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**INCIDENCE OF CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTIONS  
IN PATIENTS ADMITTED IN INTENSIVE CARE UNITS AT TERTIARY CARE  
UNIT.**

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**Abstract**

**Background:** Central venous catheterization is commonly used in critically ill patients and may cause different complications, including infection. Intensive care units (ICUs) have an increased risk of Central line associated bloodstream infection (CLABSI) due to the prevalence of invasive procedures, devices, immunosuppression, comorbidity, frailty, and elderly patients. **Aim:** The aim of this study was to analyze the incidence of central line catheter-related bloodstream infection (CRBSI) in patients admitted in Intensive care units. **Methods:** This observational Study was carried out in the department of anaesthesiology and critical care medicine in Government Medical College Srinagar over a period of one year. Patients requiring central venous catheter were selected, relevant blood investigations were done before insertion of catheter and after 48 hours after insertion. With the suspicion of new infection, physical examination and laboratory work-ups were carried out to identify the other source of infection. **Results:** A profile of 200 patients was selected with mean age of  $48.0 \pm 14.89$  years. The incidence of central line-associated bloodstream infection/catheter-related bloodstream infection (CLABSI/CRBSI) in this hospital based study in intensive care units comes out to be 36.47%. In our study there was male predominance, Sepsis seen in 39% of patients. The predominant organism isolated in CLABSI/CRBSI patients was *Staphylococcus aureus*. **Conclusion:** By knowing the risk factors to cause catheter related infections, risk of getting infection can be lowered by using aseptic technique during insertion and proper catheter care and this can further reduces morbidity and mortality related to central venous catheters.

CLABSI/CRBSI can manifest with varying degrees of severity of sepsis. Organ Dysfunction, multi organ involvement, TLC abnormalities, Oliguria, altered mental status, Hypotension. These are all markers of poor prognosis.

**Keywords:** Central venous catheters, CLABSI/CRBSI , Intensive care unit, sepsis

**Introduction:**

Central venous catheters (CVCs) are commonly used in critically ill patients for the administration of fluids, medications, blood products and parenteral nutrition, for the insertion of a transvenous pacing electrode and to monitor hemodynamic status. The use of catheters is habitual in critically ill patients; in the EPIC study, 78% of critically ill patients had some form of CVC inserted [1].

Central venous catheterization may cause different complications, including infection, haemorrhage and thrombosis. Interest in catheter-related infection lies in the mortality [2-5] and the costs [6-9] it represents.

Central venous access entails placing a large bore catheter or a venous access device in a vein in the groin, neck, or upper chest to deliver drugs that cannot be administered via mouth or arm [10]. In addition to antibiotics and chemotherapy, these catheters can be used for the administration of vasoactive drugs, blood products, and intravenous nutrition [11,12]. Moreover, central venous access is also used in intensive care units to assess venous and cardiac function, or to provide patients with continuous or intermittent renal replacement therapy [13]. However, one of the major issues related to the use of central venous catheters (CVCs) is the possibility of infection caused by microorganisms. However one of the major problems associated with the use of central venous catheters (CVCs) is colonization by micro-organisms that could result in local or systemic infections [14], leading to increased morbidity and mortality rates among patients, as well as increased financial burdens on the community [15]. Two major designations are used to define bloodstream infection due to vascular catheters. Central line associated bloodstream infections (CLABSIs) and catheter related bloodstream infections (CLABSI). Even though they are used interchangeably, they have distinct differences. The term Central Line Associated Bloodstream Infection (CLABSI) refers to infections occurring in the presence of a central venous catheter or within 48 hours after the catheter has been removed and which cannot be attributed to an infection unrelated to a catheter [16]. A catheter related blood stream infection (CLABSI) is a clinical diagnosis attributed to an intravascular catheter that can be confirmed by quantitative culture or by comparing a catheter specimen with peripheral venous blood. According to Maki, catheter colonization is defined as a semi-quantitative culture of >15 colony forming units or a quantitative culture of 10<sup>3</sup> colony forming units [10], et al. CLABSI is one of the most common nosocomial infections and a major cause of bloodstream infections, particularly for patients in intensive care. The majority of CLABSIs are acquired through central venous catheters, and recent studies have found that the risk of acquiring CLABSI via central venous catheters is 64 times greater than that of peripheral catheters [17].

