Original Article

Pneumococcal Meningitis Burden in Children Admitted Under 5 Years at Saidu Teaching Hospital Swat

Ihsan ul Haq, Sajjad Hussain, Salman Mustaan Khan, Sardar Khan, Zahir Syed and Samreen Khan

ABSTRACT

Objective: To estimate the burden of pneumococcal meningitis in hospital admitted children under 5 years.
Study Design: Descriptive / cross sectional study
Place and Duration of Study: This study was conducted at the Department of Pediatrics, Saidu Group of Teaching Hospital Swat over a period of 2 years (from September 2016 to August 2018.
Materials and Methods: A total of 246 patients with the clinical suspicion of meningitis were selected for the study. The parents were explained the need for doing lumbar puncture to rule out or confirm the disease. Minimum 3ml of CSF was collected and was sent immediately to the laboratory Saidu Group of Teaching Hospital swat along with the CSF examination request form.
Results: The mean age of the patients was 11.6±4.1 months. There were 189(77%) patients in the age range of 1-12 months, 30(12%) in the age range of 13-24 months, 10(4%) in the age range of 25-36 months and 17(7%) in the age range of 49-60 months. There were 154(62.6%) male and 92 (37.4%) female patients. Pneumococcal meningitis was found in 7 patients. Neisseria meningitides were isolated in 5 patients and H influenza in3 patients.
Conclusion: Seven cases of pneumococcal meningitis were found in this study, making streptococcus pneumoniae as the commonest bacteria isolated followed by meningococcus on second number necessitating the need for meningococcal vaccination.
Key Words: Streptococcus Pneumoniae, Meningitis, Serotypes, Pneumococcal isolates, Meningococcus, Sensitivity pattern.

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INTRODUCTION

Streptococcus Pneumoniae is a major cause of human disease, ranging from upper respiratory tract infections to severe invasive diseases such as bacteremia, pneumonia, and meningitis. In 2005, the pneumococcus was estimated to be responsible for approximately 1 million deaths worldwide in children younger than 5 years of age. Most of these deaths occurred in developing countries. Following widespread use of the Haemophilus influenzae type B (Hib) conjugate vaccine in infants, S pneumoniae emerged as the leading cause of bacterial meningitis in children younger than 2 years of age.[1]Invasive infections caused by streptococcus pneumoniae in infants and children result in significant morbidity and mortality worldwide.[2]

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The development of effective pneumococcal conjugate vaccine has focused considerable attention on the epidemiology of invasive pneumococcal disease (IPD) in children and more than 90 immunologically distinct serotypes have been found.[3] Although 90 pneumococcal serotypes are known, 7 serotypes (14, 6B, 19F, 18C, 23F, 4, and 9V) have been noted to account for 78% of invasive strains.[4]

In 2000, a 7-valent polysaccharide protein conjugate vaccine (Prevnar) was incorporated into the universal childhood vaccination schedule. Since implementation, the number of invasive pneumococcal infections caused by vaccine Serogroups isolates declined.[5] In 2005, the coverage reached over 80% in children aged 19-35 months. The total incidence of IPD declined by 75%.[6] The diagnosis of central nervous system (CNS) infection is made on examination of cerebrospinal fluid (CSF).[7] The exact etiological diagnosis is often not possible, because prior antibiotic therapy, low bacterial load and delay in plating for culture. In children the pathogen responsible for most cases of meningitis in developing countries are streptococcus pneumoniae and Haemophilus influenzae.[8]

Deaths resulting from pneumococcus pneumonia are more than pneumococcus meningitis, but surveillance for pneumonia is difficult and complex to be done on

routine basis. Therefore, surveillance for meningitis is the best method for the measurement of disease burden among young children.[9]

Acute bacterial meningitis (ABM) is an important cause of childhood mortality and those survive are at higher risk of developing permanent neurological disability.[10] ABM is among the top 10 causes of infection related deaths worldwide. Meningitis is a major cause of child mortality in Pakistan. The fatality rate in India and other developing countries has been reported as 3-5% in children. Data from Pakistan had also shown complication rate of 57% in children with ABM.[11] Half of the children who survive ABM develop neurological sequelae, which include intellectual deficits, behavioral problems and hearing loss.[12] The burden of pneumococcal disease is largely under investigated in developing countries. However, quantification of the burden of pneumococcal disease through surveillance remains a challenge because the organism is difficult to grow, and adequate laboratory facilities are limited. This has resulted in the problem being largely invisible to health care policy planners, although efficacious vaccines are available. Information about the burden of Streptococcus pneumoniae disease among children in Pakistan, is extremely limited, although acute respiratory infection is known to be a major cause of childhood deaths.[13]

MATERIALS AND METHODS

This was a descriptive, cross-sectional study, conducted at Pediatric Unit of Saidu Group of Teaching Hospital Swat over a period of 2 years(from September 2016 to august 2018)**.** Children from 1 month to 5 yearswith clinical suspicion meningitis were enrolled.

Sample technique was non-probability purposive sampling.

