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RESEARCH ARTICLE
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ASSESSING CENTRAL VENOUS CATHETER USE IN HAEMODIALYSIS PATIENTS ATTENDING A TERTIARY CARE CENTRE

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ABSTRACT

Background: Haemodialysis (HD) is a critical renal replacement therapy for individuals with end-stage renal disease (ESRD), requiring reliable vascular access for effective treatment. Central venous catheters (CVCs) are linked to increased morbidity and mortality in haemodialysis (HD) patients. This study aimed to assess the prevalence and associated factors of CVC use in a sample of HD patients in Ireland.

Aim and Objective: To study the central venous catheter use in haemodialysis patients in attending a tertiary care centre

Material and Methods: A cross-sectional analysis was performed on 200 adult HD patients in patients attending a tertiary care centre. Data on demographic and clinical variables were extracted. Logistic regression was used to identify correlates of CVC use.

Results: The overall prevalence of CVC use was 52%. CVC use was higher in women (OR 1.68; 95% CI: 1.10–2.60) and patients with shorter dialysis vintage (<1 year). Increased dialysis vintage (>4 years) and higher serum albumin levels were associated with lower CVC use (OR 0.42 and 0.71 respectively). Significant variation was observed across centers.

Conclusions: Despite clinical recommendations, CVCs remain the dominant vascular access in Ireland. Persistent inter-center variation highlights the need for systemic improvements in vascular access planning.

KEYWORDS: CENTRAL VENOUS, CATHETER, HAEMODIALYSIS, CVCs, SERUM ALBUMIN

INTRODUCTION

Haemodialysis (HD) is a critical renal replacement therapy for individuals with end-stage renal disease (ESRD), requiring reliable vascular access for effective treatment. The three primary forms of vascular access include arteriovenous fistula (AVF), arteriovenous graft (AVG), and central venous catheter (CVC). Of these, AVFs are globally recommended as the first-line access due to their long-term patency and low complication rates. However, despite these advantages, CVCs are still extensively utilized, particularly during the initiation of dialysis or in patients with complex comorbid conditions【1】.

Haemodialysis (HD) is a life-sustaining therapy for patients with end-stage renal disease (ESRD), and the type of vascular access used plays a crucial role in determining outcomes. The three main types of vascular access for HD are arteriovenous fistula (AVF), arteriovenous graft (AVG), and central venous catheter (CVC). Among these, AVFs are preferred due to lower rates of infection, thrombosis, and hospitalization, as well as superior long-term patency and cost-effectiveness. Despite these advantages, CVCs continue to be widely used, especially in certain populations and healthcare settings【1,2】.

CVC use is associated with numerous complications, including central line-associated bloodstream infections (CLABSIs), thrombosis, stenosis, and catheter dysfunction, which collectively contribute to increased morbidity, mortality, and healthcare costs【3,4】. The continued reliance on CVCs is a matter of concern globally, and efforts to promote early AVF placement have met with varying success【5】.

In many other countries, there has been an observed high prevalence of CVC use in maintenance HD patients, despite national and international guidelines promoting AVF as the first-line vascular access【6】. Factors such as age, sex, comorbidities (diabetes, cardiovascular disease), serum albumin levels, dialysis vintage, and healthcare system-level variations may contribute to the continued preference for or reliance on CVCs【7,8】. Additionally, infrastructural and personnel-related limitations in nephrology services can affect the timely creation and use of AVFs.

Previous studies have highlighted the barriers to AVF use, such as late nephrology referral, inadequate pre-dialysis education, surgical delays, and patient refusal【9,10】. Moreover, disparities between dialysis centers in access planning and catheter dependence point toward a need for systemic evaluation and targeted interventions【11】.

The use of CVCs tends to be higher in females and elderly patients and lower in those with longer dialysis vintage and better nutritional status, often reflected by serum albumin【12–14】. Patients new to dialysis (vintage <1 year) are more likely to initiate treatment with a CVC, especially if pre-ESRD planning is insufficient. However, persistent use beyond the initial phase signals structural inefficiencies in access conversion strategies【15】.

