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Original Research Article

Emergence and Prevalence of *Acinetobacter baumannii* in Tertiary Care Hospital Settings

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Abstract: *Acinetobacter baumannii* is an ubiquitous pathogen that has emerged as a major cause of healthcare associated infections. *Acinetobacter baumannii* usually causes respiratory tract, urinary tract, blood stream and surgical site infections. During the period of study from January 2015 to December 2015, a total of 237 strains of *A. baumannii* were isolated from various clinical specimens obtained from hospitalized patients. Majority of isolates were obtained from 181 miscellaneous samples(76%) (Sputum(43%), HVS(29%), Pus(20%), DTT(3%), Throat(2%), Endo Tracheal(1%), Eye swab(1%) and Aspirates(1%) and followed by total of 56 *Acinetobacter baumanii*(24%) bacterial growth were isolated from urine culture. In Our study, cefazolin the first generation of cephalosporins showed 59% resistant and Ampicillin belonging to the penicillin group showed 58% resistant to *Acinetobacter baumannii and* remaining drugs showed sensitivity to the tested antibiotics. The drug susceptibility pattern is varied according to the area and environs. In our study, majority of them were found to be sensitive to the tested antibiotics, Amikacin the (aminoglycosides group) and Imipenem (carbapenem group) are the most effective antimicrobial agent against *A. baumannii.*, so the controlment of utilisation of antibiotics in hospitals, play an crucial role in anticipation of the emergence of *Acinetobacter baumanii*.
Keywords: *Acinetobacter baumannii*, infections, penicillin, cephalosporin.

INTRODUCTION

The genus *Acinetobacter* is a member of the family *Moraxellaceae* in the order *Pseudomonadales*. More than 25 species within the genus *Acinetobacter* have been described. The most important species of this genus is *Acinetobacter baumannii* which causes 2-10% of all Gram-negative infections in the Unites State and Europe. It possesses trivial hazard to healthy individuals, but generally causes infections in those with weakened immune systems specifically, in the intensive care unit (ICU). The latter equipped with ventilators and invasive tools such as catheters are factors that predispose to *A. baumannii* infections such as Ventilator Associated Pneumonia (VAP), meningitis, wound infection, septicaemia, and urinary tract infections [1].

Acinetobacter spp. is Gram Negative, strictly aerobic, non-fastidious, non-fermenting encapsulated coccobacilli causing mostly nosocomial infections. According to most recent scientific literature, *Acinetobacter spp*. are the second most common non-fermenting Gram negative pathogen isolated from clinical samples after *Pseudomonas aeruginosa*[2]. *Acinetobacter baumannii* has become increasingly accessible for causing health care associated infections (HAI), particularly in ICUs [3].

The role of the environ contamination in the transmission of HAI in general and in *A. baumannii* infections in particular is well apprehended. *A. baumannii* does not require 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. It has a propensity to develop antibiotic resistance rapidly [4].

During the last two decades, hospital acquired infections involving multi-resistant A. *baumannii* isolates have been reported. Once it enters a hospital ward, *A. baumannii* can spread from the colonized patient to the environment and other susceptible patients. The direct environment of the patient can become contaminated by excreta, air droplets and scales of skin [5].

The virulence of these strains are enhanced by the presence of polysaccharide capsule made up of L-

rhamnose, the property of adhesion to human epithelial cells in the presence of fimbriae or capsular polysaccharide production of enzymes that may damage tissue lipids, lipopolysaccharide component of cell wall and lipid A. The potential source of contamination with *Acinetobacter* in hospital environment is the medical Equipments used for therapy or from contamination in the environment by airborne route or by contact with patients. Infection control measures and strict isolation procedure of colonized or infected patients prevent the dissemination of these strains to the environment [6, 7].

The spread of multidrug resistance determinants in *A. baumannii* occurs by conjugation, transposon acquisition or integron mobilization to gain clusters of genes encoding resistance to several antibiotic families [8]. There is increasing number of reports of the variable susceptibility of *Acinetobacter* isolates against the multiple antibiotics around the world and only few therapeutic options are available for the treatment of the infections caused by this organism [9].

