

Original Research Article

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Study of Prevalence and Antimicrobial Susceptibility Pattern of Metallo-Beta-Lactamase Producing *Acinetobacter* spp. Isolated at a Tertiary Care Institute in North West Region of Rajasthan, India

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ABSTRACT

Acinetobacter causes a wide variety of illness in debilitated and hospitalized patients. Carbapenem resistance in *Acinetobacter* is an emerging problem and is a cause of concern as many nosocomial infections with *Acinetobacter* are resistant to most other antibiotics. The present study was aimed to study metallo- β -lactamase (MBL) production in *Acinetobacter* species. During one year study (Sep.2010 to Aug.2011), all isolates of *Acinetobacter* obtained from various clinical samples like respiratory, pus, blood and others were included. Antimicrobial susceptibility testing was done by standard Kirby Bauer disk diffusion method. Metallo β -lactamase (MBL) detection was done by imipenem-EDTA combined disk method. Among 200 isolates, 21 were *Acinetobacter* spp. Out of these 21, 8 were MBL producing *Acinetobacter* spp. The MBL producing strains were most frequently recovered from urine 37.5% (03/08) followed by sputum and respiratory tract specimens 25% (02/08), blood 25% (02/08) and pus and other wound discharges 12.5% (01/08) respectively. MBL producing *Acinetobacter* spp. were 100% sensitive to colistin and polymyxin B followed by amikacin (37.50%), ceftriaxone and ciprofloxacin (12.50%) respectively, but highly resistant to ceftazidime, doxycycline, nitrofurantoin, imipenem, meropenem and tobramycin. MBL positive isolates of *Acinetobacter* spp. showed higher resistance as compared to MBL negative isolates. This study demonstrated that multidrug resistant strains of *Acinetobacter* are common in tertiary care hospitals. Unwarranted and unrestricted usage of antibiotics is associated with emergence of resistance in nosocomial pathogens. Regular monitoring and documentation of carbapenem resistant is crucial in developing strategies to control infection due to these bacteria.

Keywords

Carbapenem resistance, Metallo β -lactamase, *A. baumannii*

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Introduction

Acinetobacter causes a wide variety of illness in debilitated and hospitalized patients. These bacteria survive for long period in hospital environment and thereby the opportunities for cross infection between patients are enhanced

(Bergogne-Berezin and Towner, 1996). *Acinetobacter* species play a significant role in the colonization and infection of patients admitted in hospitals.

It has been implicated in variety of nosocomial infections. *Acinetobacter*

baumannii is intrinsically less susceptible to antibiotics than Enterobacteriaceae; moreover, it has propensity to acquire resistance. Because of frequent resistance to aminoglycosides, fluoroquinolones, ureidopenicillins and third – generation cephalosporins, carbapenems are important agents for managing *Acinetobacter* infections (Manikal *et al.*, 2000).

The resistance of *Acinetobacter baumannii* to carbapenem is now a major worldwide issue (Maltezou, 2009; Peymani *et al.*, 2011; Gupta *et al.*, 2006; Yong *et al.*, 2002). The carbapenems are β -lactam antimicrobial agent with an exceptionally broad spectrum of activity.

Carbapenem resistance in *Acinetobacter* is an emerging problem and is a cause of concern as many nosocomial *Acinetobacter* are resistant to most other antibiotics. Metallo-beta-lactamase (MBL) producing *Acinetobacter baumannii* has become a growing therapeutic concern worldwide.

The rapid detection of MBL positive isolates is necessary to control infection and to prevent their dissemination. The aim of this study was to determine the prevalence of MBL among carbapenem resistant strains of *Acinetobacter* species in our hospital.

