"Prevalence of Carbapenem Resistant Enterobacteriaceae in A Tertiary Care Hospital"

R. Sujatha1, Deepak Sameer*, Arunagiri D.2

Abstract:

Objective: The emergence of Carbapenem Resistant Enterobacteriaceae (CRE) in recent times has become a serious threat to public health due to the high mortality, potential dissemination rates and limited treatment options associated with these organisms. Thus, the present study was conducted in our tertiary care hospital to retrospectively analyze the prevalence of CRE in the hospital.

Methods: The study was carried out in the microbiology department of the tertiary care hospital over a period of 24 months. The samples tested were clinical samples from hospitalized and Out-Patient Department (OPD) patients sent to the department for microbiological testing. CRE isolates were identified using the standard protocol.

Results: A CRE prevalence rate of 16.28% was obtained from the study, from which the majority of the isolates were detected in urine samples (27.90%). Although most of the CRE isolates were detected in patient samples from the ICU (46.51%), Klebsiella pneumoniae is the most common isolate (53.48%).

Conclusion: Thus, the study shows a significant rate of carbapenem resistance among Enterobacteriaceae isolated from hospitalized patients. This emphasizes the urgent need for CRE control at the hospital, by following proper infection control measures, antimicrobial stewardship, and to rationalize the use of antibiotics.

Key words: Carbapenem Resistant Enterobacteriaceae, Antimicrobial Stewardship.

Introduction

Resistance mechanisms like Extended Spectrum Beta Lactamase (ESBL) production to commonly available antimicrobial agents is a well-recognized problem amongst members of Enterobacteriaceae and Carbapenems have served an important antimicrobial class to treat infections caused by these strains [1,2]. However, resistances to the Carbapenem group of antimicrobial agents through production of various Carbapenemases like Klebsiella Pneumoniae Carbapenamase (KPC), New Delhi Metallobetalactamase (NDM), Verona Integrin-encoded Metallobetalactamase (VIM), Imipenemase (IMP), and Oxacillinase (OXA) is being increasingly reported [1]Centre for Disease Control and Prevention (CDC) defines CRE as any family member of Enterobacteriaceae resistant to impanel, meropenem, doripenem or ertapenem [3] Enterobacteriaceae producing carbapenemases are also resistant to other beta lactam group of antimicrobial agents, thereby leaving a very few treatment options such as polymyxins and tigecycline [4]. Keeping in mind the therapeutic challenge of infection by CRE, high morbidity, mortality and potential to spread in Healthcare setting, measuring the magnitude of CRE becomes significant and thus present study was conducted to find out the occurrence of CRE in Kanpur.

Material and Methods

The study was a retrospective study carried out in the Microbiology department of a tertiary care hospital, Kanpur, from January 2019 to December 2020. The clinical samples tested were those collected from patients hospitalized in the wards, the Intensive Care Unit (ICU), the Cardiac Care Unit (CCU), the Neonatal Intensive Care Unit (NICU), the Pediatric Intensive Care Unit (PICU), as well as from OPD patients coming to the hospital for treatment. These included blood, urine, stool, end tracheal secretions, sputum, pus, wound, and other samples. All samples were processed and identified as per standard microbiology protocol. The antibiotic susceptibility was performed by disc diffusion method for all clinical isolates using the CLSI guidelines [5]. Isolates that showing resistance to one or all of the following carbapenems- meropenem, imipenem and ertapenem; as well as resistance to ceftriaxone, cefotaxime and ceftazidime were considered to be carbapenem resistant.

[1]*Professor & Head, Dept of Microbiology Rama Medical College Hospital and Research Centre, Mandhana Kanpur(India)*

Tutor, Dept of Microbiology Rama Medical College Hospital and Research Centre, Mandhana Kanpur. (India)*

[2]*Professor & HOD, Dept of Endodontics, MDC,Kanpur(India)*

Results

A total of 730 bacterial isolates were obtained from the clinical samples tested over 24 months, of which 264 were Enterobacteriaceae. 43 isolates of the total 465 Enterobacteriaceae were found to be car-bapenem resistant (16.28%).

The CRE isolates obtained are given in Table 1.shows the sample wise distribution and Table: 2 shows area wise distribution of CRE identified from the samples in the hospital .

Table 1: Sample wise distribution of CRE isolates

Type of Sample	N=43	Percentage
Urine	12	27.90%
Sputum	9	20.93%
Blood	1	2.3%
Stool	1	2.3%
Pus	11	25.58%
ET-secretion	8	18.60%
Others	1	2.3%

Table 2: Area wise distribution of CRE isolates

ICU	20	46.51%
NICU /PICU	5	11.62%
Ward	10	23.25%
OPD	1	2.3%
Post operative ward	7	16.27%

Table 3: Distribution of CRE isolates

E.coli	17	39.53%
Klebsiella spp	23	53.48%
Enterobacter aero genes	2	4.6%
Proteus spp	1	2.3%

Table 4: Resistance pattern of CRE isolates

CRE isolates	Impanel	Meropenem	Etrapenem
E.coli	18.13%	17.33%	16.85%
Klebsiella spp	50.33%	36.66%	49.39%
Enterobacter aerogenes	31.64%	31.64%	31.64%
Proteus spp	64.06%	9.37%	7.81%

Discussion

Carbapenems, owing to its broad antimicrobial spectrum, have been used extensively, especially for treatment of nosocomial infections. There has been an increased reporting and geographical spread of carbapenem resistance among Enterobacteriaceae with a mortality rate as high as 30-75%. The present study was conducted to know the prevalence of CRE. The overall prevalence of CRE was found to be 16.28%.

S. No.	Study	Year	Results-prevalence rate
1.	Watkins RR and Bonomo RA [1]	2013	4%
2.	Rao A and Indumathi VA [6]	2016	13.95%
3.	Khare V et al., [7]	2017	37.9%
4.	Pawar SK et al., [8]	2018	31.77%
5.	**In the present study**	2021	16.28%

Klebsiella sp. (53.48%) followed by E.coli (39.53%) were found to be the most common isolates among CRE in the present study which is similar to other studies where Klebsiella sp. accounts for 33-46% among all CRE [9,10,11]. Overall impanel resistance among CRE in the present study ranged from 22.9-32.9% whereas meropenem resistance ranged from 22.9-33.1% during the study period. Meta-analysis of data from Asian countries demonstrated impanels resistance varying from 0.1-5.8% and meropenem resistance varying from 0.9-2.9%. Meropenem resistance from India was found to be 2.6% in one of the study [9]

Conclusion

Thus, the study shows a significant rate of carbapenem resistance among Enterobacteriaceae isolated from hospitalized patients. This emphasizes the urgent need for CRE control at the hospital, by following proper infection control measures, antimicrobial stewardship, and to rationalize the use of antibiotics.

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