

Clinico-Microbiological Profile of Elderly Patients with Community Acquired Pneumonia Visiting a Tertiary Level Hospital of Nepal

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Abstract

Introduction: Community-acquired pneumonia is an infection of the lung parenchyma acquired in the community or in the hospital within 48 hours of admission. It is a major cause of morbidity and mortality in developed countries worldwide. The aim of this study was to evaluate the clinical and microbiological profiles of elderly patients with CAP.

Methods: This observational cross-sectional study was conducted among 73 patients with CAP who were admitted to the inpatient ward and ICU or visited the medical OPD of a tertiary centre hospital from January 2025 to June 2025. A purposive sampling technique was employed. Clinical and laboratory data from patients satisfying the inclusion criteria were collected using a proforma, entered into, and analyzed using appropriate statistical tools.

Results: The mean age of patients with CAP enrolled in this study was 75.48±6.21 years, ranging from 65 to 91 years, with a female preponderance (53.42%). The majority of patients were smokers (65.75%) and had a history of pneumonia (47.95%). COPD (42.47%) was the most common identified comorbidity, followed by hypertension (23.29%). Culture positivity was present in 24.65% of patients, with the most common isolated organism being *S. pneumoniae* (72.22%), followed by *Pseudomonas* and *Klebsiella* among culture positive cases. Radiologically, the right side (49.32%) and lower zone (83.56%) were the most commonly affected regions.

Conclusion: This study identified the clinical, microbiological, and radiological profiles of elderly patients with community-acquired pneumonia. Females and active smokers constituted a larger proportion of the patients among enrolled patients. Gram staining and culture sensitivity tests should be performed to evaluate the cause of pneumonia.

Keywords: Chest X-Ray, Community Acquired Pneumonia, Comorbidities, Elderly, Streptococcus, Sputum Culture.

Introduction

Pneumonia is an infection that affects the lung tissue. Pneumonia is typically categorized as community-acquired pneumonia (CAP), hospital-acquired pneumonia, or ventilator-associated pneumonia.¹ CAP is a leading cause of morbidity and mortality globally, particularly among the elderly.² Pneumonia is caused by the growth of microbial pathogens in the alveoli and the body's reaction to them. Gram-positive bacteria like *Streptococcus pneumoniae*, *Staphylococcus aureus*, *Haemophilus influenzae* and gram-negative bacilli like *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* are significant pathogens responsible

for CAP. Lung diseases, heart diseases, weight loss, poor functional status, and smoking are independent predictors for CAP in older patients.³ Microbiological testing via sputum examination supports etiologic confirmation, detection of resistant pathogens, and generation of local epidemiologic data that can refine empiric regimens according to local resistance patterns.⁴ In elderly patients with CAP, *Streptococcus pneumoniae* is the most frequently detected pathogen.⁵ Diagnosis in elderly patients is further challenged by atypical or nonspecific presentations, including confusion/ altered mental status or general deterioration that may overshadow classic respiratory symptoms.⁶

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In Nepal, the burden of CAP is rising due to an aging population and increasing prevalence of comorbidities like Chronic Obstructive Pulmonary Disease (COPD).⁷ While global guidelines exist, the microbiological profile of CAP varies significantly by geography. Although studies have been conducted in central Nepal (Kathmandu), there is a paucity of data regarding the clinico-microbiological profile of CAP specifically in the elderly population of Western Nepal. This study aims to evaluate the clinical characteristics, causative agents, and radiological patterns of consolidation of elderly patients with CAP visiting Western Regional Hospital to guide local empirical therapy and prevention strategies.

Methods

This hospital-based descriptive cross-sectional study was conducted in Western Regional Hospital and handles a large volume of patients with community-acquired pneumonia. Ethical approval was obtained from the Institutional Review Committee (IRC) of the Pokhara Academy of Health Sciences (Approval No: 75/081).