Today, the increasing resistance to the antimicrobial agents used in the treatment of infections caused by *A. baumannii* complex isolates has become an important health problem as in the whole world [10]. Efficient infection control strategies are needed to prevent *Acinetobacter* nosocomial infections [11]. The present study was carried out to know the incidence of *A. baumannii* infection in our hospital setting isolated from various clinical specimens and to determine their antimicrobial susceptibility.

MATERIALS AND METHODS

In this study, a total of 1000 various clinical samples including urine(300) and miscellaneous(700) (Sputum, pus, HVS, throat, DTT(Draining Tube Tip), (ET)Endo tracheal aspirates, eye swab and aspirates), collected from patients hospitalized in SSSMC & RI, during January 2015 – December 2015. Among which, 237 isolates of *A. Baumannii* were isolated from urine(56) and miscellaneous samples(181).

All samples were cultured on BHI or nutrient agar and were incubated at 37 °C in laboratory for 24 hours. The *Acinetobacter* gram negative cocobacilli were confirmed by microscopic method using direct examination (Gram stain) after 24 hours. The biochemical tests to identify different species of *Acinetobacter* were catalase, TSI, IMViC, urease, oxidase and growth at 37°C and 42 °C. The isolated samplers were kept in - 80 °C on nutrient broth containing 50% glycerol. After the identification of *Acinetobacter species*, the Kirby-Bauer disk diffusion method used to determine the drug resistance phenotype in compliance with the CLSI guidelines [12].

RESULT

Table 1: *Acinetobacter baumannii* identification in miscellaneous samples

	Sputum	HVS	Pus	DTT	Throat	ET	EyeSwab	Aspirates	**Total**
January	8	2	3	-	-	-	1	-	14
February	5	8	4	1	1	-	-	-	19
March	3	6	-	-	-	-	2	1	12
April	4	-	1	1	1	-	-	-	7
May	4	2	2	2	-	-	-	-	10
June	9	1	5	-	1	-	-	-	16
July	7	5	3	2	-	-	-	-	17
August	12	7	4	-	-	1	-	-	24
September	4	3	-	-	-	1	-	-	8
October	8	4	4	-	-	-	-	-	16
November	8	7	8	-	-	-	-	-	23
December	6	7	2	-	-	-	-	-	15
Total	78	52	36	6	3	2	3	1	**181**
Percentage %	43%	29%	20%	3%	2%	1%	1%	1%	100%
Male = 89 = 49% **Female** = 92 = 51%									

Table 2: *Acinetobacter baumannii* growth in Urine Culture

	Female	Male	No.of organisms isolated
January	4	2	6
February	9	5	14
March	1	1	2
April	-	1	1
May	6	-	6
June	1	3	4
July	1	-	1
August	3	-	3
September	1	1	2
October	3	-	3
November	3	1	4
December	6	4	10
Total	**38**	**18**	**56**
Percentage %	**68%**	**32%**	**100%**

Table 3: Antibiotic Sensitivity pattern for Miscellaneous (181) Samples

Antibiotic Name	Sensitive (%)	Resistant (%)
Cefazolin	41%	59%
Ceftazidime	62%	28%
Ciprofloxacin	90%	10%
Imipenem	100%	-
Amikacin	96%	4%
Gentamycin	92%	8%
Cefotaxime	83%	17%
Amoxyclav	81%	19%

Table 4: Antibiotic Sensitivity pattern for Urine (56) Samples

Antibiotic Name	Sensitive (%)	Resistant (%)
Nitrofurantoin	80%	20%
Norfloxacin	89%	11%
Nalidizic Acid	64%	36%
Amikacin	100%	-
Ciprofloxacin	87%	13%
Gentamycin	89%	11%
Co-trimaxazole	75%	25%
Ampicillin	42%	58%

