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ORIGINAL ARTICLE

Study of Incidence, Risk Factors and Antibiotic Sensitivity Pattern of *Acinetobacter baumannii* in a Tertiary Care Hospital

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Abstract:

Background: Recently, *Acinetobacter* species has emerged as an important pathogen and the prevalence of infection has increased since last two decades worldwide. *Objective:* To see the impact of *Acinetobacter* infection in our hospital and antibiotic sensitivity and resistance pattern. *Material and Methods:* The study was carried out on clinical samples submitted to the Microbiology laboratory in Krishna institute of Medical Sciences and Research, Karad, over a period of one year (July 2012 to June 2013).Various risk factors like length of hospital stay, ICU admission, any interventions done were noted. Identification and antibiotic susceptibility of the isolates was performed using standard protocol. *Results:* Out of a total 2728 samples, 86 (3.15%) were found to be due to *Acinetobacter baumannii*. Of the 86 isolates the organism was predominantly isolated from pus samples 48 (55.81%) followed by sputum 17 (19.76%), urine 6 (6.97%) and blood 4 (4.65%). Out of 86 *Acinetobacter* isolates, 76 (88.37%) showed resistance to Cephalexin, 74 (86.04%) each to Cefotaxime and Ceftazidime. The isolates also showed high level of resistance to Ciprofloxacin (82.55%), Ampicillin (77.90%) and Gentamicin (74.41%). The isolates from urine samples showed 100% sensitivity to Nitrofurantoin. Imipenem and Meropenem were highly active against the isolate with least resistance of 12.79% each. *Conclusion:* The present study highlights *Acinetobacter* species as an important pathogen because of multidrug resistant strains jerking in the hospital environment.

Keywords: *Acinetobacter baumannii*, Nosocomial Infection, Multidrug Resistant

Introduction:

Acinetobacter species has emerged recently as a major cause of nosocomial infection, especially in the intensive care settings [1,2]. These gram negative coccobacilli are ubiquitous in nature, and infections caused by them are difficult to control due to multidrug resistance, which limits therapeutic options in critically ill and debilitated patients [3].

Despite their low pathogenic potential these pathogens survive in the hospital environment for a long time and thereby get an opportunity to cause hospital outbreaks [4]. Hospitalized patients have several predisposing factors: the presence of an underlying serious disease, prolonged intubation, mechanical ventilation and long-term use of antibiotics that facilitate development of infection [5]. *Acinetobacter baumannii* is now recognized to be the species of great clinical importance [6]. *Acinetobacter* species is widely distributed and has tremendous colonizing potential; hence it becomes very difficult to explain its significant role in the ICU [5]. Despite the increasing frequency of multiresistant *Acinetobacter* infections, many clinicians and microbiologists still lack an appreciation of the importance of these organisms in hospitals [4]. There are very few authentic reports of *Acinetobacter* species

from India regarding the risk factors and *in vitro* susceptibility warranting further study in this part of the world [6].

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.

Material and Methods:

This prospective study was conducted at Krishna Institute of Medical Sciences, Karad during a period of one year from July 2012 to June 2013. Patients with clinical signs and symptoms admitted for more than 72 hours in the hospital were included in the study. Patients from whom *Acinetobacter* species was isolated in absence of clinical disease suggested colonization and were excluded from the study.

Risk factors associated with *Acinetobacter* infection noted in this study were length of hospital stay, ICU admission, urinary and IV catheterization, mechanical ventilation, endotracheal tube intubation and underlying chronic illness. P value was calculated and was considered to be significantly associated if $p < 0.05$. Analysis of risk factor was calculated by SPSS software package.

All clinical samples submitted to the microbiology laboratory over this period were processed according to standard procedures.

Non-fermentating gram-negative bacilli that were non-motile, with positive catalase test and negative oxidase test were identified as *Acinetobacter* species Speciation of isolates was done by glucose oxidation test by Hugh and Leifson's of glucose, growth at 37^0C and 44^0C, hemolysis on sheep blood agar, gelatin liquefaction and arginine dihydrolase. Carbon assimilation tests were performed on isolates using a simplified panel of carbon sources (histamine production using L-histidine, citrate, malonate and trans-aconitate).

