PREVALENCE OF NASAL COLONIZATION OF METHICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS (MRSA) IN PATIENTS ON CHRONIC HEMODIALYSIS

Falak Shan,[1] Ahmar Ijaz,[2] Husham Ahmad,[3] Adil Manzoor,[4] Irsa Andlleeb,[5] Altaf Ahmed[6]

Abstract

Background and Objective: Staphylococcus aureus (S. Aureus) is a major pathogen which is often colonized in the haemodialysis patient group which later on cause a widespread infection. Hence, leading to increased morbidity and mortality among these patients. This study was conducted to check the occurrence of nasal colonization of MRSA in patients undergoing chronic hemodialysis through different vascular accesses and its association with different risk factors such as diabetes, previous hospitalizations, antibiotic use and duration of hemodialysis.

Methods: This study was conducted at a dialysis center of a quaternary care hospital with a sample size of 109 involving non-probability consecutive sampling technique. Data was collected over the period of one month in January and February 2022. A swab was rotated four times 1.5cm deep inside in the anterior nares of each patient. All data was analyzed through SPSS version 22. p-value of <0.05 was considered significant with a confidence interval of 95%.

Results: 73% of the patients were male and 25% were diabetic. The participants were divided into different age groups. The occurrence of staphylococcus aureus was found out to be 26% out of which 11% were MRSA positive and 15% were MSSA positive. There was no association between the presence of these pathogens with duration of dialysis and type of vascular access along with presence of comobidities, previous use of antibiotics and episode of recent hospitalizations.

Conclusion: It can be concluded that approximately one fourth of the patients had nasal colonization of staphylococcus aureus with considerable patients having MRSA or MSSA positive. There was no significant association between the incidence of MRSA with age, gender, AV access, history of diabetes, previous hospitalizations or antibiotic use. These findings are contrary to the expected association with these risk factors.

Keywords: MRSA, hemo-dialysis, renal

How to cite: *Shah F,Ijaz A,Ahmad H, Manzoor A, Andleeb I, Ahmed A. Prevalence of nasal colonization of methicillin-resistant staphylococcus aureus (MRSA) in patients on chronic hemodialysis.JAIMC 2023; 21(3): 160-163*

As dialysis therapy results in frequent exposure of patient to the hospital environment, many studies have addressed the issue of spread of colonization strains into the environment by the patient or the healthcare worker[1]. Staphylococcus Aureus (S. aureus) is a major pathogen in the hemodialysis patient group and its colonization results in high risk of blood stream infection.[2]

The incidence of invasive MRSA (methicillin-resistant staphylococcus aureus) infection is >100 times higher among patients of chronic dialysis compared to general population,[3] this raises concerns regarding possible occult transmission within a dialysis unit.

Anterior nares provide a suitable medium for the S. aureus to colonize and survive for prolonged period.[4] Nasal bacterial flora gets modified with systemic antibiotic therapy. Risk factors of acquiring MRSA include the administration of multiple antibiotics.[5] The risk of infection is also dependent upon type of vascular access.[6] Central Venous Catheters (CVCs) are at the

1. *PKLI, Lahore*
2-6. *Department of Nephrology, PKLI, Lahore*

Correspondence:
Irsa Andlleeb ; *FCPS Nephrology; irsaandleebsohail@gmail.com*

Submission Date: 12-07-2023
1st Revision Date: 20-08-2023
Acceptance Date: 25-09-2023

highest risk of S. aureus associated VRS (Vancomycin Resistant Staphylococcus Aureus) whereas ateriovenous fistula (AVF) has lower infection rates.[7] Likewise, relatively more frequent use of CVCs as vascular access in type-II diabetics and delayed development of AVF, due to poor vascular anatomy, place them at a further higher risk of VRS.

Different treatment methods have been introduced for elimination of nasal carriage which has resulted in substantially lower incidence of infection. In order to limit the spread of MRSA and to obtain proper infection prevention procedures, the occurrence of nasal carriage of S. aureus must be investigated in patients having regular sessions in hemodialysis centers.[8]

The purpose of this research was to assess the prevalence of MRSA nasal carriage among hemodialysis patients in a tertiary care center in Pakistan.

METHODS

This analytical cross-sectional study was conducted in Pakistan Kidney and Liver Institute and Research Center (PKLI&RC) from January 2021 to April 2021. It involved non-probability consecutive sampling with sample size of 109 patients calculated using the standard formula. The study was approved by PKLI&RC institutional review board.

All the patients undergoing thrice weekly regular hemodialysis sessions of four hours per session for more than 3 months were included in this study. The total number of patients on regular hemodialysis at this institute are approximately 160.

