



## CLINICAL, BACTERIOLOGICAL, RADIOLOGICAL, STUDY OF PNEUMONIA

## Paediatrics

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## ABSTRACT

**Background:** Pneumonia remains a significant cause of pediatric morbidity and mortality, especially in developing countries like India. This study explores the clinical, bacteriological, and radiological aspects of pediatric community-acquired pneumonia (CAP) to identify correlations and improve management outcomes. **Methods:** A descriptive study was conducted at St. Philomena's Hospital from September 2018 to May 2020, involving 79 children aged 6 months to 18 years diagnosed with CAP. Data were collected on clinical presentations, laboratory findings, radiological features, and outcomes. Statistical analyses were performed using SPSS v22, with significance set at  $p < 0.05$ . **Results:** CAP predominantly affected children under 1 year (49.4%), with a male-to-female ratio of 2.2:1. Common symptoms included cough (97.5%), hurried breathing (91.1%), and fever (88.6%). Radiological evidence of pneumonia was present in all cases, with bacterial etiology (63.3%) surpassing viral (36.7%). Neutrophilia (84%), elevated ESR (73.4%), and CRP (67.1%) were significantly associated with bacterial pneumonia ( $p < 0.005$ ). Blood culture identified pathogens in 5.1% of cases, with *Streptococcus pneumoniae* being the most common. Most patients (91.1%) had no complications, and all achieved favorable outcomes. **Conclusion:** Early recognition and appropriate antibiotic management are critical in preventing complications of pediatric pneumonia. Neutrophilia, elevated ESR, and CRP serve as reliable markers for bacterial CAP. Enhanced diagnostic approaches and immunization programs are vital to mitigating the disease burden.

## KEYWORDS

Pediatric pneumonia, community-acquired pneumonia, bacterial vs. viral pneumonia, radiological findings, clinical markers.

## INTRODUCTION

Respiratory infections are the major worldwide health problem. Among these infections community acquired pneumonia is an important cause of morbidity and mortality in both industrialized and developing countries. India accounts for one-third of the total WHO south East Asia burden of under 5 mortality<sup>[1]</sup>. Pneumonia is the infection of the lung parenchyma, i.e. lower respiratory tract, infection by microorganisms including bacteria, virus, fungi<sup>[2]</sup>. CAP is defined as "the presence of signs and symptoms of pneumonia in a previously healthy Immune competent child due to an infection which is acquired outside hospital", by both the British Thoracic Society and the Infectious Diseases Society of America<sup>[3,4]</sup>.

Children can present at different stages of illness and with clinical features of CAP including; fever, cough, Hurried breathing, chest indrawing, dyspnea, crepitations, wheeze, chest pain, lethargy, vomiting. Pneumonia in which the alveolar air spaces of the lung become inflamed and filled with fluid and white blood cells, giving rise to the appearance of consolidation on the chest radiograph. severe cases of pneumonia are caused by bacteria, of which the most important are *Streptococcus pneumoniae* and *Hemophilus influenzae*<sup>[5]</sup>. Red flag signs, which include inability to drink, persistent vomiting, seizures, lethargy, reduced consciousness, stridor, or severe malnutrition<sup>[6]</sup>.

Developed countries have greater access to Chest x-ray as a diagnostic adjunct in children admitted to hospital, with consolidation, infiltrates, and air bronchograms visible in a lobar or diffuse pattern. The value of chest radiography is clear in excluding complications like pleural effusion, necrotizing pneumonia, or other diagnoses, including cardiac failure with pulmonary edema<sup>[7]</sup>.

Diagnosis of pneumonia consists of identifying the pneumonia by history, clinical examination, chest x-ray findings and, determining the etiology by microbiological, molecular and serological methods<sup>[8]</sup>. Our study is designed to clinically study the children with pneumonia, correlate clinical findings with bacteriological and radiological findings.

## MATERIAL AND METHODS

**Study Site:** ST PHILOMENA'S HOSPITAL

**Study Population:** Children who get admitted to the hospital between: September 1st 2018 – May 31st 2020

**Study Design:** Descriptive study

**Sample Size:** Sample size was estimated by using the prevalence of 24.1% for most common organism identified clinically and laboratory test in causing CAP was RSV (Respiratory syncytial virus) in India from the study by CMC Rodrigues et al. By using the below mentioned formula sample size was estimated.

