

A Cross-Sectional study of the incidence and bacteriological profile of vascular access infections among chronic hemodialysis patients at a dialysis unit in Maysan governorate

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Abstract

This study aimed to determine the incidence, causative organisms, and bacterial profile of vascular access infections among chronic hemodialysis patients at dialysis unit. A Cross-Sectional design was used from January to June 2025 among 60 patients. Swabs and blood cultures were obtained from infected sites and processed using standard bacteriological techniques. The infection of the Vascular system is one of the most frequent and serious complications encountered in hemodialysis patients. Out of 60 patients, 17 (28.3%) developed access-related infections. Staph. aureus was the most frequent isolate (47%), followed by P. aeruginosa (23%), Escherichia coli (17%), and Klebsiella pneumoniae (13%). Infection was more common in arteriovenous AVS (40%) than AVF (22.5%). The study found that the most common type of bacteria among dialysis patients was Staphylococcus aureus, with a high prevalence of approximately 28%. Furthermore, its spread in patients with vascular access is more dangerous than arteriovenous fistula infection. This necessitates increased health awareness among dialysis unit staff and the implementation of important health protocols.

Keywords: Hemodialysis, AV fistula, Shunt, Bacteriology

Introduction

Hemodialysis is a life-saving therapy for patients with End-Stage Renal Disease (ESRD) as a defiant the kidneys are no longer able to filter waste products and excess fluid from the blood sufficiently to meet the body's needs and are functioning abnormally [1-2]

This leads to an increased buildup of waste and fluid, such as in cases of uremia, resulting in the need for dialysis or possibly a kidney transplant to survive. Therefore, in the United States, more than 500,000 people live with end-stage renal disease (ESRD) [3]. ESRD can progress to chronic kidney disease (CKD) and often leads to end-stage renal disease, a major cause of reduced quality of life and often premature death [4-5]. however, A reliable vascular access is essential for effective treatment, yet it also represents a major potential route of infection. Vascular access infections are associated with increased hospitalization, morbidity, and mortality [6]. The two primary types of permanent vascular access are the arteriovenous fistula (AVF) and the arteriovenous graft (AVG) [7-8].

Although the AVF is generally preferred for its lower infection rate and longer patency, both types are vulnerable to bacterial colonization due to repeated needle punctures, poor hygiene, or contaminated dialysis equipment [9]. Common causative organisms include Staphylococcus aureus, Staphylococcus epidermidis, Pseudomonas aeruginosa, E. coli, and Klebsiella species. These organisms can cause local cellulitis, abscesses, and in severe cases, sepsis or infective endocarditis [10]. Understanding the bacterial pattern in each dialysis unit is crucial for guiding empirical antibiotic therapy and infection control measures [11-12]. Therefore, determining the incidence rate, causative organisms, and bacterial profile of vascular access infections becomes clear in order to reduce the risk of infection, decrease the incidence of kidney failure, and reduce the mortality rate among those infected, to need the determine the incidence of vascular access infections by chronic hemodialysis patients. study the identify the bacterial species responsible for these infections and to compare infection rates between arteriovenous fistula and shunt access types to reach the recommend preventive strategies based on the findings.

Materials and Methods

This current study was conducted as a cross-sectional observational study at the dialysis unit of Al-Manara University Teaching Hospital in Maysan Governorate, Iraq, from January 1 to June 30, 2025. The study included 60 adult patients undergoing chronic hemodialysis who were admitted to the hospital with an arteriovenous fistula or shunt for at least three months. The criteria for inclusion were based on the presence of a functional vascular access, while exclusion was based on vascular access difficulties, systemic infections unrelated to dialysis, or prior antibiotic treatment. Clinical examination was performed on all patients in the current study to confirm the presence of infection within the vascular access site. This was further confirmed by taking samples from infected areas of the patient's body before each dialysis session. These samples were then sent to the microbiology laboratory. Samples were cultured on blood agar and MacConkey agar and incubated at 37°C for 24-48 hours [13]. Bacterial isolates were identified based on colonization morphology, Gram staining, and standard biochemical tests. Antibiotic susceptibility testing

was performed using the Kirby-Bauer disc diffusion method according to the Clinical Laboratory Standards Institute (CLSI) guidelines [14].

Statistical analysis: The results of the structural analyses in the current study were analyzed using SPSS version 26. Quantitative variables were expressed as mean \pm standard deviation, while qualitative structural variables were expressed as frequencies and percentages. The chi-square test was used to compare the incidence of bacterial infection among different types of vascular access, while the independent samples t-test was used when necessary to compare numerical variables between groups. A significance level of less than 0.05 ($p < 0.05$) was considered the cutoff for statistical significance [15]

Results

The results of the current study, which included 60 patients using both types of vascular access methods for hemodialysis, showed that 40 patients had an Arteriovenous Fistula (AVF) and 20 had an (AVS). As shown in Table 1 and Figure 1, A total of 17 infections was documented, representing an overall infection rate of 28.3%.

