



## INTENSIVE CARE UNIT ASSOCIATED CENTRAL VENOUS CATHETER RELATED BLOOD STREAM INFECTIONS

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### ABSTRACT

**Background :** The present study entitled “ central venous catheter related blood stream infection intensive care unit” was undertaken to find out the microbiological profile and antibiotic sensitivity pattern of infections of temporary non-tunneled double lumen central venous catheters in ICU.

**Methodology :** It is a prospective study including 111 patients, was allocated randomly. Out of 111 catheterizations, 51 were inserted in femoral, 40 were inserted in IJV and 20 were inserted in subclavian vein. Patients between of age group 18 to 75 years were included. our study observed the incidence of infections, various factors influencing the infections, differentiation between contaminations and CRBSIs, identify the organisms involved in causation of CRBSIs, antibiotic sensitivity patterns of isolated organisms.

**Results :** In our study with IJV catheters, 6.3% of infections happened in 8-15 days of catheterization but 93.8% of infections happened in 16-21 days of catheterization. P value is less than 0.05 which is statistically significant. But with femoral catheters 3.6 % of infections happened in 1-3 days of catheterization, 7.1% of infections happened in 4-5 days of catheterization but 89.3% infections happened in 6-7 days of catheterization. But these values were not statistically significant (p=0.76).

In our study Out of total 28 femoral catheters, 4 catheters (14.28%) showed CRBSI, out of 16 IJV catheters, 4 (25%) showed CRBSI and out of 8 SCV catheters, 1 (12.5%) showed CRBSI. We found IJV catheters were associated with increased risk of infection compared to femoral and SCV but the p value is statistically not significant (p=0.62).

**Conclusion :** IJV and Femoral site catheterizations are associated with more infections compared to subclavian site. Patients who require CVC more than a week, femoral catheterization is discouraged expect in emergency situations. Vancomycin is the empirical drug of choice for gram positive organisms and Imipenam/Meropenam is the drug of choice for s gram negative organism. Femoral catheters should be removed by 7 days and IJV and SCV by 21 days. Catheter site should be checked regularly and proper dressing should be done.

**KEYWORDS :** catheter related blood stream infection(CRBSI), IJV, subclavian, femoral.

### Introduction –

Infections are among the most important causes of mortality worldwide and has plagued the low and lower middle countries more intensely. Although the overall global mortality has decreased in the last three decades due to infections, it is still the most important cause of disability and India is no exception which shows the same trends.

The intensive care units (ICUs) are often called “the hubs” of infections. Microbes are the organisms carrying the flag of infection, highly evolutionized species, and seriously at winning edge because of the weak arsenal of antibiotics, and limited and almost exhausted armamentarium against these organisms. The burden of “multidrug” antimicrobial resistance (MDR) in ICUs further escalates this problem. Thus, it is apt to describe the ICUs as factories for creating, disseminating, and amplifying antimicrobial resistance

The majority of CRBSIs are associated with CVCs, and the relative risk for CRBSI is higher with CVCs than with peripheral venous catheters. In another epidemiological survey by the INICC across developing countries, a total of 292 CRBSI in 36,857 catheter days were reported from the medical, surgical-neurosurgical ICUs of India. This corresponded to a CRBSI rate of 7.7 per 1000 catheter days for India; a rate too high when compared to the US medical-surgical ICUs that had a mean CRBSI rate of 1.5 cases per 1000 catheter days. There are very limited reports specifically on CRBSI from Indian setups.

In the ICU, central venous access might be needed for extended periods of time; patients can be colonized with hospital acquired organisms; and the catheter can be manipulated multiple times per day for the administration of fluids, drugs, and blood products. Further, some catheters can be inserted in urgent situations, during which optimal attention to aseptic technique might not be feasible. Recent data also suggest that a significant numbers of patients with central lines are in hospital units outside the ICU (e.g. patients on haematology–oncology wards), and many patients are discharged with central venous catheters in place where there is a substantial risk of CRBSI.

### Risk factors attributing to the variability of CRBSI incidence

- Patient setting (e.g. ICU, hospital, or home)
- Length of hospitalization time.
- Insertion techniques.
- Long-term indwelling central venous catheter.
- Site of catheterization.
- Number of catheter lumens.
- Type of catheter used.
- Local and systemic antibiotic use.
- Type and frequency of dressing.
- Type of antiseptic solution use.
- Frequency of manipulation.
- Experience of the person in charge of catheter care.
- Duration of catheterization., Emergent versus elective placement.
- Diagnostic criteria used for diagnosing catheter related infections.

