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Research Article

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Staphylococcal nasal carriage and catheter related bacteraemia in a sample of Egyptian maintenance hemodialysis patients - A single center study

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Abstract

Background: *Staphylococcus aureus* (*S. aureus*) nasal carriage may be responsible for some serious infections in hemodialyzed patients. It is incriminated as the most common aetiologic agent in CRBSI. **Aim:** To study the rate of staphylococcal nasal carriage in a sample of Egyptian maintenance HD patients, its relation to CRBSI and the patterns of culture and sensitivity in the nasal swabs and blood cultures. **Patients and Methods:** Nasal swabs were collected from 40 patients who were receiving maintenance hemodialysis with inserted temporary dialysis catheters and who did not receive any antibiotics during the previous week. Nasal swabs with subsequent culture on blood agar and blood cultures from the catheters were done for all included patients. **Results:** Our results showed that (81.8%) of the participants who had Positive blood culture had positive nasal swab, participants with positive nasal swab are 1.818 times more liable to develop positive blood culture than patients with negative nasal swab (RR=1.818; 95%CI= (1.125-2.940). Results show that coagulase negativeStaphylococci were the most frequent organism found in central blood culture (45.5%), followed by coagulase positive Staphylococci (36.4%), E.coli and Pseudomonas each accounted for (9.1%). Results showed that organisms retrieved from nasal swabs were most sensitive to vancomycin & Clindamycin (94.4% & 77.8%) respectively while 77.8% were resistant to Cefoxitin and 72.2% were resistant to Erythromycin & Trimetoprim/sulfamethoxazole respectively, and show that organisms retrieved from blood were most sensitive to Vancomycin, Doxycycline & Clindamycin (100.0%, 90.9% & 81.8%) respectively while 100.0% were resistant to Trimetoprim/ sulfamethoxazole and 63.7% were resistant to Cefoxitin, Gentamycin and Erythromycin. **Conclusion:** Staphylococcal infection accounts for the majorityof cases of CRBSIs, to a lesser extent gram negative organisms. Staphylococcal nasal carriage is a strong predictor of CRBSI. Culture and sensitivity results retrieved from nasal swabs and blood cultures showed a similarity in being both sensitive to vancomycin and clindamycin, and resistant to Trimetoprim/sulfamethoxazole.

Keywords: *S.aureus* nasal carriage, CRBSI, hemodialysis.

Introduction

Nasal carriage of *S. aureus* in the anterior nares, present in over 42% of hemodialyzed (HD) patients, plays a major role in the HD patients infection risk ([1],[2]. Bacteria harboring in the nose passes to the hands and, from the hands, to the skin [3],[4]. From the skin, *S.aureus* may cause infection by any foreign substance such as a dialysis catheter. Boela et al., showed that 84% of nasal *S. aureus* patients

carried these bacteria on their hands, against only 5% of patients who did not carry it in their nose[4]. *S. aureus* carriers who are on hemodialysis have a 1.8- to 4.7-fold increase of vascular access VA infections and bacteraemia compared with noncarrier [5]. *S. aureus* is—as for the general population —the single leading pathogen causing severe infections in dialysis patients, responsible for 27 to 39% of all bacteremias in dialysis patients[6].To the best of our knowledge, bacteriological profile of CRBSI in haemodialysis patients and the culture and sensitivity patterns of the isolates are not well studied in Egypt. Accordingly, we sought to examine the culture and sensitivity patterns observed in CRBSI, and staphylococcal nasal carriage in patients receiving haemodialysis using a temporary non-tunnelled catheters in a sample of Egyptian maintenance hemodialysis patients.

Patients and Methods

Patients: The study was a cross-sectional observational study conducted at the Nephrology Department of Ain Shams University Hospital in the period from January to June 2016. The nasal swabs were collected from 40 patients who were receiving maintenance hemodialysis with inserted temporary dialysis catheters and who did not receive any antibiotics during the previous week. All inserted catheters were internal jugular.

Methods: Nasal swabs and blood cultures from the internal jugular catheters were done for all included patients.

Nasal swabs: Cotton swabs were moistened with sterile saline and rubbed over the anterior nares both nostrils. The swabs specimens were immediately streaked on blood agar and incubated at 37 ºC for 24hours. Preliminary identification of staphylococcal isolates was performed on the basis of colony morphology, cultural characteristics, Gram-reaction, and coagulase test.

