

Bacterial Spread Pattern in Blood, Urine and Skin Wounds Isolated from Nosocomial Infections in Iran

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ABSTRACT

S. aureus is the most common gram positive bacterium causing nosocomial infection. *E. coli* and *K. pneumoniae* is the most common gram negative bacterium, causing mainly urinary tract infections. *Paeruginosa* is also very common, chiefly causing lower respiratory tract infections. The aim of this search is comparative bacterial spread pattern in blood, urine and skin wounds isolated from nosocomial infections in Iran. Materials and Methods The research was laboratory based and performed during 2007-2008 years in Azzahra hospital in Isfahan, According to statistical formula selected 100 blood, urine and skin wounds, in nosocomial infection. Bacterial identification was performed with microbiological methods. Results From 100 isolate pathogen Bacteria from nosocomial infection, frequency of *Staphylococcus* spp., *Enterobacteriaceae* and *Pseudomonas* sp. in blood infection respectively was 70%, 25% and 5%, in urine infection respectively was 45%, 50%, 5% and in skin wounds infection was 35%, 15% and 50% respectively. The result showed high frequency of gram positive coccus and gram negative bacilli in nosocomial infections. Common reasons of nosocomial infections include: hospitals house large numbers of people who are sick and whose immune systems are often in a weakened state; Increased use of outpatient treatment means that people who are in the hospital are sicker on average; Medical staff move from patient to patient, providing a way for pathogens to spread; Many medical procedures bypass the body's natural protective barriers.

Key words: *Staphylococcus*, *Enterobacteriaceae*, *Pseudomonas*, Nosocomial Infection.

INTRODUCTION

Nosocomial infection also called hospital acquired infection can be defined as: An infection acquired in hospital by a patient who was admitted for a reason other than that infection. An infection occurring in a patient in a hospital or other health care facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff of the facility (Benenson, 1995; Girard *et al.*, 2002, Jalalpoor *et al.* 2007). Patient care is provided in facilities which range from highly equipped clinics and technologically advanced university hospitals to front-line units with only basic facilities. Despite progress in public

health and hospital care, infections continue to develop in hospitalized patients, and may also affect hospital staff. Many factors promote infection among hospitalized patients: decreased immunity among patients; the increasing variety of medical procedures and invasive techniques creating potential routes of infection; and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control practices may facilitate transmission. Nosocomial infections occur worldwide and affect both developed and resource-poor countries. Infections acquired in health care settings are among the major causes of death and increased morbidity among hospitalized patients. They are a significant burden both for the patient and for public health. The most frequent nosocomial infections are infections of surgical

wounds, urinary tract infections and lower respiratory tract infections. Hospital-acquired infections add to functional disability and emotional stress of the patient and may, in some cases, lead to disabling conditions that reduce the quality of life. Nosocomial infections are also one of the leading causes of death (Ponce, 1991; Girard *et al.*, 2002). The economic costs are considerable (Plowman, 1999; Wenzel, 1995). The increased length of stay for infected patients is the greatest contributor to cost (Kirkland, 1999; Girard *et al.*, 2002). One study (Coella, 1993; Girard *et al.*, 2002) showed that the overall increase in the duration of hospitalization for patients with surgical wound infections was 8.2 days, ranging from 3 days for gynaecology to 9.9 for general surgery and 19.8 for orthopaedic surgery (Girard *et al.*, 2002). The most common NIs are urinary tract infections, lower respiratory tract infections, surgical-site infections, and primary septicemia (Astagneau *et al.*, 2001; Kampf and Kramer 2004). They lead to additional days of treatment (Foxman, 2002; Kampf and Kramer, 2004; Piednoir *et al.*, 2003). Increase the risk of death (Astagneau *et al.*, 2001; Garcia *et al.*, 2001; Kampf and Kramer 2004) and increase treatment (Jenney *et al.*, 200; Kampf and Kramer, A 2004; Reilly *et al.*, 2001). We have witnessed a cyclical parade of pathogens in hospitals. In Semmelweis's era, group A streptococci created most nosocomial problems. For the next 50 to 60 years, gram-positive cocci, particularly streptococci and *Staphylococcus aureus*, were the hospital pathogens of major concern (Weinstein 1998). These problems culminated in the pandemic of 1940 to 1950, when *S. aureus* phage type 94/96 caused major nosocomial problems. In the 1970s, gram-negative bacilli, particularly *Pseudomonas aeruginosa* and *Enterobacteriaceae*, became synonymous with nosocomial infection (Weinstein, 1998). By the late 1980s and early 1990s, several different classes of antimicrobial drugs effective against gram-negative bacilli provided a brief respite. During this time, methicillin-resistant *S. aureus* (MRSA) and vancomycin-resistant *enterococci* (VRE) emerged, signaling the return of the blue bugs. In 1990 to 1996, the three most common gram-positive pathogens - *S. aureus*, coagulase-negative staphylococci, and *enterococci* accounted for 34% of nosocomial

