

A Study to Find the Bacterial Colonization in Central Venous Catheters among the Critically Ill Patients

Suresh Kumar Chodavarapu¹, PSM Rama Ganesh², Uma Maheswara Rao³

¹Assistant Professor, Department of Aneesthesiology, NRI Institute of Medical Sciences, Bheemunipatnam, Sanghivalasa

²Assistant Professor, Department of Aneesthesiology, NRI Institute of Medical Sciences, Bheemunipatnam, Sanghivalasa

³Professor & Head, Department of Aneesthesiology, NRI Institute of Medical Sciences, Bheemunipatnam, Sanghivalasa

Received: 25-01-2023 / Revised: 25-02-2023 / Accepted: 25-03-2023

Corresponding author: Dr. Suresh Kumar Chodavarapu

Conflict of interest: Nil

Abstract

Introduction: Placement of central venous catheters (CVC) is most common procedures in ICU. In spite of the proper sterile practices, one of our previous studies reported that CRBSIs were common in subclavian vein (SCV) group. With this we conducted a study to find the commonly associated bacteria catheter related blood stream infection (CRBSI).

Methods: It was a prospective study, conducted in NRI institute of Medical Sciences. Study protocol was approved by the Institutional Ethics committee. Informed consent was taken from the participants. The study members was divided to internal jugular vein (IJV) and SCV groups. Standard 7 Fr size CVCs of same brand were used. Strict aseptic precautions were followed for placement as well maintenance; as per the guidelines, catheters were placed. The catheter was removed after one week, under strict aseptic precautions. Upon withdrawal, distal 5 cm was cut with sterile surgical blade and transported immediately to the department of Microbiology by placing in a sterile tube. Chi-square test was used for statistical analysis; $P > 0.05$ was considered to be statistically significant.

Results: In this study 60 patients were included, 30 in each group respectively. Maximum number of participants were in 18 – 30 years group and minimum in 41 – 50 years group; statistically there was no significant difference. Gram negative rods (GNRs) are the predominant pathogens, more number of pathogens were isolated in IJV. Non fermenters are the leading isolates.

Conclusion: Bacterial colonization is common in the CVCs despite of through sterilization protocol. Non fermenting GNRs are the leading isolates followed by Klebsiella.

Keywords: Catheter, Vein, Pathogen, Isolate.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Peripheral venous catheters are the devices most frequently used for vascular access; intravascular catheters are useful mainly in intensive care units (ICU) who are critically ill. Placement of central venous catheters

(CVC) is most common procedures in ICU. [1] The technical advancement and better knowledge on anatomy made CVS insertion easy and safe. Catheters provide necessary vascular access for the

administration of fluids, medications, total parenteral nutrition and so on. [2]

Different veins, subclavian vein (SCV), femoral vein (FV), internal jugular vein (IJV) are used for cannulation. But the selection is based on the clinical condition of the patient. Other than the advantages, catheterisation also leads to nosocomial infections; local site infection, catheter related blood stream infection (CRBSI), septic thrombophlebitis, endocarditis and other metastatic infections are some forms of catheter related infections (CRIs). [3] Majority of the serious CRIs are associated with CVC. [4]

Different investigators studied on this CRIs. [5] In spite of the proper sterile practices, one of our previous studies reported that CRBSIs were common in SCV group. [6] With this we conducted a study to find the commonly associated bacteria CRBSIs.

Methods

It was a prospective study, conducted in NRI institute of Medical Sciences. Study protocol was approved by the Institutional Ethics committee. Informed consent was taken from the participants. Consent was taken from blood relatives, if patient can't give consent.

Adults, admitted in respiratory intensive care unit (RICU) were included in this research. Minors, non-cooperative individuals, HIV patients, those on steroid treatment, pregnant women, trauma patients, to whom catheter was removed 7

days prior to the study due to any cause were not considered in this research.

The study members was divided in to 2 groups; randomization code was generated before initiation of the research and sealed opaque envelope method was used for allocating in groups. Based on the vein selection for CVC, the study members were divided in to group IJV and SCV.

