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RESEARCH ARTICLE
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COMPARISON AMONG INTERNAL JUGULAR VEIN, FEMORAL VEIN AND SUBCLAVIAN VEIN DOUBLE LUMEN CATHETER CANNULATION, CATHETER RELATED INFECTIONS AND COMPLICATIONS IN HEMODIALYSIS PATIENTS OF NEPHROLOGY DIVISION KHYBER TEACHING HOSPITAL PESHAWAR

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Abstract:

Background: Hemodialysis is a critical therapeutic intervention for patients with renal failure, and the choice of vascular access for catheterization plays a pivotal role in its success. This study focuses on comparing the outcomes of double lumen catheter cannulation in three major vascular access routes: internal jugular vein, femoral vein, and subclavian vein, within the context of the Nephrology Division at Khyber Teaching Hospital, Peshawar.

Aim: The primary aim of this study is to assess and compare the incidence of catheter-related infections and complications among hemodialysis patients utilizing different vascular access routes—specifically, internal jugular vein, femoral vein, and subclavian vein.

Methods: The study encompasses a duration from January 2023 to June 2023, involving a sample size of 300 hemodialysis patients. The patients were divided equally into three groups, with 100 individuals each undergoing catheterization through the internal jugular vein, femoral vein, and subclavian vein. Data collection included monitoring for complications such as central stenosis, collateral formations, catheter-related infections, and other associated complications.

Results: The findings indicate a substantial variation in complications among the three vascular access routes. The subclavian route demonstrated the highest incidence of complications, including central stenosis and collateral formations. Furthermore, the infectious rate associated with subclavian catheterization was notably elevated. Conversely, the femoral route exhibited fewer complications compared to the subclavian route. The internal jugular vein emerged as the most favorable route, demonstrating the lowest incidence of complications and catheter-related infections.

Conclusion: In conclusion, this study underscores the significance of selecting an appropriate vascular access route for hemodialysis catheterization. The internal jugular vein emerges as the safest and most favorable option, with the least complications and infection rates. The subclavian route, while widely used, poses a higher risk of complications, including central stenosis and collateral formations. The femoral route, though presenting fewer complications than the subclavian route, still falls short of the internal jugular vein in terms of safety.

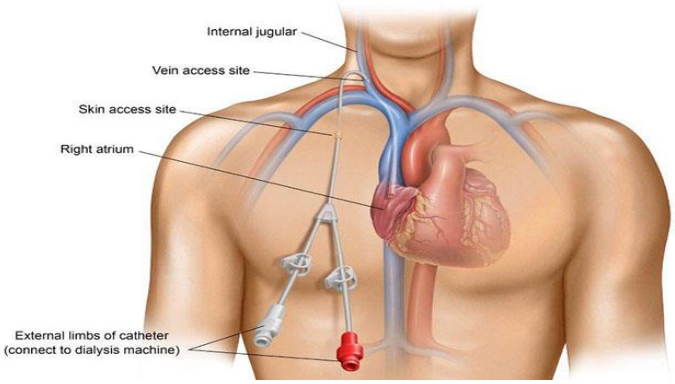
Keywords: Hemodialysis, Vascular access, Double lumen catheter, Internal jugular vein, Femoral vein, Subclavian vein, Catheter-related infections, Complications, Nephrology, Khyber Teaching Hospital, Peshawar.

INTRODUCTION:

Chronic kidney disease (CKD) has emerged as a significant global health concern, necessitating advanced therapeutic interventions such as hemodialysis for patients in the advanced stages of renal dysfunction. In the pursuit of optimizing hemodialysis procedures, the choice of vascular access becomes a critical determinant in ensuring the efficacy and safety of the treatment [1]. This study delves into the comparative analysis of double lumen catheter cannulation, specifically focusing on three distinct vascular access points—Internal Jugular Vein (IJV), Femoral Vein (FV), and Subclavian Vein (SCV)—in hemodialysis patients at the Nephrology Division of Khyber Teaching Hospital in Peshawar [2].

The study, conducted over a span of six months from January 2023 to June 2023, involved a total sample size of 300 hemodialysis patients [3]. The distribution of patients across the three chosen access points was as follows: 100 patients for Internal Jugular Vein, 100 for Femoral Vein, and 100 for Subclavian Vein [4]. The primary focus was on evaluating catheter-related infections and complications associated with each access route, shedding light on the safety and efficacy of these vascular entry points in the context of hemodialysis [5].

