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Original Research Article

Clinical, Radiological and Bacteriological Profile of Community Acquired Pneumonia: A Cross-Sectional Study

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Abstract

Background: Community acquired pneumonia (CAP) is a major cause of morbidity and mortality globally, particularly affecting individuals with comorbidities. Understanding the clinical presentation, radiological features, and bacteriological profile is essential for appropriate management and reducing mortality. Our aim is to evaluate the clinical, radiological, and bacteriological characteristics of patients admitted with community acquired pneumonia and to identify the prevalent causative microorganisms.

Methods: A cross-sectional study was conducted over one year involving 50 patients admitted with CAP at Government Dharmapuri Medical College Hospital. Patients aged above 12 years with clinical and radiological evidence of pneumonia were included. Detailed clinical evaluation, sputum culture, blood culture, chest radiography, and CT chest were performed.

Results: The study comprised 74% males and 26% females, with 62% of patients aged above 50 years. Streptococcus pneumoniae was the most common pathogen (56%), followed by Klebsiella (14%) and Staphylococcus (10%). Gram-positive organisms predominated (66%) over gram-negative organisms (22%). Common risk factors included smoking (56%), COPD (50%), diabetes mellitus (42%), and alcoholism (44%). Right lower lobe involvement was most frequent (32%). Hospital stay averaged 6-8 days, with 94% discharge rate and 6% mortality.

Conclusion: Streptococcus pneumoniae remains the predominant pathogen causing CAP in our region. Advanced age, smoking, COPD, and diabetes mellitus are significant risk factors. Early identification and appropriate empirical therapy can improve outcomes.

Keywords: Community acquired pneumonia, Streptococcus pneumoniae, bacteriological profile, sputum culture, chest radiography.

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Introduction

Pneumonia is a major cause of mortality and morbidity worldwide, ranking next to diarrhea among acute infectious diseases. It affects all age groups but particularly impacts children under five years and elderly individuals. Community acquired pneumonia (CAP) is defined as infection of lung parenchyma acquired outside the hospital setting.

The burden of pneumonia is substantial, with approximately 1.1 million hospitalizations reported annually in the United States, resulting in over 50,000 deaths. In India, lower respiratory tract infections account for approximately 20% of mortality due to infectious diseases according to the World Health Organization. Despite its significance, systematic epidemiological studies on pneumonia incidence in India remain limited. The etiology of CAP is diverse, encompassing bacterial, viral, fungal, and atypical organisms. Among bacterial causes, Streptococcus pneumoniae is the most common pathogen, followed by Haemophilus influenzae, Staphylococcus aureus, and gram-negative bacilli such as Klebsiella pneumoniae and Pseudomonas aeruginosa.

The emergence of multidrug-resistant pathogens due to inappropriate antibiotic use has complicated the management of CAP, leading to healthcare-

associated pneumonia in some cases. Several factors predispose individuals to CAP, including advanced age, immunocompromised states (diabetes mellitus, HIV infection), chronic lung diseases (COPD, bronchiectasis), cigarette smoking, and alcoholism. These comorbidities not only increase susceptibility but also worsen disease outcomes. Clinical presentation typically includes fever, cough with purulent sputum, pleuritic chest pain, and dyspnea. However, atypical presentations, particularly in elderly patients, can delay diagnosis and treatment.

Diagnosis of CAP relies on clinical assessment, radiological evidence, and microbiological confirmation. Chest radiography remains the primary imaging modality, while sputum culture and Gram staining provide etiological diagnosis. However, the yield of blood culture is relatively low (5-14%), and many patients have already received antibiotics before culture collection, affecting diagnostic accuracy.

Appropriate severity assessment using scoring systems like CURB-65 (Confusion, Urea, Respiratory rate, Blood pressure, Age ≥65 years) guides decisions regarding outpatient versus hospital management and identifies patients requiring intensive care. Despite advances in antimicrobial therapy, CAP continues to be associated with significant morbidity and mortality, particularly in elderly patients and those with multiple comorbidities.

Understanding the local epidemiology and bacteriological profile of CAP is essential for initiating appropriate empirical therapy and improving patient outcomes. Our aim is to evaluate the clinical, radiological, and bacteriological characteristics of patients admitted with community acquired pneumonia and to identify the prevalent causative microorganisms.

Materials and Methods

Study Design and Setting: This was a cross-sectional observational study conducted at the Government Dharmapuri Medical College and Hospital over a period of one year. The study included patients attending the medicine outpatient department and those admitted to medical wards with clinical and radiological evidence of community acquired pneumonia.

Study Population and Sample Size: A total of 50 patients diagnosed with community acquired pneumonia were enrolled in the study based on predefined inclusion and exclusion criteria.

