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Original Research Article

Clinical study of pneumonia cases and antibiotic utilization patterns in hospitalized patients

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Abstract:

Background: Pneumonia is a major respiratory tract infection causing high levels of morbidity, mortality and hospitalization across the globe. The use of antibiotics in the treatment of pneumonia is a critical element in treatment, but irrational use and overuse of broad-spectrum antibiotics can be contributing factors to antimicrobial resistance and sub-optimal clinical outcomes. Hence, antibiotic usage assessment of pneumonia inpatients is necessary to encourage rational use of antibiotics.

Aim: The present study was designed to assess the pneumonia cases and to study the pattern of antibiotic use in hospitalized patients.

Methodology: This was a hospital based retrospective observational study that was carried out for 1-year in the Department of General Medicine, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India , 150 patient records were included in the study for which pneumonia was the diagnosis. Information about the demographic data, clinical symptoms, co-morbid conditions, antibiotic use, route of administration, and hospital length of stay and treatment outcomes was obtained from medical records and prescription charts. Descriptive statistics (frequency and percentage) were used to analyze the data.

Results: The study results showed that patients aged over 60 years had a higher prevalence of pneumonia (39.4%) and males had higher prevalence (58.7%). Fever (88.0%) and cough (84.0%) were the most common symptoms. The most common co-morbidities were hypertension (42.0%) and diabetes mellitus (38.0%). Cephalosporins were most common (40.7%), combination therapy was most common (64.0%) and intravenous administration was most common (74.7%). The majority of patients (84.0%) made a successful recovery and were discharged successfully following treatment.

Conclusion: The study found that rational use of antibiotics and prompt clinical management played an important role in treatment outcome of pneumonia patients in hospital. Prescribing practices and adherence must be monitored continually and antibiotic stewardship principles must be adhered to for minimising complications and antimicrobial resistance.

Keywords: Pneumonia, Antibiotic Usage, Hospitalized Patients, Cephalosporins, Combination Therapy, Antimicrobial Resistance.

Introduction

Pneumonia is a respiratory infection that is a leading cause of disease and death in people of all ages and is a major global cause of morbidity and mortality [1]. It involves the inflammation of lung parenchyma, typically due to infection by bacteria, viruses and fungi, which causes fever, cough, difficulty breathing, chest pain and sputum. Pneumonia is particularly seen in the elderly, in people with weakened immune systems, and in those who have other medical problems such as diabetes mellitus, hypertension and chronic respiratory conditions. Although medical care and antimicrobial therapy have improved, pneumonia remains a public health problem because of the rise in hospitalisation rates, hospital stay and complications of severe infection [2].

Antibiotics are an important part of the management and treatment of pneumonia, particularly if hospitalized. Selecting and using antibiotics appropriately is crucial for good clinical outcomes, lower mortality, less treatment failure and less development of antimicrobial resistance [3]. The irrational prescribing, overuse of broad-spectrum antibiotics and inappropriate combination therapy practices, however, are significant issues in the healthcare environment. Thus, antibiotic

utilization pattern evaluation is crucial to identify antibiotic prescribing trends and to comply with the standard treatment guidelines.

The current study aimed to evaluate pneumonia cases and antibiotic usage pattern of hospitalized patients during one year. The objectives of the study were to describe the clinical and demographic profile of patients with pneumonia, to identify co-morbid conditions associated with pneumonia, to review prescription practices in the use of antibiotics for pneumonia and to determine the outcome of pneumonia treatment [4]. The results of the study could contribute to antibiotic stewardship and better clinical care of pneumonia in the hospital environment [5].

Background of the Study: Despite its high prevalence, increasing hospitalization rates and its high burden in terms of morbidity and mortality, especially in elderly people and those with underlying chronic diseases, pneumonia has continued to be a major health concern worldwide [6]. The condition places a significant burden on health care systems due to its high mortality risk, high level of medical care needed and the use of antibiotics for treatment [7]. In recent years, concerns over irrational use of antibiotics, the overuse of broad spectrum antimicrobials and the problem of antibiotic resistance have grown significantly [8]. Therefore, antibiotic use trends in the treatment of pneumonia have been evaluated to facilitate proper antibiotic prescribing, better treatment outcomes and antimicrobial stewardship programs [9]. The clinical characteristics of patients with pneumonia and the profile of antibiotic use, can be useful to guide the optimisation of therapeutic options and reduce complications from inappropriate antibiotic use.