Materials and Methods

The one year prospective study was conducted in the department of microbiology. Various clinical samples like, urine, sputum & respiratory tract specimens, blood, pus & other wound discharge were processed according to the standard procedures. The isolates were identified as non-fermenting Gram negative bacilli (NFGNB) on the basis of colony characteristics, Gram's staining, motility test, oxidase and alkaline reaction on Triple Sugar Iron agar. All oxidase negative

and non-motile NFGNB isolates were further identified by various tests like OF-glucose, arginine dihydrolase, growth at 44°C, citrate utilization and haemolysis on blood agar (Noyal *et al.*, 2009).

The antimicrobial susceptibility testing was done by Kirby Bauer disc diffusion method using Amikacin (30 μ g), Ceftazidime (30 μ g), Ceftriaxone (30 μ g), Ciprofloxacin (5 μ g), Cefoperazone (75 μ g), Colistin (10 μ g), Doxycycline hydrochloride (30 μ g), Imipenem (10 μ g), Meropenem (10 μ g), Nitrofurantoin (300 μ g), Piperacillin (100 μ g), Polymixin (300 μ g), Tobramycin (10 μ g), as per CLSI Guidelines (De *et al.*, 2010).

Ceftazidime, Meropenem and Imipenem resistant isolates were selected for the detection of MBL production by Ceftazidime/Meropenem/Imipenem-EDTA combined disc test (Yong *et al.*, 2002).

Results and Discussion

The present study revealed high proportion of MBL producing *Acinetobacter* isolates. Respiratory, pus, urine and blood samples collected from patients were found to be the main sources of MBL producing isolates. Early detection and infection control practices are the best defences against these organisms; therefore, systematic surveillance to detect MBL producers is necessary.

It is important to follow antibiotic restriction policies to avoid excessive use of carbapenem and other broad spectrum antibiotics.

This study shows the prevalence of MBL production was higher in *Acinetobacter* spp. 38.10%. This correlates with other studies by Noyal *et al.*, (2009) where MBL production was higher in *Acinetobacter* spp. (51%), De *et al.*, (2010) noticed *Acinetobacter* spp. (36%) (Table 1–3).

Table.1 Distribution of MBL producing *Ps. aeruginosa* and *Acinetobacter* spp.

