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CAUTI IN GENERAL SURGERY WARDS – ANALYSIS OF INCIDENCE, PATHOGENS AND RISK FACTORS

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ABSTRACT **BACKGROUND-**Around 80% of hospital acquired urinary tract infections are catheter associated, most important pathogens being multidrug-resistant Enterobacteriacae. Important risk factors associated with CAUTI include prolonged catheterization, insertion of the catheter outside of the operating room, and inadequate professional training of the person inserting the catheter.

METHODOLOGY-With this background, present study was undertaken with the aim to know the prevalence of CAUTI in general surgery patients, bacterial pathogens and risk factors. Patients posted for planned surgery and catheterized were included. Diagnosis was based on clinical and laboratory criteria.

RESULTS & CONCLUSION- Incidence of CAUTI was 28.04% with preponderance of gram negative bacilli .90% of isolates were multi-drug resistant. Significant alterable risk factors observed include attempts >1, surgery duration, catheterization duration, duration of hospitalization, staff category doing catheterization. ***Therefore***, alterable risk factors should be taken care to reduce CAUTI.

KEYWORDS : Cauti, Pathogens, Risk Factors

INTRODUCTION:

Insertion of an indwelling urinary catheter is a common procedure within perioperative services. Many studies highlight the fact that urinary catheters are over utilized, and documentation surrounding catheterization is poor.[1,2,3] In fact, as many as 86 % of patients undergoing surgery have urinary catheters. In addition, 50 percent of these catheters remain in place for more than two days. [4]

Around 80% of hospital acquired urinary tract infections are catheter associated.

In addition, CAUTI comprise the largest institutional reservoir of nosocomial pathogens [5][6] [7] , the most important being multidrug-resistant Enterobacteriacae other than *Escherichia coli*, such as *Klebsiella, Enterobacter, Proteus,* and *Citrobacter*; *Pseudomonas aeruginosa; A. baummannii; Enterococci* and *Staphylococci* and *Candida spp*. [8] Catheter Associated Urinary tract infection (CAUTI) rarely progresses to bloodstream infection, however, overall, CAUTI is the second most common cause of nosocomial bloodstream infection because of the high frequency of this infection.[7,9]

Different risk factors associated with CAUTI include female sex, older age, prolonged catheterization, impaired immunity, diabetes, renal dysfunction, severity of illness, insertion of the catheter outside of the operating room, and inadequate professional training of the person who inserts the catheter.[10]

With this background the present study was undertaken in our hospital which is a tertiary care teaching hospital. The aim was to know the incidence of CAUTI in general surgery patients, the bacterial pathogens associated with it and their antibiotic susceptibility pattern. Further, the associated risk factors for acquisition of CAUTI were determined. This was done with the objective of devising our own CAUTI prevention program.

MATERIAL AND METHODS:

This prospective observational study was conducted in general surgery wards of 1400 bedded tertiary care teaching hospital over a period of one year. Study was approved by Institutional Ethics Committee. The results of culture and sensitivity were reported to the attending clinicians for subsequent management of patients.

Subjects included patients more than 18 years of age of both sexes from General Surgery wards who were posted for planned surgery and catheterized and did not have Urinary Tract Infection at the time of surgery. Pregnant women were excluded from study. The surveillance of CAUTI was done through specially designed Infection Surveillance Performa. Data with respect to demographic details, detailed history and laboratory reports were recorded according to the Performa.

Diagnosis of CAUTI was done on clinical and laboratory criteria.
Clinical criteria included : symptomatic urinary tract infection after placement of a urinary catheter till the 48 hours after catheter removal, along with at least one of the following symptoms with no other recognized cause: fever (>38°C),suprapubic tenderness, costovertebral angle pain or tenderness,dysuria, and urgency or frequency. In addition to the clinical criteria, diagnosis of CAUTI required laboratory confirmation with a positive urine culture of 10^5 CFU/mL with no more than two species of microorganisms.[11]

Initially two urine samples were collected, one before catheterization for base line urine culture, second after catheterization within 4 hours. Thereafter the patients were followed up and urine samples were collected every alternate day up to 48 hours after the removal of catheter.[12] Samples were processed as per standard protocol using semi quantitative culture technique. All positive cultures were identified following conventional methods.[13] Antibiotic susceptibility testing was carried out as per Clinical Laboratory Standards Institute (CLSI) guidelines using the Kirby–Bauer method. Reference strains of *E. coli* (ATCC 25922), *Staphylococcus aureus* (ATCC 25923) and *Peudomonas aeruginosa* (ATCC 27853), were used to ensure quality control throughout the study. Multi-drug resistance was defined as resistance to three or more of the antimicrobials tested. Data analysis was done by means of Microsoft Excel 2007 and SPSS version 17. Chi-Square and Fisher's exact test were applied to test whether differences between values are significant. p value < 0.05 was considered as statistically significant.

