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CLINICO-MICROBIOLOGICAL PROFILE OF CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTION (CLABSI) AND ASSOCIATED RISK FACTORS AMONG PATIENTS ADMITTED IN A TERTIARY CARE HOSPITAL, NAVI-MUMBAI

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ABSTRACT

Background – Central line-associated bloodstream infection is an infection that occurs when microorganisms enter bloodstream through central line that occurs within 48 hours of central line placement. This study undertaken to determine clinico-microbiological profile, antimicrobial susceptibility pattern and risk factors associated with CLABSI.

Methods – This is a descriptive and Prospective Study from January to December 2022, under aseptic conditions 30 IPD patients' blood were cultured manually and a catheter tip culture were cultured using the semi-quantitative roll-plate and quantitative vortex method. Kirby-Bauer disk diffusion method used to study Antibiotic susceptibility profiles. All the results were statistically analysed by using Crude Odds Ratio and P value.

Result- out of 30 samples, 18 (60%) were CLABSI positive. The majority of CLABSI patients were in ICU (83%) and highly prevalent over the age of 50 (61%) and in men (66%).CLABSI rate in our study period was determined to be 2.73 (1.58 - 4.50) per 1000 catheter days. Gram Negative Bacteria (61%) were found to be higher in prevalence than Gram Positive (39%) Bacteria, with Enterobacter (36%) being with greatest incidence among GNB and S. aureus (43%) among GPC. variant and Independent risk variables were also investigated.

Conclusion- According to this study, high risk variables related with CLABSI were identified, and more MDR organisms were isolated. To reduce this, it is essential to follow proper antibiotic policies, central line insertion and maintenance bundles.

Keywords- CLABSI, ICU, risk variables, MDR.

INTRODUCTION

Nosocomial infections are illnesses or infections that manifest while receiving medical care but weren't present at the time of admission, often known as healthcare-associated infections (HAI).[1] These healthcare-associated infections (HAIs) include pneumonia related to ventilators, urinary tract infections related to catheters, and bloodstream infections related to central lines. Additionally, surgical site infections might manifest themselves at the sites of operations.[2]

To give medication or fluids, or to draw blood for diagnostic testing, doctors usually place a catheter (tube) into a significant vein in the neck, chest, or groin. The name of this technique is the central line. [3] There are two kind of Central lines: (1) tunneled catheters, which are surgically implanted into the internal jugular, subclavian, or femoral vein for long-term (weeks to months) purposes like hemodialysis or chemotherapy, and (2) non-tunneled catheters, which are generally used.[4]

Central line-associated bloodstream infection (CLABSI) is a severe infection that occurs when microorganisms enter the bloodstream through the central line. Laboratory Conformed Blood Stream Infection and do not originate from an infection at another spot on the body occurs within 48 hours of central line placement.[5]
CLABSIs result in longer hospital stays, higher healthcare costs, and a rise in mortality. According to estimates, 250,000 bloodstream infections occur annually, with intravascular devices accounting for the majority of these infections. In the United States, the rate of CLABSI in intensive care units (ICU) is found to be 0.8 per 1000 central line days. According to monitoring data from the International Nosocomial Infection Control Consortium (INICC) spanning 703 intensive care units across 50 countries from January 2010 to December 2015 the Rate of CLABSI was 4.1 per 1000 central line days.[5]
CLABSI has been associated with several life-threatening complications.[6] This study has therefore been undertaken to determine the clinico-microbiological profile and risk factors associated with CLABSI.

