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The Pattern of Bacterial Colonization and Urinary Tract Infection following endo-urological operations with double J Stent. A descriptive study.

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ABSTRACT

Introduction: Double J (DJ) ureteral stents are commonly utilized to alleviate urinary blockages but are susceptible to bacterial colonization and the formation of biofilms, which heightens the likelihood of multidrug-resistant infections, including those caused by ESKAPE pathogens. It is essential to comprehend colonization trends and antibiotic susceptibility to inform preventive and treatment approaches.

Methods: A descriptive observational study was carried out involving 110 patients receiving DJ stenting, examining demographics, stent retention periods, bacterial colonization in urine and stent cultures, and antibiotic resistance profiles via standard microbiological methods.

Results: Bacterial colonization was identified in 19.1% of urine specimens and 29.1% of cultures from DJ stents. Escherichia coli was the predominant isolate, with significant occurrences of Klebsiella, Pseudomonas, and Acinetobacter species. The average duration of stent placement was 21.4 days, with the majority of patients (76.4%) retaining stents for more than 14 days. Sensitivity testing indicated favorable responses to amikacin, Piperacillin/Tazobactam, levofloxacin, and nitrofurantoin, while certain resistant strains required colistin or tigecycline.

Conclusion: Extended DJ stenting elevates the risk of colonization by ESKAPE organisms, underscoring the importance of infection control measures, antibiotic stewardship, and the potential use of antimicrobial-coated stents to mitigate multidrug-resistant infections.

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INTRODUCTION

Stents and catheters are vital components of contemporary urology, especially in endourological procedures where specialized instruments are inserted through the urethra to reach the urinary system.[1] Ureteral stents are frequently employed after surgery to aid kidney drainage postoperatively or to address urinary tract stones.[2] Initial designs of catheters, developed in the early 20th century, often experienced issues such as migration and expulsion.[3]

With the progress in endourology and the rising use of endourological devices, there has been a notable increase in infections related to these devices.[4] The use of double-J (DJ) stents is usually connected with minor complications, including loin pain, dysuria, suprapubic discomfort, and urinary tract infections (UTIs).[5] An increased application of DJ stents has also resulted in a rise in infections associated with these stents.[6] UTIs continue to be a significant source of complications for patients with indwelling DJ stents, as colonization

of these devices can often happen asymptomatically in healthy individuals but poses a risk of infection and sepsis for those who are immunocompromised.[7]

Although many instances resolve without antibiotic treatment, specific antibiotic therapy may be necessary, particularly in cases of catheter-induced sepsis.[8] Treatment approaches rely on the local bacterial strains present and their antibiotic susceptibility profiles, which aids in preventing the indiscriminate use of antibiotics and the development of resistant bacteria.[9,10] Studies indicate that 5% to 25% of individuals with indwelling catheters experience asymptomatic bacteriuria, while 3% to 5% develop symptomatic UTIs that necessitate antibiotic treatment or catheter removal.[11-13] However, there is limited information regarding bacteriuria following the placement of DJ stents.[14] The exact microbial profile linked to DJ stent-related UTIs is not fully understood, emphasizing the need for more research to mitigate infections associated with stents.[15,16] This study aims to analyze the bacterial colonization patterns and UTIs that occur after endourological surgeries involving double J stents, along with the antibiotic sensitivity patterns of the isolated organisms.

METHODS

This cross-sectional, descriptive study was conducted in the Department of General Surgery at Nepal Police Hospital, Maharajgunj, Kathmandu, Nepal, from May 2025 to July 2025. The study population consisted of patients admitted to the Department of General Surgery who underwent endourological procedures involving the placement of double-J (DJ) stents. A convenient sampling technique was employed using a predefined proforma for data collection. The sample size was calculated based on the estimated prevalence of bacterial colonization in patients with indwelling DJ stents, which was 7.7 %.[17] Using the formula $n = (Z^2 * p * q) / e$ with a margin of error of 5%, the calculated sample size was 110. Patients eligible for inclusion were those who underwent endo-urological procedures with DJ stent placement. However, patients who did not consent to participate, those on steroid therapy, those with uncontrolled diabetes mellitus, and those already receiving antibiotic therapy were excluded from the study.

