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Research Article

PREVALENCE OF NASAL CARRIAGE OF MRSA AMONG PATIENTS UNDERGOING HAEMODIALYSIS AND IN HEALTH CARE WORKERS WORKING IN THE HAEMODIALYSIS UNITS

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ABSTRACT

Asymptomatic nasal carriage of *Staphylococcus aureus* is a major risk factor for acquiring infection in patients undergoing haemodialysis because of their decreased immunity, increased skin colonization by *Staphylococci* and multiple needle punctures required for dialysis. The present study was done to know the prevalence of nasal carriage of MRSA among patients undergoing dialysis and in HCW's during the period of October and November 2011 at GGH, Vijayawada, India. Sterile swabs were rotated into the anterior nares of patients (50) and HCW's (25) working in dialysis unit after taking informed consent. Swabs were inoculated into Nutrient agar, Blood agar, Mannitol salt agar. Identification of *Staphylococcus aureus* was done by standard methods. Antimicrobial susceptibility and Methicillin resistant strains were detected as per the CLSI guidelines. Of the 50 patients and 25 controls, 21 patients and 7 controls have been found to be nasal carriers of *Staphylococcus aureus*. All the 21 isolates of SA among cases and 4 isolates from controls were resistant to Methicillin.

Keywords: *Staphylococcus aureus*, MRSA, Nasal carriage, Haemodialysis, Health Care Workers

INTRODUCTION

Staphylococcus aureus has long been recognized as an important pathogen in hospitalized patients especially the critically ill and has severe consequences despite antibiotic therapy[1]. The success of this germ is because of the virulence factors permitting rapid tissue invasion, dissemination throughout the body, genetic plasticity permitting constant adaptation[2]. *Staphylococcus aureus* causes asymptomatic and long lasting colonization of human tissues or incorporate in bio films on inert surfaces and also cause fulminant host invasion with diverse manifestations. The impact of *S. aureus* infection on human health has dramatically increased as a result of its remarkable ability to become resistant to antimicrobials and one such strain is Methicillin Resistant *Staphylococcus aureus* (MRSA) and is associated with increase in the length of hospital stay, healthcare costs and patient morbidity and mortality[3]. Humans are the main natural reservoir of *S. aureus*, highest being in the anterior nares. Other sites include skin, perineum, pharynx, GIT, vagina and axillae. A number of large population based studies demonstrated that in 80-85 % of the cases, *S. aureus* recovered from the blood stream during *S. aureus* bacteremia is the same strain that the patients carried in their nose. The majority of dialysis patients carry the same strain on the hands and in the nose[2]. Asymptomatic nasal colonization with *S. aureus* is common, and it appears to be an important factor in the development of most infections. People who undergo haemodialysis are particularly vulnerable to *staphylococcal* infections, with the vascular access being a major port of entry[2]. Thus nasal carriage of *S. aureus* is a major risk factor for acquiring infection in these patients because of their increased skin colonization, decreased immunity and multiple needle punctures. The dialysis unit and its population provide an ideal setting for cross transmission of pathogens, because regular haemodialysis is required 2 to 3 times a week for 3 to 4 h shifts in a closed setting and because healthcare workers provide concurrent care to multiple patients[4]. The present study is important as the prevalence of MRSA has increased dramatically in the recent years.

Aims and objectives

To know the prevalence of nasal carriage of MRSA among patients undergoing dialysis and in health care workers at Government General Hospital, Vijayawada, India

MATERIALS AND METHODS

This study was undertaken in the Dialysis unit in Government General Hospital, Vijayawada, Andhra Pradesh, India, during the period of October and November 2011. Sterile swabs were rotated into the anterior nares of the dialysis patients and health care workers working in dialysis unit after taking informed consent. A total of 75 swabs (50 patients and 25 HCW's) were collected and inoculated onto Nutrient agar, Blood agar and Mac conkey agar plates and incubated overnight at 37^0C. *S. aureus* was identified based on the growth pattern and by inoculating onto Mannitol Salt Agar and by performing Slide coagulase and tube coagulase tests on all the isolates.

On Nutrient agar

Colonies were large, circular, smooth, shiny, opaque with golden yellow pigmentation (Figure 1).

On Blood agar

Colonies were haemolytic (Figure 2).

On Mac Conkey's agar

Small lactose fermenting colonies have appeared with a few strains.

Mannitol Salt Agar

This is a selective and indicator medium for the identification of *S. aureus* which has 1 % mannitol, 7.5 % sodium chloride with phenol

red as an indicator. *S. aureus* ferments mannitol and subsequently the indicator is turned from red to yellow (Figure 3).