$P = 24.1$

$q = 75.9$

$d = 10$

Using the above values at 95% Confidence level a sample size of 71 subjects with CAP will be included in the study. Considering 10% Nonresponse a sample size of  $71 + 7.1 \approx 78$  subjects with CAP will be included in the study.

**Time Frame To Address The Study:** September 1st 2018 – may 31st 2020.

## Inclusion Criteria:

- 1) All children with Pneumonia who get admitted to Pediatrics ward from age 6 months to 18 years.
- 2) All PICU admissions with Pneumonia from age 6 months to 18 years.

## Exclusion Criteria:

- 1) All new-born- inborn and out born with Pneumonia.
- 2) All infants less than 6 months of age with Pneumonia.
- 3) Pneumonia in Severely deteriorated or immune compromised children.

## METHODOLOGY

Once the child gets admitted, the patients were particularly asked about the initial presenting symptoms including fever, cough, fast breathing, chest pain, breathlessness and hemoptysis. Other important clinical details like total days of hospital stay, total WBC count, ESR in all cases, CRP, blood cultures and serological examination in relevant cases were done.

## Statistical Methods

Software Data will be entered into Microsoft excel data sheet and will

be analyzed using SPSS 22 version. Categorical data will be represented in the form of Frequencies and proportions. Chi-square will be used as test of significance for qualitative data. Continuous data will be represented as mean and standard deviation. Independent t test will be used as test of significance to identify the difference for quantitative data. p value <0.05 will be considered as statistically significant.

**RESULTS**

In the present study, 79 cases of pneumonia studied.

**Table 1: Distribution Of Study Subjects According To The Age Group (n = 79)**

Age (in Years)	No.	Percent
≤ 1	39	49.4
1-5	21	26.6
>5	19	24.1
Mean (SD)	3.38 (3.91)	
Range	0.5-16.0	

**Table 2: Distribution Of Study Subjects According To The Gender (n=79)**

Gender	No.	Percent
Male	55	69.6
Female	24	30.4

**Table 3: Distribution Of Study Subjects According To The Symptoms (n=79)**

Symptoms	No.	Percent
Fever	70	88.6
Cough	77	97.5
Cyanosis	0	0.0
Hurried Breathing	72	91.1
Refusal to feed	47	59.5
Decreased activity	47	59.5

**Table 4: Distribution Of Study Subjects According To The Signs (n=79)**

Symptoms	No.	Percent
Wheeze	53	67.1
Crepitation's	69	87.3
Chest Indrawing	70	88.6

**Table 5: Distribution Of Study Subjects According To The Previous History Of Pneumonia (n=79)**

Previous History of Pneumonia	No.	Percent
Yes	20	25.3
No	59	74.7

**Table 6: Distribution Of Study Subjects According To The Immunization (n=79)**

Immunization	No.	Percent
IAP	23	29.1
NIS	53	67.1
Incomplete	2	2.5
Unimmunized	1	1.3

**Table 7: Distribution Of Study Subjects According To The PEM (n = 79)**

PEM	No.	Percent
Normal	58	73.4
Grade 1	19	24.0
Grade 2	1	1.3
Grade 3	1	1.3

**Table 8: Distribution Of Study Subjects According To The SES (n=79)**

SES	No.	Percent
I	2	2.5
II	21	26.6
III	56	70.9

**Table 9: Distribution Of Study Subjects According To The Duration Of Hospital Stay (n=79)**

Chest X Ray	No.	Percent
Broncho-Pneumonia	18	22.8
Consolidation	32	40.5
Viral Pneumonia	29	36.7

**Table 10: Distribution Of Study Subjects According To The HB (n= 79)**

HB	No.	Percent
Normal	39	49.4
Low	40	50.6

**Table 11: Distribution Of Study Subjects According To The TC (n = 79)**

TC	No.	Percent
Normal	15	19.0
Low	1	1.3
Increased	63	79.7

**Table 12: Distribution Of Study Subjects According To The ESR (n = 79)**

ESR	No.	Percent
Normal	21	26.6
Increased	58	73.4

**Table 13: Distribution Of Study Subjects According To The CRP (n = 79)**

CRP	No.	Percent
Normal	26	32.9
Increased	53	67.1

**Table 14: Distribution Of Study Subjects According To The Blood Culture (n = 79)**

Blood Culture	No.	Percent
Not Sent	0	0.0
Klebsiella	1	1.3
Pseudomonas	1	1.3
Streptococcus	2	2.5
No Growth	75	94.9

