International Journal of Infection Control
www.ijic.info ISSN 1996-9783

ORIGINAL ARTICLE

Catheter Related Blood Stream Infections in ICU: A study from North India

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doi: 10.3396/ijic.v9i2.013.13

Abstract

Central venous catheter (CVC) insertion is common in ICU practices; this can be a source of dangerous bacteremia, sepsis, multi organ failure and sometimes even death. We conducted this study to find out the rate of Catheter colonization, Catheter related blood stream infections (CRBSI), their association and microbial spectrum of CRBSI in critical care unit over 1 year period. Patients admitted in critical care units requiring central venous catheterization and presenting with signs of septicemia during catheterization period were investigated for catheter related blood stream infections. Tip of Central venous catheter (CVC) as well as peripheral blood for culture were obtained simultaneously and processed according to pre determined protocol. Antimicrobial susceptibility testing was done for the isolated organisms.

CRBSI rate of 10/1000 catheter days was observed, with *Staphylococcus* spp. as the most common organism. Since central venous catheters are increasingly being used in the critical care, regular surveillance for infections associated with them is essential.

Key words

Catheter-related infections; Central venous catheters; Intensive care units; Microbial sensitivity tests; Catheterization, central venous and adverse effects

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Introduction

Catheter-related bloodstream infection (CRBSI) is defined as the presence of bacteraemia originating from an intravenous catheter. It is one of the most frequent, lethal and costly complications of central venous catheterization.[1] It is also the most common cause of healthcare-associated bacteraemia and septicaemia. Catheters are usually inserted for the administration of fluids, blood products, medication, nutritional solutions and for hemodynamic monitoring.[2] Central venous catheters (CVC) pose a greater risk of device related infections than any other types of medical device and are major causes of morbidity and mortality. In this study we have focused on incidence of CVC colonization, incidence of CRBSIs, various organisms related to CRBSI, their antimicrobial susceptibility pattern and association between colonization of catheter and CRBSI in our ICU setup.

Material and methods

The study was conducted in tertiary care hospital with 1000 bed capacity in eastern Uttar Pradesh area of North India. From March 2010 to March 2011, patients admitted to adult ICU (bed size 16) requiring central venous catheterization and having sign and symptoms of septicaemia after 48 hours of central venous catheter insertion were included in this study. Brief personal and epidemiological data was collected personally after taking informed consent from the patients or attendant of the patient and clinical data was taken from concerned medical staff on a pre planned form, containing vital data as well as laboratory investigation reports. In total 112 CVC tips were collected. For this, distal 5 cm (CVC tip) was cut with sterile blade and kept in a sterile container; peripheral blood sample was collected with proper aseptic precautions. Catheter tip segment was processed and reported according to pre determined protocol.[3]

Blood culture bottles were placed in BacT/ALERT 3D Automated Blood Culture system (BioMérieux). From positive blood culture bottles, few drops of media were taken after gentle agitation and subcultured on blood agar and CLED agar plates and incubated overnight at 37°C. The next morning, culture plates were examined and colony morphology was noted. Blood culture was reported negative after 7 days of incubation in BacT/ALERT system. Culture isolates were identified by standard microbiological methods and antimicrobial susceptibility was applied by Kirby-Bauer disc diffusion technique according to CLSI guidelines.[4,5]

For reporting of the laboratory results following definitions were followed:

Catheter Related Blood Stream Infection

A positive blood culture with same organism isolated from CVC tip culture was considered to indicate CRBSI.[6]

Catheter colonization

A positive quantitative catheter culture with > 1000 cfu/ml was considered as CVC colonization.[3]

Blood stream infection

Positive blood culture with negative CVC tip culture or different organism isolated from CVC tip was presumed to be blood stream infection (cause may be other than catheter.[7]

