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Research Article

Clinical Pattern of Hospital Acquired Pneumonia at Tertiary Care Teaching Hospital

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Abstract: Hospital-acquired pneumonia (HAP) and ventilator-associated pneumonia (VAP) are significant contributors to morbidity and mortality, with mortality rates nearing 62%. These infections are the second most prevalent cause of nosocomial infections overall, but they are the most common in intensive care units (ICUs). Additionally, HAP and VAP are linked to the highest mortality rates among nosocomial infections. Methods: To investigate the clinical, radiological, and bacteriological profile of hospital-acquired pneumonia (HAP) and factors influencing its outcomes, we conducted an 24-month prospective study at a governmental hospital's general ICUs. Diagnosis of HAP was based on the ATS/IDSA 2016 guidelines, requiring both radiological criteria (new or progressive infiltrates in chest x-ray) and clinical criteria (at least two of the following: fever > 38°C, leucocytosis or leucopenia with purulent secretions, decreased oxygenation). Results: The majority (53%) of study population had chronic respiratory illness followed by diabetes (31%) and other systemic illnesses. 50 (19%) of HAP patients didn't have any co-morbidities According to chest x ray and HRCT thorax reports of HAP patients, 108 (40%) had infiltrates in single lobe, 90(33%) cases had infiltrates in 2 lobes and 88(33%) cases had infiltrates in 3 or more lobes. Bilateral infiltrates seen in 52% of patients. Out of 2054 patients, 626 (30%) cases were on mechanical ventilation out of which 145(7%) developed HAP. 70 (7%) cases developed HAP among 1428(70%) cases who were not on mechanical ventilation. Out of 270 HAP cases, 145(54%) had ventilator associated pneumonia and 125(46.29%) cases had HAP among non-ventilated patients. Conclusion: High incidence rate of HAP was linked with P. aeruginosa, K. pneumoniae, tracheostomy, and APACHE II ≥17. Furthermore, high mortality rate was strongly correlated with reintubation, duration in ICU ≥5 days, HAP outcome, DM, APACHE II ≥17, and neurological diseases. More research should be conducted to reassess the impact of HAP in nongovernmental ICU settings.

Keywords: Guidelines, Hospital-acquired, Pneumonia, Ventilator-associated.

INTRODUCTION

Hospital-acquired pneumonia (HAP) is one of the most common healthcare-associated infections and remains a significant cause of morbidity and mortality worldwide. [1] Defined as pneumonia that develops 48 hours or more after hospital admission and was not present at the time of admission, HAP poses unique diagnostic and therapeutic challenges.[2] It is often associated with critically ill patients, prolonged hospital stays, and the presence of invasive devices such as ventilators or central lines. [3]

The pathogenesis of HAP is multifactorial, with risk factors including impaired host defenses, microbial colonization of the upper respiratory tract, and aspiration of contaminated secretions. [4] Common pathogens involved in HAP vary depending on geographical location and local antibiotic resistance patterns, but they frequently include Gram-negative bacilli such as Klebsiella pneumoniae, Pseudomonas aeruginosa, and Escherichia coli, as well as Gram-positive organisms like Staphylococcus aureus, particularly methicillin-resistant strains (MRSA). [5]

Understanding the clinical pattern of HAP is essential for timely diagnosis and effective management. Clinical manifestations may range from mild symptoms, such as

fever and cough, to severe respiratory distress and septic shock. [6] Additionally, HAP is associated with significant economic burdens due to increased use of antibiotics, longer durations of hospitalization, and intensive care requirements. [7-9]

This study aims to analyze the clinical pattern of HAP in a tertiary care teaching hospital, focusing on demographic characteristics, risk factors, microbiological profiles, and outcomes. By identifying these patterns, the findings can contribute to better prevention strategies, optimized treatment protocols, and improved patient outcomes in hospital settings.

METHODS

To investigate the clinical, radiological, and bacteriological profile of hospital-acquired pneumonia (HAP) and factors influencing its outcomes, we conducted an 24-month prospective study at a governmental hospital's general ICUs. Diagnosis of HAP was based on the ATS/IDSA 2016 guidelines, requiring both radiological criteria (new or progressive

infiltrates in chest x-ray) and clinical criteria (at least two of the following: fever > 38°C, leucocytosis or leucopenia with purulent secretions, decreased oxygenation).

