Original research article

Clinico-Radiological Profile of Cases with Nosocomial Pneumonia in a Tertiary Care Teaching Hospital

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Abstract

Background: Nosocomial pneumonia is a common infection with a high rate of morbidity and mortality. It significantly prolongs the hospital stay and associated higher economic burden. We in the current study tried to analyze the clinical and radiological pattern of hospital-acquired pneumonia including the causative organisms and risk factors.

Methods: This cross-sectional study was conducted in the intensive care units of Government Medical College, Mahabubnagar, Telangana. All adult patients who develop nosocomial pneumonia in critical care units as per the definition in inclusion criteria are investigated clinically, radiologically, and bacteriologically to determine the presence of pneumonia, isolate causative microorganisms, and presence of comorbid conditions like DM, COPD, CRF, etc.

Results: Out of n=40 cases hospital-acquired pneumonia was diagnosed in n=22 and ventilator-associated pneumonia was diagnosed in n=18 cases. important radiological findings in HAP of early-onset showed the presence of infiltrates similarly in the late-onset HAP infiltrates were found in maximum cases followed by consolidation and cavity formation. *K. pneumoniae* was the commonest organism isolated from 40.90% of all cases of HAP. In early-onset HAP the isolation of the organism was in 18.18% of cases and *S pneumoniae* was the second commonest organism isolated from 13.63% cases of HAP who were not mechanically ventilated.

Conclusion: All 100% cases with HAP of early-onset recovered were as of late-onset HAP 78.5% recovered. In early-onset VAP cases 80% of cases recovered whereas in late-onset VAP only 69.2% cases recovered. Based on the microorganism involved the prognosis was good in cases infected with *K. pneumoniae and S. pneumoniae* and the worst prognosis was found in cases infected with *Pseudomonas Aeruginosa.*

Keywords: Nosocomial Pneumonia, Hospital Acquired Pneumonia, Ventilator Acquired Pneumonia, Clinical Features, Radiological Features.

Introduction

Hospital-acquired pneumonia (HAP) is the common cause of nosocomial infections in intensive care units of hospitals. [1, 2] The rate of mortality from HAP is estimated to be around 30 – 70%. [3-5] Nosocomial infections are those that manifest in patients more than 48 hours after admission to the hospital but that was not incubating at the time of admission. [6] Nosocomial infections are directly related to diagnostic, interventional, or therapeutic procedures a patient undergoes in a hospital and are also influenced by the bacteriological flora prevailing within a particular unit or hospital. Ventilator-associated pneumonia usually occurs

between the duration of 48 – 72 hours following mechanical ventilation. [6, 7] Several risk factors identified for HAP include mechanical ventilation for more than 48 hours, the severity of underlying illness, existing comorbidities, and longer duration of stay in ICU. [8-10] Critical care units increasingly use high technology medicine for patient care, hemodynamic monitoring, ventilator support, hemodialysis, parenteral nutrition, and a large battery of powerful drugs, particularly antibiotics to counter infection. It is indeed a paradox that the use of high-tech medicine has brought in its wake the dangerous and all too frequent complication of nosocomial infections. National Nosocomial Infections surveillance system (NNIS) of USA data suggests Nosocomial Pneumonia (NP) is the second most common nosocomial infection in intensive care units. [11] Additionally, pneumonia is associated with the greatest mortality among nosocomial infections and with considerably increased costs of care. The widespread use of tracheal intubation and mechanical ventilation to support the critically ill has defined an expanding group of patients who are at particularly high risk for the development of nosocomial pneumonia (NP). [2] Despite advances in the diagnosis and treatment, our understanding of the NP remains subject to important limitations. The incidence of NP in the intensive care unit ranges from 9 –24% with variation relating to the intensive care, case mix, and differences in the definitions and diagnostic techniques used Despite the availability of newer antimicrobials, the treatment of nosocomial pneumonia has proved to be difficult. [12] The clinical presentation and organisms causing nosocomial pneumonia are different in different setups. Hence there is every need for early diagnosis and management of these patients to decrease morbidity and mortality.

Material and methods

This cross-sectional study was conducted in the department of the Intensive care unit, Government Medical College, Mahaboobnagar, Telangana State, India. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from the guardians/relatives of the cases of the study.

Inclusion criteria

1. Fever >38.3°C or Temperature <36°C
2. Leucocytosis >12000/cumm, or Leucopenia <4000/cu.mm
3. Purulent respiratory secretion with gram stain demonstration & Polymorph cells
4. Quantitative endotracheal aspirate cultures with growth > 10^6 CFU/ ml

Exclusion Criteria

1. Patients who had pneumonia on admission or within 48hrs of admission
2. Those with other causes of radiological infiltrates like pulmonary hemorrhage,
3. pulmonary embolism, atelectasis, congestive cardiac failure, and acute respiratory
4. distress syndrome by C.T Scan and other diagnostic modalities.

