

Incidence And Characteristics Of Double Lumen Induced Central Venous Catheter-Related Thromboembolism In Hemodialytic Patients

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Abstract

Background: Central venous catheters (CVCs) are frequently used in patients for several indications such as cancer treatment, diagnostic monitoring, parenteral nutrition, hemodialysis, and administration of fluids, blood products or medication. Double lumen catheter induced CVCs thrombosis has not been paid into proper attention in developing countries such as Indonesia.

Aims: The aim of this study is to identify the incidence and characteristic of double lumen catheter induced CVCs thrombosis in patients undergoing hemodialysis.

Methods: This systematic review has been registered in PROSPERO (CRD42020181584). A systematic search of literature for observational and randomized controlled trial was conducted in PubMed, PubMed central, and Google Scholar through April 16, 2020. Two reviewers independently searched and selected. The risk of bias was evaluated using the Newcastle-Ottawa Quality assessment tool.

Results: A total of 408 patients were included in our study. There were 192 (47.1%) male patients. The double lumen catheter was mostly placed in the jugular vein (60%), followed by subclavian vein (25%) and femoral vein (15%). Four (1.1%) patients had deep vein thrombosis after about one month of double lumen catheter placement. All these four patients, the double lumen catheter was inserted in the femoral vein. Any other significant risk factors for thrombosis other than double lumen catheter insertion not found. Out of these four patients, one of them passed away. All patients were treated using heparin.

Conclusion: The incidence of double lumen catheter induced thrombosis is low (1.1%) in patients undergoing hemodialysis. However, further larger study is needed to confirm and find the associating factors.

Introduction

Central venous catheters (CVCs) is an indwelling device that is peripherally inserted into a central vein, most commonly the internal jugular, subclavian or femoral and advanced until the terminal lumen resides within the inferior vena cava, superior vena cava or right atrium.¹ CVCs are frequently used for several indications including cancer treatment, diagnostic monitoring, parenteral nutrition, hemodialysis, and administration of fluids, blood products or medication. Potential complications of catheter related thrombosis (CRT) are thromboembolism in 10% to 15%, interruption of venous flow 10%, infection and catheter occlusion.^{2,3} Hemodialysis patient related to long-term vascular access, double lumen catheters often used for hemodialysis patient to reduced the infection rate, however, the other complication such as thrombosis remain a problem.⁴ There are several risk factors for the development of CRT including patient factors such as hypercoagulable states (malignancy, sepsis, critical illness, renal failure, inherited thrombophilias, use of certain drugs), catheter type (increased lumen diameter such as double lumen CVC) and insertion process (multiple insertion attempts, tip located above the junction between the SCV and atrium).² The pathophysiology are related to Virchow's triad of endothelial damage, stasis and hypercoagulability, described as the components involved in thrombus formation.³ Intravenous catheters may cause endothelial trauma and are often placed in patients who are hypercoagulable, leading to venous thrombosis.⁵ Catheter-related thromboembolism can be symptomatic or asymptomatic.

The incidence of catheter-related asymptomatic thromboembolism is 27% to 66% and symptomatic catheter-related thromboembolism is 0% to 28%.⁶ And if left untreated, it can contribute to decreased quality of life and can be fatal. Double lumen catheter induced CVCs thrombosis has not been paid into proper attention in developing countries such as Indonesia.

Methods

This is a retrospective cohort study conducted in General Teaching Hospital in a suburban area Indonesia. Data was taken from the medical records from January 2018 to January 2019. Inclusion criteria were patients who had undergone hemodialysis using double lumen catheter. The baseline characteristics and incidence of catheter induced thrombosis was noted using a structured questionnaire. CVCs thrombosis was confirmed using D-dimer and compression ultrasonography.

Results

A total of 408 patients were included in our study. The mean age of the patients was \pm 49.3 years. There were 192 (47.1%) male patients. The double lumen catheter was mostly placed in the jugular vein (60%), followed by subclavian vein (25%) and femoral vein (15%) (Table 1).

Four (1.1%) patients had deep vein thrombosis after about one month of double lumen catheter placement. Out of four patients, two of the patients were male. In all these four patients, the double lumen catheter was inserted in the femoral vein. Any other significant risk factors for thrombosis other than double lumen catheter insertion not found. Out of these four patients, one of them passed away. All patients were treated using heparin.

Discussion

Over 150 years ago, the German pathologist Rudolph Virchow postulated that thrombus formation and propagation resulted due to abnormalities in 3 areas namely; blood flow, vessel wall and blood components (Figure 1). Catheter insertion is a risk for thrombosis due to its damage to the endothelial wall, and contribution to stasis.⁷⁻⁹

There are also several catheter-related risk factors for development of thrombosis such as catheter tip location, number of lumens, prior catheterization at same puncture site, prolonged catheter dwell time, catheter related infection and more than one insertion attempt.^{10,11} There has been evidence on larger diameter catheters and increased thrombosis risk in recent literature.¹²⁻¹³ Catheter to vessel ratio (CVR) defined as the indwelling space or area consumed or occupied by an intravascular device inserted and positioned within a venous or arterial blood vessel. In 2016, new practice recommendations stated that the CVR is below 45% of the vessel diameter.¹⁴ Larger lumens caused larger endothelial damage. Injury to endothelium is accompanied by loss of protective molecules and expression of adhesive molecules, procoagulant activities and mitogenic factors leading to development of thrombosis.¹⁵

