

Clinico- bacteriological profile of Community Acquired Pneumonia (CAP) in children aged 3-59 months: A cross sectional study



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Submission: 09-01-2021

Revision: 24-03-2021

Publication: 01-05-2021

ABSTRACT

Background: Worldwide community-acquired pneumonia (CAP) is the major cause of high mortality among under five children in India. After introduction of Pneumococcal and H. *influenzae* vaccination there is paucity of data regarding etiological profile of pneumonia. **Aims and Objective:** To evaluate the Clinico- epidemiological profile and etiology of community acquired pneumonia in children. **Materials and Methods:** We enrolled children aged 3-59 months with CAP (based on WHO criteria of tachypnea with cough or breathing difficulty) over 18 months and recorded presenting symptoms, clinical signs and chest radiography. We performed blood and nasopharyngeal swab (NPS) bacterial culture simultaneously to detect etiological agent of community acquired pneumonia in children. **Results:** Out of 150 cases of CAP, 90 % of caeses had cough and fever and nearly 80-90% cases had tachypnea and crackles on examination. Radiological findings suggestive of pneumonia was seen in 86% cases . Most common organism isolated was *S aureus* in both NPS culture (18.7 %) and blood culture (14.7 %). Other common organisms detected in NPS culture were *S pneumoniae* (6%), *E Coli* (4.7%), *Klebsiella* (4.7%), CONS (3.3%), and *Pseudomonas* (2.7%). In blood culture the common organism detected after *S aureus* was *E coli* (5.3%), *S pneumoniae* (3.3%), *Klebsiella* (3.3%), CONS (3.8%), and *Pseudomonas* (2.5%). **Conclusions:** We observed that *S aureus* was the predominant etiological organism isolated in both blood and nasopharyngeal swab bacterial culture in patients suffering from community-acquired pneumonia.

Key words: Blood culture; Community acquired pneumonia; Nasopharyngeal swab; *S aureus*

INTRODUCTION

Pneumonia is an inflammation of the lung parenchyma usually caused by microorganisms, however noninfectious causes include aspiration of food or gastric acid, foreign bodies, hydrocarbons, hypersensitivity reactions and drug or radiation induced pneumonitis. Common bacterial agents causing pneumonia in children under 5 year includes *Klebsiella*, *Escherichia coli* (*E coli*), *Hemophilus influenzae* (*H influenzae*),

Streptococcus pneumoniae (*S pneumoniae*) and *Staphylococcus aureus* (*S aureus*).¹ World health organization (WHO) has defined pneumonia on the basis of clinical features obtained from visual inspection and respiratory rate (RR).² Acute lower respiratory tract infection (LRTI) is the leading cause of death in children less than 5 years of age. It is estimated that there were more than 120 million episodes of pneumonia among children less than five years of age during 2010–11, out of which over 10% were severe episodes.³ According

Access this article online

Website:

<http://nepjol.info/index.php/AJMS>

DOI: 10.3126/ajms.v12i5.34173

E-ISSN: 2091-0576

P-ISSN: 2467-9100

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to UNICEF (2018) under-five mortality rate in India is 36.5 per thousand live births.⁴ Out of this, pneumonia accounts for 14.6 % deaths. Incidence of childhood pneumonia in terms of episodes per child per year in India is 0.36.⁵ Statewise, Uttar Pradesh accounts for the highest number of community acquired pneumonia (CAP) cases as well as deaths (cases- 24%, deaths-26%) in children < 5 years of age followed by Bihar (cases- 16%, deaths- 22%), Madhya Pradesh (cases-9%, deaths-12%) & Rajasthan (cases-8%, deaths-11%).⁶

There is paucity of data regarding etiological diagnosis of pneumonia from western UP. Introduction of Pneumococcal and Hemophilus influenzae in Universal immunization programme might also affect present etiological profile of community acquired pneumonia. Identification of etiological agent will also help us to select appropriate antibiotics and will prevent indiscriminate use of antibiotics and resistance. Hence his study was aimed to find the Clinico- epidemiological profile and etiology of community acquired pneumonia in children.

MATERIALS AND METHODS

This cross sectional study conducted over a period of 18 months in department of Pediatrics, S N Medical College, Agra(SNMC). Children in the age group of 3-59 months with signs and symptoms suggestive of Community acquired pneumonia like cough, tachypnoea with or without chest indrawing and general danger signs like not able to drink, persistent vomiting, convulsions, lethargic or unconscious, stridor in a calm child or severe malnutrition were included in the study.⁷ Children with history of hospitalization for more than 48 hours in the last 2 weeks, children on antibiotic therapy for more than 48 hours prior to admission, and children diagnosed with bronchial asthma, bronchiolitis on clinical or radiological basis and those with underlying chronic conditions like HIV were excluded. An informed consent was taken from patient's attendant before enrolling the patient in the study. After completing detailed history and clinical examination, patients were classified in to two groups Group A (Age 3 months to 12 months) and Group B (Age 13 months to 59 months). Assessment of pneumonia severity was based on WHO classification.⁷ All children underwent chest radiography and classified as per WHO guidelines into three categories (a) No consolidation, infiltrate or effusion, (b) Other infiltrates (consolidation, infiltration or effusion), (c) Primary endpoint pneumonia. Anthropometry and immunization status were also noted.

