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Microbiological Profile And Their Resistance Pattern Among Children with Community Acquired Pneumonia in A Tertiary Care Hospital in North-East India.

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Abstract: *Community acquired pneumonia(CAP) is a common cause of morbidity and mortality in children worldwide and development of antibiotic resistance becomes a great concern for all.*
Objective *: To find out the microbiological profile among children with CAP and their antibiotic resistance patterns.*
Methodology*: It was a hospital based retrospective study of 404 children, aged 2 months to 60 months, admitted into the department of pediatrics of a tertiary care teaching hospital, as severe pneumonia (as defined by WHO case definition) from November 2013 to October 2015. Bacterial pathogens and their resistance patterns were studied from the throat swab culture and sensitivity reports.*
Results: *78.2% cases belonged to the age group of 2 – 12 months. Males predominated females ie 64.6% vs 35.4%. At least one organism was detected from 255 cases(63%). Streptococcus pneumoniae was the commonest organism(50.5%) identified, followed by Klebsiella(27%) and Staphylococcus(14.1%). Penicillin and cotrimoxazole resistance were found in almost 50% of the organisms isolated. 36.2% of Klebsiella were resistant to 3rd generation cephalosporins. Pseudomonous were resistant to amikacin and pipercillin-tazobactum (40% each). E.Coli were resistant to 3rd generation cephalosporins (45.5%) and to some extent, to ciprofloxacin (18.9%) also .*
Conclusion: *S. pneumoniae was the commonest organism in CAP in children followed by K. pneumoniae and Staphylococcus. Penicillin, cotrimoxazole and even third generation cephalosporins, ciprofloxacin resistance was found in children with CAP in this part of the country.*
Keywords: *Community acquired pneumonia, children, microbiological profile, resistance pattern*.

I. Introduction

According to the World Health Organization, about 150 million cases of pneumonia occur annually in children younger than age five years. About 20 million cases are severe enough to require hospitalization, and 2 million children die worldwide. The majority of these deaths occur in Africa and South East Asia[1]. 50% of World's pneumonia deaths occur in India which means approximately 3.7 lakh children die of pneumonia annually in India[2]. Pneumonia can be community acquired pneumonia (CAP) or hospital acquired pneumonia. Infectious Diseases Society of America (IDSA) defines CAP as "an acute infection of the pulmonary parenchyma that is associated with at least some symptoms of acute infection, accompanied by the presence of an acute infiltrate on a chest radiograph or auscultatory findings consistent with pneumonia in a patient not hospitalized or residing in a long-term care facility for more than 14 days before onset of symptoms"[3,4]. Common etiological agents of CAP in children may be bacteria or viruses. Of the bacterial causes, S. pneumonia is the commonest causative agent[5] . However, viruses cause a significant percentage of CAP infections, especially in children younger than two years of age[6]. The prevalence of viral pneumonia decreases with age. Mixed viral and bacterial infection accounts for 30 to 50 percent of CAP infections in children[7]. Breast-feeding seems to be protective. Penicillin-resistant S. pneumoniae infections can occur in children with recent antibiotic use[8].

Although the etiology of CAP is generally bacterial, the microbial pattern varies from place to place as also the antimicrobial sensitivity and emerging resistance pattern. The treatment of CAP is complicated by growing threat of antimicrobial resistance and the tendency to rely on empirical therapy. Recent years have witnessed the emergence of new pathogens and also newer antibiotics designed to combat them. Various studies have been done in different countries for example in Jordan[9], Thailand[10], United States[11] and Chile[12] regarding the microbial etiology and bacterial resistance. But there is limited published data describing microbiological causes of pneumonia in India[13]. Although a wide variety of recognized pathogens cause CAP, the precise etiology, pattern of microbial flora in various regions and settings, antibiotic sensitivity and resistance in India is still not comprehensively studied.

Throat swab/nasopharyngeal swab culture and sensitivity test is the easiest method to identify the bacterial organism, except Hemophilus influenzae, in pneumonia in children. PCR and molecular studies are not available in resource poor settings. Sputum specimens are difficult to obtain in children and are of limited use in diagnosis or therapy. Blood culture results have not been shown to change clinical management and often do not yield a pathogen[14].

Our study was an honest attempt to look into the various etiological agents of CAP in children and the resistance patterns of the organisms in this part of the country which will be of immense help to plan therapy among children in resource-limited settings.

II. Materials And Methods

Ethical clearance was taken from the Institutional Ethics Committee before the study. It was a hospital based retrospective study conducted in the department of Pediatrics of a tertiary care teaching hospital of North-East India. 404 children of ages between 2 months to 60 months, admitted as severe pneumonia [satisfying the World Health Organization (WHO) case definition of severe pneumonia ie fever, cough, fast breathing (≥ 50 / min in 2 mo – 12 mo and ≥ 40 / min in 1 – 5 yrs) and chest indrawing, requiring admission][15] from October 2013 to September 2015, were included in this study.

