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Microbiological profile of isolates from central venous catheter tip from a tertiary care hospital.

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Abstract

Introduction: Central venous catheters (CVC) are commonly used in critically ill patients and offer several advantages to peripheral intravenous access. Unfortunately, CVCs also carry unintended complications, such as infection and thrombosis leading to increased hospital stay. Hence, this study was conducted to understand the microbiological profile of isolates from CVC tips and their antimicrobial susceptibility pattern.

Material and Methods: CVC tip samples were processed on an average of 8th to 9th day of hospital stay and antimicrobial susceptibility test performed as per standard laboratory protocol. The results of culture and related information were recorded in detail. This retrospective data analysis of CVC tips was carried out in the Department of Microbiology from a period of January 1, 2020 to July 31, 2022.

Result: A total of 245 CVCs tip record were analysed.143/245(58.36%) showed no growth and102 (41.63 %) were positive for microbial culture. Klebsiella pneumoniae (27.45%) was predominant followed by Acinetobacter (19.60%) and Pseudomonas spp. (9.8%). Gram positive organisms accounted only for 20 (19.61%) and Candida albicans in 5(4.9%) cases. Gram negative organisms were resistant (53.93%) to 1st line antibiotics.

Discussion and Conclusion: Isolation of microorganisms from CVC segment indicates the colonization of catheter itself. Our study indicates the colonization rate to be 41.63% with a predominance of gramnegative organisms and Candida species. The

prevalence of microbial colonization in CVCs is significant and has gradually changed over time from grampositive cocci to gram-negative bacilli, which provides a reference for prevention and control of catheter related infections in the hospitals. Therefore, we suggest that empirical treatment should be based on knowledge of local prevalence of organisms and their susceptibility pattern rather than universal guidelines.

Keywords: Antibiotic susceptibility, CVC tip.

Introduction

Central venous catheters (CVC) are commonly used in critically ill patients and offer several advantages to peripheral intravenous access. Unfortunately, CVCs also carry unintended complications, such as Catheter related Blood Stream Infection (CRBSI) and Central line associated bloodstream infections (CLABSI) and thrombosis leading to increased hospital stay. Patients with CVCs are at risk of developing local as well as systemic infectious complications like local insertion-site infection, CRBSI, septic thrombophlebitis, endocarditis and other metastatic infections. The most serious complications are bacteraemia, sepsis and death.[1] Thus, isolation of the microorganism causing such complication and its susceptibility testing faces a major challenge to a microbiologist. [2] CVC act as portal of entry of bacteria that colonize the skin adjacent to entry point or may serve as foreign bodies that harbours micro colonies, leading to catheter related blood stream infections (CRBSI).[3] The CDC (Centres for Disease Control and prevention) defines a Central-line associated Blood Stream Infections (CLABSI) as a blood stream infection caused by an organism not related to another infection when a central line has been in place at some time during the 48 hr prior to the collection of the blood. In contrast, a Central linerelated Blood Stream Infections (CRBSI) is defined as a blood stream infection with either a positive catheter tip culture or a positive blood culture drawn from the central venous catheter consistent with a culture drawn simultaneously from a peripheral site. [4] The data was analysed to determine the percentage of infections caused by CVC and to identify the antimicrobial pattern, which would help to institute better prophylactic measures.

Aim

To understand the microbiological profile of isolates from CVC tips and their antimicrobial susceptibility pattern.

Material and Methods

This retrospective data analysis of CVC tips was carried out in the Department of Microbiology from a period of January 1, 2020 to July 31, 2022 in TNMC & BYL Nair Ch. Hospital, Mumbai, Maharashtra. All the central venous catheter tip sent for culture and antibiotic sensitivity in microbiology laboratory of TNMC & BYL Nair Ch. hospital were included in this study. A total of 245 CVC tips were received in microbiology laboratory over the study period. They were processed by on an average of 8th to 9th day of hospital stay. Extra luminal Maki's roll plate method was used for processing of catheter tip as per standard protocol. Agar plates were examined at 24 hours, 48 hours and 72 hours and organisms were identified and antibiotic sensitivity test was done by Kirby Bauer disk diffusion technique as recommended by Clinical Laboratory Standards Institute (CLSI). Statistical analysis was performed using Microsoft Excel. The results of culture and related information were recorded in detail.

Result

A total of 245 CVCs tip record were analysed.143/245(58.36%) showed no growth and

102/245(41.63 %) were positive for microbial culture. Out of 102 CVC tips showed significant growth, 57(55.88%) were male and 45 (44.11%) were female. Adult were 94/102 and paediatric growth were 8 from CVC tip. CVC tips received from various wards as mentioned in Table 1.

Table 1: Ward wise demographic distribution of significant growth from CVC tips.

