



## Emerging Trend of Acinetobacter Nosocomial Infection in Northeast of Iran

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### ABSTRACT

**Background:** *Acinetobacter* spp. emerged as an opportunistic pathogen for hospital-acquired infections. Recently, increasing antibiotic resistance among *Acinetobacter* spp. has worsened the problem. The aim of this study was to investigate the emerging trend of infection due to *Acinetobacter* in Ghaem University Hospital, Mashhad during 2006-2012.

**Methods:** The demographic data and information about predisposing factors was collected. Appropriate bacteriological samples were collected and *Acinetobacter* spp. was isolated. Antibiotics susceptibility pattern of these isolates against different antimicrobials agents was determined.

**Results:** Results confirmed that *Acinetobacter* spp. cause 20.9% of nosocomial infection during this period. The trend of *Acinetobacter* nosocomial infection was increasing and patients with risk factors such as COPD, bronchiectasia, diabetes mellitus were more prone to infection. There was significant association between these infections and invasive procedures such as catheterization, mechanical ventilation and broad-spectrum antibiotics usage.

**Conclusion:** Understanding trends in causative organisms of nosocomial infection can help us to better define our infection control policy.

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## Introduction

Hospital-acquired infections have remained a serious problem in health care settings. *Acinetobacter* spp. consists of aerobic gram-negative cocobacillary rods that are ubiquitous in environment and grow on most routine laboratory media (1).

*Acinetobacter* has been everywhere specially in healthcare systems. This organism colonizes on human skin and mucous membranes and can infect the patient's respiratory tract, blood, soft tissues, urinary tract, and central nervous system (2). The infections due to this bacteria in hospitals are associated with adverse outcomes, including prolonged hospital stay and high mortality (3, 4).

Recently *Acinetobacter* spp. acquired resistance against many antibiotics and showed extraordinary ability to develop new mechanisms of resistance that lead to pan-drug resistance (PDR) and cause extend nosocomial outbreaks. The high resistances of *Acinetobacter* have necessitated greater use of broad-spectrum antibiotics, such as imipenem (5).

In this study we present the emerging trend, prevalence profile and resistance patterns of *Acinetobacter* spp. as a causative agent of hospital-acquired infection in Ghaem university hospital in northeast of Iran since 2006 to 2012.

## Materials and Methods

The study was performed since December 2006 to January 2012 in Ghaem university hospital in Mashhad, northeast of Iran. Ghaem university hospital is an 850 beds general hospital which admits mostly the

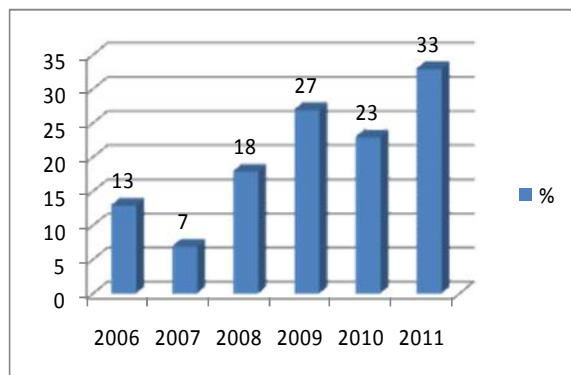
referral patients. All patients who were hospitalized with no signs and symptoms of infection and revealed symptoms of infection after 48 hours of hospitalization were included in our study (nosocomial infection). The demographic data of patients regarding age, gender, symptoms and signs was collected by a valid questionnaire. We also gathered information about any predisposing factors such as COPD (Chronic Obstructive Pulmonary Disease), diabetes mellitus, bronchiectasia, and invasive procedures such as intra-vascular catheter, mechanical ventilation that patients received. Appropriate bacteriological samples such as blood, respiratory samples (tracheal aspirate and bronchoalveolar lavage), wound swabs and urine were collected from patients by an expert nurse (6).

All clinical specimens were initially inoculated on appropriate media and standard microbiological procedures were used for isolation and identification (7, 8). Antibiotics susceptibility pattern of nosocomial isolates of *Acinetobacter* spp. against different antimicrobials agents was determined by the disc-diffusion method on Mueller Hinton agar as recommended by CLSI edition 2009 (9). The antimicrobial agents which were examined include: ampicillin, cefepime, cefazolin, ceftriaxon, cefixime, ciprofloxacin, norfloxacin, gentamicin, amikacin, kanamycin, cotrimoxazol, piperacillin and imipenem.

## Results

Among 564 patients with nosocomial infection which were detected during this period 121 (21.4%) patients were infected by *Acinetobacter* spp. The infection due this

bacterium most often observed in patients with initial diseases such as respiratory failure, pneumonia, chronic obstructive pulmonary disease (COPD), CHF and Cancer. The trend of *Acinetobacter* nosocomial infection was increasing and maximum rate of infection was reported in 2011 and then 2009 (Figure 1).



**Figure 1.** Annual rates of nosocomial infections due to *Acinetobacter*

During this period, (2006-2011) *Acinetobacter* was more prevalent during summer. Among different age group, *Acinetobacter* infections were more common among neonates and then 40-50 years old patients especially in male group.

Most of nosocomial infections caused by *Acinetobacter* observed in patients suffering from background disease such as COPD, bronchiectasia, diabetes mellitus. In our study, patients who received invasive procedures were more prone to infection with *Acinetobacter* than other patients. There was significant association between invasive procedures such as catheterization, mechanical ventilation and broad-spectrum antibiotics usage and infection with the bacteria (Table 1).

