

ORIGINAL RESEARCH

Study of Antimicrobial Resistance and Antibiotic Susceptibility Pattern in Patients with Lower Respiratory Tract Infection in Intensive Care Unit at a Tertiary Care Hospital

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Received: 17 May, 2019

Accepted: 28 June, 2019

ABSTRACT

Background: Lower respiratory tract infections (LRTI) are the most common bacterial infections among patients in neurological intensive care units (NICUs). Different scenarios might be identified by physicians dealing with nosocomial respiratory infections. The epidemiological and clinical evaluation of LRTIs acquired in the hospital setting remains a topic of outstanding relevance. Hence; the present study was conducted for evaluating antimicrobial resistance and antibiotic susceptibility pattern in patients with lower respiratory tract infection in intensive care unit. **Materials & Methods:** A total of 100 patients admitted to ICU were enrolled. Only those patients were enrolled which developed LRTI among ICU patients were enrolled. Complete demographic and clinical details of all the patients were obtained. O Clinico-pathological Indicator score (CPI score) was obtained on day 1 and day 2. Sputum samples were collected from all the patients. Blood agar and MacConkey agar were used for quantitative cultures and $>10^6$ CFU/ml on quantitative culture was considered pathological. Blood culture was done in patients with suspected bacteremia and sepsis. Antibiotic susceptibility pattern was evaluated. **Results:** Klebsiella pneumonia, Pseudomonas aeruginosa, Staphylococcus aureus, Acinetobacter baumannii and Streptococcus pneumonia were detected in 20 percent, 18 percent, 10 percent, 38 percent and 14 percent of the patients respectively. Amoxicillin and Ceftazidime were the most commonly prescribed antibiotics. Klebsiella pneumonia was susceptible to amikacin and colistin. Pseudomonas aeruginosa was susceptible to amikacin, Ceftazidime, cotrimoxazole and colistin. Staphylococcus aureus was susceptible to Linezolid and Colistin. Acinetobacter baumannii was susceptible to cotrimoxazole and colistin. **Conclusion:** Acinetobacter baumannii was the most common microorganism isolated in the present study highlighting the need for antibiogram for each ICU.

Key words: Lower respiratory tract, Infection, Intensive care unit.

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INTRODUCTION

Lower respiratory tract infections (LRTI) are the most common bacterial infections among patients in neurological intensive care units (NICUs), occurring in 10-25% of all intensive care unit (ICU) patients and resulting in high overall mortality, which may range

from 22% to 71%. Infection and antibiotic resistance are important public health issues.¹⁻³

Different scenarios might be identified by physicians dealing with nosocomial respiratory infections. On one hand, some hospitalised patients may develop nosocomial pneumonia outside the ICU, but then be

transferred to the ICU because of the development of organ failure and the need for critical care support: these patients are considered to have non-ICU-acquired nosocomial pneumonia requiring ICU admission. On the other hand, the clinical course of patients already admitted to the ICU, for a variety of reasons, may be complicated by the occurrence of a LRTI: these patients are considered to have ICU-acquired pneumonia (ICUAP). ICUAP may affect patients who are undergoing mechanical ventilation or during spontaneous breathing.⁴⁻⁶

The epidemiological and clinical evaluation of LRTIs acquired in the hospital setting remains a topic of outstanding relevance. A new definition, a ventilator-associated event (VAE), has been recently introduced in the US scientific debate, grouping all the conditions that result in a significant and sustained deterioration of oxygenation, independent of the infectious nature of the underlying process. It is important to differentiate infection from that of noninfectious disorders such as asthma, COPD, heart failure, or lung infarction. Due to their nature and ongoing treatment, these chronic noninfectious disorders can be identified based on clinical and medication history.^{7,8} Hence; the present study was conducted for evaluating antimicrobial resistance and antibiotic susceptibility pattern in patients with lower respiratory tract infection in intensive care unit.

