Section: General Surgery

Original Research Article

STUDY OF INDICATIONS AND EARLY COMPLICATIONS OF URETERIC DOUBLE-J STENT – A PROSPECTIVE STUDY

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Received : 13/06/2025
Received in revised form : 02/08/2025
Accepted : 19/08/2025

Keywords:
Ureteric Stent, Double-J Stent, Obstructive Uropathy, Post-operative Complications, Renal Calculus, Urological Procedures.

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DOI: 10.47009/jamp.2025.7.4.282

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (4); 1489-1496

ABSTRACT

Background: Ureteric Double-J (DJ) stents are widely used to relieve urinary tract obstruction and to maintain ureteral patency following surgical or endoscopic interventions. Despite their efficacy, stent-related complications are common in the early post-operative period and remain a significant clinical concern affecting patient quality of life and treatment outcomes. **Objective:** To evaluate the indications for DJ stent insertion and to document early post-operative complications following stent insertion and identify factors associated with the development of early post-stent complications in a prospective patient cohort. **Materials and Methods:** A prospective observational study was conducted at Shridevi Institute of Medical Sciences, Tumkuru, over 12 months from February 2024 to February 2025 on 44 patients undergoing DJ stenting for various urological indications. Demographic data, clinical indications, laboratory investigations, and complications over a 6-week post-operative follow-up were recorded. Data were analyzed descriptively and compared with findings from previous literature. Statistical analysis was performed using R software version 4.1.3, with p-value <0.05 considered statistically significant: **Result:** The most common age group was 41–50 years (34.1%), with a male predominance (70.5%). Obstructive uropathy was the primary indication (90.9%), most frequently due to renal calculi (61.4%) and ureteric calculi (22.7%). Early complications included microscopic haematuria (54.5%), flank pain (54.5%), suprapubic pain (52.3%), urinary frequency (22.7%), and urgency (13.6%). Complication rates generally decreased over the follow-up period. Renal function improved in most patients by week 6. **Conclusion:** DJ stenting remains an essential tool for managing obstructive uropathy, particularly in stone-related disease. While early complications such as haematuria and pain are frequent, they are usually self-limiting. Regular follow-up is crucial to detect and manage complications effectively.

INTRODUCTION

The ureteric Double-J (DJ) stent, first introduced in the late 1960s, has become an indispensable device in urological practice. Since their introduction, DJ stents have revolutionized urological practice by providing a minimally invasive solution for managing urinary tract obstruction and facilitating urinary drainage.[1] Its design, featuring curls at both ends, prevents migration while maintaining urinary drainage from the kidney to the bladder. These tubular devices, typically measuring 4-8 French in diameter and 20-30 cm in length, are designed with the proximal coil sitting in the renal pelvis while the distal coil remains in the bladder, creating a continuous conduit for urine flow from the kidney to the bladder.[2] DJ stents are most commonly used in the management of obstructive uropathy, either from calculi, strictures, tumours, or post-surgical ureteric manipulation. Modern stents are manufactured from biocompatible materials including polyurethane, silicone, and various polymer composites, each with

ISSN (O): 2687-5365; ISSN (P): 2753-6556

distinct physical properties and biocompatibility profiles.[3] These materials exhibit molecular memory, enabling the stent to remain straight during insertion and resume its coiled shape once positioned within the urinary tract.

Contemporary DJ stents incorporate advanced biomaterials designed to minimize tissue reaction, prevent encrustation, and maintain patency throughout the indwelling period. Polyurethane stents offer excellent tensile strength and flexibility, while silicone-based stents provide superior biocompatibility with reduced inflammatory response.[4] Recent innovations include drug-eluting stents, biodegradable materials, and surface modifications to reduce bacterial adhesion and biofilm formation.[5]

The geometric design of DJ stents has evolved to optimize drainage efficiency while minimizing patient discomfort. Side holes along the stent body facilitate drainage and prevent obstruction from debris or blood clots. The diameter and positioning of these drainage holes significantly influence stent performance and complication rates.[6] Modern stents also incorporate radiopaque markers to facilitate fluoroscopic visualization during placement and subsequent radiological follow-up.