infections, and the four most common gram-negative pathogens - *Escherichia coli*, *P. aeruginosa*, *Enterobacter* spp., and *Klebsiella pneumoniae* - accounted for 32% (Weinstein, 1998). Urinary tract infection This is the most common nosocomial infection; 80% of infections are associated with the use of an indwelling bladder catheter (Girard *et al.*, 2002; Mayon, 1998). Surgical site infections are also frequent: the incidence varies from 0.5 to 15% depending on the type of operation and underlying patient status (Girard *et al.*, 2002; Reseau, 1996). Nosocomial bacteraemia infections represent a small proportion of nosocomial infections (approximately 5%) but case fatality rates are high more than 50% for some microorganisms (Girard *et al.*, 2002).

The aims of this search were study and comparative bacteria spread pattern in blood, urine and skin wounds isolated from nosocomial infections in Iran.

MATERIAL AND METHODS

Clinical Isolates

A total of 100 consecutive non-repeat culture isolates of *Staphylococcus aureus*, *S. epidermidis*, *S. saprophyticus*, *Pseudomonas*, *Escherichia coli* and *Klebsiella pneumoniae* were obtained from different clinical specimens such as urine, skin wounds and blood nosocomial infections, over a period of 24 months (2007-2008).

The isolates were identified on the basis of conventional microbiological procedures. (jalalpooretal 2007, Koneman *et al.*, 2006)

Bacterial strains

Identification bacteria was performed with microbiological methods e.g Gram stains and biochemical tests with the BioMerieux database system and use of differential culture medium. In first step specimen grows on sheep blood and EMB agars then incubated at 37°C under aerobic conditions (jalalpooretal 2007, 2009a-e, Washington *et al.*, 2006).

RESULTS

From 100 isolate pathogen Bacteria from nosocomial infection, frequency of *Staphylococcus* spp., *Enterobacteriaceae* and *Pseudomonas* sp. in blood infection was 70%, 25% and 5%, in urine infection was 45%, 50%, 5% and in skin wounds

infection was 35%, 15% and 50% respectively(Fig 1, 2).

According to result, *Staphylococcus* spp. and *Enterobacteriaceae* have highly frequency in urinary nosocomial infection and blood nosocomial infections. In urinary nosocomial infections, *E. coli*

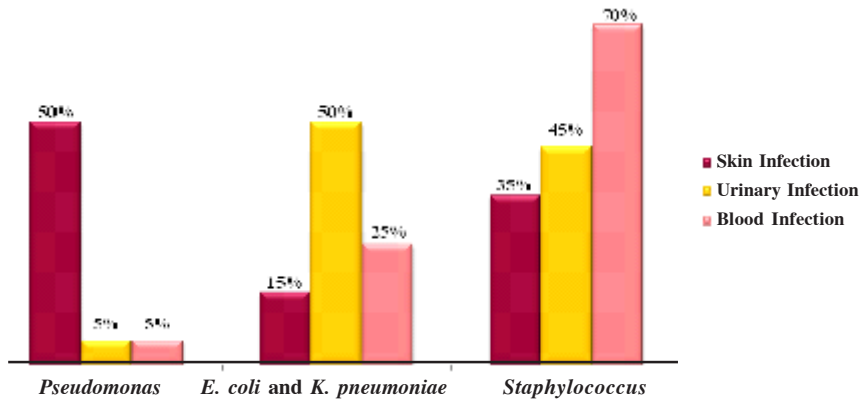


Fig. 1. Comparative Frequency of bacteria in skin wounds, urinary and blood nosocomial infections

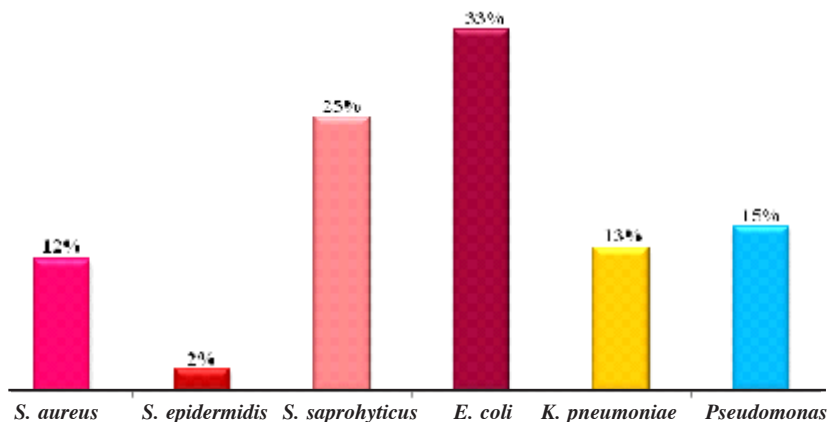


Fig. 2. Frequency of bacteria species in nosocomial infections

and *K. pneumonia* consist 50% all of isolated bacteria, in skin wounds nosocomial infections, *Pseudomonas* consist 50% all of isolated bacteria and in blood nosocomial infections *Staphylococcus* consist 70% all of isolated bacteria (Fig 1).

