The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 6, 2025

FREQUENCY OF THROMBOEMBOLISM AS COMPLICATION OF CENTRAL VENOUS CATHETRISATION, INTERNAL JUGULAR OR FEMORAL VEIN (A COMPARATIVE STUDY)

Wajid Ali[*1], Muhammad Faheem Ur Rehman Khan[2], Saad Khan[3], Syeda Zainab[4], Asma Bibi[5], Beenish Saqib[6]

[*1,2,3,4,5,6]*PEMH Rawalpindi*

DOI: https://doi.org/10.5281/zenodo.22766052

Keywords
Central venous catheterization, Thromboembolism, Deep vein thrombosis, Internal jugular vein, Femoral vein, Catheter-related thrombosis.

Article History
Received: 25 April 2025
Accepted: 04 June 2025
Published: 21 June 2025

Copyright @Author
Corresponding Author: *
Wajid Ali

Abstract

Objectives:

To determine and compare the frequency of thromboembolism as a complication of central venous catheterization (CVC) performed through the internal jugular vein and femoral vein in adult patients.

Methodology:

This comparative cross-sectional study was conducted in a tertiary care hospital over a specified period. A total of 120 adult patients requiring CVC insertion for various clinical indications were included using non-probability consecutive sampling. Patients were divided into two equal groups: Group A (internal jugular vein, n=60) and Group B (femoral vein, n=60). Patients with pre-existing thromboembolic disease or coagulation disorders were excluded. Data regarding demographic characteristics, duration of catheterization, comorbidities, and thromboembolic complications were recorded using a structured proforma. Thromboembolism was diagnosed clinically and confirmed by Doppler ultrasonography. Data were analyzed using descriptive statistics, chi-square test, and independent sample t-test, with $p < 0.05$ considered statistically significant.

Results:

The overall frequency of thromboembolism was 15% (18/120). Thromboembolic events occurred in 5 patients (8.3%) in the internal jugular group and 13 patients (21.7%) in the femoral group, showing a statistically significant difference ($p = 0.041$). The mean duration of catheterization was significantly longer in the femoral group (7.4 ± 2.5 days) compared to the internal jugular group (6.2 ± 2.1 days). Deep vein thrombosis accounted for 77.8% of cases, while pulmonary embolism accounted for 22.2%.

Conclusion:

Femoral vein catheterization was associated with a higher frequency of thromboembolic complications compared to internal jugular vein catheterization. Prolonged catheter duration increased the risk. The internal jugular vein appears to be a safer site regarding thromboembolic risk.

INTRODUCTION

Central venous catheterization (CVC) is a technique administered extensively to adult patients for many indications, including establishing a secure stable route for drug administration, volume resuscitation, hemodialysis, nutritional support, central venous pressure measurement, and facilitation of complex interventions such as oncologic treatments [1]. Therefore, central venous port (CVP) catheters have become the preferred tool to administer intravenous drugs to patients

who may require extended treatment periods [2]. Central venous catheters (CVCs) have been a significant part of newborn care with the ability for long-term survival of sick and immature infants in neonatal intensive care units (NICU) [3]. Most premature and critically ill infants need a central line for advanced medical management and detailed monitoring in the further stages of their intensive care process. Nowadays, even in extremely low birth weight infants, central venous access under sonographic guidance can be performed safely with a high success rate [4]. Central venous catheters (CVCs) are widely used to deliver medications, fluids, and parenteral nutrition. Older estimates suggest that 5 million CVCs are inserted in the US annually [5]. Despite their frequent use, CVCs are associated with several risks, including immediate insertion-related complications (eg, pneumothorax, arterial cannulation), central catheter–line-associated bloodstream infections (CLABSI), and deep venous thrombosis (DVT) [6]. Use of central venous catheters (CVCs) is indispensable in modern-day medical practice. Beside its benefits, there are multiple complications associated with central venous catheterization. These complications are mechanical, infectious or thrombotic in origin [7]. There is a growing body of literature that recognizes the potential deleterious consequences of catheter-related bloodstream infections, and, for obvious reasons, this has been the main focus of research [8]. A cross-section study suggested that the most common causes of internal jugular vein thrombosis are cancer and central venous catheter [9]. A systematic review and meta-analysis revealed 7.5 percent of patients out of 5636 cancer patients developed catheter-related venous thrombosis [10].