Majority of CRT are asymptomatic which can make identification difficult. The clinical features may be fairly self-evident such as arm or neck swelling and discomfort or venous distension. In some cases, patient may experience atypical symptoms such as jaw or shoulder pain, headache, erythema of limb, phlebitis, localised numbness and pain.⁷ Consensus opinion for the treatment of CRT is systemic

anticoagulation such as low molecular weight heparin (LMWH) for minimum of three months.^{7,16} Based on current guidelines, anticoagulation for the routine prevention of CRT is not recommended, although it is expected that vast majority of critical care patients will receive LMWH or low dose heparin (1 mg/ day) as standard care prophylaxis without increase in bleeding risk.^{17,18}

In our study, one patient passed away. We hope that in the future prophylactic anticoagulation can be given to high risk patients in order to avoid such major complications.

Limitations of our study are we only took data from the past one year since this is still a preliminary study. Another limitation is that this is a retrospective study. There are many factors that may impact thrombosis, it is difficult to account for all confounding variables with this study design. Further recommendations are we suggest study with prospective methods and larger studies are required.

Conclusion

The incidence of double lumen catheter induced thrombosis is low (1.1%) in patients undergoing hemodialysis. However, further larger study is needed to confirm and find the associating factors.

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None

References

1. Hamilton H, Bodenham A. Central venous catheters. Chichester, U.K.: Wiley-Blackwell; 2009. <https://doi.org/10.1002/9780470750186>
2. Smith Reston, Nolan Jerry. Central Venous Catheters. *BMJ*;2013;347:28-32. <https://doi.org/10.1136/bmj.f6570>
3. Verso M, Agnelli G. Venous thromboembolism associated with long-term use of central venous catheters in cancer patients. *J Clin Oncol.* 2003; 21:3665-75. <https://doi.org/10.1200/JCO.2003.08.008>
4. Wechsler RJ, Spim PW, Conant EF, Steiner RM, Needleman L: Thrombosis and infection caused by thoracic venous catheters: Pathogenesis and imaging findings. *AJR Am J Roentgen.* 1993;16:467-471. <https://doi.org/10.2214/ajr.160.3.8430537>
5. M Verso, G Agnelli. Venous Thromboembolism Associated with Long-term Use of Central Venous Catheters in Cancer Patients. *J Clin Oncol.* 2003;21:3665. <https://doi.org/10.1200/JCO.2003.08.008>
6. Debourdeau P, Espie M, Chevret S. Incidence, Risk Factors, and Outcome of Central Venous Catheter-Related Thromboembolism in Breast Cancer Patients: the CAVECCAS Study. *Cancer Medicine.* 2017;6:2732-44. <https://doi.org/10.1002/cam4.1201>
7. Wall, C., Moore, J. and Thachil, J. Catheter-related thrombosis: A practical approach. *Journal of the Intensive Care Society.* 2015;17:160-167. <https://doi.org/10.1177/1751143715618683>
8. Rooden, C., Tesselaar, M., Osanto, S., Rosendaal, F. and Huisman, M. (2005). Deep vein thrombosis associated with central venous catheters - a review. *Journal of Thrombosis and Haemostasis.* 2005; 3:2409-2419. <https://doi.org/10.1111/j.1538-7836.2005.01398.x>
9. Lee AY, et al. Incidence, risk factors and outcomes of catheter-related thrombosis in adult patient with cancer. *J Clin Oncol.* 2006;24:1404-8. <https://doi.org/10.1200/JCO.2005.03.5600>
10. Spencer, TR, Mahoney. Reducing catheter-related thrombosis using a risk reduction tool centered on catheter to vessel ratio. *Thrombosis and thrombolysis J.* 2017;44:427-34. <https://doi.org/10.1007/s11239-017-1569-y>
11. Lacy J. Catheter-related venous thrombosis. Paper presented at association for vascular. 2017.
12. Campisi C, Biffi R, Pittiruti M. Catheter-related central venous thrombosis: the development of a nationwide consensus paper in Italy. *JAVA.* 2017;12:38-46. <https://doi.org/10.2309/java.12-1-10>

