



## Original Research Article

## Influencing antimicrobial susceptibility pattern of metallo beta lactamas among gram negative bacilli in a tertiary care hospital

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## ABSTRACT

**Introduction:** Antibiotic resistance is a worldwide public health problem that requires urgent global attention and Gram-negative bacilli of the Enterobacteriaceae family well known for demonstrate drug resistance. These drug resistance microorganisms cause recurrent infections in patients in hospital units, limiting treatment alternatives and increasing morbidity and mortality rates.

**Material and Methods:** A cross sectional study was carried out in the Department of Microbiology Santosh Medical College and Hospital Ghaziabad. 150 Gram negative bacteria isolated from various clinical samples from both IPD and OPD patients were included in this study.

**Result:** Among the Gram negative bacterial isolates maximum isolates were identified as *E. coli* (50%), *Klebsiella species* (20%), *Citrobacter species* (12%), *Pseudomonas aeruginosa* (10%), *Acinetobacter species* (07%) and *Proteus species* (04%). *Enterobacteriaceae* isolate were sensitive to Imipenem (82.2%), Gentamycin (55.5%), Cefepime (42.2%), and resistant to Ampicillin (85.9%), Ceftriaxone (82.9%) and Levofloxacin (62.9%).

**Conclusion:** Routine surveillance of baseline resistance, expressing of hospital antibiotic policy and compliance with current guidelines will go long way in reducing multi drug resistance among pathogen.

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### 1. Introduction

Antimicrobial resistance is a growing problem in the 21<sup>st</sup> Century and one of the most serious problem to global public health.<sup>1</sup> The number of resistant microbial strains, geographic areas affected by drug resistance and the extent of resistance in each organism are escalating.<sup>2</sup> Moreover, the percentage of organisms exhibiting antimicrobial resistance, especially resistance to multiple antibiotics, are continually increased.<sup>3</sup> Resistant microorganisms lead to an increase in morbidity and mortality since it increases the risk of inappropriate therapy.<sup>4,5</sup> This resistance may delay and hinder treatment, resulting in complications or even death.<sup>6,7</sup> Moreover a patient may need more care, as well as the use of alternative and more expensive antibiotics which may have more severe side effects or may need

invasive treatment such as intravenous injection to be given in hospital.<sup>6,8</sup>

Experiences from surveillance network on antimicrobial use and antimicrobial resistance show that data where available, can be put to multiple uses, including orienting treatment choice, understanding antimicrobial trend, informing public health policy, identifying priority areas for interventions and monitoring the impact of interventions to certain resistance.<sup>1</sup> Therefore, the present study involves the screening of the antimicrobial resistant profile of carbapenem drug that are used in the treatment of infectious diseases.

### 2. Materials and Methods

A cross sectional study was conducted in the Department of Microbiology, Santosh Medical College and Hospital, Ghaziabad for a period of one year from October 2017 to

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2018. Ethical clearance was obtained from the Institutional Ethical Committee. A total of 150 specimens including urine, pus, blood, sputum, stool and body fluids such as cerebrospinal fluid and pleural fluid received in the bacteriology lab were taken and processed according to Standard bacteriological procedures.

### 2.1. Antimicrobial susceptibility testing

Antimicrobial Susceptibility testing was done using disc diffusion method according to Kirby-Bauer method using *Pseudomonas aeruginosa* ATCC [27853] as control.<sup>9</sup> A zone of inhibition was measured and the results were interpreted as sensitive, resistant or intermediate based on resistance data interpreted according to Clinical and Laboratory Standards Institute.<sup>10</sup>

### 2.2. Statistical test

Chi-square test was used to detect statistically significant correlation among variable significance defined as 95% ( $P < 0.05$ ).

## 3. Result

Of the total 150 samples, 74 (49%) isolates were from urine samples, 33 (22%) isolates from pus, 11 (7.3%) isolates from sputum, 09 (06%) isolates from blood, 07 (4.66%) isolates from Cather tips, 06 (4%) isolates from ETT & Ear swab and 04 (2.66%) isolates from stool. [Figure 1].