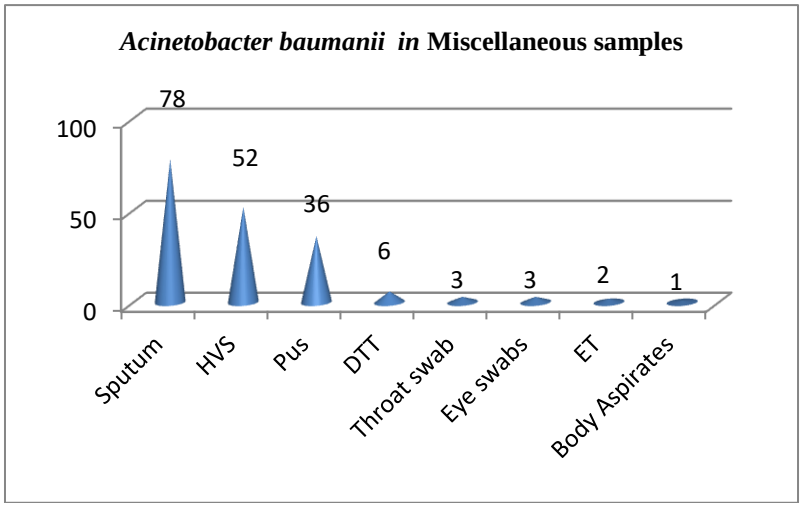

Fig-1: Distribution of *Acinetobacter baumanni* in miscellaneous samples

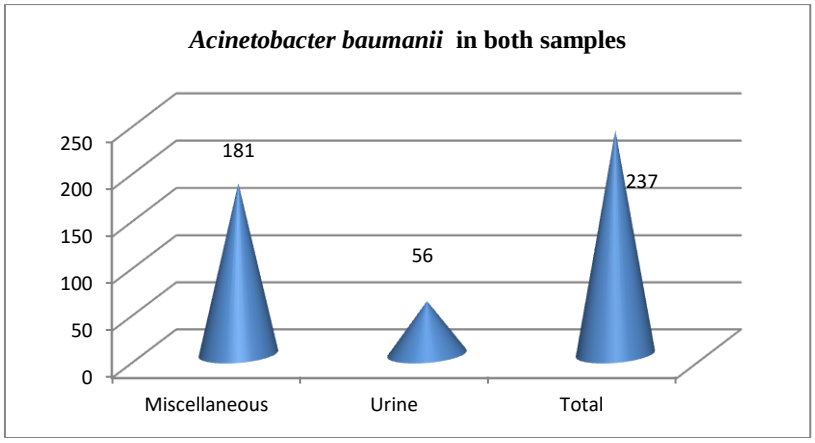

Fig-2: Disribution of *Acinetobacter baumanni* in both urine and miscellaneous samples

During the period of one year, *A. baumannii* was isolated from 237 clinical specimens (excluding blood). Of the 237 isolates, majority of the isolates were obtained from 181 (76%). Miscellaneous samples (Sputum(43%), HVS (29%), Pus(20%), DTT(3%), Throat(2%), Endo Tracheal aspirates(1%), Eye swab(1%), Aspirates(1%) and followed by a total of 56(24%) *Acinetobacter baumannii* bacterial growths were isolated from urine culture. Out of which, in Miscellaneous samples highest growth was 51% corresponded to females and 49% growth was seen in males whereas in urine samples female was found to be 68% and 32% growth was seen in males. In our study, the percentage of resistance and susceptibility among the isolates is shown in (Table 1, 2 and Figure 1,2).