The Centers for Disease Control and Prevention (CDC) estimates that there have been 50% fewer CLABSIs in the US in recent years, but thousands of patients still develop bloodstream infections each year [18] with an average rate of 0 to 2.9 per 1000 CVC days (depending upon the type of unit) and 1 per 1000 CVC days in critical care units.

**MATERIALS AND METHODS**

This Observational Study which included 200 adult patients of various systemic illness admitted in intensive care units of SSH and SMHS hospitals in the department of anaesthesiology and critical care medicine in Government Medical College Srinagar over a period of one year. Main aim of the study to evaluate bacteriological profile of CLABSIS subjects, and to study the association of various risk factors and morbidities with CLABSIS. Inclusion criteria were patients with age >18 years, and patients should have an indwelling central venous catheter for >48 hours on the date of event. Insertion of first CVC must be during the ICU stay. Patients, with age <18 years, with indwelling CVC for <48 hours, with blood culture positive at admission were not taken into study. Patients admitted with indwelling central venous catheter in place were also not eligible for study. Daily monitoring for onset of new infection in terms of clinical signs and symptoms was done by using standard criteria after 48 hours of CVC placement. With the suspicion of new infection, physical examination and laboratory work-ups were carried out to identify the other source of infection.

**Technique:**

An experienced anesthetist of ICU inserted the CVCs after surgical hand-washing and the donning of masks, sterile gowns, and gloves. The puncture site was prepared first with a solution of quaternary ammonium, then ether, and then iodine/alcohol. The surrounding areas were covered with sterile drapes. After insertion of the CVC, an occlusive gauze dressing was placed following application of povidone-iodine. The dressings were changed every 48 hours. When it was decided to remove the CVC, the connection of the CVC and the venous line were externally disinfected with iodine/alcohol. Then the line was disconnected and a sterile syringe was inserted in order to withdraw 5 mL of blood. For multiple-lumen CVCs, blood was withdrawn from each port. Immediately after, 5 mL of blood was obtained from a peripheral vein by standard venipuncture and placed in a heparinized tube. Then each intravascular device was removed aseptically after sterilization of the skin-puncture site. The distal segment of the catheter tip (5 cm) was cut off with sterile scissors, dropped into a tube, and sent to the laboratory.

All data were collected, organized in a tabulated form and statistically analyzed. The analysis was carried out using statistical package for social science (SPSS) version 24. According to Bonferroni's adjustment, a  $p < 0.05$  was considered statistically significant.

**Results:**

In this study, 200 patients in intensive care unit who were admitted for various systemic illness underwent central venous catheterization during the course of their treatment were evaluated, out of which 89 were women (44.5%) and 111 were men (55.5%). Most of the patients belonged to the age group of 41 to 50 years (37%). Their age ranged from 18 to 70 years with a mean age of  $48.0 \pm 13.89$  years [Table 1].

**Table 1: Age distribution of the study population**

Age (years)	Frequency	%

<b>21-30</b>	<b>28</b>	<b>14</b>
<b>31-40</b>	<b>24</b>	<b>12</b>
<b>41-50</b>	<b>74</b>	<b>37</b>
<b>51-60</b>	<b>48</b>	<b>24</b>
<b>61-70</b>	<b>26</b>	<b>13</b>

The site of central line insertion varies in the study group, 178 patients had Internal jugular vein (89%) for central vein access, 12 patients had femoral vein (6%) and 10 patients had subclavian vein (5%) as central venous access [Table 2].