MATERIALS & METHODS

The present study was conducted for evaluating antimicrobial resistance and antibiotic susceptibility pattern in patients with lower respiratory tract

infection in intensive care unit. A total of 100 patients admitted to ICU were enrolled. Only those patients were enrolled which developed LRTI among ICU patients were enrolled. Complete demographic and clinical details of all the patients were obtained. O Clinicopathological Indicator score (CPI score) was obtained on day 1 and day 2. Sputum samples were collected from all the patients. Blood agar and MacConkey agar were used for quantitative cultures and $>10^6$ CFU/ml on quantitative culture was considered pathological. Blood culture was done in patients with suspected bacteremia and sepsis. Antibiotic susceptibility pattern was evaluated. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software.

RESULTS

A total of 100 subjects were analyzed. Mean age of the patients was 48.3 years. Majority proportion of patients were males and were of urban residence. Klebsiella pneumonia, Pseudomonas aeruginosa, Staphylococcus aureus, Acinetobacter baumannii and Streptococcus pneumonia was detected in 20 percent, 18 percent, 10 percent, 38 percent and 14 percent of the patients respectively. Amoxicillin and Cefazidime were the most commonly prescribed antibiotics. Klebsiella pneumonia was susceptible to amikacin and colistin. Pseudomonas aeruginosa was susceptible to amikacin, Cefazidime, cotrimoxazole and colistin. Staphylococcus aureus was susceptible to Linezolid and Colistin. Acinetobacter baumannii was susceptible to cotrimoxazole and colistin.

Table 1: Microbiological profile

Microbiological profile	Number	Percentage
Klebsiella pneumonia	20	20
Pseudomonas aeruginosa	18	18
Staphylococcus aureus	10	10
Acinetobacter baumannii	38	38
Streptococcus pneumonia	14	14
Total	100	100

Table 2: Antibiotic susceptibility pattern

Sensitive antibiotics	Klebsiella pneumonia (n=20)	Pseudomonas aeruginosa (n=18)	Staphylococcus aureus (n=10)	Acinetobacter baumannii (n=38)	Streptococcus pneumonia (n=14)
Amoxicillin	0	0	0	0	5
Amikacin	10	11	3	3	6
Cefazidime	3	12	0	0	5
Levofloxacin	9	6	1	1	10
Clindamycin	3	0	0	2	12
Linezolid	0	2	8	0	10
Cotrimoxazole	5	12	2	35	11
Colistin	18	15	5	36	10

DISCUSSION

Pneumonia in the intensive care unit (ICU) has been associated with highly virulent pathogens that often

exhibit resistance to multiple antibiotics and mortality rates of 30-70%. Pseudomonas aeruginosa and Enterobacteriaceae are the leading pathogens,

followed by *Staphylococcus aureus* and polymicrobial etiologies. Recent clinical studies using monotherapy for nosocomial pneumonias resulted in low eradication rates for *P. aeruginosa* and staphylococci. Because the diagnosis and treatment of community-acquired pneumonia (CAP) continues to present decision-making challenges, a number of professional organizations have developed treatment guidelines to provide parameters for diagnosis and treatment. The Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS) both recently updated their guidelines for the treatment of CAP to take into account the changes that have occurred in antimicrobial susceptibility and the availability of newer antimicrobial agents. Both the IDSA and ATS guidelines stratify treatment according to where the patient is treated, but the ATS guidelines further characterize patients according to the presence or absence of cardiopulmonary disease or other modifying factors.⁹⁻¹¹

Hence; the present study was conducted for evaluating antimicrobial resistance and antibiotic susceptibility pattern in patients with lower respiratory tract infection in intensive care unit.

