

Case Series



Frequency of Urinary Tract Infection Following Endoscopic Double-J Stent Placement in Patients with Hydronephrosis: A Prospective Descriptive Case Series

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Abstract

Objective: To determine the frequency of urinary tract infection (UTI) following endoscopic double-J stent placement in patients with hydronephrosis.

Methodology: A prospective descriptive case series was conducted to estimate the frequency of urinary tract infection following endoscopic double-J stent placement in patients with hydronephrosis. The study performed in the department of urology at Mayo Hospital, Lahore, from December 2019 to June 2020. A total of 156 patients having age ranging from 16 to 75 years who underwent retrograde double-J stent insertion were recruited for the study. Patients suffering from preexisting UTI were excluded. UTI was determined at 6 weeks post-procedure based on urine culture ($\geq 10^5$ CFU/mL). Analysis was done by SPSS v. 22.0.

Results: The mean age was 45.29 ± 17.58 years; out of whom 111 were male (71.15%) and 45 were female (28.85%). UTI was found in 47 subjects (30.13%). With respect to age, incidence of UTI was increasing; 23.1%, 33.3% and 34.0% in age groups respectively, but the relation wasn't statistically significant ($p = 0.397$). Likewise, no statistical difference existed between males and females (33.3% vs 22.2%, $p = 0.171$).

Conclusion: A significant number of patients had UTIs after double-J stent insertion. These findings emphasize the importance of vigilant postoperative monitoring and the implementation of effective preventive strategies to reduce UTI risk.

Keywords: Urinary tract infection; Hydronephrosis; Ureteral stenting; Postoperative infection; Urine culture



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Introduction

The use of ureteral stents in the field of urology dates back to 1967; however, they continue to be an indispensable tool in several medical treatments. Double-J stents can be found in surgical operations for various diseases like ureteral strictures, uretero-pyelic junction obstruction, obstructed calculi, and malignancies.¹ Short-term applications, which normally last 4 to 6 weeks, assist with urine drainage and obstruction, and protect ureters from possible damage caused by surgery.²

Double-J stents provide constant internal urinary flow from the renal pelvis to the bladder without any necessity for external diversion, thus rendering them the choice of preference in contemporary urological practice.³ These medical devices are applied under conditions such as intrinsic or extrinsic obstruction of the ureter, ureteral trauma due to medical procedures and even preventive measures during complicated reconstructive surgeries.⁴ Nevertheless, there are numerous variations in the surgical technique used for stenting and subsequent management of patients that can impact their condition.⁵

In spite of the popularity and advantages of ureteral stents, a number of complications arise upon their usage, including a rather common one, urinary tract infection (UTI). As reported in literature, the rate of occurrence of UTI among patients with hydronephrosis after endoscopic insertion of double-J stent varies substantially between different studies, namely within 0% and 62.5% range.⁶⁻⁹ This variation may probably be accounted for by different criteria used to identify infections, patient characteristics and other factors.

Patients with hydronephrosis may be particularly susceptible to post-stenting urinary tract infection because urinary stasis and obstruction facilitate bacterial colonization. Although several international studies have reported variable rates of post-stenting UTI, data specifically addressing hydronephrosis patients remain limited,⁸⁻¹⁰ particularly in local Pakistani populations.¹¹ Moreover, considerable variation exists in reported infection frequencies due to differences in study populations, definitions of infection, and follow-up protocols.⁶⁻⁹ Therefore, this study was conducted to determine the frequency of urinary tract infection following endoscopic double-J stent placement in patients with hydronephrosis.

This research was done to find out the prevalence of UTI in patients with hydronephrosis who underwent endoscopic placement of double-J stent.

Methodology

The study was conducted at the Department of Urology, Mayo Hospital, Lahore during a span of six months from 29-12-2019 to 29-6-2020 after the approval of the

synopsis of the study (CPSP/REU/URO-2019-066-1067) dated 28 December 2019. The sample size was calculated using the single population proportion formula to estimate the frequency of urinary tract infection following endoscopic double-J stent placement using G*Power version 3.1 software. Based on previously published literature reporting a UTI frequency of 40%,⁹ a confidence level of 95% and margin of error of 8% were used, yielding a minimum required sample size of 144 patients. To improve estimate precision, 156 eligible patients were ultimately enrolled using consecutive sampling.