Of the 150 Gram negative isolates bacteriological profile showed that 50% isolates were *E.coli*, 21% *Klebsiella species*, 15% *Pseudomonas aeruginosa*, 08%, *Citrobacter species*, 07% *Acinetobacter species* and 04% *Proteus species* [Figure 2]. Antibiotic susceptibility patterns of Enterobacteriaceae, *Pseudomonas aeruginosa* and *Acinetobacter species* have been shown in the Figures 3, 4 and 5 respectively.

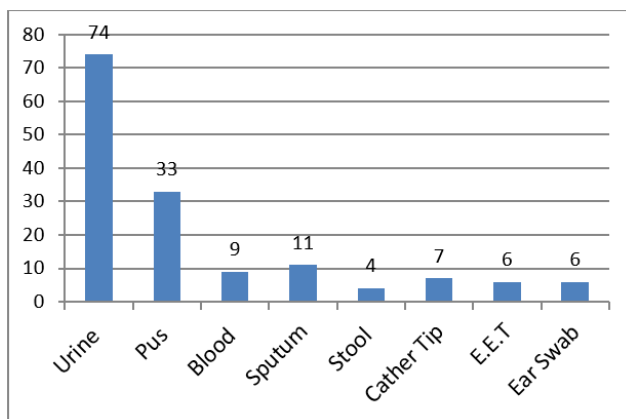


Fig. 1: Distribution of clinical samples

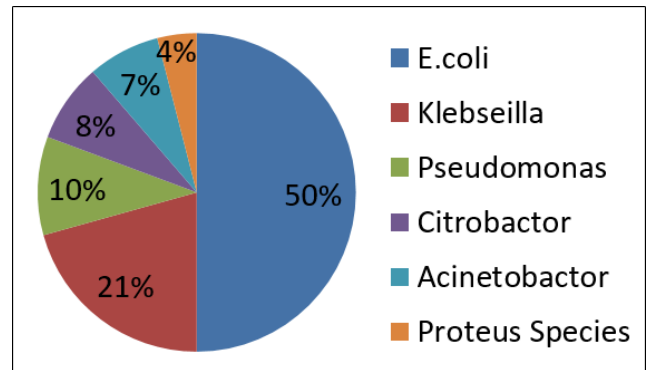


Fig. 2: Bacteriological profile of clinical isolates

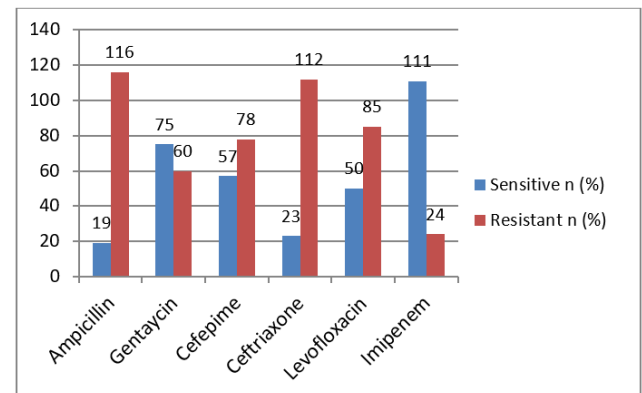


Fig. 3: Antibiotic susceptibility pattern of enterobacteriaceae family

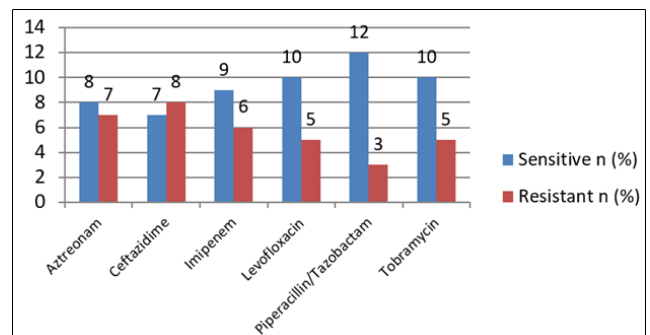


Fig. 4: Antibiotic susceptibility pattern of *Pseudomonas aeruginosa*

## 4. Discussion

Originating in a hospital setting, carbapenems are used as the last resort for treatment of Drug resistance Gram negative bacterial infection. However, since last 15 years acquired resistance to these life saving antimicrobials has been increasingly reported not only in *Pseudomonas aeruginosa* and *Acinetobacter species*,<sup>11</sup> but also among other members of Enterobacteriaceae family. *E.coli* and

