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ORIGINAL ARTICLE

Prevalence of multidrug resistant *Acinetobacter baumannii* in clinical samples in a tertiary care hospital

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Abstract

Acinetobacter baumannii, most often multidrug resistant, is a difficult to treat pathogen particularly in Intensive Care Units (ICUs) of a hospital. The aim of this study was to determine the prevalence and increasing antibiotic resistance of *A. baumannii* isolates in a tertiary care hospital. A retrospective analysis of all patients, seeking medical assistance from our institute, between January to December 2014, from whom clinical specimens (excluding blood and urine) yielded *A. baumannii* was performed. *A. baumannii* was isolated from 227 clinical specimens. Multi drug resistance was observed in 175 (77%) isolates and 30 (13%) were extensively drug resistant (XDR) being susceptible only to colistin. Strict adherence to infection control measures helped to reduce the burden of this pathogen.

Keywords: Drug resistance, multiple, bacterial; *Acinetobacter baumannii* and drug effect

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Introduction

Acinetobacter baumannii has become an increasingly frequent cause of healthcare-associated infections (HAI), particularly in ICUs.[1,2] The role of the environmental contamination in the transmission of HAI in general and in *A. baumannii* infections in particular is well recognized.[3] *A. baumannii* does not have fastidious growth requirements and is able to grow at various temperatures and pH conditions. These properties explain the ability of *Acinetobacter* species to persist in either moist or dry conditions in the hospital environment, thereby contributing to transmission.[1] It has a propensity to develop antibiotic resistance extremely rapidly.[3] Successive surveys have shown increasing resistance in clinical isolates and high proportions of strains have become resistant to older, commonly used antibiotics.[4] In most of the centers in India, *A. baumannii* has acquired resistance to broad-spectrum cephalosporins, carbapenems, tobramycin, amikacin, and fluoroquinolones and is susceptible only to tigecycline and colistin.[5]

The objective of this study was to determine the prevalence and increasing antibiotic resistance of *A. baumannii* isolates.

Materials and methods

A retrospective analysis of all patients, seeking medical assistance from our Institute, between January to December 2014, from whom clinical specimens (excluding blood and urine) yielded *A. baumannii* was performed. Data regarding the antimicrobial susceptibility of *A. baumannii* were collected and analyzed.

The specimens were primarily processed, as per standard methods, on 5% sheep blood agar and Chromogenic agar (CPS ID) (*bioMérieux, Marcy l'Etoile, France*). Identification and antimicrobial susceptibility testing was done by the Vitek-2 system (*bioMérieux, Marcy l'Etoile, France*) using IDGN and N090 panel.

Point surveillance was conducted in the Respiratory ICU (RICU) in June 2014, to identify the source of the organism in this unit. Swabs were collected from 4 patients (Forehead, Ear, Nose, Throat, Axilla, Hand, Groin, Perineum, Toe Web) who were being managed in the RICU, health care workers (anterior nares, hands – finger tips / under nails) working in the RICU and from the items that were directly and indirectly in contact with patients, including the cots and railings, bed linen, humidifiers and the suction apparatus and the fluids. All the swabs were processed as per recommended microbiological procedures and the isolates were identified as *A. baumannii* using the Vitek2 (*bioMerieux*).

Results

During the period of one year, *A. baumannii* was isolated from 227 clinical specimens (excluding blood and urine). About 160/227 (70%) of the infections were from ICUs. About 90 (40%) of the *A. baumannii* were from tracheal aspirates, 47 (20%) from purulent aspirates, 17 (7%) from sputa, 17 (7%) pleural fluid. Bronchial wash, peritoneal fluid, drain fluid, CAPD fluid, cerebrospinal fluids were the other specimens from which *A. baumannii* was isolated (Table I).

Co-infection with other organisms, predominantly Gram negative aerobes, was found in about 20 (8%) patients.