Results

In the present study, catheters were inserted for duration that ranged from 3 to 50 days with a mean of 12.5 days and a total of 1402 days. Out of 112 patients catheter colonization rate of 62.5% was seen. We found increase in CVC colonization rate with advancing duration of catheterization. CVC colonization was mostly polymicrobial. Among colonization associated organisms, gram positive cocci (40%) were most common followed by gram negative non fermenters (26.8%), fungi (*Candida sp*. 15.9%) and organisms belonging to the enterobacteriaceae family (9.7%). We found 19 blood culture positive out of 112 samples among which 5 were blood stream infection (organisms isolated did not match with organisms isolated from CVC tip culture), CRBSI rate of 14/112 (12.5%) or 10 per 1000 catheter days was observed (all 14 organisms were common among blood culture as well as CVC tip culture). We found that all CRBSI were associated with CVC colonization. In the present study out of the 14 CRBSI causing organisms two thirds were gram positive cocci (71%), 22% were non-fermenters and 7% cases were due to candida (Figure 1).

Discussion

Blood stream infections may result from health care

interventions and constitutes an important cause of morbidity and mortality among patients in critical care settings. Local risk factors, such as poor personal hygiene, occlusive dressings, moisture around the exit site, *S. aureus* nasal colonization and infection may support the role of bacterial colonization in the catheter. In our study, CVC colonization positive only cases were 70/112 (62.5%). Chopdekar *et al.* found that colonization rate was 57.6% in their study, the microbial pattern of catheter colonization revealed maximum colonization with *Candida* spp. all belonging to the non-albicans type; they found catheter colonization did not appear to have direct bearing on blood stream infection.[8] The incidence rate of catheter colonization of various other studies ranges from 31.58% to 76%.[9-11] In all other studies, gram positive cocci were the predominant colonizers of CVC but in our study we found *Candida* spp. followed by coagulase negative staphylococci. The incidence of CRBSI in our study was 12.5% or 10/1000 catheter days. This is higher than that of the National Nosocomial Infections Surveillance (NNIS) System Report (1.8 to 5.2 per 1,000 catheter days)[12] and a study by Pawar *et al.* (4.01 per 1,000 catheter days)[13] but lower than the study of Almuneef *et al.* who found CRBSI rate of 20.06 per 1,000 central-line-days in his study[14] and Yilmaz *et al.* showed that in their study period, 111 intravascular catheters through which parenteral nutrition was administered, and monitored for a total of 1646 catheter-days. CRBSI was determined in 31 cases, a CRBSI rate of 18.8 per 1,000 catheter-days.[15] The duration of catheterization is a significant factor that determined the development of catheter-related infections. Although previous studies have confirmed that central venous catheterization longer than five to seven days was associated with a higher risk of catheter-related infection,[16-19] the mean duration of catheterization in our study was 12.5 days and no attempts were made to replace catheters as the CDC guidelines of 1996[20] and 2002[21] recommended against routinely replacing CVCs to prevent catheter-related infections. The risk of infection from catheters increases with increase in duration of catheterization. Association of CVC colonization with CRBSI has not been proved and there is no study reporting increase in incidence of CRBSI with increasing CVC colonization. In our study we found all cases of CRBSI were associated with CVC colonization.

Conclusion

Catheter colonization and duration of catheterization has an important role in development of CRBSI which may lead to septicaemia and multi-organ failure. CRBSI must be suspected in the catheterized patient having sign and symptoms of septicaemia. Local antibiotics and catheter lock solutions should be used as preventive measure while inserting the central line catheter. Duration of catheterization increases the morbidity, so regular monitoring of catheterized patient should be done for both insertion site and general condition. Culture results and sensitivity pattern will guide to treat specific organism, and since most isolates are resistant to common antibiotics this may be accompanied by removal of the catheter to reduce morbidity and mortality from CRBSI.

Acknowledgement

We are thankful to Prof. Shampa Anupurba Dept. of Microbiology and Dr. Ghanshyam Yadav Dept of Anaesthesia for their kind support for this study.

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