Pneumonia and Antibiotic Usage Patterns: Pneumonia is a very serious infection of the respiratory tract which is caused by inflammation of the tissues of the lungs and the build up of fluid or pus in the alveoli (air sacs) of the lungs, causing difficulty in breathing as well as impaired gas exchange [10]. The disease can be triggered by different microorganisms such as bacteria, viruses, fungi and atypical pathogens, and bacterial pneumonia is among the most frequent types that require antibiotic treatment. Pneumonia is a disease of all age groups, but older people, people with compromised immune systems, smokers, and those with chronic conditions like diabetes mellitus, hypertension, cardiovascular disorders, and chronic obstructive pulmonary disease (COPD) are at higher risk of developing a more severe infection and complications [11]. Symptoms include fever, cough, production of sputum, shortness of breath, chest pain, tiredness, and weakness. The severity of the disease will determine if the patient will need intensive medical management and hospitalisation for pneumonia treatment. Antibiotics are still the most important treatment for bacterial pneumonia and rapid treatment is essential to minimising the severity of the pneumonia, to preventing complications and enhancing survival rates. The use of antibiotics is a pattern, ranging from choice of antibiotic, frequency of administration, route of administration, length of therapy, to the use of combinations of drugs for pneumonia [12].

In clinical practice, the broad-spectrum antibiotics, e.g. cephalosporins, macrolides, penicillins, fluoroquinolones and carbapenems are commonly used as monotherapy or combination therapy according to the severity of the infection, the clinical status of the patient and the presence of co-morbidities. In severe cases, treatment with intravenous antibiotics is often recommended due to their quick action, and in a hospital setting [13]. Growth of antimicrobial resistance, however, has been driven by irrational prescribing of antibiotics, unnecessary combination therapy, sub-optimal dosage and extended durations of therapy around the world [14]. This is why it is crucial to study antibiotic use patterns for the management of pneumonia to assess the antibiotic prescribing practices, encourage rational antibiotic use, improve the effectiveness of antibiotic management, decrease health care expenditure, and assist antibiotic stewardship programs that aim to reduce emergence of resistant pathogens [15].

Objectives of the Study

1. To evaluate the demographic and clinical profile of hospitalized pneumonia patients including age, gender distribution, and presenting symptoms.
2. To identify the common co-morbid conditions associated with pneumonia cases among hospitalized patients.
3. To assess the pattern of antibiotic utilization in the treatment of pneumonia with respect to antibiotic classes, route of administration, and type of therapy.
4. To analyze the treatment outcomes and duration of hospital stay among pneumonia patients receiving antibiotic therapy.

Methodology: The aim of this study was to assess the clinical profile of the pneumonia cases and to determine the antibiotic utilization pattern of the hospitalized patients. The methodology focused on conducting a systematic analysis of key characteristics of patients and diseases, prescribing practices and outcomes of treatment across the study period. The data collected were structured and observational to ensure reliability and consistency of the data collected.

Study Design: A retrospective observational study design was adopted for the study. The prevalence of pneumonia cases, antibiotic prescribing practices, length of treatment and clinical outcomes were determined through a review of medical records of patients diagnosed with pneumonia.

Using the observational design, the use of antibiotics in real-world clinical settings could be assessed without any impact on antibiotic prescribing by health care professionals.

Study Area: The study was conducted in Department of General Medicine, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India

Study Duration: The study was conducted over a period of one year.

Study Participants: The patients studied were those who were diagnosed with pneumonia and admitted in the selected hospital in the study period.

Inclusion Criteria

- Patients reported as clinically and radiologically proven pneumonia.
- Patients ≥ 18 years of age, both female and male.
- All patients who were admitted to the hospital during the study period.
- Patients who were treated with antibiotic treatment for pneumonia.
- Patients with full clinical and prescription information were included.

Exclusion Criteria

- Patients who do not have a complete or full medical history.
- Patients with tuberculosis, or lung cancer or other chronic respiratory disease, but not pneumonia.
- Pregnant women and children under 18 years of age.
- Patients that left the hospital without finishing the evaluation of the treatment.
- Patients who are under antibiotic treatment for infection (excluding pneumonia).

