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Staphylococcus aureus in Hemodialysis Unit: A Comparative Study between Patients and Medical Staff

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المكورات العنقودية الذهبية في وحدة غسيل الكلى: دراسة مقارنة بين المرضى والطاقم الطبي

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Abstract
Background: patients undergoing dialysis are more susceptible to *S. aureus* infection due to their health condition and the presence of medical equipment, making them vulnerable to hospital-acquired infections. This study focuses on determining the prevalence of *S. aureus*colonization among patients as well as among medical staff. Results: A total of 217 samples were collected the percentage among bacterial species were *S. aureus* 60 (27.7%) isolated bacteria. There was significant association between age groups and infection with *S. aureus* (P≤ 0.05) of all positive *S. aureus*, the most infections occurred in the age groups (48–64 years) as compared to other age groups (24; 42.1%) of patients, as well as, the most infections occurred in the age groups (48–64 years) as compared to other age groups (8; 27.6%) of medical staff. Males showed significantly higher positive the carriage rate of S. aureus (30; 35.3%) in patients and (12; 21.8%) in medical staff as compared to females (12; 33.3%), (6; 14.6%) in patients and medical staff respectively, there was a statistical difference between the duration of disease with hemodialysis and carriers of S. aureus at P≤ 0.05. The duration of disease with haemodialysis ≤60 months were higher carriage (11; 42.3%) compared to the duration of disease with haemodialysis ≥60 months (31; 32.6%). Conclusion: this study demonstrated a high prevalence of *S. aureus* in the nose and hands of hemodialysis patients and medical staff in the study area. These findings, call for an urgent need to establish prevention and control measures of *S. aureus* among patients as well as among medical staff.

Keywords: *Staphylococcus aureus*, Hemodialysis Unit, Patients and Medical Staff.

الملخص
المرضى الذين يخضعون لغسيل الكلى أكثر عرضة للإصابة بعدوى المكورات العنقودية الذهبية بسبب حالتهم الصحية ووجود المعدات الطبية، مما يجعلهم عرضة للعدوى المكتسبة من المستشفى. تركز هذه الدراسة على تحديد مدى انتشار المكورات العنقودية الذهبية بين المرضى وكذلك بين الطاقم الطبي. النتائج: تم جمع ما مجموعه 217 عينة وكانت النسبة المئوية بين الأنواع البكتيرية هي 60 (27.7٪) من البكتيريا المعزولة. كان هناك ارتباط كبير بين الفئات العمرية والإصابة بالمكورات العنقودية الذهبية (P ≤ 0.05) من جميع المكورات العنقودية الذهبية الإيجابية، كانت أكثر الإصابات في الفئات العمرية (48-64 سنة) مقارنة بالفئات العمرية الأخرى (24؛ 42.1٪) من المرضى، وكذلك كانت أكثر الإصابات في الفئات العمرية (48-64 سنة) مقارنة بالفئات العمرية الأخرى (8؛ 27.6٪) من الطاقم الطبي. أظهر الذكور معدل إيجابي أعلى بكثير لمكورات العنقودية الذهبية (30 ؛ 35.3٪) في المرضى و (12؛ 21.8٪) في الطاقم الطبي مقارنة بالإناث (12؛ 33.3٪) و (6؛ 14.6٪) في المرضى والطاقم الطبي على التوالي، وكان هناك فرق إحصائي بين مدة المرض مع غسيل الكلى وحاملي المكورات العنقودية الذهبية عند P ≤ 0.05. كانت مدة المرض مع غسيل الكلى ≥ 60 شهرًا أعلى (11؛

42.3٪) مقارنة بمدة المرض مع غسيل الكلى ≤ 60 شهرًا (31؛ 32.6٪). الخلاصة: أظهرت هذه الدراسة ارتفاع معدل انتشار المكورات العنقودية الذهبية في أنف وأيدي مرضى غسيل الكلى والطاقم الطبي في منطقة الدراسة. تدعو هذه النتائج إلى الحاجة الملحة إلى وضع تدابير للوقاية والسيطرة على المكورات العنقودية الذهبية بين المرضى وكذلك بين الطاقم الطبي.

