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A study of the bacteriological profile of acute bacterial meningitis in children of age group 2-12 years in a tertiary care hospital of northern Bihar

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Abstract

Introduction: One of the most serious and potentially fatal infectious disorders is acute bacterial meningitis (ABM). It is described as a global, either sporadic or pandemic, inflammation of the meanings. ABM is still a leading global source of mortality and long-term neurological consequences. The current study's goal was to assess the bacteriological investigation of the cerebrospinal fluid of acute meningitis patients at a tertiary care hospital in Northern Bihar, India, in terms of pathogen frequency and their sensitivity pattern.

Methods: The study, which included the age range of 2 to 12 years, was conducted at a tertiary care hospital from January 2021 to December 2022. A total of 175 samples from cases of meningitis that were clinically suspected were tested for bacteria.

Results: Based on Gram staining, 175 of them were determined to be cases of bacterial meningitis. Pediatric patients were more likely to have bacterial meningitis.

Conclusion: Acute bacterial meningitis is a medical emergency, and early detection and accurate treatment can save lives and lower morbidity rates.

Keywords: ABM, CSF, GPC, Sporadic or epidemic, Morbidity and mortality

Introduction

Meningitis is a severe infection of the meninges that cover the brain and spinal cord that is typically brought on by bacterial, viral, and fungal pathogens. Because the severity of the sickness and the treatment vary depending on whether meningitis is brought on by a virus or a bacterium, it is crucial to understand the difference. Acute bacterial meningitis (ABM), on the other hand, can be highly serious and, if not treated promptly, can lead to mental illness, hearing loss, learning disabilities, and even death. Viral meningitis is typically less severe and goes away without specific therapy. Poor disease outcomes can be caused by delays in diagnosis and treatment [1,2].

Worldwide, ABM continues to be a key factor in death and long-term neurological consequences [2]. The morbidity and mortality rates associated with this condition continue to be high, according to the World Health Organization's World Health Report.

In addition to epidemics, it is estimated that there are at least 1.2 million cases of bacterial meningitis each year, 135,000 of which result in death. Meningococci are to blame for 50,000 of the deaths and about 500,000 of these cases [3,4]. The mortality rate owing to ABM remains extremely high in India and other impoverished nations, ranging from 16-32% [1,4], despite the availability of powerful modern antibiotics. Meningococcal illness is endemic in India, as opposed to other etiological agents that have just emerged as trends in ABM [5]. The high case fatality rates and neurologic sequelae in survivors place a significant emotional and financial burden on the family and pose a significant challenge to the health care system in terms of financial and human resources, even though the rate of disease associated with meningitis is lower than other major causes of childhood mortality [6]. Since the microorganisms that cause infection fluctuate with time, place, and patient age, a regular examination of ABM is required on a global scale. The epidemiological pattern of these infections may change as a result of increased knowledge, accessibility, and use of vaccines [2,7].

The etiological agents producing nosocomial meningitis are distinct from those causing community-acquired meningitis.

Nosocomial infection is defined as a positive bacterial infection that was not present at the time of hospital admission, clinical evidence of an infection that appeared within 48 hours of admission, or clinical evidence of meningitis that appeared within one month of the patient being released from the hospital where they had undergone an invasive procedure, particularly a neurosurgical procedure.

Otherwise, it was determined that the patient had a community-acquired infection. The early detection of the causative bacterium and its antibiotic susceptibility pattern, as well as the provision of useful information regarding the typical incriminating pathogens in that region and which medications to begin empiric treatment, are all important functions of microbiology laboratories [7].

Methods

Cross-sectional prospective study is the type of study.

Study location: Research was done at the tertiary care hospital in Northern Bihar.

Study Environment: A sample of all probable meningitis cases admitted to the pediatrics department of MGM Medical College's IPD was collected.

Duration of study: two years (January 2021 to December 2022).

The formula is used to compute sample size.

N = Z (1-/2) *2PQ/(L*L) (P = Prevalence, Q = 1-p, L = Permissible Error).

Z (1-/2) =1.95 when 95 percent is taken into account. If the values are normally distributed, the 95 percent of the values will lie within 2 standard errors of the mean. Confidence interval Z=the value of Z from the probability table.

