



Care for Central Venous Catheters and Their Removal: A Retrospective Study

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Article Info

ISSN (online): 2582-8940

Volume: 05

Issue: 04

October-December 2024

Received: 03-10-2024

Accepted: 05-11-2024

Page No: 165-167

Abstract

Aim: To examine the reasons why central venous catheters are removed, if there is any clinical improvement following removal and to observe its relation to rates of CR-BSI.

Methods: We conducted a retrospective analysis of central venous catheter placement, management, and removal in ICU of Saraswathi institute of medical science, Hapur. Clinical signs of sepsis were used to characterise suspected CR-BSI, and the only possible cause of septicaemia was catheter tip colonisation. Later, a catheter tip colonisation with the same microorganism generated from a peripheral blood culture was used to define confirmed CR-BSI.

Results: A total of 87 CVCs were examined, with an average insertion time of 5.5 days. Absence of indication was the most frequent cause of removal (28.7%). Only 1 of the 17 out of 87 CVCs (19.7%) that were removed based on CRBSI suspicions had the diagnosis verified. We also checked the cultured catheters for signs of biochemical improvement after removal. We found no difference in mean insertion time among patients whose inflammatory markers improved after CVC removal, and they were no more likely to have colonised CVCs.

Conclusion: 15.6% of central venous catheters were routinely replaced after an average of 7.1 days without any apparent reason other than to avoid catheter-related infection. Even if some of these lines became colonised throughout culture, we did not see any biochemical advantages to routinely eliminating them.

Keywords: CVCs, Catheter related blood stream infection

Introduction

Peripheral vein access is a common issue in surgical patients and critical care units, particularly in patients with cancer. This issue is made more difficult by the necessity of administering chemotherapy and medications that cause severe irritation to the peripheral veins over an extended period of time, the need for frequent blood draws, the short lifespan of catheters placed into peripheral veins, the frequent occurrence of superficial thrombophlebitis, which causes discomfort for the patient, the requirement for hyperalimentation, and the monitoring of central venous pressure to direct fluid resuscitation in surgical patients who are hypovolemic.

These issues have been significantly simplified by the advent of central venous catheterization, which has also made it easier to treat patients—particularly cancer patients—who have inadequate peripheral venous access.

Problems could arise during or after the implantation of the catheter. They could have an infectious and thrombotic origin, or they could have anything to do with mechanical obstruction, accidental device damage, or malfunctioning devices ^[2].

Central venous catheters (CVC) are a ubiquitous tool in the critical care setting; however, their use does not come without risks. Potentially one of the most serious and preventable complications is catheter related bloodstream infection (CR-BSI).

Current evidence suggests that CVCs should not be routinely changed to prevent CR-BSI, and that clinical diagnosis of CR-BSI

prior to catheter removal has a very low specificity [1, 2, 3].

Aim

The aim of this study was to examine the reasons why CVCs are removed and to see whether clinical suspicion of CR-BSI is reflected by microbiological results and improvement following line removal.

Material and Methods

We conducted a retrospective analysis of central venous catheter placement, management, and removal in ICU of Saraswathi institute of medical science, Hapur.

Data was collected on insertion sites, duration of insertion, and reason for removal.

This was then matched to corresponding inflammatory markers including leukocyte count (WCC) and C-reactive protein (CRP), and microbiological culture results

Study definitions

Suspected CR-BSI: Clinical evidence of sepsis (SIRS criteria) and with no apparent source of septicemia except catheter tip colonization.

CR-BSI: Colonization of a catheter tip with the same micro-organism and sensitivity profile grown from a peripheral blood culture [4].

Routine change of CVC: CVC replacement without evidence of sepsis or problems with the functioning of the catheter.

Increasing/decreasing inflammatory marker trend: $\geq 10\%$ change in WCC or CRP

Results

A total of 87 CVCs were studied with an average duration of insertion of 5.5 days. (Table 1).

The most common reason for removal was absence of indication (28.7%).

17 out of 87 (19.5%) of CVCs were removed due to suspicion of CRBSI, and of these only 1 was confirmed (Table 2).

There was no significant difference between the duration of insertion of colonized and uncolonized CVCs (table 3).

We further examined the cultured catheters for evidence of biochemical improvement following removal (Table 4).

Of those who experienced improvement of inflammatory markers (by $\geq 10\%$) following CVC removal, we found no difference in mean duration of insertion, and similarly they were no more likely to have colonized CVCs than patients who did not experience improvement of their inflammatory markers (25% vs 29%)

Table 1: Catheter characteristics

Central venous catheters	
Number (n)	87
Catheter days	479
Duration/CVC (mean $\pm$ SE)	5.5 $\pm$ 0.3
Duration/CVC (range)	0-15
Cultured tips	45
Colonised tips	13
CR-BSI	1

In table 1- 87 total number of catheters were used for mean duration of 5.5

+0.3 days, in which 45 were cultured and 13 were colonised.