Sample Size: During the study period a total of 150 pneumonia cases were included in the study, whose patient records were eligible for the study. The sample size was deemed sufficient to assess antibiotic prescribing patterns and treatment patterns among hospitalized pneumonia patients.

Procedure: Patient information was obtained from their medical files and prescription files at the hospitals. Information on the patients was obtained from a data sheet that had relevant information about patients like demographic factors, clinical information, lab results, imaging reports, pneumonia types, co-morbidities, duration of stay, prescribed antibiotics.

The details of antibiotic used included type of antibiotic, dosing form, frequency, duration, type of monotherapy or combination drug therapy and route of administration. The appropriateness of antibiotic was determined using standard treatment guidelines and practices by physicians on antibiotic prescription.

Information collected was validated for reliability and correctness before being entered in the data base used for study analysis. No patient identifiers were disclosed to maintain confidentiality of patient information during the study.

Statistical Analysis: Analysis of collected data was done using statistical analysis packages and entering in MS Excel. Demographic and clinical profile along with the use of antibiotics was analyzed using descriptive statistics such as frequency distribution, percentages, means, and standard deviations. In cases where needed, data were presented in tabular and graphic forms. Significant p values were considered to be less than 0.05.

Results

The present research analyzed the trends in the usage of antibiotics and cases of pneumonia among hospitalized individuals for one year. One hundred and fifty medical records were analyzed for this study. The outcomes provided detailed information on age demographics, symptoms, comorbidities, patterns of antibiotic prescription, and treatment duration of pneumonia patients.

Based on the findings of the demographic characteristics, it could be noted that elderly patients showed high prevalence of pneumonia. Age above 60 years accounted for 59 subjects (39.4%), which showed that older patients were prone to developing the disease. Male subjects (58.7%) exceeded female subjects (41.3%). From the outcomes, it was found that pneumonia was associated with aging and males.

Table 1: Demographic Characteristics of Study Participants

Variables	Number of Patients	Percentage (%)
Age Group (Years)		
18–30	18	12.0
31–45	32	21.3
46–60	41	27.3
Above 60	59	39.4
Gender		
Male	88	58.7
Female	62	41.3

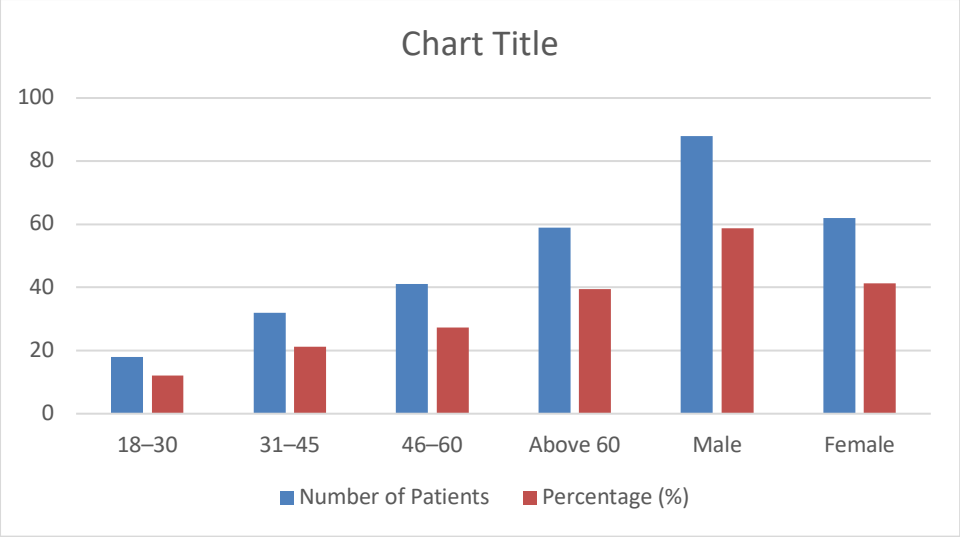

Figure 1: Graphical Representation of Demographic Characteristics of Study Participants

The symptom analysis in terms of the clinical presentation showed that fever and cough were the most commonly observed symptoms among patients suffering from pneumonia. Fever was present in 132 patients (88.0%), while cough was recorded for 126 patients (84.0%). The respiratory system was affected significantly as evidenced by the observation that there was breathlessness in 97 patients (64.7%). Sputum production and fatigue were other common symptoms observed.