After getting an informed consent from each participant. A sterile swab was rotated four times in anterior 1.5cm of each nostril. This swab was then placed on mannitol salt agar. It was left for incubation overnight at 35 degree celsius, after which mannitol fermenting colonies were selected and sub cultured on a Blood agar plates (BAP; Oxoid).[9] After another overnight incubation, these colonies were screened by using the DNase test and tube coagulase tests. The colonies having growth of S. aureus were then tested for oxacillin resistance by using 1-µg oxacillin and cefoxitin disk according to the recommendations of the Clinical Laboratory Standards Institute (CLSI).[10]

A purposeful structured performa was made for data collection and consent for each participant. It included age, gender, duration of hemodialysis, comorbidities, previous infections and hospitalization history. All the data was entered and analyzed using the Statistical package for the social sciences (SPSS) version 22. Mean and standard deviation was calculated for age and all other variables were represented as frequencies and percentages. The association of MRSA and MSSA colonization was observed with the variables mentioned above.

RESULTS

The mean age of study participants was 44.7 years with a standard deviation of 14.3. Majority of patients belonged to age group of 41-65 years. Males were 67% with male to female ratio of approximately 2:1. 53% (58) of the patients fell in the dialysis duration group of 2-5 years. 93%(101) of patients having arteriovenous fistula as arteriovenous access. Total 28 patients had positive culture for nasal swab, out of which 12 had MRSA and 16 had MSSA isolated. 27 patients had type 2 diabetes and 5 had history of recent pulmonary infections. 11 had experienced recent hospitalization and 9 had history of recent antibiotic use secondary to some infection as shown in table 1.

Table 2 shows the incidence of MRSA/MSSA in patients according to different sociodemographic characteristics with p-values. It was revealed that the middle age group 41-65 years, had 6 positive MRSA cultures with a p value of 0.441. MRSA was more prevalent in males with a frequency of 9 whereas there were only 3 positives cultures in females, p value 0.16. 26 positive samples belonged to patients having AVF as an AV access p value 0.471. Only 3 patients having history of diabetes were found out to be positive which is almost 10% of the total diabetic population, p value for MRSA 0.111. Only 1 patient having recent hospitalization was MRSA positive with a p value of 0.929. Furthermore, only 1 patient had MRSA isolated with a history of antibiotic use with a p-value of 0.895.

Table 1: Sociodemographic characteristics of study participants (n 109)

Characteristic	Frequency (%)
Age (yrs)	
Mean (44.7±14.3)	
15-40	43(39)
41-65	54(50)
>65	15(11)
Gender	
Male	73(67)
Female	36(33)
Hemodialysis duration	
<2 yrs	35(32)
2-5	58(53)
>5 yrs	16(15)
AV access	
Tunneled	7(6)
AVF	101(93)
AVG	1(1)
Presence of MRSA	12(11)
Presence of MSSA	16(15)
History of Diabetes	27(25)
History of Pulmonary infections	5(5)
History of recent hospitalization	11(10)
History of recent antibiotic use	10(9)

Table 2: Incidence of MRSA/MSSA according to sociodemographic characteristics.

Characteristic	MRSA	MSSA	p-value (MRSA)
Age			0.441
15-40	4	9	
41-65	6	7	
>65	2	0	
Gender			0.16
Male	9	12	
Female	3	4	
Duration of HD (years)			0.412
<2	5	6	
2-5	5	10	
>5	2	0	
AV access			0.471
Permcath	2	0	
AVF	10	16	
AVG	0	0	
Diabetes	2	1	0.111
History of Pumonary infections	1	0	0.555
History of previous hospitalization	1	2	0.929
History of anitbiotic use	1	1	0.895

DISCUSSION

This study is a research work performed in a single institute providing regular dialysis to the patients. The incidence of MRSA colonization was found out to be approximately 11% while 15% had MSSA colonization through nasal swab. A meta-analysis published by Zacharioudakis et al. revealed MRSA colonization in 7.2% of th heamodialys patietns which was much higher as compared to peritoneal dialysis number in the same study, which was 1.3%.[11]

A similar study conducted by Saxena et al. including 208 diabetic patients undergoing hemodialysis revealed MRSA colonization of 9.6% and MSSA in 28% patients[12]. While comparing this with our diabetic patients, the results revealed 7.4% MRSA and 3.8% MSSA nasal colonization. However, the results are not much comparable as there were only 26 diabetic patients in this study.

Resic et al. revealed MRSA colonization of 15.3% of the patients with an increased prevalence in higher age groups in contrast to this study where younger patients had a higher frequency of MRSA colonization.[12] This may be due to a higher number of patients being in the younger age group of <65 years of age. Which makes about 89% of the total study participants in this study. This shows that how renal diseases are not identified earlier in life because of difficult access to quality medical services. This leads to more people presenting to hospital already in end stage renal disease and needing dialysis.