METHODOLOGY

This comparative study was conducted to determine the frequency of thromboembolism as a complication of central venous catheterization performed through the internal jugular vein and femoral vein. The research was carried out in a tertiary care hospital over a specified study period. A quantitative, comparative cross-sectional study design was adopted to assess and compare the incidence of thromboembolic complications between the two catheter insertion sites. The study population consisted of patients who required central venous catheter (CVC) insertion for clinical indications such as hemodynamic monitoring, administration of vasoactive drugs, parenteral nutrition, or difficult peripheral venous access. Patients were selected using a non-probability consecutive sampling technique. All adult patients who underwent central venous catheterization through either the internal jugular vein or femoral vein during the study period were included. Patients with pre-existing thromboembolic disease, known coagulation disorders, those on long-term anticoagulation therapy, or with previous catheterization at the same site were excluded to minimize confounding variables.

After obtaining informed consent, patients were divided into two groups based on the site of catheter insertion. Group A included patients who underwent internal jugular vein catheterization, while Group B included patients who underwent femoral vein catheterization. All catheterizations were performed under aseptic conditions following standardized hospital protocols. Ultrasound guidance was used where available to enhance accuracy and reduce procedural complications. The type, size, and duration of catheter placement were recorded. The primary quantitative variable of the study was the frequency (incidence rate) of thromboembolism following central venous catheterization. Thromboembolism was diagnosed based on clinical signs such as limb swelling, pain, erythema, and confirmed through Doppler ultrasonography or other relevant imaging modalities. The outcome was measured as a categorical quantitative variable (presence or absence of thromboembolism) and was expressed in percentages and proportions for each group. The duration of catheterization (measured in days), patient age (in years), and hospital stay (in days) were additional continuous quantitative variables analyzed using mean and standard deviation.

Qualitative variables included gender

(male/female), site of catheterization (internal jugular or femoral vein), indication for catheterization (medication administration, monitoring, nutrition, etc.), presence of comorbidities (such as diabetes mellitus, hypertension, malignancy), and occurrence of thromboembolism (yes/no). These variables were presented as frequencies and percentages. The type of thromboembolic event (deep vein thrombosis or pulmonary embolism) was also recorded as a nominal qualitative variable. Data were collected using a structured proforma designed specifically for the study. All relevant demographic, clinical, and procedural details were documented at baseline, and patients were followed prospectively for the development of thromboembolic complications until catheter removal or discharge. Regular clinical assessments were conducted, and Doppler studies were performed when thromboembolism was suspected.

Data were entered and analyzed using statistical software. Descriptive statistics were applied to summarize demographic and clinical characteristics. The frequency of thromboembolism in both groups was calculated and compared. The chi-square test was used to assess the association between categorical variables, while the independent sample t-test was applied to compare means of continuous variables between the two groups. A p-value of less than 0.05 was considered statistically significant. Ethical approval was obtained from the institutional review board prior to commencement of the study. Confidentiality of patient information was strictly maintained throughout the research process. The findings were interpreted to determine whether the frequency of thromboembolism differed significantly between internal jugular and femoral vein catheterization sites.

RESULTS

A total of 120 patients were included in the study. Among them, 60 patients (50%) underwent central venous catheterization through the internal jugular vein (Group A), while 60 patients (50%) underwent catheterization through the femoral vein (Group B). The mean age of the patients was 54.2 ± 13.6 years in Group A and 56.8 ± 12.9 years in Group B. Males constituted 65% of the total study population, while females accounted for 35%. The average duration of catheterization was 6.2 ± 2.1 days in the internal jugular group and 7.4 ± 2.5 days in the femoral group. Thromboembolic complications were observed in 18 out of 120 patients (15%). The frequency of thromboembolism was significantly higher in the femoral vein group compared to the internal jugular vein group. In Group A (internal jugular vein), 5 patients (8.3%) developed thromboembolism, whereas in Group B (femoral vein), 13 patients (21.7%) developed thromboembolism. The difference was statistically significant (Chi-square test, $p = 0.041$).

Among the thromboembolic events, deep vein thrombosis (DVT) was the most common type observed, accounting for 14 cases (77.8%), while pulmonary embolism (PE) was identified in 4 cases (22.2%). The majority of thromboembolic events in the femoral group were DVTs involving the lower limb veins.