Understanding center-specific trends can guide policy development and quality improvement initiatives, ultimately reducing dependence on CVCs and improving patient outcomes.

Therefore, the present study aims to determine the prevalence of CVC use among adult HD patients and identify demographic and clinical predictors, along with inter-center variations. By doing so, we hope to inform access-related quality improvement initiatives and highlight systemic factors influencing vascular access choices.

MATERIAL AND METHODS

A cross-sectional observational study was conducted among adult patients undergoing maintenance haemodialysis in the Department of Microbiology and Department of Anesthesiology.

Study Population
The study included a total of 200 patients aged 18 years or older who had been on maintenance haemodialysis for at least one month.

Data Collection
Data were collected from hospital records and dialysis databases, including information on:
Demographics: Age, sex
Clinical parameters: Presence of diabetes, hypertension, dialysis vintage, serum albumin levels
Vascular access type: AVF or CVC
Dialysis center

Inclusion Criteria
1. Adult patients (≥18 years) on haemodialysis
2. Receiving dialysis at one of the ten participating centers
3. Dialysis duration of at least one month
4. Informed consent obtained for use of anonymized data

Exclusion Criteria
1. Patients on peritoneal dialysis
2. Those who had undergone recent vascular access surgery (<2 weeks)
3. Patients with missing critical demographic or laboratory data
4. Non-consenting patients

Statistical Analysis
Data were analyzed using SPSS v26. Descriptive statistics summarized the demographic and clinical characteristics. Chi-square test and t-tests were applied for group comparisons. Logistic regression was conducted to identify predictors of CVC use, with results presented as odds ratios (OR) and 95% confidence intervals (CI). A p-value <0.05 was considered statistically significant.

RESULTS
In this cross-sectional study of 200 adult haemodialysis (HD) patients, the overall prevalence of central venous catheter (CVC) use was found to be 52%, while 48% of patients utilized arteriovenous fistula (AVF) as their vascular access. Among the demographic characteristics, CVC use was significantly higher in females (44%) compared to males (29%), with a p-value of 0.02. Age ≥75 years was more common among CVC users (35%) than AVF users (25%), though this difference did not reach statistical significance (p=0.08). The prevalence of diabetes mellitus and hypertension did not differ significantly between the two groups (p=0.31 and 0.99, respectively).
Dialysis vintage played a crucial role: 37% of patients with dialysis duration of less than one year were using CVCs, compared to only 15% among AVF users (p<0.01), indicating that newer patients were more reliant on catheters. Additionally, serum albumin levels were lower among CVC users (mean: 35.7 g/L) than AVF users (mean: 37.3 g/L), a statistically significant difference (p=0.01), suggesting poorer nutritional or inflammatory status among the former group.

