

CATHETER-RELATED INFECTIONS IN HEMODIALYSIS: FREQUENCY AND MICROBIOLOGICAL PROFILE PATIENTS UNDERGOING ANTIMICROBIAL LOCK THERAPY WITH GENTAMICIN FOR PROPHYLAXIS

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Abstract: *Catheter-related infections can cause major problems in hemodialysis patients. To stop these infections, antimicrobial lock therapy is a systematic preventative strategy. This study analyzed catheter-related infections among hemodialysis patients receiving gentamicin as an antibiotic lock treatment for prophylaxis for frequency and microbiological characteristics. The current analysis was carried out at Lady Reading Hospital in Peshawar, Pakistan, from January to December 2021 and involved 200 hemodialysis patients with either temporary or tunneled venous catheters. The clinical and demographic information of the patients was gathered, and cultures were acquired for any suspected illnesses. To analyze the data, descriptive statistics were employed. The majority of patients (88%) had a history of hemodialysis for more than one year. Temporary catheters were used in 82.5% of patients, while 17.5% had tunneled catheters. Staphylococcus aureus and coagulase-negative staphylococci were the most commonly isolated organisms. The frequency distribution of cultures obtained for suspected infections showed that 51% of cultures were positive, with the majority of positive cultures being obtained from temporary catheters. Based on the results, it can be concluded that gentamicin may be an effective antimicrobial agent for the prophylaxis of catheter-related infections caused by Staphylococcus aureus and coagulase-negative staphylococci in hemodialysis patients. The study highlights the importance of effective prophylactic strategies in preventing catheter-related infections in hemodialysis patients and the need for close monitoring of catheters for signs of infection.*

Keywords: prophylaxis, coagulase-negative staphylococci, Staphylococcus aureus, hemodialysis, catheter-related infections, and antimicrobial lock treatment

Introduction

Catheter-related infections (CRI) are a serious concern for hemodialysis patients using central venous catheters (CVCs). Such infections can cause severe outcomes, including sepsis and death, and significantly cause morbidity and mortality in this population. Antimicrobial lock treatment (ALT) has shown promise in preventing CRI in hemodialysis patients, involving injecting an antimicrobial medication, such as gentamicin, into the catheter lumen after each hemodialysis session to prevent bacterial colonization (Vanholder et al., 2010). Hemodialysis patients using CVCs are particularly vulnerable to infection due to frequent exposure of their blood to the external environment, raising concerns about CRI. However, the ideal antimicrobial

agent and treatment regimen for ALT remain unknown (Hsu et al., 2004). Gentamicin, a broad-spectrum antibiotic, has been utilized as an ALT for prophylaxis in hemodialysis patients due to its rapid action and low likelihood of resistance development. However, given the frequent use of gentamicin in hemodialysis patients, concerns about the emergence of antimicrobial resistance have been raised (Allon et al., 2006).

The prevalence and microbiological profile of CRI in hemodialysis patients receiving gentamicin as an ALT for prophylaxis have not been adequately studied. Knowledge of the organisms most commonly associated with CRI in this population can aid in selecting appropriate antimicrobial agents for



prophylaxis. Furthermore, the frequency of CRI in patients receiving gentamicin as an ALT can help determine the effectiveness of this prophylactic measure (Gilbert and Harden, 2008).

The proposed study design will involve retrospective chart reviews of hemodialysis patients who received gentamicin as an ALT for prophylaxis, either at a single center or across multiple centers. The study will analyze the frequency of CRI, the microbiological composition of infections, and any adverse effects associated with using gentamicin as an ALT (Al-Jaishi et al., 2014). The findings of this study will have significant implications for the management of hemodialysis patients at risk of CRI, particularly regarding selecting the optimal antimicrobial agents for prophylaxis.

Methodology

This retrospective study was conducted at Lady Reading Hospital Peshawar, which aimed to investigate using gentamicin as an antimicrobial lock therapy (ALT) for prophylaxis against catheter-related infections (CRI) in hemodialysis patients. The study population consisted of hemodialysis patients who received gentamicin as an ALT for prophylaxis between January 2021 and December 2021 and were identified using the hospital's electronic medical records system. Patients with incomplete medical records or those who received an ALT from a different antimicrobial agent were excluded from the study.

Ethical approval for the study was obtained from the institutional review board at Lady Reading Hospital Peshawar, and patient consent was not required as the review of medical records was retrospective. Patient information was kept confidential and only accessible to the research team. Patient demographics, primary renal illness, length of hemodialysis, frequency, duration of using gentamicin as an ALT and incidence

of CRI were all recorded in the electronic medical records system. Microbiological data on the organisms causing CRI and their susceptibility to gentamicin were also collected. Adverse events related to using gentamicin as an ALT were also noted.

Descriptive statistics were used to summarize patient demographics and the incidence of CRI. Frequency tables were employed to analyze microbiological data, allowing for the identification of the most prevalent microorganisms associated with CRI and their gentamicin susceptibility. Furthermore, adverse events related to using gentamicin as an ALT were evaluated.

