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INCIDENCE OF URINARY TRACT INFECTION IN CONDOM CATHETER VS INDWELLING CATHETER IN MALES

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Abstract

Background: UTIs are common complications in hospitalized patients requiring catheterisation, prompting a study to compare indwelling and condom catheters. This study aimed to evaluate the incidence of urinary tract infection in condom catheters versus indwelling catheters in males. **Materials and Methods:** This single-center, observational, prospective study included 80 male patients from Rajiv Gandhi Government General Hospital. Patients were divided into two groups and detailed medical histories were obtained, focusing on comorbidities. The vital signs were checked before catheterisation and urine samples were collected before and 48 hours after the procedure to evaluate UTI markers, including bacterial growth and pus cells, and patients were monitored daily. **Result:** Growth in patients with indwelling catheters was observed in eight (20%) and two (5%) patients with condom catheters, showing a significant difference ($p = 0.043$). The mean catheter duration was 7.5 ± 0.0707 days for condom catheter patients and 6.62 ± 3.335 days for indwelling catheter patients, with a significant difference ($p < 0.001$). For patients without a catheter, the mean catheterisation duration was 4.05 ± 0.957 days for condom catheter users and 3.97 ± 0.967 days for indwelling catheter users, also showing a significant difference ($p < 0.001$). Candida non-albicans were detected equally in both groups 2 (5%), with no significant difference ($p = 0.164$). The age distribution differed significantly between the catheter types ($p = 0.022$). **Conclusion:** The incidence of UTIs is high in patients under 30, suggesting condom catheters for catheterisation with early removal. Implementing a catheter care bundle may effectively reduce UTIs, with Candida, non-albicans, and E. coli as predominant organisms.

INTRODUCTION

UTIs are a troublesome complication in inpatients. Most patients are bedridden and require catheterisation. Catheterisation is performed with strict aseptic precautions; however, UTI is still a common complication. To overcome this complication, a comparative study between indwelling catheters and condom catheters was performed to assess the incidence of UTI. Catheter-related UTI is considered significant in hospital settings because most inpatients with high-grade fever are catheter-related. Since condom catheters can be used only in males this study included only the male population. There is no pain or discomfort in condom catheters in males which can also be administered very easily compared to that of indwelling catheters as it is noninvasive.[1]

Our study aimed to prevent UTI, a complication of inpatients who have been admitted for other medical problems that can be easily diagnosed by routine urine and urine c/s, which are cost-effective and readily available within a short period and have been used as diagnostic criteria in this study. One way to avoid UTIs in bedridden patients is to avoid catheterisation as much as possible. Catheterisation should be performed on those who need it. The inner surface of catheters may lodge the growth of bacteria in the biofilm, promote encrustation, and protect bacteria from antimicrobial agents.[2,3] Despite sterile procedures, the space between the external catheter and urethral mucosa allows direct bacterial entry into the bladder. Uroepithelial cells of catheterised patients may transiently allow a greater quantity of bacteria to adhere to their surfaces which may precede the onset of bacteriuria and UTI.[4]

As a foreign body, the catheter may blunt an adequate antibacterial polymorphonuclear leukocyte response. Sometimes, catheter drainage may be imperfect, and the volume of urine may remain in the bladder for a

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very long time. Before attempting to catheterise a patient, one should always post the following questions to himself whether the patient needs catheterisation, how long he should be catheterised, what is the earliest time for catheter removal, is there any other alternative for catheterisation. As some catheterized patients with UTI may not have features of UTI, such as fever, chills, or abdominal pain, the best and final diagnosis can be performed only by urine examination. Catheter-associated UTIs in short-term settings are caused by a single group of bacteria, whereas polymicrobes cause long-term catheterisation. Among these, E. coli is the most common cause of catheter-associated UTI.

Aim

This study aimed to evaluate the incidence of urinary tract infection in condom catheters versus indwelling catheters in males.

MATERIALS AND METHODS

This single-center observational prospective study included 80 male patients from Department of Internal Medicine, Rajiv Gandhi Government General Hospital. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients. Ethical code: 19012017

Inclusion criteria

Patients who were male, bedridden, with an altered sensorium, and with urinary incontinence were included.

