



Catheter Induced Urinary Tract Infection: Post Surgical Prevalence with Curative and Preventive Management

Chowdhury Md. Navim Kabir^{1,2}

¹Islami Bank Central Hospital, Dhaka, Bangladesh

²Chittagong Medical College, Chattogram, Bangladesh

Email: Protik167@gmail.com

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Abstract

Urinary Tract Infection (UTI) is one of the most common infective diseases nowadays. There are many factors like clinical, anatomical, and environmental that triggered this disease. In gender differentiation, women are more prone to UTI than men though male UTI is not a rare issue overall. But above all, the impact of clinical factors on UTI has been proven to disease aggravating undoubtedly. Different recent scientific surveys showed organisms that expand nosocomial infection prevalence, are mostly inducers of UTI. So, perspective nosocomial UTI is rising day by day. Bi-channel or tri-channel urinary catheter insertion is a common part of clinical procedure mostly for those who have pathologies in the urethra like impaction of stones or any obstruction in the ureter. Emergency urinary catheterization is common in road traffic accidents in the presence or absence of urethral injury. In postoperative thoracic, abdominal surgery insertion of a catheter is not uncommon. How long this catheter is needed to be inserted is depend upon some factors. So, the duration of a catheter is a burning question. **Objective:** Postoperative urinary catheterization duration is not the same in all cases. Patients who needed to insert a catheter and keep it for a long time and how this duration effect UTI prevalence is the main objective. **Method:** 49 patients were the object of our cross-sectional study. They were inserted into urinary catheters for different durations in the postoperative period. At first, we started with 52 patients, but 3 of them have been excluded due to previous UTI diagnosis which might occur result in errors. Direct questionnaire about their comorbidities history, drug history, and operation history with catheterization history where applicable. They were informed about the research and cordially participated in the research. **Results and Discussion:** Here, we observed 49 patients of Islami Bank Central Hospital who had a catheterization history. 31 of them were

operated by laparoscopic procedure and 6 of them were UTI diagnosed with a hospitalization history of 1 - 2 days. 8 patients had a history of post-Caesarean hospitalization, and 3 had been diagnosed with UTI during culture. Average hospitalization here 2 days. In a vaginal hysterectomy, 3 of 4 patients diagnosed with UTI had a 6-day average history of hospitalization. The rest of the patients was female and voluntarily used to resist urinary urgency at different times. They were not UTI diagnosed but along with postoperative hospitalization history and anatomical affiliation stimulated the infection process. Prolonged hospital staying is a rising etiology for urinary tract infection is the ultimate proof from this research.

Subject Areas

Surgery & Surgical Specialties, Urology

Keywords

Biofilm, Bacteriuria, Laparotomy, Hysterectomy, Total Knee Replacement, Coagulase, Suprapubic Pain

1. Introduction

Urinary Tract Infection (UTI) is one of the most common infective diseases in Bangladesh and prevalence is generally seen in females. Anatomical proximity to the anus some other personal and social factors, they are more prone to UTI. Along with conventional reasons urinary catheter-associated UTI is also a burning issue for management. In the postoperative period, patients are kept catheterized for different durations for many purposes. Sometimes, sudden cessation of urine also demands catheter insertion. Post-road traffic accident situation (with /without injury of the urethra) also demands the same. During hospital, staying especially postoperative patients of prolonged catheterization is more vulnerable to UTI. How this prolongation triggered UTI is the main theme of this research manuscript. Urinary catheterization is a routine procedure in major preoperative surgical and gynecological procedures. This catheterization continued up to certain days according to patients' needs. Catheterization is needed for the facilitation of voiding, discomfort arising from a full bladder, prevention of postpartum hemorrhage, and spinal headache due to reduced movement. In different advantages, it has some disadvantages like irritation felt by the patient and potential source of biofilm-induced infection. This infection is usually well controlled, but immunosuppressed are very much vulnerable cause nosocomial infection-producing agents are also initiators of UTI mostly [1] [2] [3].

