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Original Article

Carrier Status of Methicillin-Resistant Staphylococcus Aureus (MRSA)

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Abstract

Background: To investigate nasal carriage of Methicillin-Resistant Staphylococcus aureus (MRSA) among dental healthcare workers (HCWs) , as the carriers could be the potential risk factor for the transmission of nosocomial infection when exposed to hospital setting during clinical posting.

Methods: One hundred HCWs including postgraduate trainees, house physicians, staff nurses and technicians participated in the study. Nasal specimens were obtained by using cotton swabs moistened in sterile saline. The nasal specimens collected were processed as per (CLSI, 2008). Specimens were inoculated on blood agar to look for β-hemolysis of Staphylococcus aureus. Nutrient agar was used for the direct colony identification of Staphylococcus aureus. Mannitol salt agar (MSA) and DNAse were used as selective media for the isolation of Staphylococcus aureus and incubated at 35˚C for 48 hrs.Resistance to methicillin was detected with cefoxitin(30 µg) through Disk Diffusion Test and interpreted according to (CLSI, 2009). A diameter of ≥22 mm was considered as susceptible and ≤21 mm as resistant as per (CLSI, 2010).

Results: Out of 100 nasal swabs collected, 71 nasal swabs were from the dental surgeons and 29 were from the nursing staff, 35 (35%) showed a growth of Staphylococcus aureus. Among those who were positive for Staphylococcus aureus 62.85%were positive for MRSA. Overall 22 (22%) out of a 100 individuals came out to be positive for MRSA.

Conclusion: Health care workers (HCWs) were the potential colonizers of methicillin resistant Staphylococcus aureus and may serve as reservoirs or disseminators of MRSA.

Key Words: Dental health care workers, Nasal carriage, Staphylococcus aureus, MRSA,

Introduction

Staphylococcus aureus remains as one of the most important nosocomial pathogen. Both methicillin-sensitive Staphylococcus aureus (MSSA) and methicillin-resistant Staphylococcus aureus(MRSA) have been implicated in a variety of endemic and epidemic nosocomial infections worldwide. [1]Staphylococcus aureus has been recognized as an epidemiologically important pathogen. Despite rigorous antibiotic therapy, staphylococcal infections occur frequently in hospitalized patients resulting in severe consequences.[2] Asymptomatic carriage of Staphylococcus aureus has been shown to have a higher prevalence in healthy individuals, especially in healthcare workers (HCWs).[3,4,5] Several studies conducted worldwide have reported the rate of nasal carriage of Staphylococcus aureus strains among hospital personnel varying from 16.8% to 90%.[2,5,6] Evidence suggests an increase in the carriage of MRSA among hospital personnel as the exposure to hospital environment increases the potential risk of being colonized by different hospital borne pathogens including Staphylococcus aureus. The main inhabiting ecological carrier site for Staphylococcus aureus is the anterior nares.[7,8]

Transmission of infection among dental healthcare settings is different from most other healthcare settings. The environment of the dental office is highly contaminated by airborne and blood borne microbial aerosol and spatter produced by intraoral devices, such as air-water syringes, turbines, and ultrasonic scalers.[4,5] MRSA occurrence in the dental environment is less frequently reported [1]. In most studies, MRSA carriage in dental healthcare workers has not been above the level of the normal adult population.[8,9] In the greater Houston metropolitan area 4.2% of dentists and 1.5% of dental hygienists were positive for MRSA [8,10] whereas only 1.5% of the non-institutionalized US citizens were colonized with MRSA.[8,11] Other studies showed that 21% of dental students were nasal carriers for MRSA.[8,12]Nasal carriage of MRSA among the dental staff could pose a risk for transmission of MRSA to the patients or co-workers. MRSA infection is typically preceded by the colonization of the anterior nares and skin by Staphylococcus aureus. Other sites for potential colonization of Staphylococcus aureus

includes the urine of patients with indwelling urinary catheters, implantation sites of invasive devices and the postoperative wounds.[13,14]

