Original Research Article

Assessment of Risk Factors for Catheter Associated Urinary Tract Infections

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Abstract:

Introduction: Catheter-associated urinary tract infection (CAUTI) is the second most common kind of infection acquired in healthcare settings, and it leads to higher rates of morbidity, mortality, and financial costs for patients. The purpose of this research was to evaluate the frequency and different variables that contribute to catheter-associated urinary tract infections.

Material and Methods: One hundred and forty cases undergoing Foleys catheterisation were included. Details including duration catheterization, complete clinical history and urine examination details was collected and analysed.

Results: Catheter associated urinary tract infection was observed in 44 (31.42%) cases. Around 27.28% of cases showed urinary retention, 2.28% showed incontinence, 40.90% of cases had diabetes mellitus in which 63.63% had suffering with diabetes >8 years. E. coli was commonly isolated microorganism in 34.28% followed by Klebsiella pneumonia 25.71%, Pseudomonas aeruginosa in 15%.

Conclusion: Urinary retention, incontinence, diabetes mellitus, duration of catheterization and levels of creatinine were significantly associated with CAUTI (p<0.05). Controlling this illness requires a thorough knowledge of the risk factors involved, which will enable the identification of appropriate interventions to prevent the spread of infection and improve the quality of treatment.

Keywords: Catheter Associated Urinary Tract Infection, Diabetes Mellitus, Microorganisms, Creatinine.

Introduction

Catheter-Associated Urinary Tract Infection (CAUTI) is the term used to describe an infection that occurs in people who have had a catheter inserted for a minimum of three consecutive days [1]. Approximately 40% of healthcare-associated infections are urinary tract infections, with 80% of these cases being caused by the installation of a catheter [2]. Prolonged usage of urinary catheters is a risk factor for developing catheter-associated urinary tract infections (CAUTI) [3].

According to the National Healthcare Safety Network (NHSN), instances of Catheter-Associated Urinary Tract Infections (CAUTI) were more prevalent among critically sick patients in the Intensive Care Unit (ICU) owing to the use of invasive medical devices such as urinary catheters, vein and artery catheters, and endotracheal tubes [4]. The use of a urine catheter disrupts the innate immune defence mechanism by impacting the mucous barrier, which serves to inhibit the adhesion and migration of uropathogens to the urinary bladder [5]. In addition to inducing inflammatory responses, catheter insertion results in epithelial membrane trauma in the bladder neck and urethra. In addition to increasing the risk of urinary tract infections, inflammatory and mechanical injury to the epithelium of the urinary tract affects an individual's immune response to uropathogenic substances [6].

The length of time a urine catheter is used is the primary factor that increases the risk of developing CAUTI (catheter-associated urinary tract infection) and bacteriuria (presence of bacteria in the urine).

Other possible risk factors for the disorder include being female, being pregnant, having poor nutrition, experiencing faecal incontinence, having a severe illness, and having a weakened immune system [7, 8]. With reference to the above the present study was designed to assess the incidence and various risk factors associated with catheter associated urinary tract infections.

Material S and Methods

The present prospective study was conducted in the Department of Urology in association with department of General surgery and Obstetrics and gynaecology at Mamatha Medical College, Khammam during August 2016 to June 2019. A total of 140 cases undergoing Foleys catheterisation were included. Cases with known allergy to latex, with urethral catheter more than 24 hours, with suprapubic catheter, pregnant women, with urine positive were excluded. Written informed consent was obtained from all the participants and study protocol was approved by institutional ethics committee.

All participants were asked to provide extensive medical history and sociodemographic information. Participants' medical histories, including any preexisting conditions, immunosuppressive medications, recent surgeries, and the reason for catheterization, were documented. In addition to taking a urine sample during catheterization, it was also taken at 48 hours post-catheterization, on the day of catheter removal, and in the event that the patient had fever, suprapubic discomfort, loin pain, or a change in urine colour. We documented the period of catheterization as the date on which symptoms emerged or, if earlier, as the date on which the urine specimen was submitted for culture sensitivity. There were blood tests for haemoglobin and kidney function sent on the same day of admission.

Sterilizing the catheter sample port with 10% povidone iodine allowed for the aspiration of around 3 ml of urine. In order to inoculate agar plates, each sample was promptly transferred to the microbiology lab. The growth and kind of organisms were quantitatively analysed at 24 and 48 hours. In order to determine if antibiotics were effective, the Kirby-Bauer disc diffusion method was used.