**Table 15: Distribution Of Study Subjects According To The Chest X Ray Findings (n=79)**

Duration of Hospital Stay (in Days)	No.	Percent
3	11	13.9
4	24	30.4
5	32	40.5
6	4	5.1
7	2	2.5
>7	6	7.6
Mean (SD)	4.97 (2.19)	
Range	3-18	

**Table 16: Distribution Of Study Subjects According To The Complications (n = 79)**

Complications	No.	Percent
Collapse	2	2.5
Pleural Effusion	5	6.3
None	72	91.1

**Table 17: Distribution Of Study Subjects According To The Outcome (n = 79)**

Outcome	No.	Percent
Good	79	100.0

**Table 18: Association Between Clinical And Radiological Findings (n=79)**

Symptoms	No.	Bacterial Pneumonia (n=50)	Viral Pneumonia (n=29)	P Value
Fever	70	47 (59.4) [94.0]	23 (32.9) [79.3]	0.047*
Cough	77	48 (60.8) [94.0]	29 (37.7) [100.0]	0.275
Chest Indrawing	70	43 (54.4) [86.0]	27 (38.6) [93.1]	0.338
Hurried Breathing	72	44 (55.7) [88.0]	28 (38.9) [96.6]	0.197
Refusal to feed	47	27 (34.2) [54.0]	20 (42.6) [69.0]	0.191
Decreased activity	47	28 (35.4) [56.0]	19 (40.4) [65.5]	0.406
Wheeze	53	29 (36.7) [58.0]	24 (45.2) [82.8]	0.024*
Crepitation's	69	44 (55.7) [88.0]	25 (36.2) [86.2]	0.817

**Table 19: Association Between Laboratory And Radiological Findings (n=79)**

Laboratory	No.	Bacterial Pneumonia (n=50)	Viral Pneumonia (n=29)	P Value
Low HB	39	25 (64.1) [50.0]	14 (35.9) [48.3]	0.882
Increased TC	63	42 (67.7) [84.0]	20 (32.3) [69.0]	0.117
Neutrophilia	56	47 (84.0) [94.0]	9 (16.1) [31.0]	<0.001*
Increased ESR	58	41 (72.0) [82.0]	16 (28.1) [55.2]	0.010*
Increased CRP	53	41 (72.0) [82.0]	12 (22.6) [41.4]	<0.001*

**DISCUSSION**

Pneumonia continues to pose a threat to health children in developed and developing countries despite improvements in socioeconomic status, immunization and early diagnosis and treatment. Universality, vulnerability and frequency of occurrence of ALRTI in children are well recognized all over the world.

**Age Distribution**

Age is an important predictor of morbidity and mortality in pediatric pneumonia. In the present study, conducted between the age group of six months to 18 years, majority (49.4%) were less than by Uma Maheswari Biruda, Dishita Pagala (53%)<sup>[9]</sup> and study done by Sehgal V et al<sup>[10]</sup> (52.2%).

**Sex Distribution**

In our study it was observed that male (69.6%) outweighed females (30.4%). Male: female ratio was 2.2. This was in comparison with studies done by Sehgal V et al<sup>[10]</sup> (58.25) and Drummond P et al<sup>[23]</sup> (58%).

**Signs:**

Tachypnoea has been improved to be a sensitive and specific indicator of 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 our study, tachypnoea (91.1%) and chest retractions (88.6%) were the important signs for making a clinical diagnosis of pneumonia. Crepitations (87.3%), rhonchi (67.1%) were the other associated signs. Gupta D et al<sup>[11]</sup> Margolis P et al<sup>[12]</sup>, Palafox M et al<sup>[13]</sup>, have observed that tachypnoea and chest retractions were highly specific signs in detecting pneumonia. Reddaiah VP et al<sup>[14]</sup>, have reported that crepitations were found in 76% and rhonchi in 23.2% of patients with pneumonia.

**Previous History of Pneumonia:**

In the present study 25.3% patients had previous history of pneumonia and 74.7% patients presented with new onset Pneumonia.

This is in contrast to study done by Silvia Montella<sup>[15]</sup> they found that recurrent risk of pneumonia seen in 7.7%-9% of patients.

**Clinical Diagnosis**

In our study lobar pneumonia was the most common diagnosis made at admission (40.5%), Bronchopneumonia in (22.8%), pneumonia with complications in (8.8%). Complications of pneumonia includes, pleural effusion (6.3%), collapse (2.5%).