	ADULT (94)				PEDIATRICS (8)		
Sex	**General ward**	**MICU**	**Super speciality ward**	**Total**	**Ward**	**ICU**	**Total**
Male	31	4	17	52	2	3	5
Female	27	2	13	42	0	3	3
Total	58	6	30	94	2	6	8

Out of these 102 growths, 77 (75.50%) of the total pathogens isolated were gram negative bacilli, 5 (4.9%) Candida species and 20 (19.61%) gram positive cocci. Klebsiella pneumoniae (27.45%) was the predominant organism isolated, followed by Acinetobacter spp. (19.60%) and Pseudomonas spp. (9.8%). Distribution of isolated bacteria is shown in Table 2.

Table 2: : Distribution of isolated bacteria.

Gram positive organism	**Number of isolates (%)**	**Gram negative organism**	**Number of isolates (%)**
Enterococcus spp.	9 (8.82%)	*Klebsiella pneumoniae*	28 (27.45%)
MRSA	4 (3.9%)	*Acinetobacter spp.*	20 (19.60%)
MSCONS	4 (3.9%)	*Pseudomonas spp.*	10 (9.8%)
MSSA	2 (1.96%)	*Enterobacter spp.*	9 (8.82%)
MRCONS	1 (0.98%)	*E. coli*	9 (8.82%)
Candida albicans	5 (4.9%)	*Citrobacter spp.*	1 (0.98%)

Gram negative organisms were resistant to 1st line antibiotics in 53.93% isolates. Among all the Gramnegative bacteria isolated, 23% were resistance to Carbapenem. Resistance to Colistin was not reported in any of the isolate. From the gram-positive cocci, Enterococcus species was the most common organism isolated 9 (45%), followed by MRSA, MSCONS, MSSA, MRCONS. Antimicrobial sensitivity pattern of Gram-negative bacilli and gram-positive cocci (% shows sensitivity) is shown in Table III and Table IV respectively.

Table 3: Antimicrobial sensitivity pattern of Gram-negative bacilli (% shows sensitivity)

Organism	AK	AMC	CTR	CIP	NET	PTZ	MRP	IPM	TG	CL	PI	CAZ
Klebsiella pneumoniae (28)	71.42 %	53.57 %	46.43 %	42.86 %	71.42 %	60.72 %	53.58 %	53.58 %	-	-	-	-
Acinetobacter spp. (20)	80 %	40 %	70 %	65%	55%	25 %	35%	35 %	100 %	100 %	-	-
Pseudomonas spp. (10)	-	-	-	-	-	50 %	60%	50 %	100 %	100 %	60 %	70%
Enterobacter spp. (9)	77.78 %	55.56 %	77.78 %	77.78 %	66.68 %	55.56 %	44.45 %	55.56 %	-	-	-	-
E. coli (9)	66.67 %	55.55%	44.45 %	66.67 %	55.56 %	55.56 %	44.45 %	33.33 %	-	-	-	-
Citrobacter spp. (1)	100 %	0	0	0	0	0	100 %	100 %	-	-	-	-

(CIP- Ciprofloxacin, CTR- Ceftriaxone, AMC- Amoxicillin clavulanate, NET- Netilmicin, PI- Piperacillin, PTZ- Piperacillin/ Tazobactam, IPM- Imipenem, MRP- Meropenem, GEN- Gentamycin, AK- Amikacin, CL- Colistin sulphate)

Table 4: Antimicrobial sensitivity pattern of Gram-positive cocci (% shows sensitivity

Organism	AMP	P	VA	LZ	TEI	HLG	E	CD	COT	CIP	GEN
MRSA (4)	-	0	100 %	100 %	-	-	50 %	50 %	75 %	50 %	25 %
MRCONS (1)	-	0	100 %	100 %	-	-	0	100 %	0	100 %	100 %
MSSA (2)	-	0	100 %	100 %	-	-	50 %	50 %	50 %	100 %	50 %
MSCONS (4)	-	25 %	100 %	100 %	-	-	75 %	50 %	50 %	75 %	50 %
Enterococcus spp. (9)	66.67 %	-	100 %	100 %	66.67 %	22.23 %	-	-	-	-	-

(AMP-Ampicillin, P-Penicillin, VA-Vancomycin, LZ-linezolid, TEI-Teicoplanin, E-Erythromycin, CD-Clindamycin, COT-Cotrimoxazole, CIP-Ciprofloxacin, GEN-Gentamicin).

