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Clinico-Aetiological Study of Acute Bacteral Meningitis in Children Including Neonates

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Abstract: *Acute bacterial meningitis being one of the most frequently encountered pediatric emergency with devastating consequences with a change in the aetiology and antibiotic sensitivity from time to time has felt the need for this study.*
Aims And Objectives: *To study the clinico-aetiological profile of acute bacterial meningitis in children upto 12 years of age including neonates along with bacteriological profile and antimicrobial sensitivity.*
Methods: *The study was carried out in the department of paediatrics of Assam Medical College, Dibrugarh from July 2011 to June 2012. After taking a history and thorough clinical examination including lumbar puncture, cases showing CSF findings of bacterial origin were included in the study and further evaluated.*
Results And Observations: *Out of 59 cases of bacterial meningitis who met the inclusion criteria, 76.27% cases were below the age of one year.Most frequent presenting features were fever(86.4%),altered sensorium(67%),convulsion(55.93%) and bulged fontanelle(54.23%). CSF pressure was high in 50.84% cases and CSF appearance was hazy in maximum cases (44.06%).CSF protein ranged between 151-300mg/dl in 69.49% cases, CSF sugar ranged between 21-30mg/dl in 50.84% cases and CSF cell count ranged from 51-500 cells/cubic millimetre in 86.44% cases. Gram staining of CSF revealed organisms in 30.5% cases and culture was positive in 33.89% cases. Staphylococcus aureus was the most predominant organism isolated(22.03%).All gram positive isolates were 100% sensitive to Oxacillin, Vancomycin and Linezolid. All gram negative isolates were 100% sensitive to third generation cephalosporins and Amikacin*
Conclusion: *Bacterial meningitis is one of the major cause of mortality and morbidity in children. One of the challenging task that remains is to identify the causative organism along with its culture and sensitivity pattern which keeps on changing and thereby needed to be studied periodically.*
Keywords*: bacterial meningitis, clinico-aetiology, culture and sensitivity.*

I. Introduction

Acute bacterial meningitis is a disease in which there is inflammation of the coverings of brain and the spinal cord. It primarily affects infants and children leading to increase in morbidity and adverse neurological outcome. It occurs as an endemic disease all over the world. Most common causative agents in neonates are gram negative enteric bacilli(E coli,klebsiella) and in older children are S.pneumoniae, H.influenzae and Staphylococcus. Diagnosis is made from clinical symptoms and signs along with CSF analysis and CSF culture. With the use of vaccines and antibiotics the mortality rate has been found to be decreased to 40%[1] or less than that. But injudicious use of antibiotics at suboptimal doses and prior to the culture of CSF has decreased the CSF culture positivity rate from 54- 34%[2] and culture negativity may increase upto 42.1%.[3] Though the mortality rate has decreased but the incidence rate remains the same mostly in the developing countries like India and is still a major cause of death with mortality rate above 30 – 50%[4].

II. Aims

1. To study the clinical profile of acute bacterial meningitis in chidren upto 12 years of age
2. To study the bacteriological profile and change in antimicrobial sensitivity pattern.

III. Materials And Methods

It was a hospital based crossectional study carried out in the department of paediatrics, Assam medical college & Hospital in collaboration with the department of microbiology,Assam Medical College &Hospital during the period July 2011 to June 2012. Study population included all patients from 0-12 years of age admitted in the department of paediatrics with clinical features of meningitis. For neonatal age group, clinical features of septicaemia like hypo/hyperthermia, refusal to suck, incessant crying, lethargy, irritability along with neck retraction, bulged fontanelle and seizure activity were included as a sample of the study. After thorough clinical examination and fundoscopy, lumbar puncture was performed and those showing CSF findings suggestive of bacterial meningitis with or without positive CSF gram stain and culture were included in the

study. Criteria for diagnosis of bacterial meningitis from CSF study were as laid down by Charles G Prober[5] in case of children and for neonates, as per standard textbook of neonatology[6]. Cases with CSF findings suggestive of mycobacterial or viral origin were excluded from the study.