Nasopharyngeal swab (NPS) for culture was collected from all study subjects. Patient was made to sit with head

against a wall during this procedure. A sterile Hiculture skim milk tryptone glucose glycerine medium (STGG) swab stick on flexible shaft supplied by Himedia laboratories private limited was inserted into one nostril straight back and continued along the floor of the nasal passage for several centimetres until reaching the nasopharynx . Swab was rotated 180 degrees to saturate the swab and then removed immediately, inoculated into a vial containing STGG media and the shaft was cut with scissors . The lid on the vial was replaced leaving the swab in STGG media. NPS in STGG vial was labeled and vortexed so that all the bacteria came into the suspension & kept at a temperature between 5-25° C as prescribed by the manufacturer.^{8,9} Sample was then transported within one hour to the Microbiology department, S.N. Medical College Agra for further processing maintaining a temperature of 5-25°C. Blood was collected from all patients by venipuncture. Standard procedure for venipuncture was employed with particular attention to minimize risk of contamination of blood cultures. All the NP swabs and blood culture vials ran through conventional culture technique using blood agar, chocolate agar & MacConkey agar. The study protocol was approved by the ethical committee of the institute.

RESULTS

A total of 150 patients fulfilling the inclusion criteria were enrolled in the study. Median age of the patients was 12 months, 82 (54.7%) patients were male and 68 (45.3%) were female. Severe acute malnutrition was observed in 82 (54.7%) patient, 11 (7.3%) were not immunized and 57 (38%) were partially immunized as per National immunization schedule (Table 1).

Common symptoms in decreasing order of frequency were cough (90.7%), fever (88%), difficulty in breathing (81.3%) and refusal to feed (41.3%). The other atypical symptoms were convulsion, abdominal/chest pain, regurgitation of feed and vomiting. The common signs were crackles present in 92% patients followed by tachypnea (81.3%), subcostal retraction (54%), cyanosis(10%) and wheezing (8%). Consolidation/Infiltrates (57.3%) were the most common radiological finding followed by primary end point pneumonia and no consolidation/infiltrate or effusion. Out of 150 children, a total of 103 (68.7%) were diagnosed with severe pneumonia and 47 (31.3%) with pneumonia (Table 2).

NPS culture was positive in 60(40%) cases and blood culture in 47(31.33%) cases. In this study, a higher percentage of group A patients (46.3 %) showed growth in NPS culture while only 34.3% of group B patients showed growth in NPS culture. Most common organism isolated was *S aureus*

both in NPS culture (18.7%) and blood culture (14.7 %). Other common organism detected in NPS culture were *S pneumoniae* (6%), *Ecoli*(4.7%), *Klebsiella* (4.7%), *Coagulase negative Staphylococci* (CONS) (3.3%) and *Pseudomonas* (2.7%). In blood culture the common organism detected after *S aureus* were *E coli* (5.3%), *S pneumoniae* (3.3%), *Klebsiella* (3.3%), CONS (3.8%) and *Pseudomonas* (2.5%). In this

study *S aureus* was the most common organism isolated as common, in both NPS and blood culture of the same patient in 7 (4.7%) patients, followed by *E coli* and CONS with overall presence in 2 (1.3 %) patients (Table 3).

DISCUSSION

Community acquired pneumonia is a major public health problem in India, especially in Uttar Pradesh. In spite of all the improvements made in immunization coverage, diagnostic modalities and treatment, pneumonia continues to be a major health problem and contributes significantly to morbidity and mortality.

Age is an important predictor of morbidity and mortality in pneumonias. In this study, the proportion of cases of severe pneumonia was higher in group A patients (73.7 %) than in group B (62.9 %). These findings were in concordance with other studies in India.^{10,11} The male (54.7 %) outweighs the females 68 (45.3 %), with male: female ratio of 1.21. Higher prevalence of pneumonia in males had also been reported in other studies.^{12,13} Majority of patients of pneumonia were malnourished and it was observed in 82(54.7%), we found that severe pneumonia was present in 73.3 % of patients having severe acute malnutrition. Similar observation were found in several other studies.¹⁴⁻¹⁶

In present study cough (90.7%), fever (88%), difficulty in breathing (81.3%) and refusal to feed (41.3%) were the common clinical features. Almost similar clinical features were reported by Shekhawat et al and Juvén et al.^{17,18}

In NPS culture, growth was detected in 40 % patients in present study. A higher percentage of group A patients (46.3 %) showed growth in NPS culture while only 34.3 % of group B patients showed growth in NPS culture. Higher proportion of NPS culture in younger children was seen in several other studies.¹⁹⁻²¹ In our study, *S aureus* (18.7%) was the most common organism isolated in both age groups with a higher proportion in younger patients.