Antibiotic sensitivity pattern of Miscellaneous samples were highly sensitive to the tested antibiotics Cefazolin 41%, Ceftazidime 62%, Ciprofloxacin 90%, Imipenem 100%, Amikacin 96%, Gentamycin 92%, Cefotaxime 83% and Amoxyclav 81% in contrast, the resistant pattern of Miscellaneous samples showed Cefazolin 59%, Ceftazidime 28%, Ciprofloxacin 10%, Amikacin 4%, Gentamycin 8%, Cefotaxime 17% and Amoxyclav 19%. Where as in urine samples, *A. baumannii* isolates were highly sensitive to the tested antibiotics like Nitrofurantoin 80%, Norfloxacin 89%, Nalidizic Acid 64%, Amikacin 100% Ciprofloxacin 87%, Gentamycin 89%, Cotrimaxazole 75%, Ampicillin 42% and the resistant pattern of tested antibiotis showed Nitrofurantoin 20%, Norfloxacin 11%, Nalidizic acid 36%, Ciprofloxacin 13%, Gentamycin 11%, Cotrimaxazole 25%, Ampicillin 58% (Table 3 and Table 4).

In both Miscellaneous and urine samples 100% sensitivity was found in imipenem (carbapenem group) and Amikacin(aminoglycoside group), consequently cefazolin the first generation of cephalosporins showed 59% resistant in miscellaneous samples and in urine sample Ampicillin the penicillin group showed 58% resistant to *Acinetobacter baumannii*.

DISCUSSION

In this current study the emergence and spread of A. *baumannii* was investigated from our hospitalized patients. In our study *Acinetobacter baumanni* were isolated from miscellaneous and urine samples. *Acinetobacter baumannii* were most commonly isolated from miscellaneous samples. *Acinetobacter* strains which are among the most important nosocomial pathogens survive for a long time by colonization in different environments, on the surfaces of mechanical devices used in hospitals, patients and hospital staff [13]. *Acinetobacter spp*. is the second most common non-fermenting bacteria after *Pseudomonas species* that are isolated from human specimens, especially among nosocomial infections [14].

Hospital outbreaks caused by problematic microorganisms, like multidrug-resistant *Acinetobacter baumannii*, resulting in increased morbidity and mortality, especially in intensive care units /ICU/, surgical wards in a big hospital complexes, have been reported worldwide [15]. Also, there are many reports, showing that persistent hospital environmental contamination with *A. baumannii* strains may play an important role in the nosocomial dissemination of these organisms [16, 17].

Like our study, W. Nageeb, M. Kamel *et al.* [18], also proved that *A. baumannii* was the only *Acinetobacter spp*. encountered in clinical specimens and this supported the finding that infections by other *Acinetobacter spp*. are infrequent. But in other studies found that among different *Acinetobacter spp, A. baumannii* was the most prevalent in clinical specimens and the one most often responsible for nosocomial infections [19-21].

Rahbar*et al.* [22], were determined that, *A. baumannii* shows high percentage of resistance to ceftriaxone (90.9%), piperacillin (90.9%), ceftazidime (84.1%), amikacin (85.2%),and ciprofloxacin (90.9%), this is in conflict with our results because amikacin(100%) was effective against *Acinetobacter baumannii*. In our study, we also proved that Imipenem(100%)was effective against *Acinetobacter baumannii*; hence our result is correlate with their findings in which they had also conducted the sensitivity and found that imipenem(95.5%) was the most effective agent against these organisms.

This finding was in agreement with Hoe Koo *et al.* [23], who reported that amikacin as the most effective drug among nine antimicrobial agents used. Sepideh Mostofi *et al.* [24],who reported that imipenem were the most effective agents and 59% ampicillin / sulbactam were resistant among 11 antimicrobial agents used and this is in accordance with our study we demonstrated 58% ampicillin resistant to *Acinetobacter baumannii*.

In a report from 48 European hospitals from 2002 to 2004, 32.4%, 34% and 47.6% isolates showed susceptibility to Ceftazidime, Ciprofloxacin and Gentamycin [25]. Thus in our study, higher values were recorded for fourth generation Cephalosporins and Ciprofloxacin and Gentamycin respectively.

Majority of the isolates in our study were susceptible to commonly used antibiotics such as Ceftazidime 62%, Ciprofloxacin 90%, Imipenem 100%, and Amikacin 96%, Gentamycin 92%, Cefotaxime 83% and Amoxyclav 81% for miscellaneous samples and Nitrofurantoin 80%, Norfloxacin 89%, Nalidizic Acid 64%, Amikacin 100%, Ciprofloxacin 87% ,Gentamycin 89%, Cotrimaxazole 75% in urine samples.

