

Management of Forgotten, Encrusted, and Fragmented Double-J Ureteral Stents: A Prospective Cross-Sectional Observational Study from a Tertiary Care Center.

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Abstract

Background:

Forgotten, encrusted, and fragmented double-J ureteral stents represent a preventable yet clinically demanding urological problem. Delayed retrieval increases the risk of stone formation, infection, fragmentation, and the need for combined endourological procedures.

Objectives:

To evaluate the clinical presentation, pattern of stent encrustation or fragmentation, management strategies, and short-term outcomes among patients treated for forgotten double-J ureteral stents at a tertiary care center.

Methods:

This prospective observational study included 22 consecutive patients managed at A C Subba Reddy Government Medical College & Hospital, Dargamitta, Nellore, Andhra Pradesh, India, from April 01, 2026, to April 30, 2026. Demographic details, symptoms, stent duration, imaging findings, operative procedures, complications, and clearance outcomes were analysed descriptively.

Results:

The mean age was 43.6 ± 12.8 years, and females constituted 54.5% of the cohort. The mean retained stent duration was 19.4 ± 9.7 months. Flank pain was the most frequent symptom. Encrusted-only stents were seen in 59.1%, while 27.3% had both encrustation and fragmentation. Ureteroscopy, cystolithotripsy, retrograde intrarenal surgery, and percutaneous nephrolithotomy were used according to encrustation burden. Complete stent clearance was achieved in all patients, with stone-free status in 90.9%.

Conclusion:

Multimodal endourological management provided high clearance with acceptable morbidity in patients with forgotten, encrusted, and fragmented double-J stents.

Recommendations:

Structured stent registries, patient counselling, and reminder systems should be implemented to prevent prolonged indwelling time and reduce avoidable complications.

Keywords: double-J stent; forgotten ureteral stent; encrustation; fragmentation; ureteroscopy; percutaneous nephrolithotomy; endourology

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Introduction

Double-J ureteral stents are widely used in contemporary urological practice for maintaining ureteral drainage after endoscopic stone surgery, relieving obstruction, protecting the ureter after reconstructive procedures, and supporting healing after ureteric injury. Their use is generally safe when the stent is removed or exchanged within the planned interval. However, these devices are temporary implants, and failure to retrieve them can transform a routine adjunct into a complex clinical problem. Stent-related symptoms, infection, migration, encrustation, stone formation, and fragmentation are well-recognized complications, particularly when the indwelling duration is prolonged [1,2]. Forgotten ureteral stents are especially relevant in busy tertiary care settings where patients are referred from distant areas, follow-up is fragmented, and a written or digital tracking system is not uniformly used. The patient is often asymptomatic during the early phase, and the urgency of removal is underestimated. Once mineral deposition begins, the stent can become fixed at the renal coil, ureteric segment, or vesical coil. Bacterial biofilm, urinary tract infection, lithogenic urine, previous urolithiasis, metabolic abnormalities, and chronic kidney disease further increase the likelihood of encrustation [3,4]. The classic study by el-Faqih et al. showed a strong relation between indwelling time and encrustation burden, establishing dwell time as the most important modifiable determinant [5].

The management of an encrusted or fragmented double-J stent requires careful anatomical assessment rather than forceful extraction. Imaging with ultrasonography, radiography, and computed tomography helps define the location and stone burden around the stent. Several classification systems, including the FECal and KUB grading systems, were developed to estimate complexity and guide procedure selection [6-9]. Treatment commonly requires cystolithotripsy for bladder coil encrustation, ureteroscopy for ureteric encrustation, retrograde intrarenal surgery for proximal coil disease, and percutaneous nephrolithotomy for heavy renal stone burden [7,10].

Although open surgery was used historically for severe cases, current endourological techniques allow most forgotten stents to be managed with minimally invasive approaches. The challenge is to plan staged or combined procedures according to stone burden, infection status, and renal function. Published series have shown high stent-free rates with multimodal endourology, but the number of procedures and risk of morbidity increase with longer indwelling duration and severe encrustation [10-13].

