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Special Issue: Nursing and Healthcare: Current Scenario and Future Development

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2016, 5, 7S:507-511

Evaluation of Microbial Contamination in two of Hospitals in Kermanshah Province, Western Iran

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ABSTRACT

Nosocomial infections are infections that are not present in the patient at the time of admission to hospital but develop during the course of the stay in the hospital. Nosocomial infection, is a serious health center problem that cause to increase medical costs and mortality all over the world. Environment and Personals of hospitals are the most reservoir and vehicles for the transmission of microorganisms. This study had been conducted to identify the types and sensitivity of bacterial isolates to commonly used antibiotics. For the period from the April 2012 to April 2015 collected 2208 samples of personals and all wards of two hospitals in two of hospitals in Kermanshah province ,western Iran.

Keywords: Nosocomial infection; Microbial contamination, Hospital, Iran

INTRODUCTION

Nosocomial infection is a serious problem in health-care centers, occurring in approximately 10% of admissions in developed countries and 25% in developing countries. Nosocomial infections occur most frequently in the intensive care unit [ICU]. From 5% to 10% of patients admitted to the hospitals acquire one or more infections, and the risks have increased during recent decades. Nosocomial infections among ICU patients are usually related to the use of immunosuppressant drugs or invasive devices [e.g., mechanical ventilators, urinary catheters, or central venous catheters][1, 2].

The rate of death as a Nosocomial infection in Iran 2003 among hospitalized infants in neonatal Intensive Care Unit of Imam Reza hospital in Mashhad was 17.3% [3].

Hospitals personnel's hands are the most common vehicle for the transmission of healthcare-associated pathogens, both from patient to patient, and within the healthcare environment. Hand hygiene is the leading measure for preventing the spread of antimicrobial resistance and reducing healthcare-associated infections; however, healthcare personels compliance with optimal practices remains low in most settings[3].

Normal human skin harbors bacteria, usually between 102 and 106cfu/cm2[4]. During daily activities, Hospital s personels progressively accumulate microorganisms on their hands from direct patient contact, respiratory tract care, contact with body fluids, and after being interrupted while caring for a patient[5, 6].Skin flora, for example Staphylococci and also gram-negative bacilli, can be transmitted in this way. Therefore, hand hygiene often prevents the transmission of microorganisms [2]. Studies have shown that one out of five hospital staff members has

antibiotic resistant pathogens on his/her hands [7, 8]. Despite the importance of proper hand washing in reducing the transmission of pathogens to patients and the spread of antimicrobial resistance, the inclination of HCWs to comply with recommended hand-hygiene practices has remained unacceptably low [9,10]. Hand microorganisms have been divided into three groups; resident, transient and infectious organisms[11,12]. Resident flora includes organisms with low pathogenicity such as; Coagulase Negative Staphylococci , Micrococcus and lipophilic Coryneabacterium. Hand washing does not change their number to any considerable extent, but they are seldom transmitted to patients unless via invasive procedures. Transient flora is the most important cause of nosocomial infections which is acquired primarily via contact of patients with peripheral surfaces, although it does not proliferate on the skin and can easily be washed. Pseudomonas and Escherichia coli are examples of transient microorganisms.

Hand washing with soap and water for 8-20 seconds reduces 90% of transient microorganisms. Infectious floras can be found in skin lesions until improvement of the condition. Staphylococcus aureus and β-hemolytic Streptococci are infectious organisms [11, 12]. Hand washing is the most cost effective, comfortable and easy way to prevent hospital infections, but HCWs consistently fail to perform this simple and inexpensive procedure, thereby compromising patient safety and the quality of medical care [10].

Education is the most effective policy in preventing nosocomial infection and only continuous education can reduce infectious cases. Hand washing effective in the control of up to 50% of nosocomial infections. Although hand washing is the most important, cost effective and easiest way to prevent nosocomial infection, inadequate attention has been paid to remedial hospital personnel, and unfortunately, the quality of hand washing remains low [19].

Gloving is recommended as a barrier in protecting HCWs as it reduces the risk of contamination during contact with body fluids, mucous membranes or patients' skin injuries[20, 21].

Because of the importance of nosocomial infection , this study was performed to identify the types and the source of bacterial contamination and the sensitivity of bacterial isolates to commonly used antibiotics in hospitals in the wards of one of hospitals in Kermanshah province, western Iran.

The environment significantly influences multiple factors in the chain of infection. Although microbiologically contaminated surfaces can serve as reservoirs for pathogens, these surfaces generally are not directly associated with transmission of infections to either staff or patients[12].The transmission of microorganisms from environmental surfaces to patients is largely via hand contact with the surface. Although hand hygiene is important to minimize the impact of this transfer, cleaning and disinfecting environmental surfaces appropriately is fundamental in reducing their potential contribution to the incidence of healthcare-associated infections[3].