Table 2: Clinical Symptoms Observed Among Pneumonia Patients

Clinical Symptoms	Number of Patients	Percentage (%)
Fever	132	88.0
Cough	126	84.0
Breathlessness	97	64.7
Chest Pain	58	38.7
Fatigue	71	47.3
Sputum Production	82	54.7

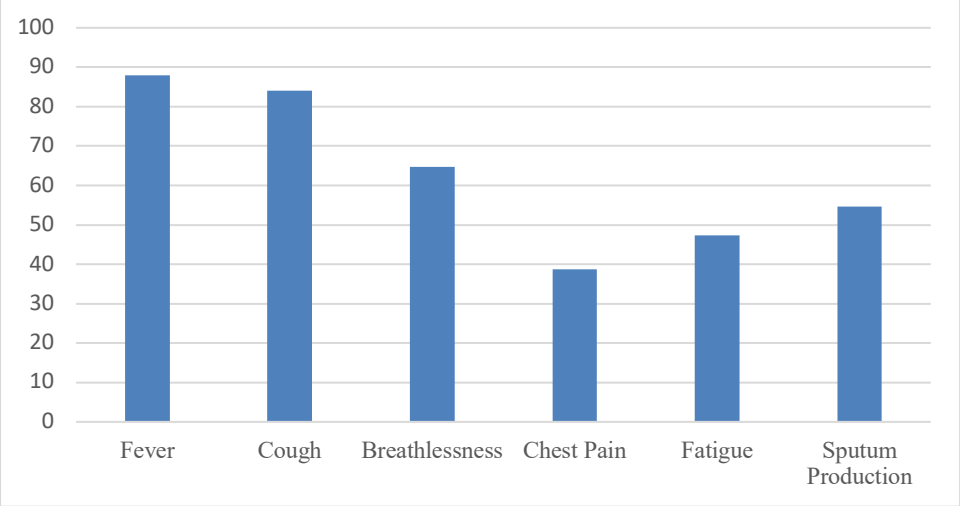

Figure 2: Graphical Representation of Clinical Symptoms Observed Among Pneumonia Patients

Assessment of co-morbidities indicated that the commonest co-morbidities associated with pneumonia were hypertension and diabetes mellitus. Sixty-three (42.0%) patients had hypertension while 57 (38.0%) had diabetes mellitus. Patients with chronic obstructive pulmonary disease (COPD) were identified in 34 patients (22.7%), indicating that respiratory diseases make patients more vulnerable. Fewer than one in five patients (26, 17.3%) had no co-morbid conditions.

Table 3: Co-Morbid Conditions Among Patients

Co-Morbidities	Number of Patients	Percentage (%)
Hypertension	63	42.0
Diabetes Mellitus	57	38.0
Chronic Obstructive Pulmonary Disease (COPD)	34	22.7
Cardiovascular Disease	29	19.3
Chronic Kidney Disease	11	7.3
No Co-Morbid Condition	26	17.3

