ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 11 | November - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

BACTERIOLOGICAL PROFILE & ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF THE BACTERIAL ISOLATES FROM CLINICALLY SUSPECTED CASES OF ACUTE BACTERIAL MENINGITIS IN CHILDREN FROM A TERTIARY CARE TEACHING HOSPITAL, CENTRAL GUJARAT

Microbiology

Dr. Priya D Mangukiya — Final year post-graduate, Department of Microbiology, Medical College Baroda & SSG Hospital, Vadodara, Gujarat.

Dr. Vidhi A Patel* — Final year Post-graduate, Department of Microbiology, Medical College Baroda & SSG Hospital, Vadodara, Gujarat. *Corresponding Author

Dr. Tanuja B Javadekar — Professor & Dean, Department of Microbiology, Medical College Baroda & SSG Hospital, Vadodara, Gujarat.

Dr. Bithika Duttaroy — Professor & Head, Department of Microbiology, Medical College Baroda & SSG Hospital, Vadodara, Gujarat.

ABSTRACT

Background: Acute bacterial meningitis (ABM) is one of the most severe and life-threatening infectious diseases. It is an inflammation of the meanings, globally distributed either as sporadic or epidemic forms. ABM remains a major cause of mortality and long-term neurological sequel worldwide. Objective of the present study was to evaluate the bacteriological analysis and their sensitivity pattern in the cerebrospinal fluid of acute meningitis patients at a tertiary care teaching hospital in Central Gujarat. **Methods:** A total 747 samples of cerebrospinal fluid (CSF) from clinically suspected cases of meningitis were subjected for bacteriological analysis. **Results:** Out of 747 CSF samples, 174 were confirmed as bacterial meningitis. ABM was more common in age group of 0-2 years. The most common organisms were Gram negative bacteria (88%). **Conclusions:** This study may play an important role in the diagnosis and more accurate treatment for the ABM patients.

KEYWORDS

Acute Bacterial Meningitis, Children, CSF, Gram negative.

INTRODUCTION:

Meningitis is a medical emergency especially in neonates and infants that requires urgent rational antibiotic therapy[1]. When a toxic newborn or young infants present with fever and lethargy or irritability, it is important to consider the diagnosis of meningitis even if the classic localizing signs and symptoms are absent[1]. Bacterial meningitis has an incidence of about 20-100 cases per 100,000 live births during the newborn period on a global trend[2].

Important host factors contributing to sepsis and meningitis are prematurity, low birth weight, prolonged rupture of the membrane and vaginal delivery without proper asepsis.[3] The common bacterial etiology in acute bacterial meningitis in neonates includes Group B streptococcus, Escherichia coli, Klebsiella spp., Enterococcus spp, Streptococcus pneumoniae while in the age group of one to six months ; S. pneumoniae, Haemophilus influenzae, Neisseria meningitidis, E. coli, in paediatric age group of six months and above, the prevalent bacterial agents of pyogenic meningitis include Neisseria meningitidis and S. pneumoniae[4]. In determining the etiology of meningitis in children, it is therefore important to consider the age, the underlying host factors.

Microbiology laboratories play a critical role not only in the early identification of the causative bacterium and its antibiotic susceptibility pattern but also in providing valuable information regarding the common incriminating pathogens in that area and also which drugs to start empiric treatment with.[5] In such a life threatening emergency as meningitis, the knowledge of idemiologic and antimicrobial susceptibility pattern of common pathogens in a given area helps to inform the choice of antibiotics.

Poor outcome of the disease is due to delay in diagnosis and initiation of treatment.[6] Increased awareness, availability and usage of vaccines may reflect as a change in the epidemiological pattern of these pathogens.[7] A regular surveillance of bacterial profile and their antibiotic susceptibility pattern is imperative for appropriate case management, infection control and rational use of antibiotics in meningitis. Therefore, this study was conducted to review the etiology and the antimicrobial susceptibility of the bacterial pathogens in childhood acute bacterial meningitis in tertiary care teaching hospital, Central Gujarat.

METHODS: The cross sectional study of 747 CSF samples of clinically suspected for meningitis among children of age group of 0-15 years were carried out during a period of January 2022 to May 2022. All the CSF samples were collected aseptically in a sterile container and transported to Department of Microbiology, Tertiary care teaching hospital, Central Gujarat.

