CLINICAL, BACTERIOLOGICAL AND RADIOLOGICAL STUDY OF COMMUNITY ACQUIRED PNEUMONIA CASES AT TERTIARY MEDICAL CENTER IN KATHMANDU, NEPAL

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ABSTRACT

Community-acquired pneumonia (CAP) remains a common and serious illness, in spite of the availability of potent new antimicrobials and effective vaccines. Despite Nepal being one of the four developing countries accounting for 40.0% of global acute respiratory infections, studies on CAP are limited and the status of adult pneumonia in our community is unknown. This cross-sectional study reviewed the clinical, bacteriological, radiological profile of 100 cases of adult CAP and followed them during the hospital stay for the outcome. The age group with the highest incidence was 60-79 years with females (55.0%) being more affected than males (45.0%). Risk factors were present in 86.0% of cases, chronic obstructive pulmonary disease (COPD), and smoking was the most common, each present in 43.0% of cases. The most common presenting feature was cough (89.80%) followed by sputum production (78.60%), fever (67.30%), shortness of breath (63.30%), chest pain (38.80%), gastrointestinal symptoms (26.50%), altered sensorium (13.30%), and hemoptysis (13.30%). Only 48.0% of patients had leukocytosis. Klebsiella pneumoniae was the most frequent organism isolated (n=4) followed by Pseudomonas aeruginosa (n=3). Fungi were isolated in 3 cases. Lobar pneumonia was seen in 99.0% of cases with the right lower zone being the most commonly involved zone on chest x-ray. Severe pneumonia with CURB-65 (confusion, blood urea nitrogen, respiratory rate, blood pressure, age>65) Score ≥3 was seen in 15.0% of cases. The mean hospital stay was 7.55 days with 28 cases requiring ICU admission and 5 cases of mortality.

KEYWORDS

CAP, risk factor, clinical feature, causative organism, chest x-ray, outcome

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INTRODUCTION

Pneumonia is an infection of the pulmonary parenchyma.[1] It can be categorized as either community-acquired pneumonia (CAP) or healthcare-associated pneumonia (HCAP), with subcategories of HCAP including hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP).[1] Community-acquired pneumonia (CAP) is a syndrome in which acute infection of the lungs develops in persons who have not been hospitalized recently and have not had regular exposure to the healthcare system.[2]

Community-acquired pneumonia (CAP) remains a common and serious illness, despite the availability of potent new antimicrobials and effective vaccines. In developing countries, CAP is still a leading cause of childhood mortality and the most common cause of adult hospitalization. It is estimated that Nepal, India, Bangladesh, and Indonesia account for 40.0% of global acute respiratory infections.[3] In Nepal, the incidence of pneumonia was 147 per 1000 under 5 children in 2015/2016 (2072/2073 FY).[4] However, the data on the incidence of adult pneumonia is not available.

In the United States, pneumonia is the sixth leading cause of death and the number one cause of death from infectious diseases. Up to 5.6 million cases of CAP occur annually, and as many as 1.1 million of these require hospitalization. Among patients with CAP who require hospitalization, the mortality rate averages 12.0% overall.[5]

Streptococcus pneumoniae remains the most common cause of CAP. Other bacteria include *Haemophilus influenzae*, *Staphylococcus aureus*, *Moraxella catarrhalis*, *Pseudomonas aeruginosa*, and other gram-negative bacilli. The order of their importance depends on the location and population studied. The causative agent remains unidentified in 30.0% to 50.0% of cases.[6] Typically CAP is characterized by a newly recognized lung infiltrate on chest imaging together with fever, cough, sputum production, shortness of breath, physical findings of consolidation, and leukocytosis, although, the presentation can differ with age and the presence of associated risk factors.

A shift in the epidemiology, antibiotic efficacy, and outcomes of infectious diseases including CAP have been observed due to the widespread use of antibiotics and early access to health care. In our community, very limited studies on CAP have been done and the status of adult pneumonia is unknown. Thus, in this study, we aimed to describe age and sex distribution, risk factors, frequency of clinical features, causative organisms, radiological involvement, and outcome of adult CAP pertinent to our community.

METHODS AND MATERIALS

After obtaining ethical clearance from the Institutional Review Committee, a descriptive cross-sectional study was conducted in CAP cases admitted between January 2018 to June 2018 in the Department of Medicine, Nepal Medical College and Teaching Hospital.

