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Comparative Spread of Facultative Anaerobic Bacteria in Inanimate Hospital Environment in One Tertiary Care Hospital in Iran

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ABSTRACT

Inanimate hospital environment can serve as reservoirs of potential pathogen and is important in chain of infection. Health care-associated infections (HAI) remain a major cause of patient morbidity and mortality. In this study we comparative spread of bacteria in high and low contact surfaces in one tertiary care hospital in Iranian. Materials and Materials The present study was performed during a 30 month period a total study 194 environmental Bacteria. Environmental samples collected from low and high contact surface with swab in TSB. Identification of bacteria, were performed with microbiological methods. Results According to result, coagulase negative *Staphylococcus* species, consist the more bacteria isolated from high and low contact hospital surfaces. Conclusion Some microbes can survive on surfaces for long times. These environmental surfaces can be involved in the transfer of microorganisms to patients and subsequently in the development of hospital-associated infections.

Key words : Inanimate Environment, High Contact Surfaces, Low Contact Surfaces, Nosocomial infection

INTRODUCTION

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 (Boyce *et al*., 2002; Ducel *et al*., 2002; Johnson 2006; Kampf *et al*., 2004; Stone *et al*., 2002). A nosocomial 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. 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 (Benenson, 1995; Girard *et al*., 2002, Boyce *et al*.,2002; Ducel *et al*.,2002; Johnson 2006; Kampf *et al*.,2004; Sehulster and Raymond,2003, Stone *et al*.,2002).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.

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. 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 *Entero-bacteriaceae*, 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 *Klebsiellapneumonia*- accounted for 32% (Weinstein, 1998). The quality of the evidence that examines the contamination of the inanimate environment should be judged according to whether the following 4 factors have been measured: (1) the degree of contamination of the nosocomial environment by specific pathogens; (2) whether temporality is addressed (i.e., whether the environment is contaminated before or after patient colonization); (3) the assessment of confounders, such as hand hygiene and the quality of cleaning of fomites; and (4) whether improved cleaning, after controlling for other interventions, reduces the risk of patient infection (Weinstein.,2004). The primary role of the infection-control practitioner is to reduce the risk of both patients and healthcare workers (HCWs) acquiring infections. The importance of understanding the role of the inanimate environment derives from continued problems in compliance with infection control measures and hand hygiene. The advent of alcohol gels may lead to increased hand hygiene compliance and may diminish the effect of contact with colonized walls, bed rails, or medical equipment. However, it may be that an additional cost-effective infection-control measure in hospitals will be better, more thorough, and more frequent environmental cleaning that reduces the risk of cross-colonization (Weinstein.,2004). Two major categories for the intensity of cleaning exist: sterilization and disinfection. Sterilization destroys all microbial life on an object or surface and occurs through the use of heat, pressure, or chemical methods. Disinfection eliminates most microbes, excluding bacterial spores, and typically involves the use of chemical agents (Weinstein.,2004).

The health-care environment contains a diverse population of microorganisms, but only a few aresignificant pathogens for susceptible humans. Microorganisms are present in great numbers in moist,organic environments, but some also can persist under dry conditions. Although pathogenicmicroorganisms can be detected in air and water and on fomites, assessing their role in causing infectionand disease is difficult (Sehulster.,2003). Only a few reports clearly delineate a "cause and effect" with respect to theenvironment and in particular, housekeeping surfaces.Eight criteria are used to evaluate the strength of evidence for an environmental source or means oftransmission of infectious agents. Applying these criteria to disease investigations allowsscientists to assess the contribution of the environment to disease transmission. An example of thisapplication is the identification of a pathogen (e.g., vancomycin-resistant *enterococci*) on anenvironmental surface during an outbreak (Sehulster.,2003). The presence of the pathogen does not establish its causalrole; its transmission from source to host could be through indirect means (e.g., via hand transferal). The surface, therefore, would be considered one of a number of potential reservoirs for the pathogen,but not the de facto source of exposure. An understanding of how infection occurs after exposure,based on the principles of the "chain of infection," is also important in evaluating the contribution of theenvironment to health-care–associated disease. All of the components of the chain must beoperational for infection to occur (Sehulster.,2003).

Aims of present study was establish comparative spread facultative anaerobic bacteria in high and low contact surfaces in Iranian hospital.

Materials and Methods

Sampling

A total of 194 consecutive non-repeat

culture samples from inanimate hospital surfaces were isolated of Azzahra-hospital during of 2005-2007 years (Jalalpoor etal 2009a-e, Sehulster and Raymond, 2003, Washington *et al*., 2006).

Inanimate hospital surfaces samples were collected from high and low hospital contact surfaces with swab (Effective sampling of surfaces requires moistened swabs) in Tryptone Soya Agar (Merck).

Bacterial species

Identification bacteria were performed with microbiological methods e.g Gram stains, and biochemical tests with the BioMerieux database system and use of differential medium. Specimen grows on sheep blood and EMB agars incubated at 37°C under aerobic conditions (Jalalpoor etal 2010a,b, 2011a0c,Washington *et al*., 2006).

RESULTS

According to result of this study, *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Staphylococcus saprophytic*, *Bacillus* spp., *Bacillus cereus*, *E. coli*, *Klebsiella* spp., *Pseudomonas* and other gram negative *Bacilli*, consist 27.32%, 4.46%, 1.54%, 15.98%, 3.09%, 2.06%, 2.58%, 3.09% and 2.06% of isolated bacteria from high contact surfaces and 14.90%, 3.09%, 2.58%, 3.60%, 3.60%, 1.54%, 3.06%, 2.58% and 2.06% of isolated bacteria from low contact hospital surfaces, respectively (Diagram 1).

