Original Article

A Retrospective Study of Spectrum and Frequency of Radiographic Findings in Community-Acquired Pneumonia

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ABSTRACT

Background: Community-acquired pneumonia (CAP) remains a major cause of morbidity worldwide. Chest radiography continues to be the first-line imaging modality for diagnosis, yet radiographic patterns vary widely.
Objectives: To analyze the spectrum and frequency of radiographic findings in 100 patients diagnosed with community-acquired pneumonia.
Methods: A retrospective descriptive study of 100 chest X-rays of clinically diagnosed CAP cases was conducted. Radiographic findings were categorized into consolidation, interstitial infiltrates, lobar involvement, multilobar disease, pleural effusion, and other ancillary signs.
Results: Consolidation was the most common radiographic finding (67%), followed by interstitial infiltrates (25%). Lobar distribution involved the right lower lobe in 35% and left lower lobe in 22%. Multilobar involvement was seen in 18% of cases. Pleural effusion was present in 12% of patients, predominantly mild. No significant cavitation or pneumothorax was identified.
Conclusion: Consolidation, especially in the lower lobes, remains the predominant radiographic feature of CAP. Understanding the frequency and distribution of findings enhances diagnostic accuracy and supports early management decisions.

Keywords: Community-Acquired Pneumonia, Chest X-rays, Consolidation.

INTRODUCTION

Community-acquired pneumonia (CAP) remains a significant infectious public health challenge worldwide, contributing to substantial morbidity and mortality. Hospital admission rates for pneumonia range from 22% to 51% across global studies, with mortality disproportionately higher in developing and underdeveloped nations. Beyond clinical outcomes, CAP also imposes a considerable socioeconomic burden; even among young, otherwise healthy adults, it accounts for more than 50 million days of restricted activity and stands as the sixth leading cause of death [1,2].

CAP is associated with a broad and evolving spectrum of pathogens, with new microorganisms continually being identified. Furthermore, host responses to infection are influenced by modern medical interventions, emerging therapies, and the increasing prevalence of co-existing diseases. Imaging plays a pivotal role in the diagnosis and management of CAP, with plain chest radiography serving as an essential, accessible, and cost-effective initial investigation in suspected pulmonary infections. In accordance with the American Thoracic Society guidelines, a posteroanterior (PA) chest radiograph—and a lateral view when feasible—should be performed in all adults in whom pneumonia is clinically suspected [3,4].

Radiographic manifestations of CAP may vary widely depending on the causative organism, host immune status, and disease severity. Identifying common patterns—such as lobar consolidation, interstitial infiltrates, air bronchograms, and pleural effusion—helps clinicians differentiate CAP from alternative diagnoses such as pulmonary edema, tuberculosis, or malignancy.

This study aims to evaluate the spectrum and frequency of radiographic findings among 100 chest X-rays of patients diagnosed with CAP in our institution.

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MATERIALS AND METHODS
Study Design
A retrospective descriptive study conducted in the Department of Respiratory Medicine.

Sample Size
100 chest X-ray (posteroanterior view wherever possible) images from clinically diagnosed CAP patients.

Inclusion Criteria
- Adults ≥18 years
- Clinical diagnosis of community-acquired pneumonia
- Chest X-ray performed at presentation

Exclusion Criteria
- Hospital-acquired pneumonia
- Immunocompromised patients (HIV, long-term steroids, transplant)
- Patients with pre-existing chronic lung disease with overlapping radiographic changes
- Incomplete or poor-quality radiographs

Radiographic Assessment
Each X-ray was evaluated independently by two radiologists. Findings were categorized as:
- Consolidation
- Interstitial infiltrates
- Air bronchograms
- Lobar/segmental distribution
- Multilobar involvement
- Pleural effusion
- Additional findings (cavitation, atelectasis, cardiomegaly)

Discrepancies were resolved by consensus.

Statistical Analysis
Descriptive statistics (frequency, percentage) were used to summarize findings.

RESULTS
Demographics
- Mean age: 47.8 ± 15.2 years
- Male-to-female ratio: 1.4:1

Table:1 - Major Radiographic Findings

Radiographic Finding	Frequency (n=100)	Percentage
Consolidation	67	67%
Interstitial infiltrates	25	25%
Air bronchograms	41	41%
Multilobar involvement	18	18%
Pleural effusion	12	12%
Cavitation	2	2%
Atelectasis	5	5%

Table:2 - Lobar Distribution of Consolidation

Lobe	Cases	Percentage
Right lower lobe	35	35%
Left lower lobe	22	22%
Right upper lobe	7	7%
Left upper lobe	4	4%
Middle lobe involvement	6	6%

Lower lobe predominance was seen in 57% of patients.