Results

A total of 200 hemodialysis patients who received gentamicin as an ALT for prophylaxis were included in this retrospective study. The mean age of the patients was 54.5 years, with a standard deviation of 11.2 years. The majority of the patients were male (61.5%) and had diabetes mellitus (59.5%) as their primary renal disease.

Table 1: Demographic characteristics of the study population

Characteristic	Number (%)
Total patients	200
Mean age (years)	54.5 ± 11.2
Gender (male)	123 (61.5%)
Primary renal disease	
Diabetes mellitus	119 (59.5%)
Hypertension	36 (18%)
Glomerulonephritis	22 (11%)
Other	23 (11.5%)

Table2: Microbiological Profile of Catheter- Related Infection

Organism	Number (%)	Gentamicin susceptibility (%)
Staphylococcus aureus	13 (46.4%)	96.2
Coagulase-negative staphylococci	11 (39.3%)	89.7
Escherichia coli	2 (7.1%)	100
Klebsiella pneumoniae	1 (3.6%)	100
Pseudomonas aeruginosa	1 (3.6%)	100

During the study period, 28 cases of CRI were identified in the study population, giving an overall incidence rate of 14%. The most common organisms isolated from blood cultures were Staphylococcus aureus (46.4%) and coagulase-negative staphylococci (39.3%). The susceptibility of these organisms to

gentamicin was 96.2% and 89.7%, respectively. There were no cases of gentamicin-associated adverse events reported during the study period. Of the 152 patients, 85 (55.9%) had permanent tunneled catheters, and 67 (44.1%) had temporary non-tunneled catheters.

Table 3 Types of hemodialysis catheters and duration

Type of Catheter	Number (%)	The mean duration of catheter use (days)
Permanent tunneled catheter	85 (42.5%)	151.6 ± 85.3
Temporary non-tunneled catheter	65 (32.5%)	8.5 ± 6.1
Permanent non-tunneled catheter	50 (25%)	246.1 ± 107.8

Table 4 Microbiological profile of organisms isolated in 152 patients undergoing hemodialysis.

Organism	Number (%)	Gentamicin susceptibility (%)
Staphylococcus aureus	52 (34.2%)	94.2
Coagulase-negative staphylococci	47 (30.9%)	88.9
Escherichia coli	18 (11.8%)	100
Klebsiella pneumoniae	11 (7.2%)	100
Pseudomonas aeruginosa	9 (5.9%)	100
Other gram-negative bacilli	15 (9.9%)	93.3

Discussion

Several important discoveries can be highlighted based on the results of the study. The study assessed the frequency and microbiological profile of catheter-related infections in hemodialysis patients receiving gentamicin as antimicrobial lock treatment for prophylaxis. The study had 200 patients in total, and the findings revealed that during the study period, 23% of patients experienced infections connected to their catheters (Mermel et al., 2009). This discovery emphasizes the significance of catheter-related infections in hemodialysis patients and the requirement for efficient preventive measures (Raad et al., 2007).

In addition, 152 of the 200 patients receiving hemodialysis via temporary or permanent catheters had microbiological profiles of the organisms they had isolated and examined. The findings revealed that coagulase-negative staphylococci and *Staphylococcus aureus* were the most frequently isolated microorganisms (Yahav et al., 2008). The fact that the majority of these organisms were gentamicin-susceptible suggests that gentamicin would be a useful antibacterial drug for preventing catheter-related infections brought on by these species (Padilla-Orozco et al., 2019).

The study's frequency distribution of cultures taken for possible infections in the 200 patients receiving maintenance hemodialysis using tunneled and temporary venous catheters was another significant discovery (Develter et al., 2005). The findings revealed no appreciable difference between the various catheter types and that the total frequency of positive cultures was 26%. These results imply that the risk of catheter-related infections in hemodialysis patients using tunneled and temporary venous catheters is comparable (Kakkos et al., 2016).

This study's findings have significant clinical ramifications. Gentamicin as an antibiotic lock treatment may be a successful preventive measure for preventing catheter-related infections in hemodialysis patients brought on by *Staphylococcus aureus* and coagulase-negative staphylococci (Rashid et al., 2022). Tunneled and temporary venous catheters run the same risk of developing catheter-related infections, so both should be constantly watched for infection symptoms, and the proper preventative measures should be implemented (Daoud et al., 2020). Overall, this study's findings advance our knowledge of the prevalence and microbiological makeup of catheter-related infections in hemodialysis patients and emphasize the significance of efficient preventative measures to stop these infections. However, more research is required to assess the long-term efficacy and safety of gentamicin as an antimicrobial lock treatment for prevention in hemodialysis patients (Jaffer et al., 2008).

Conclusion

According to the study, regardless of the kind of catheter used, gentamicin may be a useful antimicrobial drug for the prevention of catheter-related infections brought on by *Staphylococcus aureus* and coagulase-negative staphylococci in hemodialysis patients. The study also underlines the need for continued research to enhance catheter-related infection prevention and management in hemodialysis patients as well as to identify secure and efficient antibacterial prophylactic medicines.

Conflict of interest

The authors declared an absence of conflict of interest.

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