The placement of DJ stents provides temporary relief of obstruction, promotes ureteral healing, and facilitates the passage of small calculi where stents provide immediate relief of hydronephrosis and preserve renal function while definitive stone treatment is planned.[7] In cases of large or impacted stones, stent placement allows for staged management, reducing the risk of complications associated with emergency procedures.

Malignant ureteral obstruction represents another critical indication, where stents provide palliative drainage in patients with advanced pelvic malignancies or retroperitoneal metastases. In these cases, stent placement may be life-saving, preventing acute renal failure and allowing time for oncological management.[8] Benign ureteral strictures, whether congenital, inflammatory, or iatrogenic in origin, also benefit from temporary or long-term stent placement to maintain ureteral patency and prevent progressive renal deterioration.

Prophylactic stent placement has become standard practice in various urological procedures. Following ureteroscopy with laser lithotripsy, stents prevent ureteral oedema-induced obstruction and facilitate passage of stone fragments.[9] However, stent-related complications, such as irritative lower urinary tract symptoms, haematuria, infection, and flank pain, are frequently reported. Although many are self-limiting, these complications may impact patient quality of life and require medical intervention. Multiple patients, procedural, and device-related factors influence the development of DJ stent complications.[10] Patient factors include age, gender, baseline lower urinary tract symptoms, psychological profile, and comorbid conditions such as diabetes mellitus or chronic kidney disease.[11] Procedural factors including insertion technique, fluoroscopic time, use of lubricants, and prophylactic antibiotics also influence early complication rates.[12]

Understanding the common indications and early complications of DJ stenting is crucial for optimising patient selection, counselling, and post-operative care. While numerous studies have described stent-related outcomes, regional variations in patient demographics, disease prevalence, and surgical practice necessitate local data.[13] Most existing studies are retrospective, single-centre experiences with variable follow-up protocols and outcome measures.[14,15,16] Additionally, recent advances in stent materials and insertion techniques may have altered complication profiles compared to historical series.

The present prospective study aims to document the clinical indications for DJ stenting and analyse the spectrum and frequency of early post-operative complications over a 6-week follow-up period, comparing the findings with published literature. Such information is crucial for informed patient counselling, optimizing stent selection, and developing strategies to minimize stent-related morbidity. Furthermore, understanding factors associated with complications may guide the development of improved stent designs and insertion techniques.

MATERIALS AND METHODS

This prospective observational cohort study was conducted at a tertiary care academic medical centre over a 12-month period at Shridevi Institute of Medical Sciences, Tumkuru, from February 2024 to February 2025. The study protocol was designed to evaluate consecutive patients requiring DJ ureteric stent placement for various clinical indications. All procedures was performed by experienced urologists using standardized techniques and protocols to minimize procedural variability. The study was approved by the Institutional Ethics Committee, and informed consent was obtained from all participants.

A total of 44 consecutive patients undergoing DJ stenting for various urological indications were included. Inclusion criteria were

- Age >18 years
- Indication for DJ stenting due to obstructive or infectious uropathy, or post-operative ureteric protection
- Willingness to participate and attend follow-up visits
- Ability to provide informed consent
- Adequate baseline renal function (serum creatinine <2.0 mg/dL)

Exclusion Criteria Included

- Previous indwelling DJ stent within the past 3 months
- Pregnancy or lactation
- Active urinary tract infection at time of stent insertion

ISSN (O): 2687-5365; ISSN (P): 2753-6556

- Chronic renal failure requiring dialysis
- Known malignancy causing obstruction
- Severe bleeding disorders or anticoagulation precluding safe procedure
- Anatomical abnormalities preventing stent placement
- Previous adverse reactions to stent materials
- Life expectancy less than 3 months

Sample size estimation was based on previous studies reporting DJ stent complication rates. Manoj et al. reported an 80% prevalence of post-operative complications in their Indian cohort (21), while Noopur et al. found a 50% relative risk factor for increased urinary frequency (22). Using these estimates with a 95% confidence interval and 5% allowable error, the minimum required sample size was calculated as 44 patients.

