STUDY OF CATHETER ASSOCIATED URINARY TRACT INFECTION IN A TERTIARY HOSPITAL

General Medicine

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ABSTRACT

Introduction-Indwelling urethral catheters act as a source of infection leading to catheter associated urinary tract infections (CAUTI), increasing the morbidity, mortality and hospitalization of the patient.

Methodology-We studied the incidence, risk factors, microbiological and antibiotic sensitivity profile of CAUTI. Urinary samples were collected aseptically and were labelled CAUTI using CDC guidelines.

Results- The incidence of CAUTI among study subjects was 31.5%. Duration of catheterization, diabetes mellitus, renal failure and disconnection of catheter tubing were observed to be significantly associated with development of CAUTI. Escherichia coli was found to be the most common microorganism and Tigecycline was found to be most effective against all microorganisms.

Conclusion- Catheterization should be done only if necessary.

KEYWORDS

Cauti,Incidence,Risk factors,Antibiotics

INTRODUCTION

Urethral catheterization is indicated in cases of urinary retention and incontinence, for measurement of urine output and in pelvic surgeries. Bacterias from the urethra get a chance to travel through the area between the mucosa of urethra and the external surface of the catheter introducing infection in the bladder when catheter is placed.[1] The prevalance of bacteriuria increases by 3–10% daily.[2] Catheter associated urinary tract infection(CAUTI) can lead to development of cystitis, prostatitis, pyelonephritis and epididymo-orchitis. It increases the morbidity and mortality by 2.8 fold and duration of hospitalization by 1-3days.[3]

Short term catheterization means duration of catheterisation is less then 30 days while long term catheterization means duration is more than 30 days. Escherichia coli is the most frequent bacteria responsible for CAUTI. However other organisms may be coagulase negative staphylococci, Pseudomonas aeruginosa, Enterococci, Proteus mirabilis. Providencia stuartii is many times isolated with long term catheterization. Biofilm is produced by urease producing organism and cause catheter blockage.[4,5,6]

METHOD

This study was an observational study done in our tertiary hospital in first 200 patients above 18 years of age in medical ICU and wards who had an indwelling catheter after taking ethics committee approval and informed consent of patient. "CAUTI was defined as a urinary tract infection where an indwelling urinary catheter (IUC) was in place for >2 calendar days on the date of event, with day of device placement being day 1 and an indwelling urinary catheter was in place on the date of event or the day before. If an indwelling urinary catheter was in place for > 2 calendar days and then removed, the date of event for the UTI(urinary tract infection) must be the day of discontinuation or the next day for the UTI to be catheter-associated".[7] Indwelling catheter is a drainage tube that is inserted into the urinary bladder through the urethra, is left in place, and is connected to a drainage bag.[7] Pregnant females, patients already having UTI and those who have undergone urological intervention such as Trans urethral resection of prostate were excluded from the study.

Incidence of development of CAUTI out of these 200 patients who were catheterised were studied. Detailed history was taken of all the patients about their clinical features, risk factors of CAUTI such as age, gender, duration of catheterization, presence or absence of diabetes mellitus, renal failure, immunocompromised state, history of taking steroids or any other immunosuppressive drugs, neurological diseases, disconnection of catheter tubing, etc. Patients who had symptoms and signs of UTI like fever with chills, suprapubic pain or tenderness, increased frequency of micturition, dysuria, urgency, blocked catheter or cloudy urine, their urine sample was sent for routine and microscopic examination as well as for culture and sensitivity. If urine routine showed pus cells and urine culture showed colonies of not more than two species of organisms, at least one of which had bacterium of greater than or equal to 10^5CFU/ml, were considered to have CAUTI.

Antibiotic sensitivity was determined by diffusion test and antibiotics were started accordingly. For culture, urine was inoculated in various suitable culture media like blood agar, McConkey agar using calibrated loop streak method. Non-bacteriological organisms such as candida species, yeast, mould, dimorphic fungi or parasites were excluded from our study.

