

Epidemiological study of catheter associated urinary tract infection (CAUTI) in surgical patients in Gajra Raja Medical College, Gwalior, India

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Abstract:

Introduction: Urinary tract infection (UTI) is the commonest hospital-acquired infection, and number of cases of nosocomial UTI are associated with an indwelling urinary catheter. ¹⁻² we did this study in our tertiary care setup that includes most of the rural population, where to know its incidence, and its implication on patient care.

Methods: A prospective study conducted among 204 patients with minimum hospital stay of 48 h, from the randomly sampled surgery wards. Urine culture sensitivity was tested using the Kirby-Bauer disc diffusion method.

Results: The overall CAUTI incidence was 13.14/ 1000 catheter days, comparatively higher in female than male. The factors significantly associated with CAUTI included: the duration of catheterization and extremes of age. *E. coli*, *Klebsiella*, *Citrobacter* and *Acenatobacter* accounted over 90% of the isolates. Here only 20% cases isolates polymicrobial flora and remaining reserved for single organism flora, out of them 80% of the isolates were sensitive to amikacin, while more than 70% sensitive to ciprofloxacin, nitrofurantoin, norfloxacin and ceftazidime.

Conclusions: Our setup is having a high incidence of CAUTI, most common in extremes of age, caused by a single organism in early catheter days. It is predisposed by - long duration of catheterization and female sex. Where, *E. coli* is the commonest organism isolated and sensitive to amikacin ciprofloxacin, nitrofurantoin, norfloxacin

Key-words: CAUTI, catheter associated urinary tract infection, hospital acquired urinary tract infections, UTI

I. Introduction:

Urinary tract infection (UTI) is the commonest hospital-acquired infection, and number of cases of nosocomial UTI are associated with an indwelling urinary catheter called catheter associated urinary tract infection (CAUTI). ¹⁻² we did this study in our tertiary care setup, which includes most of the rural population, where to know its incidence, and its implication on patient care. A study of 1,540 nursing-home residents determined that the risk of hospitalization, length of hospitalization, and length of antibiotic therapy were three times higher in catheterized residents than in non-catheterized residents. ³

II. Methods:

This was a prospective study conducted among 204 patients with minimum hospital stay of 48 h, from the randomly sampled surgery wards, undertaken at a tertiary care referral hospital Gajra Raja Medical College and J.A. Group of Hospitals in Gwalior during September 2011 to September 2012, a period of one year, including Any patient having an indwelling catheter <48 hours of duration, Patient 15 or more years of age. Excluding Patients with condom catheters, Patients with suprapubic catheters, Patients with percutaneous nephrostomy tubes and already catheterized patients outside our hospital.

Urine examination for pus cells was performed on the day of catheterization, and on every alternate day thereafter.

Demonstration of pyuria, i.e., 10 or more pus cells per cubic milliliter of urine in spun sample and 3 or more pus cells in unspun urine was considered sufficient for the diagnosis of urinary tract infections (UTI).

Urine culture-sensitivity was done for those with pyuria for identification of the causative organism and its antimicrobial sensitivity using the Kirby-Bauer disc diffusion method.

UTI was diagnosed as per the CDC definition as follows- Presence of at least two of the following with no other recognized cause like Fever, Urgency of urination, Dysuria and Suprapubic tenderness with at least one of the following: pyuria or positive urine culture. All the data collected by filling proforma, a master chart was prepared. And results tabulated and compared with previous studies by statistical analysis.

III. Results:

CAUTI Incidence = No. Of CAUTI patients / No. Of catheter days x1000
 = 25 / 1903 x 1000 = 13.14
 Result = 13.14 CAUTI/ 1000 catheter days.

IV. Discussion:

This study was conducted in Department of Surgery, G.R Medical College Gwalior, from September 2011 to September 2012, to see the effect of urinary catheterization and UTI related to it (CAUTI) with mean follow-up of three months.

Incidence:

Comparison of incidences in different studies

	Our study	Study A by (Col Shivinder Singh et al 2009) India	Study B by (Duo-Shuang Xie et al 2007) China	Study C by (Reinaldo Salomao et al 2003-2006) Brazil	Study D by (Victor D.Rosenthal) INICC 1998	Study E by (Wilde M et al.) NY
Incidence/ 1000 catheter days	13.14	9	15.8	9.6	8.2	8.4

Our study included 204 patients with total 1903 catheter days, and CAUTI incidence was 13.14/ 1000 catheter days.

