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COMPARISON BETWEEN INTERNAL JUGULAR VEIN AND SUBCLAVIAN VEIN DOUBLE LUMEN CATHETER CANNULATION, CATHETER RELATED INFECTIONS AND COMPLICATIONS IN HEMODIALYSIS PATIENTS

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Abstract

Introduction: Hemodialysis (HD) is a technique chosen as a substitute for renal function to support the life of patients with low-grade morbidity and renal failure. Vascular access is a critical concern in patients undergoing long-term hemodialysis (HD). Limited data is available regarding the safety analysis of venous catheter-associated complications in local healthcare settings. Internal jugular vein double-lumen catheterization and subclavian vein double-lumen catheterization is be compared in terms of bacterial infection-related adverse effects in a randomized controlled study. This study aimed to identify the safest catheterization technique to decrease significant morbidity-related concerns in patients with renal disease.

Methodology: A comparative prospective study with a cohort of 218 patients (sample size determined by WHO sample size calculator) with renal failure requiring hemodialysis was selected from the Department of Nephrology, Pakistan Institute of Medical Sciences, SZABMU, Islamabad, and were divided into group A (double-lumen internal jugular vein catheter) and group B (double-lumen subclavian vein catheter) after fulfilling the selection criteria. The collected data were analyzed using SPSS version 23.

Results: In groups A and B, complications included procedure failure (18.3% vs. 8.3%), bleeding and hematoma formation (11.0% vs. 3.7%), arterial puncture (10.1% vs. 2.8%), and infection (14.7% vs. 4.6%). In group A, 32.1% of patients had positive culture reports, while in group B, 14.7% of patients had a positive culture report with p value (p=0.002).

Conclusion: Double-lumen subclavian vein catheterization had better outcomes than double-lumen internal jugular vein catheterization in terms of accessibility, infection, and complications.

Keywords: Renal failure, double lumen internal jugular vein catheter, double lumen subclavian vein catheter, hemodialysis, complications

Introduction

Hemodialysis (HD) is an artificial replacement for renal function in patients with compromised renal health and chronic kidney disease for which appropriate vascular access is essential [(1)]. Surveys from North America, Japan, and Taiwan indicate that around 2.5 million persons globally acquired dialysis, with a persistent deficit of 1.8 million in 2010 [(2)]. Approximately 430,000 people in the US regularly use hemodialysis. Catheters, arteriovenous fistulas (AVFs), and arteriovenous (AV) grafts are viable options for gaining access to veins [(3)]. A permanent double-lumen catheter is used for long-term use, ranging from a few weeks to several years. Compared with temporary catheters, they have a lower risk of infection. Insertion of permanent catheters necessitates a minimal surgical procedure, and there is a possibility of long-term complications, such as catheter fractures and stenosis or thrombosis [(4)]. At the time of starting hemodialysis (HD), approximately 80% of the patients have a CVC in place [(5)]. Double lumen tunneled catheters are advised for intermediate access, whereas double-lumen non-cuffed catheters serve as temporary entry points [(6)].

Patients can begin immediate treatment with temporary catheters to provide instant access. These work well for brief periods of time, usually from a few days to three weeks. Infections and limited patient mobility are associated with adverse effects [(4)]. Among dialysis patients, mortality is disproportionately higher in younger age groups; this is attributable to infectious (10%) and cardiovascular (40%) causes of mortality [(7)]. Some individuals experience artery puncture due to missed attempts at catheter insertion or catheter-site infection shortly after catheter implantation, which are immediate complications. However, the late negative outcomes include acute sepsis, mechanical kinking, thrombosis, and central venous stenosis [(8)]. Simple or tunneled double-lumen hemodialysis catheterization was implemented in ESRD patients [(9)]. There are limited options for insertion of venous catheters in hemodialysis treatment. Internal and external jugular vein double-lumen catheters, central venous catheterization, femoral vein catheterization, and subclavian vein catheterization are used with utmost success for frequent hemodialysis [(10)]. On average, approximately 48% of new hemodialysis patients in the US and 75% in Europe used uncuffed (UC) temporary catheters [(11)]. In comparison to AV access, hemodialysis patients have an estimated two- to three-fold higher risk of catheterization-related septicemia and mortality [(12)].