Standard 7 Fr size CVCs of same brand were used. Strict aseptic precautions were followed for placement as well maintenance; as per the guidelines, catheters were placed. [7] The catheter was removed after one week, under strict aseptic precautions. Upon withdrawal, distal 5 cm was cut with sterile surgical blade and transported immediately to the department of Microbiology by placing in a sterile tube. In the laboratory, culture, identification were carried as per the guidelines. [8, 9]

Statistical analysis: The data were analysed using SPSS version 18. Chi-square test was used for statistical analysis; $P > 0.05$ was considered to be statistically significant.

Results

In this study 60 patients of both gender were included, 30 members in each group respectively. Maximum number of participants were in 18 – 30 years group and minimum in 41 – 50 years group; statistically there was no significant difference (Table 1).

Table 1: Age wise distribution of the study participants; n (%)

Age	IJV	SCV	Total
18 – 30	17 (28.3)	13 (21.6)	30 (50)
31 – 40	6 (10)	4 (6.6)	10 (17)
41 – 50	3 (5)	4 (6.6)	7 (11.6)
51 – 60	4 (6.6)	9 (15)	13 (21.6)
Total	30 (50)	30 (50)	60 (100)
Statistical analysis	P =0.39; statistically not significant		

The male female ratio was 1.3 and 1, respectively; statistically there was no

significant difference. Gram negative rods (GNRs) are the predominant (74%; 23)

pathogens followed by gram positive cocci (7; 22%) and candida (3.2%; 1). Group wise, more number of pathogens were isolated in IJV; 42% GNRs, 13% GPC and

3.2% candida (Table 2). Non fermenters are the leading (9/23) GNR followed by *Klebsiella* (5/23).

Table 2: Age wise distribution of the study participants; n (%)

Age	IJV	SCV	Total
GNRs	13 (42)	10 (32)	23 (74.1)
GPC	4 (13)	3 (9.7)	7 (22.6)
Candida	1 (3.2)	0	1 (3.2)
Total	18 (58)	13 (42)	31 (100)

Discussion

Intravascular catheter is the commonest device purchased by all the health care organizations and this is the essential tool for the successful treatment of critically ill patients. Several reports are published on the incidence of CVC infections as well as its complications. [10] As per the reports, there were 15 million CVC days occur each year in US and around 80,000 CRBSI in ICUs. [11] According to an Indian study, the reported data on CRBSI was 47.31 per 1000 catheter-days. [12]

In this study 60 patients of both gender were included, 30 members in each group respectively. Maximum number of participants were in 18 – 30 years group and minimum in 41 – 50 years group; statistically there was no significant difference (Table 1). With age there was drop in the patient number but again raise in elderly age group. The exact reason for this is not clear. But usually the incidence of infections can increase with age and waning of immunity can also occur with age. Hence more number of patients were found in 51 – 60 years group. But why maximum number in 18 – 30 years group was not clear. Similar to this research, in a study by Patil HV, 24% of study members were in 51 – 60 years group whereas in this study it was 22%. [12] In a study by Al-Khawaja S et al. the median age was reported to be 59.3 years. [13] In this study, high infection was reported in IJV group. Organism wise, it was 58% (18) in IJV group and 42% (13) in SCV group

(Table 2). The reason for this more number of isolates in IJV is not clear. But utmost care as well as sterility practices were followed to both the groups. In spite of this there was difference in number of isolates. Almost the similar findings were reported in the literature also but the causes were not clear. [14, 15]

It was found that GNRs (74%) are the leading isolates followed by GPC (22.6%) and candida (Table 2). As we know that infective rate is high with GNRs. So high number were detected in this study. Kaur D et al [13] also reported high number of GNRs; the authors reported high numbers of *Esch. Coli* followed by *Klebsiella pneumoniae*. Where as in this research Non fermenters are the leading isolates followed by *Klebsiella*. [16]

Conclusion

Bacterial colonization is common in the CVCs despite of through sterilization protocol. Non fermenting GNRs are the Leading isolates followed by *Klebsiella*. Long term multicentric research is recommended.

References

1. Litz RJ, Radny D, Feigl GC, Mäcken T, Schwarzkopf P, Röhl AB. Ultraschallgesteuerte periphere Venenpunktion bei schlechtem Venenstatus [Ultrasound -guided peripheral venepuncture under poor venous conditions]. *Anaesthesiologie*. 2023; 72(3): 212 – 6.