In surveying different wards, infections due to *Acinetobacter* spp. were more prevalent in

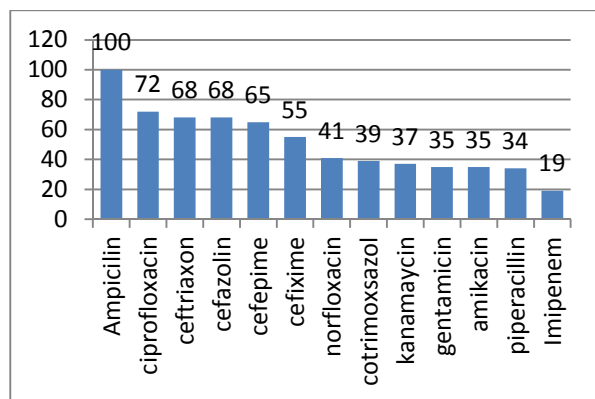
ICUs (75.2%) then NICU (15.2%), surgical (7.6%) and then other wards. *Acinetobacter* has been described as the cause of wide variety of nosocomial infections most commonly lower respiratory infection (70%), blood stream infection (14%), UTI (10%) and then wound infection (4%) and some other type of infections. In our study, the ventilator-associated pneumonia due to *Acinetobacter* spp. was the most frequent single type of infection (58%). Background disease such as chronic obstructive pulmonary disease, bronchiectasia and diabetes mellitus proved as risk factors as the rate of infection was higher among them. In 2011, *Acinetobacter* spp. were the most frequent isolated bacteria from nosocomial infections and other frequently isolated pathogens were *Klebsiella* spp. (13%), *Pseudomonas* (9.3%), *Escherichia coli* (8.3%) and Enterococci (7.2%).

**Table 1.** Relation between invasive procedures and infection with the bacteria

Invasive Procedures	Number	%
Intra Vascular Catheter	103	85.1
Mechanical Ventilation	84	69.4
Urinary Catheter	81	66.9
Suction	63	52.0
Intubation	61	50.4
Tracheostomy	38	31.4
Enteral Vascular Feeding	36	29.7
Operation	28	23.1
Arterial Catheter	25	20.6
Brain Shunt	15	12.3
Central Venous Line	5	0.4

In this study, most isolates of *Acinetobacter* spp. showed resistance against routine antibacterial agents on antimicrobial susceptibility testing. Among aminoglycosides, although amikacin was relatively effective, still 37% of *Acinetobacter* spp. showed resistance against it. Interestingly imipenem presents as the most effective antibiotics during these

years in the hospital. Resistance rates of *Acinetobacter* shows in Figure 2.



**Figure 2.** Resistance rates (%) of *Acinetobacter* spp.

## Discussion

During recent years, there are many studies, which report *Acinetobacter* spp. as the leading causative agent accounting for health-care associated infections and vast majority of hospital outbreaks. The emerging trend of *Acinetobacter* as well as increasing multidrug resistance of this bacterium in nosocomial infections emphasis the need for immediately preventive measures (10). Once endemic in healthcare facilities, *Acinetobacter* is extremely difficult to eradicate as normal infection control measures are often insufficient to halt the transmission of this organism (11). Understanding emerging trends of this organism and antibiotic resistance pattern of it can help us to better define our infection control policy.

In our study, most affected ward of hospital was intensive care units and the ventilator-associated pneumonia was the most encountered infection caused by *Acinetobacter* spp. in our hospital. So a range of enhanced

measures that focused on controlling ICUs' environmental contamination should be considered. Key measures included use of a closed tracheal suction system for all patients receiving mechanical ventilation, improved hand hygiene practice, clearer designation of responsibilities and strategies for cleaning equipment and the environment and the proper antibiotic prescribing policies (11). Specially as the most important source of *Acinetobacter* spp. is the already colonized or infected patient concerning contact isolation precautions for these patients should be re-emphasized (11).

The most common type of infection with *Acinetobacter* spp. was the lower respiratory tract. In our study as other studies, lower respiratory tract infection due to *Acinetobacter* spp. occurred most frequently in patients with mechanical ventilation, endotracheal intubation or tracheostomies and were also associated with intra vascular catheter (10). Bloodstream infections due to *Acinetobacter* spp. occurred often in patients who had mechanical ventilation and intra vascular catheter (10).

Our Laboratory results showed these *Acinetobacter* spp. have become resistant against most of commonly prescribe antibiotic. As reported by other researchers, about half of all isolates were resistant to all commonly used antibiotics including aminoglycosides, cephalosporins, extended spectrum penicillins (11, 12). Recently, of antibiotic resistance are being increasingly reported worldwide and led many serious problems such as increase mortality and length of stay in hospital (13-15).

According to this study which is similar to many other reports, multidrug resistant *Acinetobacter* is a common pathogen in

hospitals so it should be considered when prescribing antibiotics. In order to give timely and proper antibiotic therapy it is important to consider the antibiotic resistance pattern of this bacterium in the hospital (15). Even combination regimens might be considered by clinicians in order to achieve synergistic activity and to maximize antimicrobial effectiveness as well as to minimize the possibility of emergence of further resistance (11).

Emerging trend of *Acinetobacter* in the hospital could be due to lack of good infection-control performance in particular; poor personal hand hygiene and over-crowding situations in hospital. In one study *Acinetobacter* spp. were isolated from 29% of the hands of hospital staff (16). Another study reporting high carriage rates among staff members (33%) and multiple resistant strains were isolated (17). *Acinetobacter* colonization in nosocomial infection may also originate from the patients flora under the pressure of antibiotics, or contaminated equipment (18).

## Conclusion

In conclusion we should focus on reinforcing standard infection control procedures and precautions. Standard infection control practices hand hygiene, personal protective equipment, environmental contamination control, and especially some change in antibiotic prescribing policies should be emphasized.

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## Conflict of interest

None declared conflicts of interest.

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