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Original Research Article

Bacteriological and clinical profile of community acquired pneumonia in hospitalised children with associated co-morbidity in a tertiary care centre of Western Rajasthan, India

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ABSTRACT

Background: Childhood community acquired pneumonia (CAP) is a significant problem in developing countries and confirmation of microbial aetiology is important for individual, as well as public health. However, there is paucity of data from the western part of the Rajasthan, India. The study was conducted to obtain comprehensive insight into the bacteriological and clinical profile of community-acquired pneumonia with associated co-morbidity in children requiring hospitalization.
Methods: It was hospital based single centered, observational study. The study enrolled 130 children with CAP over 12 consecutive months from 2013-14, and recorded presenting symptoms, clinical signs, chest radiography and co-morbid conditions. Blood cultures and NPA (nasopharyngeal aspirates) cultures were performed.
Results: We enrolled 130 children. NPA and blood cultures yielded bacteria in only 42 (32.3%) and 29 (22.3%) children respectively. The most common organism isolated on blood culture was *Staphylococcus aureus* (10%) followed by *Streptococcus pneumonia* (3.1%). The most common organism isolated on nasopharyngeal aspirate culture was Streptococcus pneumonia (18.5%), followed by *Streptococcus aureus*. Malnutrition (48.7%) was the most common co-morbidity associated with CAP followed by asthma (3.9%).
Conclusions: The overall rate of identification of bacterial etiology of community acquired pneumonia was low. *S. pneumoniae* and *S. aureus* predominate in NPA and blood respectively. It is reasonable to conclude that *S. aureus* is the dominant pathogen in CAP in this part of world. Higher rates of isolation of *S. pneomoniae* from NPA may be because of carrier stage.

Keywords: Blood culture, CAP, NPA

INTRODUCTION

Pneumonia is the leading cause of childhood morbidity and mortality globally. It is estimated that there were over 120 million episodes of pneumonia among children younger than five years during 2010-11 of which over 10% were severe episodes.[1] A recent systematic review estimated 0.22 pneumonia episodes per child year in developing countries alone, with nearly one in eight cases progressing to severe disease.[2] Yet another systematic review estimated nearly 12 million hospitalizations in 2010 due to severe pneumonia and 3 million due to very severe disease.[3] Pneumonia is also estimated to be responsible for almost 1 million deaths among children under 5 years old 4, with maximum burden in Africa and South Asia.[3] India has a high burden of childhood pneumonia and the disease accounts for about a quarter of the under-five mortality in the country.[5] Recognizing

this burden, the World Health Organization (WHO) developed and disseminated a simple case definition for identification and treatment of pneumonia, which could be used by field-workers in resource poor settings.[6-9] It relies on the physiological principle that parenchymal lung disease results in compensatory tachypnea; therefore any tachypnea indirectly indicates parenchymal disease including pneumonia. This case definition is highly sensitive, and does not require chest radiography.

The bacteriological profile of community-acquired pneumonia is different in different countries and changing with time within the same country, probably due to frequent use of antibiotics, changes in environmental pollution, sanitation, increased awareness of the disease and vaccination coverage. Recent systematic reviews of childhood pneumonia etiology suggest that in developing countries, a few bacteria (*S. pneumoniae* and *H. influenzae*) and viruses (respiratory syncytial virus, influenza virus) are associated with majority of childhood CAP.[3,5,10-12] A systematic review from India suggested that about 15-24% of bacterial pneumonia in South Asian countries can be attributed to *S. pneumonia*.[13]

Accurate, reliable and rapid determination of etiology in childhood CAP is important because it would influence individual treatment decisions, antibiotic policy in the community, and also rational immunization policy at a national level. As there is paucity of information regarding infectious etiology of CAP in western Rajasthan, the present work is done to identify the common etiological agents of pneumonia in our hospital.

METHODS

This was a prospective, single-centre study designed to identify the clinic-etiological profile of children with diagnosis of community acquired pneumonia admitted in the hospital. The study was duration based study conducted over 1 year.

An informed consent was taken from patient's attendant before enrolling the patient in the study. The study protocol was approved by the Ethical committee of Umaid Hospital, Dr S.N. Medical College, Jodhpur, Rajasthan, India.