**Table 2: Site of central line insertion**

Site of insertion	Frequency	%
Jugular vein	178	89
Femoral vein	12	6
Subclavian vein	10	5

The study group consisted of 119 patients with catheter days more than 10 days (59.5%), of which 68 patients have complicated CLABSI/CRBSI (34%) and 18 patients had uncomplicated CLABSI/CRBSI (9%) and 33 patients had normal culture report (27.73%). Remaining 81 patients in our study group had catheter days less than 10 days of which 23 patients have developed complicated CLABSI/CRBSI (28.39%), 17 patients had uncomplicated CLABSI/CRBSI (20.98%) and 41 patients had normal culture report (50.61%) [Table 3].

**Table 3: Days of central venous catheter**

Days of catheter	>10 days n=119		<10 days n=81	
	Frequency	%	Frequency	%
Complicated CLABS/CRBSI	68	34	18	9
Un-Complicated CLABS/CRBSI	23	28.39	17	20.98
Normal tip culture	33	27.73	41	50.61

The most common indication for insertion of CVC was fluid resuscitation, (133 patients i.e. 66.5%), monitoring of Central venous pressure (32 patients i.e. 16%). There were multiple indications for CVC insertion in 19 patient’s i.e.9.5. In 16 patients (i.e. 8%) CVC in form of HD catheter was required for giving Hemodialysis [Table 4].

Table 4: Indication for insertion of CVC

Indications	Frequency	%
Fluid resuscitation	133	66.5
Monitoring of Central venous pressure	32	16
Multiple indications	19	9.5
Hemodialysis	16	8

The CLABSI/CRBSI patients (n=126). On general physical examination 17 patients had bradycardia (13.49%), 4 patients had hypertension (3.17%), 4 patients had hypothermia (3.17%), 11 patients had developed oliguria (8.73%), 14 patients had altered mental status (11.11%), 20 patients had developed hypotension (15.87%), 18 patients had developed tachypnea (14.28%), 16 patients had developed tachycardia (12.69%), 22 patients had developed fever during the course of illness (17.46%) (Fig 1).

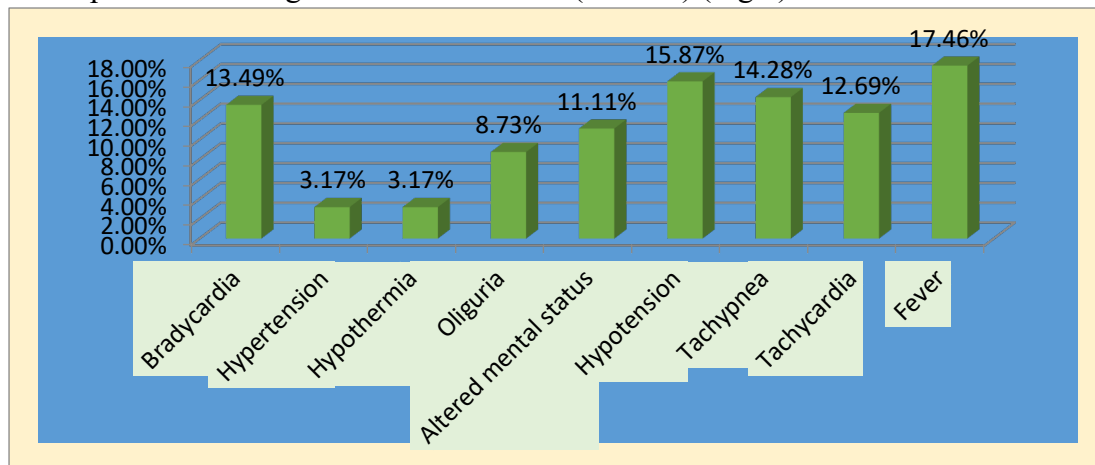
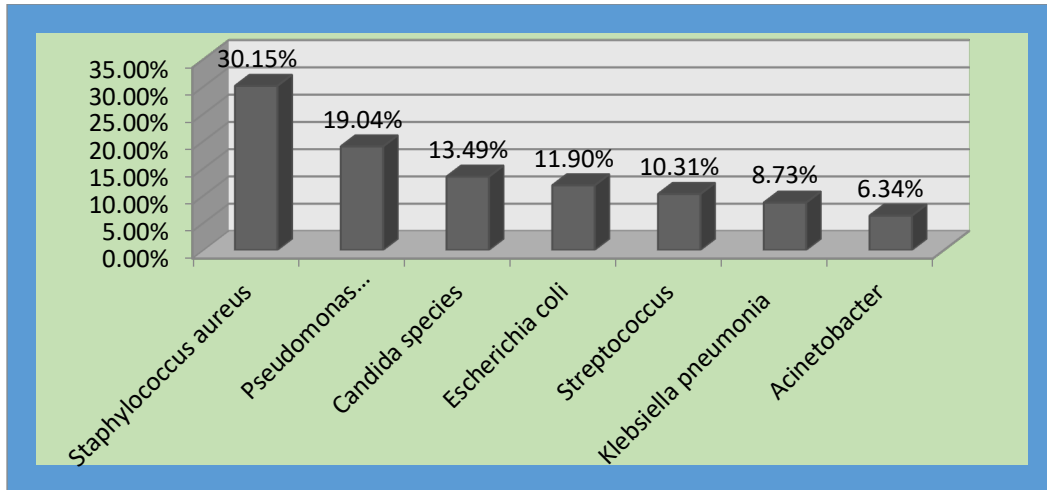