The risk factors associated with multi drug resistant (MDR) *A. baumannii* is given in Table II. Most of the patients (40%) were mechanically ventilated. Co-

Table I. Sources of *A. baumannii* isolates

Specimen	Total no of isolates	Percentage
Tracheal aspirates	90	40
Purulent aspirates	47	20
Sputum	17	7
Pleural fluid	17	7
Bronchial wash	17	7
CAPD	16	7
Peritoneal fluid	9	4
Drain fluid	9	4
Cerebrospinal fluids	5	2

Table II. Risk factors associated with MDR *A.baumanii* n=205

Risk factors	No of patients	Percentage
Surgical admission	89	43.4
Age >55	76	37
Male Gender	163	79.5
Co-morbidity*	200	97
Previous antibiotics	200	97
Mechanical ventilation	90	44
Mortality	50	24

*Comorbidity includes Congestive heart failure, coronary artery disease, chronic obstructive pulmonary disease, diabetes mellitus, end stage renal disease, asthma, cancer, human immunodeficiency virus

morbidities were observed in 200 (88%) patients. Mortality was recorded in 50 (22%) of the patients.

Resistance pattern

MDR *A. baumannii* is defined as resistance to more than three classes of antibiotics. The resistance pattern of the isolates are shown in Table III.

As most of the infections were from ICUs, point surveillance was conducted in RICU. As per the point surveillance results, colonization with *A. baumannii* was found on all the 4 patients' only on the underarms and groin. Since the patients were critically ill with several invasive gadgets and ventilator, these sites would have been probably neglected during cleaning and scrubbing. Though, hand colonization with methicillin resistant *Staphylococcus aureus* (MRSA) on two of the health care workers, none had *A. baumannii* carriage. The rest of the sampling sites were free from *A. baumannii.*

Table III. Antibiotic susceptibility pattern of *A. baumannii* isolates

Susceptibility pattern	No of isolates	Percentage
Sensitive	22	9
XDR	30	13
MDR	175	77

Discussion

The major site of *A. baumannii* isolation in this study was the respiratory tract (62%). Patients with chronic lung disease are at increased risk of airway colonization and pneumonia, especially when they require intubation.[6,7] *A. baumannii* has the ability to colonize and infect skin and soft tissue[8] and 20% of our isolates were from purulent aspirates from skin and soft tissue infections.

The individual risk factors for isolation of MDR *A. baumannii* that were identified by the multivariate analysis were male sex, underlying comorbidity of ischemic heart disease, mechanical ventilation and previous antimicrobial drug treatment.[9,10] The combination of all these factors compromises the immune system of a patient, facilitating initial colonization and subsequent progression to severe infection.[7]

There are various definitions of MDR in literature. MDR was defined as acquired non-susceptibility to at least one agent in three or more antimicrobial categories. XDR (extensively drug resistant) strains, resistant to all antimicrobials except colistin and PDR (Pan drug resistant) was defined as non-susceptibility to all agents in all antimicrobial categories.[11] In this study we have defined MDR *A. baumannii* as those which were resistant to any of the 2 classes of the five classes of antibiotics like beta lactam/beta lactamase inhibitor combinations, 3rd generation cephalosporins, carbapenems, fluoroquinolones and aminoglycosides. Reports have suggested that the community *Acinetobacter* pathogens are relatively susceptible to antibiotics, and the more resistant subtypes have occurred almost exclusively in hospitals and more so in the ICUs.[9,12,13] Due to long-term evolutionary exposure to soil organisms that produce antibiotics, *Acinetobacter* sp. can develop antibiotic resistance extremely rapidly. Most reported cases of indigenous transmissible antibiotic resistance from *Acinetobacter* spp. have been associated with plasmids belonging to broad-host-range incompatibility groups.[4,14]

As per the half-yearly antibiogram data generated by the Microbiology investigations, there is a high level

of resistance (92%) among the *A. baumannii* isolates. Similar resistance patterns are being reported by the major neighboring hospitals. Since our institute is a tertiary care hospital, patients already receiving multiple high-end antibiotics that often include the carbapenems and polymyxins are transferred to the ICUs, from other hospitals. This may be the major risk factor for the high rate of infection due to *A. baumannii* in our hospital.

