

Full Length Research Paper

Study of the antibiotic resistance pattern among the bacterial isolated from the hospital environment of Azzahra Hospital, Isfahan, Iran

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Hospital surfaces play an important role in nosocomial infection (NI), in that the health-care environment contains a diverse population of microorganisms. Antibiotic resistance is the ability of a micro-organism to withstand the effects of an antibiotic, which is a specific type of drug resistance. Antibiotic resistance evolves naturally from a natural selection through random mutation, but could also be engineered by other selections. The research was performed with laboratory method in Esfahan City and the study as a whole comprised 194 strains obtained from hospital surfaces' samples. These strains were randomly selected from different wards of the hospital with sterile swab and NB medium. According to the results, *Staphylococcus* spp. (54.7%), *Bacillus* spp. (25%) and Enterobacteriaceae (10.7%) consist of isolated bacteria. The results of this study show high frequency of antibiotic resistant strain on hospital surfaces. Establishing systems for monitoring antimicrobial resistance in hospitals and the community, and linking these findings to resistance and disease surveillance data is fundamental to developing treatment guidelines accurately and to assessing the effectiveness of interventions appropriately.

Key words: Antibiotic resistance, nosocomial infection, hospital surfaces.

INTRODUCTION

Environmental surfaces carry the least risk of disease transmission and can be safely decontaminated using less rigorous methods than those used on medical instruments and devices. Microbiologically contaminated surfaces can serve as reservoirs of potential pathogens. The surface would be considered as one of the many potential reservoirs for the pathogen, but not the de facto source of exposure (Ducel et al., 2002; Jalalpoor et al., 2007; Raymond and Aujard (2000); Sehulster and Raymond (2003). Hospital environment play an important role in NI, in that the health-care environment contains a diverse population of microorganisms. Microorganisms are present in great numbers in moist, organic environments, but some can also persist under dry conditions. Environmental source or means of transmission of infectious agents and the presence of the pathogens does not establish its causal role; though, its transmission from source to host could be through indirect means, for example, via hand transfer (Ducel et al., 2002; Jalalpoor et al., 2007; Sehulster and Raymond, 2003). The surface

would be considered as one the many potential reservoirs for the pathogen, but not the de facto source of exposure. An understanding of how infection occurs after exposure is based on the principles of the chain of infection, which is also important in evaluating the contribution of the environment to health-care-associated diseases. All of the components of the chain must be operational for infection to occur and they are as follows:

1. Adequate number of pathogenic organisms (dose).
2. Pathogenic organisms of sufficient virulence.
3. A susceptible host.
4. An appropriate mode of transmission or transferral of the organism in sufficient number from source to host.
5. The correct portal of entry into the host.

Although microbiologically contaminated surfaces can serve as reservoirs of potential pathogens, these surfaces generally are not directly associated with transmission of infections to either staff or patients (Ducel

et al., 2002; Jalalpoor et al., 2007; Sehulster and Raymond 2003). The transferral of microorganisms from environmental surfaces to patients is largely via hand contact with the surface (Ducel et al., 2002; Jalalpoor et al., 2007; Sehulster and Raymond 2003).

Antibiotic resistance is the ability of a micro-organism to withstand the effects of an antibiotic, which is a specific type of drug resistance. Antibiotic resistance evolves naturally from a natural selection through random mutation, but could also be engineered by other selections. Once such a gene is generated, the bacteria can then transfer the genetic information in a horizontal fashion, between individuals, by plasmid exchange. If a bacterium carries several resistance genes, it is called multiresistant or, informally, a superbug. However, resistance costs money, livelihoods and lives, and threatens to undermine the effectiveness of health delivery programmes (Kim 2000; Jalalpoor et al., 2007; Jalalpoor et al., 2009b).

Antibiotic resistance is a consequence of evolution via a natural selection or programmed evolution. The antibiotic action has an environmental pressure on those bacteria which have a mutation; as such, if they are allowed to survive, they will continue to reproduce, and will then pass this trait to their offspring, thereby making them a fully resistant generation (Ki, 2000; Jalalpoor et al., 2007, 2009b).

This study was primarily carried out to survey and compare the frequency of the antibiotic resistant bacterial isolated from Azzahra hospital surfaces in Iran.

METHODOLOGY

Sampling

A total of 194 bacteria were isolated from the hospital surfaces of Azzahra-hospital during years 2005 to 2007. The samples were randomly collected from high and low hospital contact surfaces with swab (Effective sampling of surfaces requires moistened swabs) in a Nutrient Broth Medium (Merck) (Jalalpoor et al., 2009b; Sehulster and Raymond 2003).

Bacterial strains

The identification test of bacteria was performed with microbiological methods, for example, gram stains and biochemical tests were done with the BioMerieux database system and the differential culture medium. In the first step, the specimen was nurtured on sheep blood and EMB agars, after which it was then incubated at 37°C under aerobic conditions (Jalalpoor et al., 2009a; Washington et al., 2006).

Antibiotic susceptibility

Antibiotic susceptibility was performed according to the antibiotic susceptibility standard disc diffusion agar (Jalalpoor et al., 2010; Wikler et al., 2006).

The susceptibility of the isolates was determined against 8

antibacterial agents by disc diffusion method, and they include: penicillin, cephalexin, clindamycin, co-trimoxazole, ampicillin, erythromycin, tetracycline and gentamicin (Merck).