Fig 1

The predominant organism isolated in CLABSI/CRBSI patients (n=126) is *Staphylococcus aureus* (30.15%) in 38 patients, 24 patients have *Pseudomonas aeruginosa* (19.04%), (13.49%) 17 patients have *Candida* species, (11.90%) 15 patients have *Escherichia coli*, (10.31%) 13 patients have *Streptococcus*, 11 patients have *Klebsiella pneumonia* (8.73%) and 8 patient has *Acinetobacter* (6.34%) in culture growth (Fig 2).

**Fig 2****Discussion:**

The use of central venous catheters (CVCs) has increased dramatically over recent years. Central venous catheterization is a relatively common procedure in many branches of medicine particularly in anaesthesia and intensive care medicine. Central venous catheterization was first performed in 1929. Since then, central venous access has become a mainstay of modern clinical practice. Despite the benefits of central venous lines to patients and clinicians, more than 15% of patients will have a catheter related complication. Bloodstream infections caused by central venous catheter remains a serious and the most emerging cause of hospital acquired infections (HAIs) worldwide. [19]

Central line-associated bloodstream infections remain a leading cause of serious healthcare-associated infections in ICUs in India, the rate being 7.9 per 1000 central line-days.[20] Central line-associated bloodstream infection (CLABSI) is mostly a complication of the presence of indwelling medical devices.

The present study was designed to assess the course of infection, microbiology of CLABSI, & to identify the degrees of severity of sepsis. We also evaluated differences in clinical signs observed, sites, duration of central line and mortality. A total of 200 patients were evaluated during the course of this study.

Most common age group affected was found to be 41- 50 years i.e. 37%, the second most common age group affected was 51-60 years (48 patients i.e. 24%). The mean age of affected patients was  $48.0 \pm 13.89$  years; this observation was in accordance to a study by Mervyn Mer et al [21], and Johnson et al [22] showed median age of 47 years.

In the present study out of a total of 200 patients 89 were women (44.5%) and 111 were men (55.5%). The male to female's ratio was 1.6:1. This finding was also comparable to the study by Mervyn Mer et al [21], Johnson et al [22] in his study had male proportion of 61% and females 39% with a male: female ratio of 1.56:1.

