ORIGINAL ARTICLE

Determinants of treatment outcomes in hospitalized pneumonia patients: A clinical and socioeconomic analysis

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Abstract

Introduction: Pneumonia, regardless of its microbial cause, remains a major global health concern, contributing significantly to morbidity and mortality across all populations. This study aimed to evaluate the impact of clinical and socioeconomic factors on the treatment of hospitalized pneumonia patients. **Materials and Methods:** An observational study involving 69 patients with a diagnosis of pneumonia was carried out in a hospital. Software called the IBM Statistical Package for the Social Sciences Statistics (version 20.0) was used for data processing and statistical analysis. The Pearson Chi-square test was used to examine categorical variables, and $P < 0.05$ was considered statistically significant. **Results:** Treatment failure was significantly associated with prolonged pre-hospital delay ($P = 0.0002$), highlighting a critical "golden window" for intervention. With an increase in age, there is a more chance of getting negative treatment outcomes with *P* value (0.0039) and regular alcohol use was linked to cases. **Discussion:** Alcohol consumption and advanced age have been associated with decreased physiological resilience and immune response. More complex clinical courses were caused by resistant Gram-negative infections, but Gram-positive cocci were more common. Poorer outcomes were linked to higher socioeconomic and educational status, possibly as a result of postponing seeking medical attention. **Conclusion:** In addition to antimicrobial therapy, early intervention and metabolic stability are crucial for the multifactorial recovery from pneumonia. To improve survival rates, risk-stratified clinical management and increased health literacy are crucial, as clinical deterioration ($P < 0.05$). General random blood sugar at discharge correlated with treatment efficacy ($P = 0.0344$), while multilobar involvement (>3 lobes) was most common in fatal.

Key words: Early intervention, general random blood sugar, multilobar involvement, pneumonia, socioeconomic determinants, treatment outcomes

INTRODUCTION

Pneumonia is a widespread and potentially fatal lung infection that results in inflammation of lung tissue and the accumulation of fluid or pus in the alveoli, disrupting normal gas exchange. Due to its high rates of incidence, morbidity, and mortality, pneumonia remains a pressing global health issue.[1] Despite progress in diagnostic methods, antibiotic treatments, and supportive care, pneumonia continues to be a leading cause of hospitalization and death worldwide.[2]

The onset and progression of pneumonia are determined by complex interactions between microbial pathogens and the body's defense mechanisms. Under normal conditions, the respiratory tract has various defense systems to help prevent infection, such as mucociliary clearance, immune responses, and macrophage activity.

When these defense mechanisms are compromised or overwhelmed by pathogenic organisms, infection can occur in the lung tissue. The inflammatory response triggered by infection leads to the accumulation of inflammatory cells,

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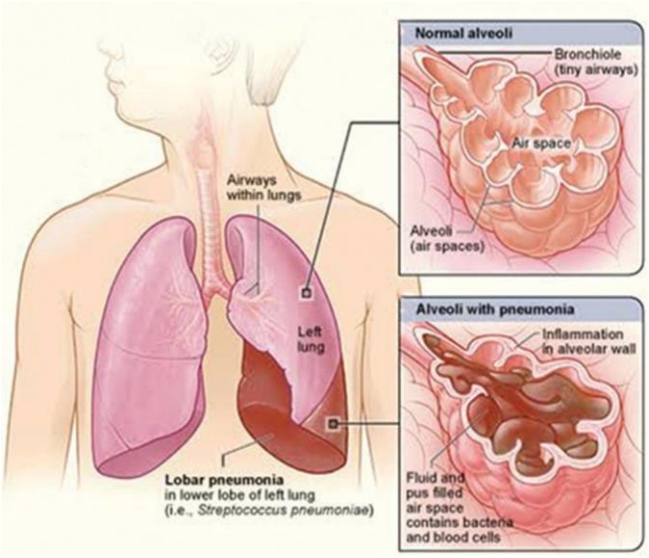

fluid, and cellular debris within the alveoli, impeding oxygen exchange and causing pneumonia symptoms, such as cough, fever, chest pain, and difficulty breathing. Numerous risk factors influence the onset and severity of pneumonia, which can be categorized into clinical, demographic, lifestyle, and socioeconomic factors.[3]

Education, wealth, career, and living conditions are thus important determinants in the clinical course and recovery of pneumonia patients.[4] Aside from socioeconomic considerations, clinical features, such as symptom intensity, comorbidities, lung involvement, and causative organism type can all have a major impact on treatment outcomes.

The purpose of this study was to look into how socioeconomic and clinical characteristics affected treatment results for pneumonia patients admitted to a tertiary care hospital.[5] The major goal is to assess the correlation between socioeconomic indicators, lifestyle habits, clinical characteristics, and treatment outcomes in pneumonia patients in the hospital. Secondary goals include investigating the relationship between these characteristics and the length of hospital stay (LOS), as well as finding significant determinants that may influence recovery and clinical prognosis in pneumonia patients.