This is in contrast to study conducted by Reddaiah VP et al<sup>[14]</sup> Bronchopneumonia was diagnosed in 64%, Lobar pneumonia in 6.4% and Mungal et al<sup>[22]</sup> also found that bronchopneumonia was the most common clinical entity associated lower respiratory tract infection.

**Radiological Findings**

Although clinical symptoms and signs are helpful indicators of the presence of disease as. Well as etiology, radiographic investigation is often used to confirm a clinical diagnosis and to help sort out whether or not antibiotics or more extensive workup is necessary.

In our study Chest x-ray showed radiological changes consistent with pneumonia in 100% of cases. Evidence of bacterial infection was found in 63.5% and viral in 36.7% of cases.

In a study conducted by Virkki R et al<sup>[16]</sup> it was found that radiological changes were seen in 85%, with evidence of bacterial infection in 64% and viral in 36% of cases.

Macintyre C. R. et al<sup>[17]</sup> have also reported radiological confirmation in 85% of cases of pneumonia.

The reasons for higher incidence of radiologically detected bacterial pneumonia in our study may be due to high incidence of bacterial pneumonia in countries like ours. Also, there may be variations in intra observer and inter observer agreement on the radiographic features used for interpreting the radiogram.

**Clinical Data in Comparison with Radiological Findings:**

Clinical symptoms and signs can help the clinician determine the need for chest radiography.

In our study, we compared the clinical data with radiological findings and found that Fever, cough and crepitations, were more correlated with bacterial pneumonia and wheeze, decreased activity, hurried breathing more correlated with viral pneumonia. This was in comparison with studies conducted by Zukin DD et al<sup>[18]</sup>, it was found that the sign with highest positive predictive value for the presence of any radiographic abnormalities was tachypnoea and chest examination findings such as crepitations and abnormal breath sounds comprised of a high-risk group, which increased significantly the likelihood of pneumonia.

There is often disagreement between pneumonia diagnosed by clinical examination and that diagnosed by chest X-ray. Chest X-ray appear to have major impact on diagnosis and management when any inconsistencies arise.

**Laboratory Investigations**

Routine investigations like white blood cell count (WBC), differential count (DC) - Neutrophils and erythrocyte sedimentation rate (ESR), CRP may provide a clue in differentiating bacterial from viral pneumonia.

Our observation shows that Leukocytosis (67.7%), neutrophilia (84%), elevated ESR (72%) and CRP (72%) significantly correlated with bacterial pneumonia (p<0.005).

This was in comparison with studies done by mehta et al<sup>[19]</sup> found that 63.15% had elevated WBC counts; 88.42% had neutrophilia, 67.27% had elevated ESR. Kumar N et al<sup>[20]</sup> found the Neutrophilia is more associated with bronchopneumonia.

**Blood Culture:**

In recent years, the best information on the bacterial etiology of pneumonia in young children has been obtained through blood culture, despite the fact that the sensitivity of this method is somewhat lower. In our study, blood <sup>culture</sup> was positive in 4 cases (5.1%). S pneumonia was the most common organism isolated (2 cases) followed by Klebsiella and Pseudomonas.

Kabra SK et al<sup>[21]</sup> have reported positive blood culture in 16% of patients. The yield of blood culture varies from 5-15% for bacterial pathogens and cannot be relied upon. Because of very low positivity of blood culture, we could not correlate our clinical findings with etiological diagnosis.

**CONCLUSION**

ARI, especially pneumonia is one of the major causes of morbidity and mortality in children. Consolidation is the predominant form of presentation in infants and preschool children admitted to our hospital.

Most common age group affected in our study was less than 1 year of age. Male are more affected than females.

Fever, Cough, Hurried breathing and chest indrawing were the most common symptoms. Crepitations and wheeze were the most common signs.

Routine hematological investigations and Chest X-ray will give much information regarding severity but not etiology of illness.

Among hematological investigations Neutrophilia and CRP are more

associated with bacterial pneumonia and its complications.

Blood culture has a poor sensitivity for bacterial pathogens and cannot be relied upon. Because of very low positivity of blood culture, we could not correlate our clinical findings with etiological diagnosis.

Chest X-ray revealed positive findings in all cases. consolidation and pleural effusion are more associated with bacterial pneumonia.

All patients admitted to our study had 100% good outcome.

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