Exclusion criteria

Female and male patients with obstructive uropathy, external genital infections, urinary retention, and external genital deformity were excluded.

Methods: Patients were divided into two groups; 40 patients were selected for condom catheterisation and the other 40 patients were selected for indwelling catheterisation based on randomization.

Patients' histories of comorbidities such as diabetes, hypertension, and renal failure were also elicited. A general examination was performed to ensure that the patients did not have any external genital infections or abnormalities. Vitals were evaluated to assess the general condition and stability of the patients. Systemic examination, which includes the cardiovascular, respiratory, abdominal, and central nervous systems, was performed. Before proceeding to the procedure, routine investigations were performed, including CBC, renal function test, liver function test, urine routine, urine c/s, blood c/s, USG abdomen and pelvis, and chest radiography.

In patients who are planning for indwelling catheterisation, the patients are undressed from the umbilicus level to the knee level, the preputial skin is retracted with strict aseptic and sterile precautions, and the tip of the catheter, which is coated with lignocaine gel, is introduced gently. Once the bulb reaches the bladder, it is inflated with saline, and the catheter is connected to the urine collection bag. Finally, the retracted preputial skin was rolled to its original position. In the case of a condom catheter, the same procedure is followed, but instead of an indwelling catheter, a condom catheter is inserted. The condom is worn over the glans penis, rolled over the shaft of the penis, and fixed to the body part. The sterile technique for handling the urinary bag was provided to the nurses and attenders.

After 48 h, a urine sample was withdrawn from the catheter tube by aspiration using a sterile syringe and sent for routine examination. Patients were monitored for signs and symptoms of UTI, urine colour was checked daily, and urine output was measured. The number of days that the patients needed a catheter and the time for catheter removal were monitored.

Patients should be subjected to ultrasonography of the abdomen and pelvis to rule out urinary retention. Urine samples were collected using a sterile needle and syringe from the rubber tube of the catheter. Handling of urinary bags should be performed with proper sterile techniques using sterile gloves.

Urine samples should be collected before catheterisation for routine examination and culture sensitivity. Another urine sample for routine examination and culture sensitivity testing was sent 48 hours after catheterisation. A significant number of pus cells and bacterial growth were carefully examined. The names of the bacteria and their sensitivities were also determined.

Statistical analysis

Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent-sample t-test. Categorical variables were compared using Pearson's chi-square test. Significance was defined as $p < 0.05$ using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

Most patients were 45 (56.2%) in the ≥ 50 years age group, followed by those 19 (23.8%) were aged 40–50 years, 10 (12.5%) aged 30 - 40 years, and those 6 (7.5%) were under 30 years of age. Comorbidities were absent in 50 (62.5%) patients, while 30 (37.5%) had comorbid conditions. Among the comorbidities, 21 (26.5%) had diabetes mellitus, 16 (20%) had hypertension, 5 (6.2%) had CKD, and 1 (1.2%) had schizophrenia.

Condom catheters were used in 40 (50%) patients, while indwelling catheters were used in 40 (50%). Ultrasound findings in 9 patients (11.2%) were CLD, 58 (72.5%) were NAD, and 13 (16.2%) were RPD. Fever was present in 1 (1.2%) patient, while fever was absent in 78 (98.8%) patients. In routine urine examinations, 70 (87.5%) patients had no pus cells, 6 (7.5%) had 6–8 pus cells, and 2 (2.5%) had 8–10 and 10–12 pus cells. Pus cells were absent in 70 (87.5%) patients, and only 10 (12.5%) were positive for pus cells.

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In urine cultures, no bacterial growth was observed in 70 (87.5%) patients, followed by E. coli in 3 (3.8%), Klebsiella in 2 (2.5%), Candida non-albicans in 4 (5.0%), and Acinetobacter in 1 (1.2%). The mean WBC count was 6416.25 ± 2154.033, serum urea was 35.02 ± 19.18, serum creatinine was 0.9466 ± 0.79814, and the number of days of catheterisation was 4.36 ± 1.632. [Table 1]

Growth was observed in 8 (20%) patients with indwelling catheters compared to 2 (5%) patients with condom catheters, with a significant difference (p = 0.043). Routine urine examination revealed that 38 (95%) patients with condom catheters and 32 (80%) patients with indwelling catheters showed no pus cells, and with 10-12 pus cells, condom catheters, and indwelling catheters were the same in 40 (100%) patients, indicating no significant infection (p = 0.159).

