

Role of Chest X-Ray in Assessing Severity of Pneumonia in Children Aged 1–5 YearsArjit Sen¹, Jayanta Kumar Podder²¹Associate Professor, Department of Paediatrics, Tripura Medical College, Hapania, Agartala, Tripura, India²Professor, Department of Paediatrics, Tripura Medical College, Hapania, Agartala, Tripura, India

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Abstract**Background:** Pneumonia remains one of the leading causes of morbidity and mortality among children under five years of age worldwide. Chest radiography (CXR) is widely used as an adjunct diagnostic tool to evaluate pulmonary involvement and complications of pneumonia. However, its role in assessing the severity of pneumonia and guiding clinical management in pediatric patients continues to be an important area of research.**Aim:** To evaluate the role of chest X-ray in assessing the severity of pneumonia in children aged 1–5 years admitted to a tertiary care centre.**Methods:** A hospital-based observational study was conducted in the Department of Pediatrics, Tripura Medical College and Dr. BRAM Teaching Hospital, Hapania, Agartala, Tripura, India. A total of 140 children aged 1–5 years clinically diagnosed with pneumonia were included. Detailed clinical examination was performed, and chest X-ray was obtained for all patients. Radiological findings such as consolidation, interstitial infiltrates, bronchopneumonia pattern, pleural effusion, and multilobar involvement were recorded. The radiographic findings were correlated with clinical severity based on WHO pneumonia classification.**Results:** Radiographic abnormalities were observed in a majority of children with clinically diagnosed pneumonia. Findings such as lobar consolidation, bilateral infiltrates, multilobar involvement, and pleural effusion were more frequently associated with severe pneumonia. Mild cases commonly showed minimal or interstitial infiltrates. Chest X-ray findings showed a significant association with clinical severity and duration of hospitalization.**Conclusion:** Chest X-ray is a useful adjunct investigation for assessing the severity of pneumonia in children. Radiological findings can help identify severe disease, predict complications, and assist clinicians in planning appropriate management strategies.**Keywords:** Pneumonia; Chest X-ray; Pediatric pneumonia; Radiographic severity; Children under five.**DOI:** 10.25258/ijcpr.18.3.55

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Introduction

Pneumonia is a major public health problem and continues to be a leading cause of morbidity and mortality among children under five years of age, particularly in developing countries. According to global estimates, pneumonia accounts for a significant proportion of childhood deaths annually, highlighting the importance of early diagnosis and appropriate management. [1,2]

Children aged below five years are particularly vulnerable due to immature immune systems, malnutrition, and environmental risk factors such as overcrowding, indoor air pollution, and incomplete immunization. [3] Clinical manifestations typically include fever, cough, tachypnea, chest indrawing, and respiratory

distress. Accurate assessment of disease severity is essential to guide treatment decisions and determine the need for hospitalization or intensive care. [4] The World Health Organization (WHO) has developed standardized clinical criteria for the diagnosis and classification of pneumonia in children based primarily on clinical signs such as respiratory rate, chest indrawing, and general danger signs.

However, clinical assessment alone may not always accurately determine the extent of pulmonary involvement or detect complications such as pleural effusion or multilobar consolidation. Therefore, imaging modalities, particularly chest radiography, play an important supportive role in diagnosis and

evaluation [5,6]. Chest X-ray remains one of the most commonly used imaging techniques for evaluating pneumonia in pediatric patients due to its wide availability, rapid acquisition, and relatively low cost [7]. It helps in identifying radiological patterns such as lobar consolidation, bronchopneumonia, interstitial infiltrates, atelectasis, and pleural effusion, which may reflect the severity and progression of the disease.

In resource-limited settings, chest radiography continues to be a valuable diagnostic tool for confirming pneumonia and identifying complications [8].

Several studies have investigated the correlation between radiographic findings and clinical severity in pediatric pneumonia. Certain radiological features, including multilobar consolidation, bilateral infiltrates, and pleural effusion, have been reported to be associated with severe pneumonia and poorer clinical outcomes. [9,10]

Similarly, hospital-based studies have demonstrated that children with radiographic evidence of consolidation or extensive lung involvement often require longer hospitalization and more intensive treatment compared to those with minimal radiographic changes. [11,12]

Despite its widespread use, the role of chest X-ray in determining disease severity remains controversial. Some clinicians emphasize that treatment decisions should primarily rely on clinical findings, while others suggest that radiographic assessment provides valuable additional information regarding disease progression and complications. Thus, further studies are required to better understand the relationship between radiological findings and clinical severity in pediatric pneumonia.