For clinical convenience, CVC-related infections (CRI) are divided into CVC-related local infections (CRLI) and CVC-related bloodstream infections (CRBSI) [(13)]. Coagulase-negative staphylococci and Staphylococcus aureus are among the major gram-positive bacteria responsible for these illnesses [(14)]. Definitive catheter site infection is defined as the presence of purulent discharge, with or without erythema of the skin at the catheter-epidermal interface [(15)]. High temperature, redness in the area around the catheter, and pain at the insertion site are the most common signs of an infection; however, these are not reliable signs for the diagnosis of catheter-related infection [(16)]. Catheter and peripheral vein specimens should be collected for culture from patients suspected of having CRI [(17, 18)]. Positive peripheral blood culture results (right internal jugular vein (25% positive), left internal jugular vein (40% positive), right subclavian (50% positive) and right femoral (33.3% positive) cultures) [(19)] preceded by positive catheter results improved infection diagnosis by 91% sensitivity and 94%

specificity [20]. The incidence of CRBSI is 1.65 events per 1,000 cultures in the United States and 6.8 infections per 1,000 were reported from a survey of 36 countries in Latin America, Asia, Europe, and Africa, most of which occur in resource-limited areas [21].

Dizziness, lightheadedness, nausea (regional wall motion abnormalities RWMAs due to ischemia of the cardiac cells), and other minor symptoms are common complications after dialysis. Muscle cramps, dialysis disequilibrium syndrome, dialyzer reactions, hemolysis, air embolism, itching (1% to 4%), chest and back discomfort (1% to 4%), vomiting and nausea (10%), and headaches (70%). Electrolyte imbalance like hypermagnesemia, hyponatremia, hypocalcemia, and the most common and clinically important hyperkalemia can also occur because of hemodialysis. Cardiac arrhythmias, pulmonary edema, and contrast medium reactions are potential causes of death during vascular access.[22-25] According to a study, 21% of patients with bacteremia caused by Staphylococcus aureus had an average hospital stay of 13 days [26]. Several studies have demonstrated that HD patients with a CVC infection experienced a significant financial burden, with an average cost of USD 23,451 per hospitalization [27]. The purpose of this study was to determine the safest catheterization technique so that severe morbidity and related health concerns of patients with renal disease could be reduced while using an acute/ temporary double-lumen catheter for hemodialysis.

Materials and Methods

This prospective cohort study was conducted at the Department of Nephrology, Pakistan Institute of Medical Sciences, SZABMU, Islamabad, after obtaining approval from the IRB review board. The sample size was calculated using the WHO calculator [1]. Total of 218 participants were included in the study, divided into two groups of 109 participants with renal failure induced through non-probability consecutive sampling. Deaths and dropouts were dealt with early in the study to include 109 patients in each group in the final analysis by replacing them with new cases. Patients between 18 and 60 years of age and of both sexes, ESRD patients requiring hemodialysis, change in catheter location due to malfunction of the preceding fistula, frequency of dialysis 2-3 sessions/week, refractory hypertension, diabetes mellitus, acidemia, refractory hyperkalemia, intoxication (salicylates, ethylene glycol, or lithium), fluid overload refractory to diuretics, uremia, pericarditis, and peripheral neuropathy and encephalopathy were included. Patients without any medical records, patients already taking antibiotics for previous bacteremia, history of neck investigations for Parathyroid /Thyroid diseases and thyroid gland malignancy, renal carcinoma were excluded, along with severe psychiatric or neurologic disease, bleeding disorder/coagulopathy, cardiac surgery, ICU patients in critical condition, patients who were non-compliant, patients who dropped out during the study period, and patients who did not give consent to participate in the study.