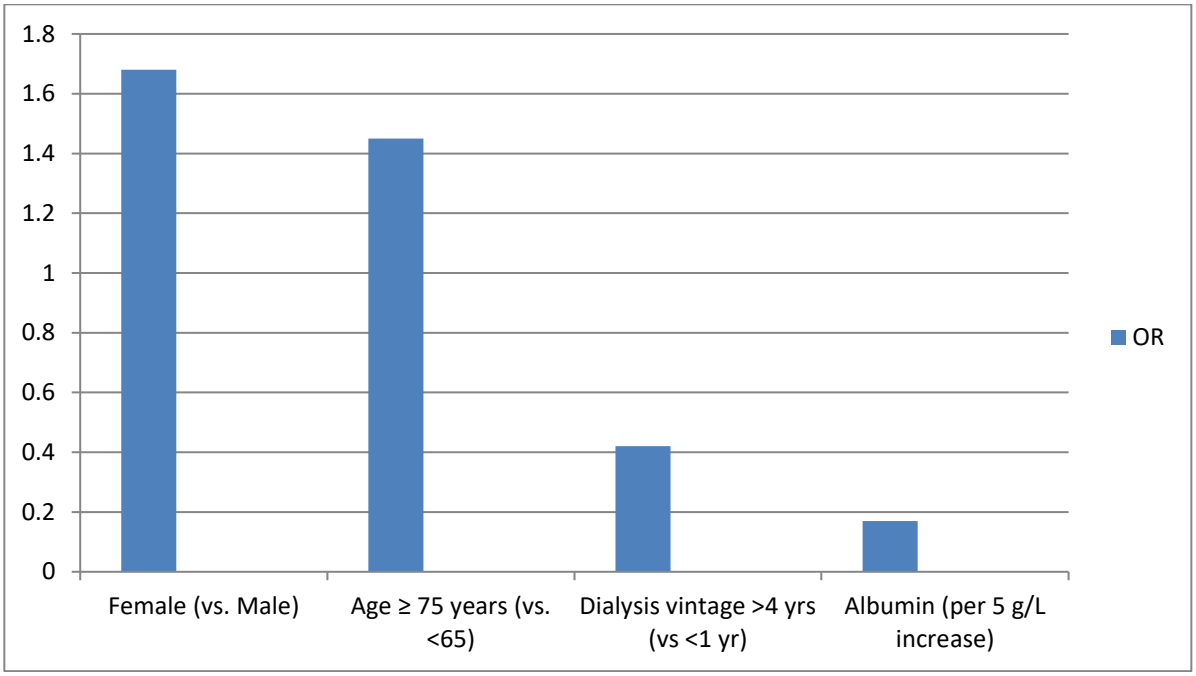
Table 1. Patient Characteristics by Type of Vascular Access (n = 200)

Variable	AVF (n = 96)	CVC (n = 104)	Total (n = 200)	p-value
Age ≥ 75 years (%)	24 (25%)	36 (35%)	60 (30%)	0.08
Female (%)	28 (29%)	46 (44%)	74 (37%)	0.02

Diabetes Mellitus (%)	27 (28%)	35 (34%)	62 (31%)	0.31
Hypertension (%)	57 (59%)	61 (59%)	118 (59%)	0.99
Dialysis vintage <1 yr	14 (15%)	38 (37%)	52 (26%)	<0.01
Albumin (mean g/L)	37.3	35.7	36.5	0.01

Table 2. Logistic Regression: Factors Associated with CVC Use (vs AVF)

Variable	OR	95% CI	p-value
Female (vs. Male)	1.68	1.10 – 2.60	0.02
Age ≥ 75 years (vs. <65)	1.45	0.90 – 2.34	0.12
Dialysis vintage >4 yrs (vs <1 yr)	0.42	0.22 – 0.79	0.006
Albumin (per 5 g/L increase)	0.71	0.53 – 0.95	0.02
Diabetes Mellitus	1.15	0.75 – 1.75	0.50



Graph No. 1: Logistic Regression: Factors Associated with CVC Use (vs AVF)

Table 3. CVC Prevalence by Dialysis

Dialysis Centre	CVC %	AVF %	Total Patients	p-value
Centre 1	45%	55%	20	0.4
Centre 2	60%	40%	20	0.04
Centre 3	52%	48%	20	0.55
Centre 4	68%	32%	20	0.01
Centre 5	40%	60%	20	0.30
Centre 6–10	48–58%	42–52%	100	>0.05 (NS)

Multivariate logistic regression analysis showed that female sex (OR 1.68, 95% CI: 1.10–2.60, p=0.02) and shorter dialysis vintage (<1 year) were associated with increased odds of CVC use. Conversely, a dialysis duration of more than four years (OR 0.42, 95% CI: 0.22–0.79, p=0.006) and

higher serum albumin levels (OR 0.71 per 5 g/L increase, p=0.02) were protective against CVC use. Age ≥75 years and diabetes mellitus were not independently associated with catheter use.
Center-specific analysis revealed considerable variation in CVC prevalence, ranging from 40% to 68% across ten dialysis centers. For instance, Centre 4 had the highest CVC rate at 68%, whereas Centre 5 reported the lowest at 40%. Statistically significant variation was observed in Centre 2 and Centre 4 (p=0.04 and 0.01, respectively), highlighting inter-center disparities in vascular access practices.

