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Pediatric Bacterial Pneumonia and its Antibiogram

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In view of the leading cause of morbidity and mortality in under five year children in developed and developing countries, the present study was undertaken in the Infosys Pediatric Department, Capital Hospital, Bhubaneswar, Orissa to find out the etiological agent and a prospective for management of childhood pneumonia by suitable antibiotics. 1 00 cases were analyzed with a suspected upper respiratory track infection out of which 60 were diagnosed as confirmed pneumonia. Forty healthy children, with the same age group, were also included as control in this study. Most of the isolates belong to gram positive cocci and gram negative bacilli. The gram positive cocci were Streptococcus pneumoniae, Staphylococcus aureus and some coagulase negative Staphylococcus spp. Like Staphylococcus haemolyticus. The predominant gram negative bacilli were Klebsiella pneumoniae, Escherichia coli and Pseudomonas aeruginosa. Quinolone and cephalosporin were found to be effective against gram positive cocci during antibiogram study and aminoglycoside and carbapenem were effective against gram negative bacilli. The present study has identified various etiological agents responsible for causing pediatric pneumonia and the treatment for pneumonia using different antibiotics.

Key words: Paediatrics, Pneumonia, Bacteria, Antibiotics, Orissa.

Pediatric respiratory disease remains an important cause of morbidity and mortality in both the developing and developed countries I .Acute respiratory infection, especially pneumonia, is responsible for a significant portion of deaths among children in developing countries. Recent global estimates indicate that there are 10 million deaths annually of children aged <5years2 and that 99%of these deaths occur in developing countries with 70% caused by infections. World Health Organization (WHO) confirm that acute respiratory illness remains a leading cause of childhood mortality, causing an estimated 1.6-2.2million deaths globally in children <5years.In North America the annual incidence younger than 5years of age is 34-40 cases per 1000. European figures taken from a study conducted in Finland are similar i.e.; 36/l000/year for children <5years of age and 16.2/l000/year for children >1year[1]. Although the death rates from neonatal tetanus have been lowered and the death rates from childhood diarrhea are becoming lower in India and Indonesia, death rates from pneumonia have

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not yet begun to fall. The reason for this relative rise in significance may lie in the failure to realize that majority of the most acute respiratory illness are not viral but rather bacterial infections, which rapidly respond to appropriate antibiotic therapi. In India contribution of pneumonia to pediatric mortality is 18.8% and in Orissa it is 15%.

The most common cause of pneumonia is the gram-positive cocci (GPC) Streptococcus pneumoniae4 which causes 95% of community-acquired pneumonia. Another GPC is Staphylococcus aureus, many coagulase negative Staphylococcus spp. are also responsible for pediatric pneumonia5. The common gram negative bacilli (GNB) causing were Klebsiella pneumoniae, Escherichia coli, which was found in infants <3 months of age6 and Pseudomonas aeruginosa.

Pediatric pneumonia is either caused by a single bacterium or by many bacteria, because delays in antimicrobial treatment can lead to adverse outcomes. The choice of antimicrobial therapy is vital. The current study investigates the distribution and drug resistant of GPC and GNB bacteria in the respiratory isolates.

MATERIAL AND METHODS

The present investigation was conducted over a period of six months during summer. The sputum and throat swab samples of the children were collected from the Infosys Pediatric Department, Capital Hospital, Unit-6, Bhubaneswar with the permission of the Chief Medical Officer. Sample processing was carried out at Microbiology labotory, Asian Institute of Public Health, Bhubaneswar. The samples were collected from genuine cases as observed referred by the pediatrician. In this study 100 samples were collected, out of which 60 cases were from pneumonic patients and 40 samples were taken from nom1al healthy children recorded as controls. Cases with typical symptoms of the disease, such as cough and cold; difficulty in breathing, fast respiration rate, fever and malnutrition were taken into consideration during the study. Information was collected in the form of questionnaire that includes child's age, sex, other socio demographic parameters and feeding practices.

The collected samples were inoculated on the Blood agar and Mac-Conkey agar for the isolation of bacteria and incubated at 37°C for observation. For micro-aerophilic culture, the plates were kept inside the candle-jar. Gram staining of the isolated colonies was done. The bacteria were identified by using the API Kits (Bio-merieux, France). Antibiotic sensitivity tests of the isolates were done by Kirby and Bauer disc diffusion tecnique[7].