Purposive sampling was used in this study. The sample size was determined using Cochran's formula for a finite population. Based on a previous study by Karki et al., the prevalence of pneumonia(p) was estimated at 3.64%.⁸ Given the low estimated prevalence of 3.64%, a standard margin of error (5%) would have yielded an uninformative confidence interval crossing zero. Therefore, a margin of error of 1.8% was selected, approximated as half the expected prevalence, to ensure the confidence interval remains within a meaningful, positive range while maintaining statistical validity for the small finite population. The total population of patients aged ≥ 65 years admitted for pneumonia in the previous year was 88(N). Assuming a 95% confidence level ($Z = 1.96$) the initial sample size calculation indicated a requirement of 415.87 participants(no). After applying the finite population correction for the known population of 88, the final required sample size was calculated to be 73(n).

The inclusion criteria required all participants to be adults aged ≥ 65 years, present with signs or symptoms of pneumonia, acquire pneumonia outside healthcare settings, and have radiological evidence of pneumonia. Exclusion criteria included pneumonia acquired in the hospital, ventilator-acquired pneumonia, or pneumonia in immunocompromised patients like HIV, malignancies or organ transplantation.

Data collection was performed after obtaining approval from the IRC. Informed consent was obtained from all the participants after explaining the purpose of the study. Data were recorded in a proforma designed for the study, which was filled out by the researcher for each patient.

Data were compiled in Microsoft Excel and imported into IBM SPSS Statistics (Version 27.0) for analysis. Descriptive statistics, including mean and standard deviation for continuous variables and frequencies and percentages for categorical variables, were calculated. Data were categorized into demographics (age, sex, ethnicity), clinical parameters (altered mental status, heart rate, respiratory rate, fever, hypoxia), history (smoking status, history of pneumonia, comorbidities), and diagnostic findings (sputum gram stain, sputum culture and sensitivity, radiological location of consolidation).

Results

A total of 73 elderly patients with community acquired pneumonia (CAP) were included in this study. Patients enrolled in this study had a mean age of 75.48 ± 6.21 . The minimum and maximum ages of the patients were 65 and 91 years, respectively. Most of the patients 43(58.90%) were aged between 70 and 79 years, followed by those aged ≥ 80 years (23.29%) and 65-69 years (17.81%). Female constituted a slightly higher proportion (53.42%) compared to males (46.58%). With respect to ethnicity, Janjati patients comprised the largest group (36.99%). The demographic profile is detailed in Table 1.

Table 1: Demographic Profile

Characteristics	Categories	Frequency	Percentage % (n=73)
Sex	Male	34	46.58
	Female	39	53.42
Age (Years)	65-69	13	17.81
	70-79	43	58.90
	≥ 80	17	23.29
Ethnicity	Brahmin	20	27.39
	Chhetri	9	12.33
	Janjati	27	36.99
	Dalit	12	16.44
	Madhesi	5	6.85

Most patients presented with signs of respiratory compromise at admission. Tachypnea (Respiratory Rate of ≥ 20 per minute) was observed in 90.41% of patients. Hypoxia (Oxygen saturation $< 90\%$) was present in 73.97% of patients. Fever was documented in 60.27% of patients while tachycardia (Heart Rate ≥ 100 per minute) was seen in 56.16% of patients. Altered mental status was noted in 12.33% of the patients. The clinical presentation is detailed in table 2.

Table 2: Clinical Presentation

Characteristics	Categories	Frequency	Percentage % (n=73)
Altered Mental Status	Absent	64	87.67
	Present	9	12.33
Heart rate (beats/min)	< 100	32	43.84
	≥ 100	41	56.16
Respiratory rate (breaths/min)	< 20	7	9.59
	≥ 20	66	90.41
Fever ($\geq 99^\circ\text{F}$)	Absent	29	39.73
	Present	44	60.27
Hypoxia($< 90\%$)	Present	54	73.97
	Absent	19	26.03

A history of active smoking was present in 65.75% of patients. Past history of pneumonia was present in 47.95% of patients. Chronic Obstructive Pulmonary Disease was the most common comorbidity observed in 42.47% of patients in this study. A total of 19 patients had more than one comorbid condition. The majority of patients (60.27%) had taken antibiotics before visiting the hospital. The detailed risk factors and comorbidities

data is given in table 3.