الكلمات المفتاحية: المكورات العنقودية، وحدة الغسيل الكلوي، المرضى، الطاقم الطبي.

Introduction

Staphylococcus aureus is one of the most significant pathogens in both community and hospital settings, responsible for a wide range of infections such as bacteremia, endocarditis, osteomyelitis, pneumonia, and wound infections [1]. In haemodialysis patients, *S. aureus* poses a particularly severe risk because of repeated vascular access, immunosuppression, and continuous exposure to healthcare environments [2]. Studies have shown that the prevalence of S. aureus nasal carriage among haemodialysis patients 26.4%, and methicillin-resistant *S. aureus* (MRSA) infections are common among this group [3]. Healthcare workers are also key reservoirs and transmitters of *S. aureus*, and cross-contamination between medical staff and patients remains a critical concern [4].

Globally, the burden of *S. aureus* infections in haemodialysis units continues to rise. The Centers for Disease Control and Prevention (CDC) estimate that up to 30% of S. aureus bacteremia cases are associated with dialysis procedures, especially when catheters are used [5]. Molecular epidemiology studies from Europe and Asia have revealed that identical *S. aureus* clones can circulate between dialysis patients and healthcare workers, indicating the need for strict infection-control programs [6].

In Libya, limited data are available regarding *S. aureus* colonization and antimicrobial resistance among haemodialysis patients and medical staff. However, existing local studies suggest a concerning trend. For instance, [7] reported a high prevalence of MRSA among hospitalized patients in Tripoli. More recently, [8] and [9] detected multidrug-resistant *S. aureus* isolates in clinical settings across Libyan hospitals, emphasizing the need for continuous surveillance and infection-control interventions. Despite these findings, little is known about the relationship between *S. aureus* strains isolated from haemodialysis patients and healthcare personnel within the same dialysis centers in Libya. Therefore, this study aims to isolate and characterize *S. aureus* strains from haemodialysis patients and healthcare staff in Libyan dialysis centers. The study focuses on determining the prevalence of colonization. This research will provide critical insights for infection control strategies and help reduce *S. aureus*–related morbidity and mortality in haemodialysis facilities across Libya.

Material and methods

Sample and data Collection

A collection of 217 samples was obtained. Of that number, 121 samples were from nasal swabs from hemodialysis patients and 96 samples were from medical personnel who worked with those patients. Medical personnel's samples consisted of 63 nasal swabs and 33 hand swabs. The collection of nasal and hand swabs from medical personnel will allow an analysis of medical personnel's nasal and hand colonization, present in Kidney Diseases and Dialysis Center in Zintan City and Gharyan Central Teaching Hospital Kidney Department, Libya, during 2022. Information about the participants were collected via a questionnaire, from patients with hemodialysis, such as the patient's age and the duration of the disease, and also, taking the questionnaire from the medical staff (doctors, nursing staff and workers) age, gender and profession.

Bacteria identification

Samples were obtained from the front part of the nostrils using sterile dry cotton swabs immersed in normal saline solution (0.9%), and from the hands, the swab was passed between the fingers and the palm of the hand. Following collection, all samples were cultured in selective media blood agar and subsequently on Mannitol salt agar plates, and incubation at 37°C for a period of 24-48 hours. Once well isolated colonies were observed, they were subjected to Gram staining and further biochemical tests including catalase and coagulase tests.

Statistical Analysis

The data were statistically analyzed using SPSS, version 26. Descriptive analysis was used Chi-square test to detect the significance between gender, age group, profession and duration of the disease. Significant differences was considered if P-values ≤ 0.05.