The objective of the present study was to evaluate the demographic profile, clinical presentation, duration of retained stent, pattern and severity of encrustation or fragmentation, management procedures, and treatment

outcomes among patients with forgotten double-J ureteral stents treated at a tertiary care center. The study also aimed to highlight practical preventive recommendations relevant to institutional stent tracking and patient counselling.

Methodology

Study design and setting

This was a hospital-based prospective cross-sectional observational study conducted in the Department of Urology at A C Subba Reddy Government Medical College & Hospital, Dargamitta, Nellore, Andhra Pradesh, India. The institution is a government tertiary-care teaching hospital providing specialist urological outpatient, emergency, inpatient, diagnostic, and operative services to patients from Nellore and surrounding regions. The Department of Urology manages patients requiring endoscopic and surgical treatment for urinary tract obstruction, urolithiasis, retained ureteral stents, and other complex urological conditions. Patients included in the study were evaluated through the urology outpatient department, emergency services, or inpatient referral system and were treated using the available endourological and operative facilities.

Study period and data collection

The retrospective study period covered five years, from **April 01, 2021, to March 31, 2026**. Case records of eligible patients diagnosed and treated during this period were reviewed. Data extraction and compilation were carried out between **April 01, 2026, and April 30, 2026**, after obtaining Institutional Ethics Committee approval. Eligible patients diagnosed and treated for forgotten, encrusted, and/or fragmented double-J ureteral stents during this period were enrolled consecutively. Clinical, radiological, operative, and outcome-related data were collected prospectively using patient records, imaging reports, operative notes, and discharge summaries after obtaining Institutional Ethics Committee approval (EC Ref No.: ECR/961/Inst/AP/2017/RR-25/97-04/28-03-26; dated 28-Mar-2026).

Study population

A total of 22 consecutive patients with forgotten, encrusted, and/or fragmented double-J ureteral stents were included in the final analysis. A forgotten stent was defined as a ureteral stent retained beyond the advised removal or exchange date and presenting with clinical, radiological, or endoscopic evidence of delayed removal-related complications. The study included adult patients of either sex who required active intervention for stent removal, encrustation clearance, or management of stent fragmentation.

Inclusion and exclusion criteria

Patients were included when they had a retained double-J ureteral stent with encrustation, fragmentation, or both, and were willing to undergo evaluation and treatment at the study center. Patients with incomplete records, those who refused intervention, and those with retained non-ureteral urinary drainage devices were excluded. Patients with active urinary tract infection were first stabilized with culture-directed antibiotics before definitive endourological treatment.

Clinical and radiological assessment

Each patient underwent detailed history-taking with documentation of the indication for original stent placement, duration of retention, symptoms, comorbidities, and prior urological procedures. Physical examination, complete blood count, renal function tests, urine microscopy, and urine culture were performed. Imaging included ultrasonography, plain radiography of the kidney-ureter-bladder region, and computed tomography when clinically indicated. The site and severity of encrustation were recorded using a practical clinical classification based on the location and burden of encrustation; standardized systems such as FECal and KUB were considered while planning treatment [8,9].

Treatment protocol

The operative approach was individualized according to stent status, stone burden, infection status, and renal function. Distal coil encrustation was managed by cystolithotripsy and cystoscopic extraction. Ureteric segment encrustation was treated by ureteroscopy with intracorporeal lithotripsy. Proximal coil encrustation and renal stone burden were managed by retrograde intrarenal surgery or percutaneous nephrolithotomy. Combined or staged procedures were selected for extensive encrustation, fragmented stents, bilateral coil involvement, or anticipated long operative time. Similar multimodal endourological principles have been described in earlier studies on retained and encrusted stents [6,7,10,13,14].

Outcome measures and statistical analysis

The primary outcome was complete stent clearance. Secondary outcomes included stone-free status, number of procedures, need for single-session or staged management, hospital stay, and perioperative complications. Complications such as postoperative fever, haematuria, mucosal injury, sepsis, ureteric avulsion, open conversion, and mortality were recorded. Data were entered in a spreadsheet and analysed using descriptive statistics. Categorical variables were expressed as frequency and

percentage, while continuous variables were summarized as mean $\pm$ standard deviation or range, as appropriate.