Individuals undergoing hemodialysis in the OPD, and inpatient wards were screened for inclusion in the study. Before enrollment, informed consent was obtained from all legal patients/ guardians. The patients and guardians were informed of the details of the study procedures and their potential benefits. Patients who met these criteria were assigned to the two groups, Group A (internal jugular vein double lumen catheter) and Group B (subclavian vein double lumen catheter). A lottery-based randomization scheme was developed and used to allocate study subjects to both interventions. Pre-assessment and management of the patients in the two groups were performed by physical examination and laboratory investigations, such as urea/creatinine, blood CP, serum electrolytes ABGs, and radiological assessment in terms of X-RAY, USG, and ECG. All investigations mentioned above were provided free of cost, including double-lumen catheters. Aseptic catheterization was initiated after local anesthesia was applied to the insertion site. Standardized practice guidelines for catheterization were followed in this study. The incidence of orthopnea has been thoroughly addressed. Follow-up was conducted when the patient underwent twice-weekly hemodialysis. The temporary double-lumen catheter was kept for four–six weeks until the permanent arteriovenous (AV) fistula/ graft was functional. All cannulation procedures were performed by the authors themselves. Complications of the double-lumen catheter were divided into early (< 24 h) and late (> 24 h). Quantitative blood cultures, culture of the catheter tip, and positivity time for cultures from the catheter and peripheral sites can detect catheter-related infections. Due to low sensitivity and specificity, clinical signs including redness, fever, or catheter site soreness, cannot diagnose catheter-related infections.

All patients suspected of having a catheter-related infection should have two sets of blood cultures obtained: one from the catheter site and the other from the peripheral site. This approach predicts catheter-related BSIs when the central venous catheter blood has a colony count 5–10 times higher than that of the peripheral blood sample. When a sample collected from the catheter shows faster growth than that collected from the peripheral vein, it is likely that the bacteremia was caused by the catheter. When a semi-quantitative culture provides greater than 15 colony-forming units (CFU), a catheter tip culture is regarded as significant for bacterial colonization. SPSS version 25 was used for the data entry and analysis. Continuous numerical variables are presented as mean and standard deviation. Frequency and percentages were used to evaluate categorical variables, such as sex, etiology, bloodstream infections, arterial puncture, venous thrombosis, and catheter occlusion. The chi-square test was used to compare catheter-related bloodstream infections between the two research groups. As a secondary outcome, other adverse effects such as arterial puncture were also compared. Statistical significance was set at $p < 0.05$.

Results

This study included 218 patients (109 per group). The mean age of group A was 43.07±10.75 and group B was 42.72±9.57 (p=0.801). 76 (69.7%) patients in Group A were male and 33 (30.3%) were female. In group B, 79 (72.5%) patients were male and 30 (27.5%) were female (p=0.654) (Table-1)

Table-1: Results of demographic variables in study groups

Demographics		Group A: (Internal jugular vein)	GroupB: (Subclavian vein)	Total	p-value
Age (Years)		43.07±10.75	42.72±9.57	-	0.801
Gender	Male	76 (69.7%)	79 (72.5%)	155 (71.1%)	0.654
	Female	33 (30.3%	30 (27.5%)	63 (28.9%)	
Occupation	Working	29 (26.6%)	21 (19.3%)	50 (22.9%)	0.197
	Non-working	80 (73.4%)	88 (80.7%)	168 (77.1%)	
Patients	Outdoor	46 (42.2%)	53 (48.6%)	99 (45.4%)	0.341
	Indoor	63 (57.8%)	56 (51.4%)	119 (54.6%)	
Marital Status	Married	89 (81.7%)	87 (79.8%)	176 (80.7%)	0.731
	Unmarried	20 (18.3%)	22 (20.2%)	42 (19.3%)	

In groups A and B, the etiology of renal failure was diabetes mellitus (22.9% vs. 23.9%, p=0.873), hypertension (63.3% vs. 61.5%, p=0.780), urinary tract infection (21.1% vs. 22.9%, 0.744), polycystic kidney disease (1.8% vs. 0.9%, p=0.561), glomerulonephritis (7.3% vs. 4.8%, p=0.391), and renal stone disease (11.0% vs. 12.8%, p=0.676).

