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COMPARE THE INCIDENCE OF CATHETER RELATED BLOODSTREAM INFECTION BETWEEN CVC (CENTRAL VENOUS CATHETER) AND PICC (PERIPHERALLY INSERTED CENTRAL CATHETER) IN ICU PATIENTS.

Clinical Research

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ABSTRACT

The aim of this prospective study is to compare the rate of catheter colonization, rate & incidence of bloodstream infection, the major causative organism in bloodstream causing catheter colonization of CVC & PICC & compare other complications related to CVC & PICC. Total no. of patient included in the study are 60-30 for CVC & 30 for PICC cannulation on the basis of quota sampling. 12yrs & older patients of both genders are eligible for the study. For CVC- subclavian and internal jugular veins were cannulated percutaneously using standard seldinger's technique. For PICC-There are 2 bedside methods: the peel-away cannula technique and the modified-Seldinger technique. The distal 5cm segment of the catheters were cut with sterile scissors, placed in a sterile transport tube and cultured using the semi quantative method. Simultaneously 10ml blood from peripheral site was sent for culture in special culture media. The following data were collected: age, sex, diagnosis, catheter access, catheter duration, development of catheter colonization and catheter related bloodstream infections. CVC have higher incidence density of bacterial colonization 60.81/1000 catheter days as compare to PICC 33.78/1000 catheter days. CVC have clinically significant higher incidence density of bloodstream infection (BSI) 33.78/1000 catheter days as compare to PICC 16.44/1000 catheter days. Most comman organism causing Catheter related bloodstream infections (CRBSI) is Klebsiella.pneumoniae in both the CVC & PICC groups. Other catheter related complications are also higher in CVC (26.67%) than in PICC (16.67%). So to conclude we found in our study that PICC's are a safer alternative to CVC's for intravenous catheterization in ICU patients.

KEYWORDS

Catheter Colonisation, Catheter related blood stream infections(CRBSI), Central venous catheter (CVC), Peripherally inserted Central Catheter (PICC)

INTRODUCTION

Intravascular catheters are used for hemodynamic monitoring, volume resuscitation, TPN, insertion of transcutaneous pacing leads & for medication infusion. On the basis of its use, central venous catheter (CVC) is monoluminal, biluminal & triluminal depending upon the actual number of lumen (1, 2 & 3 respectively). Central venous catheterisation is done at various sites - internal jugular & subclavian vein mainly.

While a PICC is inserted in a peripheral vein in the arm usually cephalic, basilic or brachial vein. In clinical studies, PICC's are conventionally used to provide cost effective long term intravenous cannulation, chemotherapy, parenteral nutrition or antibiotics administration[1]. These catheters are contraindicated in case of venous thrombosis, severe coagulopathy, respiratory failure with high FiO2, contaminated or traumatised or burnt site and end stage renal disease. Complications of intravascular catheters include mechanical complications like arterial puncture, hematoma and pneumothorax formation, kinking, obstruction & guide wire induced arrhythmias etc. Long term complications include infection and thrombosis.

Catheter related blood stream 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 venous catheterisation. Central catheters pose a greater risk of device related infections than any other types of medical device & are major causes of morbidity & mortality. They are also the main source of bacteraemia & septicaemia in hospitalized patients[2]. Therefore the aim of this study is to assess & compare the rate of catheter colonisation, the rate & incidence of blood stream infection , the major causative organism in blood stream caused by catheter colonisation of CVC & PICC & compare other complications related to CVC & PICC.

Clinical signs raising suspicion for catheter infection are: Temperature >38*C, Hypotension, Chills, Hypothermia (<36*C), Pulse >100, Respiratory rate >20/min, Sudden increase or decrease in white blood cell count, metabolic acidosis, respiratory alkalosis, acute renal failure, disseminated intravascular coagulation. Also local signs such as induration, discharge, erythema and tenderness, multiple attempts during CVC or PICC insertion, presence of hematoma, organism in the blood suspicious for catheter infection (eg. Staphylococcus. epidermidis)

MATERIAL & METHODS

After approval from institutional committee, the present study had been undertaken in the 12 bedded ICU, Department of Anaesthesiology & Critical Care, S.N.Medical College Agra between September 2014 & September 2016. All the patients admitted to the ICU during this period were eligible. Only the catheters placed & removed in the unit were analyzed.

