Acinetobacter Infections in Intensive Care Unit Patients at Al Azhar University Hospitals in Cairo

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Abstract: Background: The rising incidence of Acinetobacter infection in the ICU and in patients with immature or defective body defense system cause a great concern to all clinicians worldwide due to their extraordinary ability to develop resistance to multiple classes of antibiotics which limit array of the therapeutic options. **Objectives:** study the pattern of health care associated infections and antimicrobial susceptibility of Acinetobacter species in Intensive Care Units at Al Azhar University Hospitals in Cairo. **Subjects and Methods:** Samples collected from 200 infected patients in ICUs were subjected to direct microscopic examination and culture on blood and MacConkey's agar media. and further identification of oxidase negative Gram- negative bacilli to the species level by using VITEK 2 automated microbiology system. Susceptibility patterns were done by Modified Kirby Bauer disc-diffusion methods. **Results:** Out of 200 inpatients suffering from infections, 9 % (no=18) were found to be infected with Acinetobacter spp. It was responsible for 13.8% of Lower Respiratory Tract Infections, 8.3% of wound infections and 2.6% of Urinary Tract Infections. A. baumannii was the most predominant species (61.1%). Prolonged stay in Intensive Care Unite (p=0.03) and Chronic Obstructive Pulmonary Disease (p=0.005) were significantly associated with Acinetobacter infections. The most effective antibiotics were imipinem (83.3%), Ofloxacin (16.7%) and amikacin (5.6%). Totally 55.5% (10/18 isolates) were found to be MDR Acinetobacter isolates. **Conclusion and recommendations:** Infection due to Acinetobacter has become a significant challenge to healthcare systems. Invasive procedures and prolonged stay in ICU as well as patients suffered from different underlying diseases are associated with higher rate of infection. Eradication of Acinetobacter spp. requires adherence to good infection control practices and prudent antibiotic use.

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Key words: Acinetobacter spp., ICUs, mechanical ventilation, LRTIs, UTIs.

Introduction

Acinetobacter species are ubiquitous in nature and have been found in soil, water, animals and humans. Some strains of Acinetobacter can survive for weeks in environment, promoting transmission within the hospital settings **(Doughari et al., 2011)** They are normal inhabitants of human skin and are frequently isolated from the throat and respiratory tract of hospitalized patients **(Fournier and Richet, 2006).**

More than 30 named and unnamed species of Acinetobacter have been described **(Nemec et al., 2009),** some of which are of clinical importance, including Acinetobacter baumannii (A. baumannii), Acinetobacter gen. sp. 3, and Acinetobacter gen. sp. 13TU, while other species, like A. junii, A. johnsonii, A. ursingii, and A. schindleri, can also incidentally be associated with infections **(Dijkshoorn et al., 2007).**

A number of risk factors have been shown to be associated with Acinetobacter nosocomial infections. They include advanced age, immunosuppression, surgery, previous treatment with broad-spectrum antibiotics, use of invasive devices, burns, fecal colonization with Acinetobacter, and prolonged hospital or ICU stays **(Rungruanghiranya et al., 2005).**

Multidrug resistant Acinetobacter isolate increase therapeutic difficulty and result in high mortality rates. A baumannii has become resistant to almost all antimicrobial agents including cephalosporins, quinolones, aminoglycosides and broad spectrum β-lactams including carbapenems. Although carbapenems have been successfully used in treating most gram-negative nosocomial infections, emergence of MDR pathogens such as A. baumannii has menaced the use of this substantial class of drugs. Several studies have shown increased 'carbapenem resistance' throughout the world. **(Metan G, Alp E, Yildiz O, Percin D, Ay- gen B, Sumerkan, 2010).**

Aim of the study

The aim of this work was to study the pattern of health care associated infections and antimicrobial

susceptibility of Acinetobacter species in Intensive Care Units at Al Azhar University Hospitals in cairo.

2. Subjects and Methods

This study was conducted over the period from April 2015 till December 2015. Clinical samples were obtained from patients in Intensive Care Units at Al Azhar University Hospitals in Cairo. The collected samples were processed at the Department of Medical Microbiology and Immunology, Faculty of Medicine Al Azhar University for isolation of organisms.

