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Comparision of Clinical and Demographic Parameters of Bacterial and Viral Meningitis among Children

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Abstract

Background: Bacterial meningitis is an emergency condition that need rapid detection. **Objective:** The purpose of the present study was to compare of clinical and demographics parameters of bacterial and viral meningitis among children. **Methodology:** This cross sectional study was carried out in the Department of Microbiology at Mymensingh Medical College, Mymensingh, Bangladesh from July 2010 to January 2012 for around 2 years. Clinically suspected patients with meningitis from paediatrics wards of Mymengh Medical College & Hospital (MMCH), Mymensingh, Bangladesh were included in this study. Based on cytological tests and biochemical tests of CSF the study subjects were categorized as bacterial meningitis. **Results:** A total 115 clinically and laboratory confirmed meningitis patients were enrolled in this study. In this study, most of the cases of study population were in the age group 1 month to 5 years 97(84.3%) cases. Among 35 cases of bacterial meningitis male was predominant than female which was 23(62.8%) cases and 12(37.2%) cases respectively (p=0.05). The clinical findings of meningitis where all of the study population (115) were suffering from fever (100.0%) followed by nausea or vomiting (60.8%) and convulsion (64.3%). **Conclusion:** In conclusion statistically significantly different is found in the age group, gender and clinical features among the bacterial and viral meningitis patients.

Keywords: Demographics parameters; CSF; bacterial meningitis; viral meningitis; children

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Introduction

Meningitis is the inflammation of leptomeninges covering the brain and spinal cord. This inflammatory process is not confined to the meninges rather spread to adjacent brain tissue[1]. Meningitis presents with the characteristic combination of pyrexia, headache and stiffness of the neck and irritability of the meninges with positive Kernigs's and Brudzinski's signs[2]. Meningitis may be acute, sub acute and chronic, which may have infectious or noninfectious causes[3]. Infectious causes of meningitis include bacteria, viruses, fungi, Mycobacterium tuberculosis, Lyme disease, actinomyces, Treponema pallidum and occasionally protozoa or other parasites[1,4]. Non-infectious causes of meningitis may be due to sarcoidosis, systemic lupus erythematosus with CNS involvement, tumor and leukemia[5]. Bacterial meningitis is still a very common and serious disease[6]. Globally 1.2 million cases of bacterial meningitis are estimated to occur every year with 135,000 deaths[7].

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World Health Organization (WHO) reported that the deaths from bacterial meningitis in Europe, America, Africa and South East Asia was, 15,000, 18,000, 20,000 and 73,000 respectively[8]. Each year in USA the incidence of bacterial meningitis is 0.01% cases[9]. The incidence of bacterial meningitis varies from 0.022% to 0.266% in newborns, more common in developing countries[10]. Muangchana et al[11] reported that in Thailand the incidence of bacterial meningitis is 0.024% cases.

The case fatality rates (CFRs) in bacterial meningitis was 26.0% in developed countries even with antimicrobial therapy and availability of advanced intensive care, which were higher ranging from 16.0 to 32.0% in developing countries[12]. Permanent neurological sequelae such as hearing loss, mental retardation, seizures and behavioral changes may occur in up to 50% of survivors even having antimicrobial therapy[13]. Gurley et al[14] from Bangladesh reported that among all meningitis cases bacterial meningitis constitutes 25.0% cases and case fatality rate was 14.0% cases. The purpose of the present study was to compare of clinical and demographics parameters of bacterial and viral meningitis among children.

Methodology

Study Settings & Population: This cross-sectional study was carried out in the Department of Microbiology at Mymensingh Medical College, Mymensingh, Bangladesh. This study was conducted during the period of July 2010 to January 2012 for around 2 years. Clinically suspected meningitis patients from paediatrics wards of Mymensingh Medical College Hospital, Mymensingh, Bangladesh were included in this study. Clinically suspected patients of meningitis with 0 to 18 years of age, high body temperature, feeding problems, vomiting, irritability, seizures or sluggishness, high pitched crying were included in this study. Patients treated with antibiotics after admission, patients above 18 years of age or with brain hypoxia and brain trauma were excluded from this study.

Sample Collection Procedure: Study population were divided into categories according to the criteria of cerebrospinal fluid. On the basis of cytological tests and biochemical tests of cerebrospinal fluid the study subjects were categorized into three groups, which were identified as bacterial meningitis, viral meningitis and normal cerebrospinal fluid15. After collection of cerebrospinal fluid, physical examination, routine bed side culture in Blood agar, Chocolate agar medium and MacConkey agar media were performed. The isolates from the collected specimens were identified on the basis of colony morphology, Gram's stain and appropriate biochemical tests. Tests for protein and glucose of cerebrospinal fluid specimens were performed. The tests were done using by commercially available colorimetric reagent methods. It was done as per manufactures instructions. Protein estimation of cerebrospinal fluid (DiaSys Diagnostic Systems GmbH & Co. KG, Germany). C-reactive protein (High sensitivity C-reactive protein Enzyme Immunoassay Test Kit (LumiQuick Diagnostics, Inc. U.S.A).