2. Basic Procedure of Urinary Catheterization

Figure 1 shows the male and female catheterization. The basic procedure of urinary catheterization for male includes 5 steps. For female, it includes 4 steps.

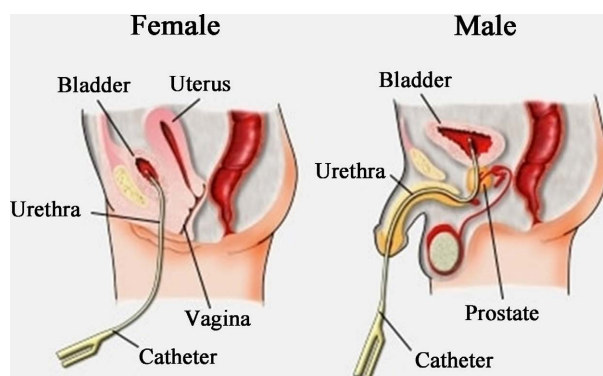


Figure 1. Male and female catheterization.

2.1. Steps for Male

Step 1: Gloving the nondominant hand and grasping the penis perpendicular to inserter's body plane.

Step 2: Cleaning the glans of penis by antiseptic soaked swabs in expanding circular motion and ensuring the removal of uses swab.

Step 3: Keeping the nondominant hand in the position without removing.

Step 4: Lubricating the tipoff catheter by lubricating jelly and inserting the tip of the catheter by dominant hand and insert into urethral meatus.

Step 5: Gently forwarding the catheter to the bladder through urethra and discontinue if any substansial resistance arise. When complete insertion will be completed use disposable syringe and draw 10 cc normal saline/distilled water by the dominant hand for inflating the balloon [4] [5] [6].

2.2. Steps for Female

Step 1: Picking the lubricated catheter with dominant hand.

Step 2: Asking the patient for deep breathing and slowly to further relax the sphincter.

Step 3: Carefully forwarding the catheter upto urinary meatus.

Step 4: Advancing the catheter up to 2 - 3 inches while labia being hold until urine begun to flow.

From the above discussion of insertion, aseptic maintenance should be in top priority cause lack of sufficient tidiness, infection can be spread in ascending pathway that cause massive septic deterioration [7] [8] [9].

3. Pathogenesis

Formation of Biofilm is a potential source of bacteriuria in the catheter insertion area. They produce an extracellular mucopolysaccharide substance as a complex organic material in which bacteria colonized. Biofilm incorporated with Tamm- Horsfall protein as well as magnesium and calcium ions. Formation of biofilm started after catheter insertion when adherence of organisms to conditioning film of host which made along with catheter surface (**Figure 2**).

Organisms in the biofilm are well protected from effect of antimicrobial resistance

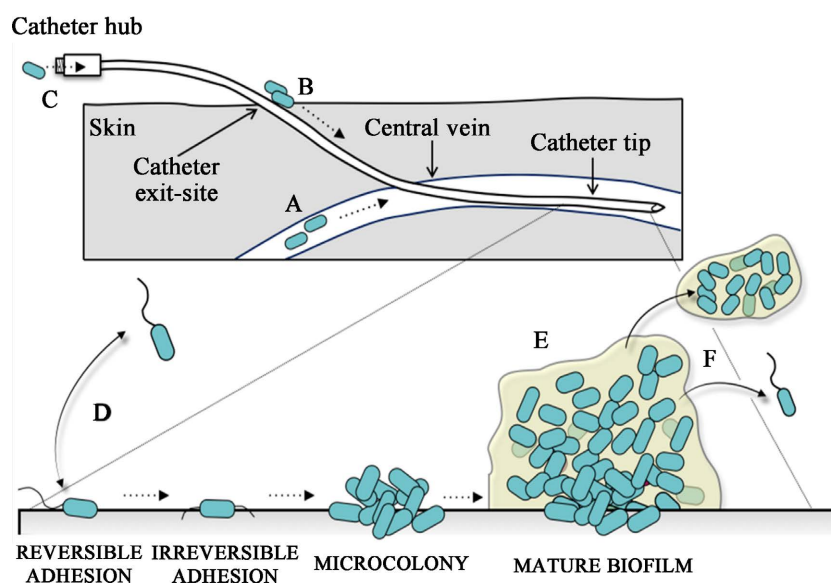


Figure 2. Biofilm formation during catheterization.