This corresponds to a Value of 1.95.

P stands for disease prevalence; in this case, 35.624 percent.

Sample Size is equal to (3.8416*35.625*64.375)/(7.125*7.125) =8810.169/50.765 =173.564.

The total number of samples was 175.

Criteria for inclusion and exclusion:

Inclusion standards

1. Children between the ages of 2 and 12 who exhibit meningitis-related symptoms and clinical signs

Exclusion standards:

1. Children between the ages of two and twelve.
2. Inadequate sample collection that results in contamination

Data collection and study technique

1. An interview was conducted with the Guardians with their permission to learn about the baby's current illness and any prior medical or surgical conditions that may have presented with symptoms of probable clinical meningitis.
2. With the parents' proper consent, a thorough physical examination, including a systemic examination, was performed to identify any developmental milestones, additional CNS sites of infection that may cause meningism (neck rigidity and fever without any CSF changes), and signs of chronic liver or kidney disease.
3. Carefully analysing blood test results in the lab to rule out dyselectrolytemia
4. After properly omitting the following criteria, CSF (3–4 ml) was taken using the Lumber Puncture Technique while the patient was seated or lying on their left side.
5. Increased ICP, but no bulging fontanelle (such as drowsiness or the cushing reaction)
    1. Papilledema by ophthalmoscopic assessment, hypertension, bradycardia, cheyne-stoke breathing pattern, and deviation of the eyeball).
6. Severe cardiopulmonary impairment necessitating intervention,
7. An infection at the lumber puncture site.
8. Evaluation of the platelet count and any associated coagulopathy.

For cytological, biochemical, and microbiological examination, CSF was sent.

Venous blood samples (2–3 ml) were collected from 2 different sites under stringent aseptic conditions before the administration of any medications and will be sent for culture. For additional biochemical and cytological analysis, blood was drawn.

Research variable

Background Variable

1. Age.
2. Gender.
3. Social and economic standing
4. Immunization history.
5. Religion.
6. Residence (Rural/Urban).

Clinical ambiguity

1. Seizure Type (Data regarding Duration, Pattern, Frequency, Post ictal state).
2. Meningeal inflammation symptoms (Neck Rigidity, Kernig Sign).
3. Blood Reports (WBC count, Serum CRP, Hb).
4. Use of antibiotics before treatment.
5. Nutritional Situation

Definition of Operation

Advisable case definition

Therapeutic description: Acute onset of fever (often > 38.5 °C rectal or 38.0 °C axillary), headache, and one of the following symptoms—neck stiffness, altered awareness, or other meningeal signs—are the hallmarks of bacterial meningitis. Clinical criteria alone cannot distinguish between pneumococcal meningitis, meningococcal meningitis, and Haemophilus influenza type b meningitis.

Lab standards for diagnostic study variable

There are three ways to confirm bacterial meningitis. (1) Method of culture: Isolation of a bacterial pathogen from a typically sterile clinical specimen, such as CSF or blood (2) Techniques for detecting antigens: locating bacterial antigens in typically sterile fluids (such as blood or CSF) using techniques like latex agglutination or counter immunoelectrophoresis (CIE). (3) Results of gram stain.

Categorization of cases

Anyone with a quick onset of fever (> 38.5 °C rectal or 38.0 °C axillary) and one of the symptoms listed below is suspected: stiff neck, altered state of consciousness, or another meningeal symptom Probable: A suspected case having at least one of the following findings from the CSF examination: leukocytosis (10-100 cells/mm3), turbid appearance, leukocytosis (> 100 cells/mm3), AND either increased protein (> 100 mg/dl) or decreased glucose (40=""> Confirmed: A case in which a bacterial pathogen (Hib, pneumococcus, or meningococcus) is grown (i.e., cultured) or recognised (i.e., by Gram stain or antigen detection methods) in the CSF or from the blood of a kid with a clinical presentation compatible with bacterial meningitis.

Data analysis

With the aid of IBM SPSS STATISTICS for Windows version 21, the data was analysed. Suitable non-parametric and parametric tests were used to analyse the categorical and continuous variables. 95 percent of the confidence interval was used to determine the level of significance. Therefore, a P value of less than 0.04 was deemed statistically significant.