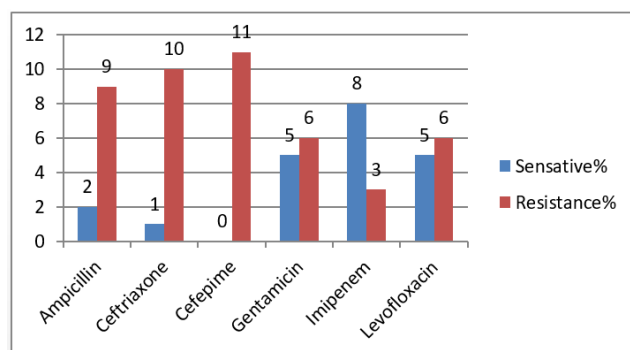


Fig. 5: Antibiotic susceptibility pattern of *acinetobacter species*

*Klebsiella pneumoniae* are the most common pathogens in Enterobacteriaceae family.<sup>12</sup> These carbapenems producing bacteria were found in many countries such as China,<sup>13</sup> Jaipur, India,<sup>14</sup> China,<sup>15</sup> Brazil,<sup>16</sup> Mexico,<sup>17</sup> Peru<sup>18</sup> and Greece.<sup>19</sup> This resistance is mainly mediated by MBLs.

In this study antibiotic sensitivity of Enterobacteriaceae family showed maximum sensitivity to Imipenem (82.2%), Gentamicin (55.5%), cefepime (42.2%) and Levofloxacin (37.0%). A study by Amin et al.<sup>20</sup> showed somewhat similar pattern with maximum sensitivity to Imipenem (86%), Gentamicin (42%), Cefepime (40%), Levofloxacin (30%). Whereas Gupta et al.<sup>11</sup> reported maximum sensitivity to Imipenem (80%), Gentamicin (45%), Levofloxacin (42.2%) and Cefepime (36.6%).

Present study showed maximum resistance to Ampicillin (85.9%), Ceftriaxone (82.9%), Levofloxacin (62.9%), Cefepime (57.7%). Irfan et al.<sup>21</sup> reported highly resistance to Imipenem (84%), Gentamicin (40%) in their study whereas Amin et al.<sup>20</sup> reported highly resistance to Ampicillin (80%) and Imipenem (86%).

In present study *Pseudomonas aeruginosa* showed maximum sensitivity to piperacillin/tazobactam (80%), Tobramycin and Levofloxacin (66.6%), and Imipenem (60%) respectively. Resistance pattern of *Pseudomonas aeruginosa* was maximum by Ceftazidime (55.5%), Aztreonam 46.6%, Imipenem and Levofloxacin 33.3%, Tobramycin and Piperacillin/Tazobactam 33.3% respectively. Attal et al.<sup>22</sup> reported were sensitive to Piperacillin/Tazobactam 40% and were resistance to Aztreonam 66.6%, whereas Irfan et al.<sup>21</sup> who reported Ceftazidime resistance to be around to be 88.1% and Amin et al. 25%.<sup>20</sup>

Metallo beta lactamase has become a major problem worldwide and the situation is worrisome to the community. These enzymes are becoming increasingly expressed by many strains of pathogenic bacteria with a potential for dissemination.<sup>12</sup> They compromise the activity of wide spectrum antibiotics creating major therapeutic difficulties with significant impact on the outcome of patient by appropriate antimicrobial selection, surveillance system and effective infection control procedures being the key factor in their control.

## 5. Conclusion

The spread of drug-resistant Gram negative bacilli in the hospital is seen as world wide problem. In the majority of hospitalized patient in ICUs who exposed to the risk. Routine surveillance of baseline resistance, guidelines of hospital antibiotic policy and compliance with existing guidelines will go long way in reducing multidrug resistance among pathogen. Early detection is crucial for the treatment with alternative antimicrobial and timely implementation of strict infection control practices. There is no standardized method for Metallo beta lactamase detection, though detection by polymerase chain reaction is highly accurate and reliable, thus, laboratory methods including culture and antimicrobial susceptibility testing with routine screening for MBL production should be done for proper diagnosis and management of all infection.

## 6. Source of Funding

None.

## 7. Conflicts of Interest

None.

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