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IJPBS |Volume 5| Issue 2|APR-JUN|2015|75-79

Research Article
Biological Sciences

INDWELLING CATHETERS, I.V CANNULAE AND ENDOTRACHEAL TUBES: THE DEN FOR MICROBES

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ABSTRACT

Background: *Indwelling devices have contributed significantly to the success of modern medicine. However the medical devices are susceptible to colonization with microbes which prelude infection. The colonization and/or infection may lead to malfunctioning of the device.* ***Aims and objectives:*** *This study was carried out to analyze the microbes colonizing the indwelling urinary catheters, intravascular cannulae and endotracheal tubes.* ***Material and methods****: The tube tips were collected aseptically and were cultured by qualitative method. The microbial growth was identified by Gram staining and standard biochemical test methods. The antibiotic sensitivity was done by Kirby-Bauer disc diffusion method and the results interpreted according to CLSI guidelines.* ***Results:*** *We found, 32(80.0%) urinary catheters, 6 (30.0 %) intravenous cannulae and 37(82.22%) endotracheal tips were colonized with microbes. Among the urinary catheter tips, 3 (7.5 %) were colonized with yeast, Candida. The commonest bacterial species isolated were E. coli, Coagulase negative staphylococci and Acinetobacter baumanii from urinary catheters, I.V cannulae and endotracheal tube tips respectively.* ***Conclusion:*** *Device related infections though, is a result of multifaceted interaction of bacterial, device and the host factors. Probably bacterial factors play a major role in the pathogenesis of such infections. It is imperative to know about the spectrum of organisms in any set up so as to decide about the antibiotic therapy and take preventive measures. Hence it is important to know the colonization rate and the organisms responsible, so that prompt preventive measures can be taken.*

KEY WORDS

Indwelling, device, colonization

INTRODUCTION

Indwelling catheters have become integral part in management of patients in hospitals. Modern health care is often incomplete without indwelling devices. These are used for providing nutrition, therapeutic fluids and drainage, in short essential for maintaining homeostasis. A large proportion of inpatients of hospitals, especially tertiary care centers, have indwelling devices kept in situ for a significant period of time.

The extensive use of medical devices has resulted in longer survival of critically ill patients. However multiple complications are associated with the use of indwelling catheters. In 1957, Elek and

Conen established that the presence of a foreign body significantly decrease the number of bacteria required to produce infection[1]. The medical devices hence have an inherent susceptibility to colonization with microbes which prelude infection. The colonization and/or infection may lead to malfunctioning of the device. Device related infections can manifest as localized or systemic complications, often requiring removal of devices.

A variety of micro-organisms may be involved as colonizers and/or pathogens. In this regard an attempt was made to analyze the microbes colonizing the indwelling urinary catheters, intravascular cannulae and endotracheal tubes.

MATERIAL AND METHODS

A prospective study was done and the study material was collected from inpatients of wards and ICU's of our teaching hospital, for a period of 6 months from July 2013 to December 2013. A total number of 105 non medicated catheter tips i.e.Peripheral Intravenous Cannulae (IVC), urinary catheters, endotracheal tubes were included for study.

The specimens were collected aseptically and sent to microbiology laboratory for immediate processing. The tips were cut at 5cm length and cultured by qualitative method which included incubation in glucose broth for 4 hours followed by smear examination and culture on sheep blood agar and Mac Conkey's agar. Positive tip culture (colonization) was defined as growth of any organism from the tip cultured, irrespective of the number of colonies isolated.

The microbial growth was identified by Gram staining and standard biochemical test methods of *Koneman*.[2]The antibiotic sensitivity was done by Kirby-Bauer disc diffusion method and the results interpreted according to CLSI guidelines.[3]

RESULTS

A total of 40 urinary catheters, 20 intravascular cannulae and 45 endotracheal tube tips were included in the study. We found 32(80.0%) urinary catheters, 6 (30.0%) intravenous cannulae and 37(82.22%) endotracheal tips were colonized with microbes. The tubes were colonized with different bacterial species only except the urinary catheters, 3 (7.5%) of which were colonized with yeast, Candida species. The commonest bacterial species isolated were E. coli, Coagulase negative staphylococci and Acinetobacter baumanii from urinary catheters, I. V cannulae and endotracheal tube tips respectively. The bacterial isolates from different samples are as shown in Table 1.