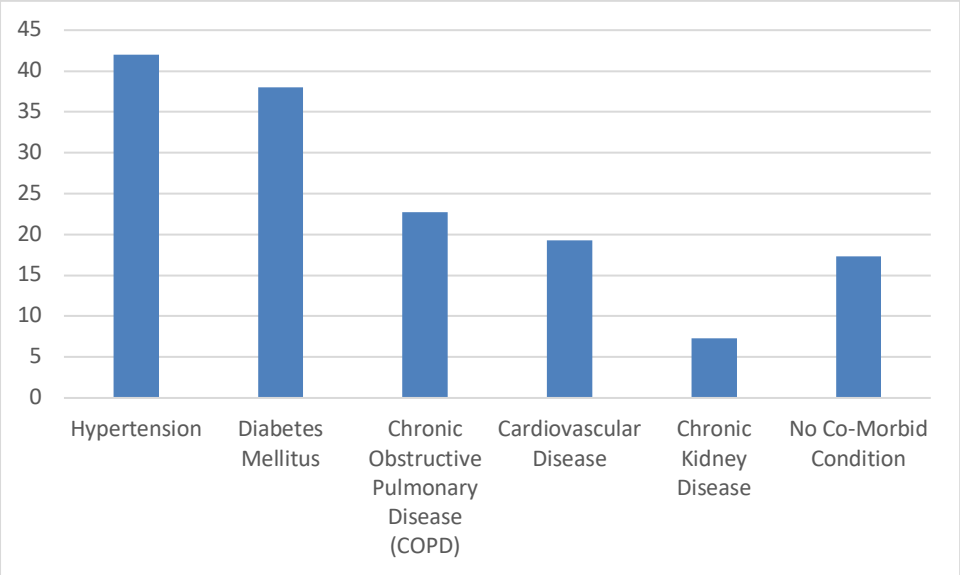

Figure 3: Graphical Representation of Co-Morbid Conditions Among Patients

Based on antibiotic utilization pattern, the most commonly prescribed antibiotics among pneumonia patients were cephalosporins. Cephalosporins represented the largest group with 61 prescriptions (40.7%) followed by macrolides with 33 prescriptions (22.0%). The most commonly prescribed antibiotics were the penicillins (24 prescriptions, 16.0%), followed by fewer prescriptions for carbapenems and aminoglycosides. The results showed the overall trend in preference for treating hospitalized cases of pneumonia with broad-spectrum antibiotics.

Table 4: Antibiotic Classes Prescribed to Pneumonia Patients

Antibiotic Class	Number of Prescriptions	Percentage (%)
Cephalosporins	61	40.7
Macrolides	33	22.0
Penicillins	24	16.0
Fluoroquinolones	18	12.0
Carbapenems	9	6.0
Aminoglycosides	5	3.3

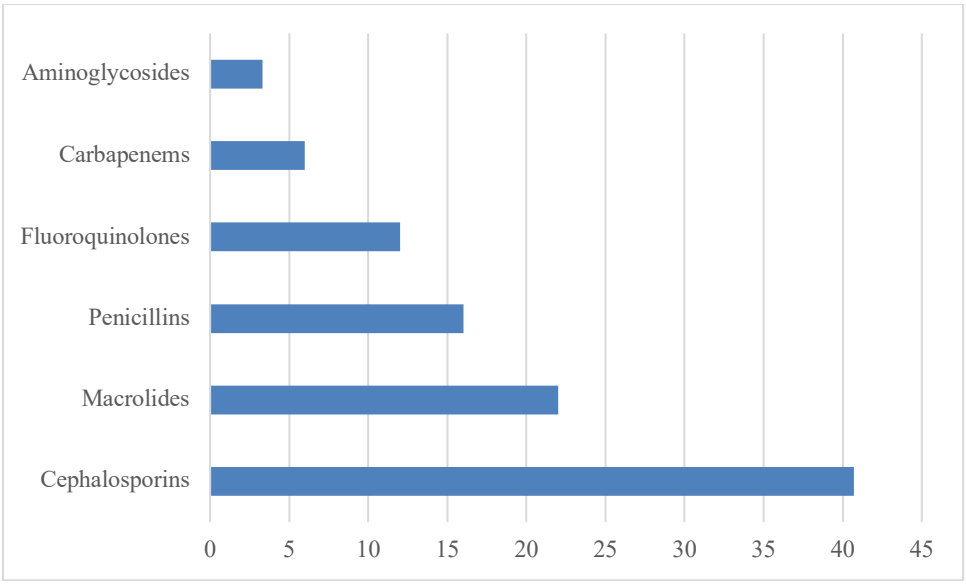

Figure 4: Graphical Representation of Antibiotic Classes Prescribed to Pneumonia Patients

Analysis of the antibiotic therapy patterns showed that combination therapy was more frequently used than single antibiotic therapy. 96 patients (64.0%) received combination antibiotic therapy while 54 patients (36.0%) received monotherapy. An increased use of combination therapy prompted a greater antimicrobial coverage in moderate to severe pneumonia patients and those with co-morbid conditions.

