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ASSESSMENT OF RISK OF INFECTION RELATED TO SURFACE CONTAMINATION AND EQUIPMENT IN A HOSPITAL IN THE CITY OF FEZ (CENTER OF MOROCCO)

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ABSTRACT

Nosocomial infections are a major cause of complications and health care are now, a major concern in hospitals. The objective of this work, realized for the first time, is to evaluate the microbiological quality of surfaces and equipment used in three services to potential infectious risks (intensive care, pediatric and hemodialysis). This study was conducted over a period of two months (February-March) of 2009. Thus, a total of twenty-eight samples (28) were recovered from various points in the three services studied. Species identification was based on microbiological and biochemical tests. We have identified bacteria of human and environmental origin have a major nosocomial risk such as: *Acinetobacter baumannii, Pseudomonas aeruginosa*, coagulase negative *Staphylococci* and *Klebsiella sp.* respectively with a percentage of about 33%, 26%, 17% and 8%. The isolation of these microorganisms varies from one service to another. These results require corrective action represented mainly by rigorous cleaning procedures. These must be included in a comprehensive policy management and prevention of nosocomial infections.

KEYWORDS: hospital environment, microbiological surveillance, surface, nosocomial infection, Fez - Morocco

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INTRODUCTION

Nosocomial infections represent real public health problem globally, with considerable impact on individuals and on the economy[1-2]. Microbiological environmental monitoring of health facilities is an essential component of prevention programs of these infections related to care. The environment represents the external source of nosocomial infection and it includes the air, surfaces, water in its uses at large and medicals equipment. The role of the hospital environment contaminated in the indirect transmission of nosocomial pathogens has been well confirmed by several authors[3-6]. Of microorganisms responsible for nosocomial infections have been found in the environment of patients colonized by bacteria: *Staphylococcus aureus*, *vancomycin resistant enterococcus* (VRE), *Acinetobacter baumanii*, *Clostridium difficile* and *Norovirus*[4]. We found these microorganisms primarily on surfaces and objects that patients and health personnel frequent touch with the hands (= high-touch surfaces)[7]. These surfaces have been defined as: the rails of bed, the bed surface, and the trolley[8]. Therefore, it is very important of focusing about cleaning and sanitizing of hospital surfaces and medical equipments as being an essential measure in the control of nosocomial infections[4]. The aim of this work, conducted for the first time in the hospital setting in Fez, was to assess the microbiological quality of the hospital environment especially neighboring surfaces in some inpatient services. The results of this study will help to sensitize and directing decision makers, including the Infection control Committee and operational hospital hygiene team to set up a strategy for risk analysis and a sampling plan tailored to master the hospital environment.

MATERIALS AND METHODS

We carried over a period of two months (February-March 2009) the levies from surfaces and equipment used in three services in hospital: intensive care, pediatric and hemodialysis. The choice of these three services is based on the fact that patients hospitalized are generally fragile and immunocompromised.

Sampling techniques

The samples were collected by swab technique as recommended by the standard ISO / DIS 14698-1 (1999)[9]. They were sampled under aseptic conditions and were channeled in a cool box kept at 2 to 8 °C at the Regional Diagnostic Laboratory Epidemiological and Environmental Hygiene (RDLEEH) under the Regional Health Directorate of Fez.

Analysis Methods

The seeding of the suspension was made over the entire surface of the Petri dish (quadrant) containing a nonselective culture medium adapted Type PCA (Plate Count Agar) and incubated at 37 °C under aerobic conditions. The incubation was carried out for 72 hours. Using swabs, we have seeded the suspension on a petri dish containing the PCA agar for the enumeration of Heterotrophic Bacteria (HB) and on various selective media Tergitol Agar with TTC®, Slantez and Bartely®, Cetrimide Agar®, Baird Parker Agar®. The bacteria searched are: *Total coliform* (TC), *Intestinal Enterococci* (EI), *Pseudomonas sp.*, *Staphylococcus sp., Escherichia coli*. The incubation conditions were performed according to the techniques of microbiology and serology[10]. The purification of the isolated strains was performed on nutrient agar[11]. All the strains isolated have been Gram stained. Full identification of the bacteria was made by traditional biochemical techniques or API gallery (Biomerieux, France)[12].Regular quality control of culture media, equipment and ambient environmental conditions in the laboratory analysis was performed according to the requirements of ISO 17025 adopted by the RDLEEH since 2008.