Statistical Analysis: Statistical analyses was performed with SPSS software, versions 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Continuous data that were normally distributed were summarized in terms of the mean, standard deviation, median, minimum, maximum and number of observations. Categorical or discrete data were summarized in terms of frequency counts and percentages. When values are missing, the denominator was stated. Chi-square test was used for comparison of categorical variables. Every effort was made to obtain missing data. A two-sided P value of less than 0.05 was considered to indicate statistical significance.

Ethical Clearance: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration) and also with the ethical guidelines of the Institutional research ethics. The Ethics review committee of Mymensingh Medical College granted formal ethics approval. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and analyzed using the coding system.

Results

A total 115 clinically and laboratory confirmed meningitis patients were enrolled in this study. In this study most of the cases of study population were in the age group 1 month to 5 years 97(84.3%) cases. The age distribution among the bacterial meningitis (35) showed the maximum 17(48.5%) in the age group 1 month to 1 year followed by 11(31.4%) in the age of more than 1 year to 5 years (Table 1).

Table 1: Age Distribution of the Study Population (n=115)

Age Group	Bacterial Meningitis	Viral Meningitis	Normal CSF	Total
Neonates (0-28 days)	2 (5.7%)	4 (05.8%)	0 (0.0)	6(05.2%)
1 Month To 1 Year	17 (48.5%)	26 (35.2%)	6 (50.0%)	49(42.6%)
1year To 5 Years	11 (31.4%)	33 (48.5%)	4 (33.3%)	48(41.7%)
5 Years To 10 Years	5 (14.2%)	5 (07.3%)	2 (08.3%)	12(10.4%)
10 Years To 18 Years	0 (0.0%)	0 (0.0%)	0 (0.0%)	0(0.0%)
Total	**35(100.0%)**	**68(100.0%)**	**12(100.0%)**	**115(100.0%)**

Table 2: Gender Distribution of the Study Population (n=115)

Gender	Bacterial Meningitis	Viral Meningitis	Normal CSF	Total
Male	23(65.7%)	37(54.4%)	7(58.3%)	67(58.3%)
Female	12(34.3%)	31(45.6%)	5(41.7%)	48(41.7%)
Total	**35(100.0%)**	**68(100.0%)**	**12(100.0%)**	**115(100.0%)**

The male patients were 67(58.2%) cases and female 48(41.7%) cases. The highest numbers of male patients were also in case of bacterial meningitis 22(62.8%), viral meningitis 37(54.4%) and normal CSF 8(66.6%). However, the difference between male and female was not statistically significant (p=0.05) (Table 3).

Among 35 cases of bacterial meningitis male was predominant than female which was 23(62.8%) cases and 12(37.2%) cases respectively. Again among 80 cases of bacterial meningitis male was also predominant than female which was 44(55.0%) cases and 36(45.0%) cases respectively. However, the difference between gender and bacterial meningitis was statistically significant (p=0.05).

The clinical findings of meningitis where all of the study population (115) were suffering from fever (100.0%) followed by nausea or vomiting (60.8%) and convulsion (64.3%). Among the bacterial meningitis (35) cases 60.0% cases and 45.7% cases were suffering from convulsion and vomiting or nausea respectively (Table 4).

Table 3: Gender Distribution of the Study Population (n=115)

Gender	Bacterial Meningitis		Total	P value
	Positive	Negative		
Male	23(62.8%)	44(55.0%)	67(58.3%)	
Female	12(37.2%)	36(45.0%)	48(41.7%)	0.05
Total	**35(100.0%)**	**80(100.0%)**	**115(100.0%)**	

Discussion

Bacterial meningitis is still a very common and serious disease[6]. Globally 1.2 million cases of bacterial meningitis are estimated to occur every year with 135,000 deaths[7]. The incidence of bacterial meningitis varies from 0.022% to 0.266% in newborns, more common in developing countries[16]. The case fatality rates (CFRs) in bacterial meningitis was 26% in developed countries even with antimicrobial therapy and availability of advanced intensive care, which were higher ranging from 16.0 to 32.0% in developing countries[12,17]. Permanent neurological complications may occur in up to 50.0% of survivors even having antimicrobial therapy[13]. Gurley et al[14] from Bangladesh have reported that among all meningitis cases bacterial meningitis has 25.0% and has also responsible for 14.0% case fatality rate. Latex agglutination test (LAT), PCR and estimation of CRP from CSF are rapid easier and reliable technique. In developing countries like Bangladesh where culture facilities are not available in all the centers, these parameters may play an important role in the diagnosis of bacterial meningitis[14]. A total of 115 clinically suspected meningitis patients age ranging from 0 day to 18 years

Table 4: Clinical Findings of Meningitis in the Study Population (n=115)

Clinical Findings of Study Subjects	Bacterial Meningitis	Viral Meningitis	Normal CSF	Total	P value
Fever	35(100.0%)	68(100.0%)	12(100.0%)	115(100.0%)	0.013
Nausea and vomiting	16(45.7%)	48(70.5%)	4(33.3%)	70(60.8%)	0.001
Convulsion	21 (60.0%)	44 (64.7%)	9 (75.0%)	74 (64.3%)	0.04

were included in the study, CSF samples were collected and analyzed by the above mentioned tests for detection of bacterial meningitis.

