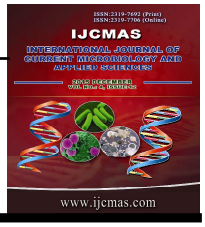
Int.J.Curr.Microbiol.App.Sci (2015) 4(12): 194-199

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 4 Number 12 (2015) pp. 194-199**
http://www.ijcmas.com



Original Research Article

Catheter – Associated Urinary Tract Infection in a SICU of a Tertiary Care Rural Hospital of India

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Keywords

Catheter – associated UTI Intensive care unit Multi drug resistant

A B S T R A C T

Catheter associated urinary tract infection is one of the major causes of health care associated infection. Due to serious ailments, intensive care unit patients are more prone to have health care associated infections. Patients staying more than 2 days in surgical intensive care unit were included in this study. Urine samples were processed from those patients and cases with urinary tract infection were established on the basis of clinical and microbiological findings. Number of cases with urinary tract infection were 21 (6%). Maximum number of isolates was Escherichia coli (28.57%). All isolates were multidrug resistant. Following simple and well-established guidelines regarding device associated infections and preventing indiscriminate use of antibiotics can control catheter associated urinary tract infection.

Introduction

Incidence of indwelling drainage device associated urinary tract infection (UTI) is increasing steadily in health care facilities, especially in intensive care units. Rate of infection is directly proportional to the days of catheterization. Microorganisms get adhered to the surface of the catheter and there they colonize and form biofilm. It has been observed that colonization and biofilm formation on device usually occur within three days of catheterization(Singh et al., 2010; Annaissie et al., 1995).

McLean et al., 1995; in their study described that up to 7 days catheterization, 10 – 50% patients develop UTI, whereas catheterization for more than 28 days may lead to 100% UTI. The risk of UTI in a catheterized patient increases by approximately 10% for each day.

Microorganisms may reach the urinary tract by three possible ways, such as; during insertion of catheter, through coat of exudate surrounding the catheter and intraluminally from tube or collection bag.If there is breach in closed drainage system microbes that enter into drainage bag are soon travel into bladder. Catheter – associated UTI (CA – UTI) is one of the major causes of health – care associated infection (HAI). This adds to patient's morbidity and mortality (Donlan et al., 2002).

This study was undertaken to evaluate the incidence of CA – UTI, in a surgical ICU(SICU) of a rural tertiary care hospital of western Maharashtra, India. The microorganisms isolated were identified and antibiotic susceptibility tests were done against them.

Materials and Methods

A prospective study of CA - UTI was done for one year. All patients, who stayed for longer than two days in SICU were included in this study (Suka et al., 2004).Patients admitted in SICU for less than two days or without complete data records were not included in this study. In suspected cases of CA – UTI, urine was collected from sampling port of indwelling catheter with sterile syringe and needle. Clinically patients were labeled as suffering from CA – UTI, if they fulfill one or more of the following criteria, such as; temperature > 38^0 C, urgency, supra pubic tenderness, pyuria (>10^5 CFU/ml of urine) in centrifuged urine and isolation of not more than two organisms on culture(catheter tip culture, Rush University Medical Centre, Chicago). Urine from the suspectedpatient was cultured on blood agar and MacConkey's agar and incubated for 24 – 48 hours. The microorganisms thus isolated were identified by conventional methods (Collee et al., 2008).

Device - associated infection (DAI rate) was calculated by following formula:

Number of DAI/1000 device days = Number of persons developing DAI x 1000/ Total number of device days (HAI programme). Device days are calculated by total number of days a device is in place for each patient (Eggleman et al., 2001; Bose et al., 2014).

Antibiotic – sensitivity of all the isolates were done using modified Kirby – Bauer disk diffusion method. Antibiotic disks used for this study were following –ampicillin (10μg), ceftazidime (10 μg), Amikacin (30 μg), Netilmycin (30 μg), ciprofloxacin (5μg), ticarcillin (75 μg), cefepime (30 μg), piperacillin/tazobactam (100/10μg), Imipenem (10μg), aztreonam (30 μg), colistin (10 μg), polymyxin B (50 μg), nitrofurantoin (300 μg), vancomycin (30 μg),cefoxitin (30 μg)and tigecycline (15 μg). Antibiotic sensitivity test was performed by following clinical and laboratory standard institute (CLSI) guidelines (CLSI guideline., 2013).