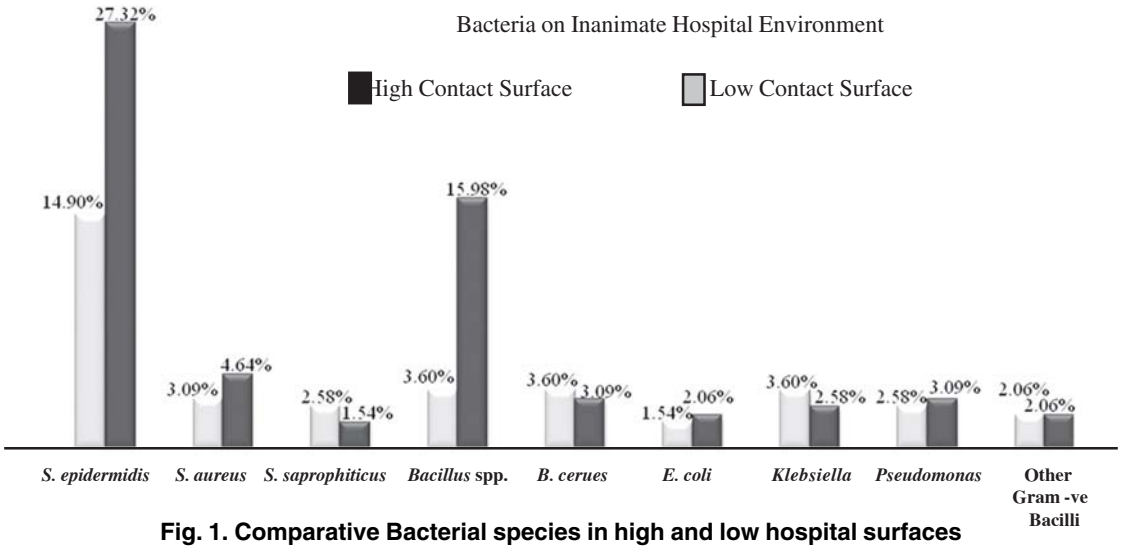

Fig. 1. Comparative Bacterial species in high and low hospital surfaces

Conclusion

The CDC/Hospital Infection Control Practices Advisory Committee guidelines for environmental infection control in health care facilities and sterilization and disinfection in health care facilities should form the basis for institutional policies regarding surface disinfection. The scientific evidence has strongly suggested that contamination of surfaces in hospital rooms plays an important role in the transmission of MRSA and VRE. According to another study, evidence also strongly suggests that contaminated surfaces are important in the spread of the emerging health care-associated pathogens noro virus, *C. difficile*, and MDR-*Acinetobacter* (Weber *et al*.,2010). According result previous study in Iranian hospital, *Staphylococcussp.* 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*.,2007). According previous study 83.33% of *Staphylococcus* spp. isolated from nosocomial infection in iran was resistance to beta

lactame antibiotics (Jalalpoor *et al*., 2007). 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 antibiotics, respectively was in *Staphylococcus* spp., *Bacillus* spp. and *Enterobacteriaceae* 82.7%, 68.4% and 80.35% (Jalalpoor *et al*., 2007).

The patient is exposed to a variety of microorganisms during hospitalization. Contact between the patient and a microorganism does not by itself necessarily result in the development of clinical disease - other factors influence the nature and frequency of nosocomial infections. The likelihood of exposure leading to infection depends partly on the characteristics of the microorganisms, including resistance to antimicrobial agents, intrinsic virulence, and amount (inoculum) of infective material. Many different bacteria, viruses, fungi and parasites may cause nosocomial infections. Infections may be caused by a microorganism acquired from another person in the hospital (cross-infection) or may be caused by the patient's own flora (endogenous infection). Some organisms may be acquired from an inanimate object or substances recently contaminated from another human source (environmental infection). 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. The economic costs are considerable.The increased length of stay for infected patients is the greatest contributor to cost.Health care settings are an environment where both infected persons and persons at increased risk of infection congregate. Patients with infections or carriers of pathogenic microorganisms admitted to hospital are potential sources of infection for patients and staff. Patients who become infected in the hospital are a further source of infection. Crowded conditions within the hospital, frequent transfers of patients from one unit to another, and concentration of patients highly susceptible to infection in one area (e.g. newborn infants, burn patients, intensive care) all contribute to the development of nosocomial infections.Prevention of nosocomial infections is the responsibility of all individuals and services providinghealth care. Everyone must work cooperatively to reduce the risk of infection for patients and staff. This includes personnel providing direct patient care, management, physical plant, provision of materials and products, and training of health workers. Infection control programmes 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. Approximately one third of nosocomial infections are preventable. Cleaning is the necessary first step of any sterilization or disinfection process. Cleaning is removing organic matter, salts, and visible soils, all of which interfere with microbial inactivation (Boyce *et al*.,2002; Jalalpoor *et al*.,2007; 2011e, Sehulster *et al*.,2003). Hand washing frequently is called the single most important measure to reduce the risks of transmitting microorganisms from one person to another or from one site to another on the same patient.Although hand hygiene is important to minimize the impact of this transfer, cleaning and disinfecting environmental surfaces as appropriate is fundamental in reducing their potential contribution to the incidence of healthcare-associated infections (Madani etal.,2009, Mielke, 2010, Rosenthaletal.,2010a ,b, Victor etal.,2010).

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