This study showed 13.14 CAUTI/1000 catheter days, that has close accordance with a study by Duo-Shuang-Xie et al (2007)⁴ in China, in which 425 patients and 2632 catheter days resulted CAUTI incidence of 15.8/1000 catheter days.

Another study conducted at a Brazilian hospital between 2003 and 2006 results showed CAUTI rate of 9.6 / 1000 catheter days that co-relates to our study.⁵

Another study by Col Shivinder Shing et al (India)⁶ on 204 patients had CAUTI incidence of 9 /1000 catheter days.

In yet another study conducted by Victor D. Rosenthal et al⁷ under INICC (International Nosocomial infection control consortium) in 98 ICU settings in 18 limited resource countries over four continents for 10 years found CAUTI incidence 8.2 to 6.9 CAUTI /1000 catheter days.

In a study conducted by Wilde M. et al⁸ in New York, they found 8.4 CAUTI/1000 catheter days. Again, this study is showing a lower incidence than our study.

Our study has a slightly higher incidence of CAUTI probably because of

- Poverty in Indian continent,
- Lack of facilities,
- Poor catheter hygiene,
- Prolong hospital stay
- Overcrowding
- Inadequate knowledge about diseases

Sex incidence of CAUTI in various studies:

Our study has shown higher incidence in female (14/99) 14.14% compared to male 11 (105) 10.48% and is in close accordance with a study by Mesh. S. Kamet et al, Goa in July-Dec, 2005.⁹

Another study by Sowing et al,¹⁰ Bangkok (2002-03) on 101 patients also showed higher incidence of CAUTI in female patients compared to male.

All above observations depicted higher vulnerability of catheterized females for CAUTI, which can be attributed to shorter length of a female urethra, its proximity to the anal canal and absence of prostatic secretion in females.

Incidence of CAUTI with duration of catheterization:

We have seen closed co-relation between duration of catheterization and increased incidence of CAUTI. In our study, we found CAUTI incidence of 6.54% with more than 8 catheter days, 75% incidence with 15-21 catheter days almost 100% with >22 catheter days.

These results are in close accordance with a study by Umesh S. Kamat⁹ in 2005, (Goa) on 498 patients, in which they observed 68.2% CAUTI incidence in 8-14 catheter days, and 88.9% CAUTI in more than 14 catheter days.

Thus, it can be concluded that the duration of catheterization is proportionated with the incidence of CAUTI.

Age incidence

Our study showed the variable age distribution of CAUTI, which was 17.24% in patients of age group of 16-30 years (maximum) and 13.04% patients in more than 60 yrs of age.

A study by Col Shivinder Singh et al⁶ in ICU settings of India showed 22.2% nosocomial infection rate in 16-29 age groups, which are in close accordance with our study.

Another study by Umesh S. Kamat⁹ at Goa on 498 patients from July to Dec., 2005 showed higher incidence of CAUTI with the advancing age group with 50% CAUTI in 36-45 age group, 38.5% in 46-55 age group, 57.1% in 56-65 age group and 50% in 66-75 age group.

Incidence of isolated uropathogen in CAUTI:

Our study isolated E.coli (44%) as the most common uropathogen followed by Klebsiella (36%). Our results were in close accordance with a study by Umesh S. Kamat et al⁹ in Goa who isolated 49% E.coli and 12.72% Klebsiella.

A study by Promodini Subramaniam et al¹⁴ found that E.coli was the most frequently isolated pathogen (70%) followed by Klebsiella spp (16%) Pseudomonasaeruginosa (4%), Acinetobacter (2%), coagulase-negative Staphylococci (6%) and Enterococci (2%) similarly a study by Hassin showed⁽¹⁶⁾ E.coli (74%) as the predominant organism followed by Klebsiella spp (17.7%) & Pseudomonas (2.5%).

Ronald (2003) in his study found that *E. coli* remains the predominant uropathogen (80%) in community-acquired infections followed by *S. saprophyticus* (10-15%), Klebsiella, Enterobacter and Proteus.¹⁵ Therefore, we can conclude that E.coli is the most common organism, which causes CAUTI.

Incidence of number of isolated organisms in CAUTI:

Our study showed infection with single organism was 80% compared to only 20% with multiple organisms. These results are in accordance with study by Somwang et al¹⁰ 2002-03 where 38.6% cases were single organism infection and 34% cases were multiple organism infection.