### Aims & objectives –

**AIM:** To Find out the microbiological profile and antibiotic sensitivity pattern of infections of temporary non tunneled double lumen central venous catheters in ICU.

### OBJECTIVES:

- To study the incidence of infections associated with CVC.
- To study various factors influencing the CVC infection.
- To differentiate between contaminated and infected CVCs using semi quantitative culture and blood culture methods.
- To identify the organisms involved in the causation of catheter related infections.
- To study the antibiotic susceptibility patterns of the isolated organisms.

### MATERIALS AND METHODS :

**Study Setting:** The study was conducted in ICU of ASRAM HOSPITAL.

**Study design:** It is a prospective study conducted from September 2015 to September 2017.

**Sample Size:** 111 patients.

**Sampling method:** Convenient random sampling.

**Study subjects:**

**Inclusion criteria:**

- Patients who required central venous catheterization irrespective of cause for it.
- Patients above 18 and below 75 years were included.

**Exclusion criteria:**

- Patients below 18 and above 75 years were excluded.
- Patients who were expired with catheter in situ were excluded from study.
- Patients with catheters inserted in other hospitals were excluded from study.

Informed consent from patients or bystanders was obtained and then catheter was inserted after taking all sterile precautions. Date of catheter insertion, site of insertion, patient's age, sex, initial laboratory values were also tabulated according to the proforma.

All patients were followed up till the day of catheter removal. Date of catheter removal, reason for catheter removal, duration of catheter days were tabulated for every patient. During the follow up period blood culture from peripheral line and catheter tip culture was sent in patients with suspected catheter related blood stream infection (CRBSI).

A case of **CRBSI was diagnosed based on CDC definition** which is

- A positive semi quantitative (>15 colony-forming units [CFU]/catheter segment) or quantitative (>10<sup>3</sup>CFU/catheter segment) cultures.
- Simultaneous quantitative blood cultures.
- Same organism (species and antibiogram) is isolated from the catheter segment and peripheral blood.
- Central venous catheter should place at least more than 3 days duration with one of the following
- Suspected infection without another confirmed source.
- Sepsis or septic shock or
- Exit site infection.

**Catheter colonization:** growth of ≥ 15 colony-forming units (semi quantitative culture) or ≥ 10<sup>3</sup> colony-forming units (quantitative culture) from a proximal or distal catheter segment **in the absence of local or systemic infection.**

**Local infection:**

erythema, tenderness, induration or purulence within 2 cm of the skin insertion site of the catheter.

**RESULTS:**

In our study data collected from 111 patients who had undergone central venous catheterizations with double lumen non tunneled catheters were included.

**TABLE 1: PERCENTAGE OF SEX DISTRIBUTION**

Sex	Frequency	Percent
Female	34	30.6
Male	77	69.4
Total	111	100.0

The above chart and table shows out of 111 patients, 34 catheters were inserted for females (30.6%) and 77 (69.4%) catheters were inserted for male patients

**TABLE 2: TYPES OF CATHETERS INSERTED**

Type of catheter	Frequency	Percent
Femoral	51	45.9
IJV	40	36.0
SCV	20	18.1
Total	111	100.0

The above chart and table shows, out of 111 catheterizations, 51 (45.9%) were inserted in femoral, 40 (36%) were inserted in IJV and 20 (18.1%) were inserted in subclavian vein.

**TABLE 3: AGE DISTRIBUTION**

Age	Frequency	Percent
<20	3	2.7

21-30	17	15.3
31-40	10	9.0
41-50	35	31.5
51-60	42	37.8
61-70	4	3.6
Total	111	100.0

The above chart and table shows the most common age group included in the study was 51-60 years (37.8%) and then 41-50 age group (31.5%) , 21-30 age group (15.3 %) 31-40 age group (9%), 61-70 age group (3.6%), less than 20 years (2.7%).

**TABLE 4: MICROBIOLOGICAL PROFILE OF CRBSI (N=9)**

CRBSI	Frequency	Percent
ACINETOBACTER	1	11.1
E.COLI	1	11.1
PSEDOMONAS	2	22.2
MRSA	5	55.6
Total	9	100.0

Out of 9 patients peripheral blood samples 5 samples (55.6%) shown MRSA, 2 samples (22.2%) shown Pseudomonas , 1 sample E.coli (11.1%) and 1 sample Acinetobacter (11.1%).

**DISCUSSION:**

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. It is also the most common cause of healthcare-associated bacteraemia and septicemia. Catheters are usually inserted for the administration of fluids, blood products, medication, nutritional solutions, haemodialysis and for hemodynamic monitoring.