RESULTS:

The patients admitted in General Surgery wards for planned surgery were included in this study. Over a period of one year total 189 patients fulfilling the inclusion criteria were followed up and studied with respect to microbiological profile of CAUTI, antibiotic susceptibility and mechanisms of resistance and associated risk factors. Out of 189 cases studied, 53 developed CAUTI. Incidence of CAUTI was 28.04%. The age and gender distribution of the CAUTI for the different age groups showed a higher number of infections in the age group 36-45 (33.96%) and 56-65 (26.42%) years. The gender distribution showed higher number of infection in females (64.15%) than in males (35.85%).

The total number of microorganisms which was isolated from the 53 infections was 55, as more than one organism was isolated from two samples. Of these, 49 were bacterial isolates with preponderance of gram negative bacilli (81.63%) & six (10.91%) were fungi(fig.1) . Commonest isolates were *E.coli* (22) and *K.pneumonae* (11)as shown in fig 2.

FIGURE NO.1: DISTRIBUTION OF BACTERIAL AND FUNGAL ISOLATES

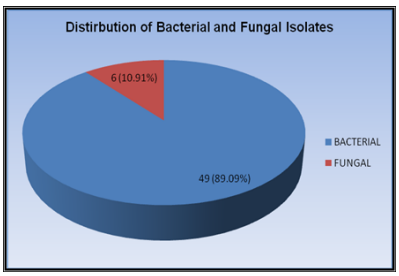
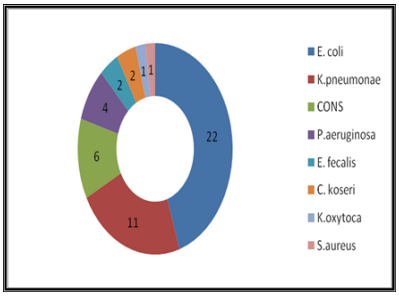


FIGURE NO.2: DISTRIBUTION OF BACTERIAL ISOLATES



With *E.coli* and *K. pneumoniae* more than 90% resistance to Ciprofloxacin, Ampicillin, and Ofloxacin was observed. 72.73% *E.coli* , 81.82% *K.pneumonae* & 75% of *P.aeruginosa* were found to be Extended Spectrum Beta Lactamase (ESBL) producers. All isolates of *E.coli* were resistant to ciprofloxacin, ampicillin, and ofloxacin and all isolates of *K. pneumoniae* were resistant to ampicillin and cotrimoxazole. All isolates of CONS (*coagulase negative staphylococci*) were resistant to penicillin and ciprofloxacin while 50% were methicillin resistant. None of them was resistant to vancomycin, linezolid and teicoplanin.Thus multidrug resistance i.e. resistance to three or more than three antibiotics was observed in more than 90% of bacterial isolates.

TABLE:DISTRIBUTION OF RISK FACTORS IN CATHET ERIZED PATIENTS

Risk factor		CAUTI Present (n=53)	CAUTI Absent (n=136)	*p* Value
Age		52.26 ± 12. 77	41.18 ± 11.61	**<0.001**
Female Gender		34	93	0.580
Diabetes Mellitus		2	3	0.621
Hypertension		2	4	0.674
Benign enlargement of Prostate		1	0	-
Low Hemoglobin		34	74	0.224
High Creatinine		5	0	-
Place of catheterization	OT	50	132	0.403
	Ward	3	4	
Catheterized by	Intern	17	5	**<0.001**
	Resident	36	131	
Type of Antiseptic	Iodine compound	17	18	0.0113
	Cetavalon	36	108	
Attempts of catheterization>1		10	4	**<0.001**
Duration of surgery(Min.)	Mean	107.23	66.29	**<0.001**
	SD	20.26	15.12	
Duration of catheterization (Hrs.)	Mean	128.43	55.3	**<0.001**
	SD	37.49	24.11	
Duration of hospitalization (Hrs.)	Mean	504	200.47	**<0.001**
	SD	323.98	125.93	

(Note: Cases with CAUTI= CAUTI Present, Cases without CAUTI= CAUTI Absent)

Qualitative Data has been described as counts and percentages and analyzed using Chi Square Test. Quantitative Data has been described using Mean ± SD and analyzed using t test.

P value for risk factors like age, attempts of catheterization >1, duration of surgery (min.), duration of catheterization (hrs.), duration of hospitalization (hrs.), catheterization done by, was <0.001. These risk factors were significant based on p value.

P value for risk factors like age, attempts of catheterization >1, duration of surgery inminutes, duration of catheterization in hours, duration of hospitalization in hours, staff category who did catheterization , was <0.001. These risk factors were found to be significant based on *p* value(see table). While other factors like, female gender and underlying low hemoglobin, high creatinine, diabetes mellitus, and hypertension were statistically non-significant. Catheterization outside operation theatre, type of antiseptic for urogenital care before catheterization, were also not found to be significant risk factors.

DISCUSSION:

High rates of device associated infections and antimicrobial resistance require strengthening infection control, instituting surveillance systems, and implementing evidence-based preventive strategies.[14]

Urinary catheter is the most commonly used device in the surgical patients. Since population under study and hospital setups for management vary considerably, not only the CAUTI rates differ but preventive strategies also. In view of this the present study was undertaken.

