

### **Clinical Profile and Short Term Outcomes of Acute Bacterial Meningitis in Children Aged 1 Month to 18 Years**

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#### **Abstract**

Acute Bacterial Meningitis (ABM) is a neurologically debilitating and life threatening medical emergency. We studied the clinical profile, the etiology using cerebrospinal fluid (CSF) by gram staining, latex agglutination test (LAT) and CSF culture. This was a hospital based observational (age range 1month to 18 years) conducted in a tertiary care hospital, New Delhi. A total of 150 cases were enrolled and age stratification was done among the study population as: 1mo to 3mo, >3mo to 3yrs and >3yrs to 18 yrs and in each group a sample size of 60, 60 and 30 cases was studied respectively. Duration of symptoms before presentation ranged from 1to 5days and 100% cases presented with fever as this was in the inclusion criteria. Considering all age groups together, decreased oral acceptance (n=87), lethargy (n=65), seizures

(n=59), vomiting (n=39), irritability (n=28) and signs of meningeal irritation (n=25) were the common presentation. Eight children had multiple episodes of seizures during the hospital stay. The mortality rate was 7.14% and 80% cases who died were within 24hrs of hospitalisation, indicating the grave nature of the disease. Considering CSF culture and LAT together, Haemophilus influenzae type b (Hib), Group B Streptococcus (GBS) and pneumococcus were the most common isolates in the present study positive in 8(24.2%) out of the 33 laboratory confirmed cases of ABM followed by methicillin sensitive staphylococcus aureus (MSSA) in 3(9%), meningococcus and acinetobacter in 2(6.1%) cases each and E.coli and enterococcus in 1(3%) case each. Among the outcomes at the discharge of patients, ventriculomegaly (on ultrasound skull), recurrent seizure episodes, hearing

loss were the common ones, others being sinus venous thrombosis and cerebral abscess which were managed appropriately. This emphasizes that timely diagnosis of ABM with identifying the organism and appropriate management hence is very important

**Keywords:** neurologically debilitating, cerebrospinal fluid, latex agglutination test, sinus venous thrombosis, cerebral abscess, ventriculomegaly

### **Introduction**

Globally, meningitis is estimated to kill 1,64,000 children each year [1]. In India approximately 52,000 children die each year from meningitis. This accounts for 2% of all deaths in children <5 years of age [2].

Etiology comprises of both infections and non-infectious causes. The clinical presentations of childhood meningitis are non-specific. Bacterial meningitis is a life-threatening neurological condition and a number of the survivors develop neurologic sequelae including intellectual deficits, behavioral problems, and hearing loss [3] hence needs prompt parenteral antibiotics, compared to viral and aseptic meningitis which carries relatively better outcome [4]. The rapid identification of acute bacterial meningitis (ABM) is critical for appropriate etiology based treatment and better outcomes.

There is a need for a periodic review of cases of bacterial meningitis worldwide, since the pathogens responsible for the infection vary with time, geography, and patient age. With introduction of Hib vaccination in several parts of India and neighbouring countries the epidemiology of ABM in India is likely to change. This study has been planned to study the clinical profile of acute bacterial meningitis in children focusing on the etiology and short term outcomes.

### **Material and Methods**

The Hospital based Observational study was conducted in department of Pediatrics, Kalawati Saran Childrens Hospital and Department of Microbiology, LHMC, New Delhi from November 2014 to March 2016. 150 Children aged 1 month to 18 years with a diagnosis of probable bacterial meningitis as per WHO criteria [5] were included in the study. Out of 150 cases, age stratification was done among the study population as: 1mo to 3mo, >3mo to 3yrs and >3yrs to 18 yrs and in each group a sample size of 60, 60 and 30 cases was studied respectively.