**SEX:** Males formed 69.4 % of the study and females formed 30.6% of the study.

**AGE:** Mean age of the patients was 46 (SD =13.37).Majority of patients studied were in 51-60 age group (37.8%),followed by 41-50 age group (31.5%) and 21-30 age group (15.3%).

**TYPE OF CATHETER:** Out of 111, 51 catheters were inserted in Femoral Vein (45.9%), 40 catheters were inserted in IJV (36%), 20 catheters were inserted in SCV (18.1%).

In our study out of 111 patients 40 patients are hypertensives ( 36.04 %) ,30 patients are diabetics (27.03%), 28 patients are CKD's (25.23%), 25 are ARF patients ( 22.52%) secondary to malaria , dengue , gastroenteritis or sepsis and 10 patients are admitted for different surgical problems (9.7%).

**REASONS FOR REMOVAL:** In our study the reasons for removal were Fever in 44 cases (39.6%), Elective removal in 48 (43.2%), AV fistula maturation in 7 (6.3%), Swelling and pain of catheterized limb in 8 (7.2%), Exit site infection in 4(3.6%).

In a study by **Anees et al.** main reasons for catheter removal were AV fistula maturation (25%), Elective removal (14.5%), fever (8.4%), death (21.1%) and miscellaneous (3.5%).

In a study by **Lukas K Kairaitis and Thomas Gottlieb** reasons for removal of catheter were Elective (40%), fever (42%), exit site infection (8%) and Mechanical complication (10%).

**CRBSI:** During the study period out of 111, 44 patients developed fever without the focus of infection other than CVC and 8 patients had pain or erythema and discharge from catheter site. These 52 patients' catheter tip and blood from peripheral line were sent for culture sensitivity. Swab culture from the local catheter site was sent for 2 patients who had exit site infection. The diagnostic criteria for CRBSI requires both positive catheter tip culture and positive blood culture taken from peripheral line (same organism growth from both) plus with signs of sepsis or septic shock or exit site infection.

Out of 52 patients 22 patients showed bacteremia for catheter tip but only 9 patients showed bacteremia for both catheter tip and blood from peripheral line .So according to diagnostic criteria in our study, 9 out

of 111 patients (8.1%) developed microbiologically proven CRBSI. **Incidence of CRBSI was 6.6 per 1000 catheter days.**

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Out of 51 patients with femoral catheters, 4 patients developed CRBSI showing bacteremia both from catheter tip and blood from peripheral line (7.84%).

Out of 40 patients with IJV catheters, 4 patients developed CRBSI showing bacteremia both from catheter tip and blood from peripheral line (10%).

Out of 20 patients with SCV, 1 patient developed CRBSI showing bacteremia both from catheter tip and blood from peripheral line (5.26%).

Different studies in literature use different criteria to diagnose CRBSI, this made comparison between studies little difficult.

In a study by **Lukas K Kairaitis and Thomas Gottlieb** which compared internal jugular and subclavian catheters, CRBSI occurs in 5-18% of catheters. This study was conducted in a prospective study, in which 105 haemodialysis catheters (79 subclavian, 26 jugular) inserted in 52 patients. This study showed Catheter-related bacteremia (CRB) was diagnosed in 17 catheters (16%), giving a bacteremia rate of 6.5 episodes per 1000 catheter days.

#### LIMITATIONS OF THE STUDY

- Not every vascular catheter inserted during the study period was sampled, random convenient sampling was done.
- We haven't studied whether pre catheterization antibiotics will decrease the infections are not.
- We haven't studied whether antibiotic lock solutions are protective or not against biofilm formation and subsequent CRBSI.
- We haven't compared triple lumen catheters against double lumen catheters in decreasing incidence of CRBSI.
- We haven't studied whether regular guide wire exchange is protective against CRBSI or not.
- The persons who are doing catheterization also not randomized so there are high chances of variable infection rates as infections depend of amount of sterile techniques used.
- The stringent definition for CRBSI may be the reason for low incidence of infections with femoral catheterization.
- Different catheter insertion sites were not randomly assigned.

#### CONCLUSION

- IJV and Femoral site catheterizations are associated with more infections compared to subclavian site.
- Patients who require CVC more than a week, femoral catheterization is discouraged expect in emergency situations.
- Vancomycin is the empirical drug of choice for gram positive organisms and Imipenam/Meropenam is the drug of choice for gram negative organism.
- Maximum barrier techniques should be followed before catheterization.
- Femoral catheters should be removed by 7 days and IJV and SCV by 21 days.
- Catheter site should be checked regularly and proper dressing should be done.

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