RESULTS

The incidence of CAUTI among study subjects was 31.5%.(63/200).Mean age of study subjects who were catheterised was 53.21 years with almost half of them belonging to 41to 60 years of age. (Table 1)

Table 1-Incidence of catheter associated UTI

CAUTI	N	%
Yes	63	31.5%
No	137	68.5%
Total	200	100.0%

Table 2. Association of CAUTI with Risk factors

Variables	CAUTI		Total	p- value
	Yes (n-63)	No (n-137)		
Male	33 (25.8%)	95 (74.2%)	128	<0.05
Female	30 (41.7%)	42 (58.3%)	72	
Mean Age (SD)	52.34+/- 7.68	42.78+/-9.19		<0.01
Duration of Catheterization (> 7 days)	38 (45.8%)	45 (54.2%)	83	<0.01

On individual risk factors assessment significant association was observed for female gender and duration of catheterization (p<0.05)

Table 3. Association of risk factors with incidence of CAUTI

Risk Factors	CAUTI			p- value
	Yes	No		
Diabetes Mellitus	33	32	65	<0.01
	50.76%	49.24%	100.0%	
Neurological Problems	8	12	20	0.45
	40%	60%	100.0%	
Immunocompromised Condition	10	5	15	<0.01
	66.67%	33.33%	100.0%	
Catheter Tubing Disconnected	33	16	49	<0.01
	67.34%	32.66%	100.0%	
Renal Failure	11	2	13	<0.01
	84.61%	15.39%	100.0%	

Diabetes mellitus, Renal Failure, Immunocompromised conditions and disconnection of catheter tubing were significantly associated with development of CAUTI (p<0.05).

Table 4 -Regression analysis for evaluation of risk factors of CAUTI

Logistic Regression: CAUTI (Yes - 1, No - 0)								
Variables	B	S.E.	Wald	d f	p- value	Odds Ratio	95% C.I.for EXP(B)	
							Lower	Upper
Gender (Female)	0.085	0.011	61.06	1	0.07	1.069	0.98	1.112
Age (years)	0.053	0.028	3.741	1	0.53	1.05	0.79	1.113
Catheterization (days)	0.017	0.003	26.325	1	<0.01	1.983	1.17	5.23
Diabetes Mellitus (Yes)	0.964	0.286	11.385	1	<0.01	2.622	1.498	4.591
Immunocompromised Condition (Yes)	0.162	0.296	0.3	1	0.58	1.176	0.659	2.099
Catheter Tubing Disconnected (Yes)	0.467	0.231	9.81	1	0.03	1.34	1.09	3.99
Renal Failure (Yes)	0.873	0.241	10.07	1	<0.01	2.22	1.29	4.14

B-Regression coefficient ; S.E- Standard error ; Wald- Wald test ; d f – Degree of freedom ; C.I- confidence interval

On regression analysis duration of catheterization, diabetes mellitus, renal failure and disconnection of catheter tubing were observed to be significantly associated with development of CAUTI (p<0.05). (Table 4)

In our study 61.90% of cases had fever, 60.31% had suprapubic pain and 30.15% of patients presented with urgency. Dysuria was present in 20.63% while mental confusion was present in 15.87% of study cases(multiple response present).

Table 5- Distribution of uropathogens isolated in cases of CAUTI

Uropathogens (n-74)*	N	%
E.coli	41	65.07%
Klebsiella	12	19.04%
Pseudomonas	10	15.87%
Proteus	6	09.52%
Enterococci	5	07.93%

*11 out of 74 cases had more than 2 organisms isolated from the culture

Table 6- Antibiotic sensitivity pattern of isolated Organisms

Organism Isolated	Sensitivity Pattern								
	Piperacillin-tazobactam	Tigecycline	Ceftriaxone	Levofloxacin	Nitrofurantoin	Meropenem	Imipenem	Colistin	Cefoperazone-Sulbactum
E .Coli (n-41)	38	41	13	21	36	40	37	40	19
	92.7%	100.0%	31.7%	51.2%	87.8%	97.6%	90.2%	97.6%	46.3%
Klebsiella (n-12)	10	11	4	3	8	9	10	10	2
	83.3%	91.7%	33.3%	25.0%	66.7%	75.0%	83.3%	83.3%	16.7%
Pseudomonas (n-10)	8	9	2	3	5	6	7	9	2
	80.0%	90.0%	20.0%	30.0%	50.0%	60.0%	70.0%	90.0%	20.0%
Proteus (n-6)	5	6	2	1	3	3	5	6	2
	83.3%	100.0%	33.3%	16.7%	50.0%	50.0%	83.3%	100.0%	33.3%
Enterococci (n-5)	5	5	2	2	4	1	4	5	1
	100.0%	100.0%	40.0%	40.0%	80.0%	20.0%	80.0%	100.0%	20.0%

Most of the organisms showed sensitivity towards tigecycline followed by colistin and piperacillin and tazobactam combination. Maximum resistance was observed for cephalosporins and fluoroquinolones. (Table 6)

Table 7 - Most common Antibiotics active against the isolated organisms according to highest sensitivity.