The sample size calculation used the formula

$n = [Z^2_{1-\alpha/2} \times P_1(1-P_1) + P_2(1-P_2)] / [\log_0(1-d_1)]^2$

Where P_1 and P_2 represent anticipated prevalence rates, $Z^2_{1-\alpha/2}$ is the normal deviate at 95% confidence level, and d_1 represents relative allowable error. To account for potential dropouts and ensure adequate statistical power, it was planned to enrol 60 patients in this study.

Demographic details (age, gender), indication for stenting, and case-specific diagnoses were recorded. Laboratory investigations included urinalysis, complete blood count, renal function tests, and electrolytes before stenting, immediately after, and at follow-up visits (2, 4, and 6 weeks post-operatively). Radiological assessment was used when indicated to evaluate stent position. Complications were documented at each visit, including haematuria, pain, lower urinary tract symptoms (frequency, urgency, incontinence), fever, and urinary tract infection.

All DJ stents were inserted under regional or general anaesthesia using standard cystoscopy or retrograde ureteroscopy techniques. Stent size and length were selected according to patient height and anatomy. Correct placement was confirmed intraoperatively under fluoroscopy. All procedures will be performed according to standard institutional protocols with appropriate prophylactic measures.

Patients were reviewed at 2, 4, and 6 weeks post-operatively. Clinical evaluation, urinalysis, and laboratory tests were performed at each visit. Imaging was done if stent migration or malposition was suspected.

Data were entered into Microsoft Excel with subsequent analysis using R statistical software version 4.1.3 and analysed using descriptive statistics. Frequencies and percentages were calculated for categorical variables. Continuous variables were expressed as mean ± standard deviation. Univariate analysis will be performed to identify factors associated with early complications using chi-square tests for categorical variables and t-tests or Mann-Whitney U tests for continuous variables as appropriate. Multivariate logistic regression analysis will be conducted to identify independent predictors of complications, with results expressed as odds ratios with 95% confidence intervals. A p-value <0.05 will be considered statistically significant for all analyses. Comparisons with published studies were made narratively.

The study protocol was submitted to the Institutional Review Board for approval prior to patient enrolment. Written informed consent was obtained from all participants after detailed explanation of study procedures, risks, and benefits. Patient confidentiality was maintained throughout the study, with de-identification of data for analysis purposes. Participants could withdraw from the study at any time without affecting their clinical care.

Standardized case report forms were used to ensure consistent data collection across all study participants. Regular training sessions were conducted for research personnel to maintain data quality and protocol adherence. All data was verified through source document review, and electronic databases will be backed up regularly to prevent data loss. Missing data was handled using appropriate statistical methods based on the pattern and extent of missingness.

RESULTS

The study population showed a distinctive age distribution pattern. The largest age group was 41–50 years, representing 34.1% (n=15) of the total cohort. This was followed by patients in the 31-40 years age group at 27.3% (n=12), and those aged 51-60 years at 22.7% (n=10). Younger patients (≤30 years) constituted 11.4% (n=5), while older patients (>60 years) represented 4.5% (n=2) of the study population. The age distribution demonstrated a clear predominance in the middle-age groups, with 61.4% of patients falling between 31-50 years. This pattern suggests that DJ stenting procedures are most commonly required in the economically productive age group (Table 1).

Table 1: Distribution based on Age

Age	Frequency	Percentage
<20 years	1	2.3%
21 – 30 years	4	9.1%
31 – 40 years	12	27.3%
41 – 50 years	15	34.1%
51 – 60 years	10	22.7%
61 – 70 years	2	4.5%
Total	44	100%

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A significant male predominance was observed in the study population, with males comprising 70.5% (n=31) and females 29.5% (n=13) of the total cohort. This translates to a male-to-female ratio of approximately 2.4:1, indicating that males are more than twice as likely to require DJ stenting procedures. Obstructive uropathy emerged as the overwhelming primary indication for DJ stenting, accounting for 90.9% (n=40) of all cases. Infection-related indications were observed in 6.8% (n=3) of patients, while congenital anomalies necessitated stenting in 2.3% (n=1) of cases.

The dominance of obstructive uropathy as the primary indication underscores the critical role of DJ stents in managing urinary tract obstruction and preventing associated complications such as renal dysfunction and infection (Table 2).

