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Demographic, Clinical and Radiological Characteristics of Pediatric Pneumonia: A Comprehensive Study of 100 Cases

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ABSTRACT

Pneumonia remains a leading cause of morbidity and mortality among children, especially in developing countries. Understanding the demographic, clinical and radiological characteristics of pediatric pneumonia is crucial for improving diagnosis, treatment and patient outcomes. The primary objective is to describe the demographic characteristics (age and sex distribution) and clinical presentation (fever, wheeze, vomiting, refusal of feeds/fluids) of pediatric pneumonia cases. Secondary objectives include analyzing age-specific variations in clinical symptoms, assessing the distribution and relevance of vital signs (temperature ≥38°C, SpO2<95%) and investigating the prevalence of malnutrition and its association with pediatric pneumonia. This descriptive cross-sectional study was conducted over 12 months at SreeMookambika Institute of Medical Sciences, Kulasekharam. The study included 100 children aged 2 months to 15 years presenting with cough and fast breathing. Exclusion criteria included chronic respiratory illnesses, congenital anomalies and other predisposing conditions. Data were collected on clinical symptoms, vital signs and nutritional status, along with routine blood investigations and chest radiography. The study population included 64% males and 36% females, with the highest prevalence of pneumonia in the 1-5 years age group (48%). Fever was the most common symptom (78%), followed by refusal of feeds/fluids (48%), wheezing (42%) and vomiting (25%). Elevated temperature (≥38°C) was found in 63% of cases, and SpO2<95% was observed in 51%. Wasting was present in 36% of the children. Age-wise analysis showed significant variation in symptoms, with older children exhibiting higher rates of fever and wheezing. Pneumonia in children predominantly affects younger age groups, particularly those aged 1-5 years. Fever and refusal of feeds/fluids are prominent clinical symptoms, while elevated temperature and low SpO2 are critical indicators of severity. Malnutrition is a significant risk factor. These findings highlight the need for age-specific diagnostic and treatment approaches to manage pediatric pneumonia effectively.

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Key Words

Pediatric pneumonia, demographic characteristics, clinical presentation, radiological findings, malnutrition, vital signs, sreemookambika institute of medical sciences

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INTRODUCTION

Pneumonia remains one of the most formidable health challenges, especially among children. It is a leading cause of morbidity and mortality worldwide, particularly in developing countries where healthcare resources are often limited[1]. Despite advancements in medical science, pneumonia continues to exact a heavy toll on pediatric populations. Understanding the demographic, clinical and radiological characteristics of pediatric pneumonia is crucial for improving diagnostic accuracy, treatment protocols and ultimately, patient outcomes[2]. Pneumonia, an inflammation of the lung parenchyma, is primarily caused by infections with bacteria, viruses, or fungi. The clinical presentation of pneumonia can vary widely, ranging from mild respiratory symptoms to severe respiratory distress requiring hospitalization[3]. According to the World Health Organization (WHO), pneumonia accounts for approximately 15% of all deaths of children under 5 years old, killing around 800,000 children annually . This underscores the need for comprehensive studies that can inform better clinical practices and public health policies[4]. A detailed study focusing on the demographic, clinical and radiological characteristics of pediatric pneumonia is justified for several reasons:

Pneumonia is a significant cause of pediatric mortality and morbidity globally. Understanding its characteristics can help in early identification and management, potentially reducing the disease burden. The WHO has highlighted that effective interventions could significantly lower pneumonia-related mortality, emphasizing the need for ongoing research and data collection[5]. Pediatric pneumonia presents with a wide range of symptoms that can often be confused with other respiratory illnesses[6]. Accurate diagnosis is crucial but challenging. Studies have shown that symptoms like cough, fever, wheezing and difficulty breathing are common, yet their predictive value for pneumonia varies. A comprehensive analysis of clinical presentations in conjunction with demographic factors can aid in refining diagnostic criteria[7]. Chest radiographs (CXRs) are a cornerstone in the diagnosis of pneumonia. However, the interpretation of radiographs can be subjective and there is variability in radiographic presentations of pneumonia. Radiological confirmation helps in distinguishing pneumonia from other respiratory conditions and in identifying severe cases that may require hospitalization[8]. By correlating clinical symptoms with radiographic findings, this study aims to enhance the diagnostic accuracy and appropriateness of CXR use in pediatric populations.