The collected data was analysed by using IBM SPSS statistical software version 26.0. Categorical variables were analysed by using Fisher's exact test and chis-quare test and continuous variables were analysed by student t test. The $p < 0.05$ was considered as statistically significant outcome.

Results

Table 1: Socio-demographic details of study participants.

Parameters	Total cases (n=140)	
	Frequency	Percentage
Age (In years)		
21-30	16	11.42%
31-40	25	17.85%
41-50	31	22.14%
51-60	28	20%
Above 60	40	28.57%
Gender		
Male	97	69.28%
Female	43	30.72%
Size of catheter		
16 fr	36	25.71%
18 fr	94	67.14%
22 fr	10	7.14%
Duration catheter		
2-5 days	86	61.42%
6-9 days	43	30.71%
10-12 days	11	7.85%
Creatinine		
<±1.5	102	72.85%
>1.5	38	27.14%
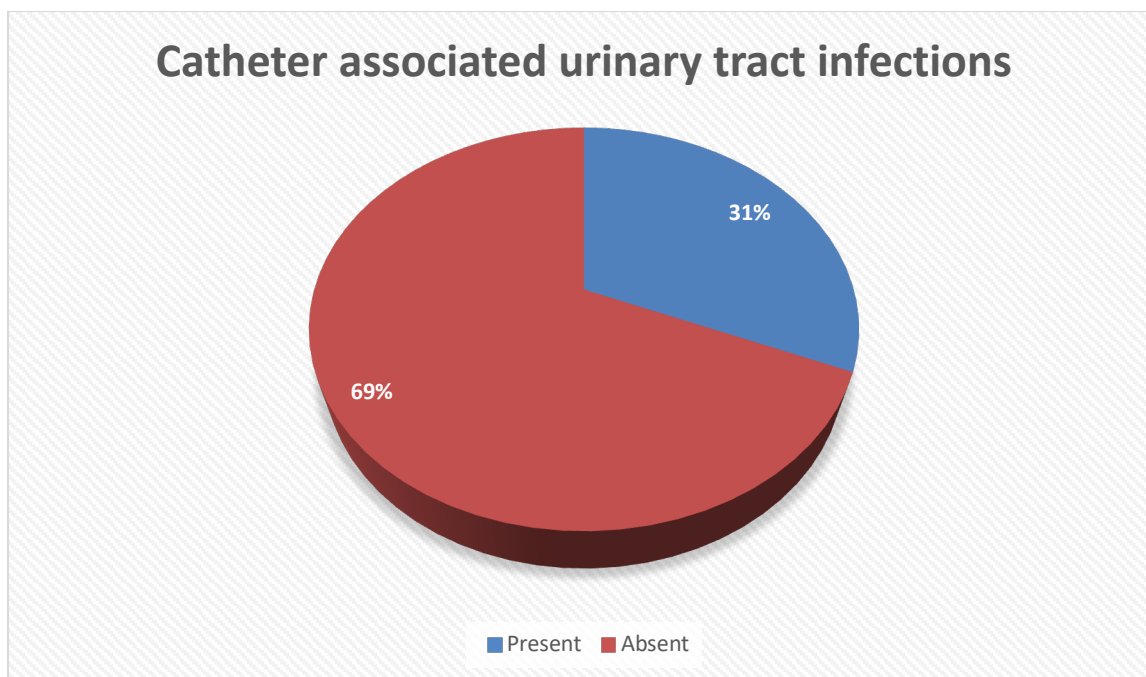
Graph 1: Details of catheter associated urinary tract infections among study participants

Table 2: Comparison of catheter associated urinary tract infection with study variables.