IV. Results

During the study period from July 2011 to June 2012, out of all the cases of Acute bacterial meningitis, 59 cases fulfilled the study criteria and were evaluated within the preview of this study. The results and observations of the study are tabulated below as follows:

Table–1
Age Distribution In Cases Of Meningitis

AGE GROUP	NUMBER OF CASES	PERCENTAGE (%)
0—1 Month	30	50.84
1—12 Months	15	25.42
1—5 Years	5	8.47
6—9 Years	5	8.47
10—12 Years	4	6.7

From the Table–1, it is observed that the age of the patient varied from neonatal period upto 12 years. Maximum number of cases were under age of one year with 76.27%.In the present study male outnumbered the female with 57.62% cases being male and 42.37% females. The common symptoms and signs as depicted in table -2 shows that fever was one of the commonest symptom seen in 86.44%cases followed by altered sensorium seen in 63%cases.

Table-2

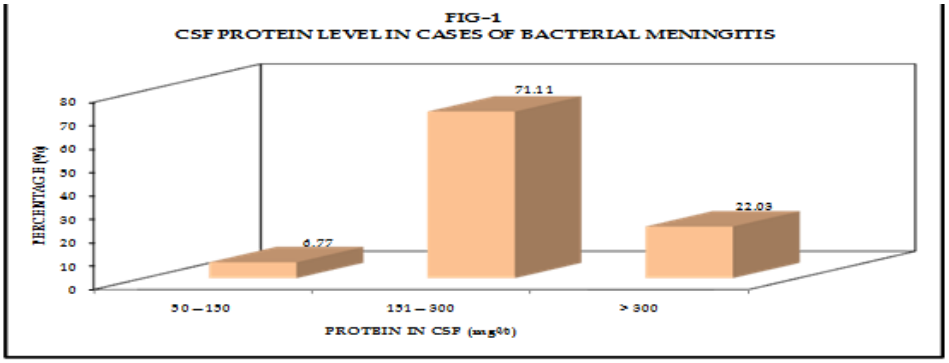
Presenting symptoms	No.of cases	Percentage(%)
Fever	51	86.44
Altered sensorium	37	63
Convulsion	33	55.93
Bulged fontanelle	32	54.23
Vomiting	21	35.59
Refusal to feed	18	30.50
Irritability	17	28.81
Neck rigidity	17	28.81
Kernig sign	15	25.42

Out of 26 cases of neonates with culture proven sepsis, 15 cases showed growth of gram positive cocci (57.69%) and 11 cases (42.30%) revealed growth of gram negative bacilli as shown in table-3.

Table– 3: Incidence Of Different Bacteria In Blood Culture

ORGANISM	NUMBER OF CULTURE POSITIVE CASES	PERCENTAGE (%)
Gram positive cocci	15	57.69
Gramnegative bacilli	11	42.30

CSF analysis revealed increased pressure in 50.84% of cases. Colour of the CSF was hazy in 45.76% of cases.CSF sugar ranged from 0-40 mg% with 50.84% of cases falling in the range 21-30mg%.CSF protein ranged from 50 to more than 300 mg% with 71.11% of cases falling in the range 151-300mg% as shown in fig 1.



Table–4 Distribution Of Cells In Csf Of Bacterial Meningitis

CELLS/mm3 OF CSF	NUMBER OF CASES	PERCENTAGE (%)
< 50	—	—
51—500	51	86.44
501—1000	3	5.08
1001—5000	3	5.08
> 5000	2	3.38

Total WBC count in CSF was found to be raised several fold in the present study. Cell count ranged from 90 to 11000 cells/mm3 of CSF. In 100% cases there was polymorphonuclear leukocytosis. In 86.44% cases cell count is within 51—500/mm3 as shown in table-4. Gram staining of CSF revealed gram positive cocci in 22.03 % of cases and gram negative bacilli in 8.47% of cases as shown in table 5.

Table–5 Incidence Of Different Bacteria In Gram Stained Smear Of Csf

GRAM STAINED SMEAR	NUMBER OF CASES	PERCENTAGE (%)
Gram positive cocci in cluster	13	22.03
Gram negative bacilli	5	8.47
No Bacteria	41	69.49

As shown in Table-5, 18(30.50%) cases were found to be smear positive for bacteria of which 13(22.03%) cases showed gram (+)ve cocci and 5(8.47) cases showed gram (–)ve bacilli. In 69.49% of cases, no bacterial growth was seen in gram stained smear of CSF. Regarding the relationship between smear examination and culture of CSF it was observed that gram stained smear could pick up the organism in all the cases where culture was positive except in two cases. And culture was positive in all the cases where gram staining showed organism (Table–6).

