

Research Article



A Prospective Study on Concurrent Drug Utilization Review of Meropenem in Tertiary Care Teaching Hospital in Kolkata

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ABSTRACT

Antimicrobial agents are some of the most widely, and often injudiciously, used therapeutic drugs worldwide. Important considerations when prescribing antimicrobial therapy include obtaining an accurate diagnosis of infection; understanding the difference between empiric and definitive therapy; identifying opportunities to switch to narrow-spectrum, cost-effective oral agents for the shortest duration necessary. The objective of the study is to evaluate the overall usage and outcome of meropenem in hospital in order to promote the rational prescribing, dispensing, and administration. The prospective observational study of meropenem usage was conducted in different Intensive Care Units and Wards of a 220 bedded tertiary care teaching hospital to assess rational use of meropenem. The study was conducted by reviewing file of 173 admitted patients who received meropenem during march 2018 to June 2018. In this study it was found that most of the patients were administered correct doses. Though over dosing and under dosing were observed in few cases and dosing modifications were required for some cases. During this study fosfomycin used frequently along with meropenem therapy. It was also found that meropenem used empirically in maximum cases. According to this study it was found that meropenem was safe for elderly patients as the number of ADR was negligible. The study showed that dosing accuracy of meropenem as per standard dosing guideline was used in most patients. However frequent inappropriate use (As per sensitivity results) of meropenem was also noted in the study which could lead to increase of antibiotic resistance in the health-care system.

Keywords: Meropenem, Dosing accuracy, Antibiotic resistance, ADR.

INTRODUCTION

The continuous increase in use of pharmaceuticals, followed by commercial promotion in a manner unknown for any other form of healthcare, has a huge cultural impact, leads to increase dependence on allopath¹. Drug use evaluation (DUE) same as Drug utilization review (DUR) is a system of ongoing, systematic, criteria-based evaluation of use of drug which helps to ensure that medicines are used appropriately for each patient. A DUE is drug- or disease-specific and can be processed so that it will assess the actual way of prescribing, dispensing or administering a drug².

A Prospective DUR involves evaluation of a patient's planned drug therapy before a medication is dispensed which allows the pharmacist to identify and resolve issues before the patient actually receives the medication. An ongoing monitoring of drug therapy to ensure positive patient outcomes is performed in case of concurrent DUR. In retrospective DUR, patient medical charts or computerized records are reviewed to determine whether the drug therapy met approved criteria and also helps improving care for their patients may be individually or within groups of patients.

Antimicrobial agents are some of the most widely, and often imprudently, used therapeutic drugs worldwide. Important considerations while prescribing antimicrobial

therapy should include an accurate diagnosis of infection; understanding the difference between empiric and definitive therapy; identifying opportunities to switch to a narrow-spectrum, cost-effective oral agents for the shortest duration necessary; understanding drug characteristics that are peculiar to antimicrobial agents (such as pharmacodynamics and efficacy at the site of infection); accounting for host characteristics that influence antimicrobial activity; and in turn, identification of the adverse effects of antimicrobial agents on the host. It is also important to understand the importance of antimicrobial stewardship, to choose the situations when antimicrobial therapy is not needed. By following these general principles, all practicing physicians should be able to use antimicrobial agents in a responsible manner that benefits both the individual patient and the community by preventing increasing trend in the development of antibiotic resistance; a major concerns of health care systems throughout the world^{3,4}.

Meropenem is a β -lactam antibiotic belonging to the carbapenem class. It Cause rapid bacterial cell death by covalently binding to penicillin-binding proteins (PBPs) involved in the biosynthesis of mucopeptides in bacterial cell walls. Bactericidal effects result through inhibition of growth of cell and division and the loss of cell wall integrity, which lead to the cell wall lysis.



According to a report from Department of Biotechnology and Research Councils United Kingdom (RCUK) in 2014, India was the highest consumer of antibiotics, followed by China and the United States. However, the per capita consumption of antibiotics in India is much lower than in several other high income countries. India has some of the highest antibiotic resistance rates among bacteria that are the source of infections in the community and healthcare facilities. Resistance to carbapenem class of antibiotics was the highest.

