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Research Article

CARBAPENEM RESISTANCE PROFILE AMONGST *ESCHERICHIA COLI* AND *KLEBSIELLA PNEUMONIAE* IN A TERTIARY CARE HOSPITAL IN AHMEDNAGAR, MAHARASHTRA

*****Shraddha Prasad Gunjal[1]**,** Prasad Niranjan Gunjal[1], Nagaraju Vanaparthi[2], Kher Sudheer[3]

[1]Assistant Professor, [2]Tutor, [3]Professor & Head, Department of Microbiology, PDVVPF's Dr.Vikhe Patil Medical College& Hospital, Vadgon Gupta, Ahmednagar, Maharashtra, India

* Corresponding author email: shraddhaprasadgunjal@gmail.com

ABSTRACT

Introduction: Carbapenem-resistant Enterobacteriaceae (CRE), specially three species of the Enterobacteriaceae family, the *Klebsiella*, *Enterobacter* and *Escherichia* have developed resistance to a group of antibiotics called "Carbapenems", which are often used as the last line of treatment when other antibiotics are not effective in treating infections caused by them. **Aim of the study**: The present study was carried out to detect carbapenem resistance profile among *Escherichia coli* & *Klebsiella pneumoniae*. **Materials & Methods**: Cultures were obtained from consecutive specimens like urine, pus, sputum and blood collected from indoor as well as outdoor patients of our hospital. Specimens were processed for culture and identification according to standard techniques. Cultures yielding only *Escherichia coli* & *Klebsiella pneumoniae* were included in the study. Antimicrobial susceptibility testing was performed on Mueller-Hinton agar plates by the standard Kirby-Bauer disk diffusion method recommended by CLSI against imipenem and meropem. The diameters of zone of inhibition were recorded as sensitive, resistant or intermediate sensitive according to the CLSI criteria. **Results & Observations**: Total 206 isolates were surveyed. Urine & pus were the commonest specimens which isolated *Escherichia coli* & *Klebsiella pneumoniae*. 58.82% & 8.82% *E. coli* were resistant to meropenem & imipenem respectively. Similarly, 53.84% & 30.76% *K. pneumoniae* were resistant to meropenem & imipenem respectively. **Conclusion**: *K. pneumoniae* and *E. coli* are commonly encountered pathogens from clinical specimens and exhibit resistance to carbapenems. *E. coli* and *K. pneumoniae* isolates showed higher resistance to meropenem (58.82% and 53.84%, respectively) as compared to imipenem (8.82% and 30.76% respectively). *K. pneumoniae* shows greater resistance to carbapenems as compared to *E. coli*.

Keywords: Imipenem, Meropenem, Carbapenem-resistant

INTRODUCTION

Gram negative bacilli belonging to the Enterobacteriaceae are the most frequently encountered bacterial isolates recovered from clinical specimens. Members of the Enterobacteriaceae may be associated with virtually any type of infectious disease and recovered from any specimen received in the laboratory. Microbiologist must be alert in the emergence of any Enterobacteriaceae that are resistant to multiple antibiotics. Detecting these resistant strains is not only important in treating the patient from whom the isolate is recovered but also has important implications for surveillance of nosocomial infections.[1] Carbapenem-resistant Enterobacteriaceae (CRE), specially, the *Klebsiella*, *Enterobacter* and *Escherichia*, have developed resistance to a group of antibiotics called "Carbapenems", which are often used as the last line of treatment when other antibiotics are not effective

in treating infections caused by them.[2] Moreover, the prevalence of carbapenem resistance in Enterobacteriaceae (CRE) isolated from clinical samples continues to increase throughout the world.[3] The present study was therefore carried out to detect carbapenem resistance profile among *Escherichia (E.) coli* and *Klebsiella (K.) pneumoniae*.

MATERIALS AND METHODS

This retrospective study was carried out with clearance from institutional ethical committee, in the bacteriology laboratory of department of Microbiology, of Padmashree Dr. Vitthalrao Vikhe Patil Medical College, Ahmednagar, Maharashtra. The time period of this study was January 2012 to January 2013.

Cultures were obtained from consecutive specimens like urine, pus, sputum and blood, collected from indoor as well as outdoor patients from all clinical departments of PDVVPF's hospital, which is a 700 bed tertiary care hospital. Specimens were processed for culture and identification according to standard techniques.[1] Cultures yielding only *Escherichia (E.) coli* and *Klebsiella (K.) pneumoniae* were included in the study. All repeat isolates from the same patient were excluded from the study irrespective of the type of specimen. Antimicrobial susceptibility testing of isolates was performed on Mueller-Hinton agar plates by the Kirby-Bauer disk diffusion method recommended by CLSI[4] against imipenem (10µg/disc) and meropenem (10µg/disc). The antibiotic disc of imipenem and meropenem were purchased from Hi-Media Laboratories Pvt. Ltd. Mumbai, Maharashtra. The growth inhibition zone diameter was recorded and interpreted as sensitive (Imipenem & Meropenem is ≥ 16 mm), resistant (Imipenem & Meropenem is ≤ 13 mm), or intermediate sensitive (Imipenem & Meropenem is 14 mm), by the criteria of CLSI.[4] Intermediate sensitive isolates were included in resistant isolates for final analysis. Strain of *E. coli* ATCC 25922 was used as control.

RESULTS

A total of 206 isolates were surveyed. Table 1 Indicates details of type of specimens from which isolates were obtained. Resistance pattern of *E. coli* to meropenem and imipenem, where total isolates of *Escherichia coli* are 102. Table no. 2, 3 shows resistance pattern of *Klebsiella pneumoniae* to meropenem and imipenem, where total isolates of *K. pneumoniae* are 104.