Blood cultures: Blood culture for all patients taken from the internal jugular catheter. A 10cc blood sample was drawn under complete aseptic precautions and inoculated on anOxoid® blood culture gas capturer bottles and incubated at 37ºC for up to 7 days, all isolates were sub-cultured on blood agar, colonies were identified according to their morphology, staphylococci appear round, smooth, raised and glistening. *S. aureus* usually forms golden yellow colonies and various degree of beta haemolysis, while the coagulase negative staph forms creamy white colonies. Microscopic examination of Gram-stained films of all isolates was done. Staphylococci are Gram-positive cocci about 0.5 - 1.0 µm in diameter. They grow in clusters, pairs and occasionally in short chains, identification of the isolated pathogen was also done by tube coagulase test and antibiogram. Statistical analysis was performed using SPSS 16.0. Categorical variables were reported as number (percentages) and continuous variables were reported as mean ± SD. Chi-square test was used for univariate analysis for factors in relation to CRBSI. Statistical significance was determined at a 5% level of significance.

Results

55%of our study participants were males while45.0%were females. The mean age of the participants was 54.6 ±11.3 and their ages range from 22-81 years.52.5% were between 40-59 years; while37.5%were 60 years or more and only 10.0% were between 20-39 years. 81.8% of the participants who had Positive central blood culture had positive nasal swab, participants with positive nasal swab were1.818 times more liable to develop positive central blood culture than patients with negative nasal swab (RR=1.818; 95%CI= (1.125-2.940). The prevalence of *S.aureus* nasal carriers in the participants of the age group 40- 59 years was the highest (47.6%),compared to the younger age group and the older age group (>60 years),although the difference was statistically non- significant.There was statistically insignificant correlation between staphylococcal nasal carriage and patients gender. Coagulase negative Staphylococci were the most frequent organism found in central blood culture (45.5%), followed bycoagulase positive Staphylococci (36.4%), *E.coli* and Pseudomonas each accounted for (9.1%). Organisms retrieved from nasal swabs were most sensitive to vancomycin & Clindamycin (94.4% & 77.8%) respectively while 77.8% were resistant to Cefoxitin and 72.2% were resistant to Erythromycin &Trimethoprim/sulfamethoxazole respectively, whereas the organisms retrieved from central venous line were most sensitive to Vancomycin, Doxycycline & Clindamycin (100.0%, 90.9% & 81.8%) respectively while 100.0% were resistant to Trimethoprim/sulfamethoxazole while 63.7% were resistant to Cefoxitin, Gentamycin and Erythromycin.

Table (1): Frequency distribution of the studied participants according to nasal swab and blood cultures

Lab Investigations	No.	%	X^2	P-value
Nasal Swab				
Negative	22	55.0	0.400	0.527
Positive	18	45.0		
Blood Culture			8.100	0.004**
Negative	29	72.5		
Positive	11	27.5		

Table (2): Antibiotic sensitivity of nasal swabs (n=18)

Antibiotic	No.	%	χ2 test	P-value
GN Gentamycin (Garamycin)				
Resistant	8	44.4	0.222	0.637
Sensitive	10	55.6		
E Erythromycin (Erythin)				
Resistant	13	72.2	3.556	0.059
Sensitive	5	27.8		
DA Clindamycin (Dalacin-c)				
Resistant	4	22.2	5.556	0.018
Sensitive	14	77.8		
SXT Trimetoprim/sulfa (Sutrim)				
Resistant	13	72.2	3.556	0.059
Sensitive	5	27.8		
VA vancomycin (vancocin)				
Resistant	1	5.6	14.222	0.000**
Sensitive	17	94.4		
FOX FOX Cefoxitin				
Resistant	14	77.8	5.556	0.018
Sensitive	4	22.2		
LEV Levofloxacin (tavanic)				
Resistant	11	61.1	0.889	0.346
Sensitive	7	38.9		
DO Doxycycline (Vibramycin)				
Resistant	11	61.1	0.889	0.346
Sensitive	7	38.9		
Total	**18**	**100.0**		

Table (3): Antibiotic sensitivity of blood cultures (n=11)

Antibiotic	No.	%	X2 test	P-value
CN Gentamycin (Garamycin)				
Resistant	7	63.6	0.818	0.366
Sensitive	4	36.4		
E Erythromycin (Erythin)				
Resistant	7	63.6	0.818	0.366
Sensitive	4	36.4		
DA Clindamycin (Dalacin-c)				
Resistant	2	18.2	4.455	0.035*
Sensitive	9	81.8		
SXT Trimetoprim/sulfa (Sutrim)				
Resistant	11	100.0		
Sensitive	0	0.0		
VA vancomycin (vancocin)				
Resistant	0	0.0		
Sensitive	11	100.0		
FOX Cefoxitin				
Resistant	7	63.6	0.818	0.366
Sensitive	4	36.4		
LEV Levofloxacin (tavanic)				
Resistant	6	54.5	0.091	0.763
Sensitive	5	45.5		
DO Doxycycline (Vibramycin)				
Resistant	1	9.1	7.364	0.007**
Sensitive	10	90.9		
Total	**11**	**100.0**		