Inclusion Criteria: Age ≥18 years, patients diagnosed as pneumonia by the treating physicians, and radiological evidence of pneumonia without clinical evidence of pneumonia.

Exclusion Criteria: History of hospitalization for ≥48 hours before the presentation, pulmonary tuberculosis, lung malignancy, immunocompromized, and non-compliance of patients.

There were 100 cases that met the criteria and were enrolled in the study after taking informed verbal consent. At the time of admission, a detailed history, examination, complete blood count (CBC), and, chest X-ray were done in all the patients. Leucocytosis of >12,000 per cumm was considered significant. Sputum samples from those with productive cough were subjected to Gram staining. Only those sputum samples which showed more than 25 polymorph nuclear cells (PMN) and less than 10 epithelial cells per low power field were considered adequate for culture and included in the study. Blood culture was done when needed.

All the cases were followed till discharge and their outcome in terms of days of hospital stay, ICU admission, and mortality were noted. Data was collected in a preformed pro forma and analyzed using SPSS version 16.0. The results were reported in terms of mean ± standard deviation, range, and compared with the previous similar studies.

RESULTS

The age of patients ranged from 18 years to 90 years with the mean age of 59.47± 18.52 years. The highest incidence was in the 60-79 years age group (43.0%). The disease was more common in females (55.0%) compared to males (45.0%). The age and sex distribution are illustrated in Fig. 1.

Risk factors- comorbidities and/or habits (smoking, alcoholism) were present in 86.0% of cases. Chronic obstructive pulmonary disease (COPD) and smoking was the most common risk factor, each present in 43.0% of cases followed

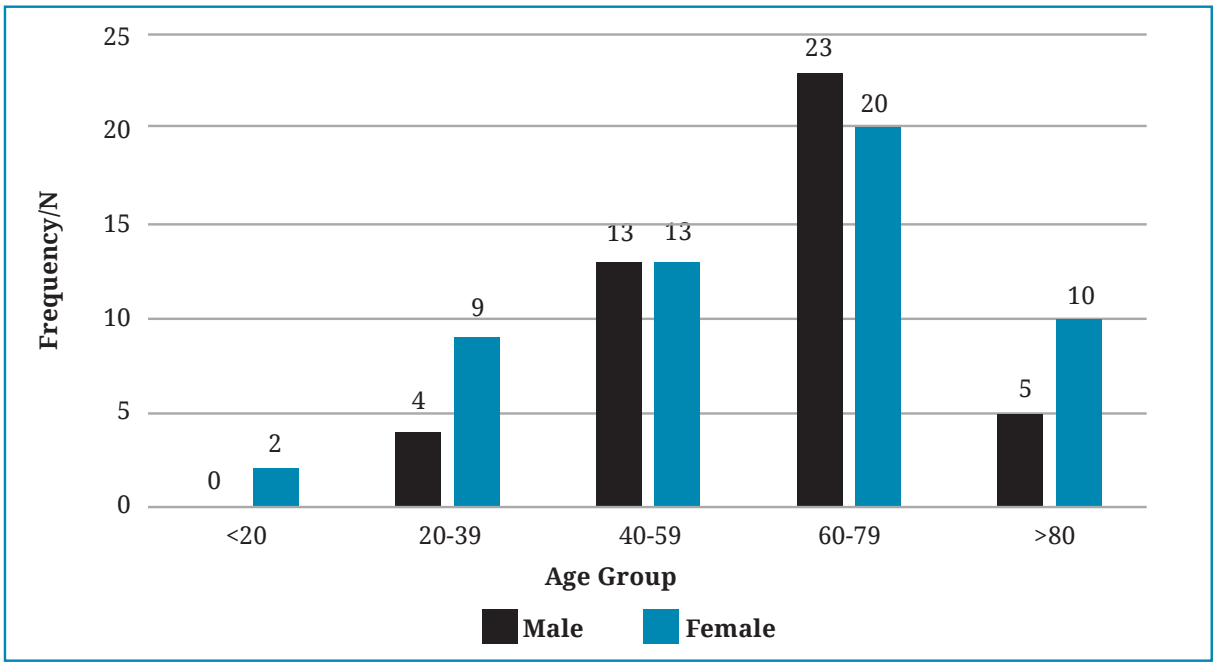

Fig. 1: Age and Sex Distribution

Table 1: LUNG ZONES INVOLVED	
LUNG ZONES	**N (%)**
Right Upper Zone	5 (5.0%)
Right Middle Zone	14 (14.0%)
Right Lower Zone	56 (56.0%)
Left Upper Zone	5 (5.0%)
Left Middle Zone	12 (12.0%)
Left Lower Zone	40 (40.0%)