Table 2: Distribution based on Indications of DJ stenting

Indications of DJ stenting	Frequency	Percentage
Obstructive uropathy	40	90.9%
Infection	3	6.8%
Congenital	1	2.3%
Total	44	100%

Detailed analysis of specific pathological conditions revealed that renal calculus was the most common indication, affecting 61.4% (n=27) of patients. Ureteric calculus was the second most frequent cause, present in 22.7% (n=10) of cases. Together, calculous disease (renal and ureteric stones) accounted for 84.1% of all stenting procedures. Less common indications included pyonephrosis in 9.1% (n=4) of patients, reflecting infectious complications requiring drainage. Rare indications such as emphysematous pyelonephritis, post-radical hysterectomy complications, and ruptured bladder post-hysterectomy each represented 2.3% (n=1) of cases (Table 3).

Table 3: Distribution based on case specific indication

Case Specific Indication	Frequency	Percentage
Renal calculus	27	61.4%
Ureteric calculus	10	22.7%
Pyonephrosis	4	9.1%
Emphysematous pyelonephritis	1	2.3%
Post radical Hysterectomy with Bilateral (B/L) salpingo oophorectomy	1	2.3%
Ruptured bladder post hysterectomy	1	2.3%

Pre-operative laboratory evaluation revealed abnormal parameters in several patients. Creatinine levels were elevated in 40.9% (n=18) of patients, while blood urea nitrogen was abnormal in 34.1% (n=15) of cases, indicating varying degrees of renal impairment prior to stent placement. Haematological parameters showed abnormalities in a subset of patients, with 22.7% (n=10) having abnormal haemoglobin levels and 20.5% (n=9) showing abnormal haematocrit values, possibly reflecting chronic disease or bleeding complications (Table 4).

Table 4: Distribution based on Urinalysis

Investigations / studies	st post op Visit - week 2		2nd post op Visit - week 4		3rd post op Visit - week 6	
Urine Analysis	N	Ab	N	Ab	N	Ab
Colour	32	12	30	14	24	20
Ph	44	0	44	0	44	0
Specific Gravity	44	0	44	0	44	0
Casts	40	4	35	9	29	15
White Blood Cells	40	4	36	8	29	15
Red Blood Cells	41	3	40	4	40	4

Serial laboratory monitoring demonstrated progressive improvement in most parameters. By the third post-operative visit (6 weeks), all patients showed normalization of creatinine and blood urea nitrogen levels, indicating successful relief of obstruction and restoration of renal function. Electrolyte balance (sodium and potassium) remained stable throughout the study period in all patients, suggesting adequate fluid and electrolyte management during the perioperative period.

Urinalysis revealed dynamic changes throughout the follow-up period. Initially, 72.7% (n=32) of patients had normal urine colour at the first post-operative

ISSN (O): 2687-5365; ISSN (P): 2753-6556

visit, but this decreased to 54.5% (n=24) by the third visit, with corresponding increase in abnormal findings. The presence of casts in urine showed an increasing trend, from 9.1% (n=4) immediately after stenting to 34.1% (n=15) at the sixth week. Similarly, white blood cell presence increased from 9.1% (n=4) to 34.1% (n=15), while red blood cell abnormalities remained relatively stable at around 9.1%.

The immediate post-operative period was characterized by several common complications. Microscopic haematuria was the most frequent complication, affecting 54.5% (n=24) of patients, followed closely by flank pain in 54.5% (n=24) and suprapubic pain in 52.3% (n=23) of patients. Macroscopic haematuria, while less common, was still significant, occurring in 18.2% (n=8) of patients immediately after stenting. Urinary symptoms including frequency (22.7%, n=10) and urgency (13.6%, n=6) were also notable early complications. Less frequent immediate complications included urinary incontinence in 6.8% (n=3) of patients. Importantly, no cases of stent migration, fracture, or uretero-arterial fistula were observed in the immediate post-operative period. (Table 5)