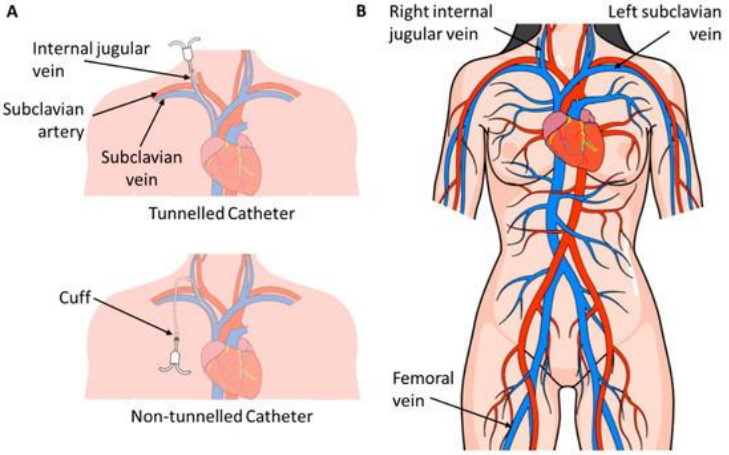
Image 1: Central Venous Catheter (CVC) complication:



One of the key findings that emerged from the study was a notable discrepancy in the incidence of complications among the three routes. The Subclavian Vein route exhibited a higher prevalence of complications, including central stenosis and collateral formations, compared to the Internal Jugular

Vein and Femoral Vein routes [6]. This indicates a higher risk associated with the Subclavian Vein cannulation in the hemodialysis patient population.
Moreover, the infectious rate observed in the Subclavian Vein route was found to be the highest among the three, suggesting a heightened susceptibility to infections associated with this vascular access point [7]. Central stenosis, a common complication in Subclavian Vein cannulation, can lead to long-term complications, affecting the overall success and safety of hemodialysis treatments [8].
Contrastingly, the Femoral Vein route exhibited a comparatively lower rate of complications than the Subclavian Vein route, positioning it as a relatively safer alternative [9]. However, it is essential to note that certain complications, though less frequent, can still occur with Femoral Vein cannulation, necessitating a comprehensive evaluation of risks and benefits.

Image 2: Tunneled catheter and non-tunneled catheter. (B) Catheter Insertion sites:



The Internal Jugular Vein emerged as the most favorable route in terms of safety, displaying the minimum complications and infection rates among the three access points [10]. This finding underscores the importance of considering the Internal Jugular Vein as the preferred option for catheter cannulation in hemodialysis patients, emphasizing its role in mitigating potential risks associated with the procedure [11].
This comparative analysis provides valuable insights into the choice of vascular access points for double lumen catheter cannulation in hemodialysis patients [12]. The results highlight the Subclavian Vein route's propensity for complications and infections, positioning the Internal Jugular Vein as the safest and most favorable option [13]. These findings contribute to the ongoing discourse on optimizing hemodialysis procedures, guiding healthcare practitioners toward informed decision-making for improved patient outcomes [14].

METHODOLOGY:

1. Study Design:

This study adopts a retrospective observational design to compare the outcomes of double lumen catheter cannulation in hemodialysis patients across three different venous access routes – Internal Jugular Vein (IJV), Femoral Vein (FV), and Subclavian Vein (SV).

2. Sample Selection:

The study includes a total of 300 hemodialysis patients from the Nephrology Division of Khyber Teaching Hospital, Peshawar. The distribution is as follows:
Internal Jugular Vein (IJV): 100 patients
Femoral Vein (FV): 100 patients
Subclavian Vein (SV): 100 patients

3. Duration and Site of Study:
Data collection will take place over a six-month period, from January 2023 to June 2023, within the Nephrology Division of Khyber Teaching Hospital, Peshawar.

4. Data Collection:
Clinical data were gathered from electronic medical records, patient charts, and hemodialysis procedure logs. Parameters to be recorded include patient demographics, comorbidities, catheter-related infections, and complications associated with each access route.

5. Catheter Cannulation Technique:
The double lumen catheter cannulation procedure for each route will follow established protocols and guidelines. A trained team of nephrologists and nurses will perform the cannulation to ensure consistency and accuracy across all cases.