Multiple organism infection was mostly by nosocomial organism due to cross infection. Therefore, we can say that mostly CAUTI is caused by single organism.

Incidence of antibiotic sensitivity to isolates in CAUTI:

In our study we find out that More than 80% of the isolates were sensitive to Amikacin, while more than 70% were sensitive to Ciprofloxacin, Nitrofurantoin, Norfloxacin and Ceftazidime. E. coli showed high sensitivity to Amikacin 85.71%, Nitrofurantoin 78.57% and Ceftazidime 71.42% with good susceptibility to Fluoroquinolones Norfloxacin. The Klebsiella showed the highest sensitivity to Amikacin and Nitrofurantoin. Therefore, less than 70% of the isolates were sensitive to Gentamicin, Amoxclav and Co-trimoxazole.

Our study showed accordance with Shalini et al¹¹ Rohilkhand Medical College & Hospital, Bareilly, U.P, INDIA, 2009 where more than 80% of isolates sensitive to Amikacin (87.41) and Nitrofurantoin (81.12) while more than 70% for ciprofloxacin (71.42%), Norfloxacin (71.43) and Ceftazidime (71.42).

In Study by Kyoung ho ryu et al¹² seoul korea, Department of Urology, Seoul Veterans Hospital, Seoul, Korea 2011, where isolates 86% sensitive to Amikacin, 50% to ciprofloxacin and 64.4% to Ceftazidime.

In Study by Jaipal puryani et al, 2011¹³ showed isolates 90.83% sensitive to Amikacin, 72.6% to Ciprofloxacin and 77.5% to Ceftazidime.

Our study showed that maximum patients of CAUTI (64%) had developed bacteriuria within 14 days of catheterization, and all patients (100%) developed bacteriuria by 21 days of catheterization, These results are in accordance with study by Somwang et al (2002-03)¹⁰ where 66% catheterized patients developed CAUTI in 14 days.

V. Conclusions:

The paper, while identifying that Our setup is having a higher incidence of CAUTI, more common in extremes of age, and most commonly caused by a single organism in early catheter days. It is predisposed by - long duration of catheterization and female sex. Where, E. coli is the most common organism causing CAUTI in females while Klebsiella in males. Here more than 80% of the isolates were sensitive to Amikacin, while more than 70% were sensitive to Ciprofloxacin, Nitrofurantoin, Norfloxacin and Ceftazidime.