Children with very severe pneumonia or complicated pneumonia, nosocomial pneumonia, immune-compromised state, tuberculosis (of any system), congenital heart disease, asthma, severe acute malnutrition(SAM) or a history of intake of antibiotics before admission were excluded from the study. Those children who fulfilled the inclusion criteria at the time of admission but subsequently expired during hospital stay were also excluded.

Written consents were taken from the parents / guardian of the children before inclusion into the study. After taking detailed history, a thorough examination, routine blood examination and chest X-ray were done in all children. Throat swab cultures were done in all the cases in the Department of Microbiology by conventional method. Statistical analysis of data was done by calculating percentages.

III. Results

total of 404 children were enrolled in the study. Table 1 shows baseline characteristics of the children. Out of 404 cases, 261(64.6%) were male and 143(35.4%) were female. Age distribution wise, 316 (78.2%) cases were found in the age group of 2-12 months followed by 65(16%) and 23 (5.6%) cases in the age group of 13-24 months and 25-60 months respectively, with an average age of 9.75±9.80 months. Season wise, 41.3% (167/404) cases were reported during winter season, 21% (85/404) during spring, 20% (81/404) during summer and 17.5% (71/404) were found during autumn season. In 26.4% (107/404) cases average hospital stay was >5 days, in 22.5% (91/404) cases average hospital stay was 5 days and in 50.9% (206/404) cases average hospital stay was <5 days.

Table 2 shows microbiological profile of children**.** Out of 404 cases (35.4%) at least one organism was detected from 255 cases (63%) including 17(6.6%) cases showing mixed growth. Organisms identified were as follows: Streptococcus pneumoniae from 129 (50.5%) cases, Klebsiella from 69 (27%), Staphylococcus from 36 (14.1%), Yeast from 11 (4.3%), E. coli from 12(4.7%), Pseudomonas from 8 (3.1%), Citrobacter from 2 (1.3%) and Providentia from 3 (1.2%) cases. Mixed growth was seen in 17 (6.7%) cases, out of which combined growth of Klebsiella & Gram positive organism (streptococcus/staphylococcus) were the commonest, seen in 8 cases (47%).

Table 1: Baseline characteristics of children

Variables		n=404	%
Age group	2-12 months	316	78.2%
	13-24 months	65	16%
	25-60 months	23	5.6%
Sex	Male	261	64.6%
	Female	143	35.4%
Season	Winter	167	41.3%
	Spring	85	21%
	Summer	81	20%
	Autumn	71	17.5%
Hospital stay	>5 days	107	26.4%
	=5 days	91	22.5%
	<5 days	206	50.9%

Out of 36 staphylococcus, coagulase negative staphylococcus (CONS) were seen in 4 and Methicillin resistant staphylococcus aureus (MRSA) in 3 cases. 101(25%) throat swabs were having normal flora and 48 (11.8%) were sterile.

When resistance patterns were analysed (Table 3), penicillin and cotrimoxazole resistance for Streptococcus was found in 55.5% and 48.3% cases respectively and for staphylococcus in 55.1% and 48.2% of cases respectively. In our study streptococci were resistant even to tetracycline, clindamycin, azithromycin and ciprifloxacin to the extent of 8 – 12% and, to 3rd generation cephalosporins, doxycycline, levofloxacin and amoxicillin in a few cases (1 – 6.5%). Staphylococci were not resistant to linezolid or vancomycin in any of the isolates. Klebsiella were resistant in 36.2% for third generation cephalosporins, 31.5% for co-trimoxazole and 29.3% for amoxycillin, and even to ciprofloxacin (13.7%) and pipercillin tazobactum combination (10.3%). For Pseudomonous amikacin, pipercillin- tazobactum combination and cotrimoxazole were resistant in 40% cases each. Providensia was resistant to cotrimoxazole, ciprofloxacin and 3rd generation cephalosporins (33.3% in each). E Coli were resistant in 45.5% of isolates to third generation cephalosporins , 36.3% to cotrimazole and to some extent, to ciprofloxacin (18.9%).

Table 2: Distribution of microbiological agents

Sterile	48(11.8%)
Normal flora	101(25%)
Streptococcus	129(50.5%)
Staphylococcus	36(14.1%)
Klebsiella	69(27%)
E Coli	12(4.7%)
Pseudomonas	8(3.1%)
Fungus	11(4.3%)
Citrobacter	2(0.7%)
Providentia	3(1.1%)
Total	404