METHODOLOGY

The study included 69 inpatients treated for pneumonia to assess clinical outcomes, and it is a prospective observational study. Hospital medical records were used to gather patient data. Clinical findings, treatment outcomes, and demographic information were all documented.

Statistical methodology IBM statistical package for the social sciences (SPSS) Statistics software was used for data operation and deducible analysis (interpretation 20.0).

The Pearson Chi-square test was used to assess categorical variables, similar as microbiological distributions and antibiotic rules. For all analyses, the deducible threshold was set at a two- tagged *P*-value threshold of lower than 0.05.

Inclusion Criteria

All patients admitted in hospital with pneumonia disease, patients of age more than 15 years.

Exclusion Criteria

Patients with pre-existing lung chronic obstructive pulmonary disease (COPD), inflammatory lung disease, lung cancers, patients who do not given consent to the study, patients who leave the hospital against medical advice, patients with incomplete medical records.

To concentrate on adolescent and adult populations, patients over the age of 15 who were admitted with a diagnosis of pneumonia were included in the study. This is because disease presentation, management, and outcomes differ significantly between pediatric and adult patients. To prevent confounding effects, patients with pre-existing chronic lung conditions were excluded, including lung cancer, inflammatory lung diseases, and COPD. These conditions can independently affect clinical outcomes, treatment response, and the severity of the illness.

To maintain ethical compliance and data reliability, patients who did not provide consent, left the hospital against medical advice, or had incomplete medical records were not included. This was done because missing or incomplete data could have an impact on the analysis's accuracy.

RESULTS

The SPSS statistical software was used to analyze categorical data using Pearson's Chi-square test.

Primary Clinical and Radiographic Predictors

The cohort's (n = 69) most important prognostic factor was the report of symptom onset. There's a "golden window" for intervention, as substantiated by the largely substantial link between a lengthy pre-hospital phase and treatment failure (P = 0.0002). Radiographically, there was a positive predictive relationship between final issues and the anatomical quantum of pulmonary involvement, specifically the number of infected lobes. Localized infection was linked to better issues, while multilobar connection (containing further than three lobes) was the most common result in cases that ended in death.

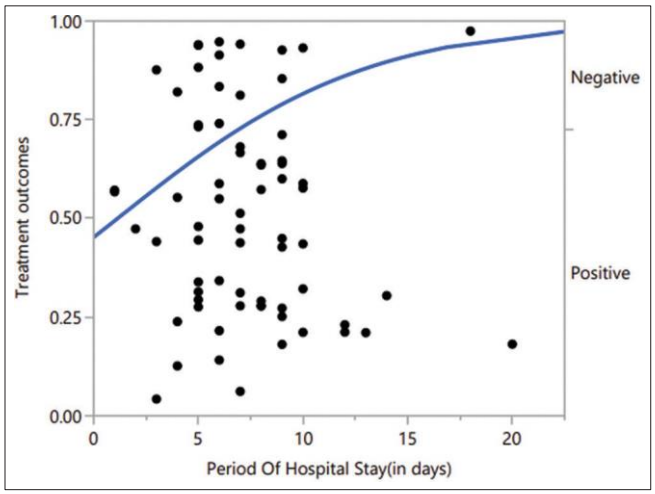

Figure 1: Impact of hospitalization duration on clinical outcomes

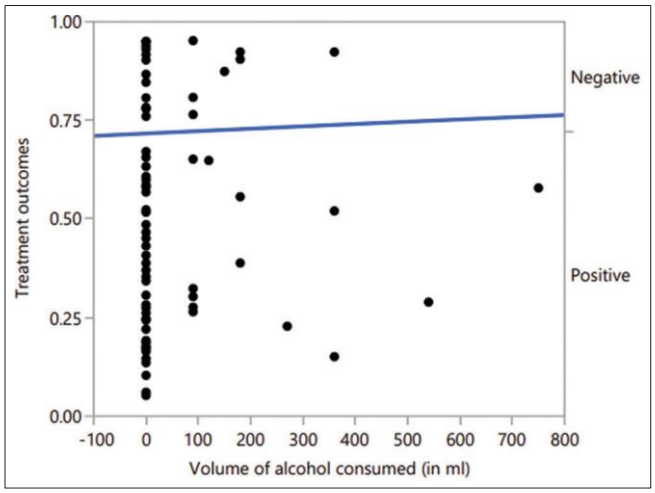

Figure 2: Impact of ethanol intake on clinical recovery

LOS

The length of hospitalization was set up to be explosively identified with treatment issues, according to analysis using IBM SPSS. Longer length of stay (LOS) was substantially associated with cases who had a prolonged clinical course and eventually had remedial failure as opposed to those who stabilized beforehand. This temporal aspect is a pivotal stage-heft for the infection's refractory character and the difficulty of the necessary clinical treatments [Figure 1].