Table 5: Pattern of Antibiotic Therapy

Therapy Pattern	Number of Patients	Percentage (%)
Monotherapy	54	36.0
Combination Therapy	96	64.0

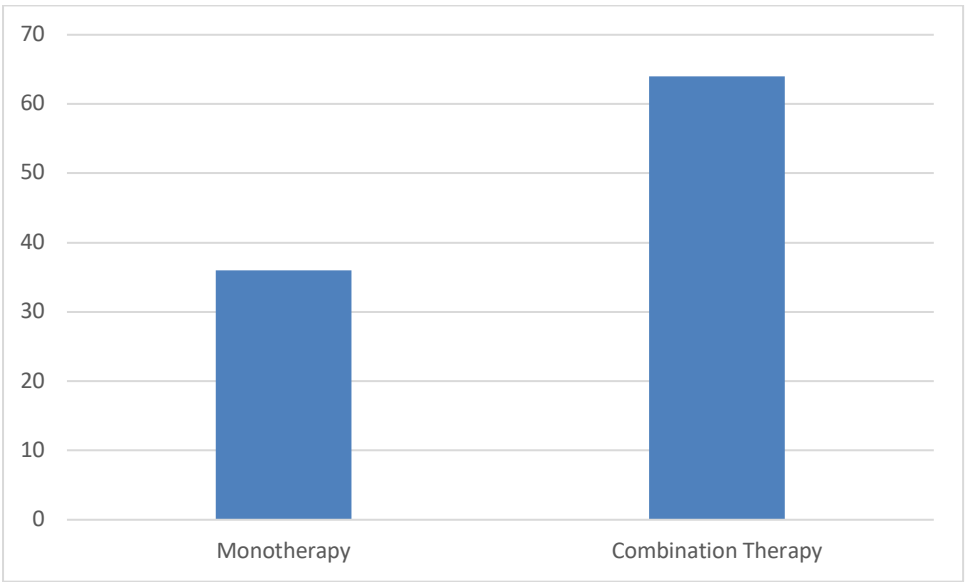

Figure 5: Graphical Representation of Pattern of Antibiotic Therapy

Antibiotic administration routes showed that the majority of pneumonia patients (68%) were hospitalised and received intravenous antibiotics. Of 112 patients (74.7%), 112 received intravenous antibiotics showing that the infections were serious and therapy needed to be commenced quickly. In 28 patients (18.7%), oral antibiotics were used for treatment; in 10 patients (6.6%), sequential therapy (IV to oral) was used. These results underscored the value of parenteral treatment in the hospital treatment for pneumonia.

Table 6: Route of Antibiotic Administration

Route of Administration	Number of Patients	Percentage (%)
Intravenous	112	74.7
Oral	28	18.7
Sequential (IV to Oral)	10	6.6