Identification to species level were done by using VITEK 2 automated microbiology system at microbiology Department of Air Force Specialized Hospital in Cairo.

Consent was taken from the patient's family to be enrolled in the study.

This study involved 200 patients (139 males, 61 females) who developed clinical evidence of infection. Demographic data of each patient were collected, these include; ward, patient name, age and gender. Clinical characteristics were reported including duration of hospitalization, presence of underlying diseases, risk factors (e.g. use of invasive devices), previous investigations and antibiotic treatment. diabetes, etc.)

Different types of specimens were collected from sputum, endotracheal tubes, Urine, infected wounds and bed sores.

All samples were subjected to: Direct microscopic examination of a Gram–stained smears, culture on MacConkey's and blood agar media and further identification of oxidase negative Gram-negative bacilli to the species level by using VITEK 2 automated microbiology system.

Acinetobacter was identified by:

1- Colony appearance: smooth, convex, glistening, sometimes mucoid, pale yellow colonies on MacConkey medium.

2- Motility: Non-motile.

3- Gram stain: Acinetobacter appears as short, Gram-negative rods, but often more coccoid and arranged in pairs or clusters.

4- Biochemical tests: negative oxidase and positive catalase test.

5- VITEK 2 automated microbiology system.

Antimicrobial susceptibility test for Acinetobacter isolates was done using a disc diffusion method (Modified Kirby Bauer technique) on Muller Hinton agar according to Clinical and Laboratory Standards Institute **(CLSI 2011)** guidelines.

3. Results

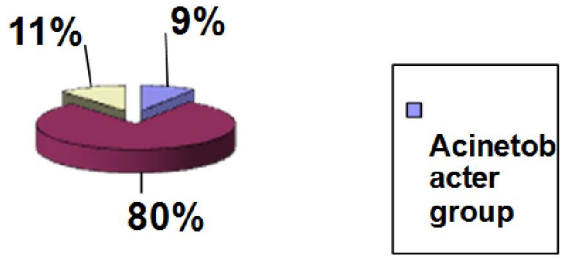

Figure (1): Distribution of Acinetobacter infected patients among studied patients.

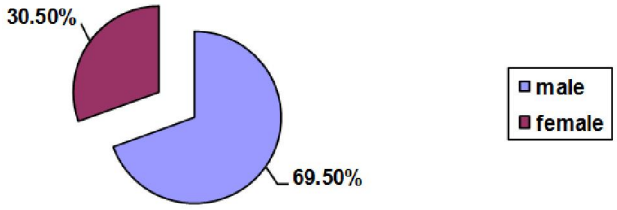

Figure (2): Acinetobacter infection according to gender

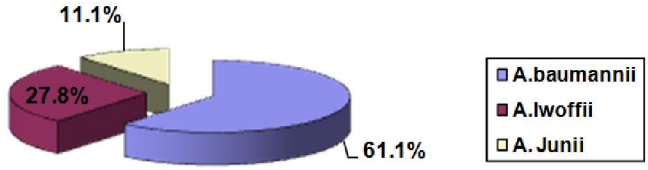

Figure (3): Different species of Acinetobacter in current study.

Table 1: Gender distribution among Acinetobacter and non-Acinetobacter groups.

Gender	Acinetobacter group (no=18)	Non- Acinetobacter group (no=160)	Total (no=178)	P value
	no. (%)	no. (%)	no. (%)	
Male	13 (10.3)	113 (89.7)	126(100)	540.
Female	5 (9.6)	47 (90.4)	52(100)	

This table showed no statistical significant difference between infection in both sex (p=0.54).

Table 2: Distribution of Acinetobacter group and non–Acinetobacter group in relation to age

Age (years)	Acinetobacter group (no=18) (%)	Non- Acinetobacter group (no=160)%	Total (no=178) (%)	P value
20-30	**2 (14.3)**	**12 (85.7)**	**14 (100)**	**0.88**
31-40	**3 (9.4)**	**29 (90.6)**	**32 (100)**	
41-60	**8 (10.1)**	**71 (89.9)**	**79 (100)**	
Above 61	**5 (9.5)**	**48 (90.5)**	**53 (100)**	

It was found that there was no specific age group for Acinetobacter infected patients (p=0.88).