Subjects and Methods

This is a prospective study conducted atArmed Forces Institute of Dentistry (AFID) Rawalpindi and Holy Family Hospital (HFH) Rawalpindi. Pakistan. This study was conducted over a 3-month period in the year 2014 from the months of October to December. After the approval to perform the study was obtained, oral consent from the subjects for the participation in the study. One hundred HCWs including postgraduate trainees, house physicians, staff nurses and technicians participated in the study. HCWs having history of upper respiratory tract infection or having taken any antibiotic during the last one week were excluded from the study. All study participants underwent swabbing of the anterior 1.5 cm of the nasal vestibule. Nasal specimens were obtained by using cotton swabs, moistened in sterile saline. The swabs were inserted into both anterior nares and rotated five times. The nasal specimens collected were processed as per (CLSI, 2008).[15] Specimens were inoculated on blood agar to look for β-hemolysis of Staphylococcus aureus. Nutrient agar was used for the direct colony identification of Staphylococcus aureus. Mannitol salt agar (MSA) and DNAse were used as selective media for the isolation of Staphylococcus aureus and incubated at 35˚C for 48 hrs. All isolates were identified routinely by Grams stain, Catalase test, Coagulase test, Mannitol Salt agar (MSA) test and the DNAse test. The identification of organisms was based on their cellular, cultural and biochemical characteristics. Resistance to methicillin was detected with cefoxitin(30 µg) through Disk Diffusion Test (Bauer et al., 1966)[16] and interpreted according to (CLSI, 2010). A diameter of ≥22 mm was considered as susceptible and ≤21 mm as resistant as per (CLSI, 2010).[17]

Results

A total of 100 nasal swabs were collected.71 nasal swabs were collected from the dental surgeons and 29 were collected from the nursing staff (Table 2).Out of 71 dental surgeons 24 (33.80%) were post graduate (PG) trainees and 47 (66.19%) were house officers. Out of the 100 samples, 35 (35%) showed a growth of Staphylococcus aureus. Among those who were positive for Staphylococcus aureus, 62.85%were positive for MRSA. Overall 22 (22%) out of a 100 individuals came out to be positive for MRSA.From the total population of 100 individuals, 88% showed a growth of either Staphylococcus aureus or staphylococcus spp. Of these, 39.77% of the individuals were detected with Staphylococcus aureus and 60.22 % of the individuals were detected with staphylococcus spp. Of a total of 62 clinical dentists that showed positive results for Staphylococcus. aureus or Staphylococcus spp., 21(33.87%) showed a growth of Staphylococcus aureus(Table 1).

Table1: Distribution of Staph. Aureus, Staph. Spp. and MRSA

Total sample		Total			MRSA positive	No Growth
		Staphylococcus aureus + staph Spp.	Staphylococcus aureus	Staphylococcus spp.		
N=100		N=88	N=35	N=53	N=22	N=12
Total Dental Surgeons	71 71/100 (71%)	62 62/71 (87.32%)	21 21/62 (33.87%)	41 41/62 (66.12%)	13 13/21 (61.90%)	09 09/71 (12.6%)
PG trainees	24 24/71(33.80%)	22 22/62(35.48%)	06 06/21 (28.57%)	16 16/41 (39.02%)	05 05/13 (38.4%)	02 02/9 (2.22%)
House officers	47 47/71 (66.19%)	40 40/62 (64.51%)	15 15/21 (71.42%)	25 25/41 (60.90%)	08 08/13 (61.5%)	07 07/9 (7.77%)
Nursing staff	29 29/100 (29.00%)	26 26/29 (89.65%)	14 14/26 (53.80%)	12 12/26 (46.1%)	09 09/14 (64.2%)	03 03/29 (10.34%)

Out of which 13 (59.09%) were methicillin resistant Staphylococcus aureus (MRSA).Of the 29 swabs collected from the dental nursing staff, 26 (89.65%) showed positive results for Staphylococcus aureus or Staphylococcus spp. Of these individuals,14 (53.8%) strains of Staphylococcus aureus were isolated, out of which 9 (64.2%) strains were methicillin resistant Staphylococcus aureus (MRSA). From the specimens taken from the nursing staff, 3 (10.34%) of the individuals showed no growth. Out of total MRSA isolated (n=22), 64.2% were from nursing staff and 59.09 % were from clinical dentists.