Due to time & sources availability quota sampling was done. Total no. of patients included in the study were 60 - 30 for CVC & 30 for PICC insertion. Our study did not accepted healthy volunteers. Patients included in the study were critically ill patients likely to require central venous or peripheral catheter for atleast 3 days, age more than 12years, white cell count on admission 4000-11000/ml, absence of skin burns, no history of allergy to sulfa containing preparations.

The CVC's & PICC's that were used in this study were having no antibiotic or antiseptic properties. CVC's & PICC's were not be tunnelled and no guidewire assisted changing of catheters was done. A skin swab sample was taken from the puncture site & sent for semi-quantitative analysis. The puncture site was prepared with alcoholic solution of 0.5% clorhexidine & the surrounding areas were covered with sterile drapes. A sterile occlusive adhesive transparent dressing was applied. Informed consent was taken before the procedure. For CVC – subclavian and internal jugular veins were cannulated percutaneously using standard Seldinger's technique[3]. For PICC - There were 2 methods of bedside PICC insertion: the peel-away cannula technique and the modified-Seldinger technique. Chest x-ray was done after every insertion. The percutaneous entry sites were examined for the presence of local inflammation and purulence. Catheter dressing gauze were changed every 48 hrs. Connecting lines were changed every 48 hrs and disposable transducer components were replaced every 96 hrs. All the lumens were flushed with normal saline every 12 hrs for prevention of catheter related thrombosis.

The CVC's or PICC's were removal under aseptic conditions and at the time of removal of the catheter , care was taken to keep the externalized portion upward and away from the skin surface. A 5 cm distal segment was cut with the sterile scissors & collected in sterile containers from all catheters. The containers were labelled and then transported immediately to the Department of Microbiology for immediate inoculation on to the culture medium.

The infection workup included analysis of the CVC & PICC tip by Semi-quantitative culture technique described by MAKI[4]. The CVC's and PICC's used in patients who died were also included. Simultaneously 10ml blood from peripheral site was sent for culture in special culture media. The following data was collected: age, sex, diagnosis, catheter access, catheter duration, development of catheter colonisation and catheter related blood stream infections.

Fisher's exact test was applied to calculate whether there was a significant association between categorical variables. P value < 0.05 was considered significant.

RESULTS & DISCUSSION

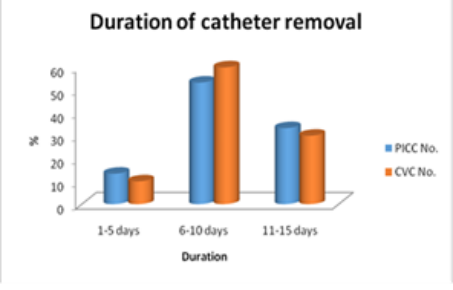
Vascular catheter related infection are the leading cause of nosocomial blood stream infections & are associated with significant morbidity in ICU. Bacterial colonisation of the central venous catheter is a common source of nosocomial infection. This study was conducted on 60 patients who were critically ill having divided into two groups of 30 each on the basis of central venous catheter inserted. Majority of them were in the age group of 21-30 years in both the groups with 36.67% in CVC group and 33.33% in PICC group. Both the groups are not statistically different on the basis of age wise distribution. Male:female ratio was 7:3 for PICC line inserted patients and 2:1 for CVC. This distribution is also statistically insignificant.

This distribution of patients in ICU on the basis of diagnosis is also statistically insignificant for both the groups. Majority of cases in both the groups were of Neuro-surgical patients 26.67% followed by obstretics, post-operative surgical patients, respiratory illness, other systemic diseases like CVA, stroke & miscellaneous like snake bite, poisoning etc.

Duration of catheterization is an independent risk factor for central venous catheter related bloodstream infections. In this study maximum no. of catheters were removed between 6-10 days in both the groups.[Table 1]

Table 1: Duration of catheter removal

Duration	PICC		CVC	
	No.	%	No.	%
1-5 days	4	13.33	3	10.00
6-10 days	16	53.33	18	60.00
11-15 days	10	33.33	9	30.00
	30	100.00	30	100.00



p-value=0.8121

The groups are not significantly different.