Tube Coagulase Test

This test is used to differentiate *Staphylococcus aureus* from coagulase negative *staphylococci*. This method is for the detection of free coagulase. About 0.1 ml of broth culture or emulsified colony is added to about 0.5 ml of human plasma in a test tube. The tube is incubated in a water bath at 37^0C for 3-6 h. A positive test shows clotted plasma (Figure 4). *Staphylococcus aureus* has been tested for Methicillin susceptibility as per CLSI guidelines, by using discs of Oxacillin 1 µg in MHA with 5 % NaCl by disc diffusion method. The other antibiotics tested were Clindamycin, Ampicillin/Sulbactam, Cefotaxime, Azithromycin.

RESULTS

Out of the 50 cases undergoing haemodialysis, 21 cases were nasal carriers of S.aureus, all of which were MRSA (Table 1). Out of 25 health care workers, 7 of them have been found to be nasal carriers of *S. aureus*, of which 4 were MRSA and the remaining 3 were MSSA (Table 1). For the various antibiotics tested, the susceptibility pattern has been indicated in Table 2. The nasal carriage of *S. aureus* was predominant between the age groups of 41 to 60 years and that of MRSA was predominant between the age groups of 21 to 50 years (Table 3).

DISCUSSION

Antibiotic resistant bacteria are an increasing problem in the world among infected patients and are associated with increase in length of hospital stay, healthcare costs and patient morbidity and mortality. MRSA is a strain of *Staphylococcus aureus* that is resistant to Methicillin, Oxacillin, Nafcillin, Cephalosporins, Imipenem and other Betalactam antibiotics[5]. The resistance is independent of β lactamase production, encoded and regulated by a sequence of genes found in a region of the chromosome called the *staphylococcal* cassette chromosome mec (SCC mec), specifically, the mecA gene on this locus encodes a low affinity penicillin binding protein (PBP2a) which is responsible for the resistance. The most important endogenous sources of infection are the skin, nares and axillae. Exogenous source like that of air borne transmission also plays an important role. Hands are one of the important vehicles of transmission of *S.aureus* from the environment to the nasal niche and from the nasal niche to several body sites. Patients undergoing haemodialysis are at an increased risk for staphylococcal colonization right from the onset of dialysis. These patients have a 1.8 to 4.7 fold increase of vascular infections and bacteremia compared with non carriers. The majority of dialysis patients carry the same strain on the hands and in the nose[2]. In addition, these strains are frequently the same as those recovered from subsequent infections.

Risk in HD patients

The annual mortality rate caused by sepsis is 100 to 300 times higher in patients with end stage renal disease than in general population. There is a strong relation between *S. aureus* bacteremia and dialysis accounting to a total of 14.5 % to 66 % of all *Staphylococcus aureus* bacteremia episodes. The progressive spread of MRSA is daunting. It was about 12-30 % during 2006-07 to up to 65 % in 2010 in the USA.

Other studies

Data from the Centre for Disease Control and Prevention showed that 59.5 % of all Healthcares – associated *S. aureus* infections in the United States are caused by MRSA[6]. In New York City, MRSA accounts for ~30 % of nosocomial infection and 50 % of associated deaths[7]. Many studies were conducted to assess the nasal carriage of MRSA among healthcare workers - The prevalence of *S.aureus* among the postgraduate and undergraduate students of Kasturba Medical College, Mangalore, India, was 100% and 75% respectively. The carrier rate of MRSA was higher among the postgraduate students (42.3%) when compared to the undergraduate students (4.16%). In comparison with a few studies, studies conducted by Roya Ghasemian *et al*[8] in the year 2006 and Wang CY *et al*[9] in the year 2007 have shown nasal carriage rates of 74.2 % and 65 % which were higher in comparison to the present study. A study conducted by Baliga S *et al*[10] in the year 2008 has shown a carriage rate of 42.3 % which is almost equal to that of the present study. Those by K Kalyani *et al*[11] (26.94 %), Vinodh kumar aadhithya *et al* (15.4 %), Palavecino E *et al*[6] (12 %), Ma'ali "Mohammad Sa'di" Abu-Rabie[1] (3.75 %) have shown much lesser prevalence rates.