MATERIALS AND METHODS

From January to December 2022, 30 IPD patients' central line tips and blood samples were collected and examined in the Microbiology Laboratory at MGM Hospital in Kamothe, Navi Mumbai. Including male and female of all age groups

1. Catheter Tip Culture- All catheter tips intended for culture were cultured using the semi-quantitative roll-plate method and the quantitative vortex method. By carefully removing the catheter tips using sterile forceps, the inoculum was then applied directly to Blood Agar, MacConkey Agar, and Mannitol Salt Agar in the lab. For the semi-quantitative method, a positive catheter-tip culture was defined as at least 15 colony-forming units (CFU/mL) and as more than 100 CFU/mL for the quantitative method. Then, utilizing biochemical systems, bacteria and fungi were identified.[7]

2. Blood Culture - Blood cultures were performed by manual method. Media used for subculture were Blood Agar and, MacConkey Agar. Identification of organism carried out by biochemical reactions.[8]
Antimicrobial susceptibility testing[9] - It was done by Disk Diffusion Technique using Kirby Bauer's method (for vancomycin E strip method) and interpretation as per recent CLSI guidelines. Following antibiotics were used in this study.

- For Gram Positive Cocci First line antibiotics- Amoxyclave, Azithromycin, Ciprofloxacin, Clindamycin Second line antibiotics- Linezolid, Vancomycin
- For Gram Negative Bacilli First line antibiotics- Amoxyclav, Amikacin, Cefuroxime, Ciprofloxacin, Ceftazidime, Ofloxacin Second line antibiotics- Ceftriaxone/Salbactum, Cefixime, Imipenem, Meropenem, Piperacilin/Tazobactam, Tigecycline, Ertapenem, Levofloxacin, Ticarcillin.

RESULT

- CLABSI is prevalent in a high number of people over the age of 50 (61%) and in men (66%).
- The majority of CLABSI patients were in ICU (83%), with a significant percentage in MICU (44%), while the remaining patients were outside of ICU (17%), particularly in MMW (11%).
- Gram Negative Bacteria (61%) were found to be higher in prevalence than Gram Positive (39%) Bacteria, with Enterobacter (36%) being the bacteria with the greatest incidence among GNB and S. aureus (43%)being the most common etiological agent for CLABSI among GPC.
- Gram positive isolates were shown to be very sensitive to Amoxyclave, Cefoxitin Clindamycin and Linezolid, while Gram negative isolates were found to be highly sensitive to Ofloxacin, Amikacin, and Levofloxacin.

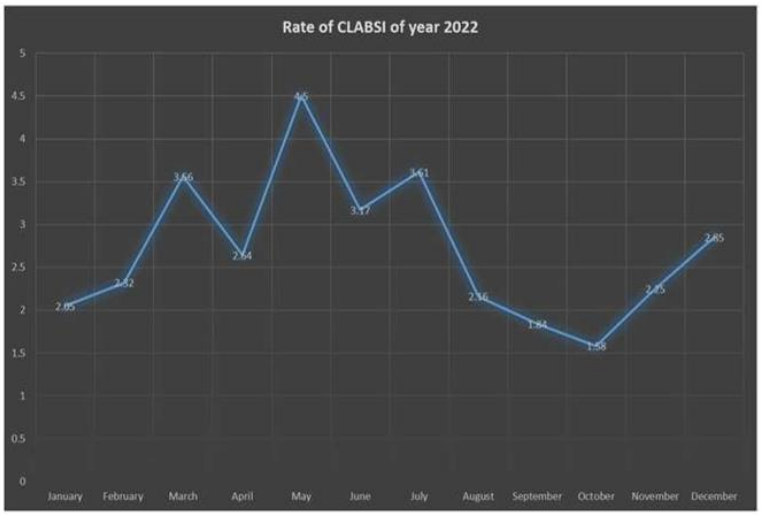
The CLABSI rate in our study period was determined to be 2.73 (1.58 - 4.50) per 1000 catheter days. (Graph 1)
Individuals at high risk in my study were found to be patients over the age of 50, male gender, with multiple CVCs, and admitted for a longer period of time with catheters in place for a prolonged duration of time. (Table 1)
Independent risk variables were also investigated, and it was discovered that patients with tunneled and PICC, patients with internal jugular and femoral access sites, and fewer sterile barriers for central line insertion with enormous amount of microbial colonization in that location were the most vulnerable to the development of Central Line Associated Blood Stream Infection.
In addition to the risk factors listed above, patients receiving parenteral nutrition, exhibiting cardiovascular disease, dialysis patients, and trauma, as well as leukocytopenic patients and hypertension, were discovered to be at the highest risk of contracting CLABSI. (Table 2)

TABLE-1 Risk Factors (variant analysis) associated with CLABSI.

