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Central Venous Catheter Tip Culture and Sensitivity Pattern from a Tertiary Care Hospital in Jammu Region, India

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Abstract

The use of Central Venous Catheters (CVC) in critically ill patients often leads to Catheter Related Blood Stream Infections (CRBSI). Blood stream infections which are associated with catheter is associated with high morbidity and mortality. Aim of the study is to find the type of organisms isolated from Central venous catheter tip and to determine their antimicrobial susceptibility pattern. A total of 100 samples were received in our laboratory over a period of one year. Samples were processed; organisms were isolated and subjected to antimicrobial sensitivity according to standard laboratory procedures. AST interpretation was done according to latest CLSI Guidelines. Of the 100 samples received in our laboratory, 11(11%) showed no growth or insignificant growth. 64% of the total samples were Gram Negative Bacilli and 23% were Gram Positive Cocci, 2% were *Candida albicans*. *Escherichia coli* and *Staphylococcus aureus* were the most common organisms isolated among gram negative bacilli and gram positive cocci respectively. Sensitive drugs in case of gram positive cocci were vancomycin and linezolid and in case of gram negative bacilli were Colistin and polymyxin B.

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Disinfectants, Variables, Process, Reactor, Automation, Design, Validation.

Introduction

Central venous catheter is used in care of critically ill patients to receive fluids and medicines.[(1)]These intravascular devices act as vehicle for entry of microorganisms that colonize the skin adjacent to the site of entry or they may serve as foreign bodies, leading to catheter related blood stream infections (CRBSI).[(2)]

CRBSI is an important cause of healthcare associated infection to the blood stream. Several studies have shown increase in risk of bacteremia and sepsis following central venous catheter (CVC) insertion, therefore, prevention of CRBSI is an essential objective when these devices are used. Risk of infection depends on the material of catheter used, reason for its use, duration of catheterization [(3)] and specific characteristics of the patient in whom catheter is placed. The administration of parenteral nutrition through intravascular catheters increases CRBSI risk. Local risk factors, such as poor personal hygiene, occlusive transparent dressing, and moisture around the exit site, *Staphylococcus aureus* nasal colonization, and contiguous infections support the role of bacterial colonization in the pathogenesis of CRBSI. Other risk factors for dialysis CRBSI include contamination of

dialysate or equipment, inadequate water treatment, dialyzer re-use, older age, higher total intravenous iron dose, increased recombinant human erythropoietin dose, recent hospitalization or surgery. Hence, CRBSI rates can differ according to the institution and health-care institute understudy [4].

CRBSI may be caused by Gram positive or Gram negative organisms but gram negative bacilli are responsible for a higher number of catheter related infections in Intensive Care Unit(ICU) than in Non- ICU patients[5]. Also, the relative risk for CRBSI is up to 64 times greater with CVCs than with peripheral venous catheters. Meta analytical study done at The Johns Hopkins University showed that bloodstream infections (BSI's) were the third leading cause of Hospital-Acquired Infections (HAI's), with an attributable mortality rate of 12-25 %[6]. The diagnosis of CRBSI requires a positive culture of blood from a peripheral vein and clear evidence that the catheter is the source. CRBSI means a patient with an intravascular catheter has at least one positive blood culture obtained from a peripheral vein, clinical manifestations of infections, and no apparent source for the BSI, except the catheter.

This study is done with the aim to find the incidence of culture positive CVC tip, type of organisms isolated and their antibiotic sensitivity pattern. This can help in selection of the appropriate antimicrobial agent for prophylaxis and empirical therapy of CRBSI.

Materials and Methods

This analytical, cross sectional study was conducted over a period of one year in the Department of Microbiology, Government Medical College & Hospital, Jammu (J&K), India which is a tertiary care hospital having referral of Jammu province. Institute Ethics Committee approval was obtained for the study. All the tips from Intensive care unit (ICU) received in Microbiology Laboratory were included in this study.

The indications for central venous catheterization were for intravenous access and/or for central venous pressure monitoring. The catheter insertion was performed under strict aseptic precautions. A short section (approximately 5 cm) of the catheter (including the area directly beneath the skin) was aseptically cut off and sent to the laboratory in a sterile tube for culture. This section of the catheter was rolled back and forth according to Extra Luminal Maki's Roll Plate Method (Figure.1) on the surface of Blood agar and MacConkey Agar plate with sterile forceps or straight wire and simultaneously Direct Gram Staining was performed. After overnight incubation, the colonies were counted. A positive culture was defined as a count more than or equal to 15 CFU/plate [3]. Significant colonies were further processed. Organisms were identified according to Colony Morphology, Gram Staining and Biochemical Tests.

Antibiotic Sensitivity was performed using Kirby-Bauer Disc Diffusion Method on Muller Hinton agar (HiMedia Labs). Different panels for Gram-Positive and Gram Negative bacteria were used as per Latest CLSI Guidelines (2019). Statistical analysis was performed using Microsoft Excel.