Primary data was collected directly by the principal investigator from patients after obtaining informed written consent. The study excluded minors, pregnant women, mentally ill individuals, and non-volunteering patients.

Inclusion Criteria: Patients included in the study were: (1) aged more than 12 years; (2) presenting with clinical features suggestive of pneumonia including fever (temperature >37.8°C), cough lasting less than 4 weeks, production of purulent sputum, chest pain, and breathlessness; and (3) having radiological evidence of pneumonia on chest X-ray or CT imaging.

Exclusion Criteria: Patients were excluded if they had: (1) hospital-acquired pneumonia; (2) HIV-positive status; (3) active tuberculosis; (4) immunocompromised conditions; (5) aspiration pneumonia; or (6) pulmonary infarction.

Clinical Evaluation: All enrolled patients underwent comprehensive clinical evaluation including detailed history taking and physical examination. Demographic data, presenting symptoms, duration of illness, smoking and alcohol history, and comorbid conditions including diabetes mellitus, hypertension, chronic obstructive pulmonary disease (COPD), and other chronic illnesses were recorded. Physical examination included assessment of vital signs, respiratory system examination for signs of consolidation (crepitations, bronchial breath sounds, dullness on percussion), and evaluation for cyanosis and altered sensorium.

Laboratory Investigations: Blood samples were collected for complete hemogram, renal function tests, and liver function tests. Sputum samples were obtained from all patients for Gram staining and culture sensitivity testing. Adequate sputum samples were defined as those containing less than 10 squamous epithelial cells and more than 25 neutrophils per low power field. Blood cultures were performed before initiation of antibiotic therapy. In patients with pleural effusion, pleural fluid was aspirated and sent for culture and sensitivity testing.

Radiological Evaluation: All patients underwent posteroanterior chest radiography to assess for consolidation, location of lung involvement (lobar, segmental, or multilobar), presence of pleural effusion, and other complications. CT chest imaging was performed in selected cases where chest X-ray findings were equivocal or to better characterize the extent and pattern of pulmonary involvement.

Data Analysis: Data were analyzed using appropriate statistical methods. Categorical variables were expressed as frequencies and percentages.

Chi-square test was used to compare categorical variables between age groups. A p-value of less

than 0.05 was considered statistically significant. The mean duration of hospital stay was calculated and compared between age groups using appropriate tests.

Results: bA total of 50 patients with community acquired pneumonia were enrolled in this study. The demographic characteristics, clinical features, bacteriological profile, radiological findings, and outcomes are presented below.

Table 1: Demographic Characteristics of Study Population

Characteristic	Number of Patients (n=50)	Percentage (%)
Age >50 years	31	62
Age <50 years	19	38
Male	37	74
Female	13	26
Mean age (years)	52.4 ± 12.3	-

The study population showed male predominance (74%) with majority of patients (62%) aged above 50 years. The age distribution demonstrated that pneumonia predominantly affected the middle-aged and elderly population, with the highest incidence in the 51-60 year age group (32%) followed by those above 60 years (30%).

Table 2: Clinical Manifestations in Study Population

Clinical Feature	Present (n)	Percentage (%)
Cough	50	100
Fever	49	98
Expectoration	49	98
Crepitations	49	98
Bronchial breath sounds	48	96
Pleuritic chest pain	43	86
Dyspnea	43	86
Hemoptysis	8	16
Cyanosis	8	16
Altered sensorium	3	6
Pleural effusion	3	6

Cough was universally present in all patients (100%), making it the most consistent clinical feature. Fever (98%), expectoration (98%), and crepitations on auscultation (98%) were present in nearly all patients.

Pleuritic chest pain and dyspnea were observed in 86% of patients each. Hemoptysis and cyanosis were relatively uncommon, present in only 16% of cases. Altered sensorium and pleural effusion were rare complications, seen in 6% of patients each.

Statistical analysis showed that pleuritic chest pain (p=0.049), dyspnea (p=0.049), and cyanosis (p=0.016) were significantly more common in patients aged above 50 years.

Table 3: Risk Factors and Comorbidities Associated with CAP

Risk Factor/Comorbidity	Total (n=50)	Percentage (%)	P-value*
Smoking	28	56	0.033
Chronic Obstructive Pulmonary Disease	25	50	0.001
Alcoholism	22	44	0.010
Diabetes Mellitus	21	42	0.001
Hypertension	18	36	0.481
*Comparison between age >50 vs <50 years			

Smoking was the most prevalent risk factor, affecting 56% of the study population. Half of the patients (50%) had underlying COPD. Alcoholism was present in 44% of patients, while diabetes mellitus affected 42%. Hypertension was noted in 36% of cases. Statistical analysis revealed that smoking (p=0.033), COPD (p=0.001), alcoholism (p=0.010), and diabetes mellitus (p=0.001) were significantly more common in patients aged above 50 years compared to younger patients. The strong association between gram-negative organisms and both smoking (63%) and COPD (63%) was particularly noteworthy, suggesting that these risk factors predispose to more resistant pathogens.

