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SPECTRUM AND ANTIBIOGRAM OF GRAM NEGATIVE BACILLI IN RESPIRATORY SPECIMENS OF ICU OF A TERTIARY CARE HOSPITAL

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ABSTRACT

Nosocomial infections are highly prominent in intensive care units (ICU), which are mainly due to the use of large numbers of invasive monitoring devices, endotracheal and tracheostomy tubes, in addition to patients' factors including extremes of age, immunocompromised status, malnutrition, severe underlying disease, wide use of antibiotics and to a high incidence of cross infection. Due to this, ICUs in hospitals have become the hub of multidrug resistant organisms. A total of 157 specimens received from our hospital's ICU were analyzed in our department over a period of one year, out of which 48 (30.5%) were culture positive. From 48 culture-positive specimens, 47 (97.9%) were gram-negative bacilli while only 01 (2.1%) was MRSA (methicillin-resistant *Staphylococcus aureus*). Antibiotic resistance pattern of all the isolates was evaluated, with all isolates showing 100% resistance to Cefotaxime, whereas Tigecycline, Colistin and Polymyxin B were found to be 100% effective against all gram-negative bacilli. The most important factor for controlling antibiotic-resistant pathogens in the ICU is rigorous adherence to infection control guidelines and prevention of antibiotic misuse.

KEYWORDS: **MDR Gram-negative bacilli, ICU, Resistogram.**

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INTRODUCTION

As per WHO, Nosocomial infection (NI) is defined as an infection acquired by a patient in a hospital or other healthcare facility that was not present or incubating at the time of admission, or that was the residual of an infection acquired during a previous admission (WHO, 2002). The hospital ICUs constitute about 25% of all NIs and the incidence is 5 to 10 times higher than in general hospital wards[1], which means that NIs are especially prominent in ICU[2].Lower respiratory tract infection (LRTI), as an NI, is a major cause of morbidity and mortality. Out of all the Nis, the most common NI is ventilator-associated pneumonia, followed by urinary tract infections, and blood stream infections[3]. Nosocomial pneumonia accounts for 15% of all nosocomial infections and affects 5.2% of hospitalized patients. Even though, there is vast diversity of pathogens causing NIs in various institutions and countries, Gram-negative bacilli (GNB) are the most common cause of LRTI in ICUs. The major concern among bacteria causing infections in ICUs is multidrug-resistance, especially among GNBs. This is a major public health problem and cause for both substantial morbidity and mortality among ICU patients. Optimizing empirical therapy requires knowledge of likely antimicrobial resistance patterns. The present study was conducted to evaluate the causative agents for LRTI in ICUs with their antibiotic resistance pattern.

MATERIALS AND METHODS

The present study was conducted in the Microbiology department of Rama Medical College, Hospital and Research Centre, Kanpur. Over a period of one year, a total of 157 respiratory specimens (sputum, endotrachael suction, tracheostomy tips, bronchioalveolar lavage) was collected from the ICU patients suffering from LRTI. The samples after receipt in the department of Microbiology were cultured on blood agar, chocolate agar and McConkey agar and incubated for 18-24 hours at 37^0C. Isolates were identified by morphology, cultural characteristics and biochemical identification tests using standard methods[4,5].

Antibiotic susceptibility testing

Antibiotic susceptibility test of all culture-positive isolates was performed by Kirby Bauer disc diffusion method[6]. Following overnight incubation, the culture was examined for areas of no growth around the disc. The zone of inhibition was interpreted as per CLSI guidelines[7].The antibiotic discs used were Amikacin(30µg), Gentamicin(10µg), Cefotaxime(30µg), Cefoperazone-sulbactam (75/30µg), Imipenem(10µg), Meropenem(10µg), Ertapenem(10µg), Tigecycline (15µg), Colistin(10µg) and Polymyxin B(300U). For quality control of disc diffusion method, control strains of *E. coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853 were used.

RESULTS

Out of 157 respiratory specimens, 48 (30.5%) were culture positive. From 48 culture-positive specimens, 47 (97.9%) were Gram-negative bacilli while only 01 (2.08%) was MRSA (methicillin-resistant *Staphylococcus aureus*). Statistically, there was significant difference between the isolated number of Gram-negative and Gram-positive bacteria where the P-value was < 0.05. Among the 47 Gram-negative isolates, *Klebsiella* spp. was found to be the commonest isolate (55.3%) followed by *Pseudomonas* (23.4%), *Acinetaobacter* spp. and *Escherichia coli* (Table 1).However, some studies have shown the prevalence of *Escherichia coli* and *Pseudomonas* spp to be higher than *Klebsiella* spp., in our study the *Klebsiella* spp. was isolated from more than 50% of culture-positive specimens, and *Pseudomonas* in only one fourth of the culture-positive specimens.