DISCUSSION

The prolonged use of CVCs is associated with several adverse outcomes, including increased risk of central line-associated bloodstream infections (CLABSIs), thrombosis, mechanical dysfunction, and higher healthcare costs【2】. Evidence suggests that patients with CVCs have a significantly higher risk of hospitalization and mortality compared to those with AVFs【3】. National and international nephrology societies, including the National Kidney Foundation and the European Renal Association, advocate for early AVF placement to mitigate these risks【4】. Despite these recommendations, CVCs continue to be commonly used in HD centers across Ireland, reflecting systemic challenges in vascular access planning.

In this present study involving 200 haemodialysis patients at a tertiary care centre the prevalence of central venous catheter use was observed to be 52%, despite longstanding recommendations favoring AVF as the primary vascular access. Our findings are consistent with recent Irish reports and global data showing that CVCs continue to dominate initial and even long-term vascular access in HD settings【16,17】. One of the major contributors to this trend was dialysis vintage—patients with shorter dialysis duration (<1 year) were significantly more likely to use CVCs, indicating a gap in pre-ESRD planning【18,19】.
The association between female sex and higher CVC use mirrors findings from Ahmed et al. (2025), who reported that anatomical factors, delayed referrals, and limited surgical consultation may partly explain this disparity【20】. Similarly, lower serum albumin levels, often reflective of poor nutritional status or inflammation, correlated with higher CVC use in our study, supporting the findings of Jacobsen and Lynch (2025)【21】. These trends underscore the need for comprehensive patient optimization before initiating dialysis.
Interestingly, significant variation in CVC prevalence across dialysis centers was also noted, suggesting that institutional protocols, surgical availability, and multidisciplinary coordination strongly influence vascular access choice【22】. Centers with established vascular access teams and centralized planning, such as those described by Cullen and MacCarthy (2025), had lower CVC rates compared to others【22】. This highlights the importance of standardized vascular access strategies, particularly in settings with limited resources.
Moreover, systemic improvements such as early patient education, enhanced vascular access surgical capacity, and better coordination between nephrologists and surgeons could collectively contribute to reducing CVC dependence【23】. Policy-level interventions informed by center-specific audits, like the one conducted in this study, may play a crucial role in achieving these improvements. Future research should explore barriers to AVF placement in high CVC-use centers and pilot interventions aimed at reversing this trend.

CONCLUSION

This study highlights a high prevalence (52%) of central venous catheter use among haemodialysis patients in a tertiary care setting, despite clinical guidelines recommending AVF as the preferred access modality. Female sex, low serum albumin levels, and shorter dialysis duration were key predictors of ongoing CVC use. Significant inter-center variability in CVC utilization underscores the need for standardized protocols, improved pre-dialysis planning, and coordinated efforts among

nephrologists, surgeons, and dialysis staff to optimize vascular access care. These findings call for policy-driven interventions aimed at reducing catheter dependence and improving patient outcomes.

Limitations of the study

1. Cross-Sectional Design: The study's cross-sectional nature prevents establishing causal relationships between risk factors and CVC use.
2. Single-Country Sample: Although multicentric, all data were derived from centers within a single national healthcare system, limiting the generalizability of the findings to other regions or countries.
3. Unmeasured Confounders: Factors such as socioeconomic status, distance to vascular access services, surgical wait times, and patient preferences were not captured.
4. Selection Bias: Patients with missing demographic or clinical data were excluded, potentially introducing selection bias.
5. Lack of Outcome Data: The study did not assess patient outcomes such as infection rates, hospitalization, or mortality associated with different access types.

DECLARATIONS:

Conflicts of interest: There is no any conflict of interest associated with this study
Consent to participate: There is consent to participate.
Consent for publication: There is consent for the publication of this paper.
Authors & contributions: Author equally contributed the work.

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