

Research Article



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Occurrence of MBL producing *Klebsiella* sp. and *E.coli* strains in a tertiary care hospital.

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Abstract

Introduction:-Emergence of MBL producing strains throughout the world and there treatment has been creating panic among the medical practitioners. Their ability to resist almost all the antibiotics makes them of major concern for its early detection and treatment. **Aim:-**To detect MBL producing *E.coli* and *Klebsiella* strains and study their antibiotic sensitivity pattern. **Material Method:-** A total of 100 clinical isolates of carbapenem resistant strains of *E.coli* and *Klebsiella* species from all clinical samples were cultured and antibiotic sensitivity was done as per standard laboratory routine procedures. **Result:-** Among total (n=100) carbapenem resistant strains, 30% were MBL producing strains; majorly from respiratory tract samples 56% followed by pus 31%, blood 28% and urine 21%. Antimicrobial resistance pattern of MBL producing strains with aztreonam was zero followed by ampicillin and sulbactam. **Conclusion:-**Screening strategy based on early detection of MBL producers on worldwide scale and for at-risk patients in areas on endemicity may prevent outbreak of infections with MBL producers.

Keywords: Metallo-Beta-Lactamase(MBL), *E.coli*, *Klebsiella*, antimicrobial resistance.

Introduction

Family Enterobacteriaceae's resistance to third generation cephalosporin is increasing, thus becoming a cause for concern. Failure in treatment because of the current β -lactam therapy comprises a big threat due to ESBL and MBL prevalence of Enterobacteriaceae. *E.coli* and *Klebsiella* species have been reported as opportunistic, worrisome nosocomial and community associated pathogens. Beta-lactam antibiotics have been the drug of choice in treating their infections. However, multiple antibacterial resistances in recent decades among *E.coli* and *Klebsiella* spp. as ESBL and MBL producers have become common, very difficult to treat and may result in death.

Extensive and sometime unnecessary use of the carbapenems, poor sanitation and large population has facilitated the emergence of carbapenem resistant bacteria. Resistance to carbapenem is predominantly mediated by MBLs, a class B type of betalactamases that recognize bivalent metal ions. The awareness of

the existence of MBL initializes indication for the need for proper use of antibiotics to stem selective pressure and spread of MDR bacterial strains.

Carbapenems have been the drugs of choice for many infections caused by Enterobacteriaceae. But resistance to them and the emergence of new beta lactamases (MBL strain) e.g., *K. pneumoniae* carbapenemase (KPC), . The most disappointing fact about MBL producing strains is their ability to be resistant to most of the drugs. This makes it essential to look for the drugs which should act effectively upon such bacterial strains.

Materials and Methods

A prospective cross sectional study was conducted on 100 carbapenem (imipenem and meropenem) resistant *E.coli* and *Klebsiella* strain from various clinical samples (urine, respiratory tract samples - sputum,

BAL, ET aspirate, pus, blood and others - stool, CSF, peritoneal, ascitic fluid, throat swab) in the institutes microbiology laboratory. Antibiotic sensitivity test was done by Kirby Bauer disc diffusion method on Muller Hinton agar according to the National

Committee for the clinical Laboratory Standard. 30 MBL producing *E.coli* and *Klebsiella* strains were detected by the standard phenotypic method. Ethical clearance for the study was taken from the ethical committee.

Results

Table I: - Frequency of isolation of *Klebsiella* and *E.coli* from MBL strains.

Total MBL strains	MBL producing <i>Klebsiella</i> strains	MBL producing <i>E.coli</i> strains	Chi*square	P** value
30	18(60)	12(40)	0.804	0.3700

Table II:-Distribution of MBL producers in various clinical specimens.

Antimicrobials	MBL Strains	
	<i>E.coli</i> (n= 12)	<i>Klebsiella</i> (n=18)
Ampicillin	1 (8)	1(6)
Cefotaxime	9 (75)	16(88)
Ceftazidime	6 (50)	14(82)
Gentamicin	6 (50)	12(67)
Nitrofurantoin	3 (25)	5(28)
Amikacin	9 (75)	14(82)
Ciprofloxacin	11 (92)	16(88)
Sulbactam	2 (16)	3(17)
Imipenem	12(100)	18(100)
Aztreonam	0	0

Table III Antibiotic resistance pattern for MBL strains of *E.coli* and *Klebsiella*.