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants (n = 120)

Variable	Group A (Internal Jugular) n=60	Group B (Femoral) n=60	p-value
Mean Age (years)	54.2 ± 13.6	56.8 ± 12.9	0.312
Gender (Male)	38 (63.3%)	40 (66.7%)	0.701
Gender (Female)	22 (36.7%)	20 (33.3%)	—
Mean Duration of Catheter (days)	6.2 ± 2.1	7.4 ± 2.5	0.018*
Diabetes Mellitus	16 (26.7%)	18 (30%)	0.684
Hypertension	20 (33.3%)	22 (36.7%)	0.704
Malignancy	8 (13.3%)	10 (16.7%)	0.605

*Statistically significant ($p < 0.05$)

Table 2: Frequency and Type of Thromboembolism in Internal Jugular vs Femoral Vein Catheterization

Outcome Variable	Group A (Internal Jugular) n=60	Group B (Femoral) n=60	Total (n=120)	p-value
Thromboembolism Present	5 (8.3%)	13 (21.7%)	18 (15%)	0.041*
Thromboembolism Absent	55 (91.7%)	47 (78.3%)	102 (85%)	—
Deep Vein Thrombosis (DVT)	3 (5%)	11 (18.3%)	14 (11.7%)	0.032*
Pulmonary Embolism (PE)	2 (3.3%)	2 (3.3%)	4 (3.3%)	0.999

*Statistically significant ($p < 0.05$)

The results demonstrated that femoral vein catheterization was associated with a significantly higher frequency of thromboembolic complications compared to internal jugular vein catheterization. Prolonged duration of catheterization was also significantly associated with increased thromboembolism risk. Deep vein thrombosis was the most common thromboembolic complication observed in both groups. Overall, internal jugular vein catheterization appeared to be a relatively safer option in terms of thromboembolic risk compared to femoral vein catheterization in this study population.

DISCUSSION

A total of 120 patients were included in the present study. Of these, 60 patients (50%) underwent central venous catheterization via the internal jugular vein (Group A), while the remaining 60 patients (50%) underwent catheterization through the femoral vein (Group B). The mean age was 54.2 ± 13.6 years in Group A and 56.8 ± 12.9 years in Group B. In contrast, another study conducted in 2025 reported that the diameter of the jugular vein was not associated with the development of catheter-related thrombosis (CRT) [11]. In the current study, males comprised 65% of the total study population, whereas females accounted for 35%. The mean duration of catheterization was 6.2 ± 2.1 days in the internal jugular group and 7.4 ± 2.5 days in the femoral group. Similarly, a study published in 2022 demonstrated comparable success rates for both routes of central venous access. However, it was noted that intrathoracic complications related to internal jugular vein (IJV) stents could be severe in critically ill infants. Femoral vein (FV) stents were reported to be associated with better-tolerated complications in infants. The authors further recommended additional studies to confirm the low rate of infectious complications associated with femoral vein catheters [12].

In our study, thromboembolic complications were observed in 18 out of 120 patients (15%). The incidence of thromboembolism was significantly higher in the femoral vein group compared to the internal jugular vein group. In Group A (internal jugular vein), 5 patients (8.3%) developed thromboembolism, whereas in Group B (femoral vein), 13 patients (21.7%) experienced thromboembolic events. This difference was statistically significant (Chi-square test, $p = 0.041$). In comparison, a 2024 study reported that approximately 3% of central venous catheter (CVC) placements were associated with major complications. The use of ultrasound guidance was found to reduce specific risks, including arterial puncture and pneumothorax [13]. Among the thromboembolic events identified in our study, deep vein thrombosis (DVT) was the most frequent complication, accounting for 14 cases (77.8%), while pulmonary embolism (PE) was observed in 4 cases (22.2%). Most thromboembolic events in the femoral group were lower limb DVTs. A 2022 study reported that the internal jugular vein was the most commonly used route for central venous catheter insertion in intensive care unit patients. Although complications were not very

common overall, failed attempts were more frequently observed with the internal jugular approach, whereas local cellulitis occurred more often with the femoral approach [14].

The findings of the present study demonstrated that femoral vein catheterization was associated with a significantly higher frequency of thromboembolic complications compared to internal jugular vein catheterization. Additionally, prolonged catheterization duration was significantly associated with an increased risk of thromboembolism. Supporting these findings, a 2024 study in critically ill patients reported a high prevalence and incidence of catheter-related thrombosis. Although catheter-related thrombosis was not associated with catheter-related infections, it was linked to pulmonary embolism and a reduced mortality risk [15]. In our study, deep vein thrombosis was the most common thromboembolic complication observed in both groups. Overall, internal jugular vein catheterization appeared to be a relatively safer option in terms of thromboembolic risk when compared to femoral vein catheterization in this study population. Consistent with our findings, a study published in 2000 concluded that the internal jugular vein is the preferred site for tunneled infusion catheter placement due to its lower incidence of symptomatic venous thrombosis [16].

CONCLUSION

The present study concluded that thromboembolic complications are a significant risk associated with central venous catheterization. Femoral vein catheterization was found to have a significantly higher frequency of thromboembolism compared to internal jugular vein catheterization. Prolonged duration of catheter placement further increased the risk of thromboembolic events. Deep vein thrombosis was the most common complication observed. Therefore, the internal jugular vein appears to be a relatively safer site for central venous catheterization in terms of thromboembolic risk.