Table 1: Culture growth in different device tips

Catheter type	No. of samples	Culture growth	No. (n)	Percentage (%)
Urinary catheter	40	E.coli	18	45
		Klebsiella spp.	4	10
		P.aeruginosa	3	7.5
		A.baumanii	2	5
		S.aureus	1	2.5
		E.faecalis	1	2.5
		Candida spp	3	7.5
		No growth	8	20
I.V Cannula	20	Coagulase- negative staphylococci	2	10
		S.aureus		
		E.coli	1	5
		A.baumanii	1	5
		E.faecalis	1	5
		No growth	1	5
			14	70
Endotracheal tube	45	A.baumanii	15	33.3
		K.pnuemoniae	12	26.6
		P.aeruginosa	8	17.7
		E.coli	4	8.8
		S.aureus	2	4.4
		C.freundii	1	2.2
		No growth	8	17.7

DISCUSSION

Indwelling medical devices are used to support or monitor the basic body requirements/functions especially in critically ill patients. They have contributed significantly to the success of modern medicine. Though improvements in materials and design of devices have been made in past decade, microbial colonization of the device and hence infection continues to be a major problem of their use.[4]The permutation of an increasingly aging population and constantly rising number of inserted devices is likely to escalate the occurrence of infections related to medical devices.

The devices are inserted at various body sites bypassing normal defense barriers. By virtue of this microbes are provided an access to the normally sterile tissues and fluids. Not only does microbial colonization of indwelling device lead to infection but it can also affect the function of device, warranting its removal. Such infections contribute to the majority of health care associated infections, which are of serious concern.

About half of all nosocomial infections are urinary tract infections(UTI's) and 80% of these are catheter associated urinary tract infections(CA-UTI).The organisms commonly found in CA-UTI's are E.*coli*, other Enterobacteriaceae and

Pseudomonas species.[5] A colonization rate of 88.4% in urinary catheters, predominantly by E. coli was reported by Taiwo S S et al.[6] The catheter colonization rate probably varies with the type of catheter material, number of days the device being in situ and also the catheter maintenance. A few other studies have reported colonization rate of 69.6% and 38.4% in urinary catheters.[7] In this study 80% of urinary catheters were colonized and E.*coli* was the predominant organism.

Intravascular Catheters are used in very sick patients for nutrition and therapy as they provide safe and reliable vascular access which allows constant hemodynamic monitoring. But they also can be a portal of entry for skin flora and may cause bacteremia.[8,9] Most often the colonizers of the CIVC are bacteria from the skin flora, which gain entry into these cannulae. Infections related to use of these have been reported to be as low as 2.7% to as high as 21%.[10,11] We found that 30% of catheters were colonized with microbes and Coagulase negative Staphylococcus (CONS) was the predominant organism. David Boon et al have also reported that 75% of the colonizers of IVC were Coagulase negative Staphylococci followed by yeasts (16%) and the gram negative bacilli (8%).[12] An intravenous cannula tip colonization rate of 6.9% was reported from Nepal.[13]

Intensive care unit (ICU) patients often require artificial airways for ventilation for short periods. These artificial devices interfere with the innate immune mechanisms of respiratory tract. The air current passing directly into trachea may also traumatize the lining mucosa thereby creating an environment for microbes to colonize and later resulting in pneumonia. Different studies have reported ventilator associated pneumonia (VAP) rates ranging from 10.5% to 34.8%. [10,11] We found that 70% of endotracheal tips were colonized predominantly by Acinetobacter species and Klebsiella species, which is concordant with another Indian study reporting it as 77.8%,[5]whereas some authors have also reported a lower rate of 40% colonization among the endotracheal tubes.[6]

The study was limited to survey of non-medicated device tips only and also as colonization preludes infection; data regarding how many of these patients developed device associated infections could not be sought. Device related infections are a result of multifaceted interaction of bacterial, device and the host factors. Probably bacterial factors play a major role in the pathogenesis of such infections. Infections due to indwelling devices contribute to serious medical consequences and soaring economic burden for the patient. It is imperative to know about the spectrum of organisms in any set up so as to decide about the antibiotic therapy and take preventive measures. Also indirectly this may help in limiting the emergence of antibiotic resistant bacteria.

CONCLUSION

Device related infections are a result of multifaceted interaction of bacterial, device and the host factors. Probably bacterial factors play a major role in the pathogenesis of such infections. It is imperative to know about the spectrum of organisms in any set up so as to decide about the antibiotic therapy and take preventive measures. Also indirectly this may help in limiting the emergence of antibiotic resistant bacteria.

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