and host defence. A single species can be found after insertion of indwelling catheter of initial episode of bacteriuria. Mature biofilm can be produced when catheter in situ for several days. For individuals with long term indwelling catheters, 3 - 5 organisms are usually isolated [10]-[16].

4. Epidemiological Prevalence

A number of 49 patients who was postoperative catheterized in different duration. Initially 52 patients have been selected but due to previous history of positive urine culture they were excluded. In a cross sectional study, they were asked about their operative history, history of catheterization with duration comorbidities and other relevant history. The participants were in different age group of 16 - 75 yrs [17] [18] [19] [20].

5. Results and Discussions

As shown in **Table 1**, most of the patients those who were participated are mostly operated by laparoscopic procedure. They were 31 in number. Second was Lower Uterine Caesarean Section (LUCS). Here total patients are 8 in number. The rest of were vaginal Hysterectomy and Total knee replacement. The number of patients was 4 and 6 respectively there. From **Table 2**, we see that patients who had been done laparoscopic procedure need to be hospitalized 1 - 2 days and average 6 patients diagnosed as UTI and the percentage was 19.35%. 8 patients who were catheterized after LUCS, need to be stayed 1-3 days (average 2 days). 3 of them were diagnosed as UTI (37.50%). 4 Patient of post vaginal hysterectomy who need to be at hospital 5 - 10 days (average 7 days). 3 patients were diagnosed as UTI which indicates 75% of them were UTI affected. In total knee replacement it was 50%. **Figure 3** is the graphical presentation of **Table 2**.

Here, the clue that has been highlighted that prolonged hospital staying trig-

gered urinary tract infection. Nosocomial infection/hospital acquired infection individually warning issue. Along with prolonged hospitalization induced UTI also a fate of nosocomial infection. In **Table 3**, we see that 15 patients who were

Table 1. Number of patients with their respective surgical pattern and percentage.

Types of Surgery	Number of Patients	Percentage
Laparoscopic Procedure	31	63.27%
LUCS	8	16.33%
Hysterectomy (Vaginal)	4	8.16%
Total Knee Replacement	6	12.26%
Total	N = 49	

Table 2. Average catheter duration in days and percentage of UTI developed patients.

Types of Surgery	Number of Patients	Catheter Duration in Days (Average)	UTI Developed No. of Patients (Percentage)
Laparoscopic Procedure	31	1 - 2 (1.16)	6 (19.35%)
LUCS	8	1 - 3 (2.38)	3 (37.50%)
Hysterectomy (Vaginal)	4	5 - 10 (6.75)	3 (75.00%)
Total Knee Replacement	6	2 - 5 (3.17)	3 (50.00%)
Total	N = 49	1 - 10 (2.06)	15 (30.61%)