Table 3: Types of clinical specimens among Acinetobacter and non -Acinetobacter groups

Clinical specimens	**Acinetobacter Group (no=18)**	**Non-Acinetobacter group (no=160)**	**Total =178**	**P value**
	no. (%)	**no. (%)**	**no. (%)**	
Respiratory (Sputum and ETT aspirate.)	**13 (13.8)**	**78 (86.2)**	**91(100)**	**0.44**
Wound exudates and bed sore	**4 (8.3)**	**44 (91.7)**	**48 (100)**	**0.30**
Urine	**1 (2.6)**	**38 (97.4)**	**39 (100)**	**0.16**

There was no statistical significant difference between Acinetobacter and non-Acinetobacter groups as regard type of infections.

Table 4: Duration of hospital stay for Acinetobacter and non -Acinetobacter groups

Duration of hospital stay (days)	Acinetobacter group (no=18)	Non- Acinetobacter group (no=160)	**Total (no=178)**	**P value**
	no. (%)	no. (%)	no. (%)	
Less than 7	4 (7.3)	51 (92.7)	55 (100)	0.03
More than 7	14 (11.4)	109 (88.6)	123 (100)	
Mean of Days ± SD	8.67±(2.612)	7.90±(2.285)		

Prolonged stay in hospital was significantly associated with Acinetobacter infection (p=0.03).

Table 5: Mechanical ventilation and VAP among Acinetobacter and non Acinetobacter groups

	Acinetobacter group (no=18)	**Non-Acinetobacter group (no= 160)**	**Total (178)**	**P value**
	no. (%)	**no. (%)**	**no. (%)**	**0.89**
Mechanical ventilation	**9 (14.5)**	**53 (85.5)**	**62 (100)**	
VAP	**9 (21)**	**34 (79)**	**43 (100)**	**0.00**

Mechanical ventilation and VAP among Acinetobacter this was statistically significant (p=0.00).

Table 6: urinary catheterization and UTIs among Acinetobacter and non Acinetobacter groups

	Acinetobacter group (no=18)	**Non-Acinetobacter group (no= 160)**	**Total 178**	**P value**
	no. (%)	**no. (%)**	**no. (%)**	
Urinary catheterization	**17 (11.2)**	**135(88.8)**	**152 (100)**	**0.166**
UTIs	**1 (3.8)**	**25 (96.2)**	**26 (100)**	**0.8**

This was no statistically significant between urinary catheterization and UTIs among Acinetobacter and non Acinetobacter groups.

Antibiotic susceptibility test:

The most effective antibiotics were imipinem (83.3%), Ofloxacin (16.7 %) and amikacin (5.6%). On the other hand strains were 100% resistant to Ampicilin/Sulbactam, Amoxacillin/Clavulinate, Gentamicin, cefazolin, Ciprofloxacin, Cefuroxime, Ceftriaxone, cefepime and cefuroxime.

Totally 83.3% (15/18 isolates) were found to be MDR Acinetobacter isolates.

4. Discussion

In this study, we were found that, patients were infected with Acinetobacter spp. with age ranging from 20-85 years [mean age ± (SD), 57.72± (12.1) year] It was found that there was no specific age group for Acinetobacter infected patients, on the other hand Higher incidence of infection was observed in males (13/18) than in females (5/18), but No statistical significant difference was found as regard age and sex when comparing Acinetobacter group with non-Acinetobacter group (p=0.45) and (p=0.56) respectively (Tables, and Figure). These results came in agreement with results obtained by **Nwadike V. et al. 2013** who isolated Acinetobacter spp. from infected patients admitted to university teaching hospital in Nigeria and found no statistical significant difference was found as regard age and sex when comparing Acinetobacter group with non-Acinetobacter group.