Results

Meningitis patients that have been diagnosed and are being treated in the paediatric medicine division at MGM Medical College and LSK Hospital. By reviewing the CSF examination, culture, and/or other pertinent assays performed during their hospital stay, the diagnosis of meningitis was confirmed. The incidence of bacterial meningitis was 97 (56.1%) out of 175 cases Table 1

Types of meningitis	No of cases	Percentage
Bacterial meningitis	97	56.1%
Tuberculous meningitis	40	33.7%
Viral/Aseptic Meningitis	38	102%
Total	175	100%

The distribution of the study participants by age group is shown **in Table 2.** The majority of the study population (36.6%) was between the ages of 2 and 3 years, while 41.7% of participants were older than 6 months.

Age	No. of cases	Percentage
1-2	33	36.6%
>2-4	20	21.0%
>4-6	13	14.2%
>6-8	9	10.1%

>8-10	8	3.1%
>10-12	14	17.0%
Total	97	100%

61 (64.2%) of the 97 instances of pyogenic meningitis were in males, whereas 36 (35.76%) were in females. Out of 97 instances of pyogenic meningitis, 26 (25.4%) and 71 (74.4%) belonged to Muslim families and Hindu families, respectively. Out of 97 cases of pyogenic meningitis, 31 (30.5%) and 66 (69.3%) were located in urban regions, according to the study's residential distribution.

Of the 97 patients registered, 52 (52.2%) belonged to a combined family, whereas 45 (47.8%) belonged to a nuclear family. Out of 97 instances of pyogenic meningitis in the current study, 56 (56.0%) belonged to normal families, while 41 (43.8%) belonged to overcrowded families. Out of 97 cases in the current study, 30 (32.5%) had smokers in their family, while 67 (67.2%) did not.

Out of 97 mothers, 41.7% had no formal education, followed by 33.6% with only a primary education, 21.3% with a middle school education, and 3.0% with a high school education. They were all only secondary school graduates.

The majority of the 97 dads were educated up to middle school (32.6%), followed by high school (19.2%), elementary school (11.1%), and post-high school diploma (6.0%). Innumeracy rates were 29.5%.

According to the research population's history of immunisation, 43.8% of the population had received all recommended immunisations, 28.5% had received some immunisations but not all, and 27.4% had received none at all.

The most common symptom among study population was fever (($\geq$38º C) found in 95.8% cases followed by pallor (51%), vomiting (47.6%), headache (45.8%), lethargy (42.8%), poor feeding (36.6%), stiffness (29.5%), shill cry (29.5%), hypoglycaemia (28.5%), cold and cough (23.4%), seizures (23.4%), convulsions (22.3%), bulging (18.3%), fontanelle (12.1%), altered sensorium (10.1%) and metabolic acidosis with respiratory distress (9.1%).

In children older than three months, cytological and biochemical findings. According to the analysis, turbidity was seen in 91.7% of cases, >100 cells/mm3 was seen in 73.3%, CSF: Plasma glucose concentration >0.5 was reported in 54.0% of cases, and protein concentration >51 mg/dl was seen in 29.5% of cases.

discoveries from cytology and biochemistry in children older than three months. In the data above, we discovered that turbidity was present in 91.7% of cases, that >100 cells/mm3was seen in 73.3% of cases, that CSF: Plasma glucose concentration >0.5 was present in 54.0% of cases, and that protein concentration >51mg/dl was present in 29.5% of cases.

Among the 97 instances of pyogenic meningitis, 63 (65.2%) were caused by Streptococcus pneumonia, 21.3% by Haemophilus influenza, 9.1% by Neisseria meningitides, and 5.0% by unidentified causes.

Discussion

Acute bacterial meningitis is rare and occurs in minor epidemics over the world, most frequently in developing nations. The World Health Organization reports that bacterial meningitis continues to have significant rates of morbidity and fatality. Acute bacterial meningitis is a major medical emergency that can have long-lasting brain effects. Early diagnosis, along with prompt treatment, can save lives and lower morbidity. In addition to epidemics, it is estimated that 1.2 million cases of bacterial meningitis occur annually, 135,000 of which result in death [8].