infections samples. According previous study in Iran, *Staphylococcus* sp. and *Enterobacteriaceae* have highly frequency in hospital biotic and abiotic condition.

CONCLUSION

According result of present paper, *Staphylococcus* sp. and *Enterobacteriaceae* consist of the more bacteria isolated of nosocomial

About importance staff hands and hospital surfaces in NIs, there is consensus that control bacterial population in these sources, lead to control these bacteria in hospital (Boyce *et al.*2002; Jalalpoor *et al.* 2007; Sehulster *et al.*, 2003). According result previous study in Iranian hospital,

Staphylococcus sp. 101 consist of isolated bacteria from hospital surfaces and 28 consist of isolated bacteria from hands of staff and according to Acidimetric test results respectively 73 species of *Staphylococcus* isolated from hospital surfaces and 19 species of *Staphylococcus* isolated from hands of staff was resistance to beta lactame antibiotics (Jalalpoor *et al.* 2010a-b, 2011a-d). According previous study 83.33% of *Staphylococcus* spp. isolated from nosocomial infection in Iran was resistance to beta lactame antibiotics, According result another study in Iran, 61.9% of bacteria isolated from biotic condition in hospital was resistance to beta lactame antibiotics, respectively was in *Staphylococcus* spp., *Bacillus* spp. and *Enterobacteriaceae* 71%, 64.72% and 50%, According another study in Iran 77.94% of bacteria isolated from abiotic condition in hospital was resistance to beta lactame antibiotics, respectively was in *Staphylococcus* spp., *Bacillus* spp. and *Enterobacteriaceae* 82.7%, 68.4% and 80.35% (Jalalpoor *et al.* 2010a-b, 2011a-e).

NIs remain a major global concern. Approximately 2 million NIs occur annually in the United States (Kampf and Kramer, 2004). Overall national prevalence rates have been described as ranging between 3.5 and 9.9% (Kampf and Kramer, 2004), but they vary significantly between departments, patient groups, types of surgical procedures, and the use of indwelling medical devices, etc (Anonymous 2002, Kampf and Kramer 2004). They lead to additional days of treatment, increase the risk of death and increase treatment costs. Staff hands and hospital surfaces have important role in NIs (Astagneau *et al.*, 2001; Garcia *et al.*, 2001; Hollenbeak *et al.*, 2002; Orsi *et al.*, 2002). Bacteria on hospital surfaces have low potential to spread. Staff hands are more sources to transmission bacteria in hospital. Increase staff hand and hospital surfaces hygiene has been considered the most important tool in control of NIs (Boyce *et al.*, 2002; Jalalpoor *et al.*, 2007; Schulster *et al.*, 2003).

The overall financial burden incurred by NIs has been estimated to be \$4.5 billion per year in the United States alone, approximately one-third of all NIs are regarded as preventable (Kampf and Kramer, 2004). Studies throughout the world

document that nosocomial infections are a major cause of morbidity and mortality (Girard *et al.*, 2002). A high frequency of nosocomial infections is evidence of a poor quality of health service delivery, and leads to avoidable costs. Many factors contribute to the frequency of nosocomial infections: hospitalized patients are often immune compromised, they undergo invasive examinations and treatments, and patient care practices and the hospital environment may facilitate the transmission of microorganisms among patients. Prevention of nosocomial infections is the responsibility of all individuals and services providing health care. Everyone must work cooperatively to reduce the risk of infection for patients and staff. This includes personnel providing direct patient care, management and physical plant, provision of materials and products, and training of health workers. Infection control programmes (Gaynes, 1998; Girard *et al.*, 2002) are effective provided they are comprehensive and include surveillance and prevention activities, as well as staff training. There must also be effective support at the national and regional levels. The nosocomial infection rate in patients in a facility is an indicator of quality and safety of care. The development of a surveillance process to monitor this rate is an essential first step to identify local problems and priorities, and evaluate the effectiveness of infection control activity. Surveillance, by itself, is an effective process to decrease the frequency of hospital-acquired infections (Girard *et al.*, 2002)

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