13. Chopra V, Ratz D, Kuhn L, Lopus T, Lee A, Krein S. Peripherally inserted central catheter-related deep vein thrombosis: contemporary patterns and predictors. *J thromb haemost.* 2014;12:847-54.
<https://doi.org/10.1111/jth.12549>
14. Steiger E. Dysfunction and thrombotic complications of vascular access devices. *JPEN.* 2006;30:1. <https://doi.org/10.1177/01486071060300S1S70>
15. Wu, K Thiagarajan. Role of endothelium in thrombosis and hemostasis. *Annual review of medicine.* 1996;47:315-31. <https://doi.org/10.1146/annurev.med.47.1.315>
16. Debourdeau P, Farge D, Beckers M, Baglin C, et al. International clinical practice guidelines for the treatment and prophylaxis of thrombosis associated with central venous catheters in patients with cancer. *J Thromb Haemost.* 2013;11:71-80.
<https://doi.org/10.1111/jth.12071>
17. Young A, Billingham L, Begum G, et al. WARP Collaborative Group. Warfarin thromboprophylaxis in cancer patients with central venous catheters (WARP): an open-label randomised trial. *Lancet.* 2009; 373: 567-574.
[https://doi.org/10.1016/S0140-6736\(09\)60205-1](https://doi.org/10.1016/S0140-6736(09)60205-1)
18. Akl EA, Vasireddi SR, Gunukula S, et al. Anticoagulation for patients with cancer and central venous catheters. *Cochrane Database Syst Rev.* 2011;16:6468
<https://doi.org/10.1002/14651858.CD006468.pub4>

Appendices

Table 1. Demography Characteristics

Variable	n	%
Gender		
Male	192	47,1
Female	216	52,9
Age Mean	± 49.3 years	
Catheter Location		
Jugular Vein	245	60
Subclavian Vein	102	25
Femoral Vein	61	15

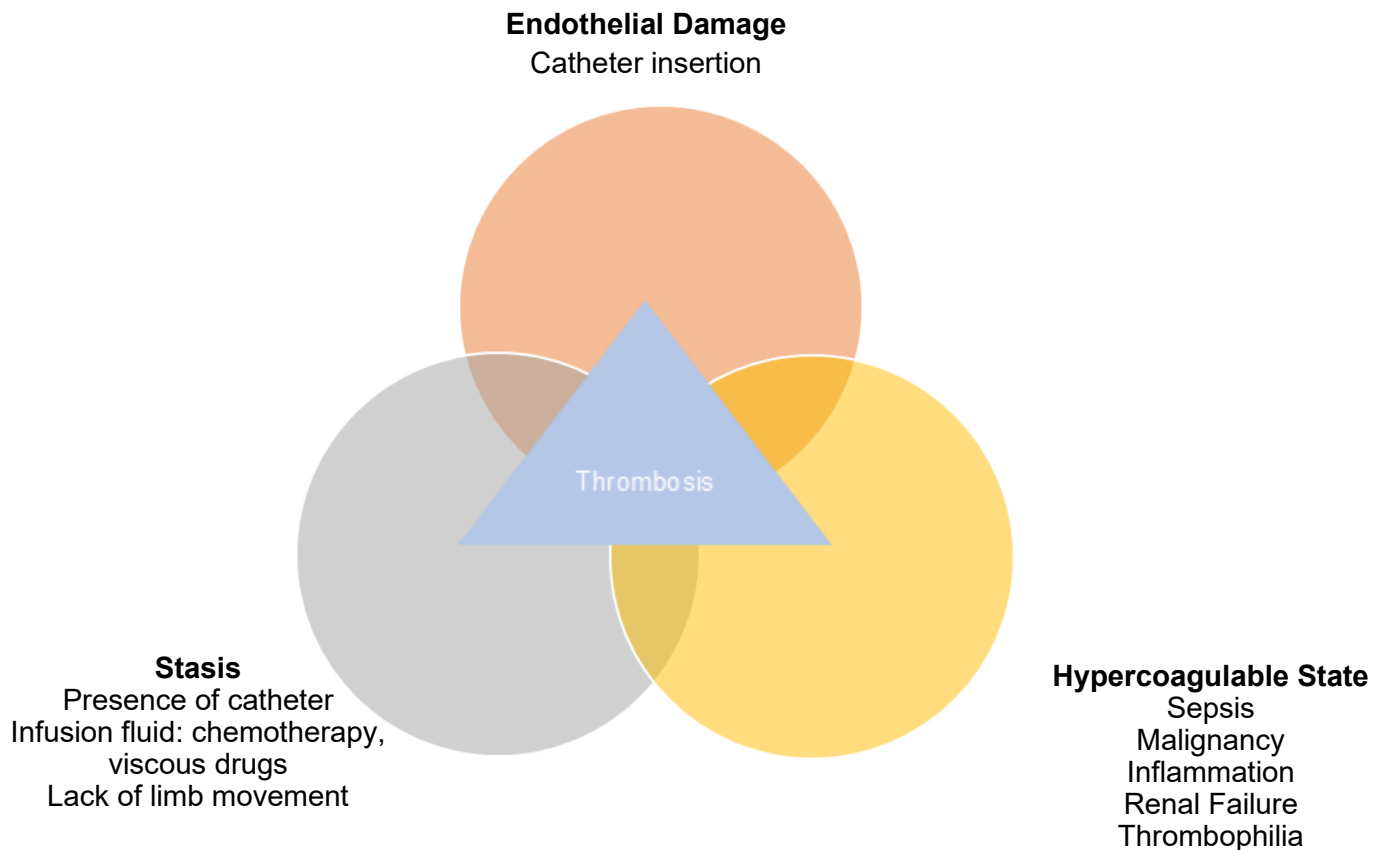


Figure 1. Postulated Mechanisms Development of CVC Related Thrombosis