Details of history and examination was filled in the pre-designed proforma including the course during hospital stay, details of treatment given (antibiotics/dose/duration), investigations done, fundoscopy, clinical improvement and complications. Baseline blood investigations- Hemogram, Liver function tests, Kidney function tests, CSF fluid analysis-cytology, sugar, protein, gram staining, culture and Latex Agglutination Test (LAT), (using Wellcogen™ Bacterial Antigen detect antigens of the following 5 organisms: E coli K1 antigen, N meningitidis A,B,C,Y,W 135 antigen, Streptococcus pneumonia antigen, Group B streptococcus antigen, H. influenza type b antigen), USG skull(if anterior fontanelle is open)[6], BERA (Brain Evoked Response Audiometry), CT scan and MRI (if required) and any other investigations advised by treating physician for the sole purpose of diagnosis and treatment A follow up visit was scheduled 7-14 day post discharge and after 3 months. At each follow up visit, a detailed neurological examination was done, Pediatric Overall Performance Category Scale (POPCS), BERA and Fundoscopy were repeated( if initial fundus examination and BERA were abnormal). Where ever

not feasible, children were contacted telephonically to assess the condition on follow up. Data was analyzed with SPSS version 17.0 software. Approval was taken from Institutional Ethical Committee.

### 3. Results and Observations

Total male were 90(60%) and females were 60(40%) and the male to female ratio was 1.5:1 which showed a male preponderance. Among the study group, 85% children were completely immunized as per the National Immunisation Program while 7% were unimmunized. Rest cases were partially immunized. 58% children received antibiotics prior to this hospitalization for the current illness but the nature of medicines taken was not known and therefore the exact number of partially treated ABM among these patients could not be ascertained.

The clinical features were protean and varied in all age groups(Table-1). Duration of symptoms before presentation ranged from 1to 5days and 100% cases presented with fever as this was in the inclusion criteria. Considering all age groups together, decreased oral acceptance (n=87), lethargy (n=65), seizures (n=59), vomiting (n=39), irritability (n=28) and signs of meningeal irritation (n=25) were the common presentation. Eight children had multiple episodes of seizures during the hospital stay.

Table 1: Age distribution of cases as related to clinical features at presentation

Clinical features	Total	Age Groups		
		1 - 3 months	>3months - 3 yrs	>3yrs - 18 yrs
		Frequency (%)	Frequency (%)	Frequency (%)
Fever	150	60 (100%)	60 (100%)	30 (100%)
Seizures	59	18 (30%)	28 (46.7%)	13 (43.3%)
Ear discharge	1	0(0%)	1 (1.7%)	0(0%)
Vomiting	39	8 (13.3%)	14 (23.3%)	17 (56.7%)
Rash	5	3 (5%)	1 (1.7%)	1 (3.3%)
Decreased oral acceptance	87	51 (85%)	28 (46.7%)	8 (26.7%)
Lethargy	65	41 (68.3%)	23 (38.3%)	1 (3.3%)
Irritability	28	8 (13.3%)	12 (20%)	8 (26.7%)
Headache	17	0 (0%)	1 (1.7%)	16 (53.3%)
Altered sensorium	7	2 (3.3%)	1 (1.7%)	4 (13.3%)
Signs of meningeal irritation	25	0 (0%)	0 (0%)	25 (83.3%)
Bulging fontanelle	5	3 (5%)	2 (3.3%)	0 (0%)

All the children had lumbar puncture for CSF analysis at admission. The CSF was clear in 146 cases (97.3%) and turbid in 4 cases (2.7%). Eight (5.3%) of the 150 children had a positive bacterial yield on CSF culture. Methicillin sensitive staphylococcus aureus(MSSA) was the most common isolated pathogen (n=3) followed by Acinetobacter baumannii (n=2) and meningococcus, E.coli and enterococci one each. Among these, only one patient had corresponding blood culture positive, i.e MSSA. On Gram staining, 22 CSF samples showed pus cells among which etiology was confirmed in 4 cases either by culture or LAT. LAT detected bacterial antigen in 26(17.3%) cases out of the total cases. Considering CSF culture and LAT together(Table-2), etiology was confirmed in 33(22%) cases. Only one case with CSF culture yield (i.e meningococcus) was detected by LAT also.

Table 2: Etiological agents in ABM detected by different diagnostic tests.

Pathogen	CSF culture	LAT
Hib	0	8
GBS	0	8
Pneumococcus	0	8
Meningococcus	1	2
MSSA	3	NA
Acinetobacter baumannii	2	NA
E.coli	1	0
Enterococcus	1	NA
TOTAL	8(5.3%)	26(17.3%)

Out of 150 cases, 10 patients left the hospital against medical advice (LAMA) or absconded before completing the treatment. Among the 140 cases left, 10 children died with a mortality rate of 7.14% in these, 8 deaths were within 24hours of hospitalization. Rest 130 children were discharged.

