (Table 5).

The CSF profile of bacterial meningitis differs between different studies; our criteria was as followed.
1- WBC count (more than 100 cell/mm3) with dominance of polymorph nuclear neutrophils. 2-Glucose level: Low (<40% of serum glucose). 3-Protein level: Elevated (>50 mg/dl).[11]

In our study, 23.6% of all patients had a WBC count (more than 100 cell/mm3), 18.1% had polymorph nuclear neutrophils dominance and 38.2% had low glucose levels in the CSF. All of the following opposes the diagnosis of bacterial meningitis and suggests other causes of meningitis. This could be related to incomplete or incorrect previous antibiotic therapy.[11](Table 6).

Our limitation in this study is similar to any other retrospective study, which is the missing data, limited resources and culturing mistakes.

CONCLUSION

We found that acute bacterial meningitis (ABM) is most common in boys between (month- 6 months) old. The most common pathogen causing ABM is streptococcus pneumoniae while the most common culture result was sterile. 23.6% of all patients had a WBC count (more than 100cell/mm3), 18.1% had polymorph nuclear neutrophils dominance and 38.2% had low glucose levels in the CSF. All of the following opposes the diagnosis of bacterial meningitis and suggests other causes of meningitis. This could be related to incomplete or incorrect previous antibiotic therapy. The mortality rate in our study was 21.8% (12 patients).

Compliance with Ethical Standards

Funding: This study was not funded by any institution.

Conflict of Interest: The authors of this study have no conflict of interests regarding the publication of this article.

Ethical approval: The names and personal details of the participants were blinded to ensure privacy.

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