CSF samples were processed and identification of isolates as per CLSI guideline. The antibiotic used for the gram negative isolates were polymyxin B (300 µg), meropenem (10 µg), imipenem(10 µg), cefepime (30 µg), doxycyclin(30 µg), amikacin (30 µg), levofloxacin(5 µg), ceftriaxone (30 µg), piperacillin+ tazobactum(100/10 µg), ceftazidime (30 µg) & ceftazidime+ clavulanic acid (30/10 µg).

The antimicrobials used for gram positive isolates were vancomycin(30 µg), linezolide(30 µg), cefoxitin(30 µg), amoxycilin+clavulinic acid (20/10 µg), cotrimoxazole (trimethoprim/sulphamethoxazole 1.25/23.75 µg), penicillin (10 units), erythromycin (15 µg) & clindamycin (2 µg). Antibiotic sensitivity was done by Kirby Bauer disc diffusion method and their antibiotic sensitivity were done as per CLSI (Clinical and Laboratory Standard Institute).[8,9]

RESULTS:

Out of 747 CSF samples, 174 were found confirmed as acute bacterial meningitis . Out of 174 culture positive cases, females were 91 and males were 83 with Female to male ratio of 1.09:1 as shown in Table 1. Majority of patient were among age group of 0-2 years as shown in table 2.

Table 1: Sex wise distribution of suspected ABM cases.

Sex wise distribution of suspected ABM cases.			
Sex	Total (747)	Positive (174)	% of positivity
Female	385	91	52.2%
Male	362	83	47.7%

Table 2: Age wise distribution of suspected ABM cases

Age wise distribution of suspected ABM cases.			
Age group	Total (747)	Positive (174)	% of positivity
0 – 2	362	89	51.1%
2 – 5	222	61	35.3 %
5 – 10	114	18	10.2 %
10 – 15	49	6	3.4 %

Out of 174 isolates, Gram negative isolates 153 (87.8%) were the most common cause of ABM as compared to Gram positive 21 (12.2%) as shown in Figure 1.

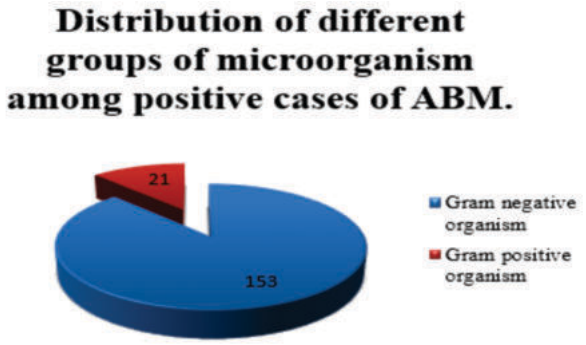

Fig. 1 Distribution of different groups of microorganism among positive cases of ABM.

Among 153 Gram negative isolates, predominant isolate was Acinetobacter spp. 72 (41.5%) followed by E.coli 41 (23.5%), Klebsiella spp. 28 (16%), and Pseudomonas spp. 12 (7%). Among 21 Gram positive isolates, Staphylococcus aureus 13 (7.47%) was predominant followed by Enterococcus spp. 8 (4.6%). The distributions of different isolates causing ABM were shown in Figure 2.

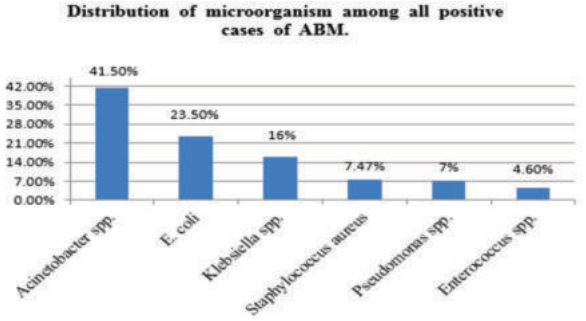

Fig. 2- Distribution of microorganism among all positive cases of ABM

The antimicrobial sensitivity pattern of the Gram negative & Gram positive isolates have been summarized in Table 3.1 & 3.2. Among gram negative isolates 6.5% were Extended spectrum beta lactamase producer (ESBL) and 19% were Methicillin resistant staphylococcus aureus (MRSA) among Staphylococcus aureus isolates.