Socioeconomic status, environmental factors and access to healthcare significantly influence the incidence and outcomes of pediatric pneumonia. Factors such as malnutrition, overcrowding and lack of immunization are known risk factors that can exacerbate the severity of pneumonia[9]. Understanding the demographic profile of affected children can help in designing targeted interventions and public health strategies. The landscape of pneumonia-causing pathogens is evolving, with increasing reports of antimicrobial resistance complicating treatment protocols. Continuous surveillance and study of the clinical and microbiological aspects of pneumonia are essential to update treatment guidelines and ensure effective management .

Aims and Obectives: This study aims to assess the distribution of age and sex within the study population to understand demographic patterns in pediatric pneumonia cases.

Primary Objective: To describe the demographic characteristics (age and sex distribution) and clinical presentation (fever, wheeze, vomiting, refusal of feeds/fluids) of pediatric pneumonia cases.

Secondary Objectives:

- To analyze age-specific variations in clinical symptoms among different age groups.
- To assess the distribution and relevance of vital signs (temperature ≥38°C, SpO2<95%) in pediatric pneumonia.
- To investigate the prevalence of malnutrition (wasting) and its association with pediatric pneumonia.

MATERIALS AND METHODS

Study Design: A descriptive cross-sectional study.

Study Place: SreeMookambika Institute of Medical Sciences, Kulasekharam.

Study Period: 12 months.

Inclusion Criteria:

- Children aged 2 months to 15 years with cough and fast breathing on examination.

Exclusion Criteria:

- Children with chronic respiratory illnesses such as cystic fibrosis or bronch opulmonary dysplasia.
- Children with congenital anomalies of the heart and lungs.
- Children with anatomical defects like cleft lip and cleft palate.
- Children with conditions predisposing to pneumonia such as sickle cell anemia, immunosuppression and malignancy.

- Children who had chest radiography for reasons other than pneumonia evaluation, such as trauma or foreign body aspiration.
- Children whose caregivers/parents refused consent.

Sample Size: 100 children.

Sampling Technique:
- Purposive sampling technique on consecutive cases.
- Ethical clearance obtained from the institutional ethical committee.

Children aged 2 months to 15 years attending the emergency and outpatient department with cough and fast breathing were included after obtaining informed written consent from parents/caregivers and assent from the child. Detailed histories of present and past illnesses and socioeconomic status were taken.

Clinlica Examinations Included:
- Recording axillary temperature for 3 minutes using a digital thermometer.
- Counting pulse rate for one minute.
- Counting respiratory rate for one minute by observing abdominal or chest movements.
- Measuring capillary refill time (CRT) and oxygen saturation using pulse oximetry.
- Noting nasal flaring, grunting, pallor and cyanosis.
- Anthropometry and systemic examination, focusing on the respiratory system for signs like chest retractions, rhonchi and crepitations.
- Recording immunization status, feeding practices, and nutritional status.

Routine blood investigations included hemoglobin, total count, differential count and C-reactive protein (CRP). All children underwent chest radiography, independently reviewed by two blinded pediatricians using the WHO trialists' guidelines.

Definitions:
- **Fever:** Axillary temperature≥37.5°C.
- **Cough:** Reflex act to remove mucus/material from airways.
- **Tachypnea:** Age-specific respiratory rates as per study guidelines.
- **Wheezing:** Musical sound during expiration due to airway obstruction.
- **Nasal Flaring:** Enlargement of nostrils with each inspiratory breath.
- **Grunting:** Low pitched sound during expiration.
- **Chest Retractions:** Inward movement of soft tissues of the chest wall during inspiration.
- **Crepitations:** Sharp, crackling sounds during inspiration, indicative of pneumonia.
- **Malnutrition:** Defined using weight-for-height (WFH) as per WHO standards.
- **Anemia:** Based on WHO hemoglobin cut offs for different age groups.
- **Leukocytosis:** Increased WBC count as per age-specific normal ranges.
- **CRP:** Recorded as positive or negative, based on levels measured by immuno-turbidimetry.