RESULTS

Counting of total aerobic mesophilic flora

After seeding and incubation of Petri dish, enumeration was conducted to determine the level of contamination of the levies and for defining the most sensitive towards of infectious risk surfaces. The table 1 presents the results obtained for different surfaces of three services.

Table 1
Enumeration of HB of the different surfaces

Services	Nature of the surface	HB Counting in cfu/25 cm2
Intensive care	Surface of romper	10^3
	Lid of the romper	996
	Laryngoscope	4
	Manifold	990
	Lunette	0
	Oxygen mask	0
	Soap	28
	Ground	35
Hemodialysis	Dialysis tube outlet	34
	Table	176
	Bed	31
	Manifold	1
	Dialysis tube inlet	0
Pediatrics (biberoneria unit)	Wall	240
	Bench	1013
	Siphon	1020
	Tap	0
	Baby bottle	993

In the services studied, the most contaminated area by HB in order of 10^2 to 10^3 cfu / 25cm^2 are surface of romper, lid of the romper and Manifold in intensive care, table in hemodialysis and siphon, baby bottle and wall in pediatric service. Note that some points, lunette, oxygen mask in intensive care service, dialysis tube inlet in hemodialysis service and Tap in pediatrics service showed no contamination.

Contamination rate into BH at the service level analyzed

From Figure 1, the Pediatric department presents the higher contamination rate (50%) followed by Intensive care service with 46% and the Hemodialysis service at 4%.

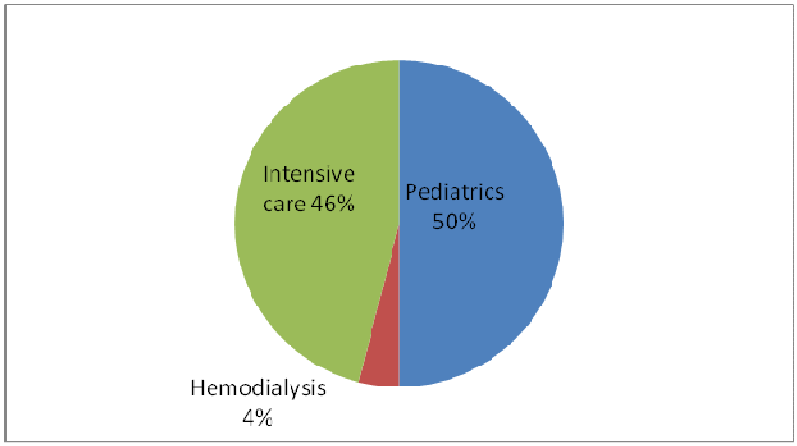

Figure 1
Percentage of HB in the three services Identification, distribution and frequency for isolated in the services studied

We were able to isolate, purify and identify 24 bacteria. Microbiological analysis showed that the analyzed surfaces are contaminated by the bacteria to major nosocomial risk. *Acinetobacter baumannii* was the microorganism most often encountered (33%), followed by *Pseudomonas aeruginosa* (26%) and *coagulase-negative Staphylococci* with a percentage of around 17%. *Micrococcus sp* and *Klebsiella* sp have been present with the same percentage 8%. Similarly for *E.coli* and *Citrobacter freundi* with 4% each one. The allocation of bacteria in the various services

depends on the nature of the surfaces and materiel present in these services as well as arrangements for cleaning, drying and storage material (Table 2).

Table 2
Distribution of bacteria isolated in the three services studied

Services	Bacteria isolated	Number
Intensive care	*Staphylococcus sp*	2
	Acinetobacter baumannii	4
	Micrococcus	2
	E. coli	1
	Klebsiella sp	1
	Pseudomonas aeruginosa	1
Hemodialysis	*Staphylococcus sp*	1
	Acinetobacter baumannii	3
	Klebseilla sp	1
	Pseudomonas aeruginosa	1
Pediatrics (biberoneria unit)	*Staphylococcus sp*	1
	Acinetobacter baumannii	1
	Pseudomonas aeruginosa	4
	Ctrobacter freundii	1