Behavioral Determinants

Habitual alcohol use was set up to be a significant factor in treatment failure and a significant donation to clinical decline ($P < 0.05$). Again, the smoking indicator didn't meet the destined deducible criterion for association with unfavourable clinical issues ($P > 0.05$), indeed, though it was measured and examined using the Pearson Chi-square test. These findings indicate that the recovery of severe pneumonia may be acutely complicated by physiological stresses associated with alcohol [Figure 2].

Physiological and Metabolic Markers

The physiological results were significantly identified with the admission temperature ($P = 0.0464$), with hyperthermic axes indicating a more aggressive systemic seditious response. The recovery may be hampered by ongoing glycemic dysregulation, as seen by the significant relationship between treatment efficacity and metabolic stability at discharge, specially general random blood sugar (GRBS) situations ($P = 0.0344$) [Figure 3].

Microbiological Profile

Gram-positive cocci predominated, with *Staphylococcus aureus* ($n = 8$), *Streptococcus pneumoniae* ($n = 3$), and *Streptococcus pyrogens* ($n = 2$) leading the pack, according to microbiological surveillance. *Klebsiella pneumoniae* ($n = 5$) and opportunistic fungal isolates similar to *Candida* species ($n = 5$) were set up to be part of the Gram-negative bacilli order, and they constantly produced more complex clinical courses.

Age-related Prognostication and Socioeconomic Paradox

Each fresh time of age was used as a stage-heft for dropped physiological reserve, and advanced chronological age was set up to be a strong independent predictor of lower treatment success ($P = 0.0039$). Ironically, a study of social variables showed that cases who belonged to the "upper" class and had postgraduate degrees were more likely to have adverse issues than their lower-rich counterparts. This implies that lesser education and influx don't serve as defensive buffers in this particular clinical setting, conceivably as a result of delayed healthcare-seeking geste [Figure 4].

Empirical Antimicrobial Utilization Patterns

The empirical treatment approach, which substantially used beta-lactam/macrolide combination rules, concentrated on broad-diapason content. The introductory frame was handed by third-generation cephalosporins (Ceftriaxone), which were frequently supplemented with Doxycycline or Azithromycin for atypical content. Anti-pseudomonal beta- lactamase asset combinations were included in escalated procedures for cases with suspected aspiration or multi-drug resistant threat (similar as Metronidazole, Sulbactam/Cefoperazone, and Piperacillin/Tazobactam). Escalation to these increased rules was qualitatively linked to longer recovery times and more severe admissions, according to statistical analysis.

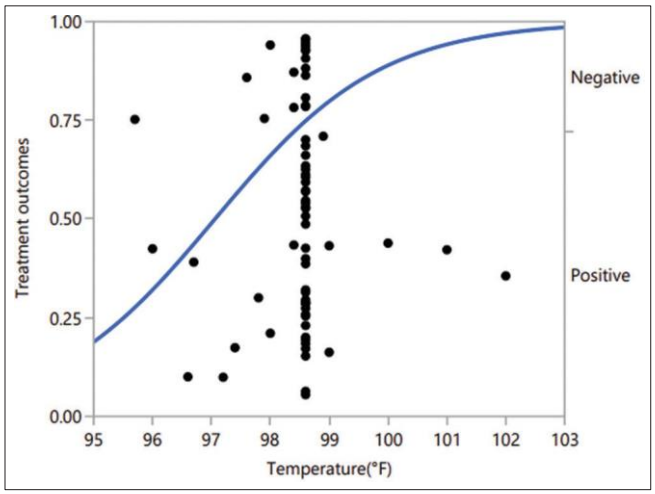

Figure 3: Temperature-treatment outcomes correlation analysis

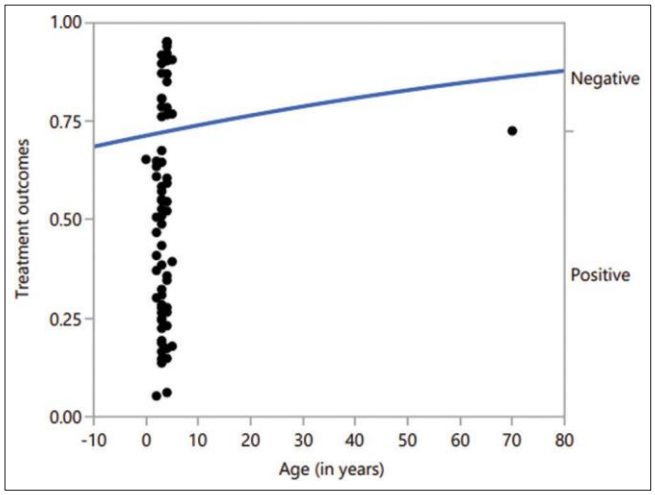

Figure 4: Correlation between advancing age and unfavorable clinical trajectories

DISCUSSION

Age

Refers to a decline in physiological and physical events that affect the body's defensive mechanisms. The key reasons connected to the higher death rates from serious respiratory infections, such as pneumonia are indicators of ageing. In Western Europe, the elderly had a higher mortality rate from pneumonia (279 fatalities/100,000). Negative clinical trajectories were positively correlated with increasing chronological age. Small increases in age were connected to increased mortality risk and a prolonged need for oxygenation, demonstrating that age-dependent physiological degradation is a crucial determinant in delayed therapy resolution.