Table 3: Risk Factors and Comorbidities

Characteristics	Categories	Frequency	Percentage % (n=73)
Smoking	Absent	25	34.25
	Present	48	65.75
Past History of Pneumonia	Absent	38	52.05
	Present	35	47.95
Co-Morbid Conditions (Some patients had multiple comorbidities so sum exceeds 73)	Chronic Obstructive Pulmonary Disease (COPD)	31	42.47
	Hypertension	17	23.29
	Type 2 Diabetes Mellitus (DM)	7	9.59
	Chronic Liver Disease	5	6.85
	Bronchial Asthma	3	4.11
	Pulmonary Tuberculosis (PTB)	3	4.11
	Hypothyroidism	3	4.11
	Chronic Kidney Disease	3	4.11
	Heart Failure with Atrial Fibrillation	1	1.37
	Membranous Nephropathy	1	1.37
	Carcinoma Lung	1	1.37
	None	19	26.03

Gram staining of sputum samples demonstrated a high positivity rate, with Gram-positive organisms detected in 89.04% of cases and Gram-negative organisms in 10.96%. However, culture positivity was observed in only 24.65% of patients. Among culture-positive isolates (n = 18), *Streptococcus pneumoniae* was the most frequently identified organism (72.22%), followed by *Pseudomonas* species (16.67%) and *Klebsiella* species (11.11%). The data is illustrated in Figure 1 and Figure 2.

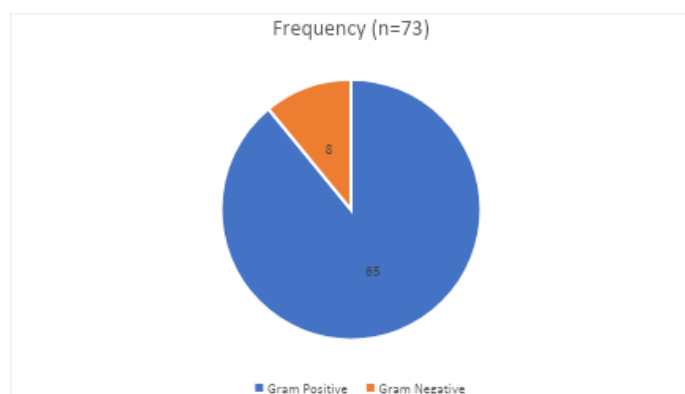


Fig 1: Distribution according to gram staining

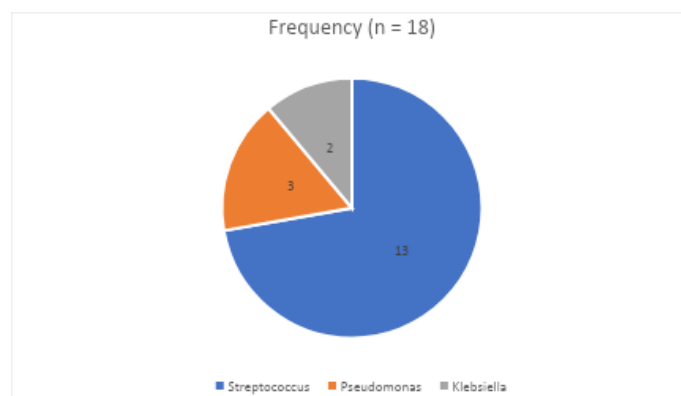


Fig 2: Distribution according to Culture reports

Radiographic evaluation revealed that the right lung was more commonly involved (49.32%) compared to the left lung (39.73%), while bilateral involvement was seen in 10.95% of patients. With respect to zonal distribution, lower lung zone involvement predominated (83.56%), followed by middle zone (12.33%) and upper zone (4.11%).