by alcoholism (36.0%), kidney disease (19.80%), neurological disease (17.40%), cardiac failure (14.0%), diabetes (11.60%) and liver disease (10.50%).

Majority of patients presented with the complaint of cough (89.80%) followed by sputum production (78.60%), fever (67.30%), shortness of breath (63.30%), chest pain (38.80%), gastrointestinal (GI) symptoms (26.50%), altered sensorium (13.30%), and hemoptysis (13.30%). The most symptomatic age group was 60-79 years.

Only 48.0% of patients had leukocytosis with a mean total leucocyte count (TLC) of 17,119.17 and a range of 12,170 to 29,240. Among 100 cases, 11 had a non-productive cough. Sputum from rest 89 cases was sent for Gram staining. Based on the criteria for adequate sputum sample for culture (containing >25 polymorphonuclear cells and < 10 epithelial cells per low power field), 59.50% (n=53) were inappropriate and not included in the study. Among the 36 sputum cultures done, 14 showed growth. Blood culture was sent in 29 cases yielding positive culture in 5- *P. aeruginosa* in one (n=1), *Staphylococcus aureus* in one (n=1), and coagulase-negative staphylococcus species, CoNS in three cases (n=3). Due to the inadequacy of sputum samples collected from these cases, the blood isolates and their antibiotic sensitivity could not be compared to support the source of bacteremia. Of the total 19 culture-positive cases (sputum and blood), *Klebsiella pneumoniae* was the most frequent organism isolated (n=4) followed by *P. aeruginosa* (n=3), CoNS (n=3), *Escherichia coli* (n=2), *H. influenzae* (n=1) and *Staph. aureus* (n=1). Other Gram-negative bacilli isolated were *Citrobacter freundii* (n=1), *Acinebacter calcoaceticus baumanii* complex (n=1). Fungi were isolated in 3 cases with *Candida albicans* in 1 case and Non- *Candida albicans* Candida species in 2 cases. Fig. 2 shows the organisms isolated in sputum and blood culture.

On chest X-ray evaluation, it was found that 99.0% (n=99) of cases had lobar pneumonia, 1.0% (n=1) interstitial pneumonia and no cases of bronchopneumonia. Among the lung zones involved, the right lower zone was the most common (56.0%) followed by left lower (40.0%), right middle (14.0%), left middle (12.0%), and lastly, right and left upper zones were equally involved, each seen in 5.0% cases (Table 1). Pleural effusion was present in 23 cases.