At discharge, POPCS was carried out in all patients. Mild disability was seen in 13 children while 3 cases had coma/vegetative state as per these scales. One case had sinus venous thrombosis and was discharged on anti-coagulants, one case had cerebral abscess and was referred to neurosurgery department, two cases had hearing loss(one had mild and other child had moderate hearing loss), eight cases had mild to moderate ventriculomegaly on USG skull and eight cases had recurrent seizures during the hospital stay and hence discharged on anti-epileptic drugs.

At first follow-up visit, POPCS was done in patients and only one child had mild overall disability. Repeat USG Skull of the 8 children with ventriculomegaly were normal on follow up . Child with sinus venous thrombosis was asymptomatic and was managed accordingly. Eight cases who were discharged on anti-

epileptic drugs (AEDs) never had repeat seizure post discharge and AEDs were continued. Repeat BERA was done of the two children with hearing loss. The child with mild hearing loss had normal repeat BERA while the other with moderate hearing loss had same degree of hearing loss.

At 3months follow-up, repeat BERA of the child with hearing loss had mild degree of hearing loss persisting. The eight children on AEDs never had repeat seizure and tapering of AEDs was planned. The child with sinus venous thrombosis had resolving thrombus on repeat neuro-imaging and anti-coagulants were continued accordingly.

### Discussion

Most of the studies done in past have not studied clinical features separately in different age groups in childhood bacterial meningitis unlike the present study. The CSF was grossly clear in 146 cases (97.3%) and turbid in 4 cases (2.7%) different from the study where they reported 40.3% to 85% of CSF sample with ABM as turbid [7-9]. The age group studied in these studies was different. Importantly, the administration of antibiotics prior to lumbar puncture also alters the macroscopic appearance. In this study, 58% children received antibiotics prior to this hospitalization for the current illness. In previous studies, cases who received prior antibiotics ranged from 35.8% to 92.5% [8,10-12].

Culture negative cases of meningitis or a low CSF culture positivity, ranging from 6 to 50% has been reported by several studies [13-16]. Low yield of bacteria on culture is explained by various reasons like prior antibiotic therapy, delay in transport of specimens to laboratory, non-availability of special media for specific pathogens, presence of autolysis enzymes in CSF and lack of a 24 hour facility for processing CSF

samples. After initiating parenteral antibiotics, complete sterilization of CSF containing meningococcus occurs within 2hrs while in case of pneumococcus, it happens within 4hrs.[17]

Considering CSF culture and LAT together, Hib, GBS and pneumococcus were the most common isolates in the present study positive in 8(24.2%) out of the 33 laboratory confirmed cases of ABM similar to that reported by other studies [10,14] followed by MSSA in 3(9%), meningococcus and acinetobacter in 2(6.1%) cases each and E.coli and enterococcus in 1(3%) cases each.

An accurate laboratory confirmation of the etiology in acute bacterial meningitis is essential to provide optimal patient therapy, appropriate case management and public health actions. Prospectively, it also provides information upon which decisions regarding immunization programs shall be taken. Although bacterial culture is considered to be the standard method, the negative effect of prior antimicrobial drug use on its sensitivity necessitates non-culture techniques like PCR and LAT for diagnosis.

ABM is a life threatening disease. The overall mortality was 10(7.14%) out of the 140 cases and rest 86.7% were discharged. Among the deaths, 80% children died with 24 hours of hospitalization emphasizing on the grave nature of the disease. In the present study, 10(6.7%) cases absconded / LAMA out of 150 cases.

The POPCS, which assess functional morbidity (general adaptive/physical) and cognitive impairment after a critical illness or injury [18], was carried out in the present study. This has not been used in studies on meningitis in past for assessing the functional morbidity and cognitive impairment.

## Conclusion

Bacterial meningitis is a medical emergency. The signs of bacterial meningitis in pediatric population are non-specific and protean and meningeal signs are less common necessitating broad clinical criteria for surveillance. Antibiotics have a profound effect on the CSF findings, the clinical course and the prognosis of the child. Death due to ABM occurs in the early phase of illness emphasizing on the grave nature of illness. If diagnosed at the earliest and treated appropriately without delay, recovery can be complete minimizing the complications.

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