Antibiotic discs were procured from HiMedia Laboratories. The discs used for gram positive isolates were: Penicillin G (10 Units), Cefoxitin (30 mcg), Gentamicin (10 mcg), Ciprofloxacin (5 mcg), Vancomycin (30 mcg), Linezolid (30 mcg).

Antibiotic discs used for gram- negative isolates were: Ampicillin (10 mcg), Piperacillin-tazobactam (100/10 mcg), Cefuroxime (30 mcg), Cefoxitin (30 mcg), Cefepime (30 mcg),

Amikacin (30 mcg), Imipenem (10 mcg), Gentamicin (10 mcg), Tobramycin (10 mcg), Ciprofloxacin (5 mcg), Cotrimoxazole (1.25/23.5 mcg), Chloramphenicol (30 mcg), Tetracycline (30 mcg), Norfloxacin (10 mcg), Amoxicillin/Clavulanic acid (20/10 mcg), Aztreonam (30 mcg).

Results and Discussions

A total of 100 samples were received in our laboratory for culture and sensitivity over a period of one year. Of the 100 samples, 11(11%) showed no growth or insignificant growth and 89 showed significant growth showing a culture positivity of 89% (Figure.2). 64% of pathogens isolated were gram negative bacilli, 23% were gram positive cocci, 2% were *Candida albicans*. *Escherichia coli* was the most common organism isolated among gram negative bacilli followed by *Klebsiella pneumoniae*. Among gram positive cocci, *Staphylococcus aureus* was the most common organism isolated. Distribution of Gram Negative Bacilli is given in (Table.1) and of Gram Positive Cocci given in (Table.2). The Antimicrobial Susceptibility Pattern is shown in (Table.3).

Table.1 Distribution of Gram negative microorganisms

Organism	Number of Isolates(n=100)
Escherichia coli	22(22%)
Klebsiella pneumoniae	15(15%)
Acinetobacter sp.	12(12%)
Pseudomonas sp.	9(9%)
Citrobacter sp.	3(3%)
Proteus vulgaris	2(2%)
Proteus mirabilis	1(1%)

Table.2 Distribution of Gram positive microorganisms

Organism	**Number of Isolates(n=100)**
Staphylococcus aureus	16(16%)
Enterococcus sp.	5(5%)
Micrococci	2(2%)

Table.3 Antibiotic Susceptibility profile of organisms

Antibiotic	**Number of Sensitive Isolates (%)**	**Number of Resistant Isolates (%)**
Penicillin	4 (19)	17 (81)
Cefoxitin	5 (24)	16 (76)
Gentamycin	60 (71)	25 (29)
Ciprofloxacin	50 (59)	35 (41)
Vancomycin	20 (95)	1 (5)
Linezolid	20 (95)	1 (5)
Ampicillin	30 (47)	34 (53)
Piperacillin-Tazobactam	40(63)	24(38)
Cefuroxime	36(56)	28 (44)
Cefepime	35 (55)	29(45)
Amikacin	52 (81)	12(19)
Imipenem	45 (70)	19(30)
Tobramycin	45(70)	19(30)
Cotrimoxazole	55 (65)	30(35)
Chloramphenicol	63(74)	22(26)
Tetracycline	47(73)	17 (27)
Amoxyclav	34(53)	30 (47)
Aztreonam	44(69)	20(31)
Colistin	64(100)	0
Polymyxin B	64(100)	0