In this study, evaluation of the use of meropenem in Ward and critical care unit in a tertiary care teaching hospital of Kolkata was take place.

The purpose of this concurrent observational study was to evaluate the appropriateness, the indication of administration, dosage, adverse drug events (ADE's), to analyze drug utilization with the ultimate goal of improving use and consumption of meropenem.

METHODOLOGY

The study was carried out in a 220 bedded tertiary care teaching hospital in kolkata, Data collection were performed according to the hospital regulations after approval of hospital research ethics committee .The study was performed for the patients under meropenem therapy. The drug utilization study of meropenem was conducted in different Wards and Intensive Care Units (ICU). The Case files of admitted patients were reviewed on daily basis, who received meropenem during the period of April 2018 to July 2018.

Inclusion Criteria: Both Male and female patients admitted in different wards and ICU under meropenem therapy were included in this study.

Exclusion Criteria: The patients below eighteen years of age were excluded from this study. Out patients were also excluded.

Data collection process- Demographic data, Antibiotic medication history (agents, doses, dose intervals, routes of administration, number of doses, initiation times, and duration of administration), Indication of use., Dosing regimen and its accuracy, route of administration, Other co-prescribed antimicrobial, Microbiological status, different types of ADR, any suspected drug interaction were collected from the case files selected for review. Clinical data of any relevant notation within the progress notes pertaining to the patient's infection, were also recorded for comparison. The data were collected in case reporting from then row data were transferred and documented in MS excel (Ver.2016) for detail analysis.

RESULTS

The table 1 showed the age distribution of patients along with their gender. The total number of patients were divided into four different age group. The age group of 61-80, numbers of patients was higher than other age groups. In this age group contains 47 male patients and

42 female patients. The age group of 19-40, least numbers of patients was observed with equal number of male and female. But in other age groups the proportions of male patients were higher than that of female patients. Only exception was observed in the age group of 41-60 where the numbers of male and female patients were 18 and 31 respectively.

Table 1: Distribution of patients on the basis of age and sex

Age distribution	Sex		Number Of Patients
	Age	Male	Female
19-40	5	5	10
41-60	18	31	49
61-80	47	42	89
≥81	15	10	25
Grand Total	85	88	173

Table 2: Distribution of study population in ward and ICU

Ward	Number of Patients	Percentage
WARD	73	42%
ICU	100	58%
Grand Total	173	100%

It was found that, (table 2) total 173 patients were treated with meropenem, in which patients admitted in ICU 100 (58%) was significantly higher than that of patients admitted in general wards 73(42%).

Table 3: Distribution of patients on the basis of dosing accuracy

Dosing Accuracy	Number of patients	Percentage
Correct dose	105	60.69%
Overdose	35	20.23%
Under dose	5	2.89%
Not Applicable	28	16.18%
Grand Total	173	100%

It is very clear (Table. 3) that almost 61% of the patients were administered correct doses. Though over dosing and under dosing were observed only in 35 and 5 patients respectively. Out of total study population 28 patients were not applicable because of insufficient data.

Table 4: Duration of doses in patients

Duration of dosing (Days)	No. of patients	Percentage
< 1 Days	3	1.73%
01 - 04 Days	109	63.00%
05 - 10 Days	54	31.21%
11 - 15 Days	4	2.31%
16 - 20 Days	3	1.73%
Grand Total	173	100%



Table shows that dosing duration analysis in number of days for total study population. Less than one day was considered as minimum time duration and 16-20 days as maximum time duration. Analysis shows that highest number of patients 109 found in 1-4 days of duration. Less than 2% of the patients were getting the dose less than 1 day and also 16-20 day time period (table 4).

Table 5: Use of meropenem based on sensitivity pattern

Pattern of use based on sensitivity	No. of patients	Percentage
Empirical	111	64%
Resistant	17	10%
Sensitive	45	24%
Grand Total	173	100%

A clear analysis on sensitivity pattern over the study population has been shown in the table indicated the empirical use of study drug on maximum number of patients which is 111 (64%). In 24% of the patient the drug was sensitive against the particular organism. In 10% of the patients the drug was used in spite of its resistance (table 5).