Another study conducted by Lai et al. about all cause mortality due to MRSA infection in hemodialysis patients revealed a 2.46 fold increased risk of dying from any cause. However, the prevalence of MRSA was 9.48% which is 11% in this study but the history of recent hospitalization was 10% with a comparable sample size.[13]

As seen in similar studies in other parts of the world, we were unable to include health care professionals directly involved in care of these dialysis patients in our research due to lack of funding. Also, there was no follow up nasal swab culture performed after treatment for the same reason. Antibiotic sensitivity details

were also not recorded for these samples. According to Friedman's classification, infections in patients undergoing hemodialysis falls under healthcare-associated infections.[14] This research was performed on a small sample size in a single center. This center is a part of a specialized health institute with better resources if compared to other government centers. The results are not an accurate representation of the whole region where statistics may vary. In order to get a better estimate of prevalence of MRSA, a much bigger sample size is needed which involves multiple dialysis centers and the participants should also include healthcare workers in the dialysis center and family members living in the same household who are in direct contact with these patients. A follow up study in including the frequency of hospitalizations and mortality involving the carriers of MRSA should be conducted.

The prevalence of MRSA colonization in the study population was found out to be 11% and MSSA colonization was 15%. This is comparable with other similar studies where the percentage varies between 9% and 15%. There was no significant association estab-lished between MRSA positivity and age, gender, type of vascular access, comorbidities such as diabetes or with history of recent hospitalization or antibiotic usage.

CONCLUSION

There is a dire need to check colonization in related healthcare workers and family members of the patients and perform follow up studies for better infection control.

Conflict of Interest: *None*

Source of Funding: *None*

REFERENCES

1. Calfee DP, Durbin LJ, Germanson TP, Toney DM, Smith EB, Farr BM. Spread of methicillin-resistant Staphylococcus aureus (MRSA) among household contacts of individuals with nosocomially acquired MRSA. Infection Control & Hospital Epidemiology. 2003 Jun;24(6):422-6.
2. Saxena AK, Panhotra BR, Venkateshappa CK, Sundaram DS, Naguib M, Uzzaman W, Al Mulhim K. The impact of nasal carriage of methicillin-resistant and methicillin-susceptible Staphylococcus aureus (MRSA & MSSA) on vascular access-related septicemia among patients with type-II diabetes on dialysis. Renal failure. 2002 Jan 1;24(6):763-77.
3. Kallen AJ, Mu Y, Bulens S, Reingold A, Petit S, Gershman KE, Ray SM, Harrison LH, Lynfield R, Dumyati G, Townes JM. Health care–associated invasive MRSA infections, 2005-2008. Jama. 2010 Aug 11;304(6): 641-7.
4. Goldblum SE, WP R, JA U, RS G. Staphylococcal carriage and infections in hemodialysis patients.
5. Aly R, Maibach HI, Strauss WG, Shinefield HR. Effects of a systemic antibiotic on nasal bacterial ecology in man. Applied Microbiology. 1970 Aug;20(2):240-4.
6. Jindal K, Chan CT, Deziel C, Hirsch D, Soroka SD, Tonelli M, Culleton BF. Hemodialysis clinical practice guidelines for the Canadian Society of Nephrology. Journal of the American Society of Nephrology: JASN. 2006 Mar 1;17(3 Suppl 1):S1-27.
7. Berlyne GM. Hemodialysis Vascular Access: Practice and Problems. Nephron. 2000 Nov 1;86(3):406.
8. Sheikholeslami NZ, Tashakori M, Bahsoun M. The Effectiveness of the mupirocin ointment in treatment of nasal carriers of Staphylococcus aureus in medical staffs in Ali Ebne Abitaleb Hospital, Rafsanjan (Southeast of Iran). Trends in Medical Research. 2011;6:191-4.
9. Mainous AG, Hueston WJ, Everett CJ, Diaz VA. Nasal carriage of Staphylococcus aureus and methicillin-resistant S aureus in the United States, 2001–2002. The Annals of Family Medicine. 2006 Mar 1;4(2):132-7.
10. Humphries R, Bobenchik AM, Hindler JA, Schuetz AN. Overview of changes to the clinical and laboratory standards institute performance standards for antimicrobial susceptibility testing, M100. Journal of clinical microbiology. 2021 Nov 18;59(12):10-128.
11. Zacharioudakis IM, Zervou FN, Ziakas PD, Mylonakis E. Meta-analysis of methicillin-resistant Staphylococcus aureus colonization and risk of infection in dialysis patients. Journal of the American Society of Nephrology: JASN. 2014 Sep;25(9):2131.
12. Resić H, Corić A, Dedeić-Ljubović A, Hukić M, Avdić E, Kukavica N. Prevalence of MRSA infections in patients on hemodialysis. Medicinski Pregled. 2007 Jan 1;60:97-100.
13. Lai CF, Liao CH, Pai MF, Chu FY, Hsu SP, Chen HY, Yang JY, Chiu YL, Peng YS, Chang SC, Hung KY. Nasal carriage of methicillin-resistant Staphylococcus aureus is associated with higher all-cause mortality in hemodialysis patients. Clinical journal of the American Society of Nephrology: CJASN. 2011 Jan; 6(1): 167.
14. Friedman ND, Kaye KS, Stout JE, McGarry SA, Trivette SL, Briggs JP, Lamm W, Clark C, MacFarquhar J, Walton AL, Reller LB. Health care–associated bloodstream infections in adults: a reason to change the accepted definition of community-acquired infections. Annals of internal medicine. 2002 Nov 19;137(10): 791-7.