In the urine culture, 38 (95%) patients with condom catheters showed no growth, compared to 32 (80%) in the indwelling catheter group. E. coli was found only in patients with indwelling catheters 3 (7.5%), along with Klebsiella 2 (5%) and Acinetobacter 1 (2.5%). Candida non-albicans were detected equally in both groups 2 (5%), with no significant differences (p = 0.164). Fever was present in only 1 (2.5%) patient with indwelling catheters, while it was absent in those with condom catheters, with no significant difference (p = 0.314).

Ultrasound findings showed no abnormalities in patients with indwelling catheters 32 (80%) compared to those with condom catheters 26 (65%). Chronic liver disease was observed in 4 (10%) patients with condom catheters and 5 (12.5%) with indwelling catheters. The RPD was higher in patients with condom catheters 10 (25%) than in those with indwelling catheters 3 (7.5%), with no significant differences (p = 0.105). [Table 2]

The average age of patients with haemorrhagic stroke (52.21 ± 9.07) was lower than patients with ischemic stroke (65.34 ± 9.47), with no significant difference (p=0.571). The eGFR was significantly lower in patients with ischemic stroke (47.84 ± 16.38) than in those with haemorrhagic stroke (79.98 ± 23.43) (p<0.0001).

Urea levels at admission were significantly higher in ischemic stroke patients (46.66 ± 4.72) than in haemorrhagic stroke (40.55 ± 4.96); (p<0.0001). Similarly, urea levels after 48 hours showed a significant increase in ischemic stroke patients (64.24 ± 17.06) compared to those with haemorrhagic strokes (48.06 ± 13.21), (p< 0.0001).

The duration of catheterisation was significantly longer for those with condom catheters (4.22 ± 1.209) than for those with indwelling catheters (4.05 ± 1.974) (p = 0.455). WBC counts were significantly higher in patients with condom catheters (6607.5 ± 6225) than in those with indwelling catheters (2328.68 ± 19.836) (p = 0.431).

Serum urea levels were higher in patients with condom catheters (36.98 ± 33.08) than in those with indwelling catheters (19.836 ± 18.555). Similarly, serum creatinine levels were higher in the patients with condom catheters (1.0730 ± 0.8202) than in those with indwelling catheters (0.92414 ± 0.63531). There were no significant differences in the serum urea (p=0.367) and serum creatinine levels (p=0.158) between the catheters. [Table 3]

Regarding the ward, 5 (12.5%) patients with condom catheters and 35 (87.5%) patients with indwelling catheters were admitted to both the ICU and non-ICU, with no significant difference (p=1). Among patients with a catheter, the mean duration in condom catheter patients was (7.5 ± 0.0707), while for those with indwelling catheters (6.62 ± 3.335), with a significant difference (p < 0.001). Of the patients without a catheter, the mean catheterisation duration for the condom catheter patients was (4.05 ± 0.957) compared to the indwelling catheter (3.97 ± 0.967), with a significant difference (p < 0.001). [Table 4]

There was a significant difference in age distribution between the catheters (p = 0.022). There were no significant differences in comorbidities, hypertension, diabetes, CKD, schizophrenia, circumcision, and ward between catheters (p=0.383, p=0.398, p=0.291, p=0.6, p=0.704, p=0.748, p=0.798, respectively). [Table 5]

Table 1: Age, UTI incidence, and microbial profile in patients using condoms and indwelling catheters.

