

12-31-2019

Correlation between Internal Jugular Vein Tunnel Cuffed Catheter Tip Position as Hemodialysis Access with Suspected Catheter Related Bacteremia and Related Risk Factors at RSCM 2018–2019

Susatyo J. Pratomo

Training Program in Surgery, Faculty of Medicine Universitas Indonesia, pratomo1206@gmail.com

Akhmadu Muradi

Division of Vascular and Endovascular Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta

Follow this and additional works at: <https://scholarhub.ui.ac.id/nrjs>



Part of the [Surgery Commons](#)

Recommended Citation

Pratomo, Susatyo J. and Muradi, Akhmadu (2019) "Correlation between Internal Jugular Vein Tunnel Cuffed Catheter Tip Position as Hemodialysis Access with Suspected Catheter Related Bacteremia and Related Risk Factors at RSCM 2018–2019," *The New Ropanasuri Journal of Surgery*: Vol. 4 : No. 2 , Article 4.

DOI: 10.7454/nrjs.v4i2.1047

Available at: <https://scholarhub.ui.ac.id/nrjs/vol4/iss2/4>

This Article is brought to you for free and open access by the Faculty of Medicine at UI Scholars Hub. It has been accepted for inclusion in The New Ropanasuri Journal of Surgery by an authorized editor of UI Scholars Hub.



Correlation between Internal Jugular Vein Tunnel Cuffed Catheter Tip Position as Hemodialysis Access with Suspected Catheter Related Bacteremia and Related Risk Factors at RSCM 2018–2019

Susatyo J Pratomo,¹ Akhmadu Muradi.²

1. Training Program in Surgery, 2. Division of Vascular and Endovascular Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta.

Email: susatyo.pratama@ui.ac.id Received: 07/Nov/2019 Accepted: 20/Dec/2019 Published: 31/Des/2019
Website: <https://scholarhub.ui.ac.id/nrjs/> DOI:10.7454/nrjs.v4i2.1047



Abstract

Introduction. Infection is the main complication of prolonged-term catheter uses as hemodialysis access. The KDOQI recommends the insertion of tunnel venous hemodialysis catheter in the right internal jugular vein (IJV) where the tip placed in the right atrium and the arterial opening enfacing the mediastinum. The previous study showed that the incidence of catheter-related bacteremia (CRB) is 35% at three months' use and 54% at six months' use. The TCC tip position as hemodialysis access in left IJV is correlated more to dysfunction and infection compared to the right IJV.

Method. A cross-sectional study was conducted with 62 subjects of hemodialysis patients using IJV TCC access. Data of TCC site of insertion, TCC tip position, suspected CRB, and subject's characteristics including age, sex, and diabetes mellitus from January 2018 to January 2019 collected from medical records. The correlation between these variables analyzed using Chi-Square test with a p-value of <0.05 considered statistically significant. The odds ratio (OR) with 95% confidence interval also analyzed.

Results. Out of 62 subjects enrolled in this study, 45 (72.6%) were 60 yr. or less, forty (66.1%) males, fifteen with diabetes mellitus as the comorbid (24.2%). Thirty-nine subjects (62.9%) TCC tip positioned in SVC, two subjects (3.2%) in CAJ, and 21 subjects (33.9%) in RA. Twenty-two of these 62 with suspected CRB (35.48%). There is no significant correlation between the TCC tip position with suspected CRB incidence ($p = 0.92$, OR 1.05, 95% CI = 0.35 – 3.08). Age, gender, and diabetes mellitus were not statistically proven as risk factors of suspected CRB.

Conclusion. There is no significant correlation between the TCC tip position and studied risk factors with suspected CRB.

Keywords: Hemodialysis, tunnel-cuffed catheter, suspected catheter-related bacteremia.