RESULTS

In this study, out of 100 collected samples 60 were from pneumonic cases and 40 were controls. The children were between the age group <1 year to 15 years. The sputum and throat swab samples were initially processed in the laboratory to explore the etiological agents, the results of which were interpreted in different tables. Various parameters were taken (Table 1) from the clinical history of the patients during samples collection. The present study population consisted of 30 boys and 30 girls suffering from pneumonia. Majority

Table 1. Clinical Parameters in Pneumonic Cases

Parameters	Number of Patients	Percentage
1. Sex		
Male	30	50
Female	30	50
2. Age		
<1 year	15	25
1-5years	25	41.66
6-10 years	10	16.66
11-15 years	10	16.66
3. Feeding Habits		
Commercial Milk	55	55
Mother's Milk	27	45
4. Cough Formation		
With Cough	56	93
Without Cough	4	7
5. Fever		
With Fever	45	75
Without Fever	15	25
6. Economic Status		
Lower Income Group	35	58
Middle Income Group	20	33
Higher Income Group	5	8

of children affected were between the age group of 1 to 5 years (41.66%) followed by <1year (25%), 6-10 years and 11-15 years (16.66% each). Children taking commercial milk suffered more (55%) than those taking mother's milk (45%). Cough was associated with upper respiratory symptoms in 93% of cases.75% of pneumonic patients were having fever. Based on the socioeconomic status, patients were categorized into three levels of income groups: lower, middle, higher. 58% of pneumonic patients belong to lower income group, 33% were from middle income group and 8% were from higher income group

During sample processing, different types of micro-organisms were isolated. It was observed that the disease was not only associated with one type of micro-organisms but in many cases more than one were found. The common micro-organisms were *E.coli, Klebsiella*

Table 2. Microorganisms isolated from Pneumonic Cases

Microorganisms	Prevalence in the sample	Percentage
Escherichia coli	3	5
Klebsiella pneumoniae	4	7
Staphylococcus aureus	4	7
Staphylococcus epidermidis	2	3
Streptococcus pneumoniae	14	23
Streptococcus mitis	7	12
Streptococcus salivarius	7	12
Other Staphylococcus spp	3	5
Mixed Culture		
E. coli + K. pneumoniae +Staph. spp	3	5
Strep. mitis + Staph. spp	2	3
P. aeruginosa + K. pneumoniae	3	5
P. aeruginosa+ Staph. spp	2	3
S. pneumoniae+ E. coli	4	7
Staph. spp. + E. coli	2	3

Table 3. Prevalence of different types of micro-organisms in normal and pneumonic cases

S. No	Normal infant	Pneumonic infant
1	*Escherichia coli*	*Escherichia coli*
2	*Klebsiella pneumoniae*	*Klebsiella pneumoniae*
3	*Streptococcus mitis*	*Streptococcus mitis*
4	*Streptococcus salivarius*	*Streptococcus salivarius*
5	*Staphylococcus aureus*	*Staphylococcus aureus*
6	*Staphylococcus lentus*	*Staphylococcus lentus*
7	*Staphylococcus xylosus*	*Staphylococcus xylosus*
8	*Staphylococcus cohinii*	*Staphylococcus cohinii*
9	*Neisseria spp*	*Neisseria spp.*
10	*NO*	*Pseudomonas spp*
11	*NO*	*Escherichia coli*
12	*NO*	*Streptococcus pneumoniae*
13	*NO*	*Staphylococcus chromogenes*
14	*NO*	*Staphylococcus sciuri*
15	*NO*	*Staphylococcus lugdunensis*
16	*NO*	*Staphylococcus hominis*
18	*NO*	*Staphylococcus haemolyticus*

Table 4. Sensitiveness of GPC against different groups of antibiotic

Antibiotics	No. of Positive cases	Percentages
Aminoglycoside	6	43
Macrolide	6	43
Penicillin	4	26
Polypeptide		
Quinolone	8	57
Cephalosporin	8	57
Glycopeptide	5	36
Sulphonamide	1	7
Tetracycline	3	21
Spiramycin	1	7

Table 5. Sensitiveness of GNB against different groups of antibiotic

Antibiotics	No. of Positive cases	Percentages
Aminoglycoside	6	43
Macrolide	6	43
Penicillin	4	26
Polypeptide	0	0
Quinolone	8	57
Cephalosporin	8	57
Glycopeptides	5	36
Sulphonamide	1	7
Tetracycline	3	21
Spiramycin	1	7

pneumoniae, Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus pneumoniae, other Streptococcus and Staphylococcus spp. (Table 2)

During the study, 60 pneumonia cases were compared with 40 normal controls for the occurrence of different micro-organisms and it was found that some bacteria were common in both while some were found only in the infected cases (Table 3).

