Original Article

Clinical and bacteriological profile of community-acquired pneumonia among children in and around Chengalpattu

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ABSTRACT

Introduction: Community-acquired pneumonia (CAP) has become the major cause of mortality among children despite the availability of potent antibiotics and effective vaccines. This created the interest to identify the most common bacteria causing pediatric CAP, which helps to reduce morbidity and mortality by early diagnosis and specific treatment. **Aims and Objectives:** To study the prevalence of CAP, most common organisms and its susceptibility pattern, risk factors, and clinical outcome of the disease. **Materials and Methods:** This was a hospital-based case series study which was carried out between April 2014 and July 2014. The study population included 52 children, in the age group of 3 months to 12 years, with clinical pneumonia. Blood samples, sputum, and gastric aspirates were collected and processed. Serology and antimicrobial susceptibility tests were also performed. Statistical analysis was performed with SPSS statistical software. **Results:** Children in the age group of 1-5 years were the most affected (46.15%) with male predominance (55.77%). The most common symptom was found to be fever (90.38%) followed by a cough (78.85%) and the most common organism isolated was *Streptococcus pneumoniae* (41.67%). The mortality was observed in two cases (3.84%). **Conclusion:** CAP is still the common cause of morbidity and mortality due to the virulence of pathogens. The resistance of methicillin-resistant *Staphylococcus aureus* strain to most of the antibiotics indicates the unnecessary use of antibiotics as one of the reasons for increasing resistance. Recurrent respiratory infections have been elicited as the risk factors for the development of severe illness.

Key words: Methicillin-resistant *Staphylococcus aureus*, Pediatric community-acquired pneumonia, *Streptococcus pneumoniae*

INTRODUCTION

Pediatric community-acquired pneumonia (CAP) is pneumonia acquired from the community in a previously healthy child and not been hospitalized within 14 days before the onset of symptoms.[1]

CAP causes two million deaths in each year among the children aged <5 years.[2] India has the greatest burden of this disease accounting for 43 million cases and 0.4 million deaths.[3]

Bacteria are the most common cause of CAP, with *Streptococcus pneumonia* isolated in nearly 50% of cases.[4] Physicians need reliable data on the relative prevalence of different etiological events in patients' area of residence, in addition to clinical, laboratory and radiological findings to initiate antibiotic treatment empirically.

The present study has been focused on identifying the most common bacteria causing pediatric CAP in this region that helps to reduce morbidity and mortality by early diagnosis and efficient treatment by specific antimicrobials.

Aims and objectives

To study the prevalence of CAP, most common organisms and its susceptibility pattern, risk factors, and clinical outcome of the disease.

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MATERIALS AND METHODS

The present case series study included 52 children in the age group of 3 months to 12 years with the symptoms of fever, cough, dyspnea, tachypnea, clinical signs, and radiological evidence of pneumonia. Babies in the perinatal period, children on anti-tuberculosis therapy, immunocompromised children and other pneumonias such as aspiration pneumonia, ventilator-associated and other hospital-acquired pneumonias, and lipoid pneumonia were excluded from the study.

Clinical samples such as expectorated sputum or induced sputum, gastric aspirate, and blood were collected from 52 children clinically diagnosed as pneumonia. The serum samples were also collected for the serological diagnosis of *Mycoplasma pneumonia*. A detailed clinical examination was performed. In all cases, baseline investigations and chest X-ray were carried out.

The collected samples were processed and cultured on bacteriological media such as nutrient agar, MacConkey agar, blood agar, chocolate agar, and mannitol salt agar. The isolates were identified by Gram-stain, colony characteristics, and biochemical parameters.

After isolating and identifying the organisms, antibiotic susceptibility tests were performed as per CLSI guidelines using the Kirby Bauer's disc diffusion method. Cold agglutination test was performed with the patient's serum to detect infection with *M. pneumonia.*

The disease pattern was assessed clinically, confirmed by radiological and microbiological methods. Clinical outcome was recorded, and the results were analyzed.

Statistical differences were analyzed using conventional Chi-square test, and $P < 0.05$ was considered significant. Data obtained was analyzed using SPSS statistical software.

RESULTS

The study group included 52 cases of clinical pneumonia. The disease pattern, outcome, and bacteria associated with pneumonia were investigated in this study.

Distribution of cases as per age and sex ($n = 52$)

The gastric aspirates collected from all the children were examined for acid-fast bacilli (AFB) by Ziehl–Neelsen technique and were found to be negative for AFB.

The serum samples were tested for *M. pneumonia* by cold agglutination test showed a titer of <1:16. Hence, all the samples were found to be negative for antibody to *M. pneumonia*.

DISCUSSION

In the present study, 52 children suspected of having clinical pneumonia were investigated. Pneumonia was radiologically confirmed in all the children. Most of the children (n = 24) with pneumonia were in the age group of 1-5 years (Figure 1) with a male:female ratio of 1.3:1 showing male predominance (Figure 2). Similar results were observed in a study carried out by Tullu *et al*.[5] in which the male:female ratio was 2.4:1.