Table 3: Resistance patterns of the organisms

Drugs	Strepto (n=123)	Staphylo (n=29)	Klebsiella (n=58)	Pseudomonous (n=5)	Providentia (n=3)	E coli (n=11)
Axoxycillin	2 (1.6%)	2 (6.8%)	17(29.3%)	1(20%)		2 (18.9%)
Amikacin			1(1.7%)	2 (40%)		
Linezolid						
Imi /Meropenam			1(1.7%)			
Piper+Tazo			6 (10.3%)	2 (40%)		1(9%)
Tetracycline	11(8.9%)	4 (13.7%)				1(9%)
Clindamycin	11(8.9%)	3 (10.3%)				
Erythro/Azithro	12(9.8%)	4 (13.7%)				
Penicillin	68(55.3%)	16 (55.1%)	6 (10.3%)			3(27.2%)
Vancomycin						
Cotrimoxazole	60 (48.8%)	14(48.2%)	18 (31%)	2 (40%)	1(33.3%)	4(36.3%)
Ciprofloxacin	15 (12.2%)	1(3.4%)	8 (13.7%)	1(20%)	1(33.3%)	2 (18.9%)
Levofloxacin	8 (6.5%)	2 (6.8%)	1(1.72%)			
Cefotax+Ceftria	4 (3.2%)	3(10.3%)	21(36.2%)		1(33.3%)	5(45.5%)
Ofloxacin		1(3.4%)				
Doxycycline	2 (1.6%)	2 (6.8%)				
Gentamycin			2 (3.4%)			1(9%)
Aztreonam						2 (18.9%)

IV. Discussion

Our study aimed to find out the common pathogens in children suffering from CAP and their resistance patterns in this part of the country, as organisms of CAP and their sensitivity and resistance patterns are different in different parts of the country. In our study, males predominated females (64.3% vs 35.7%). Age wise, maximum number of cases were found in the age group of 2 – 12 months (78.5%) and very less number in the age group of 25 – 60 months (5.7%). This shows that during the first year of life CAP is very common and incidence drastically decreases as age advances. Both findings are in concordance with study done by Mustafa S et al (2009) from Karachi[16].

Almost 40% of cases were seen during winter season and 50.9% of cases were discharged in less than 5 days.

Organisms were detected from 63% (255/404) cases. We found Streptococcus Pneumoniae to be the commonest etiological agent (50.5%) which was comparable to the study done by Bahl R. et al[17] (1995) from India, Mustafa S. et al[16], but in contrast with the study done by Numazaki K. et al[18] (2005) from Japan where commonest organism was M. Pneumoniae. Next common bacterial pathogens were K. pneumoniae (27%) and staphylococcus (14.1%). But Mustafa S.[16] , Bahl R.[17], Numazaki K.[18] , Ostroff SM[19] showed in their studies that second common bacterial pathogen was Hemophilus influenzae. Out of 36 staphylococcus CONS were isolated from 4 and MRSA from 3 cases and all these 7 cases were between 2 – 6 months of age. Hence, MRSA and

CONS are seen to be more common in younger infants. Other organisms we found were Pseudomonas, E coli, Providensia, Citrobacter and Yeast in small percentages of cases. 36.8% cases were either sterile or having normal flora. We had not found M. Pneumoniae and C. Pneumoniae, which are usually more common in children above 5 years.

Penicillin and cotrimoxazole resistance for Streptococcus was found in 55.5% and 48.3% cases respectively and for Staphylococcus in 55.1% and 48.2% of cases respectively. Therefore, penicillin and cotrimoxazole cannot be used as first line drug in CAP in this part of the country. Gram negative organisms (20 – 40%) were resistant to Amoxycillin. On the other hand, almost all Gram negative organisms (20 – 100%) were sensitive to amikacin except pseudomonas, where resistance was found in 40% of isolates. Also, 40% of pseudomonas were resistant to pipercillin & tazobactum combination. None of the Staphylococcal isolates were resistant to vancomycin and linezolid. Streptococci and Staphylococci were also found to be resistant to some extent (8 – 13%) to tetracycline, clindamycin and macrolides. We have found ciprofloxacin resistance against streptococci and gram negative organisms, which is a major cause for concern. Third generation cephalosporin resistance was also found in gram negative organisms (33.3 – 45.5%).

V. Conclusion

In our study, it was found that during the first year of life CAP is very common and incidence drastically decreases as age advances. A clear seasonal preponderance for community acquired pneumonia among children was noted, with almost 40% of cases seen during winter season. Almost half of the admitted CAP cases were discharged in less than 5 days. At least one bacterial organism was isolated in two-thirds of the cases, with Streptococcus pneumoniae being the commonest organism detected. Penicillin and cotrimoxazole resistance was seen in a large number (almost 50%) of isolates of Streptococcus pneumoniae and Staphylococcus aureus, thus implying that these two drugs commonly prescribed as first line therapy in CAP in children may be ineffective. Vancomycin and linezolid resistance has not yet been demonstrated amongst the Staphylococcal isolates. Most of the gram negative organisms were found to be sensitive to amikacin, whereas resistance was found with amoxicillin and ciprofloxacin too, for some of these organisms. These findings may help in formulation of a better antibiotic policy against community acquired pneumonia in children less than five years old in this region. The limitation of our study was that Hemophilus infuenzae could not be isolated in any of the cases, as throat swab cultures were done by conventional method, and isolation of this organism requires PCR and DNA studies.

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Contribution Of Authors

AB conducted the study, HR edited the manuscript and both AB and AG studied and analyzed the data and agreed in the decision of publication.

Conflict Of Interest

None.

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