S. No	Organism	Total numbers	MBL producers	Percentage (%)
1	<i>Acinetobacter</i> Spp.	21	08	38.10 %

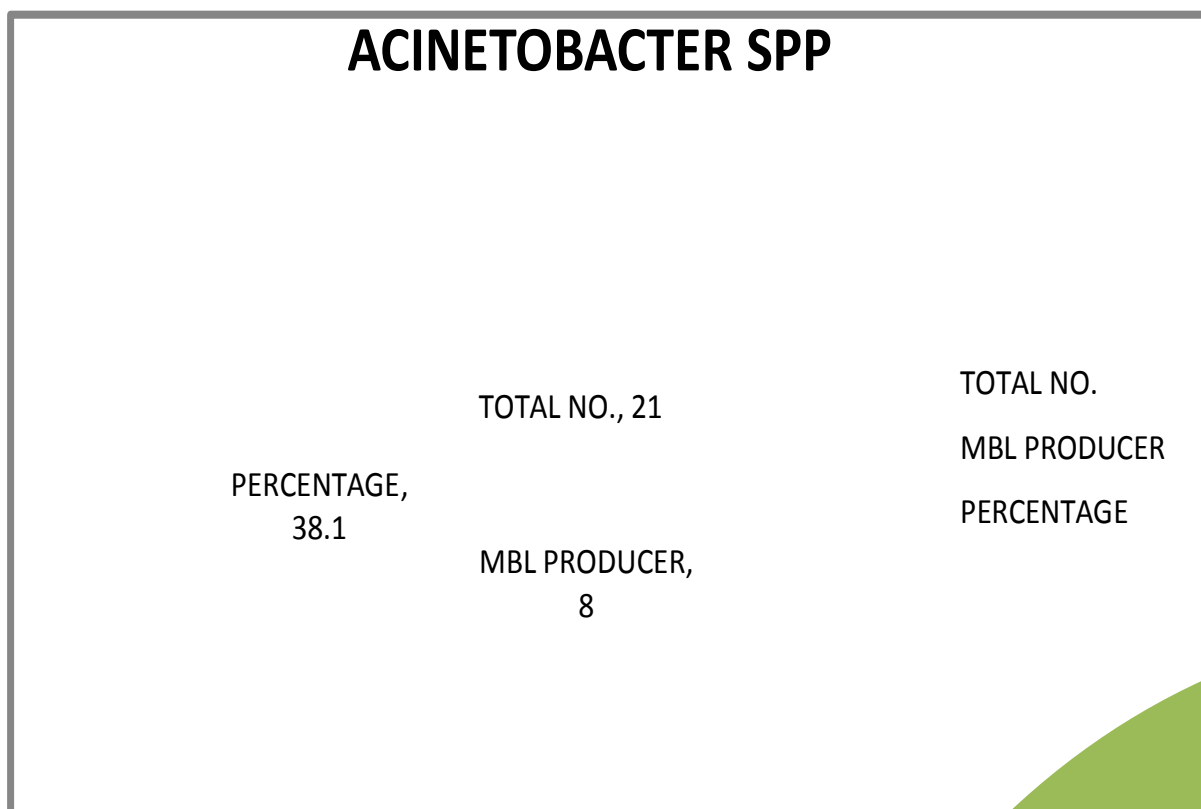


Table.2 Distribution of MBL producing and non MBL producing *Acinetobacter* spp. isolates from various clinical specimens

S.N.	Clinical sample	Total <i>Acinetobacter</i> spp. isolate (%)	<i>Acinetobacter</i> spp. MBL positive isolate (%)	<i>Acinetobacter</i> spp. MBL negative isolate (%)
1.	Urine	06 (28.57%)	03 (37.5%)	03 (23.08%)
2.	Sputum and respiratory tract specimens	08 (38.10%)	02 (25%)	06 (46.15%)
3.	Blood	05 (23.81%)	02 (25%)	03 (23.08%)
4.	Pus & other wound discharges	02 (9.52%)	01 (12.5%)	01 (7.69%)
5.	TOTAL	21	08	13