Table 1: No of *Staphylococcus aureus* isolated and no of MRSA positives

Nasal carriage	*Staphylococcus aureus*	MRSA	MSSA
Among dialysis patients	21	21	Nil
Among health care workers	7	4	3

Table 2: Antibiotic sensitivity pattern to different antibiotics tested for *Staphylococcus aureus* isolates from cases and controls

Antibiotic tested	Sensitivity among cases (21)	Sensitivity among controls (7)
Oxacillin (1 µg)	0	3 (42.86 %)
Clindamycin (2 µg)	15 (71.43 %)	5 (71.43 %)
Ampicillin/ sulbactam (10/10 µg)	19 (90.48 %)	7 (100 %)
Cefotaxime (30 µg)	14 (66.66 %)	7 (100 %)
Azithromycin (15 µg)	5 (23.81 %)	3 (42.86 %)

Table 3: Age wise distribution of MRSA and MSSA among cases and controls

Age	MRSA among cases	MRSA among controls	MSSA among cases	MSSA among controls
0-10	-	-	-	-
11-20	1 (4.76 %)	-	-	-
21-30	3 (14.28 %)	2 (28.57 %)	-	2 (28.57 %)
31-40	2 (9.52 %)	1 (14.28 %)	-	1 (14.28 %)
41-50	6 (28.57 %)	1 (14.28 %)	-	-
51-60	7 (33.33 %)	-	-	-
61-70	2 (9.52 %)	-	-	-

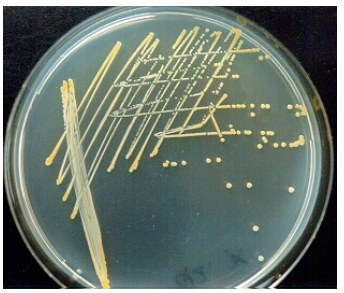

Figure 1: The colonies of *Staphylococcus aureus* on nutrient agar

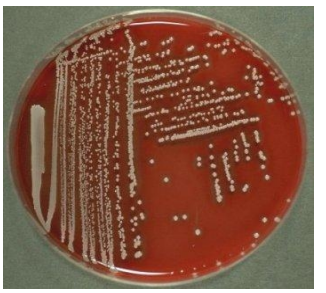

Figure 2: Colonies of *Staphylococcus aureus* on blood agar

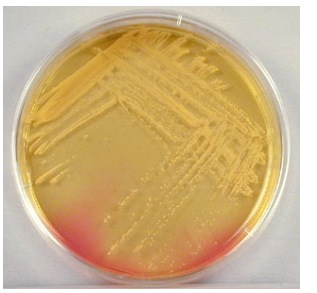

Figure 3: Colonies of *Staphylococcus aureus* on MSA

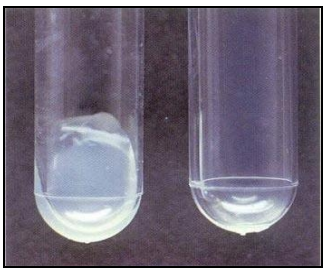

Figure 4: Tube coagulase test

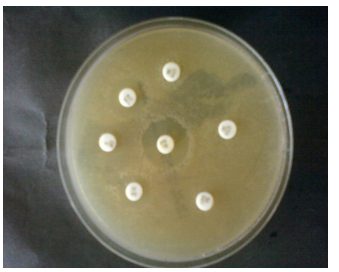

Figure 5: MHA plate

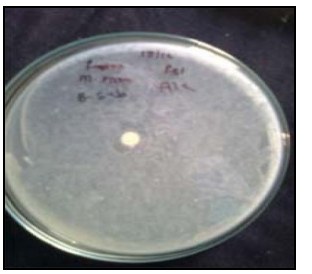

Figure 6: Methicillin susceptibility

CONCLUSION

Certainly, determining the prevalence of nasal carriage, especially among patients on hemodialysis and recognizing the appropriate pattern of antibacterial resistance, could pave the way for optimized antibiotic prescription and prevent resistance to newly developed antibiotics. Nasal carriage of MRSA among patients is considered to be an important risk factor as it acts as an important source of infection. Within the hospital, colonized HCW's act as reservoir for the spread of MRSA to uncolonized susceptible patients. Clinical isolates from invasive infections can only focus on the severity of the disease but does not give an estimate or prevalence of carriers among the healthy population. This formed the basis for our study and its importance of screening for healthy carriers of MRSA and to study the rate of colonization among the healthcare workers. Patients on hemodialysis are at an increased risk of *S. aureus* infections because of prolonged vascular access. In hemodialysis units, several patients receive dialysis concurrently which would increase the risk of transmitting MRSA person-to-person directly or indirectly via contaminated devices, equipment and supplies, environmental surfaces, or hands of personnel[12]. Furthermore, hemodialysis patients are immunosuppressed, which increases their susceptibility to infection and they require frequent hospitalizations and surgery, which increases their opportunities for exposure to nosocomial infections. Monitoring and eradication of MRSA from patients, healthcare workers and their family members should be considered to prevent continuous spread between healthcare facilities and the community.

Prevention

Infections by MRSA can be prevented significantly by regular hand washing by health care workers; periodic screening of HCWs for MRSA carriage; Eradication of nasal carriage by application of 2 % mupirocin ointment along with Chlorhexidine bath.

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