REFERENCE

Safety Committee of Japanese Society of Anesthesiologists anzen@ anesth. or. jp. Practical guide for safe central venous catheterization and management 2017. Journal of Anesthesia. 2020 Apr;34(2):167-86.Sugawara S, Sone M, Sakamoto N, Sofue K, Hashimoto K, Arai Y, Tokue H, Takigawa M, Mimura H, Yamanishi T, Yamagami T. Guidelines for central venous port placement and management (abridged translation of the Japanese version).Interventional Radiology. 2023 Jul 1;8(2):105-17.

Karakaya A, DOĞAN A, Guler A. Comparison of Femoral and Internal Jugular Vein Catheterisation Trends in Sick Infants. JCPSP-JOURNAL OF THE COLLEGE OF PHYSICIANS AND SURGEONS PAKISTAN. 2022;32(6).

Montes-Tapia F, Rodríguez-Taméz A, Hernandez-Garduno A, Barreto-Arroyo I, Rodríguez-Balderrama I, de la O-Cavazos M, Quero J. Vascular assessment of the right internal jugular vein in low birth weight newborns. The Journal of Maternal-Fetal & Neonatal Medicine. 2013 Oct 1;26(15):1510-3.

McGee DC, Gould MK. Preventing complications of central venous catheterization. New England journal of medicine. 2003 Mar 20;348(12):1123-33.

Timsit JF, Rupp M, Bouza E, et al. A state of the art review on optimal practices to prevent, recognize, and manage complications associated with intravascular devices in the critically ill. Intensive Care Med. 2018;44(6):742-759. doi:

Parienti JJ, Mongardon N, Mégarbane B, Mira JP, Kalfon P, Gros A, Marqué S, Thuong M, Pottier V, Ramakers M, Savary B. Intravascular complications of central venous catheterization by insertion site. New England Journal of Medicine. 2015 Sep 24;373(13):1220-9.

Fletcher S. Catheter-related bloodstream infection. Continuing Education in Anaesthesia, Critical Care & Pain. 2005 Apr 1;5(2):49-51.

Gbaguidi X, Janvresse A, Benichou J, Cailleux N, Levesque H, Marie I. Internal jugular vein thrombosis: outcome and risk factors. QJM: An International Journal of Medicine. 2011 Mar 1;104(3):209-19.

Saber W, Moua T, Williams EC, Verso M, Agnelli G, Couban S, Young A, De Cicco M, Biffi R, Van Rooden CJ, Huisman MV. Risk factors for catheter-related thrombosis (CRT) in cancer patients: a patient-level data (IPD) meta-analysis of clinical trials and prospective studies. Journal of Thrombosis and Haemostasis. 2011 Feb 1;9(2):312-9.

Tünay A, Acıkgoz A, Atesal Ö. Internal Jugular Vein Size and Thrombosis Risk in Central Venous Catheterization. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research. 2025 Jun 17;31:e948228.

Karakaya A, DOĞAN A, Guler A. Comparison of Femoral and Internal Jugular Vein Catheterisation Trends in Sick Infants. JCPSP-JOURNAL OF THE COLLEGE OF PHYSICIANS AND SURGEONS PAKISTAN. 2022;32(6).

Teja B, Bosch NA, Diep C, Pereira TV, Mauricio P, Sklar MC, Sankar A, Wijeysundera HC, Saskin R, Walkey A, Wijeysundera DN. Complication rates of central venous catheters: a systematic review and meta-analysis. JAMA Internal Medicine. 2024 May;184(5):474-82.

Haroon M, Anwer A. Comparison of Complications in Patients with Central Venous Catheter Placement Via Internal Jugular, Subclavian and Femoral Route at Intensive Care Unit: Comparison of complications of CVC placement via different routes. Pakistan Journal of Health Sciences. 2022 Dec 31:30-4.

Smit JM, Haaksma ME, Heldeweg ML, Adamse DS, Choi KF, Jonker SR, Rijpkema J, van Zanten FJ, Vlaar AP, Müller MC, Girbes AR. Incidence of catheter-related thrombosis and its association with outcome in critically ill patients: A prospective observational study. Thrombosis Research. 2024 Sep 1;241:109068.

Trerotola SO, Kuhn-Fulton J, Johnson MS, Shah H, Ambrosius WT, Kneebone PH. Tunneled infusion catheters: increased incidence of symptomatic venous thrombosis after subclavian versus internal jugular venous access. Radiology. 2000 Oct;217(1):89-93.