Table 4: Bacteriological Profile of Community Acquired Pneumonia

Organism Isolated	Number of Patients	Percentage (%)
Streptococcus pneumoniae	28	56
Klebsiella pneumoniae	7	14
Staphylococcus aureus	5	10
Pseudomonas aeruginosa	4	8
Escherichia coli	1	2
Mixed growth	2	4
No growth	3	6
Total	50	100

Streptococcus pneumoniae was the predominant pathogen, accounting for 56% of cases, confirming its status as the leading cause of community acquired pneumonia.

Klebsiella pneumoniae was the second most common organism (14%), followed by Staphylococcus aureus (10%) and Pseudomonas aeruginosa (8%). Gram staining revealed 66% gram-positive organisms and 22% gram-negative organisms. Sputum culture yielded organisms in 94% of cases, while blood culture was positive in only 2% of patients. Pleural fluid culture showed growth in 4% of cases. The low yield of blood culture reflects the difficulty in obtaining samples before antibiotic initiation and the relatively low rate of bacteremia in CAP.

Table 5: Radiological Pattern of Lung Involvement

Site of Consolidation	Chest X-ray (n=50)	CT Chest (n=50)	Percentage (X-ray)
Right lower lobe	16	16	32
Bilateral	12	17	24
Left lower lobe	12	11	24
Right upper lobe	4	4	8
Left upper lobe	4	2	8
Normal	2	0	4

Right lower lobe involvement was most common, accounting for 32% of cases on chest X-ray and maintained in CT chest. Bilateral involvement was observed in 24% on X-ray but increased to 34% on CT chest, demonstrating the superior sensitivity of CT in detecting multilobar disease. Left lower lobe consolidation was seen in 24% on X-ray and 22% on CT.

Upper lobe involvement was less common, with right upper lobe in 8% and left upper lobe in 8% of cases. CT chest was particularly valuable in detecting early or subtle infiltrates not visible on plain radiography, with only 4% of chest X-rays reported as normal compared to no normal findings on CT chest. The predominance of lower lobe involvement reflects the anatomical predisposition for aspiration and dependent distribution of secretions.

Hospital Stay and Outcomes

The mean duration of hospital stay was 7.78 days (range 6-8 days), with patients aged above 50 years requiring significantly longer hospitalization (8.67 ± 2.15 days) compared to younger patients (6.89 ± 1.1 days; p=0.002). This difference reflects the higher burden of comorbidities and more severe disease in elderly patients. The overall discharge rate was 94% (47 patients), while mortality was 6% (3 patients). All deaths occurred in patients aged above 50 years (p=0.016), highlighting advanced age as a significant predictor of poor outcome. The deceased patients had multiple comorbidities including diabetes mellitus, COPD, and severe bilateral pneumonia with respiratory failure requiring intensive care support.

Discussion

This cross-sectional study evaluated 50 patients with community acquired pneumonia at Government Dharmapuri Medical College Hospital to characterize the clinical, radiological, and bacteriological profile of CAP. The findings provide valuable insights into local epidemiology and can guide empirical antibiotic therapy.

The demographic profile revealed male predominance (74%) and higher incidence in patients aged above 50 years (62%), consistent with previous studies demonstrating increased pneumonia susceptibility in elderly males. The age distribution showed peak incidence in the 51-60 year group (32%), followed by patients above 60 years (30%). This pattern aligns with declining immune function, increased comorbidities, and impaired mucociliary clearance associated with aging. The male preponderance may be attributed to higher rates of smoking and occupational exposures in men.

Clinical presentation was dominated by classic respiratory symptoms. Cough was universal

(100%), while fever, expectoration, and crepitations were present in 98% of patients. Pleuritic chest pain and dyspnea affected 86% each, indicating significant pulmonary involvement. Notably, these symptoms were more prevalent in elderly patients, with statistically significant associations for pleuritic pain (p=0.049), dyspnea (p=0.049), and cyanosis (p=0.016). Hemoptysis (16%) and altered sensorium (6%) were relatively uncommon but indicated severe disease when present. The high consistency of classic symptoms underscores the importance of thorough clinical evaluation in diagnosis.

The bacteriological profile revealed Streptococcus pneumoniae as the predominant pathogen (56%), consistent with global data identifying pneumococcus as the leading cause of CAP. This finding has important therapeutic implications, as empirical therapy should reliably cover pneumococcal infections. Klebsiella pneumoniae emerged as the second most common organism (14%), particularly affecting patients with alcoholism and diabetes mellitus. The presence of Staphylococcus aureus (10%), Pseudomonas aeruginosa (8%), and Escherichia coli (2%) highlights the diverse microbial etiology of CAP. The predominance of gram-positive organisms (66%) over gram-negative organisms (22%) is reassuring, as most empirical regimens provide excellent gram-positive coverage.