Table 3.1: Antibiotic sensitive pattern in gram negative isolates

Drug	Acinetobacter spp.	E. coli spp.	Klebsiella spp.	Pseudomonas spp.
Polymyxin B	98.9%	97.1%	96.7%	94%
Meropenem	92.3%	83%	86%	98%
Cefepime	72%	59%	56%	76%
Doxycyclin	68%	40%	42%	10.4%
Amikacin	13%	62%	83.5%	31%
Levofloxacin	76.9%	59.8%	68%	32%
Ceftriaxone	23.1%	40%	12%	28.6%
Piperacillin+ Tazobactum	78.3%	31%	15%	48%
Ceftazidime	---	39.2%	42%	36%
Ceftazidime+Clavulanic acid	---	95.3%	96.2	97.1%

Table 3.2: Antibiotic sensitive pattern in gram positive isolates.

Drug	Staphylococcus aureus	Enterococcus spp.
Vancomycin	96.8%	97.9%
Linezolide	94.5%	93.2%
Amoxycillin+ clavulinic acid	10%	-
Cotrimoxazole	52.1%	-
Cefoxitin	72.6%	-
Penicillin	4.8%	78.1%
Erythromycin	58.2%	32%
Clindamycin	69.1%	46%

DISCUSSION:

Acute bacterial meningitis is a medical emergency which warrants early diagnosis and aggressive therapy. Most often therapy for bacterial meningitis has to be started before the etiology is known. The choice of antimicrobial treatment is based on the most common isolates prevalent in a particular geographical area and age group and their antibiotic susceptibility pattern. Apart from epidemics, at least 1.2 million cases of bacterial meningitis are estimated to occur every year.[10] The predominance of patients from low socio-economic status with poor hygiene, poor nutrition, alcoholism and thus decreased immunity gives an opportunity for these organisms to cause infection.[11,12] Various reasons cited in the literature for a low yield of bacteria on culture are improper technique of lumbar puncture, delay in transport of specimens to the laboratory, Non-availability of special media for specific pathogens in the emergency setting, Autolysis enzymes in CSF, fastidious nature of pathogen and antibiotic treatment prior to lumbar puncture[6,13,14]

In the present study out of 747 CSF samples, only 174 (23.2%) patients were confirmed as bacterial meningitis. Several studies from India report culture-negative cases of meningitis or a low CSF culture positivity. [15,16] In the present study, females were found to suffer with ABM 1.09 times more frequently than males & it also reflected that acute bacterial meningitis was more common in age group of 0-2 years which is similar to other studies based on bacterial meningitis in India[13,17]

In our study the most common isolates were Gram Negative 153 (87.09%) as compared to Gram positive 21 (12.1%). Among all isolates, most common isolate was Acinetobacter spp as compared to other isolates responsible for ABM. However, all the Gram-positive isolates of CSF were found to be sensitive to newer antibiotics like Linezolid and Vancomycin. The susceptibility tests of the bacterial isolates revealed that Polymyxin B 96.5% was the most effective antimicrobial agent against the entire spectrum of the Gram-negative isolates. It was followed by Meropenem 89.8% and Cefepime 65.7%.

The resistance to different group of drugs can be correlated to the indiscriminate use of antibiotics leading to a large-scale drug resistance. Emergence of resistant bacterial strains to conventional antibiotics such as Chloramphenicol, Penicillin and Ampicillin has also been reported in other studies.[7,17,18] The overall sensitivity patterns of the different clinical isolates were observed by us, are similar to the findings of previous Indian studies.[6,8,19] The mortality rate was found most commonly in early paediatric age group (0 – 2 years) as compared with others studies .[20,21,22]

CONCLUSION:

In the present study, bacterial pathogens were isolated in 747 samples showing an isolation rate of 23.2% , Female and male ratio was 1.09 :1, which showed a female preponderance. Acinetobacter spp. was the most common emerging bacteriological etiological agent in all age groups in this study, while the spectrum of isolates which causes acute bacterial meningitis varies with time, geographical region and patient's ages.

Since clinical signs of meningitis are not always reliable, a laboratory support is imperative, to achieve an early diagnosis. So more studies (preferably community based studies in hospital settings) need to be conduct in this region to enrich our knowledge and understanding the emerging trends of acute bacterial meningitis (ABM) in Central Gujarat, India. This study may play an important role in the diagnosis and more accurate treatment to the patients suffering with acute bacterial meningitis. Regular prevalence and antibiotic susceptibility studies will help to enhance antimicrobial stewardship thus minimizing the emergence and spread of antimicrobial resistance and it would also be helpful for clinicians choosing an appropriate empirical antimicrobial agents.