Clinical samples	Total MBL strains
Urine (n=44)	9(21)
Pus (n=19)	6(31)
Respiratory tract samples(sputum,BAL,ET aspirate) (n=25)	14(56)
Blood (n=7)	1(28)
Miscellaneous(stool,CSF,peritoneal,asciticfluid,throat swab) (n=5)	0

In the present study, 100 carbapenem resistant strains were studied out of which 30% were MBL producers. Out of these 30 MBL strains, 60% were *Klebsiella* species and 40% were *E.coli*.

*Chi square test (without Yates correction) with one degree of freedom.

**Fishers exact test (two tailed): not statistically significant.

Majority of MBL producing strains were from respiratory tract samples 56% followed by pus 31%, blood 28% and urine 21%.

Moreover, antimicrobial resistance pattern of MBL producing *E.coli* and *Klebsiella* strains was maximum with imipenem 100%. However resistance to aztreonam was zero followed by ampicillin 8% and

6% ,sulbactam 16% and 17% for *E.coli* and *Klebsiella* respectively.

Discussion

Prevalence of MBL strains have been studied and rate of positivity varies from region to region. Rate of MBL strains were 20% by Mita D Wadekar et al ¹from Karnataka and 6% by Nirav P. Pandya et al ²from Gujarat, while in present study total MBL strains were 30%. Higher incidence in this study can be because of the fact that the study was conducted in a tertiary care hospital where patients visiting here had already taken medications from private practitioners, thus developing resistance.

As per the present study, out of 30 MBL strains, *Klebsiella* 60% were more than *E.coli* 40%. According to study done by Mita D Wadekar et al¹ out of all the MBL positive strains derived, 54% and 46% were positive for *Klebsiella* and *E.coli* respectively. However, another study conducted by Nirav P. Pandya et al² MBL production was 8% and 3% for *Klebsiella* and *E.coli* respectively.

MBL production was seen more in *Klebsiella* as compared to *E.coli* because of the fact that bla_{NDM}, a gene responsible for MBL production is known to be generally associated with *Klebsiella* strains. Chisquare calculated by Chi square test (without Yates correction) equals 0.804 with one degree of freedom. P value calculated by fisher's exact test (two tailed) equals 0.3700. The association of MBL producing strains of *Klebsiella* and *E.coli* are not considered to be statistically significant may be because of very few number of MBL isolates were studied. (TABLE I)

According to the current study out of all MBL producing strains, maximum were isolated from respiratory tract infection samples 56% followed by pus 31%, blood 28% and urine 21% while according to a study conducted by Mita D. Wadekar et al¹ MBL producers were maximum from blood 33% followed by sputum 14%, urine 12% and pus 11%. On the contrary, another study was conducted by Jing- Jou Yan et al³ samples from wound infection were 20% and bloodstream were 7%.

Existing study was conducted in an agricultural land where husk is present in the air in the harvesting season. Due to this, symptoms like cough, sneezing are very common. This leads to self-administration of incomplete and inadequate antibiotic intake on regular basis, thus developing resistance. (TABLE II)

In present study, antimicrobial resistance was maximum with Imipenem 100% for MBL strains of *E.coli* and *Klebsiella* species followed by ciprofloxacin 92% and 88% respectively. These findings were in accordance with the study conducted by Sasirekha et al⁴ where resistance to ciprofloxacin was 68%.

In the current study as well, resistance to Aztreonam was minimum i.e. Zero with MBL strains of *E.coli* and *Klebsiella*, followed by Ampicillin 8% and 6% and Salbactam 16% and 17% respectively. Therefore, Aztreonam is the drug of choice for MBL producing

strains. This is supported by a study done by Anuradha De et al⁵ from Mumbai, India. They also suggested the administration of Imipenem or Meropenem in combination with Ampicillin-Salbactam against MBL strains. (TABLE III)

Conclusion

Emergence of MBL producing strains throughout the world and their treatment has been creating panic among the medical practitioners. Their ability to resist almost all the antibiotics makes them of major concern for its early detection and treatment. It is also suggested that the administration of Imipenem or Meropenem in combination with Ampicillin-Salbactam against MBL strains show promising result against them. However, for global containment of antimicrobial resistance before irreparable damage is done to mankind, meticulous infection control practice and judicious antibiotic use should be adopted apart from creating awareness among the general public because all of us are at risk.

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