All adult patients who develop nosocomial pneumonia in critical care units as per the definition in inclusion criteria is investigated clinically, radiologically, and bacteriologically to determine the presence of pneumonia, isolate the causative microorganism and presence of comorbid conditions like DM, COPD, CRF, etc. The outcome variable is the development of nosocomial pneumonia, which depends on the following factors like age, sex, habits-smoking, alcohol, clinical signs and symptoms, comorbid illness, organism isolated, use of medical devices like RT tube, intubation, ventilator, duration of hospital stays, etc. Investigations conducted: Relevant investigations were done in patients clinically suspected to have nosocomial pneumonia. The routine investigations included CBP, ESR, LFT, KFT, FBS, PPBS, HIV, ECG Specific investigations: Total Leukocyte Count (TLC), Differential Leukocyte Count (DLC), Chest x-ray, Sputum for- Gram stain, AFB, Culture and Sensitivity, Blood culture, Endotracheal aspirate for C/S in deserving candidates, Fiber Optic Bronchoscopy with BAL

and Endobronchial brush in deserving candidates, Arterial blood gas analysis. All the available data was uploaded on an MS Excel spreadsheet and analyzed by SPSS version 19 for descriptive and inferential statistics.

Results

A total of n=40 cases were studied in the current study based on the inclusion and exclusion criteria. Out of the n=40 cases, n=24(60%) were males and n=16(40%) were females. The age range was from 30 to 75 years. The mean age was 56.5 years the age-wise and sex-wise distribution of cases is depicted in table 1.

Table 1: demographic profile of cases included in the study

Age (Years)	*Male*	*Female*	*Frequency*	*percentage*
25-30	2	0	2	5.0
31-40	3	3	6	15.0
41-50	4	3	7	17.5
51-60	12	6	18	45.0
>60	3	4	7	17.5
Total	24	16	40	100

The primary diagnosis of critically ill patients who developed, nosocomial pneumonia was following a stroke in n=8 cases, Guillain Barre syndrome n=1(2.5%) cases, OP poisoning in n=1(2.5%) cases, chronic renal failure in n=3(7.5%) cases, COPD in n=2(5.0%) cases, IHD in n=4(10%) cases, Diabetes mellitus in n=18(45%) cases, RTA with a head injury in n=3 cases acute abdomen in n=3(7.5%) cases, bronchial asthma in n=1(2.5%). In our study out of n=40 cases, hospital-acquired pneumonia was diagnosed in n=22 out of these n=14 were males and n=8 cases were females and ventilator-associated pneumonia was diagnosed in n=18 cases out of which n=10 were males and n=8 were females. The distribution of cases has been shown in table 2. Symptoms of HAP in descending order of appearance were cough n=20 cases, expectoration n=15 cases, breathlessness n=12 cases, fever n=10 cases. The important signs were crepitations in n=15 cases, tachycardia n=10 cases, Ronchi in n=8 cases increased Tactile Vocal Fremitus (TVF) and Vocal Resonance (VR) were found in n=6 cases. The important signs of ventilator-associated pneumonia were crepitations in n=16 cases, Ronchi in n=11 cases, tachycardia in n=12 cases signs of pleural effusion were found in n=2 cases.

Table 2: Hospital-acquired pneumonia and ventilator-associated pneumonia distribution

	Frequency	**Percentage**
Hospital-acquired Pneumonia		
Early-onset HAP	8	36.36
Late-onset HAP	14	63.36
Total	22	100
Ventilator-associated pneumonia		
Early-onset VAP	5	27.78
Late-onset VAP	13	72.22
Total	18	100

The important radiological findings in HAP of early-onset showed the presence of infiltrates similarly in the late-onset HAP infiltrates were found in maximum cases followed by consolidation and cavity formation. In cases of VAP, the existence of infiltrates was also commonly found in both early-onset and late-onset VAP, and consolidation and cavitation were seen in late-onset VAP details depicted in table 3.

Table 3: Radiological profile of HAP and VAP

	Infiltrates	Consolidation	Cavity	Pleural Effusion
Hospital-Acquired Pneumonia				
Early Onset HAP	8	0	0	0
Late-Onset HAP	7	5	1	0
Ventilator-Associated Pneumonia				
Early Onset VAP	5	0	0	1
Late-Onset VAP	8	6	1	1

K. pneumoniae was the commonest organism isolated from 40.90% of all cases of HAP. In early-onset HAP the isolation of the organism was in 18.18% of cases and *S pneumoniae* was the second commonest organism isolated from 13.63% cases of HAP who were not mechanically ventilated. The description of various organisms in HAP is given in table 4. In cases of late-onset, VAP *P. aeruginosa* was isolated in 38.89% of cases *K. pneumoniae and S. aureus* was isolated in 11.11% cases of both early and late-onset VAP depicted in table 4.