Inclusion Criteria: All patients aged over 24 years, admitted to the MICU and RICU, showing signs and symptoms of pneumonia after 48 hours of hospitalization were included after obtaining informed consent.

Exclusion Criteria:

- Patients admitted with pneumonia
- Pregnant women
- Patients under 24 years of age
- Radiological infiltrates due to pulmonary hemorrhage, pulmonary embolism, pulmonary edema, lung collapse, lung tumors, and immunosuppressed patients

Patients meeting the inclusion and exclusion criteria were enrolled and assessed clinically, radiologically, and bacteriologically to confirm pneumonia and identify causative microorganisms. Investigations included CBC, RFT, LFT, CRP, FBS/PPBS, and arterial blood gas analysis. Cultures of blood, urine, sputum, and endotracheal aspirate were performed for sensitivity testing. Chest x-rays or HRCT thorax were also conducted. Empirical antibiotics were initiated and adjusted based on culture sensitivity reports. All patients were monitored until discharge or death.

RESULTS

Statistical Analysis: Quantitative data normality was checked using the Kolmogorov–Smirnov test, and presented as mean ± standard deviation, median, and interquartile range. Significant results were considered at $p < 0.05$, with a 95% Confidence Interval (CI). Nonparametric variables were compared using Mann– Whitney U or Kruskal–Wallis H tests, while parametric variables were analyzed using one-way ANOVA. Pairwise comparisons were done using Tukey's or Dunnett's tests for ANOVA or Kruskal–Wallis H test results. Qualitative variables were analyzed using Chi-square or Fisher's exact tests.

Significant and clinically relevant variables were included in multivariate analysis to identify independent predictors of outcomes. Mortality predictors were assessed using a multivariate logistic regression model, with Odds Ratios (OR) and 95% CI reported. A multivariate Cox regression model determined independent HAP predictors, with Hazard Ratios (HR) and 95% CI reported. Log-Rank test and Kaplan–Meier curves were used for bivariate analysis, with significant predictors included in multivariate Cox regression. Data analysis was performed using SPSS software version 23.0.

During the study period of 24 months, 2234 patients were admitted to MICU & RICU. 180 patients were excluded from the study as per inclusion & exclusion criteria. 2054 cases were included in the study. Out of 2054* cases, 1191 (58%) were male and 863(42%) were female. Age of the study population ranged from 18 to 80 years. 270(22.6%) developed HAP. 132(48.88%) cases developed HAP were in the age group >60 years. 180 (66.6%) male patients and 62(32%) female patients developed HAP. High incidence of HAP observed in male patients and in higher age group.

Table-1: Pattern of age & gender distribution of patients with HAP

AGE (YEARS)	MALE	FEMALE	TOTAL
18-40	20	10	25
41-60	70	38	108
>60	90	42	132
TOTAL	180	90	270

Table-2: Clinical features in patients with HAP

SYMPTOMS & SIGNS	NUMBER	%
BREATHLESSNESS	145	54
COUGH WITH EXPECTORATION	90	34
DELIRIUM	88	33
FEVER	85	31
HAEMOPTYSIS	36	13
CHEST PAIN	25	9

145(54%) patients had breathlessness. 90(34%) patients had cough with purulent expectoration. 88(33%) patients presented with delirium which was the most predominant sign noted in most of elderly patients and most of them did not have cough or fever. Some of the patients also had haemoptysis and chest pain.

Table-3: Risk factors associated with HAP

CO-MORBIDITIES	NUMBER	%
COPD	40	15
BRONCHIAL ASTHMA	22	8
BRONCHIECTATSIS	18	7
COPD WITH DIABETES	24	9
ASTHMA WITH DIABETES	20	7
COPD WITH HYPERTENSION	15	6
DIABETES	14	5
HYPERTENSION	12	4
DIABETES WITH HYPERTENSION WITH IHD	12	4
DIABETES WITH CHRONIC KIDNEY DISEASE	8	3
LIVER DISEASE	12	4
NEUROLOGICAL EVENTS	6	2
CARDIAC CAUSES	14	5
POISONING	12	4
NO CO-MORBIDITIES	50	19

Table 3 shows majority (53%) of study population had chronic respiratory illness followed by diabetes (31%) and other systemic illnesses. 50 (19%) of HAP patients didn't have any co-morbidities According to chest x ray and HRCT thorax reports of HAP patients, 108 (40%) had infiltrates in single lobe, 90(33%) cases had infiltrates in 2 lobes and 88(33%) cases had infiltrates in 3 or more lobes. Bilateral infiltrates seen in 52% of patients.