Introduction

Access selection is an important aspect to consider in managing chronic kidney disease patients with hemodialysis. The created arteriovenous fistula is an ideal access for hemodialysis. Its use met the patients' needs, durability, and minimal complications. Tunnel cuffed catheter (TCC) recommended to be used as a hemodialysis catheter access.^{1,2} Kidney Disease Outcome Quality Initiative (KDOQI) showed that the main problem related to prolonged catheter use is infection. The United States Renal Data System (USRDS) Morbidity and Mortality Study Wave 1 also showed that patients with venous catheterization and graft as hemodialysis access have higher infection-related mortality rate compared to patients with fistula access.² Katneni (2007) and Miller (2016) identification of risk factors for occurrence of catheter-related bloodstream infection include age, sex, suboptimal barrier precautions during catheter insertion, NCC, site of insertion, prolonged use of catheter, previous episodes of CRB, Staphylococcus aureus nasal carriage, diabetes mellitus, hypoalbuminemia, and recent surgery.³⁻⁵ HEMO study showed that 7.6% hemodialysis patient using catheter as access and constitute 32% of total hospitalized patients with hemodialysis access-related infection.⁶ Previous studies reported that the catheter tip

position is related to infection, especially catheter-related bacteremia. No data is providing the correlation between TCC tip position in internal jugular vein with suspected catheter-related bacteremia and related risk factors in dr. Cipto Mangunkusumo General Hospital (CMGH), Jakarta.

Method

This study was a comparative descriptive study using cross sectional design aimed to find the correlation between suspected catheter-related bacteremia and catheter tip position in patients with the internal jugular vein TCC as hemodialysis access. The study was conducted in the Vascular Surgery Division Department of Surgery, CMGH, from 2018 to 2019. The study subjects were adults with chronic kidney disease who underwent hemodialysis using internal jugular vein TCC inserted by vascular surgeons in CMGH as hemodialysis access. The criteria of catheter-related bacteremia established by the nephrologist based on clinical judgment, white blood cell count $>10.000/\mu\text{L}$, and the TCC as the main source of infection. Blood culture is not routinely checked as a mean to find the evidence of catheter-related bacteremia. The inclusion criteria were all those proceed hemodialysis with internal jugular vein TCC as the access, confirmed with chest x-ray following catheter insertion. hose that proceed hemodialysis with

malignancy, immune system defect, and history of previous hemodialysis access-related infection excluded. The risk factors observed in this study were age, gender, and diabetes mellitus. The samples enrolled using a consecutive sampling method. The accessible population was those who underwent hemodialysis with internal jugular vein access using TCC inserted by vascular surgeons in CMGH. Data analyzed using the Chi-Square test with a p-value of <0.05, the odds ratio (OR) with a 95% confidence of interval. The study approved by the Committee of Ethics, Faculty of Medicine, Universitas Indonesia No 794/UN2.F1/ETIK/PPM.00.02/2019.

Results

There were 320 subjects proceeded hemodialysis, a total of 62 subjects met the criteria, and enrolled. The subjects' characteristics and the total catheter-related bacteremia presented in table 1.

Table 1. Characteristics of the subjects

Variable	Total (n = 62)	Suspected Catheter-related bacteremia	
		Yes (n = 22)	No (n = 40)
Age			
- <60 years	45 (72.6)	16 (25.8)	29 (46.8)
- >60 years	17 (27.4)	6 (9.7)	11 (17.7)
Gender			
- Male	41 (66.1)	14 (22.6)	27 (43.5)
- Female	21 (33.9)	8 (12.9)	13 (21)
Diabetes mellitus status			
- Diabetes mellitus	15 (24.2)	6 (9.7)	9 (14.5)
- Non-diabetes mellitus	47 (75.8)	16 (25.8)	31 (50)
TCC tip position			
- Superior vena cava	39 (62.9)	14 (22.6)	25 (40.3)
- Cavo-atrial junction	2 (3.2)	0 (0)	2 (3.2)
- Right atrium	21 (33.9)	8 (12.9)	13 (21)

TCC: tunnel-cuffed catheter

In these subjects, the different sites of insertion as well as tip position as presented in table 2.