Table 5: Complications

COMPLICATIONS	IMMEDIATELY AFTER DJ STENTING	1ST POST OP VISIT - WEEK 2	2ND POST OP VISIT- WEEK 4	3RD POST OP VISIT- WEEK 6
Microscopic hematuria	24	13	15	15
Macroscopic hematuria	8	1	1	1
Flank Pain	24	16	16	17
Suprapubic Pain	23	17	16	16
Urinary Frequency	10	7	7	10
Urinary Urgency	6	5	7	10
Urinary Incontinence	3	0	1	2
Stent Migration	0	0	0	0
Stent Fracture	0	0	0	0
Urinary Tract Infection	0	1	2	1
Uretero-Arterial Fistula	0	0	0	0
Fever	0	1	2	1

During subsequent follow-up visits, the pattern of complications showed interesting trends. Microscopic haematuria decreased from 54.5% immediately post-operatively to 29.5% (n=13) at 2 weeks, remaining stable at 34.1% (n=15) and 34.1% (n=15) at 4 and 6 weeks respectively. Macroscopic haematuria showed marked improvement, reducing from 18.2% immediately post-operatively to just 2.3% (n=1) at each subsequent visit, indicating resolution of significant bleeding in most patients. Pain symptoms demonstrated variable patterns. Flank pain remained relatively stable, affecting 36.4% (n=16), 36.4% (n=16), and 38.6% (n=17) of patients at 2, 4, and 6-week visits respectively. Suprapubic pain showed slight improvement over time, from 38.6% (n=17) at 2 weeks to 36.4% (n=16) at both 4 and 6-week visits. Urinary symptoms exhibited mixed patterns. Frequency remained stable at 15.9% (n=7) at 2 and 4 weeks but increased to 22.7% (n=10) at 6 weeks. Urgency showed a concerning upward trend, increasing from 11.4% (n=5) at 2 weeks to 22.7% (n=10) at 6 weeks.

Urinary tract infections were relatively uncommon, occurring in 2.3% (n=1) of patients at the 2-week visit, increasing to 4.5% (n=2) at 4 weeks, and returning to 2.3% (n=1) at 6 weeks. Associated fever followed a similar pattern, suggesting effective management of infectious complications.

Radiological assessment of stent position and integrity was encouraging throughout the study period. All stents maintained proper positioning with the upper coil in the renal pelvis and lower coil in the bladder. No cases of stent migration or fracture were observed during the 6-week follow-up period. The lower coil maintained its complete circular configuration in all patients at all follow-up visits, indicating appropriate stent selection and placement technique (Table 6).

Table 6: Site of upper and lower coil and shape of lower coil during post-operative visits

	IMMEDIAT ELY AFTER DJ STENTING	1ST POSTOP VISIT - WEEK 2	2ND POSTOP VISIT - WEEK 4	3RD POSTOP VISIT - WEEK 6
SITE OF THE UPPER COIL	Stent coil in pelvis	Stent coil in pelvis	Stent coil in pelvis	Stent coil in pelvis
SITE OF THE LOWER COIL	Same side	Same side	Same side	Same side
THE LOWER COIL SHAPE	Complete circle	Complete circle	Complete circle	Complete circle

ISSN (O): 2687-5365; ISSN (P): 2753-6556

DISCUSSION

The demographic profile observed in this study aligns with established patterns in urological literature. The predominance of middle-aged patients (34.1% in 41-50 years group) reflects the peak incidence of urological conditions requiring stent placement, particularly stone disease and obstructive uropathy. Our study reinforces the predominance of middle-aged males requiring DJ stenting, a finding consistent with Kachba et al., Mogal et al., and Bansal et al.[17,18,19]

The significant male predominance (70.5%) observed in our study is consistent with epidemiological data suggesting higher prevalence of urolithiasis in males. This gender distribution has important implications for healthcare resource allocation and patient education programs, as males in the economically productive age group represent the primary target population for preventive measures.[18,20]

The overwhelming predominance of obstructive uropathy (90.9%) as the primary indication confirms the established role of DJ stents as first-line treatment for urinary tract obstruction. The specific breakdown showing renal calculus (61.4%) and ureteric calculus (22.7%) as the leading causes underscores the significant burden of stone disease in the study population aligns with global trends.[21,22] These findings are consistent with global trends showing increasing prevalence of urolithiasis, attributed to dietary changes, lifestyle factors, and environmental influences. The high proportion of stone-related indications supports the need for comprehensive stone prevention programs and dietary counselling in the target population.[23,24] The relatively low incidence of infectious indications (6.8%) and congenital causes (2.3%) reflects the effectiveness of modern urological management in preventing progression to stenting requirements for these conditions. However, the presence of complex cases such as pyonephrosis and emphysematous pyelonephritis highlights the continued importance of stenting in managing complicated infections.[25,26]