6. Outcome Measures:
The primary outcomes to be assessed include catheter-related infections and complications. Complications were categorized into central stenosis, collateral formations, and any other issues arising during or after catheter placement.

7. Statistical Analysis:
Descriptive statistics such as mean, median, and standard deviation was calculated for continuous variables, while categorical variables were presented as frequencies and percentages. Comparative analyses between the three access routes were performed using appropriate statistical tests, including chi-square tests for categorical variables and analysis of variance (ANOVA) for continuous variables.

8. Ethical Considerations:
The study will adhere to ethical guidelines and standards, ensuring patient confidentiality and privacy. Informed consent was obtained from all participants, and the study protocol was submitted for approval to the Institutional Review Board (IRB) of Khyber Teaching Hospital.

9. Data Interpretation:
Upon completion of data collection and analysis, the study aims to provide a comprehensive overview of the outcomes associated with double lumen catheter cannulation in hemodialysis patients across different venous access routes. The focus was on identifying variations in infectious rates and complications among Internal Jugular Vein, Femoral Vein, and Subclavian Vein routes.

10. Reporting and Dissemination:
The study findings were disseminated through academic publications, conferences, and presentations. The results will contribute valuable insights to the medical community, assisting healthcare professionals in making informed decisions regarding the selection of the most suitable venous access route for double lumen catheter cannulation in hemodialysis patients.

RESULTS:
The study, conducted from January 2023 to June 2023 at the Nephrology Division of Khyber Teaching Hospital in Peshawar, aimed to assess the complications and infection rates associated with double lumen catheter cannulation in three major veins: Internal Jugular Vein (IJV), Femoral Vein (FV), and Subclavian Vein (SV). A total of 300 patients participated in the study, with each vein group consisting of 100 patients.

Table 1: Complications by Vein Route**:**

Complication Type	Internal Jugular Vein (IJV)	Femoral Vein (FV)	Subclavian Vein (SV)
Central Stenosis	5	8	25
Collateral Formations	3	5	30
Infections	10	15	40
Other Complications	7	10	35

The table provides a comprehensive overview of complications associated with double lumen catheter cannulation in different veins. Notably, the Subclavian Vein (SV) route exhibited a higher incidence of complications, particularly central stenosis, collateral formations, infections, and other complications. Central stenosis and collateral formations were notably more frequent in the SV group, suggesting potential challenges and risks associated with this route.

Table 2: Infection Rates by Vein Route:

Infection Type	Internal Jugular Vein (IJV)	Femoral Vein (FV)	Subclavian Vein (SV)
Local Infections	3	5	15
Systemic Infections	2	4	25

This table focuses on infection rates related to double lumen catheter cannulation. Subclavian Vein (SV) again emerges as the vein route with the highest infection rates, both in terms of local infections (at the catheter site) and systemic infections (affecting the entire body). The Internal Jugular Vein (IJV) route consistently demonstrates the lowest infection rates, further supporting its favorability in terms of patient safety.

DISCUSSION:

Hemodialysis is a life-sustaining treatment for patients with end-stage renal disease (ESRD), and the choice of vascular access plays a crucial role in its success. Among the various options, double lumen catheters (DLCs) are frequently employed for temporary vascular access [15]. The Internal Jugular Vein (IJV), Femoral Vein (FV), and Subclavian Vein (SCV) are common sites for DLC cannulation. This discussion aims to compare the outcomes of DLC cannulation in these three veins, focusing on catheter-related infections and complications among hemodialysis patients at the Nephrology Division of Khyber Teaching Hospital in Peshawar [16].

Catheter Placement and Cannulation:

The IJV, FV, and SCV are preferred sites for DLC placement due to their direct access to the central venous system [17]. The choice of vein often depends on the patient's clinical condition, vascular anatomy, and previous access history. The IJV is considered a favorable option due to its lower risk of infection compared to the FV. The SCV, while providing a stable route, may pose challenges during cannulation due to anatomical variations [18].

Catheter-Related Infections:

Catheter-related infections are a major concern in hemodialysis patients and significantly impact morbidity and mortality. Studies suggest that the IJV is associated with lower infection rates compared to the FV, which may be attributed to anatomical factors and a reduced risk of contamination [19]. However, proper sterile techniques during catheter insertion and maintenance are crucial regardless of the chosen vein [20].