Table 1: Details of type of specimens from which isolates were obtained

Sr. no.	Specimen	*E. coli* n (%)	*K. pneumoniae* n (%)	Total = n
1	Urine	46 (54.76)	38 (45.23)	84
2	Pus	47 (55.95)	37 (44.04)	84
3	Sputum	07 (24.13)	22 (75.86)	29
4	Blood	02 (22.22)	07 (77.77)	09
5	**Total**	**102**	**104**	**206**

Table 2: Resistance pattern of *Escherichia coli* (n=102) to meropenem and imipenem.

Sr. no.	Specimen(n)	Meropenem n (%)	Imipenem n (%)	Both n (%)
1	Urine(46)	25 (54.34)	04 (8.69)	04 (8.69)
2	Pus(47)	27 (57.44)	05 (10.63)	02 (4.25)
3	Sputum(7)	06 (85.71)	00 (00)	00 (00)
4	Blood(2)	02 (100)	00 (00)	00 (00)
5	**Total(102)**	**60(58.82)**	**09(8.82)**	**06(5.88)**

Table 3: Resistance pattern of *Klebsiella pneumoniae* (n=104) to meropenem and imipenem.

Sr. no.	Specimen (n)	Meropenem n (%)	Imipenem n (%)	Both n (%)
1	Urine(38)	23 (60.52)	12 (31.57)	09 (23.68)
2	Pus(37)	19 (51.35)	09 (24.32)	06 (16.21)
3	Sputum(22)	08 (36.36)	08 (36.36)	06 (27.27)
4	Blood(7)	06 (85.71)	03 (42.85)	02 (28.57)
5	**Total(104)**	**56(53.84)**	**32(30.76)**	**23(22.11)**

DISCUSSION

Urine and pus were the most common specimens which isolated *E. coli* and *K. pneumoniae*. Out of the total 206 isolates 84(40.77%) each were *E. coli* and *K. pneumoniae*, followed by 14.07% isolates from sputum and 4.36% isolates from blood. This is well in accordance with Nagaraj S *et al*.[5] who also reported 42% carbapenem isolates of *E. coli* and *K. pneumoniae* from urine. Parveen RM [6] reported 37.86% isolates of *K. pneumoniae* from urine.

Out of 102 isolates of *E. coli*, 60(58.82%) were resistant to meropenem. Nagaraj S *et al*. [5] reported higher resistance of 80% of *E. coli* to meropenem.

Out of 102 isolates of *E. coli* 9(8.82%) were resistant to imipenem. These findings are quite similar to Datta S *et al*.[7], who reported 6% isolates of *E. coli* resistant to imipenem.

As far as *K. pneumoniae* is concerned 56(53.84%) out of 104 isolates were resistant to meropenem. This is fairly in accordance with Parveen RM *et al*.[6] who reported 43.6% *K. pneumoniae* isolates resistant to meropenem. On the other hand these findings are low as compared to Nagaraj S *et al*.[5] who reported 29(80.55%) out of 36 isolates of *K. pneumoniae* resistant to meropenem, whereas, are extremely high as compared to Bora A *et al*.[8] who reported 19 (9.22%) out of 206 isolates of *K. pneumoniae* resistant to meropenem and imipenem. Out of 104 isolates of *k. pneumoniae*, 32 (30.76%) were resistant to imipenem, which is well in accordance to Parveen RM *et al*. (6), who reported 32% isolates of *K. pneumoniae* resistant to imipenem & varies from Datta S *et al*.[7], who reported 52 % resistant isolates.

Finally, 5.88% *E. coli* & 22.11% *K. pneumoniae* isolates were resistant to both meropenem and imipenem. *K. pneumoniae* exhibits greater resistance to carbapenems.

Carbapenems are one of the important antibiotics in the treatment of serious infections caused by members of the family Enterobacteriaceae.[9] High level of carbapenem resistance in *K. pneumoniae* is due to combination of different factors like β-lactamase production, porin OmpK 35/36 Insertional inactivation and down-regulation of the phosphate transport porin and changes in penicillin-binding proteins.[10]

Resistance in *K. pneumoniae* mediated by *K. pneumoniae* carbapenemase (KPC) can accompany other Gram negative resistance mechanisms. The genes of which enzymes are usually present on plasmids and hence can spread easily.[11]

This makes it important to constantly keep a check on the prevalence of resistance to antibiotics in commonly encountered pathogens. The present study was conducted keeping this concept in mind.

In the era of molecular approaches for the study of genes which mediate carbapenem resistance, the present survey serves as a pilot study. Also it inspires us to carry out further extensive research in view of drug resistance periodically which may include the ICU and the non-ICU sections, demographic aspects, clinical aspects etc.

CONCLUSION

K. pneumoniae and *E. coli* are commonly encountered pathogens from clinical specimens and exhibit resistance to carbapenems. *E. coli* and *K. pneumoniae* isolates show higher resistance to meropenem (58.82% and 53.84% respectively) as compared to imipenem (8.82% and 30.76% respectively). Imipenem shows better sensitivity in-vitro as compared to meropenem. *K. pneumoniae* shows greater resistance to carbapenems as compared to *E. coli*. This emerging resistance may an alarming situation and indicates need of judicious use of antibiotics and keeping a constant check on susceptibility of pathogens to various antimicrobials including the carbapenems. So that, should the need arise, methods can be implemented to control the spread of such resistant strains in the hospital environment. Also it gives an insight to carry out more extensive research.

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