Inclusion Criteria: 1. Age 1 month to 5 years.

2. Clinical suspicion of meningitis.

Exclusion Criteria: 1. If patient's clinical condition did not permit the collection of CSF, e.g. patient is comatose or having repeated seizures.

2. Patients who did not give consent to participate.

3. Patients who did not underwent LP.

Data Collection Procedure: A detailed history was taken from the parents/attendants of all the selected patients and a thorough clinical examination including detailed neurological examination was performed. The parents were explained the need for doing lumbar puncture in suspected meningitis to rule out or confirm the disease and an informed consent was taken before doing the procedure. Lumbar puncture was performed under aseptic condition before the administration of antibiotics. It was made sure that therapy is not delayed unnecessarily. Other laboratory investigations like FBC, ESR, Blood Glucose and serumelectrolytes were also performed.

CSF Sample: Minimum 3ml of CSF was collected and sent immediately to the laboratory along with CSF examination request form, for Cytology, Biochemistry, Gram staining, Culture and sensitivity. In case patient had taken antibiotic prior to CSF collection, name and dose of antibiotic was mentioned in the form. All the laboratory investigations were done in the Microbiology laboratory of Saidu Group of Teaching Hospital, Swat.

Upon receiving of specimen macroscopic findings (color, consistency) of the CSF were recorded and the specimen was subjected to the cytology and bacterial culture.

CSF Cytology and Culture Protocol: CSF specimen was centrifuged for 15min at 200RPM and sediment was used for cytology and culture, in case quantity of CSF was less than 1ml, specimen was used directly (without centrifugation) for cytology and culture.

Cytology: CSF sediment was used for cytology. CSF cytology was done for the presence of leukocytes, RBCs and bacteria. Results were reported as positive if a CSF WBC were more than 5 per mm^3

Culture and Sensitivity: Culture of CSF was performed on chocolate agar plate containing 5% sheep blood agar and vitox supplement. This was used to promote the growth of all the three organisms of interest i.e. streptococcus pneumoniae, Haemophilus influenzae and Neisseriameningitides. One drop of centrifuged CSF deposit was placed and streaked to get isolated colonies. The plate was incubated at 37°C in CO_2 atmosphere for 24 hours.

In case of positive culture, identification of the organism was performed on the basis of colonial morphology, gram stain of colony (if required) and biochemical tests.

Identification of primary organisms of interest was based on following tests:

S. pneumoniae: Optochin susceptibility and bile solubility.

H. influenzae: Oxidase test and X and V factor test.

N. meningitides: Oxidase test

Sensitivity testing of the isolated organisms was also performed by disk diffusion method against recommended antibiotics for that particular organism. CLSI guidelines were followed in this context.

Statistical Analysis: The collected data was entered into statistical computer software SPSS version 22 and analyzed accordingly. Numerical variable like age was presented by calculating mean and standard deviation.

RESULTS

The mean age of the patients was 11.6±4.1 months. There were 189 (77%) patients in the age range of 1-12 months, 30 (12%) in the age range of 13-24 months, 10 (4%) in the age range of 25-36 months and 17 (7%) in the age range of 49-60 months (Table 1).

In the distribution of patients by sex, there were 154 (62.6%) male and 92 (37.4%) female patients (figure. 1).

In the distribution of patients by clinical examination, fever was found in 202 (82%), neck stiffness in 56 (23%), poor sucking found in 175 (71%), irritability in 224 (91%), bulging fontanelle in 59 (24%), altered level of consciousness in 125 (51%), seizures in 170 (69%), and vomiting in 39 (16%) patients (Table 2).

Table No.1: Distribution of patients by age (n=246)

Age (Months)	No. of patients	Percentage
1-12	189	77.0
13-24	30	12.0
25-36	10	4.0
37-48	0	0
49-60	17	7.0
Mean	11.6±4.1	

Key: n: Number of patients

Table No.2: Distribution of patients by clinical examination (n=246)

Clinical examination	Yes		No	
	No.	%tage	No.	%tage
Fever	202	82.0	44	18.0
Neck stiffness	56	23.0	190	77.0
Poor sucking	175	71.0	71	29.0
Irritability	224	91.0	22	9.0
Bulging fontanelle	59	24.0	187	76.0
Altered level of consciousness	125	51.0	121	49.0
Seizures	170	69.0	76	31.0
Vomiting	39	16.0	207	84.0

Key: n: Number of patients

Table No. 3: Sensitivity patterns of the organism isolated (n=246)

Antibiotics	Sensitive	Resistance
Ampicillin	Yes	No
Ceftriaxone	Yes	No
Cefotaxime	Yes	No
Vancomycin	Yes	No
Piperacillin/ Tazobactam	Yes	No
Meropenem	Yes	No
Trimethoprim/ sulfamethoxazole	No	Yes
Tetracycline	No	Yes

Key:n Number of patients

On CSF cytology meningitis was positive in 30 cases and out of 30, 18 patients were male and 12 were female. On CSF culture, S.pneumoniae was isolated in 7 patients out of 246 suspected cases. In all these 7 cases meningitis was also proven on CSF cytology.