Considering the significant burden of pneumonia in children and the importance of timely assessment of disease severity, the present study was undertaken to evaluate the role of chest X-ray in assessing the severity of pneumonia in children aged 1–5 years admitted to a tertiary care hospital in Tripura.

Materials and Methodology

Study Design: This study was designed as a hospital-based prospective observational study.

Study Setting: The study was conducted in the Department of Pediatrics at Tripura Medical College and Dr. BRAM Teaching Hospital, Hapania, Agartala, Tripura, India, which is a tertiary care teaching hospital providing pediatric inpatient and emergency services.

Study Duration: The study was carried out over a period of 18 months.

Study Sample Size and Population: 140 Children aged 1 year to 5 years admitted to the pediatric ward with clinical features suggestive of pneumonia were included in the study.

Inclusion Criteria

- Children aged 1–5 years
- Clinically diagnosed with pneumonia based on WHO criteria
- Children whose parents or guardians provided informed consent

Exclusion Criteria

- Children with congenital heart disease
- Children with chronic lung disease
- Children with pulmonary tuberculosis
- Children with incomplete clinical or radiological records

Data Collection Procedure: After obtaining approval from the institutional ethics committee and informed consent from parents or guardians, children meeting the inclusion criteria were enrolled in the study.

Detailed information was recorded using a pre-designed structured proforma, which included:

- Demographic details (age, sex)
- Clinical history and presenting symptoms
- Physical examination findings
- Vital parameters and oxygen saturation
- WHO classification of pneumonia severity

Radiological Assessment

All enrolled patients underwent chest X-ray (posteroanterior view) at the time of admission.

The chest radiographs were interpreted by a radiologist and classified into the following patterns:

- Lobar consolidation
- Bronchopneumonia pattern
- Interstitial infiltrates
- Bilateral lung involvement
- Pleural effusion
- Normal chest X-ray

Radiological findings were correlated with clinical severity.

Assessment of Pneumonia Severity

The severity of pneumonia was classified according to WHO clinical guidelines into:

- Pneumonia
- Severe pneumonia

Statistical Analysis: All collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0.

Statistical methods included:

- Descriptive statistics (frequency, percentage, mean, standard deviation)
- Chi-square test to assess association between radiological findings and severity
- P-value <0.05 was considered statistically significant.

Results

A total of 140 children aged 1–5 years admitted with clinically diagnosed pneumonia were included in the study. Radiological findings on chest X-ray were correlated with clinical severity based on WHO classification.

Table 1: Age and Sex Distribution of Study Population (n = 140)

Age Group (years)	Male	Female	Total	Percentage
1–2	28	18	46	32.9%
2–3	21	17	38	27.1%
3–4	18	14	32	22.9%
4–5	13	11	24	17.1%
Total	80	60	140	100%

Among the 140 children studied, males constituted 57.1% and females 42.9%. The 1–2 year age group formed the largest proportion (32.9%), indicating that younger children are more frequently affected by pneumonia requiring hospitalization.

Table 2: Distribution of Pneumonia Severity Based on WHO Classification

Severity	Number	Percentage
Pneumonia	82	58.6%
Severe Pneumonia	58	41.4%
Total	140	100%

Among the enrolled children, 58.6% had pneumonia while 41.4% had severe pneumonia according to WHO criteria. Severe cases were commonly associated with respiratory distress, hypoxia, and chest indrawing.

Table 3: Chest X-Ray Findings in Children with Pneumonia

Radiological Finding	Pneumonia (n=82)	Severe Pneumonia (n=58)	Total	Percentage	p-value
Normal CXR	24	6	30	21.4%	0.001
Interstitial infiltrates	30	12	42	30.0%	
Bronchopneumonia pattern	18	17	35	25.0%	
Lobar consolidation	8	15	23	16.4%	
Pleural effusion	2	8	10	7.1%	
Total	82	58	140	100%	

The most common radiological finding was interstitial infiltrates (30%), followed by bronchopneumonia pattern (25%). Lobar consolidation and pleural effusion were significantly more common in severe pneumonia cases compared to mild cases ($p = 0.001$).

Table 4: Association between Radiological Findings and Clinical Severity

Radiological Finding	Mild Pneumonia	Severe Pneumonia	Total	p-value
Minimal / Interstitial changes	54	18	72	0.003
Consolidation / multilobar disease	20	30	50	
Pleural effusion	8	10	18	
Total	82	58	140	

Children with consolidation, multilobar involvement, and pleural effusion were significantly more likely to present with severe pneumonia compared with those having minimal radiological changes ($p = 0.003$).