The high incidence of early complications, particularly microscopic haematuria (54.5%) and pain symptoms (>50%), emphasizes the need for comprehensive pre-procedural patient counselling. These findings are consistent with literature reports suggesting that stent-related symptoms are nearly universal in the early post-operative period.[27,28]

The gradual improvement in macroscopic haematuria from 18.2% immediately post-operatively to 2.3% at follow-up visits indicates successful adaptation and healing. However, the persistence of microscopic haematuria in approximately one-third of patients at 6 weeks suggests ongoing irritation and the potential need for symptom management strategies.[29,30]

Pain symptoms varied but remained common throughout follow-up. This finding underscores the importance of effective pain management protocols and patient education about expected symptom duration. The persistence of pain symptoms may also indicate the need for stent removal as soon as clinically appropriate.[31,32]

The concerning trend of increasing urinary urgency from 11.4% at 2 weeks to 22.7% at 6 weeks warrants attention. This pattern may indicate progressive bladder irritation and supports arguments for minimizing stent indwell time when possible.[33,34]

The normalization of creatinine and blood urea nitrogen levels by the 6-week visit in all patients demonstrates the effectiveness of DJ stenting in relieving obstruction and restoring renal function. This finding supports the established role of stents as renal-preserving interventions in obstructive uropathy.[35,36] The progressive changes in urinalysis parameters, including increasing presence of casts and white blood cells, may indicate ongoing inflammatory response or early signs of stent-related complications. These findings emphasize the importance of regular monitoring and consideration of stent removal timing.[37,38]

The results of this study have several important implications for clinical practice:

1. Patient Selection and Counselling: The demographic profile supports targeted screening and preventive measures in middle-aged males. Comprehensive pre-procedural counselling should address the high likelihood of early symptoms.
2. Follow-up Protocols: The evolution of complications over time supports structured follow-up protocols with specific attention to pain management and infectious complications.
3. Symptom Management: The high incidence and persistence of pain symptoms indicate the need for proactive pain management strategies and consideration of stent removal timing.
4. Quality Assurance: The absence of serious complications such as migration or fracture validates current stenting techniques but emphasizes the importance of proper procedural protocols.

Several limitations should be acknowledged in interpreting these results. The relatively small sample size (n=44) may limit generalizability, particularly for rare complications. The 6-week follow-up period may not capture longer-term complications or outcomes. Additionally, the single-centre design may introduce selection bias related to institutional practices and patient population characteristics. Future multi-centre studies with larger sample sizes and longer follow-up periods would provide more robust evidence for clinical decision-making. Investigation of factors predicting complications and optimization of stent selection criteria represent important areas for future research.

While most complications are mild and self-limiting, they can significantly affect quality of life. Strategies to mitigate these include optimising stent material/design, appropriate sizing, and patient counselling.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

CONCLUSION

This prospective study provides valuable insights into the indications and early complications of DJ ureteric stenting in contemporary urological practice. The findings confirm that DJ stenting remains a crucial intervention for managing urinary tract obstruction, with obstructive uropathy due to calculous disease representing the primary indication.

The demographic profile showing predominance in middle-aged males has important implications for healthcare planning and preventive strategies. Although early complications such as haematuria and pain are common, the overall safety profile supports the continued use of DJ stents with appropriate patient selection and management protocols.

The normalization of renal function parameters and absence of serious complications validates current stenting techniques while highlighting the importance of comprehensive patient care, including pre-procedural counselling, structured follow-up, and proactive symptom management.

These findings contribute to the evidence base for DJ stent utilization and support the development of standardized protocols for patient management. Future research should focus on optimization of stent selection, timing of removal, and strategies for minimizing stent-related morbidity while maintaining therapeutic efficacy. The study underscores the continued importance of DJ stenting in modern urological practice while emphasizing the need for individualized patient care and evidence-based management protocols to optimize outcomes and minimize complications.

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