Table 2. Internal jugular TCC insertion location and catheter tip position

TCC tip position	Right	Left	Total
- Superior vena cava	30	9	39
- Cavo-atrial junction	0	2	2
- Right atrium	19	2	21

Table 3. TCC tip position and suspected bacteremia

Characteristics	n	Suspected CRB	p value	95% CI OR
TCC tip position				
- Superior vena cava	39	14	p = 0.929*	OR 1.050 95% CI (0.357-3.089)
- Non superior vena cava	23	8		
Right insertion				
- Superior vena cava	30	11	p = 0.990*	OR 0.992 95% CI (0.301-3.628)
- Non superior vena cava	19	7		
Left insertion				
- Superior vena cava	9	3	p = 1.0**	OR 1,500 IK 95% (0,106-21,312)
- Non superior vena cava	4	1		

*Chi Square test **Fisher test

The analysis proceeded to find out the correlation as well as odds ratio of the catheter-related bacteremia (table 3). The study also analyzed suspected catheter-related bacteremia risk factors including age, gender, and diabetes mellitus status using bivariate analysis and Chi-Square test.

Table 4. Bivariate and multivariate analysis of age, gender, and DM status with catheter-related bacteremia

Variable	p value	OR (95% CI)
Age	0.985	1.011 (0.315-3.249)
Gender	0.758	1.187 (0.398-3.537)
DM status	0.675	1.292 (0.390-4.273)

Discussion

This comparative descriptive cross-sectional study showed no significant correlation between TCC tip position and catheter-related bacteraemia. The bivariate analysis proceeded on the risk factors for catheter-related bacteraemia, including age, gender, and DM status showed no significant correlation.

The study data showed that more TCC were inserted on the right internal jugular vein and more TCC tip was positioned outside the cavo-atrial junction and right atrium. NKF-KDOQI recommends the use of right internal jugular vein as the site of access with the catheter tip positioned inside the right atrium, and the catheter opening enfacing the mediastinum. With such an access, an optimal haemodialysis flow rate with a minimal complications could be achieved. The access in the subjects enrolled in the study is not adhered to NKF-KDOQI recommendation as no fluoroscopic guidance nor evaluation following the procedure of the TCC.

However, the study showed that 40% of subjects with diabetes mellitus experienced the catheter-related bacteraemia. To this data, remains the possible risk factor of catheter-related bacteraemia even though no statistically significant correlation.

The literature showed that catheter infection occurs early, and/or lately. Earlier infection mostly related to the site of catheter insertion, while slow progressing infection related to malfunctioned catheter. The catheter malfunction defined as the inability of access to provide extracorporeal blood flow of ≥ 300 mL/minute in pre-pump arterial pressure of ≤ 250 mmHg. The thrombus formation inside the catheter lumen is responsible for the increased risk of infection. According to Indonesian Renal Registry reports, haemodialysis may provide a proper function when the blood flow rate reaches up to ≤ 250 mL/minute. This practice lets a longer duration of the haemodialysis, but in contrast, it leads to more prolonged catheter use. Such treatment will result in the difficulty of determining the incidence of catheter malfunctions and, ultimately, haemodialysis access catheter infection.

The use of non-fluoroscopic modalities as the guidance might also influence the comparison of the incidence of infection and non-infection related to the TCC tip position. In this study, the TCC tip position assessed through the examination of chest x-ray following catheter insertion.

There were limited studies focused on the correlation between TCC tip position and catheter-related bacteraemia. It was first

proposed with the study of Engstrom et al. in 2013. The importance of this correlation is to improve the TCC use as haemodialysis access. Future study enrolling subjects of Indonesian specific characteristics may lead to the development of Indonesian specific recommendation.

Conclusion

There is no correlation between internal jugular vein TCC tip position as haemodialysis access with catheter-related bacteraemia. Age, sex, and DM status were not significant statistically as catheter-related bacteraemia risk factors. DM is a potential risk factor considering that 40% of subjects with DM experienced catheter-related bacteraemia. TCC tip position as haemodialysis access must be determined well in order to assess the TCC tip related infection incidence more precisely. The use of fluoroscopy for procedure of insertion is recommended.