Fever was reported as the predominant symptom in 47 children (90.38%), followed by a cough (78.85%) and breathlessness (67.31%). Episodes of vomiting and diarrhea were also present in 9.61% and 5.77% of children, respectively (Figure 3). Campbell *et al*.[6] also stated fever as a predominant and important clinical symptom of pneumonia.

In the present study, culture positivity rate of 23.08% was observed. The rate of isolation of the organism from sputum culture and blood culture was 13.46% and 9.61%, respectively (Table 1). Blood cultures are valuable when positive but negative results

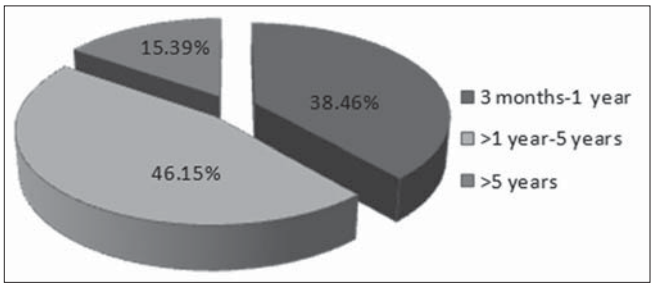

Figure 1: Age distribution. Chi-square value = 2.427; $P = 0.297$

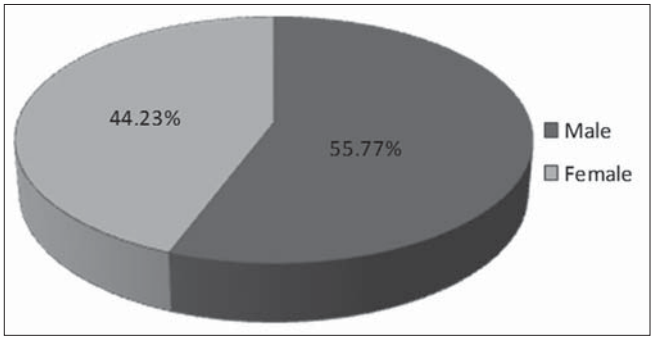

Figure 2: Sex distribution. Chi-square value = 0.028; $P = 0.867$

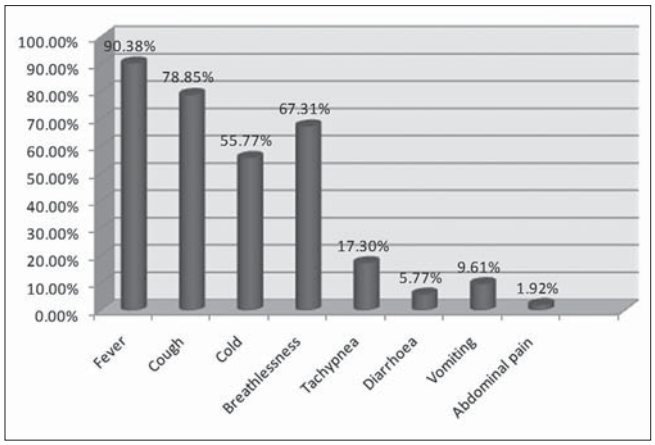

Figure 3: Clinical profile of children with pneumonia. Chi-square value = 1.372; P = 0.927 (for predominant symptom)

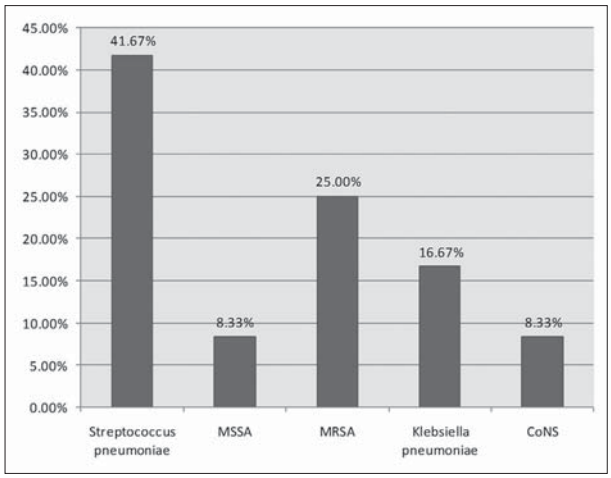

Figure 4: Organisms isolated by blood/sputum culture in children with pneumonia

Table 1: Blood and sputum culture analysis (*n*=52)

Results	Number of cases	Percentage
Positive	12	23.08
Negative	40	76.92

are more common even in severe cases. Indian studies showed sputum culture positivity of 10-33%. In a study done by Falade *et al*.,[7] blood culture was positive in 18% of cases. Agarwal[8] reported blood culture positivity in 21.9% of cases. In our study, decreased culture positivity could be due to prior administration of antibiotics, and proper sputum collection is difficult in children.