MATERIALS AND METHODS

A cross sectional study had been conducted in all 15 units in one of hospitals at Kermanshah province, western of Iran; including almost 255 beds (15 units).for the period from April 2014 to April 2015. A total of 2208 samples were collected from hands of medical staffs , and from different sites related to the devices and utensils used in the units including; medical instruments, surgical instruments, sphygmomanometer, sets of intravenous (IV) fluid, masks of O2 supplying apparatus, drums, and from the gowns of medical staffs, bed clothes, beside swabs were also taken from the surroundings; floor, sink ,walls, windows and door handles, cabinets, slots of cooling and heating devices.

To assess the quality of sterilizing equipment (autoclave and oven) we randomly evaluated some sterile packages from each ward. To asses the presence of bacteria, particularly methicillin resistant Staphylococcus aureus (MRSA) that might be transmitted by personnel's hands. Totally 80 people, including doctors, nurses, health care workers and food service personnel were included in this part of study. All samples were obtained from personnel during working hands. Samples of food staff were taken of their bare hands during food preparation. Water samples were taken from each water supply and then cultured on Tripticase soy agar (Merck, Germany) using pour plate method in the laboratory within 30 minutes after sampling. Personal data such as; gender, age, job position, work experience and type of ICU, were collected.

After obtaining informed consent, samples of staffs' hands and hair in different work shifts were cultured by sterile swabs once per day. The samples were transported to the laboratory in a cool-box and culture was carried out on the

same day. Cotton tipped sterile swabs that were moistened in sterile thioglyculate broth (Merk, Germany) were used to take sampling.

Swabs were incubated for 24 hrs and then in Blood agar(5.0% sheep blood) EMB agar , and incubated(Merck, Germany), at 37°C for (24-48) hours. Isolation and identification of microorganisms were done according to the standard procedure(13). Purification of bacterial growth colonies yield pure isolates of bacteria and subsequently their cultural, morphological, microscopical and biochemical characteristics had been studied according to the correlated references (14). 91% of isolates were obtained including Gram positive bacterial isolates, and 9% of Gram negative. Susceptibility test for all isolates were investigated according to standard method by using Mueller -Hinton agar(15). 20 types of commonly used antibiotics in Iran as follow:

Amikacin, Ampicillin, Amoxicillin ,Cefepime, Clindamycin, Cefotaxime, Cephalothin, Chloramphenicol, Ceftazidime, Ciprofloxacine, Ceftriaxon, Erythromycin, Imipenem, Levofloxacin, Meropenem ,Nalidixic acid, Piperacillin, Tetracycline, Ticarcillin, Vancomycin. All discs were purchased from Padtanteb, Iran. All methodological variants were assessed using the same inoculums which were standardized to 0.5 McFarland turbidity. Two standard strains were processed in parallel as controls for the disk diffusion test: Enterococcus faecalis ATCC 29212 and S. aureus ATCC 25923 [14,15].Finally, the data were analyzed using SPSS software (version19), Pearson's chi-square and Fisher's exact test.

RESULTS

Of the 2208 cultures, 10 different microbes were isolated, including 2009 samples(91%) were positive and 199 samples(9%)were negative. Of the samples that were found to contain microorganisms, 1356 samples (67.4%) had only 1 microorganism, 23.4% had 2 microorganisms, 5.4% had 3 microorganisms, 2.1% had 4 microorganisms and 1.7% had multiple organisms.

Staphylococcus saprophyticus among Gram positive bacteria and Ecoli among gram negative bacteria the genus, showed the highest resistance to most of the tested antibiotics.

The microorganisms identified included Staphylococcus saprophyticus isolates 71.3%, bacillus isolates 12.4%, Coryneabacterium, isolates 5.1%, fungal species, isolates 4.5%, Streptococcus spp isolates 2.4%, Gram negative bacillus,3.2% and Staphylococcus aureus isolates 1.1%.

Staphylococcus saprophyticus (74.5%) ,Bacillus, Coryneabacterium, were the predominant isolates among Gram-positive and Enterobacter spp, E Coli and Klebsiella were the predominant isolates among negative bacteria, respectively.

Doors(85.6%), Windows(80.1%), Personnel's hands(79.5%), kitchen (71.4%) and Nursing station(65.8%) were the most contaminated sites in our study, respectively.

MRSA isolates were isolated from Doors and Personnel's hands. Five MRSA isolates were obtained of hand samples.

Among 80 personnels that included in this study ,54cases(67%) were female and 26 cases were (32%) were male. Of 80 samples, 71 (88%) had positive and 9(11%) were negative growth. There was no significant relationship between microbial contamination and gender, job position, work experience or type of personnels.

All of gram negative isolates were 3.2%. Enterococcus(1.2%), Klebsiella(0.9%), E Coli(0.8%) and Pseudomonas aeruginosa (0.3)were respectively.