Table-6

nature of organism	positive culture	smear	
		positive	negative
gRAM POSITIVE COCCI	13	13	0
gRAM POSITIVE DIPLOCOCCI	1	0	1
gRAM NEGATIVE BACILLI	6	5	1

Table–7 Incidence Of Different Bacteria Isolated From Csf

ORGANISM	NUMBER OF CASES	PERCENTAGE (%)
Staphylococcus aureus	13	22.03
E Coli	4	6.77
Klebsiella	2	3.38
Streptococcus pneumoniae	1	1.69
Unknown	39	66.10

Incidence of different bacteria isolated from CSF Culture is shown in Table–7. It is seen that the most common organism isolated in the present study is Staphylococcus aureus accounting for 22.03% of the total cases. E Coli contributed to 6.77% of the total cases. Klebsiella pneumoniae was found in 3.38% cases. Streptococcus pneumoniae was found in 1.69% cases. In 66.10% cases no organisms could be isolated from gram stained smear or from culture of CSF. The presence of bacteria in gram stained smear and culture is considered as definitive evidence of bacterial meningitis. In this study of 59 cases, 20 (33.89%) were bacteriologically proved (Table–8) while remaining 39(66.10%) cases were diagnosed on the basis of other

criteria of CSF as laid down by standard textbook. Among 30 neonates with sepsis, CSF culture was positive for 8(26.66%) cases.

Table-8 Incidence Of Bacteriological Association With Acute Bacterial Meningitis Cases

TOTAL NUMBER OF CASES	NUMBER OF CULTURE (+) CASES	NUMBER OF SMEAR (+) CASES	NUMBER OF SMEAR AND CULTURE (+) CASES	NUMBER OF SMEAR AND CULTURE (–) CASES
59	20 (33.89%)	18 (30.50%)	20 (32.20%)	39 (66.10%)

Table–9: Antimicrobial Sensitivity Pattern of the Cultured Organisms

ANTIBIOTIC	GRAM POSITIVE				GRAM NEGATIVE			
	Streptococcus pneumoniae		Staphylococcus aureus		Klebsiella Pneumoniae		E Coli	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Amikacin	1	100	13	100	2	100	4	100
Ampicillin	-	-	5	38	-	-	-	-
Penicillin	1	100	5	38	-	-	-	-
Ceftriaxone	1	100	11	85	2	100	4	100
Ciprofloxacin	1	100	5	38	2	100	3	75
Linezolid	1	100	13	100	-	-	-	-
Oxacillin	1	100	13	100	-	-	-	-
Ofloxacin	1	100	8	60	2	100	4	100
Piperacillin-taz	1	100	11	85	2	100	3	75
Vancomycin	1	100	13	100	-	-	-	-

From the Table–9, it is seen that all the gram positive, 100% sensitive to Amikacin, the 3rd generation cephalosporins, Oxacillin, Vancomycin and Linezolid. Poor sensitivity of gram positive isolates to Ampicillin, Penicillin and Ciprofloxacin is also seen. Gram negative isolates are highly sensitive to Amikacin, Ciprofloxacin and Ofloxacin.

V. Discussion

Present study included the cases of bacterial meningitis from neonatal period up to 12 years of age. Highest incidence was noted below the age of one year (76.27%) with maximum number of cases being in the neonatal age group (50.84%). These observations correlate with the observation made by workers like BN Rao *et al* (1998)[7], Nandita Chinchankar *et al* (1999)[8]. They have found the incidence of ABM in children below 1 year as 64.9% and 75 respectively %.Fever was present in 86.44% of cases in the present study. Similar observations were also reported by different workers in their studies like Carpenter and Petersdorf (1962)[9], Sehgal H (1972)[4] and James A Berkley *et al* (2001)[10].They reported fever in more than 80% cases of ABM.