A critical observation was the strong association between gram-negative organisms and risk factors such as smoking (63%) and COPD (63%). This correlation suggests that patients with structural lung disease are predisposed to colonization and infection with more resistant pathogens.

This finding has practical implications: empirical therapy for smokers and COPD patients should include coverage for gram-negative organisms, particularly Pseudomonas in severe cases.

Sputum culture demonstrated high yield (94%), emphasizing its value in etiological diagnosis when adequate samples are obtained. In contrast, blood culture was positive in only 2% of cases, consistent with literature reports of 5-14% positivity.

The low blood culture yield likely reflects prior antibiotic exposure, difficulty obtaining samples before treatment initiation, and the relatively low rate of bacteremia in CAP. These findings support targeted blood culture collection in high-risk patients (severe CAP, immunocompromised hosts, ICU admission) rather than routine use. Risk factors and comorbidities were highly prevalent in the study population. Smoking affected 56% of patients, COPD 50%, alcoholism 44%, diabetes mellitus 42%, and hypertension 36%. Statistical analysis confirmed significant associations between advanced age and smoking (p=0.033), COPD (p=0.001), alcoholism (p=0.010), and diabetes mellitus (p=0.001). These findings underscore the importance of addressing modifiable risk factors, particularly smoking cessation counseling. The high prevalence of diabetes mellitus highlights the need for glycemic control in pneumonia management, as hyperglycemia impairs neutrophil function and increases infection risk.

Radiological evaluation demonstrated that right lower lobe involvement was most common (32%), followed by bilateral (24%) and left lower lobe consolidation (24%). This distribution pattern reflects anatomical factors, as the right main bronchus is wider and more vertical, facilitating aspiration of secretions into the right lung. CT chest proved superior to plain radiography in detecting bilateral disease, with 34% bilateral involvement on CT compared to 24% on X-ray. This enhanced sensitivity is particularly valuable in immunocompromised patients or when clinical suspicion remains high despite normal or equivocal radiographs.

Hospital stay duration was significantly longer in elderly patients (8.67 days vs 6.89 days; p=0.002), reflecting increased disease severity and delayed recovery in this population. The overall mortality rate was 6%, exclusively occurring in patients above 50 years (p=0.016). All deaths involved patients with multiple comorbidities and severe bilateral pneumonia progressing to respiratory failure. These findings emphasize the importance of risk stratification using tools like CURB-65 to identify high-risk patients requiring intensive monitoring and aggressive management.

The study has several strengths, including comprehensive clinical, radiological, and bacteriological evaluation of patients. However, limitations include the relatively small sample size, single-center design, and lack of viral pathogen detection. Future multicenter studies with larger populations and molecular diagnostic methods would provide more robust data on local epidemiology.

In conclusion, this study characterizes the clinical, radiological, and bacteriological profile of CAP, demonstrating Streptococcus pneumoniae predominance, high burden of comorbidities, and significant morbidity in elderly patients. These findings can guide development of evidence-based empirical antibiotic protocols tailored to local resistance patterns, potentially improving outcomes and reducing inappropriate antibiotic use.

Conclusion

Community acquired pneumonia predominantly affects males and elderly patients with peak incidence in the 40-60 year age group.

Streptococcus pneumoniae remains the most common causative pathogen (56%), followed by Klebsiella pneumoniae (14%) and Staphylococcus aureus (10%). Gram-positive organisms predominate overall, but gram-negative pathogens are more common in patients with COPD and smoking history.

Clinical presentation is characterized by near-universal presence of cough, fever, and expectoration, with pleuritic pain and dyspnea in the majority. Right lower lobe involvement is the most frequent radiological pattern, though bilateral disease is more common than initially apparent on plain radiography. CT chest demonstrates superior sensitivity in detecting multilobar involvement.

Smoking, COPD, diabetes mellitus, and alcoholism are significant modifiable and non-modifiable risk factors requiring targeted interventions. The association between gram-negative organisms and structural lung disease (COPD, smoking) necessitates broader spectrum empirical coverage in these patients. Sputum culture remains valuable for etiological diagnosis, while blood culture yield is low and should be reserved for high-risk cases.

Advanced age is a significant predictor of prolonged hospital stay and mortality, with all deaths occurring in patients above 50 years. Early recognition, appropriate severity assessment using CURB-65 or similar tools, and prompt initiation of guideline-concordant empirical therapy are essential to improve outcomes. This study provides baseline data on local microbial epidemiology that can inform evidence-based empirical antibiotic protocols and potentially reduce mortality from Community acquired pneumonia.

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