Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Paediatrics

Management of Acute Bacterial Meningitis in Children

Dr. Md. Nazrul Islam[1*], Dr. Md. Moniruzzaman Mollah[1], Dr. Ahmed Ferdous[1], Dr. Md. Abul Fazal[1]

[1]Assistant Professor, Department of Paediatrics, Shaheed Ziaur Rahman Medical College & Hospital, Bogura, Bangladesh

DOI: 10.36347/sjams.2023.v11i06.015 | **Received:** 01.05.2023 | **Accepted:** 04.06.2023 | **Published:** 14.06.2023

***Corresponding author:** Dr. Md. Nazrul Islam
Assistant Professor, Department of Paediatrics, Shaheed Ziaur Rahman Medical College & Hospital, Bogura, Bangladesh

Abstract **Original Research Article**

Background: Meningitis is an infection of the membranes that protect the spinal cord as well as brain. Bacterial meningitis (BM) continues to be a major source of mortality and morbidity in infants and children throughout the world despite of advances in antibiotics. But in Bangladesh, we have not enough research-based information regarding the treatment and outcomes of acute bacterial meningitis in children. ***Aim of the study:*** The aim of this study was to evaluate the management of acute bacterial meningitis in children. ***Methods:*** This prospective observational study was conducted in the department of Paediatrics, Shaheed Ziaur Rahman Medical College & Hospital, Bogura, Bangladesh during the period from January 2020 to December 2022. In total 47 patients with acute *bacterial meningitis* were enrolled in this study as study subjects. Proper written consent was taken from all the participants before data collection. As per the inclusion criteria of this study, patients with bacterial meningitis aged between 2 and 16 years were included. All the demographic and clinical data of the participants were recorded. A predesigned questionnaire was used in data collection. All data were processed, analyzed and disseminated using MS Excel and SPSS version 23 program as necessary. ***Results:*** In this intervention, as antibiotic therapy, 'ceftriaxone alone' was used in the highest number of cases which was used in 36%. Besides this, 'ampicillin plus gentamycin', 'ceftriaxone plus gentamycin' and 'crystalline penicillin plus chloramphenicol' were used in 21%, 28% and 15% cases respectively. On the other hand, steroid was used among 45% patients. Finally in analyzing the outcomes among the participants we observed that, majority of the patients got 'good outcomes or improvement' which was in 66%. Poor outcomes were found among one third of total cases (34%). ***Conclusion:*** Proper antibiotic selection and timely use of steroids may reduce the complications and deaths among acute meningitis patients. The hospital has to create awareness among the health care professionals to give due attention to patients presented with severe clinical features like seizure and irritability as these were the alarming signs of poor outcomes.

Keywords: Management, Bacterial, Meningitis, BM, Children, Acute neurologic complication.

1. INTRODUCTION

Meningitis is one of the most common CNS (Central nervous systems) infection types. It is an inflammation of the report that involves the subarachnoid space or spinal fluid [1]. Even though there are numbers of causes of meningitis, bacterial meningitis is one of the most potentially serious infections occurring in infants as well as in children [2]. Bacterial meningitis (BM) is a severe, potentially life-threatening infection which is associated with high rates of mortality, morbidity as well as significant disability in survivors [3]. In most resource-limited settings, the mortality of untreated bacterial meningitis (BM) approaches 100%, these morbidities and mortality due to bacterial meningitis continued the same in the past two decades [4-6]. Worldwide, bacterial meningitis (BM) affects approximately 1.2 million people each year, with more than two-thirds of these occurring <5 years of age [7]. Bacterial meningitis causes almost 170,000 deaths in every year and as many as 50% of survivors experience neurological sequelae [8, 9]. During the recent years, mortality rates related to bacterial meningitis have been increasing and are estimated to the range from 20% to 25% [8]. WHO reported that, BM as an important cause of childhood morbidity as well as mortality apart from the five major killer diseases of children under five years [10]. Acute bacterial meningitis (BM) is reported as a life-threatening bacterial infection in several studies. But the good news is, the overall rates of the incidences of BM have been declining since the introduction of some vaccines against the three most common meningeal pathogens and by the application of intrapartum antibiotic prophylaxis for Group B Streptococcus. The major objective of this study was to evaluate the management of acute bacterial meningitis in children.