Susceptibility tests for some antibiotics showed different results depending on the genus of bacteria and type of antibiotic. For Enterobacter spp. the resistance was highly significant against 8 antibiotics (Ampicillin, Amoxicillin ,Cefepime, Clindamycin, Levofloxacin, Erythromycin, Piperacillin, Chloramphenicol) while it was sensitive 12 antibiotics(Amikacin, Cefotaxime, Cephalothin, Ceftazidime, Ciprofloxacine, Ceftriaxon, Imipenem, Meropenem ,Nalidixic acid, Tetracycline, Ticarcillin, Vancomycin).

Among Gram positive bacteria , susceptibility tests conducted for Staphylococcus saprophyticus, showed resistance which was highly significant against 15 antibiotics (Ampicillin, Amoxicillin , Clindamycin, , Chloramphenicol, Erythromycin, Levofloxacin, Ceftazidime, Cephalothin, Cefepime, Cefotaxime, Nalidixic acid, Piperacillin, Tetracycline, Ticarcillin, Vancomycin), while it was sensitive to 5 antibiotics(Amikacin, Ciprofloxacine, Ceftriaxon, Imipenem, Meropenem,).

Contamination in males was 67.7% and in females was 63.69%. Fishers' exact test revealed no significant relationship between transient flora and gender ($P< 0.5$).

In this study staphylococcus saprophyticus was more resistant than other bacteria. staphylococcus saprophyticus was resistant to 15 cases of antibiotics (75%).

Culture technique was according to the Association for the Advancement of Medical Instrumentation (AAMI) standard procedure. The AAMI recommendations for microbial contamination are based on techniques using Tryptic soy agar as the medium and incubations at 37°C for 48h(16).

DISCUSSION

This study of the microbial contamination of hospital wards found a high degree of contamination(87.8%) of all units, including significant numbers of bacteria that are known to be the etiologic agent of nosocomial infections and antibiotic resistance of isolates, exhibit the potential of the units for serving as a reservoir of microbes for nosocomial infections.

We examined microbial contamination of two hospitals in kermanshah, western Iran. All Hospitals personnels in the different wards such as; ICU, CCU, Operation Rooms, surgery, internal, cardiology, neonatal and pediatrics were included. Our results showed that there was a high rate of microbial contamination on the personnels' hands (85.9%). Our results revealed the most common isolated organisms were Staphylococcus saprophyticus (71.3%), bacillus(12.4%), Coryneabacterium(5.1%), fungi(4.5%),Streptococcus spp(2.4%),Gram negative bacilli(3.2%) and Staphylococcus aureus(1.1%)respectively.

Gradual increase in the resistant of microbes to previously and recently produced antibiotics may interfere with the tremendous effort provided by health facilities to control the spread of microbial disease. This problem could be controlled to some extent by restriction of purposeless uses of antibiotics and by eliminating contamination in the environment of hospitals by applying strict quality standards concerned with the hygienic manners both of patients and health staff, and the performance of invasive procedures using aseptic technique.

Fungal species were identified in 4.5% of the samples. Thus, fungal colonies within the hospital wards could infect patients through either direct contact with the unit or inhalation of spores released from the reservoir. Staphylococcus aureus species were identified in 1.1% of samples, and 4 isolates was identified as methicillin-resistant (MRSA). Our study results suggest that personals hands can function as a reservoir for MRSA.

The study of Khodadad A., et al. in 2004 in Tehran, Iran, showed that the most common isolated organisms from staff's hands was Coagulase negative Staphylococci (79.4%) (17).

In another study in 2004, Zobeiri et al. showed that 88.03% of samples had contamination with transient flora (18).

Khodavaisy et al. in 2011 studied on 40 HCWs in one hospital. Their results showed that the rate of contamination of hands and rings was 73.1%. Most of the isolates known to cause nosocomial infections were: Staphylococci (23%), Klebsiella spp. (7.9%), Enterobacter spp. (4.7%), Escherichia coli (3.9%), Acinetobacter spp. (3.1%), and Pseudomonas spp. (2.3%)(19).

In conclusion, Hospitals personnels must follow careful hand washing techniques to minimize the transmission of disease and they should remove rings, watches, and bracelets before washing their hands. No live flowers, plants or standing water are allowed in patient rooms because of the bacteria and fungus that grow in them. Any personal items that fall on the floor need to be cleaned before using them again. Separate bins are provided for dirty linen and trash. Bathrooms and bedside commodes are for patient use only.

Food stored in the refrigerator and cannot be stored in patient's room. Food attracts insects that can transmit diseases. Personels and all visitors should Clean their hands well, before entering and after leaving patient's room.

The air in the hospital is filtered to keep it as clean as possible. Each patient room is cleaned daily. Shoes should be worn , inside and outside the patient room(22).

Acknowledgement
Kermanshah University of Medical Sciences provided the funding for this project.

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