MIC (minimum inhibitory concentration) of Imipenem was also detected in Imipenem - resistant isolates using E strip. All antibiotic disks were obtained from Hi - media private Limited, India and the E strips for MIC detection was obtained from AB BioMerieux.

Results and Discussion

Total 350 urine samples from catheterized patients were processed within a period of six month in the microbiology department. Out of 350 urine samples, 21 were culture positive.

Out of 350 patients, 21(6%) were culture positive and diagnosed as CA – UTI cases. Infection rate per 1000 device day was 13.8.

The commonest organism isolated from urine of CA – UTI patients were *E. coli*, 6 (28.7%), followed by *P. aeruginosa*, 4 (19.04%), *K. pneumoniae*, 3 (14.28%) and *S.aureus, CONS, Enterococcus* and *Acinetobacter spp*, 2 (9.52%) each.

All isolates were resistant to ampicillin. Tigecycline and nitrofurantoin show high degree of susceptibility against all isolates. Colistin and polymyxin were used against *P. aeruginosa* and *A. baumannii* and found to

be very effective. Vancomycin was used only for gram-positive cocci. All *Staphylococci* were sensitive to vancomycin and one of the *Enterococci* was vancomycin resistant. All *Staphylococci* were methicillin sensitive as detected by cefoxitin disk ((CLSI guideline., 2013).

The ICU patients are usually in critical health conditions and can easily acquire HAI. This causes prolonged hospital stay, thereby imposing burden on both patients and the health care facilities. UTI is the second most common cause of HAI. Globally, the incidence of UTI in an ICU is more than 15%(Singh et al., 2010).In CA – UTI patient, the person is either currently catheterized or has been catheterized within the previous 48 hours. The most successful treatment of CA – UTI is removal of the catheter if possible and by restricting it's use only where it is clearly indicated. Urinary catheterization is the commonest predisposing factor for nosocomial UTI. Catheterization disturbs host defense mechanisms and creates easier access of uropathogens from urethral meatus to urinary bladder. It has been observed that causative uropathogens for UTI was present in the urethral meatus in 67% women and 29% men just prior to development of CA – bacteriuria.(Hootan TM et al, 2009)Microorganisms may reach the urinary tract by three possible ways, such as; during insertion of catheter, through coat of exudate surrounding the catheter and intraluminally from tube or collection bag. If there is breach in closed drainage system microbes that enter into drainage bag are soon travel into bladder. It has also been observed that uroepithelial cells from catheterized patients are more susceptible to binding of microorganisms. (Barford JMT et al, 2009).

Over the period of one year, we processed 350 urine samples from suspected cases of CA – UTI patients, admitted in a SICU. Outof which, 21(6%) were culture positive. Infection rate/1000 urinary device days were 13.8. Researchers from different region of India observed different rates of CA – UTI in their health care facilities. Datta et al., 2014 reported 10.75%, Singh et al.,2010;observed 0.23% and Prasanna et al.,2008 described 95% of CA – UTI incidences from different parts of India. Habibi et al., 2008;observed incidence of HAI/1000 urinary catheter dayto be 11.3. Greene et al, (2008) reported that 36% of cases of UTI were found in acute health-care setting. Xie DS et al (2011) isolated fungi (21.28%), followed by *E.coli* (17.02%) and *P.aeruginosa* (10.64%) from cases of UTI admitted in ICU.

In our study, maximum number of isolation was of *E. coli*, 6 (28.57%), followed by *P. aeruginosa, Klebsiella spp, S. aureus, CONS* and *Acinetobacter spp*. We found multi drug resistance among various hospital strains. One of the isolates of *A.baumannii* was resistant to Imipenem by Kirby Bauer disk diffusion method but was found to be susceptible for the same by MIC detection. Sinha et al., 2007;also reported similar observation. In our study, all isolates were resistant to ampicillin.

We found that, all non-fermentinggram-negative bacilli were 100% susceptible against colistin, polymyxin B and tigecycline. While using colistin and polymyxin B, one has to be careful, because of side effects, such as, nephrotoxicity (27 – 58%). Tigecycline (Gar 936) is a new glycylcycline derivative of tetracycline, bacteriostatic in nature and effective against both gram- positive as well as gram-negative organisms. This can be used against multidrug resistant organisms (Levin et al., 2003; Pachon – Ibanez et al., 2004).