Enrolment of children aged 1 month to 18 years, fulfilling the WHO IMCI case definition of CAP designed for children <5 years was carried out. Tachypnoea was defined as respiratory rate >60/min for infants <2 months; >50/min for infants 2-12 months; >40/min for children >12–60 months; and >30/min for children >60 months. Children with duration of illness >7 days; those with previous hospitalization within the preceding 30 days, evidence of immunodeficiency were excluded. All children received standard treatment including antibiotics, other medications as required and supportive care as per institution guideline.

Each child underwent a detailed history and clinical examination. After that, pneumonia severity was categorized based on the WHO classification. In addition, all children underwent chest radiography. The chest radiographic of all children were reviewed by a senior paediatrician and radiologist and classified as alveolar, interstitial, and bronchopneumonia. The co-morbid conditions associated and immunization status were also noted.

A blood sample was drawn by venipuncture for routine investigations (hemogram, blood biochemistry). One to three ml blood was processed for bacterial culture using BACTEC/ALERT media. The bottles were incubated at 37°C for seven days and isolates were identified to species level by conventional biochemical and serological tests. A nasopharyngeal aspirate (NPA) specimen was obtained from all children using a sterile, disposable suction catheter and subjected to bacterial cultures.

Data was managed on Microsoft (r) Excel spread sheet, all the entries were double checked and analysis was performed using SPSS version 16.

RESULTS

In a period of 12 months, a total of 130 children were enrolled. Their baseline characteristic were noted and workup were done. Blood cultures and nasopharyngeal aspirates were sent for etiological diagnosis. There were 88 (67.7%) males and 42 (32.3%) females. Majority of patients were in the age group of 12-59 months (51.5%) followed by age group of <12 month (35.4%) and >60 months (13.1%). A total of 84/130 children (74.3%) were diagnosed with severe pneumonia and 29/130 children (25.7%) with very sever disease. Acute malnutrition defined as weight for age z score less than 3 , was observed in 63/130 children (48.7%). It was most common co-morbid condition identified in the admitted children. There were 68/130 children (52.3%) who were completely immunised and 25/130 children (19.2%) were partially immunised as per national immunization schedule.

Almost all children presented with cough, fever and rapid breathing. The common symptoms in the decreasing order of frequencies were cough (97.7%), fever (92.3%) and rapid breathing (89.2%). The other atypical symptoms were refusal to feed, convulsions, abdominal pain, chest pain and vomiting. The common signs were crackles, chest retractions and wheezes. A large proportion of these children had clinical diagnosis of bronchopneumonia (56.9%) followed by Lobar pneumonia and pneumonia with complications.

Blood cultures were positive in 29/130 patients (22.3%) and nasopharyngeal aspirates were positive in 42/130 patients (32.3%). The most common organism isolated on blood culture was *Staphylococcus aureus* (10%) followed by *Streptococcus pneumonia* (3.1%) and *Pseudomonas*

aeruginosa (3.1%). The most common organism isolated on nasopharyngeal aspirate culture was *Streptococcus pneumonia* (18.5%), followed by *Streptococcus aureus*, *Hemophilus influenza*, *Klebsiella* and *Pseudomonas*.

In this study, 21.5% cases require ICU admission and 78.5% cases were admitted to general ward. The number of patients expired were 11 out of 130. The case fatality rate was 8.5%.

Table 1: Baseline characteristic of children enrolled in the study.

	Number (n)	Percentage
Gender		
Male	88	67.7
Female	42	32.3
Age group		
<12 months	46	35.4
12 -59 month	67	51.5
≥60 months	17	13.1
Severity		
Severe pneumonia	94	72.3
Very severe pneumonia	36	27.7
Co-morbidity		
Malnutrition	63	48.5
Asthma	5	3.8
Others	4	3.1
Immunization status		
Immunized	68	52.3
Partially immunized	25	19.2
Not immunized	37	28.5

Table 2: Presenting symptoms, clinical examination findings and chest radiograph at enrolment into the study.