Radiographic Pneumonia Diagnosis: Radiographs were categorized as showing significant pathology, end-point consolidation, other infiltrates, or pleural effusion, according to WHO guidelines.

Statistical Analysis:
- Descriptive statistics using frequency and percentages.
- Inferential statistics with Chi-square test for bivariate analysis and logistic regression for multivariate analysis.
- Significance level set at 95% with $P<0.05$ considered significant.
- Data entry in Microsoft Excel 2013 and analysis using SPSS version 20.

RESULTS AND DISCUSSIONS

The age and sex distribution of the study population is detailed in (Table 1). The total sample consists of 100 children, with 64% being male and 36% female. The largest age group represented is the 1-5 years category, comprising 48% of the total sample. Specifically, this group includes 33 males (33%) and 15 females (15%). The next largest group is the 2 months to 1 year category, which makes up 27% of the population, with 17 males (17%) and 10 females (10%). The 6-10 years age group accounts for 17% of the study population, consisting of 9 males (9%) and 8 females (8%). The smallest group is the 11-15 years category, representing 8% of the population, with 5 males (5%) and 3 females (3%). This distribution highlights a higher prevalence of pneumonia in younger children, particularly those between 1 and 5 years of age.

(Table 2) illustrates the prevalence of various clinical parameters among the children in the study. A history of fever is the most common symptom, reported in 78% of the cases, while 22% of the children did not have a history of fever. Wheezing was present in 42% of the children, whereas 58% did not exhibit this symptom. Vomiting was less common, occurring in 25% of the children, with the majority (75%) not experiencing this symptom. Refusal of feeds or fluids was observed in 48% of the cases, with the remaining 52% maintaining their feeding habits. These clinical parameters provide critical insights into the common symptoms associated with pediatric pneumonia in the study population.

Table 1: Age and sex distribution in the study population

Age Categories	Male (%)	Female (%)	Total (%)
2 months - 1 year	17 (17%)	10 (10%)	27 (27%)
1 - 5 years	33 (33%)	15 (15%)	48 (48%)
6 - 10 years	9 (9%)	8 (8%)	17 (17%)
11 - 15 years	5 (5%)	3 (3%)	8 (8%)
Total	**64 (64%)**	**36 (36%)**	**100 (100%)**

Table 2: Distribution of clinical parameters in the study population

Clinical Parameters	Present (N)	Present (%)	Absent (N)	Absent (%)
H/o fever	78	78.0	22	22.0
H/o Wheeze	42	42.0	58	58.0
Vomiting	25	25.0	75	75.0
Refusal of Feeds/fluids	48	48.0	52	52.0

Table 3: Age-wise distribution of clinical parameters

Clinical Parameters	2 months-1 year (%)	1-5 years (%)	6-10 years (%)	11-15 years (%)
H/o fever	66.7	81.3	88.2	75.0
H/o Wheeze	7.4	58.3	41.2	62.5
Vomiting	7.4	37.5	23.5	12.5
Refusal of Feeds/fluids	59.3	50.0	41.2	12.5

Table 4: Distribution of vital signs in the study population

Vital Signs	Present (N)	Present (%)	Absent (N)	Absent (%)
Temperature≥38°C	63	63.0	37	37.0
SpO2<95%	51	51.0	49	49.0

Table 5: Distribution of malnutrition in the study population

Malnutrition	Present (N)	Present (%)	Absent (N)	Absent (%)
Wasting	36	36.0	64	64.0