The incidence of catheter associated urinary tract infections in present study was 28.04%. Emori TG and Gaynes RP concluded that in teaching hospitals with beds<500 and with beds >500, the rate of nosocomial UTI was 32.0% and 31.5% respectively.[15]

As was observed in the present study one third of infections were in the age group of 36-45. A surveillance report by Talaat et al stated that patients above 40 years of age had a significantly higher risk of acquiring CAUTIs.[16]

Hussain et al indicated that females and elderly and debilitated patients were at a higher risk of acquiring infections.[17]The present study observations indicated the same with 64.15% infections occurring in females as against 35.85 % in males.

Common organisms associated with CAUTI differ according to type of healthcare facility. In surgical patients enterobacteriacae group of organisms being the commonest in contrast to ICU patients where *Pseudomonas aeruginosa* and *Acinetobacter species* predominate.[18] The present study revealed *E. coli* as the most common aetiological agent in CAUTI (40.00% prevalence), which was in accordance to that obtained by Kamat et al, Al-Sweih et al, Habte et al and Khan BA et al.[12,19,20,21]

Kamat et al from India observed *C. albicans* as 4th most common isolate accounting for 11% of infections. In present study, 10.91% infections had fungal aetiology and all were non-albicans Candida species.[12]

Risk factors associated with infection during catheterization are grouped into the alterable and unalterable factors. Alterable factors include indications for catheterization, length of catheterization, catheter care techniques and type of drainage system. Unalterable factors are usually host factors associated with an increased risk of infection during or after instrumentation and these include female sex, older age, severe underlying illness and meatal colonization.[22] Nevertheless development of CAUTI depends on whether the patient is catheterized by skilled and trained person or not.[23]

In the present study various risk factors were analyzed.

As can be seen in the Table - catheterization was done either by intern or resident doctors (Junior Resident & Senior Resident). Out of total, 167 patients were catheterized by resident and 22 by interns. Of 53 patients who developed CAUTI, 36i.e.57.92% were catheterized by resident doctors and 17i.e. 32.07% cases by interns. Among non CAUTI patients, 131 and 5 patients were catheterized by resident

doctors and interns respectively. Though number of catheterizations by interns is comparatively small and the total number of study subjects catheterized by residents is >7 times the subjects catheterized by interns,the difference was found to be statistically significant *(p<0.001)*. The exact reason for this could not be pointed out, according to us it may be that interns being in training phase followed all the aseptic precautions and other guidelines diligently.

There was no study in the reviewed literature stating that more the number of attempts of catheterization, more is the chance of CAUTI. However, it was hypothesized that more than one attempt might act as risk factor as this would lead to breach in mucosal continuity and thus predisposing to infection. So, we studied this factor and it was found to be statistically significant *(p<0.001)*.

Tang KK et al found that catheterization was significantly associated with surgery lasting longer than 90 min*(p< 0.001)*.[24] In the present study too, duration of surgery was found to be significant risk factor for development of CAUTI. Mean value for duration of surgery was 107.23 minutes with standard deviation 20.26 in cases with CAUTI. Mean value for duration of surgery was 66.29 minutes with standard deviation 15.12 in cases without CAUTI *(p<0.001, significant)*.

Maki DG et al concluded that the most important, potentially modifiable risk factor, identified in every study, is prolonged catheterization, beyond 6 days (RR 5.1-6.8); by the 30th day of catheterization, infection is near-universal.[8] Ksycki MF et al had observed that, catheterization for more than 2 days was a significant risk factor for urinary tract infection (9.4% versus 4.5%; P=0.004).[25]

In present study, for 189 patients, total days of catheterization were 578 and average days of catheterization were 3.06 days. For 53 CAUTI cases, average days of catheterization were 5.25 days and total days of catheterization were 278. For 136 cases without CAUTI, average days of catheterization were 2.20 days and total days of catheterization were 300. Hence extra average days of catheterization in CAUTI cases was 3.05 days *(p<0.001, significant)*.

In contrast to other studies[11] place of catheterization outside operation theatre, low hemoglobin, high creatinine, diabetes mellitus, and hypertension were not found to be significant risk factors in the present study. This may be because study population had very few patients i. e. around 2-5% in each of these categories.

This study documents that incidence of CAUTI in patients from general surgery wards is 28.04% with *Escherichia coli* as the most common pathogen. The following risk factors were identified as being significantly associated with CAUTI: patient age, attempts of catheterization >1, duration of surgery, duration of catheterization, duration of hospitalization, and staff category who did catheterization. ***Thus to conclude***, the standard guidelines for insertion and care of urinary catheter must be followed diligently. The alterable risk factors should always be kept in mind while catheterizing a patient and form the basis of infection prevention strategy in catheterized patients. Multidrug resistant strains in such patients are common and hence antibiotic treatment should be revised after receiving antibiotic sensitivity report, if there is chance of prolongation of catheterization. Above all, reviewing urinary catheter necessity daily and early removal of catheter is of utmost importance in reducing CAUTI

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