Number of Involved Lobes

Multilobar pulmonary involvement and mortality were found to be significantly correlated in the present study, indicating that the severity of the disease is reflected in the extent of lung involvement.[6] Previous research indicates that radiographic extent is a good predictor of pneumonia patients' mortality.[6] Furthermore, it has been demonstrated that multilobar infiltrates increase the risk of intensive care unit admission and death because they impair gas exchange and result in widespread alveolar inflammation.[7]

Alcohol Use

Long-term alcohol consumption was significantly associated with poor outcomes in this study, suggesting weakened host defenses.[8] Alcohol has been shown to change the immune system and increase susceptibility to pneumonia. A systematic review found that heavy alcohol use increases mortality and the risk of pneumonia.[9]

LOS

Long hospital stays were linked to poor outcomes, suggesting that they are a reflection of the severity or complications of the disease.[10] Research indicates that longer hospital stays are linked to higher mortality and complication rates.[11] Longer hospital stays have also been linked to worse outcomes for pneumonia patients and a greater healthcare burden.[11]

Temperature at Administration

This study showed that the systemic inflammatory response affects prognosis, with admission temperature having a significant effect on outcome.[12] According to clinical recommendations, one of the most important severity factors for pneumonia is abnormal temperature.[13] In addition, research shows that extreme temperatures are linked to increased mortality rates because of severe infection and cytokine response.[13]

GRBS at Discharge

Poor outcomes were significantly correlated with metabolic instability as measured by elevated GRBS levels, suggesting a hampered recovery.[14] According to a meta-analysis, patients with pneumonia who have high blood glucose levels die much more frequently. According to a different study, hospitalized patients' hyperglycemia is independently linked to increased mortality.[14]

Gram-Positive and Gram-Negative Bacteria

Bacteria are both Gram-positive and Gram-negative. According to this study, infections brought on by pathogenic organisms – especially Gram-negative pathogens – were linked to unfavourable outcomes. Research indicates that hospital-acquired pneumonia mortality is significantly higher

when Gram-negative bacteria are present.[15] According to additional microbiological analyses, the main culprits behind serious hospital-acquired infections are resistant Gram-negative organisms.[16]

Empirical Therapy

In accordance with advised clinical practice, the majority of the empirical therapy used in this study involved broad-spectrum antibiotics. According to studies, the mortality rate from nosocomial pneumonia significantly rises when proper antibiotic treatment is delayed.[17] In a similar vein, it has been acknowledged that the most crucial element affecting survival in severe illnesses is prompt, efficient antibiotic treatment.[18]

Hospital Stay Duration

Prolonged symptoms before admission were significantly linked to poor outcomes, highlighting the importance of early treatment. Early administration of antibiotics to patients with pneumonia has been shown to significantly reduce their mortality rates.[19] Early treatment initiation improves survival rates, according to studies on care quality.[20]

Level of Education

In this study, outcomes exhibited an inverse correlation with elevated educational attainment. However, most population studies show that people with lower socioeconomic status tend to have worse health outcomes.[21]

However, because of sample size limitations, our study was unable to validate the significant difference between other variables and pneumonia treatment outcomes. Improving patient outcomes requires prompt diagnosis.

As a result, examining the combined effects of socioeconomic and clinical determinants on pneumonia outcomes is critical for better understanding illness patterns and enhancing medical therapies. Research on these determinants can help with the early identification of high-risk individuals, treatment strategy optimization, and preventive healthcare implementation.

CONCLUSION

A complex interplay between lifestyle factors, timely intervention, and physiological vulnerability determines clinical outcomes in pneumonia. While formal education does not consistently indicate functional health literacy, advanced age and long-term alcohol consumption are established indicators of a poor prognosis. A "golden window" that combines early symptom recognition with established medical management is essential for the best possible recovery. Reactive treatment should give way to risk-stratified, precision management to lower the burden of disease. Clinicians can address both immediate illness and underlying risk factors by integrating acute bedside markers, such as multilobar involvement and metabolic instability, with community-level health education on nutrition and quitting smoking. Improving recovery and guaranteeing a successful discharge depend on the early detection of these prognostic indicators.

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