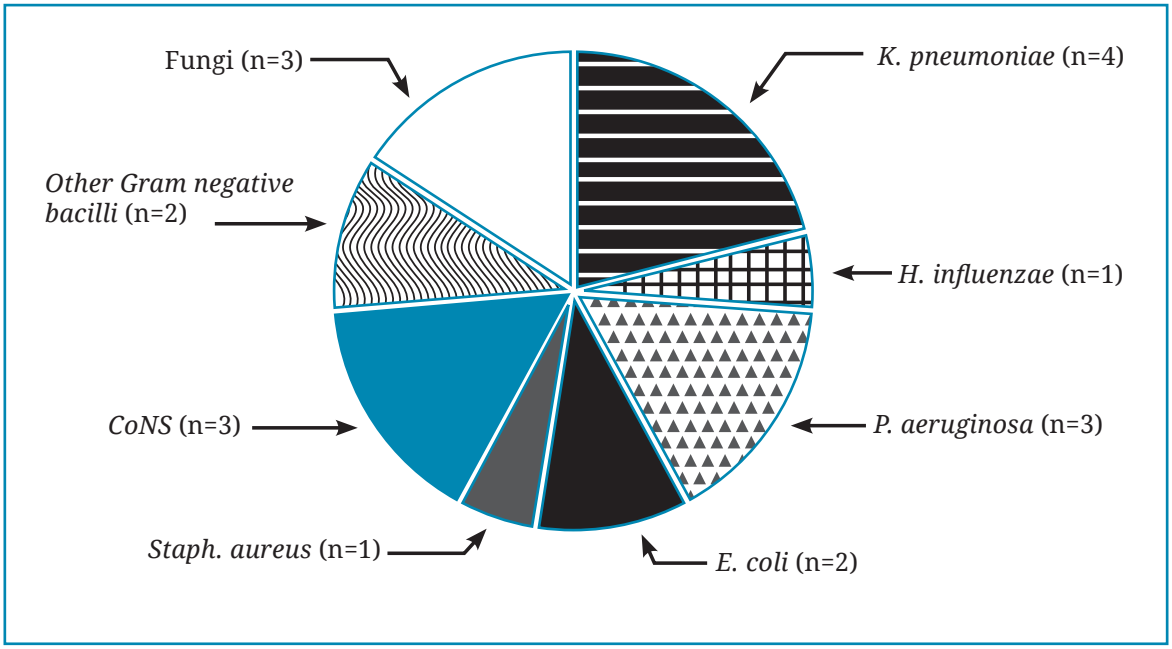

Fig. 2: Organisms Isolated from Sputum and Blood Culture.

The average hospital stay was 7.55± 7.24 days with a range of 1-70 days. Severe pneumonia (CURB-65 pneumonia severity score ≥3) was present in 15.0% of cases. The number of patients requiring ICU admission was 28, and mortality was present in 5.0% of total cases.

DISCUSSION

In our study, the mean age was found to be 59.47 years, and it is higher than a study conducted in the western region of Nepal (mean age = 51.3 years).[3] The mean age in years ranged from 47.0-54.33 in the Indian study group and from 67.1 to 78.0 in European studies.[7-12] Comparatively lower mean age in our study might be a reflection of the lower life expectancy of our country compared to the developed nations. Studies have repeatedly shown a rise in the incidence of CAP among elderly with a large number of cases clumped after age ≥ 65 years.[13-15] The present study only reinforces this fact as the highest incidence was found in the 60-79 years age group (43.0%). This is often attributed to poor immune defenses and the likelihood of having comorbidities in the elderly.[16,17] We found females (55.0%) to be more affected than males (45.0%). This is similar to the findings of Kejriwal A. et al and Pipalia H.[8,18] However, it stands contrary to the majority of surveys that have consistently shown male predominance.[7, 19, 20]

COPD and smoking, each present in 43.0% of cases, were observed to be the most common risk factors in our study. This parallels with the findings of other studies.[7, 8, 21] The presence of risk factors in 86.0% cases in our survey was significantly higher than what is usually observed.[3, 21] This can be partly explained if we consider the time of year the data was collected. It is a well-known fact that COPD, one of the strong risk factors for CAP, has the highest exacerbation during the winter season. Since most of the data was collected during winter, the study subjects were found to be mostly co-morbid.

In the current study, 89.80% of patients presented with cough while expectoration, fever, and dyspnea were subsequent frequent complaints. This roughly replicates the observations of other studies but figures are not the same. Though fever was the 3rd most common symptom, it was only present in 67.30% cases compared to a range of 90-100% in other studies.[7, 16, 21, 22] This may be due to use of over the counter antipyretics before seeking hospital care which is fairly common in our setting. Also, elderly patients are frequently afebrile and the temperature is deceptively low in the morning due to normal diurnal variation.

Leucocytosis was only present in less than half of the patients (48%). This may be because only a WBC count of more than 12,000 per cumm at the time of admission was considered and those presenting with normal or mild leukocytosis (10,000-12,000 per cumm), who may have developed significant leukocytosis during the course of admission, were not taken into account. Variation in presenting features among different age groups was not observed, unlike some studies which emphasize atypical symptoms such as confusion and altered mental status to be more common among the elderly.[23,24] Although every single patient did not have a constellation of symptoms such as sudden onset of high fever,

cough (with or without sputum production), dyspnea, and chest pain, the majority did have 2 or more symptoms of typical pneumonia along with new pulmonary infiltrate. Complete absence or subtle symptoms were only observed in those with multiple comorbidities, neurological disability, and sick patients requiring intubation who were either unable to report symptoms or had compromised immunity altering their presentation. It has been shown that clinical features poorly correlate with microbial etiology and are only 40% accurate in differentiating typical versus atypical pathogens.[25]