Results

Characterization and identification of *S. aureus*

Blood agar rich medium is used to grow and isolate *S. aureus* as well as to detect its ability to produce a clear area of lysis. On blood agar, hemolysis of the agar was found in the area surrounding of *S. aureus* colony, in the form of smooth convex circular colonies with diameters ranging from 2-3 mm.

Mannitol salt agar is the selective differential environment for growth Staphylococcus species. *S. aureus* were capable of fermenting Mannitol (phenol red, to turn yellow) surrounding colonies, however *S. epidermidis* were not. *Staphylococcus aureus* appeared as Gram-positive, spherical cells arranged in characteristic clusters when observed under the light microscope.

The catalase test is very important to differentiate between *S. aureus* and other coagulase negative Staphylococcus species, bubbles of oxygen was observed for catalase-positive. As well as, Coagulase test differentiates *S. aureus* from other coagulase negative Staphylococcus species. The cells of *S. aureus* were appeared clustered or close together, which means the test is positive as shown in Plate (1 A and B).

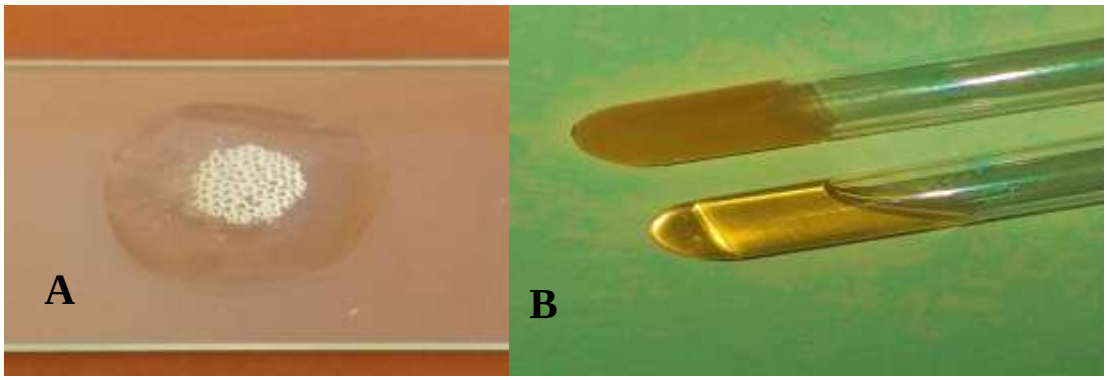

Plate 1: (A&B). A.catalase test of*S. aureus*. B. Coagulase Test of *S. aureus*

Isolation bacteria

A total of 217 samples were collected (121 nasal swabs from patients, 63 nasal swabs from medical staff and 33 hand swabs from medical staff). The highest percentage among bacterial species were S. epidermidis 135 (62.2%), then *S. aureus* 60 (27.7%) and the lowest percentage was Streptococcus Spp. 6 (2.8 %) isolated bacteria, as shown in Table 1.

Table 1 . Types and percentage of isolated bacteria.

Type of bacteria isolated	No.	%
S. epidermes	135	62.2
S. aureus	60	27.7
Bacillis Bacteria ve+	12	5.5
Bacillis Bacteria ve-	4	1.8
Streptococcus Spp	6	2.8
Total	**217**	**100%**

Out of the total 217 samples examined in this study, *S. aureus* was found to be present in 27.7% (60 samples). In addition, a high prevalence of *S. aureus* among hemodialysis patients was found to be 34.7% (42 samples) while among medical personnel 27% (17 samples) of their nasal swabs were positive with *S. aureus*, and only one sample from hand swabs (3%). This is summarized below in Table 2 detailing the distribution of samples for the presence or absence of *S. aureus*.

Table 2: Number and percentage of isolated *S. aureus* in samples.