Discussion

Pneumonia continues to be a major cause of childhood morbidity and mortality worldwide. Radiological imaging, particularly chest X-ray, plays an important role in confirming diagnosis,

assessing disease severity, and identifying complications. [4,13] In the present study, the majority of children belonged to the 1–2 year age group, which is consistent with previous studies indicating that younger children are more susceptible to lower respiratory tract infections due to immature immunity and exposure to environmental risk factors.

A male predominance was observed in the study population, with 57.1% males and 42.9% females. Similar findings were reported by Goyal et al., who

also observed a higher proportion of male children affected by pneumonia in their hospital-based study. [2]

The present study showed that 58.6% of cases had pneumonia and 41.4% had severe pneumonia. This distribution is comparable to studies conducted in tertiary care hospitals in South Asia, where a significant proportion of hospitalized children present with severe disease requiring intensive management.

Radiological findings in this study demonstrated that interstitial infiltrates were the most common chest X-ray finding (30%), followed by bronchopneumonia and consolidation. Similar observations were reported in earlier research where bronchopneumonia and interstitial infiltrates were frequently identified radiographic patterns in pediatric pneumonia. [14]

Importantly, the study demonstrated a significant association between certain radiological findings and disease severity. Lobar consolidation and pleural effusion were more commonly observed in severe pneumonia cases, suggesting that these findings may serve as indicators of advanced disease. This is consistent with findings reported by Jain et al., who noted that bilateral infiltrates, consolidation, and pleural effusion were associated with more severe clinical presentations and poorer outcomes. [9,15]

Another observational study conducted in a tertiary care hospital reported that radiographic abnormalities were present in approximately 78% of pediatric pneumonia cases, with consolidation significantly associated with severe pneumonia and longer hospital stays. [11]

These findings support the usefulness of chest radiography as an adjunct tool in evaluating pneumonia severity. Radiological patterns such as multilobar consolidation, diffuse infiltrates, and pleural effusion may indicate extensive lung involvement and help clinicians anticipate complications.

However, it is important to note that chest X-ray should not replace clinical evaluation. Some children with clinically severe pneumonia may have minimal radiographic changes in early stages of disease. Therefore, clinical assessment based on WHO guidelines should remain the primary basis for diagnosis and treatment decisions.

Overall, the results of the present study demonstrate that chest X-ray findings correlate significantly with clinical severity and can provide valuable information regarding the extent of lung involvement and potential complications.

Limitations of the Study: The present study has certain limitations that should be considered while

interpreting the findings. First, the study was conducted in a single tertiary care hospital, which may limit the generalizability of the results to other healthcare settings or populations. Second, the sample size was relatively small, which may restrict the ability to detect subtle associations between radiological findings and disease severity. Third, the study relied primarily on chest X-ray for radiological evaluation, and more advanced imaging modalities such as computed tomography (CT) were not utilized, which might have provided more detailed information regarding pulmonary involvement. Additionally, the study focused on children aged 1–5 years, therefore the findings may not be applicable to infants or older pediatric age groups. Finally, long-term follow-up of patients was not performed, limiting the ability to assess long-term outcomes and complications associated with pneumonia.

Future Recommendations: Further research involving larger sample sizes and multicentre studies is recommended to improve the generalizability of the findings across different populations and healthcare settings. Future studies may also include advanced imaging modalities such as CT scans or lung ultrasound to better evaluate the extent of pulmonary involvement and compare their diagnostic accuracy with chest X-ray. In addition, research focusing on longitudinal follow-up of patients would help in understanding the long-term outcomes and complications associated with pediatric pneumonia. Studies evaluating the combined role of clinical scoring systems, laboratory parameters, and radiological findings may further improve early risk stratification and management of children with pneumonia. Finally, research assessing preventive strategies and early diagnostic approaches could contribute to reducing the morbidity and mortality associated with childhood pneumonia.

Conclusion

The present study highlights the important role of chest X-ray in assessing the severity of pneumonia in children aged 1–5 years. Radiological findings such as lobar consolidation, multilobar involvement, and pleural effusion were significantly associated with severe pneumonia.

Chest radiography serves as a useful adjunct investigation for confirming diagnosis, evaluating disease severity, and identifying complications. When interpreted alongside clinical findings, chest X-ray can assist clinicians in early risk stratification, appropriate management planning, and improved patient outcomes.