Statistical analyses

All the statistical analyses were carried out using SPSS version 14. Chi-square and Fisher test were used for the determination of the significance of association; as such, $p < 0.05$ was considered to be significant.

RESULTS

According to the result, *Staphylococcus* spp. (54.7%), *Bacillus* spp. (25%) and Enterobacteriaceae (10.7%) consist of isolated bacteria (Figure 1).

According to the antibiogram pattern, 20.5, 71, 72, 39.5, 85, 56.5, 60.5 and 77.5% of *Staphylococcus* sp., 32, 61.5, 58, 50.5, 71, 82, 87 and 93% of *Bacillus* sp. and 16.5, 74.5, 6.25, 77.75, 65, 57.5, 64.25 and 94% of Enterobacteriaceae were sensitive to penicillin, cephalexin, clindamycin, co-trimoxazole, ampicillin, erythromycin, tetracycline and gentamicin (Table 1).

Conclusion

In this study, when the results obtained were compared with those of previously published articles that are similar to this research, it was observed that the results showed high frequency of antibiotic resistant strains on hospital surfaces. Also, the result demonstrated that the frequency of *Staphylococcus* spp. and *Bacillus* spp. was 38.85%.

According to the results of the previous study about bacterial epidemiology in hospitals, *Bacillus* sp. and *Staphylococcus* sp. were the major bacteria that were isolated from the hospital environment (Jalalpoor et al., 2009a; Mansuri et al., 2007; Nasiry, 2000).

Several studies have demonstrated that the patterns of antibiotic usage greatly affected the number of resistant organisms that were developed. Approximately, one third of the nosocomial infections are preventable. Moreover, cleaning is the first necessary step of any sterilization or disinfection process. Cleaning is the removal of organic matter, salts and visible soils from the environment, all of which interfere with microbial inactivation (Ducel et al., 2002).

Environmental surfaces carry the least risk of disease transmission and can be safely decontaminated using less rigorous methods than those used on medical instruments and devices. Isolation precautions are designed to prevent transmission of microorganisms by common routes in hospitals. However, because agents and host factors are more difficult to control, interruption of transfer of microorganisms is directed primarily at transmission (Madani et al., 2009; Mielke, 2010; Rosenthal et al., 2010).

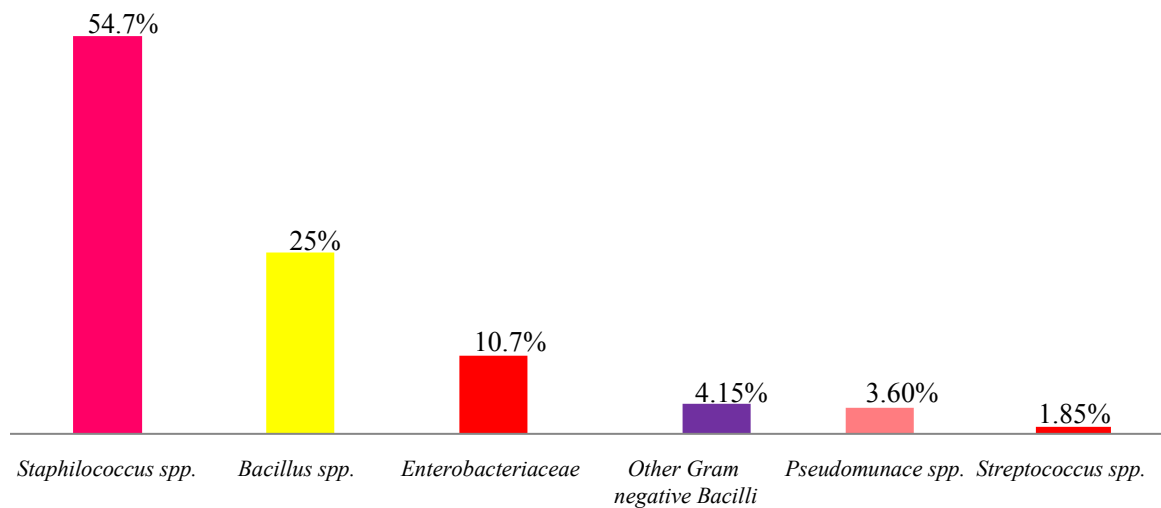


Figure 1. Comparative frequency of the bacterial isolated from the hospital environment.

Table 1. Bacterial sensitivity pattern to antibiotics.

Antibiotic	Bacteria							
	Bacteria (%)	T (%)	E (%)	AM (%)	SXT (%)	CC (%)	CTX (%)	P (%)
<i>S. aureus</i>	78	50	66	100	20	67	75	19
<i>S. epidermidis</i>	77	71	47	70	59	77	67	22
<i>Bacillus spp.</i>	86	82	82	82	68	41	57	64
<i>B. cereus</i>	100	92	82	60	33	75	66	0
<i>K. pneumoniae</i>	100	66	65	80	100	0	71	20
<i>E. coli</i>	88	62.5	50	50	55.5	12.5	78	33

GM: Gentamicin, T: tetracycline, E: erythromycin, AM: ampicillin, SXT: co-trimoxazole, CC: Clindamycin, CTX: cephotaxime, P: penicillin.

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