Figure.1 Extra luminal Maki's roll plate

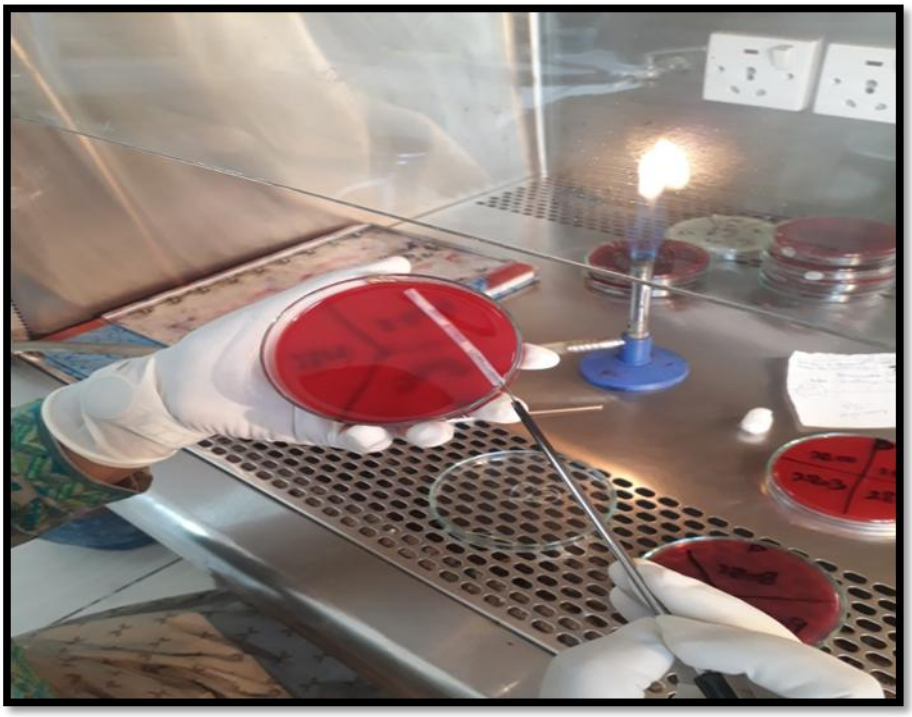
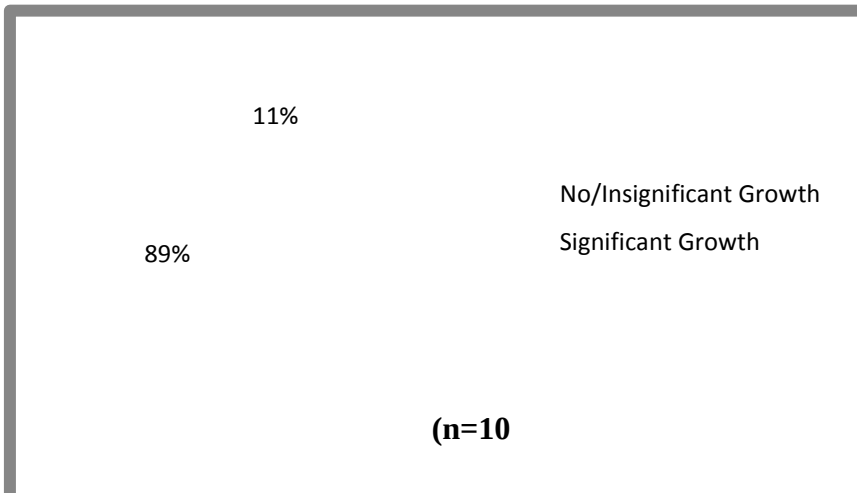


Figure.2 Culture positivity



Our study was done to investigate the rate of bacterial colonization and infection in central venous catheter tip culture together with antibiotic susceptibility profile of isolated bacteria. Central venous catheter is frequently used in hospital settings and colonization of CVC with a microorganism is one of the main risk factor for occurrence of CRBSI. In most of the studies done on central venous catheters, gram positive cocci were most frequently isolated [7-9], but in our study most common organisms isolated were gram negative bacilli of which *Escherichia coli* was most predominant, consistent with some of the studies done recently[10,11]. In the study of Ramanathan Parameswaran *et al.*, 2011 64% of the pathogens causing CRBSI were Gram-positive, 36% were Gram- negative. According to Krishnan *et al.*, 2011 Gram positive cocci constituted 27% of isolates and

gram negative bacilli were 56%. The proportion of Gram negative CRBSI was much higher than that reported in western hospitals [12]. Siefert *et al.*, 2003 showed *coagulase- negative staphylococci* was present in 50% cases of CRBSI in their study [13]. According to Almuneef *et al.*, 2006 total 50 CRBSI samples were received, 48% were polymicrobial, 32% were due to Gram – negative bacilli, and 10% were due to Gram positive organisms. In our study among infections caused by gram positive isolates *Staphylococcus aureus* was the most common organism. Various literatures shows that common organisms causing CVC associated infections are *Staphylococcus aureus, Candida sp.* and Gram negative bacilli [14, 15] and our study also correlated with these findings.

Our study shows most sensitive drugs among Gram negative isolates were Colistin, Polymyxin B, and intermediate sensitive were Imipenem, Amikacin, Aztreonam, Piperacillin -tazobactam and Tobramycin. Antibiotics like Penicillin, Ampicillin, and Cefepime showed high degree of resistance. Whereas study of Sapkota *et al.*, 2017 concluded that chloramphenicol was the most sensitive drug, Piperacillin –tazobactam showed decrease sensitivity and antibiotics like Gentamicin and Amikacin as resistant drugs. Colistin also showed 100% sensitive in their study, which correlated with our study. [16]

Among Gram positive cocci, most effective drugs were Vancomycin and Linezolid, which was in concordance with the study of Mansur *et al.*, 2014; where vancomycin was the 100% sensitive drug. [17]

Conclusion

The present study has highlighted shift in colonizers of central venous catheter predominantly towards Gram negative bacilli and their appropriate antibiotic sensitivity profile. These findings can help in implementing educational and training programs on CRBSI for health personnel who can enable better management of these devices with regard to prevention, diagnosis and treatment. Hence, in order to reduce the mortality and morbidity of CRBSI, active intervention is required to ascertain the signs of sepsis in the patient at the earliest and send the properly collected samples at appropriate time for an early diagnosis.

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