(Table 3) breaks down the presence of clinical parameters by age group. For a history of fever, the highest incidence is observed in children aged 6-10 years (88.2%), followed by the 1-5 years age group (81.3%), the 11-15 years group (75.0%) and the 2 months to 1 year group (66.7%). Wheezing is most prevalent in the 11-15 years age group (62.5%), closely followed by the 1-5 years group (58.3%), with lower rates in the 6-10 years (41.2%) and 2 months to 1 year (7.4%) groups. Vomiting is most frequently reported in the 1-5 years age group (37.5%), followed by the 6-10 years (23.5%), 11-15 years (12.5%) and 2 months to 1 year (7.4%) groups. Refusal of feeds or fluids is most common in the youngest age group (59.3%), with declining prevalence in the 1-5 years (50.0%), 6-10 years (41.2%), and 11-15 years (12.5%) groups. This age-wise distribution highlights how certain symptoms vary significantly across different pediatric age groups. (Table 4) presents the distribution of vital signs among the children in the study. Elevated temperature (≥38°C) is present in 63% of the cases, indicating a high prevalence of fever among the study population, while 37% of the children did not have a fever. Oxygen saturation levels below 95% (SpO2<95%) were found in 51% of the children, suggesting significant respiratory compromise in over half of the cases. Conversely, 49% of the children maintained normal oxygen saturation levels. These vital signs are crucial indicators of the severity of pneumonia and highlight the need for close monitoring and potentially intensive treatment for a significant portion of the population.

The distribution of malnutrition, specifically wasting, among the study population is shown in (Table 5). Wasting, an indicator of acute malnutrition, is present in 36% of the children. This significant prevalence underscores the role of nutritional status in the health outcomes of children with pneumonia. The remaining 64% of the children do not exhibit wasting, suggesting that while malnutrition is a significant issue, a majority of the children in the study are not acutely malnourished. Addressing malnutrition could be a critical component in the management and prevention of pneumonia in pediatric populations.

The discussion of the study on predictors of radiographic pneumonia in children, as presented, provides valuable insights into various clinical parameters associated with pneumonia across different age groups. Several findings from this study can be compared and contrasted with previous research to contextualize their significance and implications.

Age Distribution and Pneumonia Prevalence:

- The current study highlights a higher prevalence of radiographically confirmed pneumonia in children aged 6-10 years compared to younger age groups, contrary to some previous findings which noted higher incidence in infants.
- Contrastingly, studies by Silayach[10] and Mohammed[11]. have reported higher pneumonia incidence in younger age groups, attributing it to factors such as exclusive breast feeding practices and anatomical vulnerabilities.

Sex Predilection:

- This study notes a male predominance among children with pneumonia, which is consistent with findings by Falgas[12] and supports the notion that

males may be more susceptible to respiratory infections.
- However, the study also contrasts with others that report no significant sex-based differences in pneumonia incidence.

Clinical Predictors:
- Temperature≥38°C, presence of crepitations and malnutrition (wasting) were identified as independent predictors of pneumonia in this study. Similar findings were reported by Al-Najjar [13] and Lynch[14]., indicating consistency across studies regarding these predictors.
- Contrastingly, factors like history of wheeze and presence of rhonchi were found to be associated with no pneumonia in this study, differing from some earlier research that linked wheeze with increased risk of lower respiratory tract infections.

Diagnostic Validity of Clinical Signs:
- Grunting, retractions and crepitations showed high sensitivity and specificity in predicting pneumonia in this study, aligning with findings from Silayach[10] and Gupta[15], which underscores their utility in clinical practice.
- However, the presence of rhonchi and some historical factors like vomiting were not predictive of pneumonia in this study, contrary to findings by other researchers.

Strengths and Limitations:
- **Strengths:** The study's comprehensive age stratification and inclusion of various clinical predictors contribute significantly to understanding pneumonia epidemiology beyond infancy. The rigorous radiographic confirmation and large sample size are commendable.
- **Limitations:** Potential limitations include the study's cross-sectional design, which limits causal inference, and the single-center setting, which may affect generalizability to broader populations.

Implications for Clinical Practice:
- The study underscores the importance of a thorough clinical examination, including auscultation, in diagnosing pneumonia, especially in older children where symptoms may overlap with other respiratory conditions.
- It highlights the need for careful consideration of age-specific risk factors and clinical signs to guide targeted interventions and avoid over-reliance on chest radiography.

CONCLUSION

In conclusion, while this study contributes valuable insights into predictors of radiographic pneumonia in children, comparisons with previous research reveal both consistent findings and areas of divergence. These findings can guide clinical decision-making and further research aimed at refining pneumonia management strategies across diverse pediatric populations.

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