Discussion

MRSA outbreaks in hospitals can be traced to the medical personnel as being a major source of infection. [18] The main reservoir for Staphylococcus aureus is the anterior nares.[5] Colonization of MRSA in anterior nares servers as a reservoir from which MRSA can be introduced into the body when the host defenses are breached.[19] It is important to accurately detect MRSA in patients not only for choosing an appropriate

antibiotic therapy, but also for the rapid control of the MRSA epidemic. In this study we have assessed the prevalence of colonization of MRSA among dental health care workers and the possibility of its spread in dental hospital. Results of bacteriological study of nasal swabs from participating HCWs in this study revealed Staphylococcus aureus strains be present in 35% of the HCWS (dental surgeons and dental nursing staff). Among Staphylococcus aureus isolates N=22 (62.85%) were MRSA positive strains. The overall MRSA carriage rate in dentists was N=13 (64.90 %) out of N=21 positive isolates of Staphylococcus aureus and in the dental nursing staff was N=9 (64.2%) out of N=14 positive isolates of Staphylococcus aureus. This proves that Staphylococcus aureus remain one of the most commonly encountered nosocomial pathogen. Human carriers are predominantly colonized by Staphylococcus aureus in the nares and contamination of hands.[20]In the hospitals, MRSA holds immense clinical significance[21]. The results of this study regarding the carrier rate of MRSA among dentists and dental nursing staff coincide with the results reported by Opal et al. (1990), who found high rates (56%) of Staphylococcus aureus colonization among nurses, 65% of which were MRSA positive[22]. High rates of nasal carriage of Staphylococcus aureus have been reported by Badawi et al.(2001), and Kamp et al.(2003)but their studies showed much lower rates of MRSA carriage (26% and 5%; 33.8% and 0.7% respectively.[23, 24] Higher nasal carriage rates (33% and 48%) for Staphylococcus aureus in the HCWs have been reported in two Pakistani studies.[25, 26] The population sample for this study is also from Pakistan and shows a N=35 (39.77%) out of N=88 positive isolates for nasal carriage of Staphylococcus aureus, similar to the rate reported in the other two Pakistani studies. Prevalence of the nasal carriage of Staphylococcus aureus in other countries ranged between 16.8-56.1%.[2]The difference in the nasal carriage rates of Staphylococcus aureus, can be due to the differences in geographical distribution of the population, differences in the quality and size of samples and the difference in the culturemethods utilized to detect Staphylococcus aureus.This study showed 62.85% (N=22/N=35) of the total population detected with Staph. Aureus to be MRSA positive.

Varying rates for MRSA carriage have been reported by the HCWs in Pakistan (14%) and India (39.7%). [26, 27] A high nasal carriage rateof MRSA observed in this study can be attributed to several factors including a high prevalence of MRSA among patients which increases the potential exposure of acquiring MRSA among theHCWs.[24] A study done by Jain K et al. (2014) in central India, states that a higher prevalence of MRSA among patients leads to a higher prevalence of MRSA nasal carriage among the health care workers that have a direct patient contact.[28] Suboptimal infection control practices in the hospitals have a strong influence on the possibility of transmission of MRSA between patients and hospital staff.[29] These suboptimal infection control practices include: failure to perform active surveillance cultures to identify the colonized patient's timely, HCWs non-compliance with hand hygiene and non-compliance with the use of protective barrier equipment's. In our study, nursing staff showed a comparatively higher carriage rate of MRSA as compared to the dental surgeons. This can be explained by the fact that HCWs including the dental nursing staff having direct patient contact have a higher MRSA carriage rate than those who have lesser contact.[30] Study done by Lakshmi S. Kakhandki et al. (2012) states higher carriage rate in nursing staff than clinical doctors which is in accordance to our study.[31]

Conclusion

Health care workers are potential colonizers of methicillin resistant Staphylococcus aureus and may serve as reservoirs or disseminators of MRSA.

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