2. METHODOLOGY

This prospective observational study was conducted in the department of Paediatrics, Shaheed Ziaur Rahman Medical College & Hospital, Bogura, Bangladesh during the period from January 2020 to December 2022. In total 47 patients with acute *bacterial meningitis* were enrolled in this study as the study subjects. Proper written consent was taken from all the participants before data collection. The whole intervention was conducted in accordance with the principles of human research specified in the Helsinki Declaration [11] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [12]. As per the inclusion criteria of this study, patients with acute bacterial meningitis aged between 2 and 16 years were included. On the other hand, according to the exclusion criteria of this study, patients who were lost to follow within 7 days after starting treatment, patients above 16 years old and patients whose mother was not willing to take participate in the study were excluded. All the demographic and clinical data of the participants were recorded. A predesigned questionnaire was used in data collection. All data were processed, analyzed and disseminated using MS Excel and SPSS version 23 program as necessary.

3. RESULT

In this study, 47 participants were included and all of them were children between the age of 2 and 16 years. Most of the patients were from 2-3 years' age group which was 26%. Besides this, 19% cases were from 4-8 years' and 13% were from 9-16 years' age groups. The male-female ratio of the participants was 1.14:1. In distributing the involvement of causative organisms among our participants, we observed that, 36% of the patients were infected by N. meningitidis, 34% were infected by S. pneumonia, 11% were infected by Streptococcus agalactiae which were noticeable. On the other hand, H. influenzae type b, E. coli, Streptococcus pyogenes and some other pathogenic bacteria were involved in some cases. In analyzing the clinical presentations among our total participants, we observed that, in more than 50% of the cases fever, vomiting, seizure, headache, decreased feeding and meningeal signs were present which were in 92%, 82%, 67%, 58% and 51% patients respectively. In this intervention, as antibiotic therapy, 'ceftriaxone alone' was used in the highest number of cases which was used in 36%. Besides this, 'ampicillin plus gentamycin', 'ceftriaxone plus gentamycin' and 'crystalline penicillin plus chloramphenicol' were used in 21%, 28% and 15% cases respectively. On the other hand, steroid was used among 45% patients. Finally in analyzing the outcomes among the participants we observed that, majority of the patients got 'good outcomes or improvement' which was in 66%. Poor outcomes were found among one third of total cases (34%). In this study, death was occurred in 9% cases and acute neurologic complications were found among 6% cases.

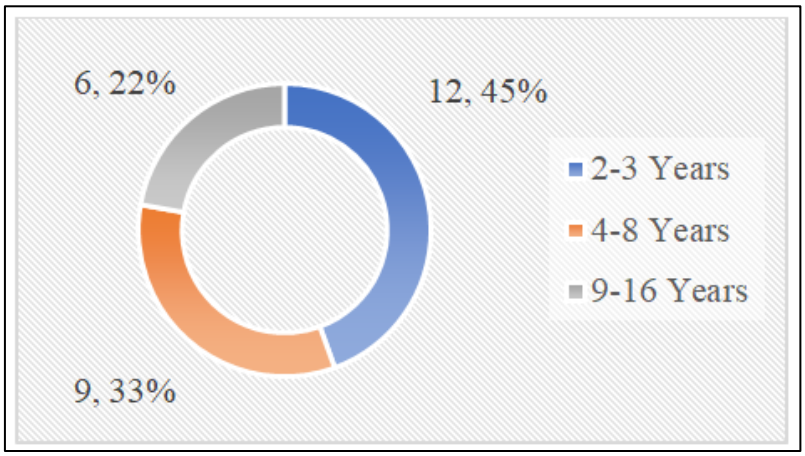

Figure 1: Age distribution of the participants, (N= 47)

Table 1: Involvement of causative organisms among participants, (N= 47)

Bacterial species	n	%
N. meningitidis	17	36%
S. pneumoniae	16	34%
Streptococcus agalactiae	5	11%
H. influenzae type b	2	4%
E. coli	3	6%
Streptococcus pyogenes	1	2%
Other	3	6%