Table 6: A detailed study over the type of microorganism found in study population

Name of Microorganism	No. of Patients	Percentage
<i>Acinetobacter baumannii</i>	2	1.15%
<i>Burkholderia cepacia</i>	4	2.31%
<i>Enterococcus faecalis</i>	3	1.73%
<i>Escherichia coli</i>	21	12.13%
Gram negative bacilli	4	2.31%
Gram positive cocci	4	2.31%
<i>Klebsiella pneumonia</i>	20	11.56%
<i>Morganella morganii</i>	1	0.57%
Not identified	104	60.11%
<i>Pseudomonas aeruginosa</i>	6	3.46%
<i>Pseudomonas putida</i>	1	0.57%
<i>Raoultella ornithinolytica</i>	1	0.57%
<i>Streptococcus pneumonia</i>	2	1.15%
Grand Total	173	100%

Out of the identified organism for which meropenem was used, *Escherichia coli* is the most prevalent, followed by *Klebsiella pneumoniae* was found in 21 and 20 patients respectively (table 6).

Urinary tract infection was one of the major causes for use of meropenem. Almost 30% of the patients were under meropenem therapy for this. Other than that it was used in 16 patients with LRTI disease. Though in case of COPD (15) and sepsis (13) patients study drug was found to be used very commonly (table 7).

Table 7: Distribution of patients on the basis of diagnosis

Diagnosis	No. of Patients	Percentage
UTI	51	29.47%
LRTI	16	9.24%
Pneumonia	9	5.20%
Sepsis	13	7.51%
COPD & Asthma	15	8.67%
Cholecystectomy	5	2.89%
Pancreatitis	4	2.31%
Billiary Peritonitis	2	1.15%
CA lungs	2	1.15%
Others	56	32.36%
Grand Total	173	100%

Table 8: Analysis of ADR in total study population

Other ADR	No. of Patients	Percentage
Vomiting	1	0.57%
Constipation	3	1.73%
Diarrhoea	1	0.57%
Haemoglobin decreased	1	0.57%
Rash and Black patches	3	1.73%
Nausea	1	0.57%
No ADR	163	94.21%
Grand Total	173	100%

Out of 173 patients, less than 5% of the patients were under any kind of adverse drug reaction. Among this, constipation and rash-black patch were accounting the major portion that is almost 1.73% of the total population (table 8).

Table 9: Number of time other antibiotic used along with meropenem

Antibiotics	Number of time used along with meropenem	Percentage
Fosfomycin	18	10.40%
Targocid	12	6.93%
Tgcycline	8	4.62%
Colistin	8	4.62%
Syscan	8	4.62%
Amikacin	5	2.89%
Doxycycline	5	2.89%
Ticobact	4	2.31%
Levofloxacin	4	2.31%
Minocycline	4	2.31%

It is observed that (table 9) majority of the time, i.e. more than 10% of the total population was under fosfomycin therapy along with meropenem. Except fosfomycin the next most prevalent antibiotic was targocid, which is used 12 times along with meropenem.

DISCUSSION AND CONCLUSION

Now a days irrational use of antibiotics has been lead to the occurrence of drug resistance, which is big challenge for medical sciences. Rational use of the drugs in a systematic manner from the initial day is the best way to cope with this problem. During this prospective observational study it has been found that, dosing accuracy is maintained strictly for the efficacy of the drug and most importantly for the safety of the patients.

According to the study, meropenem was broadly used for these three specific diseases viz. Urosepsis (found in 50 patients out of 173), LRTI (found in 16 patients) & pneumonia (found in 9 patients). In most cases *Klebsiella pneumonia*, *Escherichia coli*, these two bacteria were found.

The study was performed in Eastern Region of India which showed that, the drug utilization review of meropenam. Hope this study will help in clinical, educational and economical purpose.

This study specifically assessed the pattern of utilization of meropenem and its effectiveness in the health care

system. More than 170 patients data were reviewed throughout the period, which provided a detailed concept of drug utilization review of meropenem. The study showed that accurate dose of meropenem as per standard dosing guideline was used in most patients. However frequent inappropriate use (As per sensitivity results) of meropenem was also noted in the study which could lead to increase of antibiotic resistance in the healthcare system.

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