		Frequency (%)
Age group (in years)	< 30	6 (7.5%)
	30 - 40	10 (12.5%)
	40 - 50	19 (23.8%)
	≥ 50	45 (56.2%)
Co-morbidity	Present	30 (37.5%)
	Absent	50 (62.5%)
Type of co-morbidities	Hypertension	16 (20%)
	Diabetes mellitus	21 (26.5%)
	CKD	5 (6.2%)
	Schizophrenia	1 (1.2%)
Catheters	Condom	40 (50%)
	Indwelling	40 (50%)
USG KUB	CLD	9 (11.2%)
	NAD	58 (72.5%)
	RPD	13 (16.2%)
Fever	Present	1 (1.2%)
	Absent	79 (98.8%)

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Urine R/E (pus cell)	None	70 (87.5%)
	6-8	6 (7.5%)
	8-10	2 (2.5%)
	10-12	2 (2.5%)
Pus cells	Present	10 (12.5%)
	Absent	70 (87.5%)
Urine culture	No growth	70 (87.5%)
	E. coli	3 (3.8%)
	Klebsiella	2 (2.5%)
	Candida non- albicans	4 (5%)
	Acinetobacter	1 (1.2%)
Parameters (Mean±SD)	WBC count	6416.25 ± 2154.033
	Serum urea	35.02 ± 19.185
	Serum creatinine	0.9466 ± 0.79814
	Number of days catheterisation	4.36 ± 1.632

Table 2: Comparison of clinical outcomes between condom and indwelling urinary catheters

		Catheter		P- value
		Condom	Indwelling	
Growth	Present	2 (5%)	8 (20%)	0.043
	Absent	38 (95%)	32 (80%)	
Urine R/E (pus cell)	None	38 (95%)	32 (80%)	0.159
	6-8	2 (5%)	4 (10%)	
	8-10	0	2 (5%)	
	10-12	40 (100%)	40 (100%)	
Organism	No growth	38 (95%)	32 (80%)	0.164
	E. coli	0%	3 (7.5%)	
	Klebsiella	0%	2 (5%)	
	Candida non- albicans	2 (5%)	2 (5%)	
	Acinetobacter	0	1 (2.5%)	
Fever	Present	0	1 (2.5%)	0.314
	Absent	40 (100%)	39 (97.5%)	
USG	CLD	4 (10%)	5 (12.5%)	0.105
	NAD	26 (65%)	32 (80%)	
	RPD	10 (25%)	3 (7.5%)	

Table 3: Comparison between parameters and type of catheter

Parameters	Catheter		P- value
	Condom	Indwelling	
Number of days catheterisation	4.22±1.209	4.05±1.974	0.455
WBC Count	6607.5±6225	2328.68±19.836	0.431
Serum urea	36.98±33.08	19.836±18.555	0.367
Serum creatinine	1.0730±0.8202	0.92414±0.63531	0.158

Table 4: Comparison of catheterisation duration and ward between condom and indwelling catheters

		Catheter		P- value
		Condom	Indwelling	
Ward	ICU	5 (12.5%)	35 (87.5%)	1
	Non-ICU	5 (12.5%)	35 (87.5%)	
Number of days catheterisation (Mean ± SD)	Present	7.5±0.0707	6.62±3.335	<0.001
	Absent	4.05±0.957	3.97±0.967	<0.001

Table 5: Comparison of age and comorbidity profiles in patients between condom and indwelling catheters

		Catheter		P- value
		Condom	Indwelling	
Age in years	< 30	3 (50%)	3 (50%)	0.022
	30 - 40	2 (20%)	8 (80%)	
	40 - 50	1 (5.3%)	18 (94.78%)	
	≥ 50	4 (8.9%)	41 (91.1%)	
Co-morbidity	Present	5 (16.7%)	25 (83.3%)	0.383
	Absent	5 (10%)	45 (90%)	
Hypertension	Present	1 (6.2%)	15 (93.8%)	0.398
	Absent	9 (14.1%)	55 (85.9%)	
Diabetes	Present	14 (19%)	17 (81%)	0.291
	Absent	6 (10.2%)	53 (89.8%)	
CKD	Present	1 (20%)	4 (80%)	0.6
	Absent	9 (12%)	66 (88%)	
Schizophrenia	Present	0%	1 (100%)	0.704
	Absent	10 (12.7%)	69 (87.3%)	
Circumcision	Done	1 (16.7%)	5 (83.3%)	0.748
	Not done	9 (12.2%)	65 (87.8%)	