A total of 100 subjects were analyzed. Mean age of the patients was 48.3 years. Majority proportion of patients were males and were of urban residence. *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Acinetobacter baumannii* and *Streptococcus pneumoniae* was detected in 20 percent, 18 percent, 10 percent, 38 percent and 14 percent of the patients respectively. Amoxicillin and Ceftazidime were the most commonly prescribed antibiotics. *Klebsiella pneumoniae* was susceptible to amikacin and colistin. Giang M. Tran et al defined the pattern of antimicrobial resistance in ICU patients with ventilator-associated pneumonia. Antimicrobial resistance was commonly found in ceftriaxone (88%), ceftazidime (80%), ciprofloxacin (77%), cefepime (75%), levofloxacin (72%). Overall, the rate of antimicrobial resistance to any drug was 93% (n = 153/164), with the majority (87%) being resistant to at least 2 drugs. The three commonly isolated microorganisms were *Acinetobacter* (n = 75), *Klebsiella* (n = 39), and *Pseudomonas aeruginosa* (n = 29). *Acinetobacter baumannii* were virtually resistant to ceftazidime, ceftriaxone, piperacillin, imipenem, meropenem, ertapenem, ciprofloxacin and levofloxacin. High rates (>70%) of ceftriaxone and ceftazidime-resistant *Klebsiella* were also observed. These data indicated that critically ill patients on ventilator in Vietnam were at disturbingly high risk of antimicrobial resistance.¹²

Outcomes research is the measurement of the impact of illness and the effect of treatment on clinically relevant end-points. There are no well-controlled studies that provide definitive estimates of the magnitude of the impact of antimicrobial therapy on these outcomes for patients with community-acquired pneumonia or other respiratory tract infections, such

as acute exacerbations of chronic bronchitis. Most studies of the impact of drug resistance on outcomes for patients with respiratory tract infections have focused on the impact of β -lactam drug resistance on outcomes for patients with community-acquired pneumococcal pneumonia. In general, these studies have demonstrated that outcomes are not affected by current levels of drug resistance, but most studies are hampered by small sample size, inability to control adequately for severity of illness and concordance of therapy, and inclusion of few subjects with high-level drug resistance.^{13, 14}

Pseudomonas aeruginosa was susceptible to amikacin, Ceftazidime, cotrimoxazole and colistin. *Staphylococcus aureus* was susceptible to Linezolid and Colistin. *Acinetobacter baumannii* was susceptible to cotrimoxazole and colistin. In another study conducted by Mahendra M et al, authors evaluated antibiotic Prescription, Organisms and its Resistance Pattern in Patients Admitted to Respiratory ICU with Respiratory Infection. Demographic details, comorbidities, Clinco-pathological score (CPI) on day 1 and 2 of admission, duration of ICU admission, number of antibiotics used, antibiotic prescription, antimicrobial resistance pattern of patients were collected using APRISE questionnaire. 352 patients were screened and 303 patients were included into study. Mean age was 56.05 ± 16.37 and 190 (62.70%) were men. Most common diagnosis was Pneumonia (66%). Piperacillin-tazobactam was most common empirical antibiotic used. They found 60% resistance to piperacillin-tazobactam. *Acinetobacter baumannii* was the most common organism isolated (29.2%) and was highly resistant to Carbapenem (60%). *Klebsiella pneumoniae* was resistant to Amikacin (45%), piperacillin (55%) and Ceftazidime (50%). Piperacillin-tazobactam was the most common antibiotic prescribed to patients with respiratory infection admitted to ICU.¹⁵

In another previous study conducted by Hamishehkar H et al, authors evaluated a total number of 556 isolates from 328 patients were evaluated. The most common sites of infections included respiratory (51.7%), urinary (24.8%), and blood (10.4%). The most frequently isolated microorganisms were *Enterobacter aerogenes* (50.6%) followed by *Escherichia coli* (16.7%) and *Pseudomonas aeruginosa* (7.5%). *Staphylococcus aureus* was the most frequent pathogen among gram-positives (39.7%). The rate of methicillin-resistant *Staphylococcus aureus* (MRSA) was 87.5%. Multidrug-resistant (MDR) gram-negative bacteria were documented in 25.8% of *Acinetobacter*, 20% of *Klebsiella*, and 16.6% of *Pseudomonas*. The most active antimicrobials were vancomycin (93.5%) followed by amikacin (71.5%) and gentamicin (46%). The overall antibiotic susceptibility was as follows: 36% ciprofloxacin, 19% imipenem, 20% trimethoprim-sulfamethoxazole, 20.5% ceftazidime, and 12% ceftriaxone.¹⁶

CONCLUSION

Acinetobacter baumannii was the most common microorganism isolated in the present study highlighting the need for antibiogram for each ICU.

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