Table 2: Central venous catheters by reason for removal

	No longer indicated	Suspected CR-BSI	Discharged from ITU	Routine change	Death	Other
Number	25	17	17	14	11	3
Mean duration (days $\pm$ SE)	6.5 $\pm$ 0.7	6.9 $\pm$ 0.6	3.6 $\pm$ 0.5	7.1 $\pm$ 0.4	2.1 $\pm$ 0.6	4.7 $\pm$ 3.2
Cultured	11	17	4	12	0	1
Colonised	2	6	2	3	0	0
CR-BSI	0	1	0	0	0	0

In table 2 – 25 catheters were removed as they were no longer needed, 17 were suspected to have CR-BSI, 17 were discharged from ITC, 14 were changed routinely and 11 had death.

Table 3: Comparison of cultured CVCs

*p = 0.426	Colonised	Uncolonised
Number	13	35
Days/CVC (mean $\pm$ SE)	7.2 $\pm$ 0.6*	6.5 $\pm$ 0.5*
WCC (mean $\pm$ SE)	13.8 $\pm$ 2.0	16.7 $\pm$ 1.7
CRP (mean $\pm$ SE)	90.8 $\pm$ 18.2	115.6 $\pm$ 14.6

In Table 3- 13 were colonised CVCs and 35 were uncolonized CVCs.

Table 4: CVCs by trend of inflammatory markers post removal

WCC and CRP 48-hours post removal	Increasing trend	Decreasing trend	No change
Number	9	12	25
Mean duration (days $\pm$ SE)	6.2 $\pm$ 1.0	6.7 $\pm$ 0.9	6.7 $\pm$ 0.6
Colonised tips	2	3	8
Confirmed CR-BSI	0	1	0

In Table4 – 9 showed increasing trend of inflammatory markers post removal, 12 showed decreasing trend and 25 had no change of inflammatory markers.

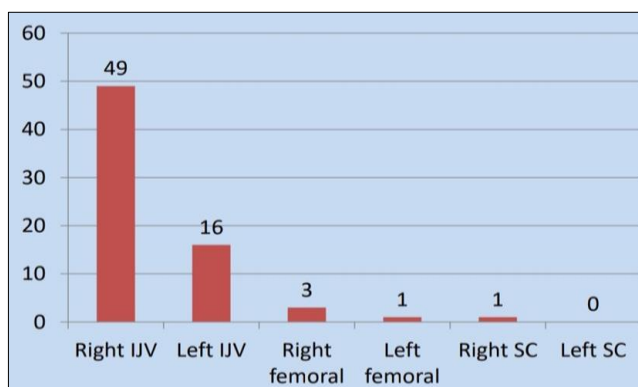


Fig 1: Central venous catheters by insertion site

In Figure 1 – right IJV is the most common insertion site of CVC followed by left IJV, right femoral, left femoral, right SC and left SC.

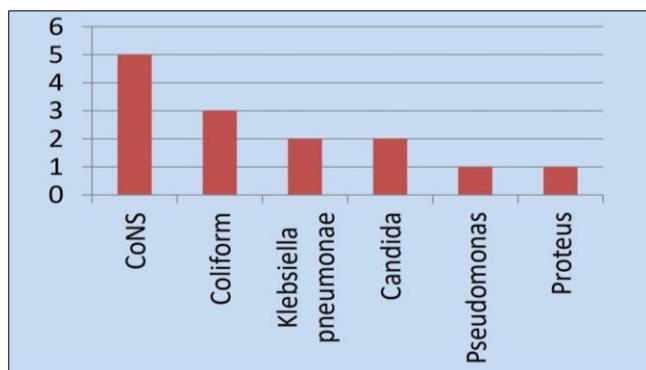


Fig 2: Colonization of CVC tips by bacteria

In figure 2 – most common colonization of CVCs tips by CONS bacteria then coliform followed by Klebsiella pneumoniae, candida, pseudomonas and proteus.

Discussion

In our study, total of 87 CCs were studied for a duration of 5.5 days, among which 28.7% CVCs were removed without indication and 19.5% CVCs were removed due to suspicion of CR-BSI. There was no significant difference between the duration of insertion of colonized and uncolonized CVCs, which is similar to the findings found in Lorente *et al.* study (3).

Further there was no biochemical improvement after removal of catheter and there was no difference in mean duration of insertion and similarly they were no more likely to have colonized CVCs than patients who did not experience improvement of their inflammatory markers (25% vs 29%).

Conclusion

We observed a rate of CR-BSI of 2.09/1000 days.

We found that 15.6% of central venous catheters were routinely changed after an average of 7.1 days without obvious indication other than to prevent catheter-related infection.

Furthermore, we did not find any biochemical benefit to removing colonized CVCs.

This is consistent with current literature which shows that routine replacement does not reduce rates of catheter-related bloodstream infection compared with changing them when clinically indicated [2, 5].

A more conservative approach to catheter removal is also likely to be beneficial even in those with suspected CR-BSI [3, 6].

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