Table.1 Catheter associated UTI in SICU (n= 21)

No. of cases	No. of cases with UTI detected (culture positive)	Total No. of device days	Infection rate/1000 device days
350	21(6%)	1520	13.8

Table.2 Number and percentage of different isolates obtained from urine samples (n = 21)

Organisms	Number of isolates	Percentage
Escherichia coli	6	28.57
Pseudomonas aeruginosa (*P.aeruginosa*)	4	19.04
Klebsiella pneumoniae (*K. pneumoniae*)	3	14.28
Staphylococcus aureus (*S. aureus*)	2	9.52
Coagulase negative staphylococci (*CONS*)	2	9.52
Enterococcus spp	2	9.52
Acinetobacter spp	2	9.52

Table.3 Antibiotic sensitivity pattern of various clinical isolates from urine samples of CA – UTI cases

Antibiotics	*E.coli* (n=6)	*P.aeruginosa* (n=4)	*K. pneumoniae* (n=3)	*S.aureus* (n=2)	*CONS* (n=2)	*Enterococcus* (n=2)	*Acinetobacter* (n=2)
Ampicillin	0	0	0	0	0	0	0
Vancomycin	-	-	-	2 (100%)	1(50%)	1(50%)	-
Amikacin	5(83.3%)	3(75%)	2(66.66%)	2(100%)	1(50%)	1(50%)	1(50%)
Ceftazidime	2(33.33%)	2(50%)	0	1(50%)	1(50%)	1(50%)	0(50%)
Netilmycin	2(33.33%)	1(25%)	1(33.33%)	2(100%)	1(50%)	1(50%)	0(50%)
Ciprofloxacin	2(33.33%)	1(25%)	1(33.33%)	1(50%)	1(50%)	1(50%)	0(50%)
Ticarcillin	2(33.33%)	1(25%)	1(33.33%)	-	-	-	0
Piperacillin/ Tazobactam	3(50%)	2(50%)	1(33.33%)	-	-	-	0
Aztreonam	3(50%)	2(50%)	2(66.66%)	-	-	-	-
Imipenem	4(66.66%)	3(75%)	2(66.66%)	-	-	-	2(100%)
Polymyxin B	-	4(100%)	-	-	-	-	2(100%)
Colistin	-	4(100%)	-	-	-	-	2(100%)
Tigecycline	6(100%)	4(100%)	3(100%)	2(100%)	2(100%)	1(50%)	2(100%)
Cefoxitin	2(33.33%)	1(25%)	0	2(100%)	2(100%)	1(50%)	0
Nitrofurantoin	5(83.3%)	4(100%)	2(66.66%)	2(100%)	2(100%)	2(100%)	1(50%)

However, some researchers found tigecycline – resistant strains in their work (Neonakis et al., 2011). All our *S.aureus* and *CONS* were methicillin – sensitive and

vancomycin sensitive. One strain of *enterococcus spp* was vancomycin resistant. Methicillin resistance was detected using 30μg cefoxitin disk, as per CLSI guideline, 2013. Cefoxitin has been recently recommended by CLSI for detection of methicillin resistant *Staphylococci* and is more reliable than oxacillin, 1μg (CLSI guideline, 2013). During their research, Xie DS et al (2011) found that 88% *E.coli* and 100% of *P.aeruginosa* isolated from ICU patients' urine were resistant to ciprofloxacin. In their work *P. aeruginosa* also showed 100%(resistance to Amikacin ceftazidime and meropenem. According to some researchers, antibiotic treatment is controversial. Initially it reduces bacterial load in urine but there is always chances of development of resistant bacteria (Hootan TM et al, 2009).

In conclusion, the SICU patients are usually admitted with serious health conditions. They can easily acquire HAI because of their low immune status. This prolongs their hospital stay, thereby imposing burden on both patients and the hospitals resources. To prevent CA – UTI, simple measures, such as; proper hand washing should be followed meticulously. Health care associated workers should follow well-established guidelines on prevention of DAI. Use of antibiotic or antiseptic coated urinary catheters help to prevent CA – UTI (CDC. NHSN manual, 2009).

Acknowledgement

Authors are grateful to Pravara Institute of Medical Sciences (Deemed University) for it's valuable support.

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