Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(5):1500-1503

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Antibiotic sensitivity pattern of bacterial isolates of ventilated patients from the intensive care unit of a tertiary care hospital in rural India

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ABSTRACT

To undertake an audit of the antimicrobial (AM) sensitivity pattern of bacterial isolates in the intensive care units (ICU) of a tertiary hospital of Bankura, India. A cross sectional retrospective study. Blood, urine sample and tip of endotracheal tube and tracheal aspirate sent for the culture of the ventilated patient. SPSS software was used for calculation of % R of 95% confidence interval (CI). Of 100 patients selected 61 patents (61%) are culture positive and 39 (39%) are culture negative. Lower respiratory tract infection (LRTI) was the most common infection, followed by urinary tract infection (UTI) and bacteraemia. The most common infections occurring in ICU in order of frequency were Pseudomonas aeruginosa (36.06%), Acinetobacter baumannii (26.2%), Klebsiella pneumoniae (14.7%) and Staphylococcus epidermidis (8.2%).A very high rate of resistance (80-100%) was observed to ciprofloxacin, ceftazidime, and amoxicillin/clavulanic acid combination. Least resistance was noted to meropenem and doxycycline. P. aeruginosa isolates showed high rate of resistance to cephalexin (92.5%), cefotaxime (66.4%) and ceftriaxone (60%). Meropenem is the most effective antibiotic followed by Imipenem and Amikacin. Most bacteria isolated from ICU of Bankura sammilani medical college and hospital were resistant to the third generation of cephalosporins, and quinolone antibiotics. Most commonly isolated organisms were from endotracheal aspirate. Regular surveillance of antibiotic susceptibility patterns is very important for setting orders to guide the clinician in choosing empirical or directed therapy of infected patients.

INTRODUCTION

Antibiotic resistance is a major world-wide problem in the intensive care unit (ICU), including in India. It has been realized that the spread of drug resistant organisms in the ICU is related to the widespread use of broad spectrum antibiotics. The rate of antimicrobial resistance in the ICU is several folds higher than in the general hospital setting. Many surveillance efforts have drawn attention to this phenomenon. [1-4]

ICU is one of potential sources of nosocomial infections even in countries where extensive infection control measures are routinely implemented. The international study of infection in ICU which was conducted in 2007, and involved with 1265 ICUs from 75 countries, demonstrated that patients who had longer ICU stays had higher rates of infection, especially infections due to resistant *Staphylococci*, *Acinetobacter*, *Pseudomonas* species, and *Candida* species. Moreover, the ICU mortality of infected patients was more than twice that of non-infected patients. [4] Most ICU patients that acquired infections are associated with the use of invasive devices such as catheters and mechanical ventilators [5]. Prevention of the emergence and dissemination of resistant microorganisms will reduce adverse events and their attendant costs. Appropriate antimicrobial stewardship that includes optimal selection, dose, and duration of treatment, as well as control of antimicrobial use, will prevent or slow the emergence of resistance among microorganisms [6]. Therefore, the present study was designed to know the bacterial profile and determine the antimicrobial resistance pattern among patients admitted to the ICU of our institute.

1. To identify the group of organisms developing resistance
2. To identify the classes of drugs against, which resistance has emerged
3. To assess the possible factors that can favour the development of AMR so that antibiotic policy can be formulated for the proper and effective use of antibiotics.

EXPERIMENTAL SECTION

A cross-sectional study was carried out based on reports of bacteria isolates from the ICU of Bankura sammilani medical college and Hospital, from January 2013 to June 2013. Approval from the Institutional Research and Ethical committee was obtained prior to the commencement of the study. All samples that were collected aseptically from the 100 patients were plated right after the collection. Identification of all causative microorganisms was performed by standard microbiologic methods.

Inclusion criteria: All the patients 18 years and above who were under mechanical ventilation for more than 48 hours.

Exclusion criteria: All patients with prior culture and sensitivity done.

Collection: Endotracheal aspirate (≥1 ml) or tip of endotracheal tube was collected under aseptic precaution after 48 hours of intubation. Two separate specimens of blood culture were taken from different sites and urine specimen and Foleys catheter were sent for culture.

RESULTS

Specimens were collected from 100 patients who were given antimicrobial treatment, of which 61 (61%) were cultured positive and 39 (39%) were negative. Table 1 showing the organisms isolated from different samples. Data are expressed in absolute no.

Table 1

Organism	Tracheal aspirate	Blood culture	Urine culture
P. aeruginosa	12	4	6
baumannii	12	3	1
K. pneumonia	6	1	2
Staph. Epidermidis	1	2	2
MRSA	3	1	0
E.coli	0	2	2
P. vulgaris	0	0	1

Table 2 showing total no. and proportion of organisms found in total isolates

Organism	Total isolates	% of isolate
P. aeruginosa	22	36.06%
A. baumannii	16	26.2%
K. pneumonia	9	14.7%
Staph. Epidermidis	5	8.2%
MRSA	4	6.56%
E.coli	4	6.56%
P. vulgaris	1	1.63%

Table 3 showing antibiotic resistance pattern of predominant organisms found in ITU of Bankura medical college, values are expressed in percentage