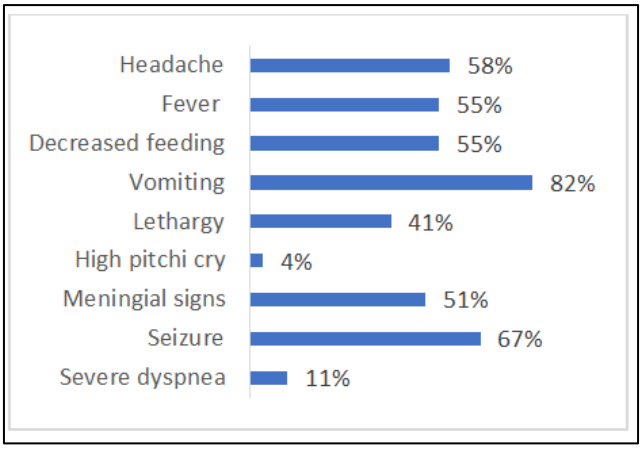

Figure 2: Clinical presentations of participants, (N= 47)

Table 2: Major drugs used among participants, (N= 47)

Drugs	**n**	**%**
Ampicillin plus gentamycin	10	21%
Ceftriaxone plus gentamycin	13	28%
Crystalline penicillin plus chloramphenicol	7	15%
Ceftriaxone alone	17	36%
Steroid	21	45%

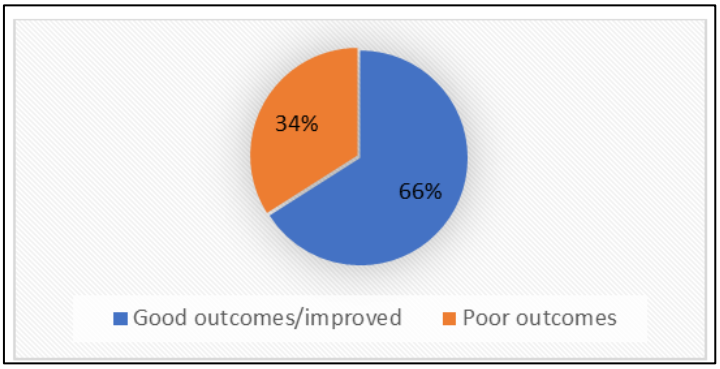

Figure 3: Outcomes of treated children, (N= 47)

Table 3: Deaths and major complications among the participants, (N= 47)

Outcome	n	%
Death	4	9%
Delayed fever	9	19%
Acute neurologic complication	3	6%

4. DISCUSSION

The aim of this study was to evaluate the management of acute bacterial meningitis in children. The prevalence of Streptococcus pneumoniae strains that are relatively resistant to penicillin is increasing day by day and many of the penicillin-resistant pneumococci have reduced the susceptibility to some third-generation cephalosporins which leads to the increasing rates of treatment failure. As a result of that, vancomycin plus either cefotaxime or ceftriaxone should be used as the empirical antibiotic therapy in children presenting with signs as well as symptoms of acute BM in the US. Early initiation of optimal antibiotic therapies for confirmed or suspected bacterial meningitis, pending the CSF results, has been found to be one of the most important factors to reduce morbidity as well as lethality [9, 10]. In the current study, most of the young infants were initially treated with ceftriaxone alone. The selection and timing of the initiation of ABs were in-line with the current recommendation for developing countries [13]. The choice of antibiotics was also similar to the studies conducted in some resource-limited settings. The median duration of treatment from diagnosis were similar to the study from Italy (1 hour) and even better than that from another study conducted in Uganda [14]. The cumulative incidence of poor outcomes in this study was 34%; including acute neurologic complications at 6%, delayed fever at 19% and sudden death at 9% of patients. The incidence of poor outcomes

was comparable with most of the studies from resource-limited settings [15, 16]. But it could be slightly lower than those reports since only the short-term treatment outcomes were included and had no follow-up after discharge which could increase the rate of both the mortality as well as neurologic complications in those studies. Among patients initially treated with ampicillin along with gentamycin, almost 90% improved without complications. The patients initially treated with ceftriaxone along with gentamycin experienced having comparatively poorer outcomes, as those patients initially presented with severe clinical features at the time of admission. All the findings of this study may be helpful in further similar studies.

Limitation of the study:

This was a single-centered study with small-sized samples. Moreover, the study was conducted over a very short period of time. So, the findings of this study may not reflect the exact scenario of the whole country.