Risk Factors (variant analysis)	Odds ratio	95%CI	*P* value
Age			
<12 years	0.27	[0.02 , 3.67]	0.16 (Not significant)
12 – 49	0.68	[0.13 , 3.55]	0.32 (Not significant)
Advance Age >50 years	Reference	-	-
Gender			
Female	Reference	-	-
Male	1.42	[0.32 , 6.46]	0.32 (Not significant)
Duration of Hospital stay			
Less than 2 weeks	Reference	-	-
More than 2 weeks	7.85	[1.31 , 47.04]	0.01 (significant)
Duration of central line placement			
Less than 2 weeks	Reference	-	-
More than 2 weeks	6.25	[1.05 , 37.07]	0.02 (significant)
Multiple CVCs			
One CVC	Reference	-	-
More than one CVC	13	[2.07 , 81.48]	0.00 (significant)

Risk Factors (Independent)	CLABSI (n=18)	CLABSI Percentage
Type of CVC		
Tunneled	16	88.88%
PICC	10	55.55%
Dialysis	09	50%
Non-tunneled	01	5.55%
Implanted Ports	00	0%
Insertion site		
Internal jugular	05	27.77%
Femoral	05	27.77%
Subclavian	02	11.11%
Lack of maximal sterile barriers for CVC insertion	04	22.22%
Heavy microbial colonization at insertion site	15	83.33%
INTERVENTIONS		
Parenteral nutrition	16	88.88%
Vasoactive medicine	05	27.77%
Blood product Transfusion	04	22.22%
Glucocorticoids	04	22.22%
MEDICAL HISTORY		
Cardiovascular illness	12	66.66%
Dialysis	09	50%
Trauma	07	38.88%
Gastrostomy Tube	04	22.22%
Previous ICU admissions	04	22.22%
Tracheostomy Tube	03	16.66%
Organ transplant	01	5.55%
Malignancy	01	5.55%
VITAL SIGNS AND LAB VALUES		
Leukocytopenia <1000/ul	10	55.55%
Hypotension	08	44.44%
Low platelet count	05	27.77%
Diabetes mellitus	03	16.66%

TABLE-2Independent Risk Factors Affiliated among Patients with CLABSI.



DISCUSSION

Our results demonstrated that the prevalence of CLABSI was higher in the age categories 50 and older (61.11%), and the population was largely males (66.66%). However, current study and study conducted by Elauoty RM, Ali ZH, et al. are related because, the maximum number of CLABSI patients in their study ranged in age from 51 to 65. This might be because older individuals have weaker immune systems than younger ones, are more prone to have co-morbid diseases, and need more medication and antibiotics. And they also discovered that around half of the patients who had been studied were men.[10]

The rate of CLABSI occurrences in the present study was 83.33% in the ICU, compared to 16.66% in Wards settings, such as the MMW, FMW. The research carried out by Krishnan S, Kumar A, Sethi P et al. and the current investigation, however, are comparable. In that study, the rates of central lines being placed in the ward, ICU, and emergency ward were 42.5%, 30%, and 27.5%, respectively.[11]

Gram Negative Bacteria were more prevalent in our study, compared to Gram Positive Bacteria's. The most prevalent bacteria in the Gram Negative populations were Enterobacter species (36%), and S. aureus (42.85%).