Depending on the stage and progression of the disease sensorium of patients with ABM varies. In the present study altered sensorium was noted in 67% of the cases. Nandita chinchankar *et al* (1999)[8] reported 98% cases of ABM with altered sensorium. Vipin M Vashistha *et al* (2009)[11] reported 62.7% cases with altered sensorium. Convulsion is a frequently presenting feature mostly in young infants. It occurs during the disease process or it may be a sequelae of ABM. In this study convulsion was noticed in 55.93% cases. Similar incidence was reported by Nandita Chinchankar *et al* (1999)[8]&Vipin M Vashistha *et al*(2009)[11] which ranges from 12.8% to 81%. In the present study bulging fontanelle was observed in 54.23% cases. Previous studies carried out by Groover *et al* (1961)[12], and Singh *et al* (1982)[13], bulging fontanelle was reported ranging from 12.6% to 56%.

In the present study, CSF cell count was found to be raised several fold in all the cases ranging from 95 to 11000/ mm3 of CSF. In most of the cases there is polymorphonuclear pleocytosis. Similar results of polymorphonuclar CSF pleocytosis was recorded by previous workers like N Chinchankar *et al* (1999)[8].

The protein level in CSF was found to be high in all the cases in present study ranging from 80mg/dl to more than 300 mg/dl in all cases. Similar raised protein level was recorded in previous studies done by N Chinchankar (1999)[8] and Irshad Ahmed (2004)[14].

In the present study CSF glucose was found to be reduced in most of the cases.Maximum number of cases (50.84%) showed CSF sugar level between 21mg/dl to 30mg/dl. Similar observations were found by BV

Bhatt *et al* (1980)[15] and BN Rao(1998)[7].

In the present study identification of the aetiological agent could be done in 30.50% cases in which Gram stained smear was positive and CSF culture was positive in 33.89% cases. Similar rate of CSF bacteriological yield were found in previous studies Irshad Ahmed(2004)[14] *et al* .

Staphylococcus aureus was isolated from 22.03% cases in and were the most predominant organism isolated in the present study. There is high incidence of staphylococcal meningitis was recorded in several Indian studies in the past. The incidence of staphylococcus aureus in the present study is comparable to other studies done by A Sharma *et al* (2007)[16].

Streptococcus pneumoniae was found in only 1.69% of cases in the present study The incidence of this organism as an causative agent of ABM was observed ranging from 2.2% to 39.5% by authors like Irshad Ahmed *et al*(2004)[14],TA Ogunlesi *et al* (2005)[17] and Vipin M Vashistha *et al*(2009)[11]. Gram negative bacilli were isolated in the 10.16% cases in the present study with Escherichia Coli in 6.77% of the cases. Klebsiella was found in 3.38% cases. Incidence of E.Coli as a causative agent of ABM was found to be comparable to the present study done by Vipin M Vashistha *et al* (2009)[11] 7.5%.Incidence of ABM due to infection with Klebsiella comparable to the present study were found by authors like RP Fule *et al*(1987)[18] -3% and BN Rao *et al*(1994)[3] -6.5%. A preponderance of Gram negative bacillary meningitis has been described by Harsh *et al* (1986)[19]

Antimicrobial sensitivity pattern of isolated organism showed that all the gram positive are 100% sensitive to Amikacin and third generation Cephalosporins, Oxacillin, Vancomycin and Linezolid. Gram negative isolates were highly sensitive to Amikacin, Ciprofloxacin and Ofloxacin. Ampicillin and Crystalline penicillin are less sensitive for most of the organisms.

Similar antibiotic sensitivity pattern was reported by BN Rao *et al* (1995)[7]showing poor sensitivity of the isolates to Ampicillin, Tetracycline and high sensitivity of 3rd generation Cephalosporins. TA Ogunlesi *et al* (2005)[17] also reported resistance of the isolated pathogens to penicillin, Ampicillin and high sensitivity to Ciprofloxacin and Ceftriaxone. In their study chloramphenicol still seems to be sensitive in around 90—95% of the isolated pathogen. A Sharma *et al* (2007)[16] reported that gram positive isolates were 100% sensitive to Vancomycin and Linezolid followed by Piperacillin-tazobactum in their study.

VI. Conclusion

The present study highlights the clinical presentation along with changing bacteriological profile of the disease in this part of the country. Poor response of the isolated organisms to the commonly used empirical antibiotics is also noticed. This study indicates the necessity of large-scale multicentric studies to define the etiology of ABM in diverse settings in order to make policy decisions on the appropriate preventive and therapeutic measures.

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