REFERENCES:

1. Ogunlesi TA, Okeniyi JAO, Oyelaemi OA. Pyogenic Meningitis in Ilesa, Nigeria. Indian Paed 2005; 42:1019-1023
2. World Health Organization. Detecting meningococcal meningitis epidemics in highly endemic African countries. Wkly Epidemiol Recd 2003; 78(33) : 294-296
3. Barik KL, Biswas P , Das KK, Laha S , Paul S, Mondal S. Bacteriological profile, antibiotic susceptibility pattern and other factors related to neonatal meningitis: A cross-sectional hospital-based study from West Bengal. Asian Journal of Medical Sciences ; Jan 2022 ; 13 (1) ; 93-98.
4. Forbes BA, Sahm DF, Weisfeld AS. Editors. Streptococcus, Meningitis and other infections of the central nervous system. In: laboratory manual of Bailey & Scotts diagnostic microbiology. 12th Ed. Mosby Elsevier publication 2007. Pp. 907-916
5. You MD. Ampicillin in the treatment of meningitis due to Haemophilus influenza: an appraisal after 6 years of experience. J Pediatr 1969; 74 :848-51.
6. Gaurav MB, Komal PD, Sumeeta ST, Kanu PJ, Jayasukh MD, Pooja JS. Bacteriological profile of pyogenic meningitis in tertiary care hospital. National J Med Res. 2012 ; 3(2) : 313-7.
7. Bareja R, Pottathil S, Shah RK, Grover PS, Singh VA. Trends in bacterial etiology amongst cases of meningitis. J Acad Indus Res. 2013 ; 1(12) : 761-5.
8. Ananthanarayan and Paniker. Text Book of Microbiology ; Meningitis university press India 7th editions. 2014 ; 667-9.
9. Clinical and Laboratory Standards Institute (CLSI) M100. Performance standards for antimicrobial susceptibility testing 31st edition. CLSI 2021.
10. Centre for Disease Control and Prevention. MVPDB / Meningitis Laboratory Atlanta Georgia 30329 USA; http://www.cdc.gov/ meningitis /bacterial.html.
11. Dey A, Nath BK, Bhattacharjee P, et al. Bacteriological profile of patients with acute Pyogenic meningitis - a hospital based study. J. Evid. Based Med. Healthc. 2016; 3(19), 758- 763.
12. Ghia CJ , Rambhad GS. Meningococcal Disease Burden in India: A Systematic Review and Meta- Analysis. Medical and Scientific Affairs, Microbiology Insights;2021; 14; 1–10 .
13. Yadhav KML. Study of Bacterial Meningitis in Children below 5 Years. Journal of Clinical and Diagnostic Research. 2014; 8(4): DC04-6.
14. Tunkel AR, Hartman BJ, Kaplan SL. Practice Guidelines for the Management of Bacterial Meningitis. Clinical Infectious Diseases. 2004; 39: 1267-84.
15. Khan F, Rizvi M, Fatima N, Shukla I, Malik A, Khatoon R. Bacterial meningitis in North India Trends over a period of eight years. Neurology Asia. 2011; 16(1): 47-56.
16. Tang LM, Chen ST, Hsu WC, Lyu RK. Acute Bacterial Meningitis meningitis in adults a hospital based epidemiological study. QJM. 1999;92:719-25.
17. Sudharshan RC, Reddy MP, Neelima A. Pattern and antibiogram of bacterial meningitis in children at a tertiary care hospital. J Scientific and Innovative Res. 2013; 2(6): 1012- 6.
18. Modi S, Anand AK. Phenotypic Characterization and Antibiogram of CSF Isolates in Acute Bacterial Meningitis. J Clin Diagos Res. 2013;7(12):2704-8.
19. Thomas K. Invasive Bacterial Infection Surveillance (IBIS) group International Clinical Epidemiology Network (INCLEN) Prospective multi centric hospital surveillance of Streptococcus pneumonia disease in India. Lancet. 1999; 353:121621.
20. Shrestha RG, Tandukar S, Ansari S. Bacterial meningitis in children under 15 years of age in Nepal BMC Pediatrics. 2015;15:94.
21. Farag HFM, Fattah–Abdel MM, Youssri AM. Bacterial meningitis among children in Alexandria. Indian J Med Microbiol. 2005; 23(2): 95-101.
22. Basri R, Zueter AR, Mohamed Z, Alam MK, Norsa'adah B, Hasan SA, et al. Burden of bacterial meningitis a retrospective review on laboratory parameters and factors associated with death in meningitis Kelantan Malaysia. Nagoya J Medical Sci. 2015;77(1-2):59-68.