During antibiogram study, the effects of different antibiotic groups were studied against GPC and GNB. GPC were found to be more sensitive to quinolone and cephalosporin and GNB were found to be more sensitive to amino glycoside (Table 4 and Table 5).

DISCUSSION

In this small investigation, the author have interrogated the subjects and concerned about their sex, age, feeding habits, cough formation, fever and economic status of their family. Out of the 60 infected cases studied, the percentage of occurrence of pneumonia was found to same in both the sex which corroborates with the findings of Delport SD and Brisley T who reported that sex distribution was equal8 in severe community- acquired pneumonia in children. But the result found is in contradiction with Utsunomiya Y et al9 and Tullu MS et als who had reported the occurrence of pneumonia more in males than in females. However, this variation may be due to the more number of male patients hospitalized during that time or prevalence of more male children included in the study area. Among the cases studied, it was also observed that maximum pneumonic cases were between the age-group 1-5years (41.66%) followed by <1year (25%). Similar results were reported by Muhe L[10], Deb SK[11] and Lakhanpaul M et al[1] where pneumonia is responsible for about 70% of all acute lower respiratory tract infection deaths among children below 5years of age. The other findings (Table1) indicated were no way different from the observation made by Keeley DJ et a112, Clark JE and Spencer D13, Shah N et al14 and Deb SK[11].

In this bacteriological analysis taking 100 children into consideration, it was observed that Streptococcus pneumoniae(23%) is the prime cause of the disease followed by other Streptococcus spp.(12%), Klebsiella pneumoniae(7%), Staphylococcus aureus (7%) , Escherichia coli(5%), coagulase negative

Staphylococcus spp.(5%).Similar types of work were done by Lakhanpaul M et all, Patwari A.K. et at', where Streptococcus pneumoniae along with other micro-organisms such as Klebsiella pneumoniae, E. coli , Staphylococcus aureus were isolated with little bit of difference in percentage recovery. Also Tullu MS et als had isolated the GNB and coagulase negative Staphylococci which corroborates with the present findinds.

In this study, the micro- organisms isolated from the throat of normal controls and pneumonic cases were also compared. It was

found that some bacteria were common while some were found only in infected cases[15].

During the antibiogram studies, GPC were found to be more sensitive to quinolone and cephalosporin. Similar results were observed by Bradley[16] who found that third generation cephalosporin appear to be the effective therapy for pneumonia caused by virtually all current isolates of *Streptococcus pneumoniae*. Payen *et al.,*[17] found fluoroquinolone especially ciprofloxacin was active against a wide spectrum of GPC because of their broad antimicrobial activIty. Clark and Spencer[3]also suggested that cefuroxime, the most often used intravenous antibiotics.

GNB were found to be more sensitive against aminoglycoside, carbapenem and quinolones. Similar results were found by Gonlugur *et al.,*[18] who found different respiratory isolates of GNB sensitive to gentamicin, amikacin, imipenem and ciprofloxacin. Also Tullu *et al.,* observed that *E. coli* and *Klebsiella* had maximum susceptibility to amikacin.

CONCLUSION

The present study identified many etiological agents responsible for pediatric pneumoma. *Streptococcus pneumoniae* is the major causative agents along with other α-haemolytic *Streptococcus* spp., *Staphylococcus aureus* and other coagulase negative *Staphylococcus* spp. are also found to cause pediatric pneumonia. At the same time GNB are also responsible for the dreaded disease. Different groups of antibiotics are effective for the treatment of pediatric pneumonia. Quinolone and cephalosporin are found to be effective against GPC while aminoglycoside and carbapenem show their effectiveness against GNB.The knowledge of common organisms and their antibiotic susceptibility is important for institution of appropriate antimicrobial therapy. Research is ongoing to identify the most sensitive and specific tools to identify the causative organisms so that more directed treatment can be used. Further research is required so that clinicians can move further towards practicing evidence based medicines to eradicate the disease.

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