The incidence of CLABSI/CRBSI in our hospital based study in intensive care units comes out 34.37%. Other studies have shown variable incidence, Patil et al study showed incidence of 47.13 while other studies have shown lower incidences.[23-25] This variability of incidences in various studies could be due to various factors like techniques, site of catheterization, type

of catheter used, catheter care and diagnostic criteria used for diagnosing CLABSI/CRBSI. The high infective complication rate in the present study may have been due to the fact that our hospital is catering to the lower socioeconomic group. Therefore, the overall hygiene of the patients is poor. Secondly, it was usually done as an emergency procedure.

The site of central line insertion varies in the study group, 178 patients have Internal jugular vein (89%) for central vein access, 12 patients had femoral vein (6%) and 10 patients have subclavian vein (5%) as central venous access. In these preferred routes, femoral route has greater incidence of CLABSI/CRBSI, according to the study conducted by Mehta et al., [20] The study group consisted of 119 patients with catheter days more than 10 days (59.5%), of which 68 patients had complicated CLABSI/CRBSI (34%) and 18 patients had uncomplicated CLABSI/CRBSI (9%) and 33 patients had normal culture report (27.73%). Remaining 81 patients in our study group has catheter days less than 10 days of which 23 patients have developed complicated CLABSI/CRBSI (28.39%), 17 patients had uncomplicated CLABSI/CRBSI (20.98%) and 41 patients have normal culture report (50.61%). In our study incidence of CLABSI/CRBSI is more in catheter days more than 10 days, which shows greater is duration of catheterization more is risk of developing catheter related infection. Similar finding is also mentioned in the study conducted by Patil et al.. [26]

The microbiology of CLABSI in this study showed *Staphylococcus aureus* as most common organism cultured in (30.15%) in 38 patients, 24 patients had *Pseudomonas aeruginosa* (19.04), (13.49%) 17 patients had *Candida* species, (11.90%) 15 patients had *Escherichia coli*, (10.31%) 13 patients have *Streptococcus*, 11 patients have *Klebsiella pneumonia* (8.73%) and 8 patient has *Acinetobacter* (6.34%) in culture growth. In a study by Chopdekar K et all [27], the incidence of *Staphylococcus aureus* was 13.2% (divided as MRSA 11.32%+MSSA1.88%), *Pseudomonas* was seen in 16.95%, *candida* species in 22.64%, coagulase negative *Staphylococcus* in 11.32%, *Klebsiella pneumoniae* in 9.43%, *Escherichia coli* in 3.77% patients, *Acinetobacter baumannii* in 1.88%. This study however in addition isolated other organism which included *E.faecalis*, *Proteus vulgaris* and *Citrobacter koseri*. Study by Parameswaran et al [28] found *Staphylococcus aureus* in 40%, *candida* species and *Pseudomonas aeruginosa* in 16%, coagulase negative *staphylococcus*, *Escherichia coli* and *klebsiella pneumoniae* in 8% each and *Acinetobacter baumannii* in 4% of patients. Our results were at times in concordance with few studies and at times in contrast to other studies. These differences were mainly due to differences of antibiogram and isolates across various sites of studies and the differences in their infection management protocols and antibiotic policies.

Our findings justify frequent clinical assessment of patients with indwelling catheter, and based on the signs and symptoms we can suspect central line related infections timely. And patients with risk factors like chronic illness, immune-compromised status, prolonged catheter days should be frequently monitored and blood culture and antibiotic sensitivity testing should be carried out timely to improve outcomes. Our findings also suggest that more research is needed as the literature is scarce.

### Conclusion:

Catheter related blood stream infection is a very serious complication of central venous catheter. It is more common in patients who have co-morbidities. In our study we found that femoral CVCs related infection is highly prevalent in patients and *Staphylococcus aureus* is

the highly prevalent organism and shows their antibiotic sensitivity. So by using aseptic technique during insertion and proper catheter care we can reduce the chances of infection and further morbidity and mortality related to CVCs.

**Conflict of interest: Nil**

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