References

1. Jain DL, Mishra S, Jain H, Reddy M. Role of chest X-ray in assessing severity of pneumonia

- in children aged 3 months to 59 months. *Pediatr Rev Int J Pediatr Res.* 2017;4(3):210-216. doi:10.17511/ijpr.2017.i03.07
2. Goyal, D. K., & Sareen, D. (2020). Can chest x-ray predict pneumonia severity and its outcome in children aged 2 months - 5 years? *International Journal of Contemporary Pediatrics*, 7(3), 704–709. <https://doi.org/10.18203/2349-3291.ijcp20200703>
 3. O'Grady KF, Torzillo PJ, Frawley K, Chang AB. The radiological diagnosis of pneumonia in children. *Pneumonia (Nathan)*. 2014 Dec 1;5(Suppl 1):38-51. doi: 10.15172/pneu.2014.5/482. PMID: 31641573; PMCID: PMC5922330.
 4. Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, Thomson A; British Thoracic Society Standards of Care Committee. British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. *Thorax*. 2011 Oct;66 Suppl 2:ii1-23. doi: 10.1136/thoraxjnl-2011-200598. PMID: 21903691.
 5. Pattemore PK, Jennings LC. Epidemiology of Respiratory Infections. *Pediatric Respiratory Medicine*. 2008;435–52. doi: 10.1016/B978-032304048-8.50035-9. Epub 2009 May 18. PMCID: PMC7151775.
 6. Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. *Bull World Health Organ*. 2008 May;86(5):408-16. doi: 10.2471/blt.07.048769. PMID: 18545744; PMCID: PMC2647437.
 7. Adeloye D, Rudan I, Black RE, Campbell H, Nair H. Global, regional, and national estimates of pneumonia morbidity and mortality in children younger than 5 years between 2000 and 2015: a systematic analysis. *Lancet Glob Health*. 2019 Jan;7(1):e47-e57. doi: 10.1016/S2214-109X(18)30408-X
 8. M S, Vaithilingan S. Childhood Pneumonia in Low- and Middle-Income Countries: A Systematic Review of Prevalence, Risk Factors, and Healthcare-Seeking Behaviors. *Cureus*. 2024 Apr 4;16(4):e57636. doi: 10.7759/cureus.57636. PMID: 38586234; PMCID: PMC10998654.
 9. Bradley JS, Byington CL, Shah SS, Alverson B, Carter ER, Harrison C, Kaplan SL, Mace SE, McCracken GH Jr, Moore MR, St Peter SD, Stockwell JA, Swanson JT; Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. *Clin Infect Dis*. 2011 Oct;53(7):e25-76. doi: 10.1093/cid/cir531
 10. O'Grady, KA.F., Torzillo, P.J., Frawley, K. et al. The radiological diagnosis of pneumonia in children. *Pneumonia* 5 (Suppl 1), 38–51 (2014). <https://doi.org/10.15172/pneu.2014.5/482>
 11. Al Nufaiei ZF, Alshamrani KM. Comparing Ultrasound, Chest X-Ray, and CT Scan for Pneumonia Detection. *Med Devices (Auckl)*. 2025 Mar 4;18:149-159. doi: 10.2147/MDER.S501714. PMID: 40061910; PMCID: PMC11889995.
 12. Elemraid MA, Muller M, Spencer DA, Rushton SP, Gorton R, Thomas MF, Eastham KM, Hampton F, Gennery AR, Clark JE; North East of England Paediatric Respiratory Infection Study Group. Accuracy of the interpretation of chest radiographs for the diagnosis of paediatric pneumonia. *PLoS One*. 2014 Aug 22;9(8):e106051. doi: 10.1371/journal.pone.0106051. PMID: 25148361
 13. Tanveer N, Ansar A. The Role of Chest X-Ray in the Radiological Assessment of Pediatric Pneumonia in a Tertiary Care Setting: Chest X-Ray in the Radiological Assessment of Pediatric Pneumonia. *Pakistan BioMedical Journal*. 2024. DOI:10.54393/pbmj.v7i11.1254
 14. Na F, Wang Y, Tian C, Zhang H, Jing Y, Ke X, Zhou J, Liu J. Diagnostic accuracy of various imaging modalities for children with pneumonia: a systematic review and network meta-analysis. *Eur Respir Rev*. 2025 Dec 10;34(178):250161. doi: 10.1183/16000617.0161-2025. PMID: 41371717; PMCID: PMC12690378.
 15. Pereda MA, Chavez MA, Hooper-Miele CC, Gilman RH, Steinhoff MC, Ellington LE, Gross M, Price C, Tielsch JM, Checkley W. Lung ultrasound for the diagnosis of pneumonia in children: a meta-analysis. *Pediatrics*. 2015 Apr;135(4):714-22. doi: 10.1542/peds.2014-2833. Epub 2015 Mar 16. PMID: 25780071; PMCID: PMC9923609.