Pleural Effusion

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- Mild: 10 cases
- Moderate: 2 cases
- No cases of massive effusion

DISCUSSION

The present study provides a comprehensive evaluation of radiographic patterns observed in community-acquired pneumonia (CAP) and demonstrates that consolidation, particularly in the lower lobes, remains the predominant imaging finding. These results are consistent with the classic radiological presentation of bacterial pneumonia described in earlier epidemiological studies, where lobar consolidation is frequently reported as the hallmark of pneumococcal and other bacterial pneumonias.

The high prevalence of consolidation (67%) in our cohort aligns closely with patterns described in previous radiological reviews, including those by Nambu et al., who emphasized that typical bacterial pathogens—especially *Streptococcus pneumoniae*—commonly produce dense lobar opacities on chest X-ray [5]. Similarly, the study by Sowmya et al. (2025) reported that lobar consolidation was the most common radiographic pattern (55.3%) among 150 CAP cases, reinforcing that consolidation remains the dominant imaging feature in contemporary clinical settings [6].

The lower-lobe predominance (57%) observed in our study has also been described across multiple studies. Ali (2020) noted frequent involvement of right-sided zones, especially the right upper and middle zones, but lower-lobe disease remained common [7]. The anatomical predisposition of lower lobes—owing to gravity-dependent ventilation and aspiration tendency—has been widely recognized in the literature as a major factor for this distribution.

Air bronchograms, found in 41% of cases, further support alveolar disease. This radiographic sign is frequently associated with CAP and is considered a useful differentiator from non-infectious causes of opacification, such as atelectasis or malignancy. Nambu et al. highlighted the diagnostic value of air bronchograms, especially in distinguishing pneumonic consolidation from obstructive atelectasis [5].

The interstitial infiltrates identified in 25% of our radiographs may correspond to atypical pathogens such as *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, or viral infections. This is consistent with findings from Tsai et al. (2022), who reported mixed radiographic presentations in severe CAP, with atypical pathogens contributing significantly to interstitial and diffuse alveolar patterns [8]. Advanced radiological reviews also indicate that early-stage CAP or partially treated infections may initially manifest with interstitial changes before progressing to consolidation.

Multilobar involvement (18%) in our study is clinically relevant because multilobar disease is often associated with severe CAP and worse outcomes. Studies by Hati et al. (2025) and Tsai et al. (2022) similarly noted that multilobar involvement correlates with higher inflammatory markers, increased hospitalization rates, and the need for intensive care support [9,8]. Furthermore, Ali (2020) also demonstrated a significant relationship between multilobar involvement and severity indicated by CURB-65 scoring.

Pleural effusion, observed in 12% of our cases—predominantly mild—is within expected ranges reported in CAP literature. While Nambu et al. reported effusions as a frequent associated finding in both typical and atypical pneumonia, they tend to occur more commonly in bacterial infections and often indicate a more advanced phase of disease. Sowmya et al. also reported cavitary consolidation in fungal and polymicrobial infections, though this was uncommon in bacterial CAP, which supports our finding of minimal cavitation (2%).

Radiographic variability across patients highlights the importance of integrating imaging findings with clinical and microbiological data. Advanced neural network and artificial intelligence tools for pneumonia detection emphasize that radiographic patterns may overlap significantly among different etiologies, reinforcing the need for expert interpretation. Even so, chest radiography remains indispensable as the first-line imaging modality due to its accessibility, cost-effectiveness, and rapid diagnostic utility, as outlined in studies on imaging algorithms for CAP [10].

Taken together, the findings of our study closely reflect the established radiographic spectrum of CAP described across multiple global studies. Lower-lobe consolidation remains the dominant pattern; interstitial infiltrates, multilobar disease, and pleural effusions serve as important indicators of disease variability, severity, and potential pathogen involvement. Continuous documentation of these radiographic trends is essential, particularly in the context of emerging pathogens, antimicrobial resistance, and evolving epidemiology

CONCLUSION

This study reinforces that consolidation—particularly in the lower lobes—is the most frequent radiographic abnormality in patients with community-acquired pneumonia. The distribution and spectrum of radiographic findings closely align with established evidence, reaffirming the diagnostic value of chest radiography as a first-line imaging tool. Although advanced

imaging techniques and microbiological diagnostics continue to evolve, the chest X-ray remains essential for early recognition, pattern identification, and guiding initial management decisions. Continued assessment of radiographic trends is vital as new pathogens emerge and clinical presentations evolve.

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