The pathogen spectrum identified on culture was maximum number of *S. pneumonia* (41.67%), followed by MRSA (25%), Klebsiella pneumonia (16.67%), Staphylococcus aureus (8.33%), and coagulase-negative Staphylococci (CoNS) (8.33%) (Figure 4). Pneumococcal CAP is common in all age groups, and this is in well agreement with previous studies by Rao *et al*. from South India 2013[9] and by Juvén *et al*. 2001[10] and the other one from Texas USA by Wubbel *et al*. 1999.[11] However, pneumococcal etiology was more frequent (42.10%) than the one found by Wubbel *et al*.[11] (27%) and Juvén *et al*.[10] (37%). In the present study, none of the cultures were found to be positive for Haemophilus influenzae Type b (Hib), probably because of fastidious growth requirements of the organism or due to the proper immunization schedules which include Hib vaccine as a part of pentavalent vaccine which is in accordance with the study by Karambelkar *et al*.[12]

In the present study, antibiotic sensitivity pattern of *S. pneumonia* showed maximum sensitivity to penicillin, ampicillin, erythromycin, cefotaxime, quinolones, and vancomycin. There were a total of four *S. aureus* isolated out of which three were methicillin resistant. The drug-resistant pattern of *S. aureus* to other drugs was as follows: Penicillin, ampicillin, erythromycin, gentamicin, cefotaxime - 75% each, amikacin - 50%, ciprofloxacin - 25%, and vancomycin - 0% (Figure 5). The IBIS study also reported that among *S. pneumonia*e, resistance to penicillin was rare (1.3%), and none of the isolates were resistant to injectable third generation cephalosporins.[13,14]

In our study, none of the serum samples showed positive for *M. pneumonia*, the titer value was <1:16 in all the children. However, the studies done by Esposito *et al*.,[15] *M. pneumonia* contributes to pediatric CAP (33.5%) and Principi and Esposito[16] also stated that mycoplasmal infections were common in young children.

In our study, out of 52 children with clinical pneumonia, 50 (96.15%) recovered completely without any complications with standard line of treatment, including 13 children who had past history of similar illness, 3 known cases of developmental delay, 2 children with mental retardation and situs inverses totalis was found in 1 child.

In our study, mortality was observed (Table 2) in 2 cases (3.84%), with chest X-ray results as bronchopneumonia (1 case) and extensive pneumonitis (1 case). Out of these two cases, MRSA was isolated in one known case of developmental delay and methicillin-sensitive *S. aureus* (MSSA) in one, with chest wall deformity and respiratory distress. The study by Karambelkar *et al*.[12] also showed mortality in CAP in children due to MSSA. The mortality due to

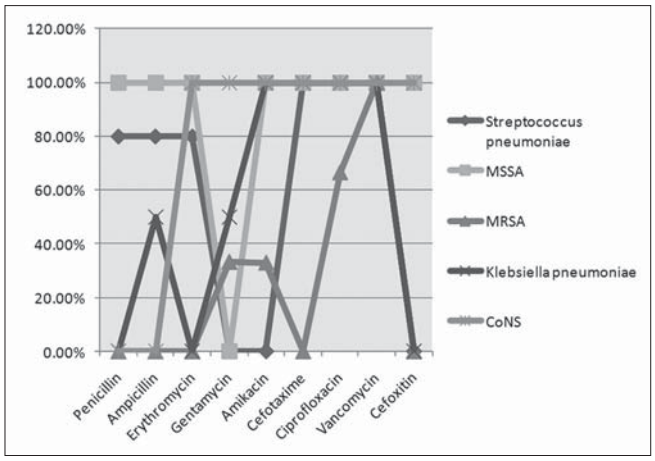

Figure 5: Sensitivity pattern of organisms isolated

Table 2: Analysis of clinical outcome/mortality in children with pneumonia (*n*=52)

Cllinical outcome	Culture	
	Positive	Negative
Total number of cases	12	33
Death	2	0
Children well at time of discharge	10	40

Chi-square value=33.973; *P*=0.000

severe pneumonia among all hospitalized children was reported to be 1.35%, 3.32%, and 0.89% in a multi centric study carried out at Chandigarh, Kolkata, and Vellore.[12] In the million death study done in India, among all the causes of childhood mortality, 27.6% deaths were attributed to pneumonia.[17]

CONCLUSION

In the present study, more number of pneumonia cases in children were observed in the age group of 1-5 years with a male preponderance, and the most common symptom was fever followed by the cough and breathlessness. Blood culture and sputum cultures results were positive in 23.08% of cases, and the most common bacterial pathogen isolated were *S. pneumonia* followed by MRSA, *K. pneumonia*, MSSA, and CoNS.

The isolates showed a greater sensitivity to the antibiotics except the MRSA strain which was resistant to most of the antibiotics. The unnecessary use of antibiotics is one of the reasons for increasing resistance. Recurrent respiratory infections have been elicited as the risk factors for the development of severe illness. The mortality was observed in two cases, both the children were above 2 years of age and the bacterial pathogens isolated were MRSA and MSSA.

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