In this present study, on the basis of cytological and biochemical examination of CSF, the study population are categorized into three groups. We found bacterial meningitis in 35(30.4%) cases, viral meningitis 68(59.1%) cases and normal CSF in 12(10.4%) cases. Alamgir et al[18] from Bangladesh and Nussinovitch et al[19] from Israel also observed similar categories of the study populations in their study. Alamgir et al[18] in Bangladesh had observed identical categories of the patients having clinically suspected meningitis where they had observed bacterial meningitis 38(25.34%), aseptic meningitis 94(62.66%) and non meningitis 18(12.0%). This finding is consistent with the present study. Similarly, Narchi[20] in Saudi Arabia observed in his study that 35(35.7%) were bacterial meningitis and 63(64.3%) were aseptic meningitis, which are comparable with the present study. Similar findings were also reported by Nussinovitch et al[19] from Israel, Gurley et al[14] and Chowdhury et al[21] from Bangladesh, where they found 19.74% cases, 24.0% cases and 20.0% cases of bacterial meningitis cases respectively.

In this study, the age of the study population ranges from 20 days to 10 years in case of bacterial meningitis, 14 days to 10 years in case of viral meningitis and 3 months to 8 years in case of normal CSF findings. Das et al[22] also observed parallel age range among the total study population, where they found the age ranges from 3 months to 13 years of age in their study. In the present study, majority of study population 42.6% were in the age range from 1 month to 1 year and 41.7% were in the age range from 1 year to 5 years. Chowdhury et al[21] from Bangladesh also found 49.6% cases in the age ranges from 1 month to 1 year and 26.2% cases in the age ranges from 1 month to 5 years which are almost similar to the present study.

In this present study, among the bacterial meningitis, the male and female ratio was 65.7:34.2, in viral meningitis 54.4:45.5 and in normal CSF 58.3:41.6. As regards to the incidence of meningitis in male and female, Taskin et al[23] observed in their study, male and female ratio was 59.1:40.9 in bacterial meningitis, 72.7:27.3 in viral meningitis and 60:40 in normal CSF findings which are comparable with the present study. Similar findings were reported by Das et al[22] in India. The results of the present study closely resemble with the above mentioned study. No significant difference was found among the three groups regarding the sex incident in this study. The higher rate of positivity of bacterial meningitis in male subjects may be due to inclusion of higher number of male patients in this study population.

In the present study, all the cases of study population were presented with fever (100%). In case of bacterial meningitis 45.7% cases and 60.0% cases were presented with nausea or vomiting and convulsion respectively. In case of viral meningitis 70.5% cases and 64.7% cases are presented with nausea or vomiting and convulsion respectively and in case of normal CSF findings nausea or vomiting and convulsion were presented 33.3% and 75.0% of cases respectively. These findings of the present study is very similar with the study of Taskin et al[23] where they have also found fever in 100% cases; furthermore, 27.2% cases and 31.8% cases are presented with nausea or vomiting and convulsion respectively among the bacterial meningitis. Again in case of viral meningitis 54.5% cases and 31.8% cases are presented with nausea or vomiting and convulsion respectively. They have also found in their study, among the non-meningitis group 90.0% cases having convulsion and 10.0% of cases having nausea or vomiting.

Conclusion

In conclusion the most of the cases of study population are in the age group of less than 5 years. Again, the highest numbers of male patients are also found in case of bacterial meningitis, viral meningitis and normal CSF. Considering the bacterial meningitis male is also predominant than female. The most common clinical findings of meningitis cases are suffering from fever followed by nausea or vomiting and convulsion. Therefore, a large scale study should be conducted country wide to get the real scenario.

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Conflict of Interest
The authors have no conflicts of interest to disclose.

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Authors' contributions
Habiba U, Hossain MA, Mahmud MC conceived and designed the study, analyzed the data, interpreted the results, and wrote up the draft manuscript. Habiba U contributed to the analysis of the data, interpretation of the results and critically reviewing the manuscript. Bhuiyan MSI, Rafique MAA, Mostofa HA involved in the manuscript review and editing. All authors read and approved the final manuscript.

Data Availability
Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the

corresponding author on reasonable request.

Ethics Approval and Consent to Participate
Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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