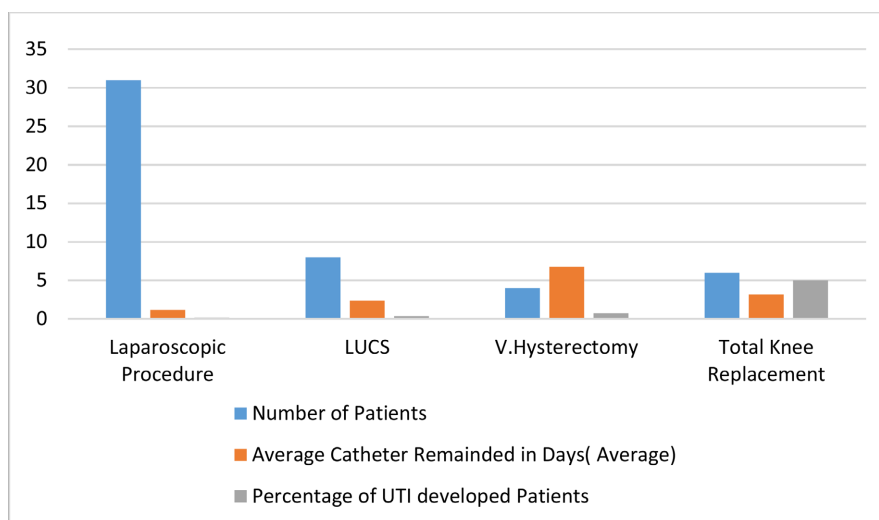


Figure 3. Graphical presentation of **Table 2**.

Table 3. Number of patients with their distribution according to organism isolated in culture.

Total Number of Patients Diagnosed as UTI	<i>E. coli</i>	Acinetobacter	Proteus	Pseudomonus
15	11	1	1	2

diagnosed as UTI out of 49 patients, are mostly affected by *E. coli* (11 in number). *E. coli* is the most prominent organism that triggered different nosocomial infection. So UTI would be an alarming and threatening condition if effective and patient friendly hospital management can't be ensured.

6. Microbiological Etiology

From **Table 3**, involvement of *E. coli* in UTI prevalence has been seen. During isolation of microorganism, *E. coli* is most frequently isolated from urine sample. Some other notable organism regarded UTI are *Enterobacteriaceae*, *Enterococci* spp., coagulase negative *Staphylococcus*, *Pseudomonas aeruginosa*, other non-fermenters, and *Candida* spp. also frequently isolated. The urine of patients having indwelling catheter is a prime source of production of resistant gram negative bacteria in acute and long term care like Extended Spectrum Beta-Lactamase (ESBL) producing *Enterobacteriaceae* [21] [22] [23] [24] [25].

7. Diagnostic Criteria

7.1. Microbiological Criteria

For maintaining a closed drainage system, urine specimen in culture procedure should be collected directly from catheter or tubing with a needle (**Figure 4**). When amount of micro-organisms isolated from the urine sample crossed $\geq 100,000$ cfu/ml then evidence of catheter induced UTI can be accepted. Catheter in situ for more than 2 weeks is inducer for biofilm formation. During insertion of new catheter for getting more specific result urine sample should be collected in the newly inserted catheter as well as the former one [26] [27].

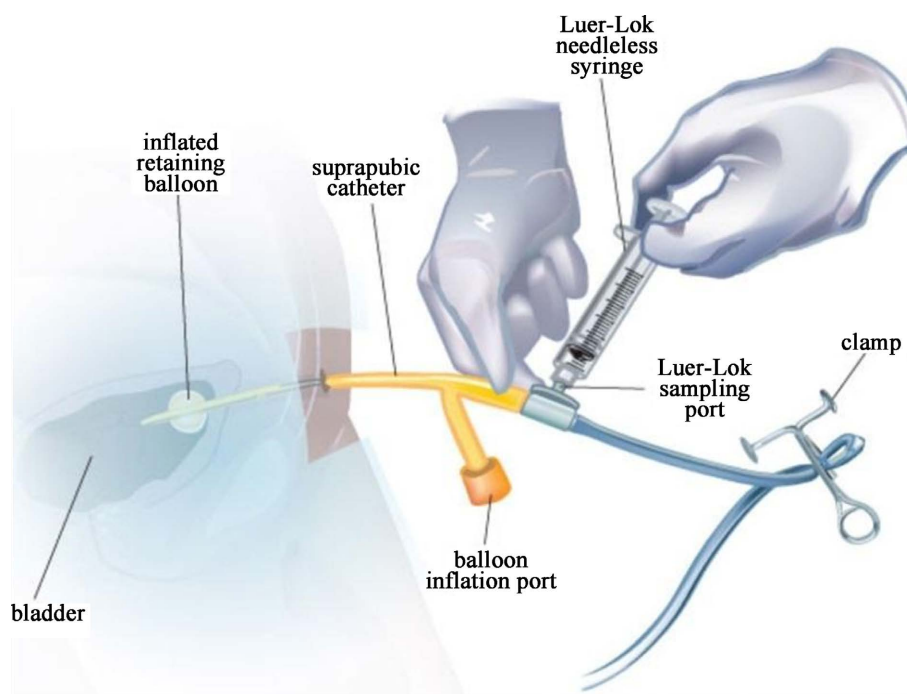


Figure 4. Aseptic technique for urine collection.