Discussion

In our study total of 245 CVCs tip record were analysed.143/245(58.36%) showed no growth and 102/245(41.63 %) were positive for microbial culture. Similarly, Sapkota J et al in their study observed, out of 53 samples, 21 (39.6%) showed significant growth of organism. Remaining samples either had no organism grown or had insignificant growth.[5] Bhavana C et al studied 150 cases, of which 95 (63.33%) were male and 55 (36.67%) were female. Male to female ratio was 1.73:1. [11] Similarly in our study, out of 102 CVC tips growth, 57(55.88%) were male and 45 (44.11%) were

female. Male to female ratio was 1.27:1. The male gender has been stated as risk factor for the development of CLABSI/CRBSI in most of the studies.[11] However, the reason for this high incidence in males could not be attributable to any reasons. In our study most common indication for central line insertion was haemodialysis, followed by infusion of intravenous fluids, medications and hemodynamic monitoring. Majority of the study group was distributed in general ward 60 (58.82%), followed by superspeciality 30 (29.41%), ICU 12 (11.76%). Similarly, Bhavana C et al in their study observed same findings. In their study, majority of the study group was distributed in Nephrology department (58.67%), followed by Medicine (8.67%), Paediatric surgery (7.33%) and remaining 25.32% distributed among other departments. Isolation of microorganisms from CVC segment indicates the colonization of catheter itself. [5] Study conducted by Sapkota J et al, the colonization rate was 39.6%.[5] Similarly, Bhavana C et al in their study observed colonization rate was 12.67% of the cases, in which only central line tip was culture positive with no evidence of bloodstream infections.[11] According to our study the colonization rate was found to be 41.63% with a predominance of gram-negative organisms and Candida species. Sapkota J et al in their study observed, out of 53 samples, 21 (39.6%) showed the significant growth. 52.3% of pathogens isolated were gram negative bacilli, 33.3% were gram positive cocci. In 9.6 % samples, polymicrobial growth was observed and 4.8% were Candida albicans. Acinetobacter baumannii was the most common organism isolated followed by Staph. aureus and Klebsiella pneumoniae. [5] Inamdar et al observed, of the 47 isolates grown from patients with CRLI (Central line related local infection), 27 were Gram negative bacilli (57.44%) and 20 Gram positive cocci (42.56%). Of these 21.27% of these isolates were MSSA, 19.14% Klebsiella pneumoniae, 17.02% Acinetobacter spp., 14.8% Pseudomonas aeruginosa, 8.5% MRSA, 6.3% Coagulase negative Staphylococcus aureus (CONS) and 4.2% Enterococcus spp. [2] In our study, out of 102 growth, 77 (75.50%) of the total pathogens isolated were gram negative bacilli, 5 (4.9%) candida species and 20 (19.61%) gram positive cocci. Klebsiella pneumoniae (27.45%) was the predominant organism isolated, followed by Acinetobacter spp. (19.60%) and Pseudomonas spp. (9.8%). In most of the earlier studies gram-positive cocci were the predominant colonizer of CVC.[6] However, our study showed the predominant organisms to be gram negative bacilli, which is consistent with some recent studies. [2, 5,6,7,8,9] Our study showed 100% efficacy to Vancomycin and Linezolid, which are used only in gram positive cocci ,100% efficacy to Colistin was reported in gram negative bacilli similarly observed in study done by Sapkota J et al. [5] In our study, gram negative organisms were resistant to 1 st line antibiotics in 53.93% isolates. Similarly, Inamdar er al observed 58.82% isolates were resistant to 1st line antibiotics.[2] Our study observed, among all the Gramnegative bacteria isolated, 23% were resistance to Carbapenem. Inamdar et al in their study found most isolates were carbapenem sensitive.[2] According to various literature common organism colonizing CVC and associated with infections are CONS, Staph aureus, Candida spp. and gram-negative bacilli. [5,10] Our study also confirmed these findings.

Conclusion

The prevalence of microbial colonization in CVCs is still significant and has gradually changed over time from gram-positive cocci to gram-negative bacilli, which will

provide a reference for prevention and control of catheter related infections in the hospitals. Microbiological profile and antibiotic profile of CVC tip infections in a tertiary care hospital, will help the institute to use appropriate antimicrobial agent and also helps the clinician to deescalate or change the antimicrobial for better management of patients admitted in ICU. Therefore, it is suggested that empirical treatment should be based on knowledge of local prevalence of organisms and their susceptibility pattern rather than universal guidelines.

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Abbreviations

CDC - Centres for Disease Control and prevention

CLABSI- Central line associated bloodstream infections

CLSI- Clinical Laboratory Standards Institute

CRBSI- Catheter related Blood Stream Infection

CRLI- Central line related local infection

CVC- Central venous catheters

ICU-Intensive care unit

MRCONS- Methicillin resistance coagulase negative staphylococcus

MRSA-Methicillin resistance staphylococcus aureus

MSCONS-Methicillin sensitive coagulase negative staphylococcus

MSSA-Methicillin sensitive staphylococcus aureus