Meningitis death statistics by global region are as follows, according to the WHO's World Health Report: about 20,000 meningitis deaths worldwide occur in Africa, followed by 18,000 in America, 73,000 in South East Asia, 15,000 in Europe, 25,000 in the Eastern Mediterranean, and 20,000 in the Western Pacific. Meningitis was the cause of 0.9% of baby fatalities in the USA. [3,8].

Meningitis is an endemic disease in India, and cases of meningococcal meningitis are seldom or infrequently reported. In India, there were 8367 documented cases of bacterial meningitis overall in 2005, and 485 of those cases resulted in fatalities. The majority of cases were reported from the following states: Andhra Pradesh (3734 cases, 36 deaths), Madhya Pradesh (1039 cases, 6 deaths), Uttar Pradesh (659 cases, 124 deaths), West Bengal (702 cases, 64 deaths), Delhi (292 cases, 50 deaths), Maharashtra (394 cases, 100 deaths), and Karnataka (464 cases, 19 deaths) [5].

In the current study, the cases of bacterial meningitis was the highest and the most number of patients were in the age group of 2 to 3 years, male patients were predominant and the highest no. of patients belonged to Hindu religion in the urban area. The literacy rate of mother and father were mostly illiterate, and majority of the people were vaccinated, with highest shown symptoms to be fever. 21.3% were positive for CSF culute and most of the isolates were Gram-negaitve. The maximum no. of meningitis were due to Streptococcus pneumonia.

Conclusion

To make an early diagnosis of meningitis, a laboratory confirmation is essential because clinical indications of meningitis are not always reliable. Since Northern Bihar is a zone of encephalitis that is highly prevalent, more studies (preferably community-based studies or prospective studies in hospital settings) must be conducted in this area to improve our knowledge of and understanding of the emerging trends of acute bacterial meningitis (ABM). By correlating ABM with ABM, we can lessen the disease burden. This research could have a significant impact on how individuals with acute bacterial meningitis are diagnosed and treated. Regular prevalence and antibiotic susceptibility investigations will improve antimicrobial stewardship and reduce the emergence and spread of antibiotic resistance. They will also be beneficial for physicians in selecting the best empirical antimicrobial. Therefore, ongoing research into the problem's actual scope, the range of diseases it can cause, and the development of antibiotic resistance brought on by these infections is necessary.

References

1. Modi GB, Patel KD, Soni S, Patel KJ, Mangukiya JD, Jain PS. Bacteriological profile of pyogenic meningitis in tertiary care hospital, Ahmedabad. National journal of medical research. 2012 Sep 30;2(03):313-7.
2. Mani R, Pradhan S, Nagarathna S, Wasiulla R, Chandramuki A. Bacteriological profile of community acquired acute bacterial meningitis: a ten-year retrospective study in a tertiary neurocare centre in South India. Indian journal of medical microbiology. 2007 Apr 1;25(2):108-14.
3. Vyse A, Wolter JM, Chen J, Ng T, Soriano-Gabarro M. Meningococcal disease in Asia: an under-recognized public health burden. Epidemiology & Infection. 2011 Jul;139(7):967-85.

4. Singh AK, Kumar A, Gaur V, Jasuja K, Pandey J, Mishra R. Bacteriological profile of acute bacterial meningitis at a tertiary care hospital of north India. Int J Res Med Sci. 2016 Oct;4(10):4387-93.
5. Park K. Park's Textbook of Preventive and Social Medicine. Banarsidas Bhanot; Jabalpur: 2017. Mental Health.:868-75.
6. Raj S, Reddy PM. Pattern and antibiogram of bacterial meningitis in children at a tertiary care hospital. J Sci Innov Res JSIR. 2013;2(26):1012-6.
7. Bareja R, Pottathil S, Shah RK, Grover PS, Singh VA. Trends in bacterial etiology amongst cases of meningitis. J Acad Indus Res. 2013 May;1(12):761-5.’
8. Castillo D, Harcourt B, Hatcher C, Jackson M, Katz L, Mair R, Mayer L, Mcgee L, Novak R, Rahalison L, Schmink S. Laboratory Methods for the Diagnosis of Meningitis Caused by Neisseria meningitidis, Streptococcus pneumoniae, and Haemophilus influenza: WHO manual.