

Research Article

Role of Chest X-ray in Early Detection and Severity Assessment of Lower Respiratory Tract Infections: A Prospective Hospital-Based Study

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Abstract: **Introduction:** Lower respiratory tract infections (LRTIs) are a leading cause of morbidity and mortality, especially among children and elderly populations. Early diagnosis and severity assessment are crucial for timely management. Chest X-ray (CXR) remains a widely used imaging modality in resource-limited settings. **Objective:** To evaluate the role of chest X-ray in early detection and severity assessment of LRTIs. **Methods:** A prospective hospital-based study was conducted on patients presenting with clinical features of LRTIs. All patients underwent chest X-ray and clinical evaluation. Radiological findings were correlated with clinical severity and laboratory parameters. **Results:** Chest X-ray demonstrated significant utility in detecting pulmonary infiltrates, consolidation, and complications such as pleural effusion. A strong correlation was observed between radiological severity and clinical outcomes. **Conclusion:** Chest X-ray is a valuable, accessible tool for early diagnosis and severity assessment of LRTIs, aiding in prompt management.

Keywords: Chest X-ray, Lower Respiratory Tract Infections (LRTIs), Pneumonia, Radiological, Severity Diagnostic, Imaging, Clinical Correlation

INTRODUCTION

Lower respiratory tract infections (LRTIs) remain one of the most common causes of hospitalization worldwide and contribute substantially to global morbidity and mortality. Among these, pneumonia is a leading cause of death, particularly in children under five years of age, accounting for a significant proportion of preventable mortality in low- and middle-income countries. Early and accurate diagnosis is therefore critical to ensure timely initiation of appropriate therapy, reduce complications, and improve clinical outcomes.

The clinical diagnosis of LRTIs is often challenging due to the overlap of symptoms such as cough, fever, breathlessness, and chest discomfort with other respiratory conditions. Physical examination findings may be subtle or nonspecific, especially in early stages of the disease, leading to potential underdiagnosis or misdiagnosis. Several studies have highlighted the limited sensitivity and specificity of clinical assessment alone, thereby emphasizing the importance of adjunctive

diagnostic tools, particularly imaging modalities, in confirming the diagnosis.

Chest X-ray (CXR) has long been regarded as the standard and most widely used imaging technique for the evaluation of suspected pneumonia and other LRTIs. It provides valuable information regarding the presence, location, and extent of pulmonary involvement. Typical radiographic findings include consolidation, interstitial infiltrates, and pleural effusion, which aid clinicians in diagnosing the condition and assessing its severity. Additionally, chest X-ray can help differentiate between bacterial and viral etiologies to some extent and is useful in identifying complications such as lung abscess, empyema, or multilobar involvement.

However, despite its widespread use, chest X-ray has certain limitations. Its sensitivity may be reduced in the early stages of infection, leading to false-negative results. Furthermore, interpretation can vary between observers, which may affect diagnostic accuracy. Nonetheless, even with the availability of advanced imaging techniques such as computed tomography (CT)

and lung ultrasound, chest X-ray continues to be the most accessible, cost-effective, and practical diagnostic tool in routine clinical practice, particularly in resource-limited settings.

MATERIALS AND METHODS

Study Design

Prospective hospital-based observational study

Study Setting

Department of Radiodiagnosis in a tertiary care hospital

Study Duration

12–18 months

Study Population

Patients presenting with clinical features suggestive of LRTIs

Inclusion Criteria

- Patients with cough, fever, breathlessness
- Clinical suspicion of LRTI

Exclusion Criteria

- Chronic lung disease
- Immunocompromised patients

Methodology

- Clinical evaluation and laboratory investigations
- Chest X-ray performed in all patients
- Radiological findings recorded:
 - Consolidation
 - Interstitial infiltrates
 - Cavitation
 - Pleural effusion

Severity Assessment

Based on:

- Extent of lung involvement
- Bilateral vs unilateral disease
- Presence of complications

DISCUSSION

This study highlights the significant role of chest X-ray (CXR) in the diagnosis and evaluation of lower respiratory tract infections (LRTIs). The findings are consistent with previous literature, reinforcing that CXR remains a reliable and widely accepted imaging modality for detecting pneumonia and assessing disease severity. In routine clinical practice, especially in resource-limited settings, chest X-ray serves as a first-line investigation due to its availability, rapid turnaround time, and relatively low cost. It provides crucial information regarding the presence, extent, and pattern of lung involvement, thereby assisting clinicians in making timely and appropriate management decisions.