Measures to Address Potential Sources of Bias

Several measures were adopted to reduce potential bias. Selection bias was minimized by including all consecutive eligible patients treated during the predefined study period rather than selecting cases according to disease severity or treatment outcome. Uniform inclusion and exclusion criteria were applied to the entire cohort.

To reduce information and misclassification bias, clinical, laboratory, radiological, operative, and outcome data were cross-checked using available case records, investigation reports, imaging findings, operative notes, and discharge summaries. Consistent operational definitions were applied for forgotten stent, encrustation, fragmentation, complete stent clearance, stone-free status, and perioperative complications.

Treatment decisions were based on the location and severity of encrustation, associated stone burden, infection status, and renal function rather than the anticipated study outcome. Patients with active urinary tract infection received culture-directed antibiotic treatment before definitive intervention, thereby reducing variability related to uncontrolled infection. All predefined primary and secondary outcomes were reported for the complete included cohort to limit selective outcome reporting. As this was a retrospective descriptive study without an untreated comparison group, causal associations were not inferred.

Ethical considerations

Institutional Ethics Committee approval was obtained before commencement of the study. Written informed consent was obtained from all participants before intervention. Confidentiality of patient identity and clinical records was maintained throughout data collection and analysis.

Results

A total of 22 patients with forgotten, encrusted, and/or fragmented double-J ureteral stents were included in the final analysis. The mean age of the study population was 43.6 ± 12.8 years, with the largest proportion of patients belonging to the 41–60 years age group. Females constituted 54.5% of the cohort. Diabetes mellitus was the most common associated comorbidity, observed in 27.3% of patients, followed by hypertension in 18.2%. Previous stenting for ureteric calculi was the most frequent primary indication for double-J stent placement. Baseline

demographic and clinical characteristics are shown in Table 1.

Table 1. Demographic and clinical profile of the study population

Variable	Category	Number	Percentage
Age group	≤30 years	4	18.2
	31–40 years	5	22.7
	41–60 years	9	40.9
	>60 years	4	18.2
Sex	Male	10	45.5
	Female	12	54.5
Comorbidities	Diabetes mellitus	6	27.3
	Hypertension	4	18.2
	Chronic kidney disease	2	9.1
Primary indication for DJ stenting	Ureteric calculus	12	54.5
	Renal calculus	5	22.7
	Postoperative ureteric protection	3	13.6
	Pelvi-ureteric junction obstruction	2	9.1

The duration of retained stent placement ranged from 5 months to 42 months, with a mean duration of 19.4 ± 9.7 months. Most patients had retained stents for more than one year. Flank pain was the most common presenting complaint, followed by lower urinary tract symptoms,

dysuria, fever, and haematuria. Urine culture was positive in 8 patients, and all culture-positive patients received appropriate antibiotic therapy before definitive intervention. The clinical presentation and duration of the retained stent are summarized in Table 2.

Table 2. Duration of retained stent and presenting symptoms

Variable	Category	Number	Percentage
Duration of retained stent	<6 months	2	9.1
	6–12 months	6	27.3
	13–24 months	8	36.4
	>24 months	6	27.3
Presenting symptoms*	Flank pain	17	77.3
	Lower urinary tract symptoms	13	59.1
	Dysuria	11	50.0
	Fever	7	31.8
	Haematuria	5	22.7
Urine culture	Positive	8	36.4
	Negative	14	63.6

*Multiple symptoms were present in some patients.

On imaging and endoscopic assessment, isolated encrustation was observed in 13 patients, encrustation with fragmentation in 6 patients, and isolated fragmentation without major encrustation in 3 patients. Encrustation involving both the proximal and distal coils was seen in 8

patients. Based on the severity of encrustation, most patients were categorized under moderate to severe grades. The pattern and grading of stent encrustation are presented in Table 3.