Table-2: Results of etiology of renal failure in study groups

Etiology of renal failure		Group A: (Internal jugular vein)	Group B: (Subclavian vein)	Total	p-value
Diabetes mellitus	Yes	25 (22.9%)	26 (23.9%)	51 (23.4%)	0.873
	No	84 (77.1%)	83 (76.1%)	167 (76.6%)	
Hypertension	Yes	69 (63.3%)	67 (61.5%)	136 (62.4%)	0.780
	No	40 (36.7%)	42 (38.5%)	82 (37.6%)	
Urinary tract infection	Yes	23 (21.1%)	25 (22.9%)	48 (22.0%)	0.744
	No	86 (78.9%)	84 (77.1%)	170 (78.0%)	
Polycystic kidney disease	Yes	2 (1.8%)	1 (0.9%)	3 (1.4%)	0.561
	No	107 (98.2%)	108 (99.1%)	215 (98.6%)	

Glomerulonephritis	Yes	8 (7.3%)	5 (4.6%)	13 (6.0%)	0.391
	No	101 (92.7%)	104 (95.4%)	205 (94.0%)	
Renal Stone Disease	Yes	12 (11.0%)	14 (12.8%)	26 (11.9%)	0.676
	No	97 (89.0%)	95 (87.2%)	192 (88.1%)	

Number of dialysis/weeks in group A and B were (2.51±0.50 vs 2.52±0.49, p=0.893) and mean of dialysis after cannulation were (20.55±2.41 vs 19.39±2.59, p=0.001).

Table-3: Results of hemodialysis after catheterization in study groups

Hemodialysis after catheterization	Groups	Mean	SD	p value
No. of dialysis/week	Group A: (Internal jugular vein)	2.51	0.50	0.893
	Group B: (Subclavian vein)	2.52	0.49	
Total no. of dialysis after cannulation	Group A: (Internal jugular vein)	20.55	2.41	0.001*
	Group B: (Subclavian vein)	19.39	2.59	

In groups A and B, early postoperative complications included procedure failure (18.3% vs. 8.3%, p=0.028), bleeding and hematoma formation (11.0% vs. 3.7%, p=0.038), arterial puncture (10.1% vs. 2.8%, p=0.027), pneumothorax or hemothorax (12.8% vs. 5.5%, p=0.061), and catheter malposition (5.5% vs. 0.9%, p=0.055).

Table-4: Results of early postoperative complications in study groups

Early post op complications		Group A: (Internal jugular vein)	Group B: (Subclavian vein)	Total	p value
Procedure failure	Yes	20 (18.3%)	9 (8.3%)	29 (13.3%)	0.028*
	No	89 (81.7%)	100 (91.7%)	189 86.7%)	
Bleeding and Hematoma formation	Yes	12 (11.0%)	4 (3.7%)	16 (7.3%)	0.038*
	No	97 (89.0%)	105 (96.3%)	202 (92.7%)	
Arterial puncture	Yes	11 (10.1%)	3 (2.8%)	14 (6.4%)	0.027*
	No	98 (89.9%)	106 (97.2%)	204 (93.6%)	
Pneumothorax or Hemothorax	Yes	14 (12.8%)	6 (5.5%)	20 (9.2%)	0.061
	No	95 (87.2%)	103 (94.5%)	198 (90.8%)	
Catheter malposition	Yes	6 (5.5%)	1 (0.9%)	7 (3.2%)	0.055
	No	103 (94.5%)	108 (99.1%)	211(96.8%)	

Late postoperative complications in groups A and B were venous thrombosis (2.8% vs. 0.9%, p=0.313), infection (14.7% vs. 4.6%, p=0.012), catheter occlusion (3.7% vs. 0.9%, p=0.175), malfunction (2.8% vs. 0.0%, p=0.081), and arrhythmia (1.8% vs. 0.9%, p=0.561).

