ORIGINAL RESEARCH

A study of Acinetobacter from various clinical specimens & its antibiotic sensitivity pattern in a tertiary care hospital

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Abstract

Background: Acinetobacter baumannii has emerged as a significant hospital pathogen, quickly becoming resistant to commonly prescribed antimicrobials.

Objectives: To isolate various species of Acinetobacter, to compare inpatients (ICU's & wards) and outpatients isolates and to know it's frequency from various clinical specimens.

Material and methods: The retrospective study is conducted in the department of Microbiology, Krishna Institute of Medical Sciences, Secunderabad, from January 2013 to December 2014. The various clinical specimens from inpatients and outpatients were included. The samples were processed as per the standard guidelines. Identification & antibiotic sensitivity testing was done by using GN and AST 281 cards (Vitek 2 compact, BioMerieux) respectively. MIC values of antibiotics were obtained and reporting was done as per the CLSI guidelines. The data was captured from the laboratory computer and analysed.

Results: A total of 496 Acinetobacter species were isolated from 2459 samples (20.17%) from the entire hospital, in which *Acinetobacter baumannii* was 462(93.16%), *Acinetobacter lwoffii* was 16(3.22%), *Acinetobacter junii* was 13(2.62%), *Acinetobacter haemolyticus* was 5(1.00%). Maximum isolates observed from endotracheal tube secretions (39.51%) followed by blood specimens (15.12%), sputum (12.70%), pus swab (8.66%), clean catch (5.84%) and others (18.17%).

Conclusions: In this study, Acinetobacter isolates showed multidrug resistant pattern mostly in inpatients and hence there is a need for emphasizing the importance of hand washing and use of disinfectants in prevention of transmission of infection in health care setups.

Keywords: Acinetobacter; multi-drug resistance; *Acinetobacter baumannii*; Acinetobacter Spp; VITEK

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Introduction

In 1911, a Dutch microbiologist by the name of Martinus Willem Beigerinck discovered an aerobic, gram-negative, non-fermentative bacterium we now know to be of the genus Acinetobacter [1]. Acinetobacter began to be recognized as a significant hospital pathogen in the late 1970s, but at that time it was easily treated as it was susceptible to commonly used antimicrobials. In 1986 a pair of researchers, Bouvet and Grimont, delineated 12 DNA groups of Acinetobacter using DNA-DNA hybridization and proposed 4 new species [2].

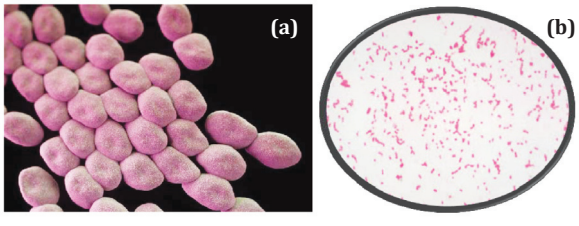

Figure 1: (a) Acinetobacter in electron microscope (b) Acinetobacter in Gram stain.

The genus Acinetobacter are Gram-negative, strictly aerobic, non-fermenting, non-fastidious, non-motile, catalase-positive, and oxidase negative coccobacillary bacteria that can cause healthcare-associated infections and can survive for prolonged periods in the environment and on the hands of healthcare workers [3]. More than two third of Acinetobacter infections are due to *Acinetobacter baumannii*. *Acinetobacter baumannii* causes health care associated infections like bacteremia, wound infections, ventilator-associated pneumonia and meningitis [4-7].

Acinetobacter baumannii also has the ability to form biofilms, which may play a role in the process of colonization. Biofilms help the bacteria resist disinfection while also allowing the participating cells to trade resistance genes, further facilitating the persistence of the pathogen [8].

Epidemiology

They can colonise skin, wounds, respiratory and gastrointestinal tract. Acinetobacter spp found in water and soil, also from food (Raw vegetables) and arthropods [9]. Acinetobacter spp broadly found in hospital settings mostly in ICU [10], tropical environment [11], humid climate [11], wars (Recent wars in Kuwait, Iraq and Afghanistan) [4], natural disasters (Earthquake in Marmara Turkey – in 1999) [5]. They can survive in enviroment for weeks. Fomite contamination in hospital promotes transmission. They can survive in dry environment had better survival rates than strains isolated from wet sources [12] and can be found in bed rails due to specific iron acquisition system of Acinetobacter [13].

Widespread environmental contamination is often demonstrated, and outbreaks of infection have been traced to respiratory care equipment, wound care procedures, humidifiers, and patient care items [14-16].

Material and methods

The study is conducted in the department of Microbiology, Krishna Institute of Medical Sciences, Secunderabad. It is a retsopective study in a tertiary care hospital. The study period is from January 2013 to December 2014. The various clinical specimens from inpatients and outpatients were included. The samples were processed as per the standard guidelines. Identification & antibiotic sensitivity testing was done by using GN and AST 281 cards (Vitek 2 compact, BioMerieux) respectively. The quality control for GN card was done by using ATCC 700323– Enterobacter hormaechei, ATCC17666- Stenotrophomonas maltophilia. The quality control for AST N281 was done by ATCC25922 – Escherichia coli, ATCC 27853- Pseudomonas aeruginosa and ATCC 35218- Escherichia coli, are followed as per manufacturer's instruction. MIC values of antibiotics were obtained and reporting was done as per the CLSI guidelines. The data was captured from the laboratory computer and analysed [17].