Table 3. Pattern and severity of DJ stent encrustation and fragmentation

Variable	Category	Number	Percentage
Stent status	Encrusted only	13	59.1
	Encrusted and fragmented	6	27.3
	Fragmented only	3	13.6
Site of encrustation	Distal coil only	6	27.3
	Proximal coil only	4	18.2
	Ureteric segment	4	18.2
	Both proximal and distal coils	8	36.4
	Both proximal and distal coils	8	36.4
Severity grade	Mild	5	22.7
	Moderate	9	40.9
	Severe	8	36.4

Endoscopic management was the preferred approach in most patients. Cystolithotripsy and ureteroscopy were the most commonly performed procedures. Combined endourological procedures were required in patients with extensive encrustation involving both coils or associated fragmentation. A single-session procedure was adequate in

13 patients, whereas 9 patients required staged management. Percutaneous nephrolithotomy was required in 5 patients with significant proximal coil encrustation or renal stone burden. The operative management details are shown in Table 4.

Table 4. Management procedures performed

Procedure*	Number	Percentage
Cystoscopic stent removal alone	3	13.6
Cystolithotripsy	15	68.2
Ureteroscopy with intracorporeal lithotripsy	16	72.7
Retrograde intrarenal surgery	7	31.8
Percutaneous nephrolithotomy	5	22.7
Extracorporeal shock wave lithotripsy	2	9.1
Single-session management	13	59.1
Staged management	9	40.9

**Some patients required more than one procedure.*

Complete stent clearance was achieved in all 22 patients. Stone-free status after completion of all planned procedures was achieved in 20 patients, while 2 patients had clinically insignificant residual fragments that were managed conservatively. The mean number of procedures required per patient was 1.6 ± 0.7 . The mean hospital stay was $4.8 \pm$

2.1 days. Postoperative fever was the most common complication, followed by transient haematuria. No mortality, ureteric avulsion, or open surgical conversion was observed. Outcome measures and complications are summarized in Table 5.

Table 5. Treatment outcomes and complications

Outcome variable	Number / Value	Percentage
Complete stent clearance	22	100.0
Stone-free status	20	90.9
Clinically insignificant residual fragments	2	9.1
Single-session complete clearance	13	59.1
Staged clearance	9	40.9
Mean number of procedures per patient	1.6 ± 0.7	—
Mean hospital stay, days	4.8 ± 2.1	—
Postoperative fever	3	13.6
Transient haematuria	2	9.1
Ureteric mucosal injury	1	4.5
Sepsis	1	4.5
Open surgical conversion	0	0
Mortality	0	0

Overall, forgotten double-J ureteral stents most commonly presented with flank pain and urinary symptoms, and the majority had moderate to severe encrustation at the time of diagnosis. Multimodal endourological management achieved complete stent clearance in all patients, with acceptable morbidity and no requirement for open surgical conversion.

Discussion

Forgotten double-J ureteral stents remain an avoidable source of morbidity despite the routine nature of ureteral stenting. The present prospective observational study evaluated 22 patients managed over a short study period at a tertiary care center and showed that most patients presented after more than one year of stent retention. This pattern is consistent with earlier reports describing prolonged indwelling time as the dominant factor behind encrustation, fragmentation, and increased procedural complexity [3-5,10]. The mean retained duration of 19.4 months in the present cohort explains the high proportion of moderate to severe encrustation.

The demographic profile showed a slight female predominance and a mean age in the fourth decade. Ureteric calculus was the most common original indication for stent placement, reflecting the close relationship between stone disease and forgotten stent morbidity. This observation agrees with the systematic review by Wang et al., where stone-related treatment was the leading indication for original stent insertion [4]. Diabetes mellitus, hypertension, and chronic kidney disease were present in a subset of patients, and these conditions have practical relevance because they increase the risk of infection, delayed recovery, and perioperative physiological stress.

Flank pain was the leading presenting symptom, followed by lower urinary tract symptoms and dysuria. These symptoms are not specific, but their occurrence in a patient

with a previous stent history should prompt imaging. Positive urine culture was found in 36.4% of patients, highlighting the need for microbiological assessment before endoscopic intervention. Biofilm and infection can accelerate mineral deposition and complicate operative management; therefore, culture-directed treatment before definitive surgery is a key safety step [3,6].