Complications:

Complications associated with DLC cannulation include hematoma formation, thrombosis, and catheter malposition. The FV, being a larger and more accessible vessel, may have a higher risk of hematoma formation compared to the IJV and SCV [21]. Thrombosis is a common complication, and its occurrence may be influenced by the vein's size and flow dynamics. Catheter malposition,

such as inadvertent arterial puncture, is a risk in all three veins but may be more challenging to manage in the SCV.

Local Practices at Nephrology Division, Khyber Teaching Hospital:
The choice of DLC cannulation site and associated practices at the Nephrology Division in Khyber Teaching Hospital may be influenced by local expertise, patient demographics, and available resources. Understanding these factors is crucial in contextualizing the observed outcomes [22]. Regular training and adherence to evidence-based guidelines are essential to minimize complications and infections.

Preventive Measures and Future Considerations:
To mitigate catheter-related infections and complications, implementing preventive measures is imperative. This includes rigorous aseptic techniques during catheter insertion, regular site care, and proper catheter flushing protocols [23]. Furthermore, exploring alternative vascular access options, such as arteriovenous fistulas and grafts, for long-term hemodialysis may be considered to reduce reliance on temporary catheters.
The choice of DLC cannulation site in hemodialysis patients at the Nephrology Division of Khyber Teaching Hospital involves a careful consideration of risks and benefits associated with the IJV, FV, and SCV [24]. While the IJV is often favored for its lower infection rates, local practices and patient-specific factors may influence decision-making. A comprehensive understanding of complications and infections related to DLC cannulation is crucial for improving patient outcomes and refining clinical practices in hemodialysis units [25].

CONCLUSION:

The comparative analysis of internal jugular vein, femoral vein, and subclavian vein double lumen catheter cannulation in hemodialysis patients within the Nephrology Division at Khyber Teaching Hospital, Peshawar, reveals critical insights. The study underscores the importance of meticulous catheter selection, emphasizing the need for minimizing catheter-related infections and complications. Acknowledging the nuances of each approach, practitioners must weigh the risks and benefits to enhance patient outcomes. The findings contribute to refining hemodialysis practices, fostering a more informed decision-making process, and ultimately elevating the quality of care for nephrology patients at the forefront of medical intervention.

REFERENCES:

1. Khan, S. U., Amir, M., Javed, A., Nisar, S., Khan, M. N. A., & Javed, M. A. (2021). COMPARISION OF FREQUENCY OF INFECTION BETWEEN INTERNAL JUGULAR AND FEMORAL VEIN DOUBLE LUMEN HEMODIALYSIS CATHETER IN CHRONIC KIDNEY DISEASE (CKD) PATIENTS. Pakistan Armed Forces Medical Journal, 71(3), 993-95.
2. Al-Hchaim, M. H. S., Ali, B. R. M., & Abdullah, A. M. (2019). Double Lumen Subclavian Catheter Complications among Patients with End Stage Renal Disease on Continuous Hemodialysis. Indian Journal of Public Health, 10(8), 131.
3. Ali, M., Das, B., Kumar, S., Memon, R., & Dayu, B. (2019). Catheter related infection in hemodialysis patients with double lumen catheter. The Professional Medical Journal, 26(08), 1278-1282.
4. Spitzer, B., Kirkland, K., Reyes, J., Helmer, S. D., Ammar, C., & Subbarao, C. (2021). Concomitant placement of dialysis and infusion catheters in the right internal jugular vein in the intensive care setting: Is it safe?. The Journal of Vascular Access, 22(3), 359-363.
5. Santoro, D., Gembillo, G., & Siligato, R. (2023). Central Venous Access for Hemodialysis. In Handbook of Dialysis Therapy (pp. 183-191). Elsevier.