Clinical parameters	Catheter associated urinary tract infection (n=44)		Chi-square p-value
	Frequency	**Percentage**	
Gender			
Male	13	29.55%	0.001
Female	31	70.45%	
Urinary retention			
With	12	27.28%	0.0194
without	32	72.72%	
Incontinence			
With	01	2.28%	0.001
without	43	97.72%	
Diabetes mellitus			
With	18	40.90%	0.0328
Without	26	59.09%	
Duration of diabetes mellitus			
<8 years	16	36.37%	2.764
>8 years	28	63.63%	
Place of catheterization			
OT	35	79.54%	0.0442
Ward	06	13.64%	
Casualty	03	6.81%	
Drainage system			
Open system	10	22.72%	0.001
Closed system	34	77.28%	
Duration catheterization			
< 6 days	41	93.18%	0.0212
> 6 days	03	6.81%	
Haemoglobin			
>10	26	59.09%	0.758
<10	18	40.90%	
Creatinine			
<±1.5	33	75%	0.001
>1.5	11	25%	

Microbial Profile

E. coli — 34.28%
Klebsiella pneumonia — 25.71%
Pseudomonas aeruginosa — 15%
Enterococcus faecalis — 13.57%
Salmonella enteric — 4.28%
Proteus — 4.28%
Staphylococcus Aureus — 2.85%

0.00% 5.00% 10.00% 15.00% 20.00% 25.00% 30.00% 35.00% 40.00%
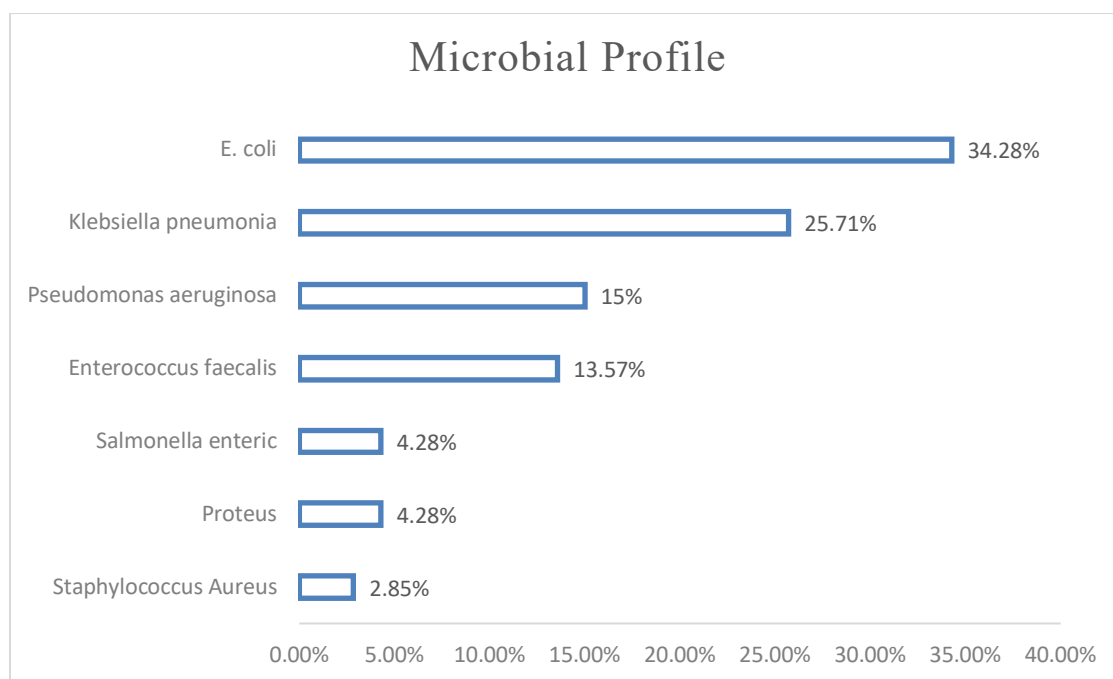
Graph 2: Microbial profile of study participants

Discussion

Majority participants above 60 years of age followed by 41-50 years (22.14%), 51-60 years (20%) and 31-40 years (17.85%) with more male participants (69.28%). 67.14% of the cases had 18 fr catheter, 25.71% cases had 16 fr catheter and 7.14% of cases had 22 fr catheter. The duration of catheter was 2-5 days in 61.42%, 6-9 days in 30.71% and 10-12 days in 7.85% of cases. The levels of creatinine were <1.5 in 72.85% of cases (Table 1).

Catheter associated urinary tract infection was observed in 31.42% of cases (Graph 1). Around 27.28% showed urinary retention, 2.28% showed incontinence, 40.90% of cases had diabetes mellitus in which 63.63% had suffering with diabetes more than 8 years and 36.37% were below 8 years. Majority participants had received catheter in operation theatre. The catheter was placed more than 6 days in 6.81% of cases and <6 days in 93.18% of cases. The haemoglobin levels were above 10 in 59.09% of cases and <10 in 40.90% of cases. The levels of creatinine were <1.5 in 75% of subjects and >1.5 in 25% of cases. In comparison of catheter associated urinary tract infections were significantly associated with urinary retention, incontinence, diabetes mellitus, duration of catheterization and levels of creatinine (p<0.05) (Table 2).