	Number (n)	Percentage
Symptoms		
Cough	127	97.7
Fever	120	92.3
Rapid breathing	116	89.2
Refusal to feed	9	6.9
Signs		
Chest retractions	109	83.8
Crackles	94	72.3
Wheezes	19	14.6
Abnormal breath sounds	20	15.4
Clinical diagnosis of cases		
Bronchopneumonia	74	56.9
Lobar pneumonia	40	30.8
Pneumonia with complication (ARDS, Empyema, effusion, pneumothorax)	16	12.3

Table 3: Bacterial culture in clinical specimen.

Organism	Blood n=130	Nasopharyngeal aspirates n=130
Staphylococcus aureus	13	12
Streptococcus pneumonia	4	24
Pseudomonas aeruginosa	4	3
Hemophilus influenzae	-	5
Staphylococcus albus	3	1
Klebsiella spp	2	3
Enterococci	2	-
Citrobacter	1	-
Total	**29**	**48**

DISCUSSION

Pneumonia continues to pose threat to health of children in developed and developing countries despite improvement in socioeconomic status, immunization and early diagnosis and treatment. Age is an important predictor of morbidity and mortality in paediatric pneumonias. The maximum number of cases of CAP (51.5%) belongs to the age group 12 month-59 months. This is in accordance with other studies in India, the most vulnerable age group for pneumonia was 12 month - 59 month.[14] The male (67.69%) outweighs the females (32.31%). This can be explained on the basis of gender bias prevalent in this part. In the present study, 52.3% cases were completely immunized while 48.7% cases were either partially immunized or unimmunised.

The WHO protocol puts forward two signs as the "entry criteria" or basis for examining a child bellow five years of age for possible pneumonia: cough or difficult breathing. The incidences of these symptoms in present study are almost 90% comparable to other studies in India.[15]

Tachypnoea has been considered to be a sensitive and specific indicator for the presence of pneumonia. Also the traditional, method of making a clinical diagnosis of pneumonia has been by the recognition of auscultatory signs, in particular crepitations, in a child with cough. In this study, tachypnoea (89.2%) and chest retractions (83.8%) were the important findings for making a clinical diagnosis of pneumonia. Crepitations (72.31%), wheeze (14.61%) and abnormal breath sounds (15.38%) were the other associated signs. These findings are in consonance with other studies which showed that tachypnoea and chest retractions were highly specific signs for detecting pneumonia.[16,17]

In this study, bronchopneumonia was the most common diagnosis made at admission (56.9%) followed by lobar pneumonia in 30.8% and pneumonia with complications were seen in 12.3%. Complications of pneumonia include empyema, pleural effusion, pneumothorax and ARDS.

These findings were similar to other studies conducted earlier.[18]

Malnutrition was associated with 48.7% of cases and asthma with 3.9% of cases. Malnutrition was most common co-morbidity associated with CAP. This was in concordance with other studies that shows malnutrition, congenital anomalies and asthma to be the significant risk factors associated with pneumonia.[19]

In this study, blood culture was positive in 29 cases (22.3%). The yield of blood culture varies from 5-15% for bacterial pathogens in other studies.[15]

In the small number of positive blood cultures, *S. aureus* predominated, rather than *S. pneumoniae* or *H. influenzae*, expected in a vaccinenaive pediatric population such as our cohort. Clinical experience suggests that S. aureus is frequently responsible for community acquired infections in India, although it has not previously been documented as the most frequent cause of bacteraemia in childhood pneumonia. In contrast, it is the most frequently recovered pathogen in parapneumonic effusions/empyema complicating pneumonia and also commonly isolated in blood cultures from infants with bacteraemia.[20-22] Therefore it is reasonable to conclude that *S. aureus* may be an important pathogen in childhood pneumonia as well.

In the present study, we could identify etiological agent by the conventional culture studies of NPA nasopharyngeal aspirate in 32.3% cases. The common organisms isolated were *S. pneumoniae* followed by *S. aureus* and *H. influenzae*. Present study results are consistent with some previous results from India. The rate of isolation in previous Indian studies for *S. pneumoniae* was 9% to 40% and for *H. influenzae* was 7.6% to 22.7%.[15,23,24] It has been debated that nasopharyngeal colonization may or may not translate into disease itself. Though this is true, studies have shown nasopharyngeal colonization to be a risk factor for development of pneumonia. In a study from China, compared to controls, the isolation of *S. pneumoniae* was more in children with radiologically-confirmed pneumonias.[25]

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