In this study *Acinetobacter baumannii* were resistant to commonly used antibiotics such as cefazolin the first generation of cephalosporins showed 59% resistant in miscellaneous samples and in urine sample Ampicillin (penicillin group) showed 58% resistant. This means MDR isolates are increasing and developing resistant, possibly due to indiscriminate use of these antibiotics in healthcare settings. It is re-emphasized that broad spectrum antibiotics should be used with caution.

CONCLUSION

Overall results indicate that *A. baumannii* is more amenable for nosocomial infections. Our study, cefozolin the first generation of cephalosporins showed 59% resistant and Ampicillin the penicillin group showed 58% resistant to *Acinetobacter baumannii* and remaining showed sensitivity to the tested antibiotics, this is due to drug susceptibility pattern is varying according to the area and environmental set up.In this view, in response to uncontrolled use of antibiotics, multi-drug resistant *A. baumannii* in hospital environment will be increased, so control of antibiotics usage in hospitals play an important role in preventing the emergence of such strains and infections caused by *A. baumannii*. It also indicated the important role of hospital environment as a source of infection and in spread and transmissibility of *A. baumannii* among hospitalized patients, so appliance of strict infection control measures is very important to reduce the transmission of infections.

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REFERENCES

1. Omer MI, Gumaa SA, Hassan AA, Idris KH, Ali OA, Osman MM, Saleh MS, Mohamed NA, Khaled MM; Prevalence and Resistance Profile of Acinetobacter baumannii Clinical Isolates from a Private Hospital in Khartoum, Sudan. American Journal of Microbiological Research, 2015; 3(2):76-9.
2. Gautam V, Singhal L, Ray P; *Burkholoderi acepacia* complex beyond *Pseudomonas* and *Acinetobacter*, Ind J Med Microbiol., 2011; 29: 4-12.
3. Sinha N, Agarwal J, Srivastava S, Singh M; Analysis of carbapenem-resistant *Acinetobacter* from a tertiary care setting in North India. Indian J Med Microbiol., 2013; 31(1): 60-63.
4. Aygün G, Demirkiran O, Utku T, Mete B, Ürkmez S, Yılmaz M, Yaşar H, Dikmen Y, Öztürk R; Environmental contamination during a carbapenem-resistant Acinetobacter baumannii outbreak in an intensive care unit. Journal of Hospital Infection, 2002; 52(4):259-62.
5. Zeana C, Larson E, Sahni J, Bayuga SJ, Wu F, Della- latta P; The epidemiology of multidrug-resistant *Acinetobacter baumannii*does the community represent a reservoir Infect Control Hosp Epidemiol., 2003; 24:275-9.
6. Forster DH, Daschner FD; *Acinetobacter species* as nosocomial pathogens. Eur J ClinMicrobiol Infect Dis., 1998; 17:73-7.
7. Bergogne E,Towner KJ; *Acinetobacter spp* as nosocomial pathogen,microbiological,clinical and epidemiological features, Clinical microbiology reviews, 1996; 148165.
8. Esterly J, Richardson CL, Eltoukhy NS, Qi C, Scheetz MH; Genetic Mechanisms of Antimicrobial Resistance of *Acinetobacter baumannii*, Ann Pharmacother., 2011.
9. CurcioD, Fernández F; Tigecycline Disk Diffusion Breakpoints of *Acinetobacter spp*, a Clinical Point of ViewJ. Clin. Microbiol., 2007; 45(6):2095.
10. Bergogne-Berezin E, Towner KJ; *Acinetobacter spp* as nosocomial pathogens: Microbiological, clinical and epidemiological features, Clin Microbiol Rev., 1996; 9: 148-65.