Discussion

Staphylococcus aureus carriage in the nose has been shown to be more common in patients receiving long-term hemodialysis than in the general population[7]. *S. aureus* nasal carriage plays an important role in epidemiology and pathogenesis in chronic hemodialyzed patient infections, especially in patients requiring vascular access for prolonged periods. These staphylococcal infections present a serious clinical problem in the routine management of hemodialyzed patients. That is why, a greater understanding of *S. aureus* colonization prevalence and microbiology is essential to guide efforts in reducing antibiotic resistant strains spread. In this study, the nasal carriage rate of *S.aureus* was found to be 45% in 40 patients, this percentage is close to that of Ghazvini and Hekmat who reported a rate of *S. aureus* nasal carriage of 40.5% in hemodialyzed patients in Mashhad, Iran[8], and agreed with the rate prevalence of S. aureus nasal carriage of 42.9% in hemodialyzed patients in Fez city, Morocco [9], it was however lower than that found in the study done in Ivory Coast where it reached 85.7% in hemodialyzed patients[10]. In the studies from other countries, the rate of *S.aureus*

nasal carriers ranged from 59.5% to76% in different dialysis centers [11].Our data demonstrated that the prevalence of *Staphylococcus aureus* nasal carriers in the participants of the age group 40- 59 years was the highest (47.6%),compared to the younger age group and the older age group (>60 years),although the difference was statistically non- significant, these data disagree with study done by Anil K Saxena in Saudi Arabia who reported patients > 65 years age had a significantly higher prevalence of nasal carriage of S. aureus[12] .Our finding that (81.8%) of the participants who had Positive central blood culture had positive nasal swab and that participants with positive nasal swab were more liable to develop positive central blood culture than patients with negative nasal swab agreed with study of Johnson LB, et al. who reported that the rate of *S. aureus* nasal carriage due to *S. aureus* in the HD population ranges between 11 and 57%, and is associated with a threefold higher relative risk of developing *S. aureus*-related CRBSI[13]. Coagulase negative staphylococci were the most frequent organism found in the blood cultures (45.5%), followed by coagulase positive staphylococci (36.4%), E.coli and Pseudomonas each accounted for (9.1%).Mostly skin derived organisms especially *Staphylococcus epidermidis* and *Staphylococcus aureus* have been implicated to be the aetiological agents of CRBSI[14]. However, few studies report Gram negatives, especially *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* as the culprits[15] ,[16]. Some other recent studies also noted a significant proportion of Gram-negative bacterial cultures, but *Enterobacter*, *E. coli*, and *Klebsiella* were more frequently isolated[17],[18]. Antibiotic Sensitivity of Positive Nasal Swabs showed that organisms retrieved from nasal swabs were most sensitive to Vancomycin &clindamycin (100.0% & 72.2%) respectively while 77.8% were resistant to cefoxitin and 72.2% were resistant to Erythromycin & Trimethoprim/ sulfamethoxazole respectively, the resistance profiles of isolated organisms in our study demonstrated multidrug resistance which agreed with the study done by Kim HB et al who reported that the organisms retrieved from nasal swabs were most resistance to Trimethoprim/sulfamethoxazole, doxycycline and tetracycline (72%), levofloxacin (61%), gentamycin and cloxacillin (44.5%)[19]. These findings support the relationship between methicillin resistance and resistance to other antibiotics that were reported by previous studies, which is a major problem in the treatment of *S. aureus* infections as reported by previous studies [19],[20]. Our study has some limitations, the number of patients was small and we did not perform genotyping for the isolated strains from the anterior nares and those from the central blood cultures to match.

Conclusion

In view of the high resistance rates to many of the commonly used antibiotics, treatment of MRSA infections may not be effective. Since colonized patients have no signs or symptoms of infection, and can still serve as a source from which transmission may occur and can also serve as reservoirs, thus adequate establishment of staphylococcal nasal carrier status accompanied by characterization of cultured isolates along with antibiotic susceptibility testing is crucial in patients particularly prone to infections caused by these bacteria, such as those receiving hemodialysis in order to develop infection prevention measures and treatment strategies. Each hemodialysis center must make a periodic assessment of *S. aureus* antibiotics sensitivity currently used.

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