The literature suggests that as the number of days of catheterisation increases, the probability of developing catheter related blood stream infection increases[5]. Catheters whether CVC or PICC removed 1-5 days after insertion have the least colonisation and BSI incidence. In our study, duration of catheterization is found to be important risk factor in developing catheter related colonisation and blood stream infections. We divided duration of catheterisation into 3 groups i.e. 1-5 days, 6-10 days, 11-15 days. We found that value of correlation coefficient between catheter colonisation and blood stream infections, with duration increases from 0, +0.20 to +0.32 respectively in three groups. This indicates that as the duration of catheterization increases number of catheters developing colonisation and blood stream infections also increases although the result is not significant as p >0.05. Other studies support our findings[6]. It suggests that by limiting the duration of catheterisation, rate of catheter related infection can be minimized[7]. Although the guidelines for the prevention of intravascular catheter related infections, Centre For Disease Control and Prevention (CDC), 2002 recommend against routinely replacing the central venous catheter to prevent catheter related infections. But we routinely changed our venous catheters both

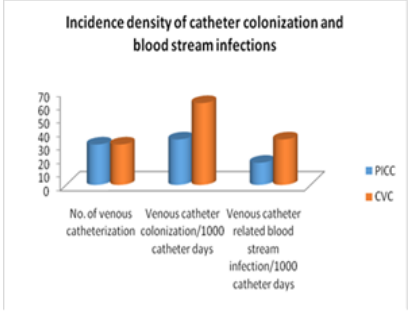
CVC and PICC every 14 days as there are studies which suggests central venous catheterisation longer than 5 to 7 days was associated with a higher risk of catheter related infection[8].

In our study, the gauze dressings were changed every 48 hrs because the CDC guidelines of 2002 recommend that gauze dressings be replaced every 2 days (category IB). In our study we have used occlusive transparent dressings (TEGADERM).

Central venous catheter (CVC) have higher incidence density of bacterial colonization 60.81/1000 catheter days as compare to Peripherally inserted central catheter (PICC) 33.78/1000 catheter days. CVC have clinically significantly higher incidence density of blood stream infection (BSI) 33.78/1000 catheter days as compare to PICC 16.44/1000 catheter days. [Table. 2].

Table 2: Incidence density of catheter colonization & bloodstream infection

Type of catheter	No. of venous catheterization	Venous catheter colonization/1000 catheter days	Venous catheter related blood stream infection/ 1000 catheter days
PICC	30	33.78	16.44
CVC	30	60.81	33.78



Total no. of catheter days for cvc= 296
Total no. of catheter days for picc= 304.

Comparing to other studies it was found to be 24/1000 catheter days for CVC and 23/1000 catheter days for PICC[9]. In an another non randomized study , infection rate for CVC was 6/1000 catheter days and for PICC 2.2/1000 catheter days[4].Some studies shows that although PICC's are associated with a lower risk of BSI than CVC in outpatients, hospitalized patients may be just as likely to experience BSI with PICC than with CVC.

The organisms causing blood stream infections most frequently found in our study were gram negative bacilli with Klebsiella being most common in both CVC & PICC infection. 42.87% bacterial isolates from PICC infection and 50% from CVC infection were found to be Klebsiella followed by Acinetobacter (28.57% & 30% for PICC & CVC respectively). Among gram positive we found Staphylococcus.aureus causing 28.57% of PICC and 10% of CVC infection.[Table 3] This result is consistent with another study where 42% of infection were polymicrobial, 32% were due to gram negative bacilli and 10% were due to gram positive organisms[10].[Table 3]

Table 3 : Organisms for Bloodstream Infection

Organisms	PICC(N=7)		CVC(N=10)	
	No.	%	No.	%
Kleibsiella	3	42.85	5	50.00

Acinetobacter	2	28.57	3	30.00
Staph.aureus	2	28.57%	1	10.00
pseudomonas	0	0	1	10.00
	7	100.00	10	100.00

p-value=0.7193

The groups are not significantly different

According to some literature coagulase negative staphylococci, the predominant species on human skin are the most common agents of catheter related infections[11]. While in the study of Ramanathan Parmeswaran et al 2011, the commonest pathogen was S.aureus followed by Pseudomonas.aeruginosa.

Other catheter related complications like hematoma formation, kinking, occlusion etc are also higher in CVC (26.67%) than in PICC (16.67%). [Table. 4]

Table 4: Other Complications

COMPLICATIONS	PICC(N=5)	CVC(N=8)
1.Hematoma formation	0	2
2.catheter kinking	2	2
3.lumen occlusion	2	2
4.catheter rupture	1	1
5.pneumothorax	0	1

	%	%
complications	16.67	26.67

CONCLUSION

In our study we found that PICC's are a safer alternative to CVC's for intravenous catheterization in ICU patients as the CRBSI rate and density from PICC's are much lower than that of CVC's. Also other mechanical complications are fewer with PICC insertion than CVC insertion.

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