Patients aged 16-75 years of any gender presenting with hydronephrosis were considered, whereas patients with recurrent renal stones or repeat procedures (as per medical records), malignant renal disease (as per medical records), with existing UTI prior to stent placement (on clinical examination), with coagulopathies (INR >2) or uremia due to bladder outflow obstruction (on clinical examination) were excluded.

Prior to stent insertion, all patients underwent clinical evaluation for symptoms suggestive of urinary tract infection, including dysuria, fever, urinary frequency, and suprapubic discomfort. Patients with clinical suspicion of active UTI were excluded from the study. Prior to stent insertion, all patients underwent clinical evaluation for symptoms suggestive of urinary tract infection, including dysuria, fever, urinary frequency, and suprapubic discomfort. Patients with clinical suspicion of active UTI were excluded from the study. Routine preoperative urine cultures were not performed due to departmental practice limitations; therefore, asymptomatic bacteriuria could not be completely excluded. However, patients with symptomatic infection or documented recent UTI were not included.

A total of 156 patients meeting the selection criteria were enrolled from the wards of the Department of Urology, Mayo Hospital, Lahore. Informed consent was obtained from all participants. Demographic details, including name, age, gender, and address, were recorded.

All patients underwent endoscopic double-J stent placement under local anesthesia by a single surgical team with assistance from the researcher. The stent was inserted retrogradely using a cystoscope. A single prophylactic broad-spectrum antibiotic (most commonly ceftriaxone) intravenous was administered approximately two hours prior to stent insertion, in accordance with departmental protocol. In all patients, a 5F or 6F double-J stent with side holes was placed and left in situ for six weeks. All enrolled patients completed the planned six-week indwelling period, and no patient required early stent removal or exchange during follow-up.

Postoperatively, patients were shifted to the surgical ward and followed until discharge. They were subsequently followed in the outpatient department for six

weeks. After six weeks, patients were evaluated for UTI using urine culture & no patients were lost to follow-up during the six-week study period. Urinary tract infection was defined as a positive urine culture showing significant bacterial growth ($\geq 10^5$ CFU/mL), with or without accompanying urinary symptoms.¹⁰

Data were entered and analyzed using SPSS version 22.0. Continuous variables, such as age, were summarized as mean $\pm$ standard deviation. Gender and UTI which are categorical variables were described in terms of frequencies and percentages. For determining the relation between the two, stratification was done according to age and gender, and post-stratification analysis was done using the Chi-square test. The 95% confidence interval for UTI frequency was also calculated. The level of significance was set at $p \leq 0.05$.

Results

In total, 156 individuals were enrolled in the study. The average age was 45.29 ± 17.58 years (with age range between 16 and 75 years). Of the total sample size, 111 participants were male (71.15%), while 45 were female (28.85%).

The main aim of the research was to investigate the development of UTIs after the insertion of the endoscopic double-J stent. UTIs developed among 47 subjects, with their frequency at 30.13% (95% CI: 22.9%–37.4%).

Patients were categorized into three age groups as follows: 16–35 years ($n=52$, 33.33%), 36–55 years ($n=51$, 32.69%), and 56–75 years ($n=53$, 33.97%). The prevalence of UTI among each age group was 23.1% (12 out of 52), 33.3% (17 out of 51), and 34.0% (18 out of 53), respectively. UTI frequency was numerically higher in older age groups; however, the association was not statistically significant ($p = 0.397$), since no correlation exists between age and UTI incidence in this cohort.

With regards to gender classification, UTI occurred in 37 males (33.3%) and 10 females (22.2%). While there is an increased proportion in male participants, no significant statistical difference could be found ($p=0.171$).

A table summarizing the comparisons between the stratified analysis of UTIs according to age groups and gender classification is presented in Table 1.

Discussion

Double-J stent are widely used in urological practice for temporary urinary diversion; however, their use may be associated with complications including urinary tract infection, hematuria, dysuria, and stent colonization.^{11–14}