11. Sunenshine RH, Wright MO, Maragakis LL, Harris AD, Song X, Hebden J, Cosgrove SE, Anderson A, Carnell J, Jernigan DB, Kleinbaum DG; Multidrug-resistant Acinetobacter infection mortality rate and length of hospitalization. Emerg Infect Dis., 2007; 13(1):97-103.
12. Clinical and Laboratory Standards Institute; Performance Standards for Antimicrobial Susceptibility Testing; Twentieth Informational Supplement, 2012; M100-S222012.
13. Mulin B, Talon D, Viel JF, Vincent C, Leprat R, Thouverez M, Michel-Briand Y; Risk factors for nosocomial colonization with multiresistant Acinetobacter baumannii. European Journal of Clinical Microbiology and Infectious Diseases, 1995; 14(7):569-76.
14. Albrecht MA, Griffith ME, Murray CK, Chung KK, Horvath EE, Ward JA, Hospenthal DR, Holcomb JB, Wolf SE; Impact of Acinetobacter infection on the mortality of burn patients. Journal of the American College of Surgeons, 2006; 203(4):546-50.
15. Moro M, Nizzero P, Biancardi A, Baldan R, Scarpellini P, Curti C, Cichero P, Ossi C, Mancini N, Colombo S, Marazzi M; An outbreak caused by multidrug-resistant OXA-58-positive Acinetobacter baumannii in an intensive care unit in Italy. Journal of Hospital Infection, 2008; 68(1):97-9.
16. AllenK, TGreen; Hospital outbreak of multiresistant *Acinetobacter anitratus* an airborne of spread, J Hosp Infect., 1987; 9:110-119.
17. Crombach WH, Dijkshoorn L, van Noort-Klaassen M, Niessen J, van Knippenberg-Gordebeke G; Control of an epidemic spread of a multi-resistant strain ofAcinetobactercalcoaceticus in a hospital. Intensive care medicine, 1989; 15(3):166-70.
18. Nageeb W, Kamel M, Zakaria S, Metwally L; Phenotypic characterization of Acinetobacter baumannii isolates from intensive care units at a tertiary-care hospital in Egypt/Caractérisationphénotypique des isolatsd'Acinetobacter baumannii prélevésdans des unités de soinsintensifs d'un hôpital de soins de santé tertiaires en Égypte. Eastern Mediterranean Health Journal, 2014; 20(3):203.
19. Lone R, Shah A, Kadri SM, Lone S, Faisal S; Nosocomial multi-drug-resistant Acinetobacter infections-clinical findings, risk factors and demographic characteristics. Bangladesh Journal of Medical Microbiology, 2009; 3(1):34-8.
20. Joshi SG, Litake GM, Niphadkar KB, Ghole VS; Multidrug resistant Acinetobacter baumannii isolates from a teaching hospital. Journal of infection and chemotherapy, 2003; 9(2):187-90.
21. Basustaoglu AC, Kisa O, Sacilik SC, Ozyurt M, Yildiran ST; Epidemiological characterization of hospital-acquired Acinetobacter baumannii isolates from a 1500-bed teaching hospital by phenotypic and genotypic methods. Journal of Hospital Infection, 2001; 47(3):246-7.
22. Rahbar M, Mehrgan H, Aliakbari NH; Prevalence of antibiotic-resistant *Acinetobacter baumannii* in a 1000-bed tertiary care hospital in Tehran, Iran. Indian J. Pathol. Microbiol., 2010; 53:290-293.
23. Hoe Koo S, Kwon KC, Cho HH, Sung JY; Genetic Basis of multidrug-resistant *Acinetobacter*

baumannii clinical isolates from three university hospitals in Chungcheong Province, Korea. Korean J. Lab. Med., 2010; 30:498-506.

24. Mostofi S, Mirnejad R, Masjedian F; Multi-drug resistance in *Acinetobacter baumannii* strains isolated from clinical specimens from three hospitals in Tehran, African Journal of Microbiology Research, 2011;5(21):3579-3982.
25. Peleg AY, Seifert H, Paterson DL;*Acinetobacter baumannii*, emergence of a successful pathogen. Clin Microbiol Rev., 2008; 21: 538-582.