In the distribution of patients by organism isolated, there were 7(2.8%) patients of streptococcus pneumonia, 5(2%)patients of Neisseria meningitidis and 3 (1.2 %) patient of H.influenzae (figure.2).

On CSF culture and sensitivity of S. Pneumonia was sensitive to, Ampicillin, Ceftriaxone, Cefotaxime, Vancomycin, Piperacillin/Tazobactam, Meropenern and resistant to Trimethoprim / Sulphamethoxazole and Tetracycline as shown in (Table 3).

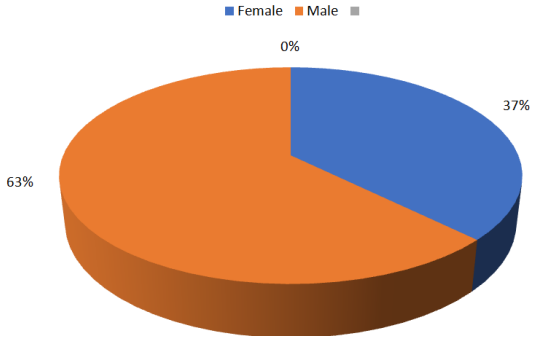

Figure No. 1 Gender Distribution of Patients.

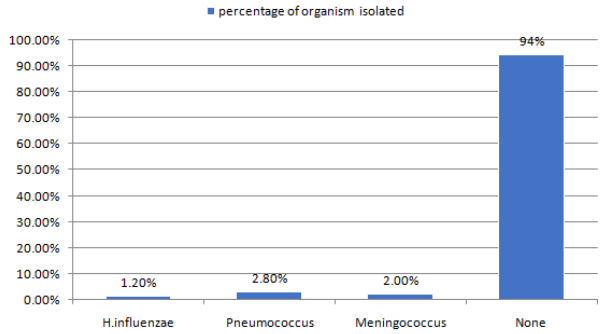

Figure No..2: Percentage of organism isolated.

DISCUSSION

Worldwide ABM remains a devastating disease and cause fatal outcome and neurological sequelae, particularly in the developing countries. Most of the deaths occur during first 48 hours[14, 15]. In the developing countries, where an attempt has been made to measure the burden of Pneumococcal meningitis, Its incidence has been found to be higher than Europe and USA, before the implementation of conjugated vaccine. [16]

In this study majority of the patients (77%) presented below one year of age with mean age of 11.6±4 months, confirming that meningitis is more common in younger age group. These findings are comparable with the research work done by Zaidi et al[17], Iregbu K C et al[18] and NazS et al[19], however Dhurbajooti. J et al[20] has reported only 46.8% cases under one year.

This study shows a male to female ratio 1.67 to 1. Similar male preponderance was observed in the studies conducted by Bari A et al[24] and Dhurbajooti. J et al[20] showing the male to female ratio of 1.6 to 1 and 1.8 to 1 respectively. The relative frequency of different signs and symptoms in this study are much similar to those observed by Marji S[22], Bari A et al[21], Zaidi et al[17] and Fayyaz J et al[23].

CSF culture was positive only in 15 patients (6%) in our study. Bari A et al[21] in their comparative study has shown 7% CSF culture positivity in 2013 while they have reported 12% positivity in 2012. Similarly, Afridi J M et[24] al has reported 7.9% CSF culture positivity in their study. However CSF culture positivity was relatively higher (13.9%) in a study conducted by Gaurav B M et al[25]atAhmedabad India. These high incidences of sterile CSF may be due to empirical antibiotic use prior referral to a tertiary care hospital or improper laboratory handling of specimen

In our study Pneumococcus was the predominating organism, 7(2.8%), followed by Meningococcus 5(2%) and H. influenzae 3(1.2%). The results are comparable with the research papers by Bari A et al[14,21]. The sensitivity pattern of common organisms found in our study is also comparable with the studies of Afridi J M et al[24] conducted in Peshawar and Sharma B et al[26]conducted at New Dehli India

Based on the above discussion, it is suggested that a nationwide multicenter study should be conducted to properly assess the burden of pneumococcal meningitis in our country. Like our research work other studies have also reported a low frequency of 2 to 3% positivity.[7, 27]

CONCLUSION

Seven cases of pneumococcal meningitis were found in this study, making streptococcus pneumoniae as commonest bacteria isolated followed by meningococcus on second number necessitating the need for Meningococcal vaccination.

Suggestion: It is suggested that to further assess the invasive pneumococcal disease (IPD) burden in the form pneumococcal meningitis a nationwide multicenter study should be conducted.

Author's Contribution:

Concept & Design of Study:	Ihsan ul Haq
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Data Analysis:	Sardar Khan, Zahir Syed, Samreen Khan
Revisiting Critically:	Ihsan ul Haq, Sajjad Hussain
Final Approval of version:	Ihsan ul Haq

Conflict of Interest: The study has no conflict of interest to declare by any author.

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