Abstract

Introduction: Hospital-acquired pneumonia (HAP) is the most common nosocomial infections with high mortality. Outcome of HAP patients depends on several risk factors such as patient conditions and comorbid illness. Identification of risk factors responsible for mortality in HAP patients will help in better patient management. Emergence of resistance to antibiotics employed in the management of HAP has made treatment difficult and has increased rates of treatment failure, hospitalization duration and cost of therapy. To control the development of antibiotic resistance, there is a need for the surveillance of antibiotic resistance patterns and utilization pattern of antibiotics used in the treatment of HAP.

Objectives: Objective of the study was to identify the risk factors associated with mortality in HAP and to develop mortality prediction model, analyse antibiotic resistance pattern in microorganisms isolated from HAP patients and study the antibiotic consumption pattern in HAP patients.

Methodology: A prospective observational study was carried out in a tertiary care teaching hospital. HAP patients who fulfilled the inclusion criteria were identified and enrolled in the study after obtaining informed consent. Patient data like demography, social habits, previous medication history, vital signs and symptoms, details of diagnostic tests performed, comorbid diseases, mechanical ventilation and its duration, physiological and biochemical parameters, severity assessment (APACHE II), number of antibiotics prescribed, it’s generic name, dose, duration and route of administration, duration of hospitalisation period and outcome (recovery or death) were recorded in the case record forms (CRF). Unit price of each antibiotic prescribed was obtained from the hospital formulary. Etiological pathogens isolated, their gram-staining characteristics, number of isolated microorganisms and their culture sensitivity report were obtained from microbiology report. Risk factors responsible for mortality in HAP patients were identified by Univariate logistic regression and odds ratio was calculated. Mortality prediction model was developed using multiple logistic regression. Utilisation pattern of antibiotics in HAP patients was measured in terms of DDD/100 bed-days using WHO, ABC Calc v3.1.

Results: Total of 505 patients were enrolled in the study. The mean age of study population was 55.1±16.2 years. The majority of patients were males (66.9%) and 230 (45.5%) patients were on ventilation. Mortality among HAP patients was 23.6%. Mechanical ventilation (MV),
Immunosuppression (IS), Liver insufficiency (LI), APACHE II score >20, Male sex, Age >60 years, Pulmonary disease (PD) were independently associated with mortality in HAP patients and based on that mortality prediction model was developed. 10 different pathogens were isolated from study population and majority of the patients were infected with gram-negative bacteria. *Klebsiella pneumoniae* was the most common microorganism isolated followed by *Acinetobacter species* and *Pseudomonas aeruginosa*. Highest mortality was observed in Methicillin-resistant *Staphylococcus aureus* (MRSA) infected patients, followed by *Acinetobacter species* and *Pseudomonas aeruginosa*. Analysis of sensitivity pattern of isolated microorganisms showed that majority of the microorganism were sensitive to Colistin and Tigecycline. MRSA was 100% sensitive to Linezolid, Doxycycline and Cotrimoxazole. *Streptococcus pneumoniae* showed 100% sensitivity to Chloramphenicol, Penicillin G, Piperacillin, Cefoperazone/sulbactam and Colistin. Based on the sensitivity pattern of the various microorganisms isolated from the HAP patients, cumulative susceptibility data (antibiogram) was prepared. Analysis of antibiotic consumption pattern showed Piperacillin/tazobactam was the highly prescribed drug with 12 DDD/100 bed days, followed by Azithromycin, Ceftriaxone and Cotrimoxazole. Among the different combination of antibiotics used Piperacillin/tazobactam and Azithromycin combination was found to be prescribed for the majority of HAP patients. The combination of triple regimen Piperacillin/tazobactam, Ceftriaxone and Azithromycin was associated with high cost among the other combinations.

**Conclusion:** Measures against the factors identified as independently influencing the outcome of HAP may improve the prognosis of the still leading cause of mortality among nosocomial infections. Antibiogram developed can be utilized to design suitable antibiotic policy and intervention aimed at reducing antibiotic resistance.