Organisms	Most Sensitive Antibiotic			
	N	%	N	%
E.coli	Tigecycline	100.0%	Meropenem, Colistin	97.6%
Klebsiella	Tigecycline	91.7%	Imipenem, Colistin	83.3%
Pseudomonas	Tigecycline	90.0%	Colistin	90.0%
Proteus	Tigecycline	100.0%	Colistin	100.0%
Enterococci	Tigecycline	100.0%	Piperacillin+Tazobactam Colistin	100.0%

Tigecycline was the most effective antibiotic active against all organisms followed by meropenem, imipenem and colistin. (Table 7)

DISCUSSION

In our study we found 31.5% of catheterized patients developed CAUTI. Bagchi et al. in his study of 220 patients found the incidence to be 29% and S G Kulkarni et al. in his study of 204 patients found the incidence to be 21.47%.[8,9] However the incidence of CAUTI reported by Leelakrishna P et al. was 42.9% and Khan et al. was 59%.[3,10] Other studies reported the same to be 51.4% and 41%.[11,12] In our study we found a lower incidence of CAUTI due to strict infection control practices.

We found on regression analysis duration of catheterization, diabetes mellitus, renal failure and disconnection of catheter tubing to be significantly associated with development of CAUTI (p<0.05). However there was no significant association of gender, age, immunocompromised condition as p value >0.05, while in a prospective study done by Leelakrishna P. age was also one of the risk factors of CAUTI. In the present study, fever(62%) was most commonly observed clinical feature followed by suprapubic pain or tenderness(61%), mental confusion(15.87%), urgency(30%) and dysuria(20%) while Paul A in his study contrary to ours found that the majority of the patients (>90%) were asymptomatic.[13] Fever cannot be

attributed only to CAUTI as it can also be due to primary disease in our study. Moreover criteria of CAUTI now includes presence of clinical symptoms along with positive urine culture.

In our study, the most common isolated organism found in urine culture was Escherichia coli (65.07%) while Sangamithra et al. also in her study found the most common organism responsible for CAUTI as E. coli (36%).[14] There are many studies in the literature in which the most frequent organism for CAUTI is E. coli ranging from (30.5% to 47.36%).[9,15,16,17] The other common organisms responsible for CAUTI in our study were Klebsiella(19.04%), Pseudomonas(15.87%), Proteus (9.52%) and enterococci (7.93%) while S.G Kulkarni found the incidence of organism to be Klebsiella(19.2%), Pseudomonas (14.10%), Candida(8.70%), Streptococci(5.20%), Staphylococcus aureus (3.50%) and gram negative bacilli (1.75%).[9] Similarly Bagchi found Klebsiella(19.7%), Pseudomonas(12.12%), Candida(10.6%), Enterococcus(6.06%), CONS(6.06%), Staphylococcus aureus(4.55%), Citrobacter(3.03%) and Proteus(3.03%).[8]

In our study most of the organisms showed sensitivity towards tigecycline followed by colistin and piperacillin and tazobactam combination, while maximum resistance was observed for cephalosporins followed by fluoroquinolones and nitrofurantoin. The results were similar to various previous reports.[18,19] Hanumanth et al. also observed high resistance towards cephalosporins while highest sensitivity was observed towards for tigecycline, colistin and meropenem.[18]

From the data, it appears that CAUTI in this study is resistant to third generation cephalosporins like ceftriaxone and cefoperazone & sulbactam combination, to fluoroquinolones like levofloxacin and also to nitrofurantoin to a large extent. One of the reason can be easy availability of these drugs in the hospital and trend to use them as first line antibiotics for other infectious diseases in hospital as well as for empirical treatment of CAUTI till culture reports are awaited. We suggest that local anti-biogram should be made of every hospital and empirical antibiotic if absolutely needed should be given accordingly.

CONCLUSION

The incidence of CAUTI in our study was 31%.The common risk factors found were duration of catheterization, diabetes mellitus, renal failure and disconnection of catheter tubing.The common clinical features were fever, followed by suprapubic pain or tenderness, urgency, dysuria and mental confusion. The most frequent bacteria isolated was E.coli which was susceptible to tigecycline, meropenem, colistin and piperacillin-tazobactam while resistance was seen with cephalosporins and fluoroquinolones group of antibiotics. The other organisms isolated were Klebsiella(19.04%), Pseudomonas(15.87%), Proteus(9.52%) and Enterococci(7.93%). They all showed the same pattern of sensitivity and resistance.

We all physicians should try to avoid unnecessary catheterization and if at all it has to be done, precautions to minimize it should be taken. This will help to reduce the morbidity and mortality of the patients admitted with primary disease. This can be possible when strict infection control practices and policies are in place.

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