Results of this study showed that among Acinetobacter group 72.2 % (13/18) showed LRTIs, 22.2% (4/18) showed wound infections and 5.6% (1/18) UTIs. This is in accordance with **Custovic A et al. (2014)** it was observed the most frequently site of Acinetobacter infection were respiratory infections 74.1%. Surgical site infections were registered in 11.1%, while Urinary tract infections were 3.7%. **Ye et al. (2010)** reported also that respiratory tract was the predominant site of growth (57.9%).

As Regard to duration of hospital stay, the present study reported that prolonged stay in hospital was significantly associated with Acinetobacter infection (p=0.03). These results come in agreement with studies done by **Yu et al. (2004**) in China, **Agodi et al. (2006)** in Italy, **Joshi et al. (2006)** in India, **Falagas and Kopterides (2006)** in Greece, **Baran et al. (2008**) in Turkey and **Nwadike V. et al. 2013** in Nigeria, who reported that longer duration of hospital ICU stay was a significant risk factor for Acinetobacter infections (p≤0.05). Also in Malaysia **Zakuan et al. (2009)** reported that Acinetobacter patients were most located in ICUs and had a longer stay and **Lone et al. (2009)** in India found that a longer stay in hospital (beyond the first week) was significantly associated with a remarkably higher rate of infection (p<0.05). Moreover, **Ye et al. (2010)** reported that prolonged ICU stay was significant risk factor (p<0.001). However, these results differed from **Prashanth and Badrinath (2006)** in India who found no correlations between Acinetobacter infections and prolonged hospital stay.

As Regard to invasive device The present study found that out of 178 infected patients, 62 patients (34.8%) were found to be mechanically ventilated. 43/62 (69.4%) of all mechanically ventilated patients: developed VAP. Acinetobacter spp. represented (21%) 9/43 of all patients developed VAP and represented (14.5) 9/62 of all mechanically ventilated patients. This was statistically insignificant (p=0.00). These results agreed with **Mahgoub et al. (2002), Ayan et al. (2003), Baran et al. (2008), Lone et al. (2009), Zakuan et al. (2009), Hernández et al. (2010) and Nwadike V. et al. 2013,** who recorded that mechanical ventilation was significant risk factor for Acinetobacter infections.

As regard urinary catheterization, out of 178 infected patients, 152 patients (85.3%) were inserting urinary catheters. Totally 26/178 (14.6%) developed UTIs, Acinetobacter UTIs represented (3.8%) 1/26 patients of all patients with UTIs and represented (0.6%) 1/178 of all patients inserting urinary catheters. This was statistically insignificant (p=0.8). These results agreed with **Nwadike V. et al. (2013)** who reported that urinary catheters were a no significant risk factor for Acinetobacter infections (0.47). These results differed from **Mahgoub et al. (2002), Ayan et al. (2003), Baran et al. (2008), Lone et al. (2009), Zakuan et al. (2009) and Hernández et al. (2010)** who reported that urinary catheters were a significant risk factor for Acinetobacter infections (p≤0.05).

In the present study the most effective antibiotics against Acinetobacter spp. were imipinem (83.3%), Ofloxacin (16.7 %) and amikacin (5.6%). On the other hand strains were 100% resistant to Ampicilin/Sulbactam, Amoxacillin/Clavulinate, Gentamicin, cefazolin, Ciprofloxacin, Cefuroxime, Ceftriaxone, cefepime and cefuroxime.

Our results were in agreement with **Enas A. et al. (2013)** In the present study the majority of Acinetobacter isolates were multidrug resistant (MDR) showing resistance to three or more classes of antibiotics. Also, **Eser et al. (2009)** who reported that 41% of Acinetobacter spp. were found to be MDR and resistance rates for amikacin, piperacillin/tazobactam, cefepime, ceftriaxone, tetracycline, trimetoprim/sulfomethoxazole were 80.4%, 98%, 92.2%, 100%, 100%, 86.3% respectively. **Cetin et al. (2009)** found that most of the isolates were MDR, and they were found to be sensitive to imipenem (56%), gentamicin (53%), and resistant to ciprofloxacin (95.5%), piperacillin/tazobactam (94%8) and ampicillin-sulbactam (62.1%).

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