7.2. Clinical Criteria

Localized symptoms like catheter obstruction, suprapubic pain, acute hematuria, costovertebral angle pain/tenderness without fever are common clinical features of catheter induced UTI. Fever is usually uncommon, but bacteriuric evidence with fever shouldn't be overlooked for proper diagnosis [28] [29].

8. Protocol

8.1. Preventive

To prevent catheter, associated UTI primary preference should be consist with indwelling catheter avoidance, ensure rational catheter insertion in ideal clinical indication. In the operative procedure, catheter insertion is not usual, so rational use should be ensured. Some operative indications of catheter insertion such as contiguous structures surgery of genitourinary tract, infusion of a large volume of diuretics during surgery, and monitoring of urine volume during surgery. Some other indicatory situations like management of acute urinary obstruction/injury, management of urinary incontinence for the patients of skin grafting, pressure ulcer and exceptional circumstances like end-of-life care where insertion may be done for patient's comfort. Other than these, catheterization should be discouraged [30] [31] [32] [33].

8.2. Curative

Antibiotic prophylaxis should be introduced after sending the urine sample for culture. For management, dosage should be completed within 7 days. If unresponsive, it can be continued up to another 7 days. Older people who become infected after removal of indwelling catheter after 2 - 3 days should be carried on this process. But urine culture sensitivity should be on first preference for choosing actual antibiotic otherwise irrational use causes bacterial resistance. Patient's physical condition, symptoms, co-morbidities are big issues in antibiotic administration. Injectable antibiotic is a drug of choice in prolonged hospitalization as prophylaxis. Trimethoprim, Sulfamethoxazole, Nitrofurantoin, Ciprofloxacin, Cephalosporin are commonly used in catheter induced UTI management. Patient's those who followed antibiotic regimen after diagnosed UTI got effective result in comparing those who didn't follow. About 40% patients become recovered from catheter induced UTI [34] [35] [36] [37] (**Table 4**).

Total 6 patients who have history of taking antibiotic regimen according to physician's advice were recovered from UTI. So, the percentage is 40%. This is the evidence of accuracy of rational antibiotic use in UTI management from this research.

9. EAU Guidelines:

For improving management protocol, European Association of Urology (EAU) introduces some guidelines. Some of are:

- Prefer Urine Culture for the diagnostic purpose.

Table 4. Percentage of patients who take different antibiotic to recovery from UTI.

Name of Organism Found in Urine	Number of Patients	Number of Recovered Patients Who Take Antibiotics	Percentage
<i>E. coli</i>	11	4	36.36%
Pseudomonus	2	1	50.00%
Acinetobacter	1	0	0
Proteus	1	1	100%
	Total = 15	Total = 6	

- Vaginal estrogen Replacement for menopausal patients.
- Use immunoactive prophylaxis to reduce UTI in all age groups.
- If nonantimicrobial intervention becomes failed, use continuous or post-coital antimicrobial prophylaxis should be followed. Here, short-term antimicrobials can be more effective [38] [39].

10. Conclusion

Catheter insertion is a proven clinical innovation in acute and chronic genitourinary management. Rational use of it can ensure patient comfort and safety, as well as proper use of antibiotics, which can reduce the risk of urinary tract infection and associated diseases. Raising awareness in people about prophylactic antibiotic use could be a blessing for the proper management of catheter-induced UTIs.

Conflicts of Interest

The author declares no conflicts of interest.

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