Figure 2: (a) VITEK 2 compact, BioMerieux; (b) GN cards.

VITEK 2 compact principle

The VITEK 2 Compact, automated microbiology system utilises growth based technology. It makes use of colorimetric reagent cards that are incubated and interpreted automatically. It has application in clinical laboratories. It has compliance for electronic records and signatures and a colorimetric reagent card to identify GN, GP, YST [9].

The reagent cards have 64 wells that can each contain an individual test substrate. Substrates measure various metabolic activities such as acidification, alkalinization, enzyme hydrolysis, and growth in the presence of inhibitory substances. An optically clear film present on both sides of the card allows for the appropriate level of oxygen transmission while maintaining a sealed vessel that prevents contact with the organism-substrate admixtures. Each card has a pre-inserted transfer tube used for inoculation. Cards have bar codes that contain information on product type, lot number, expiration date, and a unique identifier that can be linked to the sample either before or after loading the card onto the system [18].

Results

A total of 496 Acinetobacter species were isolated from 2459 samples (20.17%) from the entire hospital, in which among inpatients, ICU patients showed maximum isolates (53.69% in 2013; 47.09% in 2014) as compared to ward patients (38.42% in 2013; 45.39% in 2014) (Table1). Acinetobacter baumanii was 462(93.16%), Acinetobacter lwofii was 16 (3.22%), *Acinetobacter junii* was 13(2.62%), *Acinetobacter haemolyticus* was 5(1.00%) (Table 2). Maximum isolates observed from endotracheal tube secretions (39.51%) followed by blood specimens (15.12%), sputum (12.70%), pus swab (8.66%), clean catch (5.84%)and others (18.17%). Inpatient showed more isolates (92.11% in 2013 and 92.4% in 2014) than outpatients (7.88%in 2013; 7.5% in 2014) (Table 3). Majority were found to be colistin sensitive (80-90%) followed by gentamycin (50-86%) followed by cefeperazone+sulbactam combination (46-58%) and carbapenems (~50%) as compared to other β-lactam antibiotics (<20%).

Table1: Yearly distribution of Acinetobacter spp isolates (January 2013-December 2014).

	Total (n=496)					
	IP				*OP*	
	ICU		*WARDS*			
YEAR	*No.*	*%*	*No.*	*%*	*No.*	*%*
2013 (n=203)	109	53.69%	78	38.42%	16	7.88%
2014 (n=293)	138	47.09%	133	45.39%	22	7.5%

Table 2: Different species of Acinetobacter isolates (January 2013-december 2014).

Acinetobacter spp.	***No. of culture positive (496)***	***Culture positive (in %)*** (20.17%)
Acinetobacter baumanni	462	93.16%
Acinetobacter lwoffii	16	3.22%
Acinetobacter junii	13	2.62%
Acinetobacter hemolyticus	5	1%

Discussion

From the study, Acinetobacter is mostly isolated from ET secretions which could be due to its ability to colonise in respiratory tract. They are predominantly found in inpatients, mostly in ICU's. Acinetobacter has become resistant to a number of antimicrobials due to its overuse. Acinetobacter has acquired an impressive intrinsic resistance mechanisms and can acquire new mechanisms via plasmids, integrons, and transposons. It also acquire resistance through change in porins and efflux pump.

Despite the various mechanisms of resistance Acinetobacter are susceptible to few antimicrobials including - colistin, gentamycin, cefperazone+sulbactam combination and carbapenems (i.e. imipenem and meropenem).

Conclusions

In this study, Acinetobacter isolates showed multi-drug resistant pattern mostly in inpatients. Measures to prevent the intrahospital transmission of Acinetobacter is done by monitoring by surveillance of multi-drug resistant Gram negative bacilli hospital acquired infection. Success in infection control has been attained by if health care workers are educated about the proper way to manage MDR Acinetobacter and emphasizing the importance of hand washing and use of disinfectants in prevention of transmission of infection in health care setups.

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Conflict of interest

Authors declare no conflict of interest.

Table 3: Yearly distribution of Acinetobacter spp. in different clinical specimen.

Name of samples	*2013 (n=203)*		*2014 (n=293)*		*Total (n=496)*
	No.	*%*	*No.*	*%*	
ET secretions	66	32.5%	130	44.36%	196 (76.87%)
Blood	41	20.14%	34	11.6%	75 (31.79%)
Sputum	21	10.34%	42	14.33%	63 (24.33%)
Pus and pus swabs	16	7.88%	27	9.21%	43 (17.09%)
Urine (Clean catch)	16	7.88%	13	4.43%	29 (12.31%)
Body fluids	8	3.94%	15	5.11%	23 (9.05%)
Broncheal wash	7	3.4%	13	4.43%	20 (7.83%)
Tissue	7	3.4%	1	0.34%	8 (3.74%)
Tracheal secretions	7	3.4%	2	0.68%	9 (4.08%)
Urine (Catheter catch)	6	2.9%	6	2.04%	12 (4.78%)
Central line	5	2.4%	7	2.38%	12 (4.78%)
Wound swabs and fluid	2	0.98%	2	0.68%	4 (1.66%)
Catheter tip	1	0.49%	1	0.34%	2 (0.83%)

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