Original Research Article

Carrier status of Acinetobacter among healthcare personnel and prevalence of the same in the environment

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Abstract

Background: Acinetobacter baumanii is an increasingly troublesome nosocomial pathogen, often with multidrug and multi resistant strains, mainly in intensive care units (ICUs), being responsible for different types of nosocomial infections. **Objectives**: The objective was to determine prevalence of carriers of Acinetobacter Spp. and predisposing risk factors among healthcare workers (HCWs) in ICUs and their role as source in nosocomial infection. **Materials and Methods**: Specimens from nose, throat, axilla and hands of all HCWs (55 (40 staff nurses, 15 attenders)) from ICUs and 30 HCWs from general wards were collected and processed by standard laboratory procedures. **Results**: Prevalence of A. baumanii carriers was 18.18%. Higher carrier rate was observed in male than female HCWs (12.72% Vs 5.5%). carrier rate was 22.2% and 18.75% in SICU and PICU respectively with none from general wards. Carrier rate was 7.3% at axilla and hands. **Conclusion**: Colonization of hospitalized patients play an important role in subsequent colonization of hands of hospital staff during trivial contacts, there by contributing to the spread and persistenceof outbreaks.

Key words; Acinetobacter, Carriers, Healthcare workers, ICUs, Nosocomial infections

Introduction

Acinetobacter baumanii (A.baumanii) is an increasingly troublesome nosocomial pathogen, often with multi-drug and pan-drug resistant strains; mainly in intensive care units (ICUs) being responsible for different types of nosocomial infections with increasingly limited therapeutic options, higher mortality and morbidity [1].

Their ubiquitous nature in the ICU environment and inadequate infection-control practice have continuously raised the incidence of acinetobacter infections over the past two decades [2]. ICU environmental contamination appears to be another important source. The significant environmental reservoirs in the ICU include room surfaces, ventilators, ventilator tubing, mattresses, hand washing sinks, gowns and gloves [2]. Despite the global alarm caused by Acinetobacter, relatively few studies on this issue have been published. The understanding and recognition of Acinetobacter infections in the ICU is critically needed [2]. Acinetobacter is ubiquitous in the outside environmentand has been isolated from hospital personnel, and hospital equipment [2]. Several hospital-wide outbreaks have been previously described. Hospital personnel are the most important reservoir of these highly resistant pathogens in the ICUs. Hand and skin transmission of this organism by health-care workers (HCWs) have been well documented. The significant environmental reservoirs in the ICU include room surfaces, ventilators, resuscitation bags, mattresses, hand-washing sinks, gowns and gloves [2]. Surprisingly, despite the increasing incidence of Acinetobacter infections, only a limited number of clinical studies regarding the treatment of these highly resistant pathogens are available [2].

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Materials and Methods

Study design and setting: This prospective observational study was carried out from July 2015 to December 2015, in the diagnostic laboratory of Microbiology department.

Study population, sample size, and sampling strategy: The study population consisted of HCWs

working in different ICUs of the hospital. A total of 220 random specimens were collected from 55 HCWs, consisting of 40 staff nurses, 15 attenders/ayas from ICCU, NICU, surgical ICU (SICU). 120 specimens from 30 HCWs from general wards were also collected and processed to determine the carrier state. The present carrier study among HCWs was conducted in ICUs of our hospital with the patients suffering from nosocomial infections namely; catheter associated urinary tract infection, ventilator associated pneumonia, lower respiratory tract infection (LRTI), chronic obstructive pulmonary disease with LRTI. Study was conducted in our ICUs witnessing higher incidence of culture proven nosocomial infections due to Acinetobacter species.

Specimen collection: Four specimens per HCW were collected, namely web spaces of hands, axilla, throat, and nose by using a sterile swab soaked in sterile normal saline as per standard laboratory procedures [3]. Institutional ethical committee clearance was obtained for conducting the study. Informed consentwas obtained from HCWs before sample collection.

HCWs with < 6months experience in our hospital and HCWs suffering from an infectious disease were excluded from the study. HCWs with isolation of Acinetobacter spp. from at least one of the body sites namely, nose, throat, axilla, and hands were considered as carriers for Acinetobacter spp.

Environment samples were collected from ventilatory circuit, suction apparatus, beds, floor, air-conditioner vents, medicine/dressing trolleys, window stills, door handles, wash basins. Four swabs were collected from each site.