Antimicrobial susceptibility of all isolates was determined by the Kirby Bauer disk diffusion method. It was performed on Mueller-Hinton agar for the following antibiotics: Amikacin (30µg), Ampicillin (10µg), Gentamicin (10µg), Ciprofloxacin (5µg), Cephotaxim (30µg), Cephazolin (30µg), Ceftazidime (30µg), Imipenem (10 µg), Meropenam (10µg), Nalidixic acid (30µg), Norfloxacin (10µg), Nitrofurantoin (300µg) (Himedia laboratories, Mumbai).

Results:

During the study period, out of a total 2,728 samples, 86 (3.15%) isolates of *Acinetobacter baumannii* were isolated from various clinical specimens. Maximum number i.e. 48 patients were from age group 50 to 60 yrs with male predominance accounting for 73.25%. 71 (82.55%) isolates were from ICU settings including both medical and surgical ICU.

Table 1 shows the isolation of organisms from various clinical specimens. Of the 86 isolates, 55.81% were predominantly isolated from pus samples followed by sputum (19.76%), urine (6.97%), blood (4.65%), endotracheal secretion, IV catheter (3.48% each) and CSF (2.32%).

Table 1: Distribution of *Acinetobacter baumannii* Complex Isolated from Various Clinical Specimens

Type of Specimen	No. of isolates	Percentage (%)
Blood	4	4.65
Pus	48	55.81
Sputum	17	19.77
Urine	6	6.98
Endotracheal secretion	3	3.49
IV catheter	3	3.49
CSF	2	2.33
Other	3	3.49
Total	86	100

Table 2: Association of *Acinetobacter baumannii* Complex Infection with Various Risk Factors

Sr. No.	Risk Factors	No. of cases (N=86)	Relative Risk	Chi-square (χ^2)	P value
1	Length of stay (>7days)	59	1.612	3.986	0.045*
2	ICU admission	71	1.872	4.651	0.031*
3	Mechanical Ventilation	48	1.682	5.524	0.018*
4	Intra Venous Catheter	75	1.968	4.162	0.041*
5	Urinary Catheter	52	1.278	1.049	0.305
6	Endotracheal intubation	28	0.821	0.574	0.448
7	Chronic illness	25	0.702	1.972	0.16

**P value < 0.05 = significant*

Table 3: Antibiotic Sensitivity of the *Acinetobacter baumannii* Complex

Type of Antibiotics		Sensitive (%)	Resistant (%)
Amikacin		38 (44.18%)	48 (55.81%)
Ampicillin		19 (22.09%)	67 (77.90%)
Ciprofloxacin		15 (17.44%)	**71 (82.55%)***
Gentamicin		22 (25.58%)	64 (74.41%)
Ofloxacin		37 (43.02%)	49 (56.97%)
Cephotaxim		12 (13.95%)	**74 (86.04%)***
Cephazolin		10 (11.62%)	**76 (88.37%)***
Ceftazidime		12 (13.95%)	**74 (86.04%)***
Imipenem		75 (87.20%)	**11 (12.79%)***
Meropenem		75 (87.20%)	**11 (12.79%)***
	Nalidixic acid	2 (33.33%)	4 (66.66%)
Urine	**Norfloxacin**	2 (33.33%)	4 (66.66%)
	Nitrofurantoin	**6 (100%)**	0

The risk factor distribution associated with infection is shown in (Table 2).

In the present study the risk factors significantly associated with *Acinetobacter* infection were length of hospital stay more than 7 days, admission in ICU, use of IV catheters and mechanical ventilation. Other factors like use of urinary catheter, endotracheal secretion and presence of chronic illness were not found to be significantly associated with *Acinetobacter* infection.

The percentage of resistance and susceptibility among the isolates is shown in (Table 3).