Samples		Postive		Negitive		Total	
		No.	%	No.	%	No.	%
Patients		42	34.7%	79	65.3%	121	100%
medical staff	Nose	17	27%	46	73%	63	100%
	Hand	1	3%	32	97%	33	100%
Total		**60**		**157**		**217**	

In Table 3, shows that, There was significant association between age groups and infection with S. aureus (P≤ 0.05) of all positive *S. aureus*, the most infections occurred in the age groups (48–64 years) as compared to other age groups (24; 42.1%) of patients, as well as, the most infections occurred in the age groups (48–64 years) as compared to other age groups (8; 27.6%) of medical staff. However, the less infection occurred in the age groups (31-47 years) (9; 24.3%) of patients, while (≥30) (4; 10.3%) of medical staff.

Table 3:Number and percentage of positive samples of *S. aureus* in different age groups of samples.

Age group	patients						medical staff					
	Positive		Negative		Total		Positive		Negative		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
≥30	3	33.3	6	66.7	9	100	4	10.3	35	89.7	39	100
31-47	9	24.3	28	75.7	37	100	5	20.8	19	79.2	24	100
48-64	24	42.1	33	57.9	57	100	8	27.6	21	72.4	29	100
≤65	6	33.3	12	66.7	18	100	1	25	3	75	4	100
Total	**42**		**79**		**121**		**18**		**78**		**96**	

Males showed significantly higher positive the carriage rate of *S. aureus* (30; 35.3%) in patients and (12; 21.8%) in medical staff as compared to females (12; 33.3%), (6; 14.6%) in patients and medical staff respectively, as shown in table 4. The difference was statistically significant (P ≤ 0.05).

Table 4: Number and percentage of positive samples of *S. aureus* in gender of samples.

Gender	Patients						medical staff					
	Positive		Negative		Total		Positive		Negative		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	30	35.3	55	64.7	85	100	12	21.8	43	78.2	55	100
Female	12	33.3	24	66.7	36	100	6	14.6	35	85.4	41	100
Total	**42**		**79**		**121**		**18**		**78**		**96**	

Higher carriage, (30; 51.7 %) of *S. aureus* was recorded in the employee patient as compared to retired patient (12; 19%). There was statistical significant difference (P≤ 0.05) between professions of patients. While highest carriage, (7; 25.9%) of *S. aureus* was recorded in the workers, followed by (5; 17.2%) in the doctors, then (6; 15%) in the nursing staff. There was also statistical significant difference (P≤ 0.05) between professions of medical staff.

Table 5: Number and percentage of positive samples of *S. aureus* in profession of samples.

Profession	Positive		Negative		Total	
	No.	%	No.	%	No.	%
Employee patient	30	51.7	28	48.3	58	100
Retired patient	12	19	51	81	63	100
Total	42		79		121	
Doctors	5	17.2	24	82.8	29	100
Nursing staff	6	15	34	85	40	100
Workers	7	25.9	20	74.1	27	100
Total	**18**		**78**		**96**	

Table 6. Shown that, there was a statistical difference between the duration of disease with hemodialysis and carriers of *S. aureus* at P≤ 0.05. The duration of disease with haemodialysis ≤60 months were higher carriage (11; 42.3%) compared to the duration of disease with haemodialysis ≥60 months (31; 32.6%).

Table 6: Number and percentage of positive samples of *S. aureus* in duration of samples.

Duration of the disease	Positive		Negative		Total	
	No.	%	No.	%	No.	%
≥60 months	31	32.6	64	67.4	95	100
≤60 months	11	42.3	15	57.7	26	100
Total	**42**		**79**		**121**	