The etiological identification was possible in only 19.0% of cases in the present study. Delayed collection (more than 24 hours after hospital admission) and inadequacy of sputum samples for culture were major reasons for low yield. It has been shown that increasing time lapse between inpatient antibiotic exposure and specimen collection for culture significantly reduces bacterial detection.[26] The yield has been quite variable in different studies with 24.0% in Nepal, 44.80% in Spain, and a range of 45.80-75.0% in different parts of India.[3,7,20,21] *S. pneumoniae* has been consistently identified as the most common pathogen all around the world.[21, 27]At the same time, an increase in the isolation of Gram-negative organisms has raised concerns.[7] In our study, the majority of isolates were Gram-negative organisms (n=14) which can be attributed to the study subjects being mostly elderly and comorbid. Old age, smoking and underlying respiratory disease such as COPD are reported to predispose CAP caused by Gram-negative pathogens.[16, 21] *K. pneumoniae* was the most common organism isolated followed by *P. aeruginosa*. Other studies have also reported *P. aeruginosa* and *K. pneumoniae* to be 2nd or 3rd most common isolated organisms.[16-18] However, the incidence and relative frequency of pathogens in our study may not truly represent their actual frequency because microbiological tests were not performed in all cases and serological test for atypical organisms was not available.

CoNS was isolated from single blood culture in 3 of our cases. Bloodstream infection with CoNS requires at least two blood cultures positive for CoNS within 5 days or one positive blood culture plus clinical evidence of infection.[28] Use of other cues such as time required for growth (shorter time favors infection), recovery of genetically identical isolates has been suggested to differentiate bacteremia from contamination.[29-31] In the cases where CoNS was isolated in our study, repeat blood cultures were not sent and they did not have clinical evidence of CoNS infection such as unresponsiveness to empirical treatment, sepsis and prolonged hospital stay. This indicates contamination rather than causal relation. Likewise, Candida species was isolated in 3 cases, however, primary Candida pneumonia is rare. Lung involvement occurs during the course of dissemination of infection in immunosuppressed patients and presents as multiple microabscesses throughout lung field rather than lobar infiltrate.[32] Thus, absence of other foci of candida infection, neutropenia and corroborative chest x-ray finding in our study subjects suggests isolation of Candida species in culture may only represent colonization of the tracheobronchial tree.[33]

Based on radiological involvement, we had most cases of lobar pneumonia (99.0%, n=99) with 1 case of interstitial pneumonia and no case of bronchopneumonia, and the most commonly involved zone was right lower. This observation is comparable with other studies.[17,20,34] Generally lobar consolidation are considered to be due to the "typical" bacteria, and interstitial infiltrates are due to "atypical" bacteria and nonbacterial causes. However, high interobserver variation and sufficient overlap in radiologic appearance, make it unreliable to differentiate bacterial from nonbacterial pneumonia or typical from atypical bacterial infection based on chest X-ray alone.[25] Mortality was present in 5.0% of cases which is higher compared to 1.0% mortality in western Nepal.[3] However, it falls under the range of 4.0-15.0% observed in several other studies.[20, 21, 22, 35]

Limitation of study: Delayed sample collection (>24 hours after hospital admission), collected specimen unsuitable for culture (PMN<25/ LPF, epithelial cells >10/ LPF), lack of use of urine antigen test for *S. pneumoniae* and *H. influenza* and serological tests to identify atypical organisms and viruses, unavailability of bronchoalveolar lavage to collect specimen in cases with non-productive sputum, and use of antibiotics before reaching tertiary center were major issues in this study affecting the microbiological yield.

In conclusion age more than 60 years, COPD, and smoking are the major risk factors, gram negative organisms are the most common isolates and lobar consolidation is the most frequent radiological evidence in CAP cases in our community. Although we were able to define epidemiological factors and common pathogens, there still remains a question whether the rise of Gram negative isolates represent a true shift in etiology or is just a result of insufficient tests to isolate organisms, rampant use of antibiotics before culture, use of pneumococcal and influenza vaccination among COPD patients and other unidentified factors. This makes room for further studies in the future to map the exact microbiological pattern by addressing the limitations of our study.

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