The proposed study was initiated only after obtaining formal ethical approval from the Institutional Review Committee of the Nepal Police Hospital (Reference No. 42). Before enrollment, written informed consent will be obtained from each participant to ensure voluntary participation, with full disclosure of the study's purpose, procedures, potential risks, and benefits.

All enrolled patients underwent stent placement as part of various indicated endo-urological procedures such as ureteroscopy, percutaneous nephrolithotomy, or other similar interventions. Following the stenting procedure, patients were clinically monitored throughout the indwelling period of the double-J (DJ) stent. The follow-up was continued until the scheduled or clinically indicated time of DJ stent removal. To minimize the risk of infection, a single dose of prophylactic broad-spectrum antibiotic was administered (Injection Ceftriazone 1 gm) 30 minutes before the endo-urological intervention.

Before removing the DJ stent, a mid-stream urine (MSU) sample was collected from each patient under sterile conditions and sent for routine urine culture and sensitivity analysis. At the time of stent removal, a 2–3 cm segment of the distal end of the DJ stent was aseptically cut and sent for microbiological culture to evaluate for bacterial colonization or biofilm formation. This helped assess the microbiological profile associated with indwelling stents and any potential correlation with urinary tract infections or asymptomatic bacteriuria. The collected data were inserted into MS Excel, and then SPSS version 21.0 was used for processing, analysis, and interpretation.

RESULTS

Patient demographics

Table 1: Patient Demographics

Age group	Number (Percentage)
Mean age	39.6 (18-74 years)
18-40	59 (53.64 %)
41-60	33 (30.0%)
>60	18 (16.36 %)
Gender Distribution	
Male	68 (61.82 %)
Female	42 (38.18 %)

Among 110 patients, the mean age of the patient was 39.6 (18- 74 years). There were 68 (61.82%) male and 42(38.18%) female patients. Patients in the age group 18-40 required endourological procedure with a DJ stent (n=59/53.64%). (Table:1)

Bacterial colonization and duration of DJ stenting

Table 2: Bacterial colonization and duration of DJ stenting

Bacterial Colonization	Number/Percentage
Bacterial colonization with urine samples	21 (19.09%)
Bacterial colonization with DJ stent culture	32 (29.09%)
DJ stent duration	
Average duration	21.4 days (7-42)
<14 days	26 (23.64 %)
>14 days	84 (76.36 %)

The total duration of the DJ placement ranged from 7 to 42 days. Among them, 26 (23.64 %) patients had stents placed for less than 14 days, and 84 (76.36%) patients had stents for equal to or more than 14 days. Bacterial colonies were found in 21 (19.09 %) of the urine samples and 32 (29.09 %) of the culture of the tip of the DJ stent segment. (Table:2)

Isolation of organisms

Table 3: Organism Isolated in Urine Culture

Organisms	Number (Percentage)
E. Coli	11 (52.38 %)
Klebsiella Pneumoniae	5 (23.82 %)
Pseudomonas Aeruginosa	2 (9.52 %)
Proteus Mirabilis	2 (9.52 %)
Acinetobacter Baumannii	1 (4.76 %)

Urine culture samples showed Escherichia Coli (11/52.38 %) as the most commonly isolated organism, followed by Klebsiella and Pseudomonas. Other organisms isolated were Proteus and Acinetobacter. (Table:3)

Table 4: Organism Isolated in DJ Stent Culture

Organisms	Number (Percentage)
E. Coli	15 (46.88 %)
Klebsiella Pneumoniae	8 (25.0 %)
Pseudomonas Aeruginosa	6 (18.75 %)
Proteus Mirabilis	2 (6.25 %)
Acinetobacter Baumannii	1 (3.12 %)

However, cultures from the DJ stent tip showed c oncerning reports of a high percentage of ESKAPE organisms, with Klebsiella, Pseudomonas, and Acinetobacter prevailing with 25, 18.75, and 6.25 % respectively. (Table:4)