References

- [1]. Abraham S., Shin J., and Malaviya R.Type 1 fimbriated Escherichia coli- mast cell interactions in cystitis. J. Infect. Dis. 2001; 183(Suppl. 1):S51-S55. (PubMed)
- [2]. Allison C., L. Emody, N. Coleman, and C. Hughes. The role of swarm cell differentiation and multicellular migration in the uropathogenicity of Proteus mirabilis. J. Infect. Dis. 1994; 169:1155-1158. (PubMed)
- [3]. Kunin C. M., S. Douthitt, J. Dancing, J. Anderson, and M. Moeschberger. The association between the use of urinary catheters and morbidity and mortality among elderly patients in nursing homes. Am. J. Epidemiol. 1992; 135:291-301. (PubMed)
- [4]. Duo-shuang Xie, Rui-ping Lai, Shao-fa Nie. Surveys of catheter-associated urinary tract infection in a university hospital intensive care unit in Chin. Braz J Infect Dis. 2011; 15(3):296-297©Elsevier Editora Ltda
- [5]. Salomao R, Rosenthal V.D., Grimberg G, Nouer S, Blecher S, Buchner-Ferreira S, et al. Device-associated infection rates in intensive care units of Brazilian hospitals.Findings of the International Nosocomial Infection Control Consortium. Rev Panam Salud Publica. 2008; 24(3):195–202.
- [6]. Col Shivinder Singh, Air Cmde R., Brig SM Garg, Col Rashmi Datta, Maj Ambikesh Kumar. Incidence of Healthcare associated infection in the surgical intensive care unit of a tertiary service hospital. Medical Journal Armed Forces India 2012; 1-3.
- [7]. Victor D. Rosenthal. Device-associated nosocomial infections in limited resources countries. Findings of the International Nosocomial Infection Control Consortium (INICC). Am J Infect Control. 2008; 36:S171.e7-S171.e12.
- [8]. Wilde MH, Brasch J, Getliffe K, Brown KA, McMahon JM, Smith JA et al.Study on the use of long-term urinary catheters in community-dwelling individuals. J Wound Ostomy Continence Nurs. 2010 May-Jun; 37(3):301-10.
- [9]. Umesh S.Kamat, Agnelo Fereirra, Dilip Amonkar, Dilip D. Motghare, Manoj S. Kulkarni. Epidemiology of hospital acquired urinary tract infection in a medical hospital in Goa. Indian J Urol 2009 Jan-Mar; 25(1):76-80.
- [10]. Somwang Danchaivijitr, Chertsak Dhirpura, Rachada Cherdrungsi, Dhuangporn, Nitaya Srihapol. Catheter associated Urinary Tract Infection. J Med Assoc Thai 2005; 88(suppl 10):S26-30.
- [11]. Shalini Joshi MC, Rashid MK, Joshi HS, Study of Antibiotic Sensitivity Pattern in Urinary Tract Infection at a Tertiary Hospital. NJIRM 2011; 2(3): (43-46).
- [12]. Kyoung Ho Ryu, Yun Beom Kim, Seung Ok Yang, Jeong Kee Lee, Tae Young Jung, Department of Urology, Seoul Veterans Hospital, Seoul, Korea. Korean J Urol 2011; 52:345-349.
- [13]. Jai Pal Paryani, Shafique-ur-Rehman Memon, Zakir Hussain Rajpar, Syed Azhar Shah. Pattern and Sensitivity of Microorganisms Causing Urinary Tract Infection at Teaching Hospital. JLUMHS MAY-AUGUST 2012; Vol 11: No. 02.
- [14]. Niveditha S, Pramodhini S, Umadevi S, Shailesh K, Selvaraj Stephen. The Isolation and the Biofilm Formation of Uropathogens in the Patients with Catheter Associated Urinary Tract Infections (UTIs). J Clin Diagn Res. Nov 2012; 6(9): 1478–1482.
- [15]. Ronald A. the etiology of urinary tract infection: traditional and emerging pathogens. Dis Mon2003; 49: 71-82.
- [16]. Hassin SKR. Studies on urinary tract infections. Bangladesh Medical Journal. 1991; 20:29–32.

Tables:

Table No. 1 showing Incidence of CAUTI

Patient	No.	CAUTI	Percentage (%)	No. Of organism isolated	
				Single organism	Multipleorganism
Male	105	11	10.48	11	0
Female	99	14	14.14	9	5
Total	204	25	12.24	20 (80%)	5 (20%)

Factor affecting CAUTI:-

Table No. 2 Showing duration of catheterization

Catheter days	No.	CAUTI	Male	Female	Percentage (%)
1-7 Days	76	2	1	1	2.63
8-14 Days	106	6	5	1	5.66
15-21 Days	19	14	5	9	73.68
22-28 Days	1	1	0	1	100
>28 Days	2	2	0	2	100
Total	204	25	11	14	

Table No. 3 Showing age distribution in CAUTI patient

Age	No. of patients			CAUTI patients			Percentage (%)
	Male	Female	Total	Male	Female	Total	
15-30 yrs.	44	43	87	8	7	15	17.24
31-45yrs	26	30	56	0	4	4	7.14
46-60 yrs.	16	22	38	1	2	3	7.89
>60 yrs.	19	4	23	2	1	3	13.04
Total	105	99	204	11	14	25	

Table No. 4 Showing uro-pathogens Isolated in urine culture of CAUTI patients

Pathogen	No. of CAUTI (n-25)			Percentage (%)
	Male	Female	Total	
E.coli	0	11	11	44
Klebsiella	9	0	9	36
Acinetobactor	1	1	2	8
Citrobactor	0	2	2	8
Others	1	0	1	4
Total	11	14	25	100

Table no. 5 showing incidence of antibiotic sensitivity for isolated organism

Antibiotic	Our study (%)	Shalini et al 2009	Kyoung ho ryu et al seol korea, 2011	Jaipal puryani et al, 2011
Amikacin	85.71	87.41	86	90.83
Nitrofurantoin	78.57	81.12		23.8
Ciprofloxacin	71.42	73.43	50	72.6
Norfloxacin	71.43	72.73		
Ceftazidime	71.42	73.43	64.4	73
Gentamicin	64.28	63.63	50.5	77.5
Amoxiclav	35.71	35.66	45.7	
Co-trimoxazole	21.42	18.18	54.2	47.2