Table 4: Type of organisms isolated in HAP and VAP

Organism	**Early Onset HAP**	**Late Onset HAP**
Klebsiella pneumoniae	4 (18.18%)	5 (22.72%)
Staphylococcus Aureus	1 (4.54%)	4 (18.18%)
Pseudomonas Aeruginosa	0 (0.0%)	5 (22.75%)
Streptococcus Pneumoniae	3 (13.36%)	0(0.0%)
Organism	**Early Onset VAP**	**Late Onset VAP**
Klebsiella pneumoniae	2 (11.11%)	2 (11.11%)
Staphylococcus Aureus	2 (11.11%)	2 (11.11%)
Pseudomonas Aeruginosa	0(0.0%)	7 (38.89%)
Streptococcus Pneumoniae	1 (5.56%)	0 (0.0%)
Mixed Infections	0 (0.0%)	2 (11.11%)

The evaluation of risk factors for HAP revealed n=10(45.45%) cases with diabetes mellitus and advanced age was in n=8(36.36%) cases, COPD was found in n=2(9.09%) cases, chronic renal failure and head trauma was in n=1(4.54%) case. For VAS the risk factors were advanced age n=5(27.78%) diabetes mellitus n=6(33.33%) chronic renal failure n=2(11.11%) nasogastric tube in n=3(16.67%) and COPD in n=2(11.11%) cases. Based on the prognosis and recovery in the cases it was found the prognosis was good in cases infected with *K. pneumoniae and S. pneumoniae* and the worst prognosis was found in cases infected with *Pseudomonas Aeruginosa.* The rate of mortality revealed that there were no cases of mortality in Early-onset HAP and in Late-onset HAP n=3 cases died. Similarly, in Early-onset VAP there was death in n=1 case and in late-onset, VAP n=4 cases died. Out of all HAP cases, 13.63% died and 22.22% deaths were in VAP cases.

Discussion

Nosocomial infections are five times more common in ICU patients because of altered sensorium, the presence of invasive devices, and prior use of antibiotics in these patients. [13] This study was conducted to determine the clinical-radiological pattern of nosocomial pneumonia including HAP, VAP, and organisms causing it. Predisposing factors for nosocomial pneumonia including HAP and VAP was also studied. The incidence of HAP was more common in the higher age group the mean age cases included in our study was 56.5 years. In a similar study Berba et al., [14] found higher age is a risk factor for nosocomial infections.

In the current, we also noted that the incidence was higher in males as compared to females this was in agreement with observations of other similar studies. [15, 16] The common signs of HAP included cough n=20 cases, expectoration n=15 cases, breathlessness n=12 cases. Important signs of VAS included crepitations in n=16 cases, Ronchi in n=11 cases, tachycardia in n=12 cases signs of pleural effusion were found in n=2 cases. Delirium was observed in a large number of elderly cases was associated with poor outcomes. Alberti et al., [17] in a similar study found delirium was an important sign of poor prognosis in patients with severe pneumonia which agrees with the results of this study. Some of the cases may not have a fever or respiratory symptoms such as atypical presentations usually make it difficult for physicians to diagnose correctly. [18] Diagnosis of nosocomial pneumonia using clinical criteria alone is often not accurate because fever and leukocytosis occur in many febrile conditions and colonization of the respiratory tract with gram-negative bacilli are common in intubated patients even in absence of pneumonia. [13] Also, chest X-ray infiltrates in patients on mechanical ventilation may be due to causes other than pneumonia. Diagnostic bronchoscopy with protected brushing of specimen or Bronchoscopy and Bronchoalveolar lavage (BAL) for culture increases the specificity of diagnosis. [19] The radiological findings of the current study in cases of HAP were infiltrated; other radiological findings are consolidation and cavity. The most common radiological finding in VAP is infiltrated, other radiological findings being consolidation, cavity, and pleural effusion. Bronchoscopy was done in those patients whose sputum and endotracheal aspirate reports were inconclusive and, in those patients, not responding to treatment. The result of our study showed that Klebsiella pneumoniae was the most common organism isolated in the patients with early-onset as well as late-onset hospital-acquired pneumonia. Whereas a study by Donald EC [20] showed Streptococcus pneumoniae was the most common organism isolated in early-onset nosocomial pneumonia and Klebsiella pneumoniae was the most common organism isolated in the patients with HAP. But the pattern and organisms depend upon the host-microbial flora and healthcare environment. In this study, the prognosis was good in cases infected with *K. pneumoniae and S. pneumoniae,* and the worst prognosis was found in cases infected with *Pseudomonas Aeruginosa* in agreement with observations of Jordi R et al., [21] Fagon et al., [22] documented that the risk of infection increases with duration of hospital stay which is following observations of our study as mortality is higher in late-onset hospital-acquired pneumonia and late-onset ventilator-associated pneumonia.

Conclusion

Nosocomial pneumonia is an important risk associated with critically ill patients in the intensive care unit (ICU). In this study, we found all 100% of patients with HAP of early-onset recovered were as late-onset HAP 78.5% recovered. In early-onset VAP cases 80% of cases recovered whereas in late-onset VAP only 69.2% cases recovered. Based on the microorganism involved the prognosis was good in cases infected with *K. pneumoniae and S. pneumoniae* and the worst prognosis was found in cases infected with *Pseudomonas Aeruginosa.*

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