The emergence of antimicrobial-resistant *Acinetobacter* species is due both to the selective pressure exerted by the indiscriminate use of broad-spectrum antimicrobials and transmission of strains among patients, although the relative contributions of these mechanisms are not yet known.[15-16]

Antimicrobial treatment of the clinical infections caused by *A. baumannii* strains, may be compromised by the multiple-drug resistance of many isolates to beta-lactams, aminoglycosides, and fluoroquinolones.[4,17,18] Most of our patients were hospitalized for long term in intensive care units on broad spectrum antibiotics. They were treated with cefoperazone-sulbactum and carbapenems for long term which might have contributed to resistance to these drugs.

Colistin and tigecycline remain the only active antibiotics and have become the last resort of treatment.[19,20] A delay in the administration of tigecycline or colistin, alone or in combination, has the potential to increase the risk of mortality.[21] However, *A. baumannii* can develop resistance to both colistin and tigecycline, and thus, extreme vigilance is required to diagnose the development of resistance during treatment.[22] Unfortunately, resistance to colistin has emerged with its increasing use, and the recent observation of hetero-resistance to colistin among clinical strains of MDR *A. baumannii* is also a significant cause for concern.[5] Pan-resistance typically is the result of the convergence of multiple resistance mechanisms.[23]

In our study 13% of our isolates were resistant to tigecycline and were sensitive only to colistin. In such cases colistin is the only drug for treatment and to prevent its resistance and to enhance its activity, combination therapy would be helpful. Colistin activity can be enhanced when combined with some other antibiotics with different modes of action such as carbapenems, rifampicin and ceftazidime.[24-26] Combination therapy of colistin with meropenem has synergistic effect / additive effect. Colistin acts on outer membrane of cell wall and creates pores allowing the other drugs to enter into the bacterial cell. Meropenem has bactericidal activity and binds to PBP of cell wall and inhibits cell wall synthesis.[24, 27]

Though there was no recorded outbreak of *A. baumannii* during the study period in our Institute, there was an increase in the number of isolations, especially from the ICUs. Subsequent to the point surveillance, the infection control protocol in the ICUs was revised along with training of health care workers and the clinicians. The important measures that were strictly implemented included thorough scrubbing of the patients using 4% chlorhexidine body wash, care of the environment with regular wet mopping schedules, regular cleaning of suction bottles, trolleys and other patient care items. The respiratory therapist was instructed strictly to wash hands before and after tracheal suctions and proper maintenance of tracheal wounds to avoid infection. Hand hygiene was strictly

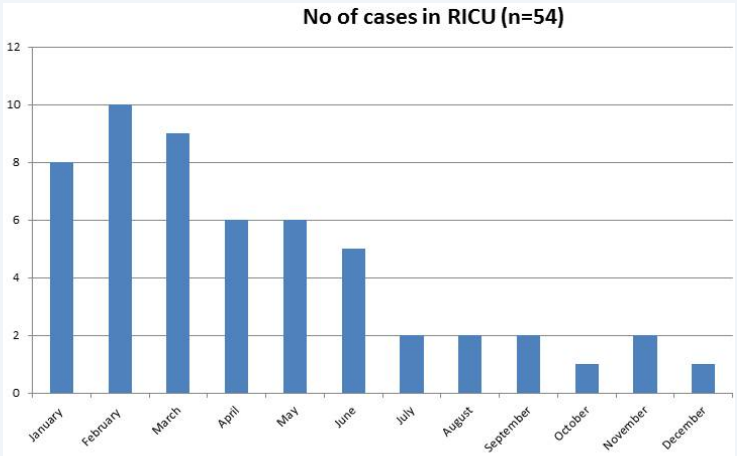

Figure 1. Results of point surveillance conducted at RICU

implemented. The 2 HCWs which had MRSA underwent the recommended MRSA nasal decolonization protocol.

Following the implementation of strict infection control measures in June there was a reduction in *A. baumannii* infections in the RICU (Figure 1).

Conclusion

The high prevalence of the organism in clinical specimens together with its multidrug resistance has made *A. baumannii* an important nosocomial pathogen leading to significant morbidity and mortality. A combination of a review of hand-washing practice, education about the spread of bacteria via hands and contaminated environment, and the revision of infection control procedures would help in the control of this organism in hospitals.

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