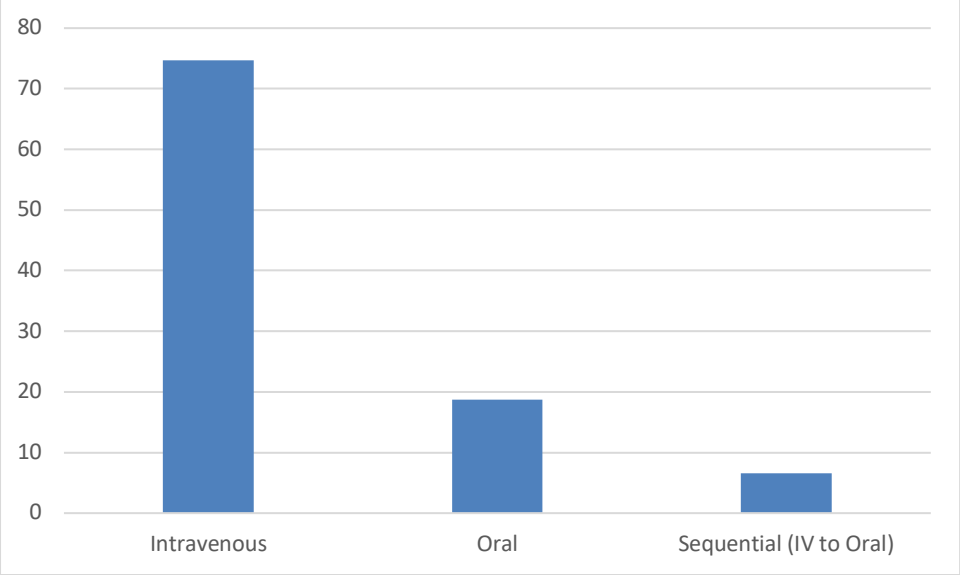

Figure 6: Route of Antibiotic Administration

The analysis of the duration of hospital stays revealed that most patients had to stay in hospital for 5–10 days. Of these, 84 patients (56.0%) were still hospitalized during this period, and 37 patients (24.7%) had been hospitalized for over 10 days. The length of hospital stay for a diagnosis of any type in 29 patients (19.3%) was less than 5 days. The results showed that pneumonia was associated with moderate length of hospital stay, especially for the elderly and patients with co-morbid conditions.

Table 7: Duration of Hospital Stay

Duration of Stay	Number of Patients	Percentage (%)
Less than 5 Days	29	19.3
5–10 Days	84	56.0
More than 10 Days	37	24.7

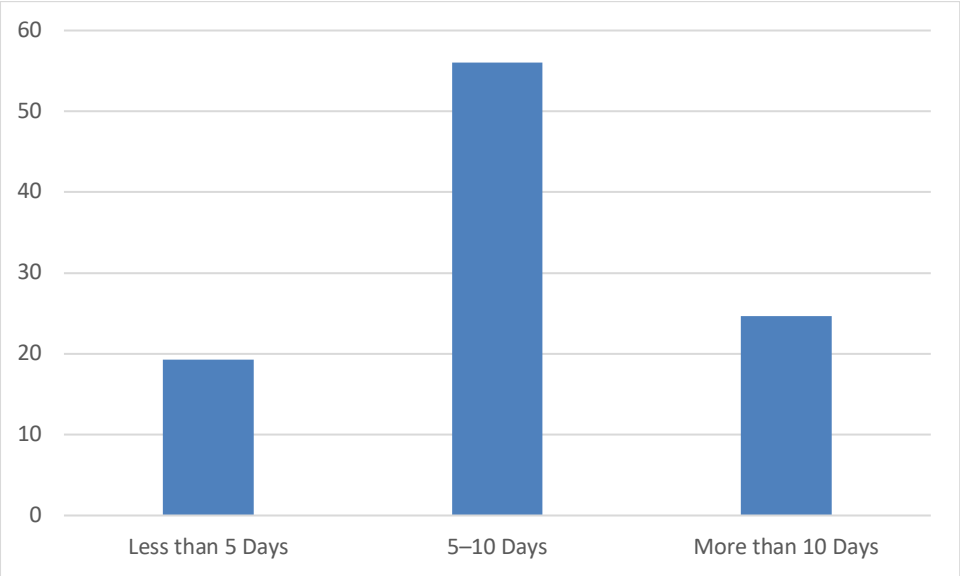

Figure 7: Duration of Hospital Stay

The treatment outcome analysis showed that the antibiotic treatment was effective for most of the patients with pneumonia. Out of 150 patients, 126 patients (84.0%) recovered and were discharged successfully. In 11 patients (7.3%) referral to the higher healthcare centers was required and 13 patients (8.7%) died. The findings indicated that the clinical outcomes of most hospitalized patients were favourable due to appropriate antibiotic management.

Table 8: Treatment Outcomes Among Pneumonia Patients

Treatment Outcome	Number of Patients	Percentage (%)
Recovered and discharged	126	84.0
Referred to Higher Center	11	7.3
Mortality	13	8.7