Discussion

S. aureus is the most dangerous of all of the many common staphylococcal bacteria, which causes a wide range of clinical infections and mortality among hemodialysis patients. In this study shown 27.7% of prevalence of *S. aureus* among hemodialysis patients and medical staff. However more than that reported by [10] 37.5%, of prevalence of *S. aureus*, among all microorganisms isolated from 65 patients hemodialysis in Janzour kidney service center, Tripoli, Libya. While there are many studies found less than that, in East Africa, nasal carriage of *S. aureus* was detected in 80 hemodialysis and healthcare workers (19.4%) [11] and in the Nephrology Clinic at Hospital Canselor Tuanku Muhriz (HCTM), in Kuala Lumpur, Malaysia, shown that (20.1%) of *S. aureus* isolates were detected from 27 patients [12]. On the other hand, the nasal carriage rate of S. aureus was found to be 24.4% and 18.8% in patients on hemodialysis and healthcare workers respectively [13]. In this study, the nasal carriage rate of *S. aureus* was high 34.7% and 27% of patients and medical staff. The high prevalence of *S. aureus* among medical staff and patients in our study may indicate the need for better infection prevention and control practices in our community.

The current study showed that, the highest prevalence of *S. aureus* was in the age group (48-64) years among patients 42.1% as compared to the study conducted by [14] in Tanzania which showed 31.8% in the age group (31–60) years. As alternatively, [15] reported that a higher rate (52.6%) of the age group (30-59) years. While older age is usually linked to lower immunity, it is plausible that people aged 48 to 64 are more likely to fall ill due to increased exposure from more hospital visits and social and professional interactions compared to those over 65 years. The lower carriage observed in patients over 65 years can be due to less mobility, more social isolation, and more rigid infection control policies.

The findings of this study showed that, there were significant difference at ($P \leq 0.05$) of S. aureus prevalence in male and female patients, male patients were higher as compared to females 35.3%, 33.3% respectively. The higher prevalence of *S. aureus* in male patients compared to female patients is consistent with other studies conducted on hemodialysis patients, The study conducted by [16] in India, as well as, [14] in Tanzania were 66%, 54.5% of malesrespectively. The reason for the differences between the gender may be in hygiene practices and behavior such as washing hands and using soap or doing work that requires physical contact and occupation also could be attributed to hormonal and physiological factors.

even though, in 2019, [17] reported that there were no significant differences prevalence of *S. aureus* during the duration of infection. On the other hand, the current study showed that the highest prevalence of *S. aureus* for the duration of infection ≤60 months was 42.3%, and other study conducted on patients with hemodialysis showed 64.8% for duration > 3 months by [16] in India.

Conclusion

This study demonstrated a high prevalence of *S. aureus* in the nose and hands of hemodialysis patients and medical staff in the study area. These findings call for an urgent need to establish prevention and control measures of *S. aureus* among patients as well as among medical staff. We recommend conducting a study to determine the prevalence of antibiotic-resistant *S. aureus*.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

References

[1] Tong, S. Y. C., Davis, J. S., Eichenberger, E., Holland, T. L., & Fowler, V. G. (2015). Staphylococcus aureus infections: Epidemiology, pathophysiology, clinical manifestations, and management. Clinical Microbiology Reviews, 28(3), 603–661.

[2] Bezerra, D. T., Mesquita-Ferrari, R. A., Fernandes, K. P. S., Bussadori, S. K., Motta, L. J., Ando-Suguimoto, E. S., ... & Horliana, A. C. R. T. (2025, January). Prevalence of Nasal *Staphylococcus aureus* Carriage in Patients Undergoing Hemodialysis and Assessment of Risk Factors: A Cross-Sectional Study of Outpatients at a University Hospital. In Healthcare (Vol. 13, No. 3, p. 245). MDPI.

[3] Grothe, C., Taminato, M., Belasco, A., Sesso, R., & Barbosa, D. (2014). Screening and treatment for *Staphylococcus aureus* in patients undergoing hemodialysis: A systematic review and meta-analysis. BMC Nephrology, 15(1), 202

[4] Moremi, N., Claus, H., Vogel, U., & Mshana, S. E. (2019). The role of patients and healthcare workers *Staphylococcus aureus* nasal colonization in occurrence of surgical site infection among patients admitted in two centers in Tanzania. Antimicrobial Resistance & Infection Control, 8(1), 102.