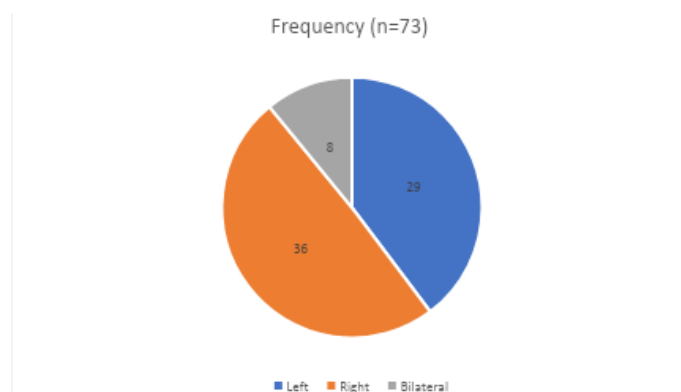


Fig 3: Distribution on basis of side of lung

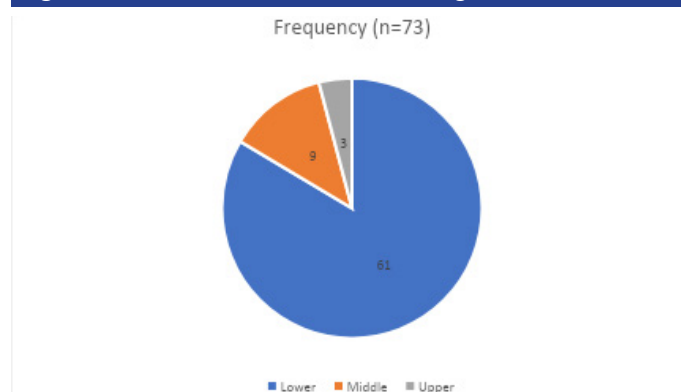


Fig 4: Distribution on basis of zone of lung

Discussion

Community-acquired pneumonia (CAP) is a leading cause of hospitalization and mortality in the elderly.⁹ The mean age of patients in our study was higher than the study conducted by Karki et al. where the mean was 70.57±10.21.⁸ In another study by Zalacain et al., the mean age was similar to that in our study.¹⁰ This consistency validates our study population as representative of the typical clinical presentation described in international literature. Another study by LV in China showed

a higher mean age of 79.8 ± 8.8 years.¹¹ Overall, the relatively higher mean age in our sample highlights that our results are particularly applicable to older elderly patients.

The female preponderance observed in our cohort parallels the findings of Karki et al.⁸ This similarity is significant because it corroborates the demographic shift known as the 'feminization of aging,' indicating that women constitute a larger proportion of the geriatric population seeking healthcare in this setting. However, in other studies conducted by Zalacain R, Shrestha R and LV et al., males were more predominant than females.¹⁰⁻¹² These differences may stem from variations in health-seeking behavior or regional risk factors specific to the male populations in those studies.

Smoking prevalence in our cohort (65.75%) was comparable to Karki et al. (64.29%), reinforcing smoking as a key modifiable risk factor.⁸ This consistency reinforces the strong epidemiological association between smoking and pneumonia. The high prevalence observed across both studies underscores the significant burden of tobacco use as a modifiable risk factor, highlighting the urgent need for targeted smoking cessation interventions in this patient population.

Our observation that 42.47% of patients had comorbid COPD resonates with the findings of Karki et al.⁸ In a study by Zalacain R et al showed respiratory disease was observed in 42% of patients which is in accordance with our study.¹⁰ Another study by Shah et al. showed that the prevalence of COPD was 43%.¹³ This consistency validates the significant burden of chronic lung disease in CAP patients. Clinically, this underscores the necessity of optimizing COPD management to reduce pneumonia risk and potentially tailoring empirical antibiotic therapy to cover pathogens frequently associated with COPD patients. In other study by Shirley Paz B et al., 25.16% had comorbidity with diabetes and was the most common comorbidity followed by renal disease and heart failure.¹⁴

The ethnic breakdown largely mirrors the general population of our Western Nepal catchment area. Janjati patients made up the largest group at 36.99%, followed by Brahmin (27.39%), Dalit (16.44%), Chhetri (12.33%), and Madhesi (6.85%). The higher numbers in the Janjati and Brahmin groups likely reflect disparities in healthcare access, outdoor occupational hazards, or heavy exposure to indoor biomass fuels, all known drivers of respiratory infections in Nepal.

Increased respiratory rate was the most common clinical sign we saw. A striking 90.41% of patients had a respiratory rate of 20 breaths/min or higher. Alongside this, 73.97% arrived with hypoxia ($\text{SpO}_2 < 90\%$). These findings suggest severe respiratory compromise and impaired gas exchange.

Only 60.27% of our patients presented with a fever. While this might seem low compared to younger, healthier adults, it perfectly illustrates the blunted immune response expected in older age. Absence of a fever should never be used to confidently rule out pneumonia in geriatric care.