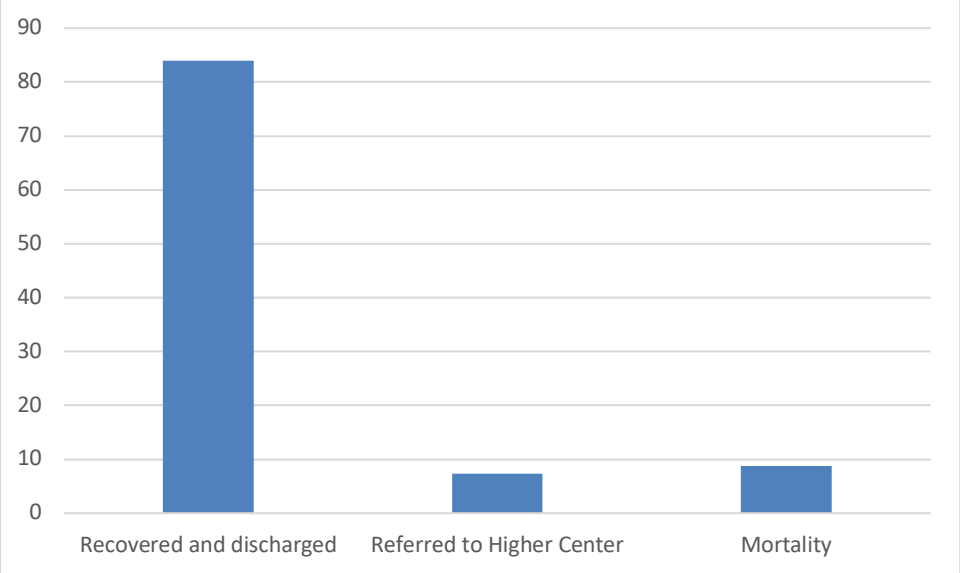

Figure 8: Treatment Outcomes Among Pneumonia Patients

Discussion

The current study aimed to assess pneumonia cases and antibiotic consumption patterns of hospitalized patients over a 12-month period. The results showed that pneumonia was more common in elderly subjects (39.4%) especially in those over 60 years of age (Kollef, 2000) [16]. Male patients (58.7%) were affected more frequently than female patients (41.3%). This was in line with earlier clinical studies that have shown that elderly people are more prone to respiratory infection because of their lowered immunity and having several other co-morbid conditions (Plouffe et al., 2000) [17]. The most common presenting symptoms identified were fever (88.0%), cough (84.0%) and breathlessness (64.7%). The high prevalence of respiratory symptoms reflected the high level of respiratory involvement in the pneumonia patients and the importance of early diagnosis and timely medical management in patients admitted to hospital (Santos et al., 2008) [18].

Moreover, there was also observed a correlation between co-morbid diseases and pneumonia. The most common associated illnesses among patients included hypertension (42.0%) and diabetes mellitus (38.0%). The presence of pre-existing respiratory diseases was higher among the patients with pneumonia (22.7%), which showed that pre-existing respiratory diseases increased the vulnerability to the disease of pneumonia (Shankar et al., 2003) [19]. Antibiotic use analysis revealed that the most commonly used antibiotics were cephalosporins (40.7%), macrolides (22.0%) and penicillins (16.0%). The high proportion of broad-spectrum antibiotics use was related to the current practice of hospital prescriptions that are based on achieving effective empirical therapy against common respiratory pathogens. Besides, combination antibiotic therapy was more commonly used than monotherapy (64.0% vs. 36.0%) especially in moderate to severe pneumonia and for patients with co-morbidities (Höffken & Niederman, 2002) [20].

The route of antibiotic delivery suggested that IV routes of administration (74.7%) were given as preferred routes, likely due to the requirement for early antibiotic therapy in hospitalized patients with severe infections. The majority of patients (56.0%) were hospitalized for 5-10 days and 24.7% were hospitalized for over 10 days reflecting long recovery times in complicated cases. The treatment outcome analysis showed the clinical recovery was favourable in most of the patients, 84.0% of whom were discharged after successful treatment. In 8.7%

cases, however, death was noted, which may have been attributed to late diagnosis, advanced age, severe infections and/or co-morbid conditions. Overall, the results indicated that the use of an appropriate antibiotic regime and timely clinical intervention had significant impact on treatment outcomes of hospitalized pneumonia patients.

Conclusion

In conclusion, the present study showed that pneumonia was still hospitalization leading cause especially during older age and in patients with hypertension and diabetes mellitus as co-morbidities. The results showed that, the most common clinical symptoms among pneumonia patients were fever, cough and breathlessness. Cephalosporins were the most commonly prescribed drugs and photosensitizing/antibiotic therapy was preferred in hospitalized patients. Appropriate antibiotic therapy led to good clinical recovery in most patients with successful discharge but minority of patients had poor outcomes, including death. The overall study emphasized the need for early diagnosis, rational use of antibiotics, careful management of associated co-morbidities and timely clinical management to improve treatment outcomes and minimize complications of pneumonia.

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