Antibiotic sensitivity

Table 5: Antibiotic sensitivity among organisms isolated

Antibiotic	Urine culture (n)	DJ stent culture (n)
Amikacin	17	23
Levofloxacin	14	16
Nitrofurantoin	14	13
Ciprofloxacin	11	10
Cefixime	10	9
Amoxycillin	8	7
Cefepime	8	6
Piperacillin-Tazobactum	15	22
Polymyxin	3	8
Tigecycline	2	6
Colistin	2	6

Among both the urine and DJ stent culture samples, amikacin, Piperacillin/Tazobactam, levofloxacin, and nitrofurantoin were mostly found sensitive towards the organisms. However, a few cases needed stronger antibiotics like colistin and Tigecycline for management. (Table:5)

DISCUSSION

In this study, among 110 patients undergoing endourological procedures with DJ stenting, the mean age was 39.6 years (range 18–74), with a predominance of males (61.8%). Most patients (53.6%) were in the 18–40 age group. The mean duration of DJ stenting was 21.4 days, with 76.4% of patients having stents in place for more than 14 days. Bacterial colonization was identified in 19.1% of urine samples and 29.1% of DJ stent tip cultures. Escherichia coli was the most common organism isolated in both urine (52.4%) and DJ stent cultures (46.9%), followed by Klebsiella pneumoniae and Pseudomonas aeruginosa. Antibiotic sensitivity testing showed good susceptibility to amikacin, Piperacillin/ Tazobactam, levofloxacin, and nitrofurantoin, although some resistant organisms required treatment with colistin or tigecycline.

The current study sheds light on the demographics and patterns of bacterial colonization in patients undergoing endourological procedures with DJ stenting. A large portion of the patients fell within a younger age bracket (18–40 years), predominantly male, which aligns with previous reports on urolithiasis and obstructive uropathy, where men are more frequently affected due to greater susceptibility to dehydration and dietary influences.[18,19] The average duration of stenting was found to be 21.4 days, which is consistent with existing practice guidelines; however, the observation that 76% of patients had extended stent durations beyond 14 days may lead to increased colonization rates, as noted in past studies.[20,21]

Bacterial colonization in urine and DJ stents was notable, with rates of 19% and 29%, respectively, highlighting the ongoing issue of biofilm formation on stents.[22] Escherichia coli emerged as the most commonly isolated pathogen, followed by Klebsiella and Pseudomonas, which is consistent with international findings regarding urinary pathogens in catheterized patients.[23] Furthermore, the presence of ESKAPE pathogens—particularly Klebsiella pneumoniae, Pseudomonas aeruginosa, and Acinetobacter baumannii—was emphasized due to their resistance and ability to evade standard antibiotic treatments, creating significant challenges in urology and healthcare environments.[24] Their prevalence stresses the need for effective infection control measures and prudent antibiotic use to combat multidrug resistance.[25]

In terms of antibiotic sensitivity, the higher efficacy against amikacin, Piperacillin/Tazobactam, levofloxacin, and nitrofurantoin makes them reasonable empirical choices; however, the identification of resistant strains necessitating drugs like colistin and tigecycline highlights the emerging risk of difficult-to-treat gram-negative infections.[26] These findings imply that merely performing routine urine cultures could underestimate colonization levels, and examining the stent tip could facilitate more precise antimicrobial treatment.

Nonetheless, the findings are subject to limitations, such as being derived from a single center, a relatively small participant group, and the absence of long-term follow-up regarding infectious complications, which restricts the broader applicability of the results. Future multicenter investigations with molecular characterization of resistance genes would enhance the understanding of colonization dynamics and the actual impact of ESKAPE organisms on stent-associated infections.[27]

CONCLUSIONS

This research reveals a notable prevalence of bacterial colonization in patients with DJ stents, with E. coli identified as the most common organism, alongside the worrisome presence of ESKAPE pathogens like Klebsiella, Pseudomonas, and Acinetobacter species. These results emphasize the necessity of reducing the duration of stent placement, utilizing stringent aseptic practices, and consistently monitoring urine and stent cultures to inform targeted antibiotic treatment. To combat ESKAPE organisms, it is crucial to implement strategies such as antibiotic stewardship, surveillance cultures, the application of antimicrobial-coated stents, and strict adherence to infection control measures to curb multidrug resistance and enhance patient outcomes.

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CONFLICT OF INTEREST

None

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