2. Franco-Sadud R, Schnobrich D, Mathews BK, Candotti C, Abdel-Ghani S, Perez MG, Rodgers SC, Mader MJ, Haro EK, Dancel R, Cho J, Grikis L, Lucas BP; SHM Point-of-care Ultrasound Task Force; Soni NJ. Recommendations on the Use of Ultrasound Guidance for Central and Peripheral Vascular Access in Adults: A Position Statement of the Society of Hospital Medicine. *J Hosp Med.* 2019; 14(9): E1 – E22.
3. Tada M, Yamada N, Matsumoto T, Takeda C, Furukawa TA, Watanabe N. Ultrasound guidance versus landmark method for peripheral venous cannulation in adults. *Cochrane Database Syst Rev.* 2022; 12(12): CD 013434.
4. Banerjee A., Goswami P., Mukherjee C. Bhattacharya: Bacterial colonization of intravenous cannulae in cardiac surgery. *Ind J. Anaesth.* 2003; 47(3): 190 – 3.
5. Böll B, Schalk E, Buchheidt D, Hasenkamp J, Kiehl M, Kiderlen TR, Kochanek M, Koldehoff M, Kostrewa P, Claßen AY, Mellinghoff SC, Metzner B, Penack O, Ruhnke M, Vehreschild MJGT, Weissinger F, Wolf HH, Karthaus M, Hentrich M. Central venous catheter-related infections in hematology and oncology: 2020 updated guidelines on diagnosis, management, and prevention by the Infectious Diseases Working Party (AGIHO) of the German Society of Hematology and Medical Oncology (DGHO). *Ann Hematol.* 2021; 100(1): 239 – 59.
6. Hemalatha P, Suresh Kumar C, Rao MH, Chaudhary A, Samantaray A, Janaki Subhadra P. Comparison of bacterial colonization of central venous catheters introduced through two different routes – a prospective, randomized, observational study. *J Clin Sci Res.* 2017; 6: 153 – 9.
7. Swaminathan L, Flanders S, Horowitz J, Zhang Q, O'Malley M, Chopra V. Safety and Outcomes of Midline Catheters vs Peripherally Inserted Central Catheters for Patients With Short-term Indications: A Multicenter Study. *JAMA Intern Med.* 2022; 182(1): 50 – 8.
8. Maki DG, Weiss CE & Sarafin WH A semi quantitative culture method for identifying intravenous cannulae related infection. *N Eng J Med.* 1977; 292 - 9.
9. Jaya Chandra T, Lakshmi Prasanna T, Venkateswar Rao A. A study on isolation and identification of bacteria causing nosocomial infections on mobile phones of health care workers. *Calicut Med. J.* 2011; 9: e2.
10. Trottier SJ, Veremakis C, O'Brien J, et al: Femoral deep vein thrombosis associated with central venous catheterization: results from a prospective, randomized trial. *Crit Care Med.* 1995; 23: 52 – 9.
11. Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med.* 2000; 132: 391 – 402.
12. Patil HV, Patil VC, Ramteerthkar MN, Kulkarni RD. Central venous catheter-related bloodstream infections in the intensive care unit. *Indian J Crit Care Med.* 2011; 15(4): 213 – 23.
13. Al-Khawaja S, Saeed NK, Al-Khawaja S, Azzam N, Al-Biltagi M. Trends of central line-associated bloodstream infections in the intensive care unit in the Kingdom of Bahrain: Four years' experience. *World J Crit Care Med.* 2021; 10(5): 220 – 31.
14. Balkhy HH, El-Saed A, Al-Abri SS, Alsalman J, Alansari H, Al Maskari Z, El Gammal A, Al Nasser W, AlJardani A, Althaqafi A. Rates of central line-associated bloodstream infection in tertiary care hospitals in 3 Arabian gulf countries: 6-year surveillance study. *Am J Infect Control.* 2017; 45: e49 – e51.
15. Kaur D, Jaspal S, Bajwa SS. The impact of open versus closed catheter access

system of central venous catheter on infection prevention in critically ill patients: A comparative evaluation. Iran J Nurs Midwifery Res. 2020; 25: 497 – 501.

16. Kenfuni M. M., Gallouo M., Alafifi Mahmoud Tsikambu, A. C. D. Alafifi R., Moataz A., Dakir M., Debbagh A.,

& Aboutaieb R. Pyonephrose: Risk factors, clinical, para-clinical and anatomopathological profile about 19 cases. Journal of Medical Research and Health Sciences. 2022; 5(2): 1770–1773.