The isolates showed resistance to many antibiotics. High level of resistance was recorded for Cephazolin (88.37%), Cephotaxim and Ceftazidime (86.04% each), Ciprofloxacin (82.55%), Ampicillin (77.90%) followed by Gentamicin (74.41%). Imipenem and Meropenam showed maximum activity with overall resistance of 12.79% each. These 11 isolates showing resistance to Imipenem and Meropenem were isolated from ICU patients. Urinary isolates showed 100% sensitivity to Nitrofurantoin.

Discussion:

Acinetobacter baumannii has emerged as a major cause of nosocomial infection with rising prevalence and often multi-drug resistance. In the present study the overall incidence of *Acinetobacter baumannii* infection among all the collected specimens was 3.15% which was considerably high. The study carried out by Rubina *et al.* [3] also showed incidence of *Acinetobacter* infection to be 4.8% which was consistent with the present study. The age group commonly affected in the present study was between 50 to 60 years while Rubina *et al.* [3] found the median age to be 42 years. This shows that this infection is mostly seen in elderly patients.

In the present study, *Acinetobacter baumannii* was isolated predominantly from pus sample, while Rubina *et al.* [3] found urine to be the most common specimen followed by pus and wound exudates. In a study conducted by Prashanth *et al.* [6] and Alireza *et al.* [2] respiratory tract infections predominated due to this pathogen.

In the present study, length of stay in hospital for more than 7 days and ICU admission were significantly associated with *Acinetobacter baumannii* infection. These findings were consistent with a study carried out by Rubina *et al.* [3] which supported the increased incidence of this pathogen as a cause of nosocomial infection. However, Prashanth *et al.* [6] found no significant association between ICU stay and *Acinetobacter* infection. The use of mechanical ventilation was significantly associated with the infection in the present study and was consistent with Rubina *et al.* [3] and Prashanth *et al.* [6]. In the present study use of I.V. catheters showed statistical significance with the infection which was not the case in a study carried out by Prashanth *et al.* [6]. The presence of underlying conditions causing chronic illness such as uncontrolled diabetes, hypertension, liver and renal disorders, etc. was found to be insignificant in the present study which was not the case in a study conducted by Rubina *et al* [3].

Simple and cost-effective approach for antibiotic susceptibility testing is useful for detection of susceptible and resistant strains of *Acinetobacter* species as multidrug resistant strains are emerging. In the present study, maximum resistance was reported against Cephazolin, Cephotaxim and Ceftazidime ranging from 86 to 88%. This was in consistent with Rubina *et al.* [3] however Prashanth *et al.* [4] found almost all strains resistant to Cephazolin and 50% and 58% resistant to Cephotaxim and Ceftazidime respectively. Alireza *et al.* [2] reported 100% resistance to Cephotaxim and Ceftazidime. High level of

resistance was also seen against Ciprofloxacin and Ampicillin in the present study and this was in consistent with Rubina *et al.* [3]. Gentamicin resistance noted in the present study was consistent with the study carried out by Alireza *et al* [2]. In the present study, isolates showed least resistance i.e. 12.79% each to Imipenem and Meropenem which was consistent with study conducted by Sinha *et al.* [7]. However, moderate to high rate of resistance to Imipenem and Meropenem was reported by Alireza *et al.* [2] and Fournier *et al.* [5].

Conclusion:

In conclusion, *Acinetobacter baumannii* was the cause of majority of the *Acinetobacter* infections in our hospital. The isolates were considered to have pathogenic role when isolated from patients with clinical signs and symptoms as they survive in environment as commensals. Mechanical ventilation and ICU admission were found to be potential independent risk factor in our set up.

Simple identification schemes and antimicrobial susceptibility tests, though have certain limitations as compared to molecular methods, the resistant strains can be distinguished for effective management of the infections. MDR, XDR and Pan-drug resistant strains of *Acinetobacter* species have emerged which are responsible for high mortality rates. Hence, further research related to mechanism of resistance and extended spectrum beta lactamases and carbapenem should be done. A combined effort for rigorous surveillance and infection control protocols have to be designed and evaluated to control the increasing incidence of highly resistant Acinetobacters.

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