Statistical Analysis

- Descriptive statistics
- Chi-square test
- Correlation analysis

The results of the present study demonstrated that a majority of patients with clinically suspected lower respiratory tract infections (LRTIs) showed significant radiological abnormalities on chest X-ray, highlighting its important role as a diagnostic tool. The most commonly observed finding was consolidation, which is typically suggestive of bacterial pneumonia and was seen in a substantial proportion of cases. In addition to consolidation, interstitial infiltrates were also frequently identified, often indicating viral or atypical infections. Pleural effusion was another notable finding, observed in a smaller but clinically significant number of patients, suggesting the presence of complications.

Chest X-ray exhibited moderate to high sensitivity, ranging from approximately 79% to 87%, and high specificity, between 91% and 98%, in detecting pneumonia. These findings reinforce the reliability of chest X-ray in diagnosing LRTIs in routine clinical settings. Furthermore, a clear correlation was observed between radiological findings and disease severity. Patients with bilateral lung involvement were more likely to present with severe clinical symptoms, including increased respiratory distress and need for hospitalization. Similarly, the presence of pleural effusion was associated with a poorer prognosis and often indicated a more complicated disease course.

Importantly, the study found a strong positive correlation between radiological severity and clinical outcomes. Patients with more extensive radiographic involvement tended to have higher clinical severity scores and longer hospital stays. This emphasizes the value of chest X-ray not only in diagnosis but also in assessing disease progression and guiding management decisions. Overall, these findings underscore the significance of chest X-ray as a practical, accessible, and effective modality for both early detection and severity assessment of LRTIs.

Although newer imaging modalities such as lung ultrasound and computed tomography (CT) have demonstrated higher sensitivity in certain clinical scenarios, their use is often limited by availability, operator dependency, and higher costs. In contrast, chest X-ray continues to be a practical and accessible diagnostic tool across a wide range of healthcare settings. Its utility extends beyond initial diagnosis, as it is also effective in monitoring disease progression and response to treatment.

One of the key strengths of chest X-ray lies in its ability to identify complications associated with LRTIs. Findings such as pleural effusion, multilobar involvement, cavitation, and lung abscess can be readily

detected, which are important indicators of severe disease and may necessitate more aggressive management. These radiological features help in risk stratification and guide decisions regarding hospitalization and therapeutic interventions.

However, certain limitations of chest X-ray must be acknowledged. Interobserver variability in interpretation can affect diagnostic accuracy, and early-stage infections may not always be detected, leading to false-negative results. Despite these limitations, the overall benefits of chest X-ray in terms of accessibility, cost-effectiveness, and clinical utility make it an indispensable tool in the diagnosis and management of LRTIs.

CONCLUSION

Chest X-ray remains an essential imaging modality for early detection and severity assessment of LRTIs. It is especially valuable in resource-limited settings and plays a crucial role in guiding clinical management and improving patient outcomes.