	Number (N)	Percentage (%)
Age Group		
3-12 months	80	53.0
13-59 months	70	47.0
Gender		
Male	82	54.7
Female	68	45.3
Co-morbidity		
Malnutrition	82	54.7
Immunization Status		
Immunized	82	54.7
Partially Immunized	57	38.0
Not Immunized	11	7.3

	Number	Percentage
Symptoms		
Cough	136	90.7 %
Fever	132	88.0%
Difficult breathing	122	81.3 %
Refusal to feed	65	41.3%
Signs		
Tachypnea	122	81.3 %
Crackles	138	92.0 %
Wheezing	12	8.0 %
Subcostal Retraction	81	54.0 %
Cyanosis	15	10.0 %
Radiological Finding		
No consolidation/ infiltrate/ effusion	21	14.0 %
Other infiltrate	86	57.3 %
Primary end point pneumonia	43	28.7 %
Severity		
Pneumonia	47	31.3 %
Severe Pneumonia	103	68.7 %

Organism	NPS Culture(60/150)			Blood Culture(47/150)			NPS Culture and blood culture in same patient		
	Total No (%)	Group A* No. (%)	Group B** No (%)	Total No. (%)	Group A No.(%)	Group B No (%)	Total No. (%)	Group A. No (%)	Group B. No (%)
<i>S aureus</i>	28 (18.7)	16 (20.0)	12 (17.1)	22 (14.7)	11 (13.8)	11 (15.7)	7 (4.7)	4 (5.0)	3 (4.3)
<i>S pneumoniae</i>	9 (6.0)	6 (7.5)	3 (4.3)	5 (3.3)	3 (3.8)	2 (2.9)	1 (0.6)	1 (1.3)	0
<i>E coli</i>	7 (4.7)	5 (6.3)	2 (2.9)	8 (5.3)	6 (7.5)	2 (2.9)	2 (1.3)	1 (1.3)	1 (1.4)
<i>Klebsiella</i>	7 (4.7)	4 (5.0)	3 (4.3)	5 (3.3)	4 (5.0)	1 (1.4)	1 (0.6)	0	1 (1.4)
<i>Coagulase negative Staphylococci (CONS)</i>	5 (3.3)	3 (3.8)	2 (2.9)	4 (2.7)	3 (3.8)	1 (1.4)	2 (1.3)	1 (1.3)	1 (1.4)
<i>Pseudomonas</i>	4 (2.7)	2 (2.5)	2 (2.9)	3 (2.0)	2 (2.5)	1 (1.4)	0	0	0

*Group A (Age 3 months to 12 months), ** Group B (Age 13 months to 59 months)

Other common organism detected in NPS culture were *S pneumoniae* (6%), *E coli* (4.7%), *Klebsiella* (4.7%), CONS (3.3%) and *Pseudomonas* (2.7%) in decreasing frequency. Findings in our study was different from the study done by Mathew et al who found *S pneumoniae* as the most common organism (255/2323; 10.97 %) in nasopharyngeal specimens followed by *H influenzae* (31/2323; 1.33 %) & *S aureus* (22/2323; 0.95 %).²² This can be attributed to the introduction of the pentavalent vaccine and *H influenzae* vaccine in the universal immunization programme in our country. The most common organism detected in blood culture in this study was *S aureus* (14.7 %) followed by *E coli* (5.3%), *S pneumoniae* (3.3%), *Klebsiella* (3.3%), CONS (3.8%) and *Pseudomonas* (2.5%)s. Mathew et al also found *S aureus* as the most common organism in blood culture specimens followed by *S pneumoniae* and *Klebsiella* in his study.²² In another study done by Shekhawat et al also detected *S aureus* in 10.0% cases, as the most common organism followed by *S pneumoniae* and *Pseudomonas* in 3.1 % cases each.¹⁷ *S aureus* was the most common organism isolated as common, in both NPS and blood culture of the same patient (4.7%), followed by *E coli* and CONS.

CONCLUSION

S aureus was the most common organism isolated in present study. Inclusion of pentavalent vaccine in universal immunization programme may be the cause of change in etiological profile of pneumonia in under 5 children. Further studies with larger sample size are required to validate our findings.

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Author's contribution:

MS,PK,SP- Concept and design of study; **RK,RD,MN**- Supervised data collection and Literature review; **ZS, SP**- Data collection, analysis and first draft of manuscript; **MS,PK**- Statistical analysis, interpretation of results and final draft of manuscript; **AA**- Literature review and interpretation of lab results.

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Source of Funding: None, **Conflict of Interest:** None.