Microbiological processing: Samples from HCWs were collected with swabs pre-moistened with sterile distilled water. Environmental samples from dry surfaces were taken with absorbent cotton-wool swabs, which were moistened with peptone water.

The swabs were inoculated within one hour in enriched brain heart infusion broth and incubated for 24 hours at 37°C. After incubation the broth was subcultured on 5% sheep blood agar and Mac Conkey agar. The bacteria isolated from all these cultures were identified based on standard bacteriological techniques.

The susceptibility of Acinetobacter spp. isolates was performed on Muller-hinton agar by Kirby-bauer disc diffusion method as per clinical laboratory standards institute guidelines [4]. Antibiotics used were AMC (Amoxycillin+clavalunicacid), GEN (Gentamycin), CIP (Ciprofloxacin), CTX (Cefotaxime), CXM (Cefuroxime), NT (Netilmycin), CAZ (Ceftazidime), PTZ (Piparacillin+Tazobactum), CIS (Ceftrioxone).

Typing of isolates from carriers: Typing of Acinetobacter spp. was done by antibiogram typing. Association of Acinetobacter spp. carrier with different nosocomial infections in different areas of the hospital was done by identical antibiogram type of Acinetobacter spp. from carriers and patients.

Results were quantitated by analysing number of cases of nosocomial infections associated with antibiogram type of Acinetobacter spp. fromcarriers by retrospective review of case sheets and prospective observation.

Results

The present study reveals a prevalence of 18.18% (10/55) for A. baumanii carriers among HCWs (nurses and attenders/ayas), working in different ICUs of our tertiary care hospital. None of the carriers for another Acinetobacter spp were observed. Higher carrier rate was observed among male than female HCWs and higher rate in nurses than attenders.

Distribution of carrier rates in different ICUs was not statistically significant. Carrier rate of A. baumanii was highest in SICU followed by ICCU.

Table-1: Distribution of Acinetobacter carriers in ICUs.

Name of ICU	Total number of HCWs studied	Acinetobacter carrier rate
ICCU	05	1
MICU	15	3
NICU	10	1
SICU	09	2
PICU	16	3
Total	**55**	**10**

Note: Carrier rate is highest in SICU, least in NICU

Table-2: Distribution of carriers at different body sites

Body sites	Acinetobacter carrier rate(%)
Nose	1(1.8)
Throat	3(5.5)
Axilla	4(7.27)
Hands	4(7.27)

Note: Axilla and Hands show the same carrier rate

Table-3: Distribution of antibiogram types of A. baumanii

Strains of A.baumanii	Antibiogram type	Number of antibiogram type
Antibiogram type 1	S to all drugs	1
Antibiogram type 2	S to meropenem, R to all drugs	3
Antibiogram type 3	R to all drugs	6

Note: R; Resistant, S; Susceptible

Carrier rate ataxilla and hands was 7.27% (4/55) followed by throat 5.5% (3/55), nose 1.8% (1/55).

Three antibiogram types of A. baumanii were observed and AB-1 (6 strains) were resistant to all drugs. These strains were associated with majority of nosocomial infections. AB-2 (3 strains) were sensitive to meropenem, resistant to others, AB-3 (1 strain) was sensitive to all antibiotics. Antibiotics used were AMC (Amoxycillin+clavalunicacid), GEN (Gentamycin), CIP (Ciprofloxacin), CTX (Cefotaxime), CXM (Cefuroxime), NT (Netilmycin), CAZ (Ceftazidime), PTZ (Piparacillin+Tazobactum), CIS (Ceftrioxone).

One strain of A. baumanii was isolated from ventilatory circuit, suction apparatus, wash basin each and two strains were isolated from medicine/dressing trolley.

Discussion

A. baumanii is an increasingly important healthcare associated antibiotic resistant pathogen. However, less is known about the economic value of an active screening programme targeting this pathogen compared with others (eg, MRSA)[5].

Emerging infections due to Multidrug resistant strains of Acinetobacter spp. in the ICU is a therapeutic concern for clinicians worldwide. Inspite of several large scale multicentric studies, the source/reservoirs, transmission dynamics and failure to control infections due to Acinetobacter spp. has remained an enigma in ICUs [1]. The present carrier study conducted in ICUs of tertiary care hospital highlights the role of apparently healthy HCWs as carriers of A. baumani, acting as source or reservoirs of this nosocomial pathogen.