The development of UTI after stent placement may be related to bacterial adherence and biofilm formation on the stent surface. Biofilms facilitate bacterial persistence and reduce antibiotic penetration, thereby increasing susceptibility to bacteriuria and symptomatic infection.^{2,3} Prolonged indwelling duration and urinary stasis in hydronephrosis may further contribute to bacterial colonization. The development of UTI after stent placement may be related to bacterial adherence and biofilm formation on the stent surface. Biofilms facilitate bacterial persistence and reduce antibiotic penetration, thereby increasing susceptibility to bacteriuria and symptomatic infection. Prolonged indwelling duration and urinary stasis in hydronephrosis may further contribute to bacterial colonization.³ The current study involves 156 participants whose mean age was 45.29 ± 17.58 years old, out of which 111 (71.15%) were males and 45 (28.85%) females. The post-procedural UTI occurred in 47 individuals (30.13%). The rate of UTI among patients with stents has been inconsistent in various studies conducted so far. A recent prospective Pakistani study by Mobin et al. reported that urinary tract infection was significantly associated with ureteral stent encrustation, highlighting the important contribution of infection and bacterial colonization to stent-related complications.¹⁵ Geavlete et al., in a large retrospective analysis of 50,000 ureteral stenting procedures, reported urinary tract infection in 14.8% of cases, further demonstrating that UTI remains one of the most common complications associated with double-J stenting.¹⁶

Studies focusing specifically on hydronephrosis pa-

Table 1. Stratified Comparison of Urinary Tract Infection According to Age Groups and Gender

Variable	Category	UTI Present n (%)	UTI Absent n (%)	Total n (%)	p-value
Age group (years)	16–35	12 (23.1)	40 (76.9)	52 (100)	0.397
	36–55	17 (33.3)	34 (66.7)	51 (100)	
	56–75	18 (34.0)	35 (66.0)	53 (100)	
Gender	Male	37 (33.3)	74 (66.7)	111 (100)	0.171
	Female	10 (22.2)	35 (77.8)	45(100)	

Footnotes: Values are presented as number (%); Statistical analysis was performed using the chi-square test; A p -value ≤ 0.05 was considered statistically significant.

tients have also demonstrated variable findings. Pansota et al. reported no cases of UTI following endoscopic double-J stent insertion in patients with obstructive uropathy.⁶ However, Pogorelic et al. observed a 9% frequency of UTI in patients with primary hydronephrosis undergoing double-J stenting,⁷ while Ozgar et al. reported a 7% incidence.¹⁷ In contrast, Ray et al. reported a markedly higher UTI rate of 62.5% following endoscopic double-J stent insertion.⁸ Shabeena et al. reported bacterial colonization in 47.2% of patients undergoing double-J stenting, with *Escherichia coli* being the most common isolate (20%), followed by *Streptococcus* species (17.5%) and *Pseudomonas* species (12.5%). The study concluded that bacteriuria and stent colonization increase with prolonged stent indwelling time and that many isolates demonstrate antibiotic resistance.¹⁸ Supporting the possible microbiological basis of post-stenting UTI, Choi et al. reported that prolonged ureteral stent indwelling was associated with frequent urinary tract infection and bacterial colonization involving both bladder and renal pelvic urine cultures, suggesting progressive microbial migration and persistence along the stent surface.¹⁹

In the present study, age- and gender-based stratification showed no statistically significant association with UTI occurrence ($p > 0.05$). UTI was less frequent in patients aged 16–35 years compared with older age groups, and although males had a higher UTI frequency than females, the difference was not statistically significant.

This study has several limitations. As a single-center descriptive case series, causal relationships could not be established. Pre-procedural urine cultures were not routinely performed, and microbiological profiles, bacterial resistance patterns, and predominant organisms were not analyzed. Therefore, the study could not evaluate asymptomatic bacteriuria or characterize pathogen-specific infection patterns. Additionally, the absence of a non-stented comparison group limits direct attribution of infection risk to stent placement alone. Future multicenter prospective analytical studies incorporating microbiological analysis are recommended.

Conclusion

A considerable proportion of patients developed urinary tract infection following endoscopic double-J stent placement. These findings highlight the importance of postoperative surveillance and the need for further analytical studies to identify modifiable risk factors and preventive strategies.

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Authors' Contribution Statement

ABG contributed to the design, acquisition, analysis, interpretation of data, critical review of the manuscript, and final approval of the version to be published. NUS contributed to the acquisition, analysis, interpretation of data, and drafting of the manuscript. SFH contributed to the acquisition, analysis, interpretation of data, and drafting of the manuscript. MA contributed to the acquisition, analysis, interpretation of data, and drafting of the manuscript. SK contributed to the conception, design, acquisition, drafting of the manuscript, critical review of the manuscript, and final approval of the version to be published. SI contributed to the acquisition, analysis, critical review of the manuscript, and final approval of the version to be published. All authors are accountable for their work and ensure the accuracy and integrity of the study.

Conflict of Interest

Authors declared no conflict of interest

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None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.