Table-5: Results of late post op complication in study groups

Late post op complication		Group A: (Internal jugular vein)	Group B: (Subclavian vein)	Total	p value
Venous thrombosis	Yes	3 (2.8%)	1 (0.9%)	4 (1.8%)	0.313
	No	106 (97.2%)	108 (99.1%)	214 (98.2%)	
Infection	Yes	16 (14.7%)	5 (4.6%)	21 (9.6%)	0.012
	No	93 (85.3%)	104 (95.4%)	197 (90.4%)	
Catheter occlusion	Yes	4 (3.7%)	1 (0.9%)	5 (2.3%)	0.175
	No	105 (96.3%)	108 (99.1%)	213 (97.7%)	
Malfunction	Yes	3 (2.8%)	0 (0.0%)	3 (1.4%)	0.081
	No	106 (97.2%)	109 (100.0%)	215 (98.6%)	
Arrhythmia	Yes	2 (1.8%)	1 (0.9%)	3 (1.4%)	0.561
	No	107 (98.2%)	108 (99.1%)	215 (98.6%)	

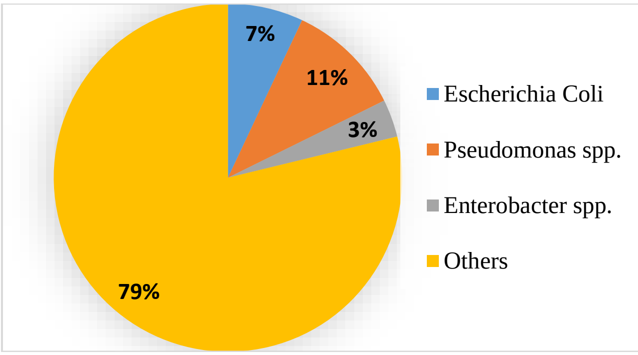

Figure 1: Gram negative organisms

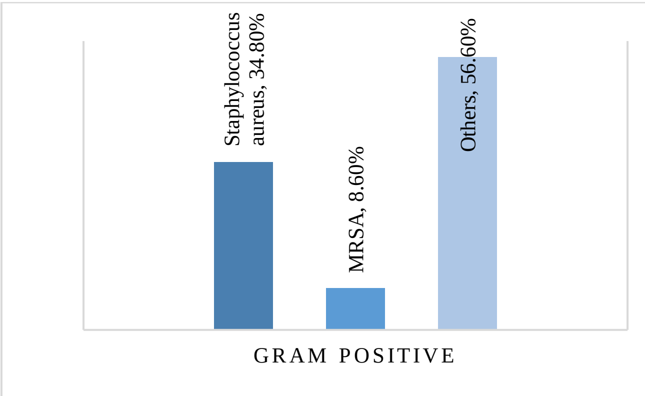

Figure 2: Gram positive organism

In groups A and B, early postoperative complications included procedure failure (18.3% vs. 8.3%, p=0.028), bleeding and hematoma formation (11.0% vs. 3.7%, p=0.038), arterial puncture (10.1% vs. 2.8%, p=0.027), pneumothorax or hemothorax (12.8% vs. 5.5%, p=0.061), and catheter malposition (5.5% vs. 0.9%, p=0.055). In group A, 35 (32.1%) patients had positive culture reports (blood was transported in transparent blood culture bottles) and in group B, 16 (14.7%) patients had positive culture reports (p=0. 002). The expected microorganisms were Candida, Staphylococcus aureus, and Streptococcus viridans, Enterococcus, Enterobacter, Escherichia coli, Klebsiella, Pseudomonas aeruginosa, and Acinetobacter.

