ORIGINAL RESEARCH

Evaluation of *Streptococcus pneumoniae* in suspected cases of Meningitis in children under 5 yrs age group

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Abstract
Bacterial meningitis is a severe infection of the brain with high mortality and morbidity. *Streptococcus pneumoniae* is the most common cause of community-acquired bacterial meningitis, accounting for 70%-75% of cases. In this study 77 CSF samples from suspected cases of meningitis were collected. 02 Isolates of *S. pneumoniae* and 04 other bacteria were detected in the study. None of the isolate have shown resistance to any of the tested Anti-Microbial. Most of the samples were collected after administration of antibiotics, which may lead to reduced recovery of organism.
Keywords:*Streptococcus pneumoniae* Meningitis,Children

Introduction

Streptococcus pneumoniae is the leading cause of meningitis, with a case fatality of up to about 50%. Children younger than 5 years are at greater risk for pneumococcal meningitis compared with other populations. As one of the most prevalent pathogens causing bacterial meningitis, *Streptococcus pneumoniae* (*S. pneumoniae*) was responsible for over 300,000 meningitis cases and 40,000 deaths globally in 2017 [1]. Especially for under-fives,Lanceolate Gram-positive diplococcus *S. pneumoniae* is also known as Pneumococcus. Despite the fact that there are 90 serotypes and more than *Pneumococcal subgroups*, 11 of the most prevalent serotypes account for about 75% of all invasive infections in children around the world. Following hospital release, the probability of neurological sequelae in survivors approaches 20% globally. Therefore, it is crucial that the child with Meningitis has an early diagnosis and adequate care. About 5-7 cases of bacterial Meningitis occur for every 100,000 people. The most frequent causes of acute bacterial Meningitis in otherwise healthy children in developed nations are currently *Neisseria meningitidis* and *Streptococcus pneumonia* [2]. The major causes of bacterial Meningitis, along with Pneumonia and Sepsis, are *Neisseria meningitidis*,*Streptococcus pneumoniae*, and *Haemophilus influenzae* type b[3]. Reports of increasing drug resistance is also coming from different part of world therefore it is important to diagnose infection early. The development and worldwide usage of pneumococcal conjugate vaccines (PCVs), decreases the morbidity and mortality from Pneumococcal infection. However use of this vaccine is still limited in developing country.

Aim: this study aim to detect proportion of *S. pneumoniae* in suspected cases of Meningitis in children under of 5 yr. of age group.

Methodology

Material and Methods

Study area and Study period: This was a Hospital based cross-sectional study design conducted in the Department of Microbiology of a tertiary care hospital over a period of 1 year from August 2021 to July 2022

Study design: This was a Hospital based cross-sectional study.

Study population: Under-five children who were suspected for meningitis.

Ethical consideration: Study was approved by Institutional Ethics committee. Data collection and processing was started after taking written consent from parents.

Procedure

CSF samples from all suspected cases were collected by lumber puncture in a sterile container under aseptic precautions. Samples were divided in three screw cap Pedvial for Microbiological assay, Routine Biochemistry and Haematology (Cell count) and sent to respective lab immediately. In the Microbiology lab sample was centrifuged and Sediment was cultured on Blood Agar, Chocolate Agar and MacConkey Agar and was incubated aerobically under candle Jar at 37 ℃ for 24-48 hrs. for bacterial isolation and identification. Chemical analysis and cytological analysis was conducted based on standard operating procedures.

Isolation and identification of bacteria: After overnight incubation all culture media plates were examined for growth of colonies. *S. pneumoniae* from all positive CSF cultures were identified and characterized on the basis of morphology, cultural characteristics, and standard biochemical testing. Antibiotic sensitivity was performed using Kirby Baur disc diffusion method as per CLSI guidelines.

Discussion

We have received 77 CSF samples from suspected cases of Meningitis from children under 5 year of age. Culture found growth of organism in 7.7% of cases while 92.3% cases remain sterile. Among the Organism grown in this study, CSF samples showed growth of *S. pneumoniae* 2.6% and other bacteria 5.1%. (Table-1). In our study, about 55.84% of enrolled patients had received antibiotics prior to hospitalization. Inclusion of cases known to have been managed prior with antibiotics probably reduced the number of cultures with positive results. Most patients admitted in tertiary care centers received antibiotics over the counter as community antibiotic use is very prevalent in India.

In the present study, antibiotic usage prior to admission was reported in 43(55.84%) cases while 17(22%) did not use any antibiotics and in 17(22%) cases, no records were present.(Table-2) Those with positive antibiotic history, majority (95.34%) of samples were sterile and culture growth were seen in 4.66% cases. In those with negative or unknown antibiotic history, about 88% were found sterile while 12% were culture positive. In positive antibiotic history group, in CSF samples, organisms detected were *K. pneumoniae* and *Pseudomonas*, while in those with no prior antibiotic usage, *S. pneumoniae* was detected in CSF sample. In those with unknown antibiotic usage, *S. pneumoniae*, *E. coli* and *Enterococcus* were detected. Bacterial Meningitis is a medical emergency that is characterized by meningeal inflammation brought on by a bacterial infection. Untreated, its mortality approaches 100%, and even with current antibiotics and advanced paediatric intensive care, the mortality rate of the disease is approximately 5-10%.