The present carrier study reports a prevalence of 18.8% (10/55) of carrier state. other studies have reported a variable carrier rate. Present study highlights the role of carrier of A. baumani at different body sites like, nose, axilla, hands and throat. A. A. Hershan et al, reported a prevalence of carrier rate of 14.63% [1]. Acinetobacter spp. have been found in 27% of hospital sink taps and 20% of hospital floor swab cultures [6]. Marchaim Dhor et al, screened six body sites nostrils, pharynx, skin, rectum, wounds and endotrachial aspirates, reported sensitivity of 55%, and sensitivities of single sites ranged from 13.5%-29% [7]. Lee et al have reported a colonization prevalence of 0.5-4% [5]. Joseph et al, concluded that A. baumanii is known to survive in healthcare environment are very effective human colonizers [8].

In our study A. Baumanii was isolated on different occasions from our ICU environment including ventilator circuit, floor, medicine/dressing trolleys, and wash basins. Joseph et al have isolated A. baumanii from suction apparatus, floor, dressing trolley, door handle and VAP patients and have found that it can be a very effective human colonizer [8].

The quantitative antibiogram typing revealed that there were two clusters of Acinetobacter baumanii of which the MDR cluster is large, while very few isolates belonged to the susceptible cluster [8]. HCWs are

generally considered as the primary mediators involved in transmission of isolates from the environment to the patients and/or vice versa [8]. The current centre for disease control and prevention (CDC) guidelines also recommend disinfection of medical equipment surfaces, bedside equipment, and environmental surfaces like, bedrails, bedside tables, carts, commodes, door knobs and faucet handle with a low or intermediate-level disinfectant to prevent the spread of health-care associated infections[8].

A. baumanii has a higher propensity to be transmitted to HCWs than do other MDR bacteria. This may be a factor in nosocomial spread, explaining in part the recent worldwide emergence of MDR A. baumanii [9].

Bayuga et al, have reported a very high prevalence of the carrier state for A. baumani (26.66%)[10]. Carriers of A. Baumannii were absent in randomly selected HCWs from general wards ie. outside the ICU. As such in our hospital incidence of A. Baumannii infections are negligible. This again highlights the importance of carriers as most important source of A. Baumannii in ICUs than other environmental sources.

Colonization of hospitalized patients play an important role in subsequent contamination of the hands of hospital staff during trivial contacts, thereby contributing to the spread and persistence of outbreaks [6].

The ICU environment and the equipment can get contaminated directly with the secretions/discharges from patients during various patient care activities or indirectly through the contaminated hands of HCWs [8].

Patients in ICU are usually sicker, have more invasive procedures, receive prolonged antibiotic therapy and are in close contact with similar patients. The combination of all these factors compromises the immune system of a patient, facilitating initial colonization and subsequent progression to severe infection [11].

Limitation of the study: The major limitation of this study is that we have not studied hand hygiene and other infection control measures practiced in our ICUs; therefore, further studies are needed to examine the various infection control measures and evaluate the usefulness of such measures. We could not elucidate the exact mode of transmission of Acinetobacter between the environment and the patients. The findings from our tertiary care teaching hospital may not be pertinent to other hospitals. In terms of samples analysed, and no matched cohort or control cases were involved.

Conclusion

Acinetobacter spp are increasingly important nosocomial pathogens and are capable of rapid adaptation to the hospital environment. There is no doubt that these organisms will pose continuing problems in the future, which is disturbing because of the extent of their ever-increasing antibiotic resistance profiles. Continued awareness of the need to maintain good housekeeping and control of the environment, including equipment decontamination, strict attention to hand washing and isolation procedures, and control of antibiotic usage, appears to be the combination of measures most likely to control the previously unabated spread of Acinetobacter spp. in hospitals.

Summary: Emerging infections due to MDR strains of Acinetobacter spp. In the ICU is a therapeutic concern for clinicians worldwide. Few treatment options are currently available, including sulbactum and polymyxins. Due to limited therapeutic options, prevention and infection control measures are essential. These should include not only traditional infection control measures, but also antibiotic control strategies in the ICU. Ifinfection control meaures are not practiced, there is a potential risk of future outbreaks.

Contribution from the author

- Dr. Kavita Nimboor: Data Collection, Analysis and preparation of Manuscript.
- Dr. Shubha. D.S: Data Collection, Analysis and Preparation of the Manuscript.
- Dr. Sudhindra. K.S: Analysis and Preparation of the Manuscript.
- Dr. Sumanta. A: Analysis and Preparation of the Manuscript.
- Dr. Jagadevi: Analysis and Preparation of the Manuscript.

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