Table-6: Results of culture report in study groups

Culture Report	Group A: (Internal jugular vein)	Group B: (Subclavian vein)	Total	p-value
Positive	35 (32.1%)	16 (14.7%)	51 (23.4%)	0.002*
Negative	74 (67.9%)	93 (85.3%)	167 (76.6%)	
Gram Positive	16 (45.7%)	7 (43.7%)	23 (45.1%)	0.081*
Gram Negative	19 (54.3%)	9 (56.3%)	28 (54.9%)	
Early Infection	1	0	1 (4.8%)	1/218 (0.5%)
Late Infection	15	5	20 (95.2%)	20/218 (9.17%)
Gram Positive	Staphylococcus aureus		8/23 (34.8%)	
	MRSA		2/23 (8.6%)	
Gram Negative	Escherichia Coli		2/28 (7%)	
	Pseudomonas spp.		3/28 (10.7%)	
	Enterobacter spp.		1/28 (3.5%)	

Discussion

Catheter-related infections affect 5-26% of patients, and thrombotic complications affect 2-26% of patients, with total complication rates ranging up to 15%. Patients with these consequences face serious dangers to their lives and require expensive medical care [28]. Old age, a low Karnofsky score, poor cleanliness, and the number of hospitalizations can all be risk factors for infections in general; however, poor hygiene is a risk factor for vascular access site infection [29]. A history of catheter-related infections, methicillin-resistant Staphylococcus aureus (MRSA), bacteremia, or bacteriuria within three months before catheterization, immunosuppression, and diabetes mellitus are typically linked to an increased risk of infection [30]. It is important to identify high-risk patients before catheter installation.

Microorganisms colonizing the catheter surface generate a mucopolysaccharide matrix, known as a biofilm. Catheter-related bloodstream infections (CRBSI) are associated with biofilm density [31]. After a catheter is inserted, biofilms can develop three days later and usually appear on the outside after fewer than ten days. However, biofilms accumulate in the catheter lumen with longer catheter stays (more than or equivalent to 30 days) [32]. In our study population, only one case of infection occurred within three days representing an acute reaction. Group A had a higher probability of procedure failure than Group B ($p < 0.028$), bleeding and hematoma development in Group A patients (11.0%) and Group B cases (3.7%) were significant ($p < 0.038$), and statistically significant variation in arterial puncture ($p < 0.027$) existed between the two groups. Group A had a greater rate of arterial puncture, indicating the possibility that the particular technique used in group A may be more likely to cause significant side effects. Pneumothorax or hemothorax ($p=0.061$) and catheter malposition ($p=0.055$) were found to be similar in both groups, although there were trends towards higher rates in Group A. These findings emphasize the importance of careful evaluation and management of potential complications in the early postoperative period, particularly in cases in which higher risks are observed.

According to the statistics of my study, the male predominance was 69.7% and 72.5% in Groups A and B, respectively. These findings are consistent with the demographics of previously released data on patients on HD [33]. The disparities in HD prevalence between the sexes may be explained by physiological differences, as well as the benefits and drawbacks of HD in society [33]. A similar correlation between age and health care needs was found in an Indian study, also advocating for regular checks and close attention to any health issues that may arise [34]. Subclavian vein (SCV) and internal jugular vein (IJV) catheters were compared by Shafiq et al. regarding procedural problems, tolerability, patient comfort, and cost-effectiveness [1]. They concluded that SCV is better than IJV because of its lower risk of complications, patient comfort, and cost-effectiveness compared to IJV, SCV is a superior location for HD catheterization [1]. The femoral site of catheter insertion can be associated with a higher rate of bloodstream infection and catheter colonization than the IJ and SC sites [35]. The choice of catheter site should be carefully made. The site of catheter insertion was carefully chosen. These results are in accordance with those of the present study. The total number of dialysis sessions following cannulation differed between the two groups in a statistically significant way ($p < 0.001$).

Breschan et al. revealed that subclavian venous catheters had a greater incidence of infection than internal jugular venous catheters (15.5% vs. 4.7%, $p=0.01$) and an earlier onset of catheter-associated infection [36]. Khalid et al. reported that the prevalence of bloodstream infection was higher in patients with internal jugular vein access (5.7%) than in those with subclavian access (3.8%) [37]. These findings are consistent with our findings, which proved the superiority of the subclavian vein catheter.