Disclosure

The author(s) declare have no conflict of interest to disclose

References

1. National Kidney Foundation-Kidney Disease Improving Global Outcomes (NKF-KDIGO), KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney International supplements*. 2013;3. Available on website: <https://kdigo.org/guidelines>
2. National Kidney Foundation-Kidney Disease Outcome Quality Initiative (NKF-KDOQI), 2006 updates clinical practice guidelines and recommendations for vascular access. 2006. Available on website: http://www.kidney.org/sites/default/files/docs/12-50-0210_jag_dcp_guide_lines_va_oct06_sectionc_ofc.pdf.
3. Kementerian Kesehatan Republik Indonesia Pusat Data Dan Informasi, Situasi Penyakit Ginjal Kronis, 2017.
4. Indonesian Renal Registry, 10th Report of Indonesian Renal Registry, 2017.
5. United States Renal Data system, 2018 Annual data report, 2018.
6. Allon M, Sexton DJ. Literature review: Tunneled, cuffed hemodialysis catheter-related bacteremia. *UpToDate*. 2018.
7. Bodenham AR, Simcock L. Complication of central venous access. In: Hamilton H, Bodenham AR, editors. *Central Venous Catheter*. West Sussex: Wiley-Blackwell; 2009. p.175-201.
8. Elliott TSJ. The pathogenesis and preventions of catheter-related infections. In: Hamilton H, Bodenham AR, editors. *Central Venous Catheter*. West Sussex: Wiley-Blackwell; 2009. p.206-215.
9. Engstrom BI, Horvath JJ, Stewart JK, Sydnor RH, Miller MJ, Smith TP, et.al. Tunneled internal jugularis hemodialysis catheter: Impact of laterality and tip position on catheter dysfunction and infection rates. *J Vasc Interv Radiol*. 2013;24:1295-1302.
10. Basri NS. Komplikasi infeksi pemasangan kateter lumen ganda sebagai akses hemodialisis [tesis, in Bahasa]. Jakarta: Universitas Indonesia; 2017 (unpublished).
11. Katneni R, Hedayati S S. Central venous catheter related bacteremia in chronic hemodialysis patients: epidemiology and evidence-based management (review). *Nature Clin Pract Nephrol*. 2007; 3: 256-266.

12. Beathard GA, Urbanes A. Reducing tunneled hemodialysis catheter morbidity-Infection associated with tunneled hemodialysis catheter. *Seminars in dialysis*. 2008;21:6:528-538.
13. Ghonemy TA, Farag SE, Soliman SA, Amin EM, Zidan AA. Vascular access complication and risk factors in hemodialysis patients: A single center study. *Alexandr J Med*. 2016;52: 67-71.
14. Miller LM, Clark E, Dipchand C, Hiremath S, Kappel J, Klali M, Lok C et.al. Hemodialysis tunneled catheter related infection. *Canadian J Kidn Health Dis*. 2016;3:1-11.
15. Marques MG, Maia P, Ponce P. Dialysis catheter malfunction. *Port J Nephrol Hypert*. 2017; 31(3):184-191.
16. Smith RN, Nolan JP. Clinical review: Central venous catheter. *BMJ*. 2013; 347:28-32.
17. Aslam S, Vaida F, Ritter M, Mehta RL. Systematic review and meta-analysis on management of hemodialysis catheter-related bacteremia. *J Am Soc Nephrol*. 2014; 25: 2927-2941.
18. Kirkwood BR, Sterne JAC. *Essential medical statistics*. 2nd ed. Blackwell Publishing Ltd, Oxford, UK. 2003.
19. Ghazali MV, Sastromihardjo S, Soedjarwo SR, Soelaryo T, Pramulyo HS. *Studi cross sectional*. Dalam: Sastroasmoro S, Ismael S, editor. *Dasar-dasar metodologi penelitian klinis*. Edisi ke-4. Jakarta: Sagung Seto; 2011. Hal 130-145
20. Dahlan MS. *Metode MSD pintu gerbang memahami epidemiologi, biostatistik, dan metodologi penelitian*. Edisi 2. Jakarta: Epidemiologi Indonesia; 2017.