Similar study conducted by Siddiqui AH, et al. revealed a significant incidence of K. pneumoniae (32%), followed by Escherichia coli (17%) among Gram negatives. Staphylococcus aureus (9%), which is less common among Gram-positive bacteria, was outnumbered by Enterococcus sp. (14%).This research was based on A total of 103 isolates were found to meet the requirements for CLABSI patients.[12]

According to our study, the most efficient antibiotic against Gram-positive isolates was linezolid (LZ). Unlike our investigation, they discovered that 53% S. aureus and 53% Enterococcus sensitive to ceftriaxone. Vancomycin was effective against S. aureus and CoNS isolates, and it was effective against 97% of Enterococcus isolates.[13] We discovered that, the most effective antibiotic for GNBs was found to be ofloxacin (OF). On the other hand, the isolated GNBs all exhibited total resistance to amoxyclave (AMC). A first ranking antibiotic for MDR GNBs, was found to be Levofloxacin. Ceftriaxone/Salbactum (CIS) was the second-most effective antibiotic. cefixime (CMC) and ticarcillin were the three antibiotics that all MDR GNBs displayed highest resistance to.

The result of our study ties well with previous studies wherein researchers from Al-Mousa HH et al. discovered that Acinetobacter baumannii was 77.6% resistant to imipenem and meropenem and Klebsiella pneumoniae was 29.4% resistant in their study on device-associated healthcareacquired infections.[14]

Contrary to the findings of our research, the study by Weiner LM et al. discovered that the CLABSI infections, especially K. pneumoniae and K. oxytoca, had the largest proportion of Enterobacteriaceae that were resistant to carbapenem.[15] All Enterobacteriaceae CLABSI pathogens tested in 2014 had a carbapenem resistance rate of 7.1%. Our research revealed that among CLABSI infections, the proportion of Enterobacteriaceae that were resistant to carbapenems was half or less. In particular, Klebsiella species and enterococcus were 50% resistant, whereas Acinetobacter isolated showed 100% resistance to carbapenems. In contrast, Enterobacteriaceae pathogens more frequently displayed resistance to penicillins like Ticarcillin (TCC) and 3rd generation cephalosporins like Cefixime (CMC).

The analysis carried out by us over a year on 30 ICU and Ward patients with central line. However, it estimates a lower CLABSI rate for year 2022, 2.73 (within a range of 1.58 to 4.50) per 1000 CL days, is comparable to the Bukhari SZ et al. In this investigation, which was conducted in the year 2012. Although this study involved 97 ICU patients, the overall CLABSI rate was 6.5 (range 3.5- 19.6) per 1000 CL days.[16]

In the research which we carried out TABLE-1 shows variant analyses of risk factors, and the results show that age over 50 and the male gender are at high risk. And CLABSI was more common in individuals who had extended hospital stays, prolonged central line implantation times, and more CVCs at place.

In the current investigation, certain independent risk factor analyses, shown in TABLE 2, indicated that patients with tunneled and PICC catheters, who frequently used internal jugular vein and femoral vein as insertion sites, had an elevated risk of developing CLABSI infection. Along with these characteristics, the risk of CLABSI is higher in patients who have a high level of microbial colonization at the site of CVC insertion who frequently lack the highest level of sterile barriers during CVC insertion, as well as in patients receiving parenteral nutrition, with Cardiovascular illness, Dialysis and Trauma. And those with Low white blood cell count and hypotension.

Our risk factors findings are in line with that of Wylie MC et al. In their investigation, it was demonstrated that receiving parenteral nourishment, receiving blood transfusions, and having central venous access for a long time were all major risk factors. Three newly discovered risk variables were CVC installation in the ICU, medical cardiovascular disease, receiving a gastrostomy tube.[17]

CONCLUSION

The purpose of this study was to assess the clinical and microbiological profile of CLABSI while investigating the risk factors attributed to it. According to the aforementioned statements and finings high risk variables related with CLABSI were identified, and more MDR and MRSA organisms were isolated. To reduce this, it is essential to follow proper antibiotic policies, central line insertion and maintenance bundles.

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