Table-1
Spectrum of Gram-negative bacilli from respiratory specimens of ICU

S. No.	Isolates	Total no.of Isolates
01	*Klebsiella pneumoniae*	26 (55.3%)
02	*Pseudomonas aeruginosa*	11 (23.4%)
03	*Acinetobacter* spp	07 (14.9%)
04	*Escherichia coli*	03 (6.4%)
Total		47

Antibiotic resistance pattern

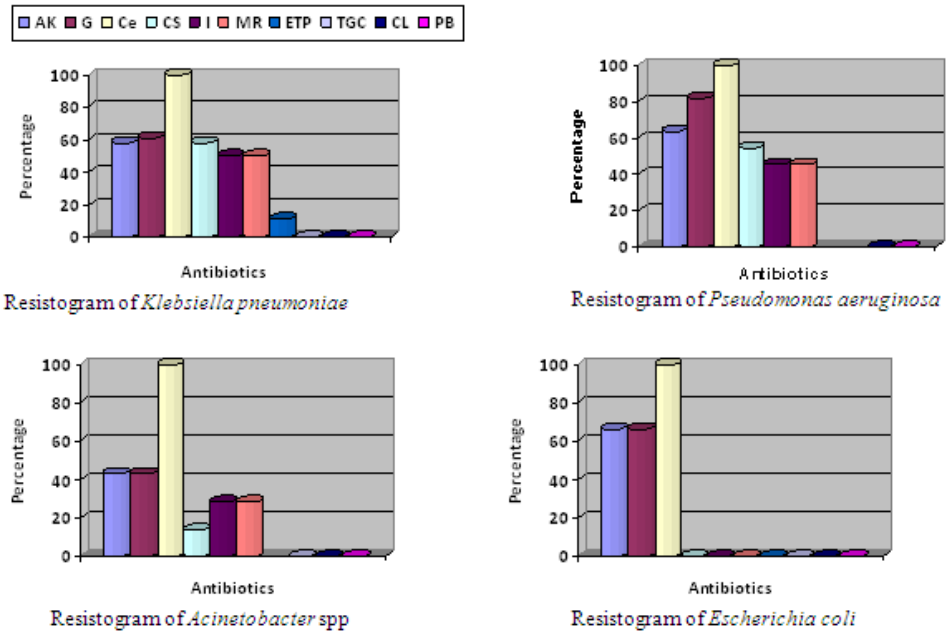
The Resistogram of all the isolates is shown in Table 2 and Fig 1. All 47 isolates were found to be 100% resistant to Cefotaxime and 100% sensitive to Tigecycline, Colistin and Polymyxin B. Cefoperazone-sulbactam, Imipenem and Meropenem are found to be ineffective in around 50% isolates of *Klebsiella* and *Pseudomonas* whereas these antibiotics are 100% effective in *Escherichia coli*. Ertapenem is also 100% effective in all isolates except in *Klebsiella* in which it is 90% effective.

Table-2
Antibiotic resistance pattern (Resistogram) of Gram-negative bacilli

S. no	GNB	Total no of isolates	AK (%)	G (%)	Ce (%)	CS (%)	I (%)	MR (%)	ETP (%)	TGC (%)	CL (%)	PB (%)
1	*Klebsiella pneumoniae*	26	15 (57.7)	16 (61.5)	26 (100)	15 (57.7)	13 (50)	13 (50)	3 (11.5)	0 (0)	0 (0)	0 (0)
2	*Pseudomonas aeruginosa*	11	7 (63.6)	9 (81.8)	11 (100)	6 (54.5)	6 (54.5)	(54.5)	NA	NA	0 (0)	0 (0)
3	*Acinetobacter* spp.	07	3 (42.8)	3 (42.8)	7 (100)	1 (14.3)	2 (28.6)	2 (28.6)	NA	0 (0)	0 (0)	0 (0)
4	*Escherichia coli*	03	2 (66)	2 (66)	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

AK: Amikacin, G: Gentamicin, Ce: Cefotaxime, CS: Cefoperazone-sulbactam, I: Imipenem, M: Meropenem, E: Ertapenem, T: Tigecycline, C: Colistin, P: Polymyxin B, NA: Not applicable

Figure 1
Comparison of Resistograms of all 4 Gram-negative isolates



DISCUSSION

LRTI is a frequent complication in patients admitted in ICU. It is frequently polymicrobial with predominantly multidrug resistant GNB. In our study, GNB (47/48, 97.5%) were mainly responsible for LRTIs and only 1 (2.5%) case was caused by Gram-positive cocci. Out of all the culture-positive isolates, *Klebsiella pneumoniae* was isolated in maximum number, i.e. 26 (55.3%) followed by *Pseudomonas aeruginosa* in 11 (23.4%) cases and *Acinetobacter* spp. in 7 (14.9%) cases. This is in comparison to a study conducted by Bhaumik et al who had reported *Klebsiella*, *Pseudomonas* and *Acinetobacter* as the three most commonly isolated pathogens in respiratory specimens from ICU patients[8]. In the present study, 100% resistance was exhibited against cefotaxime in all the Gram negative isolates which is comparable to the findings of Al Jawady et al and Kumari et at who have reported 98.9% and 90% resistance in Gram-negative isolates respectively[9,10]. *Klebsiella pneumoniae* showed 57.7% resistance to amikacin which is in comparison to a study by Gunjal et al who reported 60% resistance to amikacin[11]. More than 50% isolates of *Klebsiella* and *Pseudomonas* were resistant to imipenem and meropenem. Out of all carbapenems, ertapenem was found to be most sensitive (88.5% and 100%) against all *Klebsiella* and *Escherichia coli*. Carbapenems have to be used cautiously since they are the last hope among all the newer antimicrobial agents as there is a high rate resistance seen against third generation cephalosporins due to selective extensive usage of these antibiotics.

CONCLUSION

Gram negative bacilli are the predominant pathogens causing respiratory tract infections in ICU patients. The increasing trend of resistance in Gram negative bacilli is highly disturbing and challenging. Judicious use of older as well as newer antimicrobial agents is essential to prevent the emergence of multidrug resistant bacteria in the ICU.

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