Over half the patients (56.16%) had tachycardia (a heart rate ≥ 100 beats/min). This points to a heavy systemic inflammatory response and increased metabolic demand—likely driven by hypoxia or early sepsis—meaning many of these patients require incredibly close hemodynamic monitoring from the moment they arrive.

12.33% of our patients presented with an altered mental status. In elderly patients, sudden confusion or delirium is frequently the very first warning sign of a severe infection due to lowered physiological reserves. If clinicians wait for a cough or fever and miss these neurocognitive symptoms, it can severely delay life-saving treatment.

We observed a marked dissociation between high Gram stain positivity (89.04%) and low culture yield (24.65%). Several factors may account for this 'culture-negative' phenomenon. Foremost is the likelihood of prior antibiotic administration; many patients (60.27%) in our study had received empirical therapy before hospital admission, which can render bacteria non-viable for culture despite remaining visible on Gram stain. Additionally, the fragility of fastidious organisms like *S. pneumoniae* means that delays in sample transport or processing can result in autolysis and culture failure. This gap highlights the utility of Gram staining as a rapid diagnostic tool, even when culture yield is compromised. The pathogen profile of our study demonstrates a strong concordance with the findings of Shrestha et al., who reported a similar culture positivity rate of 24% with *S. pneumoniae* as the leading isolate (62.5%).¹² This similarity is significant as it corroborates the continued dominance of *S. pneumoniae* in this demographic, suggesting that empirical antibiotic regimens targeting pneumococcal infections remain appropriate for our local population. The presence of Gram-negative bacilli is notable and is likely associated with the high prevalence of COPD in our elderly cohort. This aligns with global trends where elderly patients with comorbidities are at higher risk for Gram-negative infection compared to the general population. Another study conducted by Shah et al. showed higher culture positivity where the culture positivity (38.88 %) and showed *Klebsiella* present in 21.05% of cases, followed by *Pseudomonas* and *Escherichia*.¹³ However, this could be due to the reporting of both blood and sputum cultures in that study. Another study by Bhattacharya et al. showed sputum positivity in 75% of cases, with the most common organism being *Streptococcus pneumoniae* in 41.40% of patients.¹⁵ Despite these variations, the data from our study serves as a vital epidemiological update, highlighting the specific burden of pneumococcal disease in this setting and underscoring the need for targeted stewardship to maintain susceptibility in these key pathogens.

Radiological findings in our study was similar to a study conducted by Shah et al. where 56.82% of patients showed right-sided pneumonia and 72.72% showed lower lobe preponderance, followed by middle and upper lobes.¹³ The similarity between these studies validates the external consistency of our data and reinforces the established anatomical understanding of pneumonia pathogenesis. Anatomically, the right main bronchus is wider and more vertical than the left, facilitating the gravity-dependent aspiration of pathogens and predisposing the right lower lobe to infection.

Conclusion

This study delineates the clinico-microbiological and radiological profile of community-acquired pneumonia among elderly patients. Pneumonia was observed more frequently in older females than males. Microbiologically, *Streptococcus pneumoniae* remained the predominant etiological agent in Western Nepal; however, Gram-negative organisms also accounted for a substantial proportion of cases, underscoring

the importance of maintaining broader pathogen coverage in this setting. A high prevalence of smoking and chronic obstructive pulmonary disease (COPD) was noted, suggesting that these factors may represent key contributors to disease burden in this population. The observed discordance between Gram stain and culture findings highlights a potential impact of prior antibiotic exposure and reinforces the need to consider antecedent antimicrobial use when interpreting microbiological investigations. Radiologically, right-sided lung involvement was more common than left-sided involvement, with the lower zones being most frequently affected. However, the relatively small sample size, convenience sampling, and cross-sectional design may limit the generalizability and causal interpretation of the findings. Prior antibiotic use and reliance mainly on sputum-based microbiological methods may have reduced culture yield and underestimated pathogen diversity. Despite these limitations, the study offers valuable region-specific data that can guide empirical therapy and serve as a foundation for larger multicenter studies in the future.

Conflict of Interest: None

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