DISCUSSION

The role of the hospital environment contaminated in the indirect transmission of nosocomial pathogens constitutes, for many years a subject of scientific studies. In our work, we have studied several surfaces of the hospital environment. Different opportunists pathogenic bacteria were identified which the majority are of *nonfermenting gram-negative bacteria*, widely widespread in the environment. These bacteria can be responsible for nosocomial infections. According to Barbut F. et *al*.,[13] the surfaces are generally contaminated by microorganisms derived from the patient himself (infected or colonized simply) or sedimentation of particles in the air (*Aspergillus*). Surface contamination depends, besides the quality of organic cleaning, many factors related to microorganism: its lifetime on an inert support (which varies depending on the material, the temperature of desiccation) of its adhesion to the surface, of its capacity to produce a biofilm and his ability to withstand the unfavorable conditions (sporulation). The germs isolated from three services are mainly *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and *Staphylococcus sp.*. The isolation rate of these germs varies from one service to another. In a study involving 1417 of intensive care services and 10038 patients in 17 countries in Western Europe, isolated bacteria were most Gram-negative bacilli (58.8%) than Gram-positive cocci (41.2%). Those Gram-negative bacilli were represented by 24.4% of *Pseudomonas aeruginosa*, 14.1% of *Enterobacteriaceae* and 7.9% of *Acinetobacter*[14]. According to Elatrous S. et *al*.,[15] the prevalence of *Pseudomonas aeruginosa* and *Acinetobacter baumannii* is only 20% and 18% respectively. By against in our study, *Acinetobacter baumannii* is the dominating (33%) followed by *Pseudomonas aeruginosa* with 26%. This constitutes a potential risk to patients. The literature[16], reports that *Acinetobacter* is one of the important opportunistic pathogens involved in hospital acquired infection. They cause various types of human infections leading to morbidity and mortality. Of these *Acinetobacter* species, *Acinetobacter baumannii* is the most prevalent in clinical specimens causing pneumonia[16]. Another typical example of opportunistic pathogenic bacteria, *Pseudomonas aeruginosa* is the third leading cause of nosocomial infections after *Escherichia coli* and *Staphylococcus aureus*[17]. Recently, Walker et *al*.,[18] reported that *P. aeruginosa* was predominantly found in biofilms in taps in neonatal units and was a possible source of the infections observed. *P. aeruginosa* was also been found in the water used in a hemodialysis center in a hospital in Fez[19], this can explain the contamination of

surface and materials by this type of bacteria. Currently, this is very disturbing into well as the presence of this type of bacteria is their resistance to most antibiotics[20]. Indeed, according Minchella A. et *al*.[21], increasing the resistance of nosocomial strains widely prescribed against antibiotics in a hospital setting is alarming. In this study we have not encountered *Staphylococcus aureus*, but a special intent must be observed for this Staphylococcal species. Indeed, some authors report that *Staphylococcus aureus* is one of the important causal agents of nosocomial infections worldwide[22-24]. In addition, these bacteria have been found not only resistant to antibiotics but also antiseptic[25-27]. Concerning pediatrics service, our results do not corroborate with those of the study conducted by E. Tudela et *al*.,[28] who have tested 11 series surface samples with samples at the level of 45 points. The results have highlighted the presence of *coagulase-negative Staphylococci*, *Bacillus sp*., *E. cloacae*, *Micrococcus species*, *Pseudomonas fluorescens*, *Bulkhorderia cepacia*, and polymicrobial flora environmental unspecified. Of environmental origin microorganisms such as *Pseudomonas aeruginosa* and *Acinetobacter baumannii* are responsible for the transmission and infection from an environmental reservoir[29]. For the micro-organisms from the digestive tract (*Klebsiella pneumonia*; *Escherichia coli*), and the skin (*Staphylococcus aureus*), interhuman transmission is certainly predominant in relation to the transmission from the environment that requires high survivability of microorganisms. Other pathogenic germs also found in this study *Klebsiella* sp. with 8%. This species are found everywhere in nature. They can be found in water, soil, plants, animals and humans. *Klebsiella* organisms can lead to a wide range of disease states, notably pneumonia, urinary tract infections, septicemia, meningitis and diarrhea[30]. To avoid a health risk due to bacterial contamination, a microbiological monitoring of the hospital environment is necessary.

CONCLUSION

The hospital environment is certainly playing a role in the transmission of microorganisms responsible for nosocomial infections. This environment usually includes water, air, equipment and surfaces. In this work, realized for the first time in the center of Morocco, we are interested in surfaces and materials present in three services to potential infectious risks (intensive care, pediatrics and hemodialysis) and we isolated bacteria from human and environmentally origin namely: *Acinetobacter Baumannii (*33%*), Pseudomonas aeruginosa* (26%), *coagulase-negative Staphylococci* (17%) and *Klebsiella sp.* (8%). The results observed in this work, even if for a very short period of study on the assessment of infection risks related to the contamination of surfaces and materiel in a hospital setting should lead to sensitization of the staff concerned. It is appropriate therefore be emphasized rigorous cleaning procedures for the effective prevention of nosocomial infections or associated with hospital infections environment.

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