[5] Rha, B. (2023). Vital signs: Health disparities in hemodialysis-associated *Staphylococcus aureus* bloodstream infections—United States, 2017–2020. MMWR. Morbidity and mortality weekly report, 72

[6] Nandhini, P., Kumar, P., Mickymaray, S., Alothaim, A. S., Somasundaram, J., & Rajan, M. (2022). Recent developments in methicillin-resistant *Staphylococcus aureus* (MRSA) treatment: a review. Antibiotics, 11(5), 606.

[7] Aetrugh, S., Aboshkiwa, M., Husien, W., Erhuma, M., Corrente, M., Grandolfo, E., ... & Mustafa, M. (2017). Antimicrobial resistance profile and molecular characterization of methicillin-resistant Staphylococcus isolates in Tripoli Central Hospital, Libya. Libyan International Medical University Journal, 2(01), 74-83

[8] Moman, R., Moman, R. M., Alsaid, A. M., & Furarah, A. M. (2023). Prevalence of nasal carriage of methicillin-resistant *Staphylococcus aureus* among healthcare workers in Tarhuna and mesllata hospitals. Emerg Technol Innov Res, 10.

[9] Ibrahim, K., Thwood, D., ELgheriani, H., Salem, M., Elgadiym, Z., Zaghdani, A., & Elzagheid, A. (2024). Prevalence of multi-drug resistant bacteria in intensive care units at Tripoli University Hospital, Tripoli, Libya. Libyan Journal of Medicine, 19(1), 2348235.

[10] Etumi, N. E. H. (2024). Complication of Hemodialysis Catheter Bloodstream Infections: Impact of Infecting Organism. International Science and Technology Journal, 34, 1-16.

[11] Serem, E. (2020). Comparison of *Staphylococcus aureus* nasal carriage by patients and healthcare workers in selected dialysis centers in Nairobi and neighbouring counties.

[12] Sukri, K. M., Mohamed, N. A., Isahak, I., & Marwan, A. A. (2023). Prevalence and Susceptibility of *Staphylococcus aureus* Nasal Carriage Strains Isolated from Haemodialysis Patients. Malaysian Journal of Medicine & Health Sciences, 19.

[13] Saffari, F., Radfar, A., Sobhanipoor, M. H., & Ahmadrajabi, R. (2020). Spa gene-based molecular typing of nasal methicillin-susceptible *Staphylococcus aureus* from patients and health-care workers in a dialysis center in southeast Iran. Pathogens and Global Health, 114(3), 160-163.

[14] Joachim, A., Moyo, S. J., Nkinda, L., Majigo, M., Mmbaga, E., Mbembati, N., & Lyamuya, E. F. (2017). Prevalence of methicillin-resistant *Staphylococcus aureus* carriage on admission among patients attending regional hospitals in Dar es Salaam, Tanzania. BMC research notes, 10, 1-7.

[15] Kang, Y. C., Tai, W. C., Yu, C. C., Kang, J. H., & Huang, Y. C. (2012). Methicillin-resistant *Staphylococcus aureus* nasal carriage among patients receiving hemodialysis in Taiwan: prevalence rate, molecular characterization and de-colonization. BMC infectious diseases, 12, 1-7.

[16] Devraj, A., Siva Tez Pinnamaneni, V., Biswal, M., Ramachandran, R., & Jha, V. (2016). Extranasal *Staphylococcus aureus* colonization predisposes to bloodstream infections in patients on hemodialysis with noncuffed internal jugular vein catheters. Hemodialysis International, 21(1), 35-40.

[17] Ghavghani, F. R., Rahbarnia, L., Naghili, B., Dehnad, A., Bazmani, A., Varshochi, M., & Ghaffari Agdam, M. H. (2019). Nasal and extra nasal MRSA colonization in hemodialysis patients of north-west of Iran. BMC Research Notes, 12, 1-5.K. Elissa, "Title of paper if known," unpublished.