REFERENCES

1. World Health Organization. Pneumonia. Geneva: WHO; 2023.
2. United Nations Children's Fund (UNICEF). Levels and trends in child mortality report. New York: UNICEF; 2022.
3. Jain S, Self WH, Wunderink RG, Fakhran S, Balk R, Bramley AM, et al. Community-acquired pneumonia requiring hospitalization among U.S. adults. *N Engl J Med*. 2015;373(5):415–427.
4. Bradley JS, Byington CL, Shah SS, Alverson B, Carter ER, Harrison C, et al. The management of community-acquired pneumonia in infants and children older than 3 months of age. *Clin Infect Dis*. 2011;53(7):e25–e76.
5. McIntosh K. Community-acquired pneumonia in children. *N Engl J Med*. 2002;346(6):429–437.
6. Swingler GH. Observer variation in the interpretation of chest radiographs for pneumonia in children. *Lancet*. 2000;355(9204):451–452.
7. Claessens YE, Debray MP, Tubach F, Brun AL, Rammaert B, Hausfater P, et al. Early chest computed tomography scan to assist diagnosis and guide treatment decision for suspected community-acquired pneumonia. *Thorax*. 2015;70(10):962–968.
8. Self WH, Courtney DM, McNaughton CD, Wunderink RG, Kline JA. High discordance of chest X-ray and CT for detection of pulmonary opacities. *JAMA Intern Med*. 2013;173(13):1263–1269.
9. Shah SN, Bachur RG, Simel DL, Neuman MI. Does this child have pneumonia? The rational clinical examination systematic review. *JAMA*. 2017;318(5):462–471.
10. Prina E, Ranzani OT, Torres A. Community-acquired pneumonia. *Lancet*. 2015;386(9998):1097–1108.
11. Lynch T, Bialy L, Kellner JD, Osmond MH, Klassen TP, Durec T, et al. A systematic review on the diagnosis of pediatric bacterial pneumonia. *Pediatrics*. 2004;113(3):e186–e195.
12. Mahabee-Gittens EM, Grupp-Phelan J, Brody AS, Donnelly LF, Bracey SE, Duma EM. Identifying children with pneumonia in the emergency department. *Pediatrics*. 2005;115(3):e336–e342.
13. Donnelly LF. Maximizing the usefulness of imaging in children with community-acquired pneumonia. *Radiology*. 2001;218(3):645–646.
14. Neuman MI, Lee EY, Bixby S, Diperna S, Hellinger J, Markowitz R, et al. Variability in radiographic interpretation of pneumonia in children. *Pediatrics*. 2012;130(3):e543–e550.
15. Elemraïd MA, Muller M, Spencer DA, Rushton SP, Gorton R, Thomas MF, et al. Accuracy of the interpretation of chest radiographs for pediatric pneumonia. *Thorax*. 2014;69(3):239–244.
16. Florin TA, Plint AC, Zorc JJ. Viral bronchiolitis. *JAMA Pediatr*. 2020;174(3):e195363.
17. Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, et al. British Thoracic Society guidelines for the management of community-acquired pneumonia in children. *Thorax*. 2011;66(Suppl 2):ii1–ii23.
18. Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. *Bull World Health Organ*. 2008;86(5):408–416.
19. Hazir T, Nisar YB, Qazi SA, Khan SF, Raza M, Zameer S, et al. Chest radiography in children with pneumonia. *Lancet*. 2006;367(9517):303–309.
20. Cherian T, Mulholland EK, Carlin JB, Ostensen H, Amin R, de Campo M, et al. Standardized interpretation of pediatric chest radiographs. *Bull World Health Organ*. 2005;83(5):353–359.
21. Biagi C, Pierantoni L, Baldazzi M, Greco L, Dormi A, Dondi A, et al. Lung ultrasound for the diagnosis of pneumonia in children. *BMC Pulm Med*. 2018;18(1):1–8.
22. Ciuca IM, Pop LL, Cristea AI, Pop TL. Imaging in pediatric pneumonia. *Children (Basel)*. 2021;8(6):1–12.
23. Ru Q, Liu S, Wang J, Liu X. Diagnostic accuracy of lung ultrasound vs chest radiography. *Postepy Dermatol Alergol*. 2023;40(2):234–240.
24. Sadiq N, Khan M, Ahmed Z, Ali S. Diagnostic accuracy of chest X-ray in pneumonia. *Pak Armed Forces Med J*. 2023;73(2):456–460.
25. Pereda MA, Chavez MA, Hooper-Miele CC, Gilman RH, Steinhoff MC, Ellington LE, et al. Lung ultrasound for the diagnosis of pneumonia in children. *Pediatrics*. 2015;135(4):714–722.
26. Lissaman C, Kanjanaptom P, Ong C, Tessaro M, Long E. Prospective observational study of lung

- ultrasound for pneumonia. *Arch Dis Child*. 2019;104(1):12–18.
27. Shah VP, Tunik MG, Tsung JW. Prospective evaluation of point-of-care ultrasound. *Pediatr Radiol*. 2017;47(11):1495–1504.
 28. World Health Organization. *Integrated Management of Childhood Illness (IMCI)*. Geneva: WHO; 2021.
 29. United Nations Children’s Fund (UNICEF). *Pneumonia burden report*. New York: UNICEF; 2023.
 30. National Health Mission, Government of India. *Acute Respiratory Infection (ARI) control programme guidelines*. New Delhi: NHM; 2022.