Shrestha *et al*.[4] in her research showed growth of other organism but didn't found any *S. pneumoniae*.In the study done by Karode *et al*.[5] most commonly isolated pathogens in CSF were *Klebsiella* (15.3%), *Enterococcus* (5.7%), *E. coli* (5.7%), *S. aureus* (3.8%),*Streptococcus pneumonia* (1.9%), and *Acinetobacter* (1.9%).Owusu *et al*.[6] in their study reported *S. pneumoniae*(77.7%)as the most common bacteria. In a study conducted by Jiang *et al*.[7] in CSF samples of patients, the most prevalent pathogens were *E. coli* (28.5%) followed by*Streptococcus pneumoniae*(17.8%).

In the present study, 50% mortality was reported in lab confirmed *S. pneumoniae* infection.(Table-3) Shrestha *et al*.[4] in their study reported case fatality rate of *S. pneumoniae* as 50%. In a study by Gouveia *et al*.[8], overall case fatality among hospitalized patients with Pneumococcal Meningitis was 37%.

On CSF biochemistry, 50% of *S. pneumoniae* cases have leukocytes count 10-500 cells/ mm^3; CSF protein 100-150 mg/dL and CSF glucose 1-10 mg/dL while rest 50% *S. pneumoniae* cases have leukocytes in range of 501-1000/mm^3; protein 150-300 mg/dL and Glucose 11-13 mg/dL. In a study done by Gouevia *et al*.[8], risk factors for case-fatality beside extremes of age, coma on admission and penicillin resistance were CSF protein >300 mg/dl, blood leukocyte count <15000 cells/mm^3.

In the present study, none of the case were vaccinated against *Streptococcus pneumonia* (Table-4).Karode *et al*.[5] in their study reported that 44.2% children with Meningitis were completely immunized, 19.2% incompletely immunized and 36.5% were unimmunized. In the present study, all *S. pneumoniae* isolates were sensitive for Chloramphenicol, Vancomycin, Ceftriaxone, Cotrimoxazole, Erythromycin, Penicillin, Cefoxitin. (Table-5) Wang *et al*.[9] reported very high prevalence of penicillin resistant *S. pneumoniae* from several countries with resistance rates ranging from 53.4% to 73.4%.Jiang *et al*.[7] in their study reported antibiotic susceptibility rates of *S. pneumoniae* isolates to Penicillin G, Erythromycin, Chloramphenicol, Ceftriaxone and Tetracycline were 68.8%, 0.0%, 87.5%, 81.3% and 0.0%, respectively. Gentamycin, Ofloxacin, Linezolid and Vancomycin were identified as the most effective antibiotics for *S. pneumoniae*, each with sensitivity rates of 100%.

Conclusion

Streptococcus pneumoniae is an important cause of Meningitis among children can leads to morbidity and mortality requires a high index of suspicion, prompt diagnosis, and rapid treatmen. In this study only 02 isolates of *S. pneumoniae* were detected. There are reports of increasing drug resistance in *S. pneumonia*

worldwide but in the present study, *S. pneumoniae* did not show resistance to any tested drug.While the incidence and mortality have declined with improved neonatal intensive care practices and universal adoption of preventative screening and prophylaxis programs, the associated morbidity remains unchanged.

Table1: Culture Growth (n=77)

Isolates grown	Number	Percentage %
S.pneumoniae	2	2.6
Other	4	5.1
Sterile	71	92.3
Total	77	

Table2: History of antibiotics consumption

	Given		Not Given		Not Known		
Isolates	**Number**	**Percentage(%)**	**Number**	**Percentage(%)**	**Number**	**Percentage(%)**	**Total**
Total Sample	43	55.84	17	22	17	22	**77**
Sterile	41	95.34	16	94.11	14	82.35	**71**
Organism Grown	2	4.66	1	5.89	3	17.65	**6**
Culture growth							
Streptococcuspneumoniae	0	0.00%	1	100%	1	33%	2
Other Organism	2	50.00%	0	0%	2	0%	4
Total	2	100.00%	1	100%	3	100%	6

Table3: Final Outcome of*S. Pneumonia* infected cases

Laboratory confirmed cases *Streptococcus pneumoniae*	Outcome	Number	Percentage%
2	Cured and discharged	1	50%
	Death	1	50%

Table4: Vaccination status

Laboratory confirmed case of*Streptococcus pneumoniae*	Vaccinationstatus		Percentage(%)
2	Vaccinated	0	0%
	Notvaccinated	2	100%

Table 5: Antibiotic Sensitivity Pattern

S. No.	Antibioticsused(micrograms)	Chloremphenicol	Vancomycin	Ceftriaxone	Co-trimoxazole	Erythromycin	Penicillin	Cefoxitin
1	*S. pneumoniae1*	Sensitive	Sensitive	Sensitive	Sensitive	Sensitive	Sensitive	Sensitive
2	*S. pneumoniae*2	Sensitive	Sensitive	Sensitive	Sensitive	Sensitive	Sensitive	Sensitive

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