5. CONCLUSION & RECOMMENDATION

This study was conducted to assess antimicrobial use patterns and determine treatment outcomes among children hospitalized with acute bacterial meningitis. The hospital has to create awareness of the health care professionals to give due attention to patients presented with severe clinical features like seizure and irritability as these are the alarming signs of poor outcomes. For getting more specific results, we would like to recommend for conducting similar more studies in several places with larger sized samples.

Funding: No funding sources.

Conflict of interest: None declared.

Ethical approval: The study was approved by the institutional ethics committee.

REFERENCES

1. Kliegman, R. M., Behrman, R. E., & Jenson, H. B. (2008). Nelson text book of pediatrics (chapter-602, HTML). 18th ed.
2. Boyles, T. H., Bamford, C., Bateman, K., Blumberg, L., Dramowski, A., Karstaedt, A., ... & Mendelson, M. (2013). Guidelines for the management of acute meningitis in children and adults in South Africa. *Southern African Journal of Epidemiology and Infection*, *28*(1), 5-15.
3. Ahmed, A. (2012). Etiology of Bacterial Meningitis in Ethiopia, 2007-2011: A Retrospective Study (A thesis).
4. Kim, K. S. (2010). Acute bacterial meningitis in infants and children. *The Lancet infectious diseases*, *10*(1), 32-42.
5. Antoniuk, S. A., Hamdar, F., Ducci, R. D., Kira, A. T., Cat, M. N., & Cruz, C. R. D. (2011). Childhood acute bacterial meningitis: risk factors for acute neurological complications and neurological sequelae. *Jornal de Pediatria*, *87*, 535-540.
6. Ansari, I., & Pokhrel, Y. (2011). Culture proven bacterial meningitis in children: agents, clinical profile and outcome. *Kathmandu University Medical Journal*, *9*(1), 36-40.
7. Juganariu, G., Miftode, E., & Teodor, D. (2012). Clinical features and course of becterial meningitis in children. *Med Chir Soc Med Nat Iaşi*, 116(3), 722-726.
8. Tebruegge, M., & Curtis, N. (2008). Epidemiology, etiology, pathogenesis, and diagnosis of recurrent bacterial meningitis. *Clinical microbiology reviews*, *21*(3), 519-537.
9. Namani, S. A., Koci, B. M., Milenković, Z., Koci, R., Qehaja-Buçaj, E., Ajazaj, L., ... & Ismaili-Jaha, V. (2013). Early neurologic complications and long-term sequelae of childhood bacterial meningitis in a limited-resource country (Kosovo). *Child's Nervous System*, *29*, 275-280.
10. World Health Organization. (1997). Antimicrobial and support therapy for bacterial meningitis in children; Report, Geneva, Switzerland. Food, Drug, cosmetic law quarterly, WHO/ CHD/98.6.
11. World Medical Association. (2001) .World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. Bulletin of the World Health Organization, 79(4) ,373-374. World Health Organization. https://apps.who.int/iris/handle/10665/268312.
12. Voigt, P., & von dem Bussche, A. (2017). Enforcement and fines under the GDPR. The EU general data protection regulation (GDPR): a practical guide. *Springer International Publishing*, *10*, 978-3.
13. Lin, M. C., Chi, H., Chiu, N. C., Huang, F. Y., & Ho, C. S. (2012). Factors for poor prognosis of neonatal bacterial meningitis in a medical center in Northern Taiwan. *Journal of Microbiology, Immunology and Infection*, *45*(6), 442-447.
14. Klinger, G., Chin, C. N., Beyene, J., & Perlman, M. (2000). Predicting the outcome of neonatal bacterial meningitis. *Pediatrics*, *106*(3), 477-482.
15. Prasad, K., Kumar, A., Singhal, T., & Gupta, P. K. (2007). Third generation cephalosporins versus conventional antibiotics for treating acute bacterial meningitis. *Cochrane database of systematic reviews*, (4).
16. Theodoridou, K., Vasilopoulou, V. A., Katsiaflaka, A., Theodoridou, M. N., Roka, V., Rachiotis, G., & Hadjichristodoulou, C. S. (2013). Association of treatment for bacterial meningitis with the development of sequelae. *International Journal of Infectious Diseases*, *17*(9), e707-e713.