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Ward	ICU	1 (10%)	9 (90%)	0.798
	Non-ICU	9 (12.9%)	61 (87.1%)	

DISCUSSION

In our study, of 80 male patients, most of the patients (45 patients) were aged > 50 years, accounting for 56.2% of the total patients, 23.8% were aged between 40 and 50 years, 12.5% were aged 30-40 years, and 7.5% were aged < 30 years. Regarding comorbidities, 63% of the patients had comorbidities, such as diabetes mellitus, hypertension, and CKD. The remaining 27% of the patients were free of comorbid conditions. Among the patients with comorbid conditions, 26% had diabetes mellitus, 20% had hypertension, 6.2% had CKD, and only one patient had schizophrenia.

In an ultrasonogram of the abdomen, 72.5% of the patients had a normal study, 16.2% had renal parenchymal disease, and the remaining 11.2% had chronic liver disease. None of the patients had an obstructive uropathy. During the study after catheterisation, only one patient who was catheterized with an indwelling catheter developed fever with chills, and the remaining patients did not show any features of UTI.

Urine samples were sent for routine examination and culture before catheterisation and after 48 h. Routine examination was normal in 87.5% of patients, 7.5% of patients showed pus cells in the range of 6-8, 2.5% of patients showed pus cells in the range of 8-10 and the remaining 2.5% of patients showed pus cells in the range of 10-12. A urine culture study revealed growth in 13.5% of patients, and the remaining 87.5% had no growth. Among the culture-positive patients, 5% were positive for Candida non-albicans, 3.8% patients were positive for E. coli, 2.5% were positive for Klebsiella species, and 1.2% patients showed positive for Acinetobacter species. When the incidence of microbial growth in urine was compared between the condom catheter and indwelling catheter groups, the incidence of catheter-associated urinary tract infections in the indwelling catheter group was 20%, whereas in the condom catheter group, the incidence was 5%, which was significantly lower than that in the indwelling catheter group. However, if the urine pus cells were compared between the two groups, about 5% of patients showed pus cells of 6-8 cells in the condom catheter group and the remaining 95% of patients showed normal pus cells, whereas in the indwelling catheter group, 10% showed pus cells of 6-8, 5% showed pus cells of 8-10 cells, another 5% showed pus cells of 10 -12 cells and the remaining 80% had normal findings.

Among the patients who were urine culture-positive, the condom catheter group showed 5% positivity only for Candida non-albicans, whereas in the indwelling catheter group, 7.5% were positive for E. coli growth, 5% were positive for Klebsiella growth, 5% showed growth for Candida non-albicans growth, and the remaining 2.5% showed growth for Acinetobacter species, which was not significant (p=0.164).

When patients were compared between the ICU and non-ICU settings, approximately 10% of the patients showed growth in urine culture, whereas, in patients in non-ICU settings, 12.9% were positive for growth in urine culture, which was not significant (p=0.798).

When patients were compared between circumcision and uncircumcision status, the incidence of UTI in the circumcised group was 16.7%, whereas in the non-circumcised group is 12.2%, which was insignificant (p=0.748).

For these two groups, t-values were calculated and found to be 4.995 and 4.008 for the condom catheter and indwelling catheter groups, respectively, with p<0.001 for both, which was significant. Hence, there was a positive correlation between the duration of catheterisation and the incidence of UTI in both condoms and indwelling catheterisation.

According to age-wise data, the incidence of UTI is 50% in patients aged <30 years, 20% in patients aged 30-40 years of age, 5.3% in patients aged 40-50 years, and 8.9% in patients aged >50 years.

CONCLUSION

The incidence of urinary infections is prevalent among patients aged < 30 years, so the patients in that age group can be catheterized with a condom catheter and early removal should be attempted. Implementing a catheter care bundle in hospitals may also be effective in preventing UTIs. The most common organism found in catheterized patients was Candida non-albicans, accounting for 5% of infections overall, and predominating in patients with condom catheters. In patients with indwelling catheters, the predominant organism was E. coli, constituting 7.5% of the total indwelling catheter population.

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