The operative profile confirms the value of multimodal endourology. Ureteroscopy and cystolithotripsy were the most frequently used procedures, while retrograde intrarenal surgery and percutaneous nephrolithotomy were reserved for proximal coil disease and renal stone burden. Complete stent clearance was achieved in all patients, and 90.9% were stone-free after completion of planned procedures. These findings are comparable with published series in which combined endourological techniques achieved high stent-free rates and reduced the need for open surgery [7,12-14]. The need for staged procedures in 40.9% of patients reflects the burden of encrustation and the importance of avoiding prolonged single-session operative stress.

Complications were limited and manageable. Postoperative fever, transient haematuria, mucosal injury, and one episode of sepsis were observed, while no ureteric avulsion, open conversion, or mortality occurred. This outcome supports the principle that careful preoperative planning, infection control, staged decision-making, and appropriate choice of access route can improve safety. Grading systems such as FECal and KUB support structured treatment planning, although clinical judgement remains essential when encrustation is extensive, or the stent is fragmented [8,9].

The findings are generalizable to similar tertiary care hospitals managing referred urolithiasis patients with delayed follow-up, limited stent tracking, and variable patient awareness. Because the sample was consecutive and the treatment strategy reflected routine clinical practice, the results provide practical guidance for comparable resource

settings. Still, institutions with advanced laser systems, digital stent registries, and longer follow-up pathways can report different procedure numbers, hospital stays, and complication rates.

Conclusion

Forgotten, encrusted, and fragmented double-J ureteral stents are clinically significant complications of delayed stent removal. In this prospective observational study of 22 patients, most cases were related to stone disease and prolonged indwelling duration. Flank pain and urinary symptoms were the commonest presentations, while moderate to severe encrustation was frequent at diagnosis. Multimodal endourological management using cystolithotripsy, ureteroscopy, retrograde intrarenal surgery, and percutaneous nephrolithotomy achieved complete stent clearance in all patients, with low morbidity and no open conversion. The study supports individualized, staged, and infection-controlled management for complex retained stents. Prevention through stent registries, written discharge advice, and active reminder systems remains essential to reduce avoidable patient morbidity.

Limitations

The study was conducted in a single tertiary care center with a small sample size and a short recruitment period. Long-term renal functional outcomes, recurrence of stone disease, and delayed ureteric complications were not assessed. The severity grading was based on practical clinical categorization rather than uniform application of a single validated scoring system for all patients.

Recommendations

Every patient receiving a double-J ureteral stent should receive written information on the indication, insertion date, expected removal date, and warning symptoms. A digital or manual stent registry should be maintained in the urology department, with responsibility assigned to a named staff member. Reminder systems using phone calls, text messages, or hospital records should be used before the scheduled removal date. High-risk patients with stone disease, infection, diabetes, chronic kidney disease, or poor follow-up access require closer surveillance. For retained stents, imaging-based procedural planning, urine culture optimization, and staged endourological treatment should be preferred over forceful extraction.

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Abbreviations

DJ: Double-J
ESWL: Extracorporeal shock wave lithotripsy
FECal: Forgotten, encrusted, and calcified
KUB: Kidney-ureter-bladder
LUTS: Lower urinary tract symptoms
PCNL: Percutaneous nephrolithotomy
RIRS: Retrograde intrarenal surgery
URS: Ureteroscopy

Source of Funding

The study had no funding.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Dr. Chenna Sai Krishna: Conceptualization of the study, study design, clinical evaluation, supervision of patient enrolment and data collection, interpretation of urological findings, manuscript drafting, correspondence, and final coordination of article submission.

Dr. Juturu Jayaraju: Clinical case identification, urological assessment, operative management support, data collection, interpretation of radiological and operative findings, literature review, and critical revision of the manuscript.

Dr. Gidion Bangla: Clinical support in perioperative and allied surgical care, review of patient records, assessment of associated surgical variables, literature review, and critical editing of the manuscript.

Data Availability

Data are available from the corresponding author on reasonable request.

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