Table-4: Influence of mechanical ventilation on HAP

DETAILS OF PATIENT	VENTILATED	NON-VENTILATED	TOTAL
PATIENTS IN MICU +RICU	626	1428	2054
PATIENTS WITH HAP	145	125	270

Out of 2054 patients, 626 (30%) cases were on mechanical ventilation out of which 145(7%) developed HAP. 70 (7%) cases developed HAP among 1428(70%) cases who were not on mechanical ventilation. Out of 270 HAP cases, 145(54%) had ventilator associated pneumonia and 125(46.29%) cases had HAP among non-ventilated patients.

Table-5: Incidence of sepsis, septic shock and mortality in patients with HAP

DETAILS OF PATIENTS	SEPSIS		SEPTIC SHOCK	
	NUMBER	%	NUMBER	%
NUMBER & %	72	50	36	18
RECOVERED	43	60	15	42
DEATH	29	40	21	58

Out of 270 cases, 72 developed sepsis, 29 died and 40% of the cases recovered. 36 patients had septic shock, 42%of them recovered and 58% died. Higher incidence of morbidity seen among HAP patients with sepsis and septic shock.

DISCUSSION

Hospital-acquired pneumonia (HAP) is a significant nosocomial infection with high morbidity and mortality rates. The clinical pattern of HAP is characterized by several key features: Incidence and Risk Factors: HAP typically occurs 48 hours or more after hospital admission. [10] Risk factors include older age, mechanical ventilation, prolonged hospital stay, comorbidities such as chronic respiratory illnesses, and immunosuppression. Patients with these risk factors are more likely to develop HAP. [11]

Clinical Presentation: Patients with HAP often present with fever, chills, rigor, cough, dyspnea, and chest pain. Clinical criteria for diagnosis include new or progressive infiltrates on chest X-ray and at least two of the following: fever > 38°C, leukocytosis or leukopenia with purulent secretions, and decreased oxygenation. [12] Microbial Etiology: The most common pathogens associated with HAP are gram-negative bacilli (e.g., Klebsiella pneumoniae, Pseudomonas aeruginosa) and gram-positive cocci (e.g., methicillin-sensitive Staphylococcus aureus, methicillin-resistant

Staphylococcus aureus). [13] The presence of multidrug- resistant organisms complicates treatment and increases mortality rates. [14]

Radiological Findings: Chest X-rays and high-resolution CT scans are essential for diagnosing HAP. Radiological criteria include new or progressive

infiltrates, which help differentiate HAP from other causes of respiratory symptoms. [15]

Management and Outcomes: Management of HAP involves empirical antibiotic therapy, which is later adjusted based on culture and sensitivity results. Early diagnosis and appropriate antimicrobial treatment are crucial for improving outcomes. [16] Preventive measures, such as strict infection control practices and minimizing unnecessary use of invasive devices, are essential to reduce the incidence of HAP. [17]

Mortality and Morbidity: HAP is associated with high mortality rates, ranging from 31.4% to 82%, depending on various factors such as patient age, comorbidities, and the presence of multidrug-resistant pathogens. [18] Early intervention and effective management strategies are vital to reduce morbidity and mortality associated with HAP. [19]

CONCLUSION

High incidence rate of HAP was linked with P. aeruginosa, K. pneumoniae, tracheostomy, and APACHE II ≥17. Furthermore, high mortality rate was strongly correlated with reintubation, duration in ICU ≥5 days, HAP outcome, DM, APACHE II ≥17, and neurological diseases. More research should be conducted to reassess the impact of HAP in nongovernmental ICU settings.

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