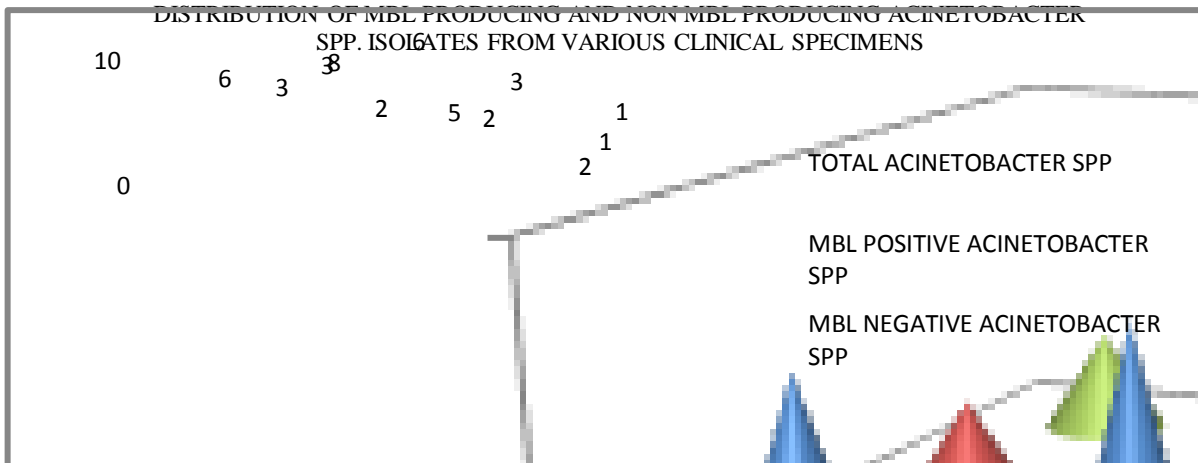
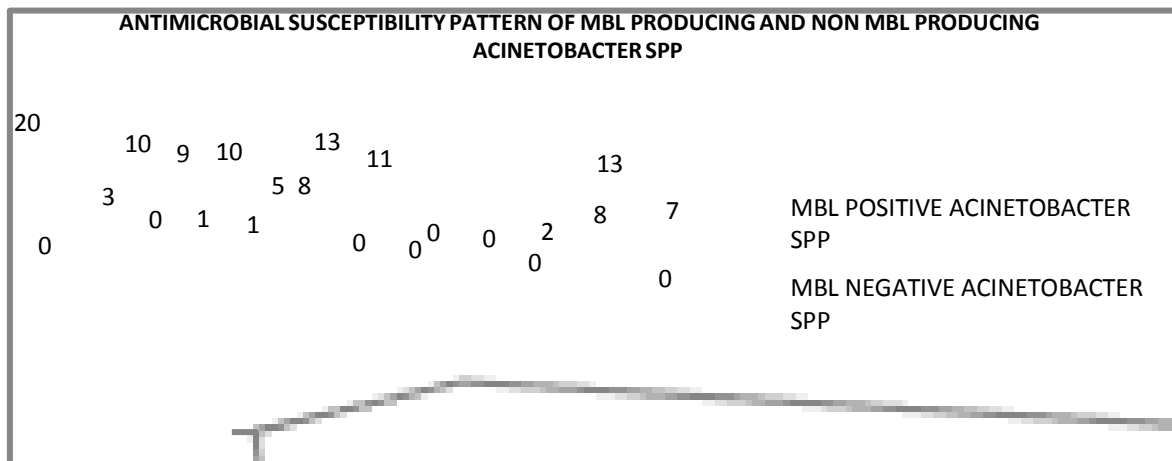


Table.3 Antimicrobial susceptibility pattern of MBL producing and non-MBL producing *Acinetobacter* spp.

S. No.	Name of drug	<i>Acinetobacter</i> spp. MBL positive isolates (%)	<i>Acinetobacter</i> spp. MBL negative isolates (%)
1.	Amikacin	03 (37.50%)	10 (76.92%)
2.	Ceftazidime	00(0.00%)	09 (69.23%)
3.	Ceftriaxone	01 (12.50%)	10 (76.92%)
4.	Ciprofloxacin	01 (12.50%)	05 (38.46)
5.	Colistine	08 (100%)	13 (100%)
6.	Doxycycline hydrochloride	00 (0.00%)	11 (84.62%)
7.	Imipenem	00 (0.00%)	12 (92.31%)
8.	Meropenem	00 (0.00%)	07 (53.85%)
9.	Nitrofurantoin*	00 (0.00%)	02 (33.33%)
10.	Polymixin-B	08 (100%)	13 (100%)
11.	Tobramycin	00 (0.00%)	07 (53.85%)

* Nitrofurantoin were tested against urinary isolates only.



MBL producing *Acinetobacter* spp. strains were most frequently recovered from urine 37.5% followed by sputum and respiratory tract specimens 25%, blood 25% and pus & other wound discharges 12.5% respectively. Similar observations were noticed by Kyungwon Lee *et al.*, (2003) where MBL producing *Acinetobacter* spp. were most frequently obtained from urine 29.2% followed by sputum 13.3% and wound 9.9%, Bum Sik Chin *et al.*, (2011) noticed 9.43% *Acinetobacter* spp. from urine.

MBL producing *Acinetobacter* spp. were 100% sensitive to colistin and polymyxin B followed by amikacin (37.50%), ceftriaxone and ciprofloxacin (12.50%) respectively. Similar results were also observed by De *et al.*, (2010), Fatima Kaleem *et al.*, (2010), Bum Sik Chin *et al.*, (2011)

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