



Study of Acute Bacterial Meningitis: Demographics, Symptoms and Signs

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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 and the most common pathogens responsible for it. **Methods:** This is a retrospective study composed of all children (newborns until 12 years old) who reviewed clinics between 30/5/2018 and 21/3/2020 and were diagnosed with ABM. **Results:** This study included 50 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 (25 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. **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]. 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 and the most common pathogens responsible for ABM.



Materials and Methods

This is a retrospective study composed of all children (newborns until 12 years old) who reviewed clinics between 30/5/2018 and 21/3/2020 and were diagnosed with ABM.

This study included 50 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 patient's information was obtained from the hospital's data including (age-sex-symptoms- blood sample-meningeal signs).

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

Statistical analysis was done using SPSS 25.0.

Results

Total number of participants was 50 and most of the participants were boys between (1 month -6months) old. (Table 1). All values in our tables are from 50 total cases.

Table 1: Demographic variables of our study:

Variable		Frequency	percent	total
Age	<month	3	6	50
	1 month-6 months	20	40	
	6 months- 1 year	6	12	
	1 year- 6 years	9	18	
	6 years- 12 years	12	24	
Gender	Male	31	62	50
	Female	19	38	

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 (2-3).

Table 2: Frequency of symptoms in each age group:

Age	Number of cases	Symptoms								
		Frequency of symptom in each age group								
		Fever	Poor breastfeeding	Convulsion	Vomiting	Headache	Altered sensation	Respiratory distress	Diarrhea	Pain
<month	3	1	3	-	2	-	-	1	-	-
1 month-6 months	20	6	10	10	-	-	-	1	1	-
6 months- 1 year	6	5	2	3	3	1	1	-	1	-
1 year- 6 years	9	8	-	4	6	1	1	-	-	-
6 years- 12 years	12	11	-0	2	11	8	1	-	-	1

*Multiple Symptoms could be found in the same patients



Table 3: 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	3	-	-	-	-	1	5
1 month - 6 months	20	-	-	-	-	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	-	-

*Multiple Signs could be found in the same patients

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 4)

Table 4: Pathogens causing bacterial meningitis in our study

Variable	All patients	
	frequency	percent
Sterile	25	50
Staphylococcus	5	10
<i>Streptococcus pneumoniae</i>	14	28
<i>Streptococcus type b</i>	1	2
<i>Hemophilus Influenzae type b</i>	3	6
Multiple organisms	1	2
<i>Pseudomonas</i>	1	2
Total	50	100%

Discussion

ABM is a frightening diagnosis among both parents and practitioners; therefore, a rapid diagnosis is needed 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 (40% of all patients). (Table 1)

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 [7].

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 *Hemophilus influenzae type b* (3 cases), *staphylococcus* (5 cases), *streptococcus* (1 case), *pseudomonas* (1 case) and multiple organisms (1 case). (Table 4)



Conclusion:

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

Compliance with Ethical Standards:

Funding: This study was not funded by any institution.

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

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