Numerous studies have shown that placing a dialysis catheter based on anatomical characteristics results in a greater rate of arterial puncture than ultrasonic guidance in the subclavian and internal jugular veins. Researchers have found that the subclavian approach was linked to a decreased incidence of bloodstream infections connected to the placement of catheters when compared to internal jugular access [(38)]. The probability of vascular perforation is a serious issue for experienced clinicians [(39)]. The process of placing catheter causes IJV injury at a higher rate than SCV damage, which is consistent with previous data [(40)]. The disadvantage of the IJV technique is that it doubles the probability of infections such as bacteremia and tunnel infection [(8)]. The placement of a central venous catheter through subclavian catheterization is more suitable because it has a reduced risks and increases the likelihood that patients will recover quickly and safely. Subclavian catheterization requires shorter access time than the internal jugular method. This method can be used in hospitals without access to color Doppler ultrasound machines. Shafique et al. reported that patients with an internal jugular vein double-lumen catheter had a significantly lower incidence of bacterial infection (32.3% vs. 16.1%).[(1)] Results of the present study suggest that 14.7% of infections in Group A and 4.6% of infections in Group B were significant, suggesting the superiority of SVC ($p < 0.012$).

There was no statistically significant difference between the two groups in terms of the frequency of venous thrombosis, catheter occlusion, or arrhythmia. Common organisms found in the cultures are shown in Figure 1 and 2. Methicillin-resistant Staphylococcus aureus (MRSA) (8.6% of positive cultures) represents a drug-resistant culture. Patients afflicted with MRSA require specific treatment options, and ceftazidime/avibactam and ceftolozane/tazobactam drugs have recently been used for the treatment of drug-resistant organisms [(41)]. Routine prophylactic antibiotic therapy is advised in uremic patients with a substantially weakened immune status (e.g., diabetes mellitus) to prevent future catheter-related infections [(42)]. The present study could not establish such a connection with DM.

Adherence to all Standard Operating Procedures (SOPs) helps reduce the occurrence of catheter-associated infections. For instance, between 2001 and 2009, the number of central line-associated bloodstream infections (CLABSIs) among patients admitted to critical care units (ICUs) in the United States dropped from 3.64 to 1.65 infections per 1000 central-line days [(43)].

The following are just a few of the interventions aimed at preventing the spread of infection related to central venous access: (1) intravenous antibiotic prophylaxis; (2) aseptic preparation of the physician, staff, and patients; (3) antiseptic solution selection; (4) catheters containing antimicrobial agents selection; (5) catheter insertion site selection; (6) catheter fixation method; (7) insertion site dressings; (8) catheter maintenance procedures; and (9) aseptic techniques using an existing central venous catheter for injection or aspiration [(44)].

To maintain a catheter, it is necessary to (1) establish the ideal length of catheterization, (2) inspect the catheter site, (3) replace the catheter at regular intervals, and (4) replace the catheter with a guidewire rather than a new insertion site. Choose a site that is not contaminated or potentially contaminated (such as burned or infected skin, inguinal area, area next to a tracheostomy, or open surgical wound). When selecting an insertion site for an adult, an upper body location should be chosen to reduce the risk of infection [(44)]. Catheter-related consequences (CRCs), including device failure, infections, and stenosis, place an additional financial burden on hemodialysis patients and the public health system, while necessitating expensive hemodialysis to maintain the life of essential patients [(45)]. Helpless patients see an increased financial strain on IJV device handlers negatively when it occurs before using a costly AV graft or fistula.

Conclusion: Subclavian vein (Group B) is a superior location for HD catheterization than the internal jugular vein (Group A) because of the higher incidence of culture-positive cases and infection. We also conclude that subclavian vein double-lumen catheterization has better outcomes than internal jugular vein double-lumen catheterization in terms of infection and complications at the PIMS hospital in Islamabad.

Limitations And Recommendations: Our study was based on a single center with a limited sample size and time constraints. We recommend that a comprehensive study with a larger sample size be conducted at multiple centers to determine the benefits of subclavian vein double-lumen catheterization in hemodialysis patients.

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