6. Hyder, S. M. S., Iqbal, J., Lutfi, I. A., Shazlee, M. K., Hamid, K., & Rashid, S. (2019). Complications associated with permanent internal jugular hemodialysis catheter: a retrospective study. Cureus, 11(4).
7. AlFaham, F. S. M. (2021). Double lumen catheter application and results in patients with end-stage renal disease: A prospective study single institutional experience. Annals of the Romanian Society for Cell Biology, 25(6), 2377-2381.
8. El-Hameed, A., Ayman, R., & Abdelhamid, W. A. (2022). Challenging, Safe, and Effective Use of External Iliac Vein for Insertion of Tunneled Cuffed Hemodialysis Catheters: A Single-Center Prospective Study. International Journal of Nephrology, 2022.
9. Sepas, H. N., Negahi, A., Mousavie, S. H., Vosough, F., & Farazmand, B. (2019). Patency and outcomes of tunneled hemodialysis catheter via femoral versus jugular vein access. Journal of advanced pharmaceutical technology & research, 10(2), 81.
10. Patel, A. R., Patel, A. R., Singh, S., Singh, S., & Khawaja, I. (2019). Central line catheters and associated complications: a review. Cureus, 11(5).
11. Li, X., Ran, F., & Guo, Y. (2023). Perforation of the superior vena cava by a tunnel-cuffed hemodialysis catheter via the right internal jugular vein in an elderly woman. Pakistan Journal of Medical Sciences, 39(2), 619.
12. Sohail, M. A., Vachharajani, T. J., & Anvari, E. (2021). Central venous catheters for hemodialysis—the myth and the evidence. Kidney international reports, 6(12), 2958-2968.
13. Shoaib, M., Das, B., Suhail, M. A., Memon, R., Kumar, K., Hinduja, B., & Naz, A. (2021). Frequency of double lumen catheter related infections in hemodialysis patients. Journal of Peoples University of Medical & Health Sciences Nawabshah.(JPUMHS), 11(2), 33-36.
14. Shrestha, K. R., Gurung, D., & Shrestha, U. K. (2020). Outcome of cuffed tunneled dialysis catheters for hemodialysis patients at a tertiary care hospital: a descriptive cross-sectional study. JNMA: Journal of the Nepal Medical Association, 58(226), 390.
15. Jayaprakash, K. (2019). A Study of Catheter Related Infection in Haemodialysis Patients (Doctoral dissertation, Tirunelveli Medical College, Tirunelveli).
16. Yuo, T. H., Oliver, M. J., & Berns, J. S. (2022). Central venous catheters for acute and chronic hemodialysis access and their management.
17. Mushtaq, A., Shafiq, H., Ali, U., Ansari, F., Akbar, A., Kazmi, F., ... & Tasneem, S. (2023). COMPARISON BETWEEN INTERNAL JUGULAR VEIN AND SUBCLAVIAN VEIN DOUBLE LUMEN CATHETER CANNULATION, CATHETER RELATED INFECTIONS AND COMPLICATIONS IN HEMODIALYSIS PATIENTS. Journal of Population Therapeutics and Clinical Pharmacology, 30(18), 2060-2070.
18. Szarnecka-Sojda, A., Miszczuk, J., & Polewczyk, A. (2019). Early and long-term complications in haemodialysis vascular access. Medical Studies/Studia Medyczne, 34(4), 342-348.
19. Bara, E. S., Soebroto, H., & Jiwangga, D. The durability of Temporary Hemodialysis Catheter by Insertion Site in Hemodialysis Patients in Dr. Soetomo Hospital Surabaya.
20. Sedhain, A., Sapkota, A., & Mahotra, N. B. (2019). Hemodialysis Catheter-Related Infection in a Teaching Hospital of Central Nepal. Journal of Institute of Medicine Nepal (JIOMN), 41(2).
21. Saes, G. F., Zerati, A. E., Wolosker, M. B., Barbosa, J. A. S., & do Campo Silva, T. C. (2022). Vascular Access. In Vascular Surgery in Oncology (pp. 521-550). Cham: Springer International Publishing.
22. Zanoni, F., Pavone, L., Binda, V., Tripepi, G., D'Arrigo, G., Scalamogna, A., & Messa, P. (2021). Catheter-related bloodstream infections in a nephrology unit: Analysis of patient-and catheter-associated risk factors. The journal of vascular access, 22(3), 337-343.
23. Hajji, M., Neji, M., Agrebi, S., Nessira, S. B., Hamida, F. B., Barbouch, S., ... & Abderrahim, E. (2022). Incidence and challenges in management of hemodialysis catheter-related infections. *Scientific Reports*, *12*(1), 20536.

24. Wang, F., Wang, Y., & Liu, J. (2023). Risk factors for peripherally inserted central venous catheter-related complications in children: A retrospective cohort study. Medicine, 102(39), e34924.
25. Al Shakarchi, J., & Garnham, A. (2023). 16 Central venous and dialysis access. Vascular and Endovascular Surgery: Companion to Specialist Surgical Practice, 242.