E. coli was commonly isolated microorganism in 34.28%, followed by Klebsiella pneumonia 25.71%, Pseudomonas aeruginosa in 15%, Enterococcus faecalis in 13.57%, Salmonella enteric in 4.28%, Proteus in 4.28% and staphylococcus aureus in 2.85% of cases (Graph 2). An observational study conducted by Anggi A et al. in a hospital setting examined 42 individuals with catheter and determined that 44.4% of these cases were proven to have urinary tract infection (UTI) using urine culture. The prevalence of Pseudomonas aeruginosa was 16.7% and Enterococcus faecalis was 12.5%, making them the most frequently occurring pathogens.

Patients who were over 50 years old (P < 0.03) who used catheters for more than 6 days (P < 0.03) had a substantially higher risk of having urinary tract infections (UTIs) [9]. In a prospective study conducted by Hariati H et al., involving 82 cases, a significant correlation was observed between age, diabetes mellitus, duration of catheterization, and indication for catheter use with catheter-associated urinary tract infection (p<0.05).

However, no significant associations were found between UTI and the drainage system, gender, and catheter case (p>0.05). E. coli was the most frequently isolated pathogen, accounting for 36.11% of cases. Staphylococcus aureus followed with a prevalence of 19.44%, while pseudomonas aeruginosa was found in 5.56% of cases. Staphylococcus epidermis, Acinetobacter, and Enterobacter each accounted for 8.33% of cases. [10]

Ventura MT et al. and Mohammadzadeh M et al. found that the incidence of catheter-associated urinary tract infections was higher in those aged 60 years and above [11,12], which aligns with the results of the current investigation. Gillen JR et al. and Nitzan O et al. found that diabetes mellitus is a separate risk factor for catheter-associated urinary tract infection (UTI), which may prolong the duration of the disease [13,14]. A retrospective cohort research conducted by Letica-Kriegel AS et al.

found that the incidence of catheter-associated urinary tract infections (CAUTI) increases with each extra day of catheterization. The study also identified many risk variables that contribute to the likelihood of developing CAUTI [15].

A study conducted by Perrin K et al. found that older age, female gender, stool incontinence, and diabetes mellitus were correlated with catheter-associated urinary tract infections (CAUTI). The study also revealed that the average duration for CAUTI to occur after catheter insertion was 6 days [16]. In a prospective study conducted by Shiva Verma et al., CAUTI was identified in 26 out of 163 patients. Female gender, catheterization length exceeding 5 days, mechanical ventilation, and diabetes mellitus were identified as independent risk factors for the occurrence of CAUTI [17].

In a study conducted by Sawsan AO et al., it was shown that female gender and cases with duration of more than 30 days were often linked to Catheter-Associated Urinary Tract Infections (CAUTI) [18]. A retrospective study conducted by Hagerty Thomas et al. found a positive correlation between increased incidence of catheter-associated urinary tract infections (CAUTI) and longer periods of catheterization [19].

Lalitha AV et al. found that Escherichia coli accounted for 32.4% of the identified organisms, whereas Enterococcus faecalis accounted for 30.6%. Furthermore, the length of time that the catheter was in place, the duration of stay in the Paediatric Intensive Care Unit (PICU), and the length of hospital stay were shown to have a significant correlation with Catheter-Associated Urinary Tract Infections (CAUTI) [20].

The present study results were similar to the findings of above studies where old age group peoples and duration of catheterization are more prone CAUTI. The present study has limitations in terms of single centric with low sample size. Further multicentric studies are required to evaluate the multiple factors associated with increased prevalence of CAUTI.

Conclusion

The present study findings indicated that the occurrence of catheter-associated urinary tract infection may be decreased by minimizing the length of time the catheter is in place, implementing tight safeguards during catheter insertion, and effectively managing diabetes mellitus. The female gender is an inherent and unchangeable host factor; hence catheterization in females should only be performed when absolutely necessary. Controlling this illness requires a thorough knowledge of the risk factors involved, which will enable the identification of appropriate interventions to prevent the spread of infection and improve the quality of treatment.

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