Table 1: percentage the bacterial infection type with av fistula and AV shunt

| Access Type | No. of Patients | Staph. aureus | P. aeruginosa | E. coli | Klebsiella pneumoniae |
|-------------|-----------------|---------------|---------------|---------|-----------------------|
| AVF | 40 | 5 | 2 | 1 | 1 |
| AVS | 20 | 3 | 2 | 2 | 1 |
| Total | 60 | 8 (47%) | 4 (23%) | 3 (17%) | 2 (13%) |

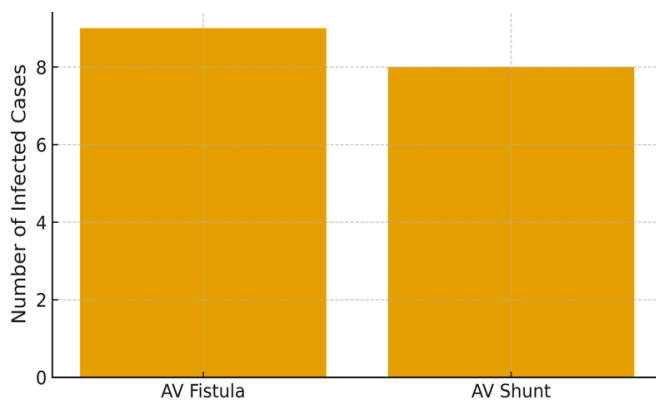


Figure 1: Difference between the types of patients with hemodialysis

The AV shunt group had the highest infection rate, with 8 cases (40%), compared to 9 cases (22.5%) in the AV fistula group. Regarding the causative agents of bacterial pathogens in hemodialysis, the most common are Staph. aureus, P. aeruginosa, E coli, and, to a lesser extent, as Klebsiella pneumoniae, with varying infection rates: (8) 47%, (4) 23%, (3) 17%, and (2) 13%, respectively, as shown in Figure 2. This can also be observed from the similarity in bacterial distribution between the two groups in the current study, with Staph aureus predominating in both the AVF and AVS, as illustrated in Figure 4.

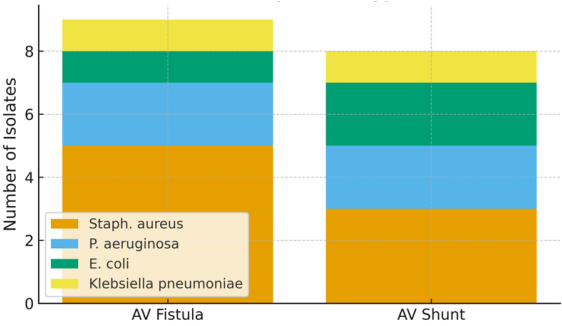


Figure 2: Infection by bacteria in type hemodialysis patients

In the current study, the mean age was 55 ± 14 years per patient, and the male-to-female ratio was 1.3:1. As shown in Table 2 and Figure 3, the incidence rates were significantly higher among shunt users compared to those with arteriovenous fistulas in dialysis patients 40% and 22.5%, respectively.

Table 2: The Bacterial infection type with AVF and AVS

| Type | No. of non-infection | No. Infection | Male | Female |
|-------|----------------------|---------------|------|--------|
| AVF | 31 | 9 (22.5%) | 6 | 3 |
| AVS | 12 | 8 (40.0%) | 5 | 3 |
| Total | 43 | 17 (28.3%) | 11 | 6 |

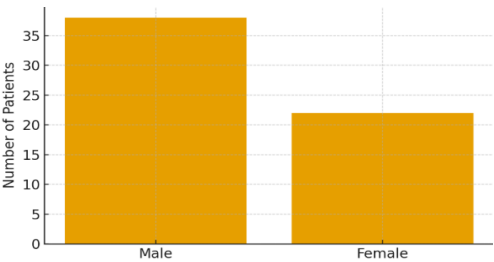


Figure 3: Difference in incidence rate between the sexes in dialysis patients

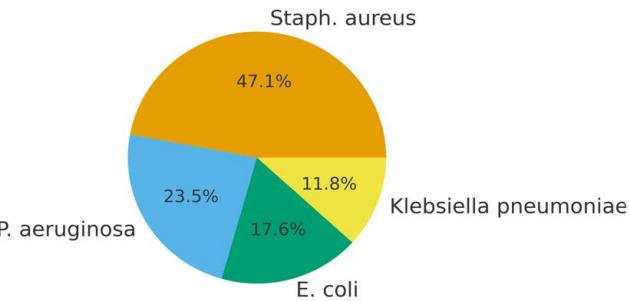


Figure 4: Distribution of causative agents among bacterial types among dialysis patients

Discussion

The table results indicate that the incidence of vascular access site infections in hemodialysis patients was increased among those with AVS compared to those with AVF. This aligns with recent studies such as in 2010 and 2025 [16-17] which confirms a decreased rate of inflammatory complications characterizes compared to AVS compared to AVF due to a reduced likelihood of bacterial colonization and fewer surgical interventions[18-19]. However, the results also showed that Staph. aureus was the most common pathogen, accounting for 47% of cases, consistent with [20], also this is consistent with recent clinical reports indicating that Staph. aureus particularly Staph. aureus remains the leading cause of vascular access site infections in dialysis patients [21], due to its high biofilm formation capacity [22-23]. In contrast, Pseudomonas aeruginosa, E. coli, and Klebsiella pneumoniae were found at lower rates, ranging from 13% to 23%, which is consistent with other research on the prevalence of gram-negative bacteria in cases of late-stage infection or those associated with poor sterilization or repeated catheterization [24-25].

The current study underscores the importance of adhering to established and rigorous protocols for managing vascular access. It also highlights the importance of hygiene for nurses and staff in the dialysis unit, including disinfection of access sites before catheter insertion, to minimize infection. This is further emphasized by following the updated KDOQI guidelines for 2022, as highlighted by 2022 and 2024 [26-27].

Conclusion

Bacterial infections at the vascular access site remain the most serious obstacle and challenge for chronic hemodialysis patients. The incidence rate of 28% is high in this group, and Staph. aureus is the most common causative agent. Furthermore, vascular access infections are more dangerous than arteriovenous fistula infections. Therefore, increased monitoring and awareness among dialysis center staff are crucial. Implementing hygiene and public health standards and protocols can help reduce infection rates among patients undergoing chronic hemodialysis. Focusing on this type of infection in dialysis patients is essential to raise awareness and

achieve a comprehensive understanding of infection prevention

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