Antibiotic	P.aeruginosa n=22	Acinatobacter n=16	K.pneumoniae n=9	S.epidermidis n=5	MRSA n=4	E.coli n=4
Ampicillin	90.9(20/22)	87.5(14/16)	77.8(7/9)	100(5/5)	100(4/4)	100
Cephalexin	95.45(21/22)	93.7(15/16)	88.9(8/9)	100(5/5)	100(4/4)	75(3/4)
Ceftazidime	36.4(8/22)	62.5(10/16)	55.5(5/9)	40(2/5)	50(2/4)	50(2/4)
Ceftriaxone	68.2(15/22)	93.7(15/16)	66.7(6/9)	80(4/5)	75(3/4)	75(3/4)
Cefepime	27.3(6/22)	31.2(5/16)	22.2(2/9)	40(2/5)	75(3/4)	50(2/4)
Imipenem	22.7(5/22)	25(4/16)	33.3(3/9)	20(1/5)	50(2/4)	25(1/4)
Meropenem	13.6(3/22)	18.7(3/16)	11.1(1/9)	20(1/5)	25(1/4)	25(1/4)
Amikacin	31.8(7/22)	43.7(7/16)	44.4(5/9)	40(2/5)	25(1/4)	25(1/4)
Gentamicin	45.4(10/22)	56.2(9/16)	66.7(6/9)	60(3/5)	75(2/4)	25(1/4)
Ciprofloxacin	72.7(16/22)	75(12/16)	77.8(7/9)	80(4/5)	75(3/4)	75(3/4)
Levofloxacin	45.4(10/22)	68.7(11/16)	44.4(4/9)	60(3/5)	50(2/4)	50(2/4)
Ofloxacin	50(11/22)	81.2(13/16)	55.5(5/9)	40(2/5)	50(2/4)	25(1/4)
Co-trimoxazole	77.3(17/22)	100(16/16)	88.9(8/9)	80(4/5)	100(4/4)	50(2/4)

DISCUSSION

Antimicrobial agents (AMs) are among the most commonly used drugs in hospitalized patients. The emergence of AM resistance in ICUs is of great concern as it increases the likelihood of drug interactions/side effects and cost of therapy due to use of newer antibiotics. Resistance may also be responsible for prolonged hospital stays and can affect prognosis. The problem of resistance in a hospital is difficult to understand without the knowledge of AM use pattern. [7]

Our result revealed that *P. aeruginosa*, *Klebsiella* spp., *A.Baumannii, S. Epidermidis, MRSA* and *E. coli* were predominant isolates. Organisms are most commonly found from tracheal aspirates followed by urine sample and blood sample. High degree of antibiotic resistance is found in *P. aeruginosa, A.Baumannii* and *Klebsiella* spp. *P. aeruginosa* isolates showed high rate of resistance to cephalexin (95.4%), ampicillin (90.9%), and ceftriaxone (68.2%). Meropenem was the most effective (only 13.6% resistance) antibiotic against *P. aeruginosa* followed by Imipenem (22.7%), and Cefepime (27.3%) and Amikacin (31.8). The occurrence of MDR *Pseudomonas* was observed in 22 out of 100 samples in our study confirming it to be the most common Hospital acquired infection as evidenced by many studies conducted at different parts of India in addition to studies done in AIIMS, Delhi and from ICUs of seven different hospitals in Goa. [8, 9, 10]

Our study shows that *A.Baumannii* is another organism that frequently isolated in our ICU. It is most commonly isolated from tracheal aspirates followed by blood culture. It is highly resistant against cephalexin, ceftriaxone, and fluoroquinolones, moderately resistant against ceftazidime. It was found to be sensitive against Imipenem and Meropenem. Some studies however found good sensitivity of *A.Baumannii* [11]. *A.Baumannii* is seen as emerging infection in ICU setting.

In our study, *Klebsiella*, one of the main bacterial pathogen seen in ICU complicating COPD LRTI patients etc., and also a hospital acquired infection as per India report on Global resistance, was observed to be resistant to drugs such as ampicillin/amoxicillin, co-trimoxazole, third generation cephalosporins, fluoroquinolones. Least resistance was exhibited to gentamycin, amikacin and carbapenems mimicking the results of many studies. [10, 12, 13, 14, 15] . Another study reported 100% sensitivity to meropenem against *Klebsiella*

Spp [16]. This finding suggests that meropenem should be used judiciously in ventilated patients to prevent any further increase in resistance to meropenem.

In our study both *S. epidermidis and S. Aureus* showed almost full resistance to penicillin. But they show good sensitivity against meropenem, Imipenem and amikacin. to penicillin.

Varying levels of resistance of the various penicillins to *S. aureus* and *S. Epidermidis* have been reported in studies carried out in ICUs in India.[17] MRSA showed high resistance to co-trimoxazole and ampicillin/amoxicillin followed by fluoroquinolones in our study.

Highest resistance by *E. coli* was noted against ampicillin/amoxicillin followed by fluoroquinolones, co-trimoxazole and third generation cephalosporins in our study. This pattern of resistance has been shown by many studies. [12], [13], [18]. Least resistance was observed in our study against gentamycin, amikacin, meropenem and Imipenem which is similar to the studies of WHO [18].

In our study only one isolate of *P.vulgaris* is found in urine sample which is sensitive in amikacin.

Antibiotic disc sensitivity test results may vary with hospital setting, while infection rate in a hospital may depend on the hospital environment, antibiotic use and other infection control practices. All these would limit the applicability of the findings of this study to other hospital settings.

CONCLUSION

We conclude that *P. aeruginosa* are the most common etiological agents of infection in ICU. Lrti is the most common infection in ICU especially in ventilated patient. There is an alarmingly high rate of resistance to cephalosporins, beta lactam-_ lactamase inhibitors, and carbapenem against predominant organisms. Although meropenem is still sensitive against most pathogens but resistance is rising. Judicious use of older and newer antimicrobial agents is essential to prevent the emergence of multi drug resistant bacteria in the ICU.

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