

REVIEW

Management of forgotten double J stents: Insight from a systematic review of case reports

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Summary *Background: Double J Stent is one of the procedures frequently performed in the field of urology. Forgotten DJ Stent is a problem that can cause serious complications. This systematic review aims to explore complications and management of patients with forgotten double J stents.*

Methods: Scientific literature was obtained from PubMed, ScienceDirect, and Google Scholar with a publication year limited to 2013-2023. The search string included 'forgotten DJ stent, case report, complication'. Inclusion criteria were as follows: (1) case report or series, (2) available individual patient data, and (3) English language. Data are presented descriptively.

Results: Of the 210 records, 14 articles published were analyzed after the full-text assessment. Forgotten DJ stent sufferers vary from age 7 years to 88 years. Male gender was predominant. The initial symptoms were flank pain and micturition disorders. The complications experienced were encrustation, multiple stones formation, emphysematous pyelonephritis, emphysematous perinephric abscess, fragmentation, and vesical calculus. In management, it was found that procedures were selected according to patient's situation at that time and the condition of the stent. There are case reports that report management that differed from those initially planned. All the patients were alive after treatment.

Conclusions: A forgotten DJ stent can have serious consequences. The management approach requires a combination of various endourological procedures. In consideration of potential complications, urologists need to be careful in making decisions about the choice of technique used.

KEY WORDS: *Complication; Management, Forgotten Double J stents; Endourology.*

Submitted 26 October 2024; Accepted 9 December 2024

INTRODUCTION

The DJ Stent is one of the tools that urologists need to drain and divert upper urinary tract. Over the past few decades, there have been continued advances in placement techniques and materials used for ureteral stent. This technique has gained recognition from urologists worldwide as a necessary procedure in urology surgical

practice. The DJ stent is the most frequently applied indwelling stent in the treatment of symptoms of upper urinary tract obstruction (1).

The DJ stent is essential and frequently employed in various procedures. It helps keep the ureters open, ensuring the reduction of swelling and the healing of any potential injuries. Therefore, it is considered a useful tool in the postoperative therapy of patients with retroperitoneal tumours or fibrosis, ureteropelvic junction stenosis, ureteral strictures, ureteral stones, or iatrogenic ureteral injury, A DJ stent is typically the preferred treatment option for patients suffering from obstructive uropathy caused by urinary tract stones.

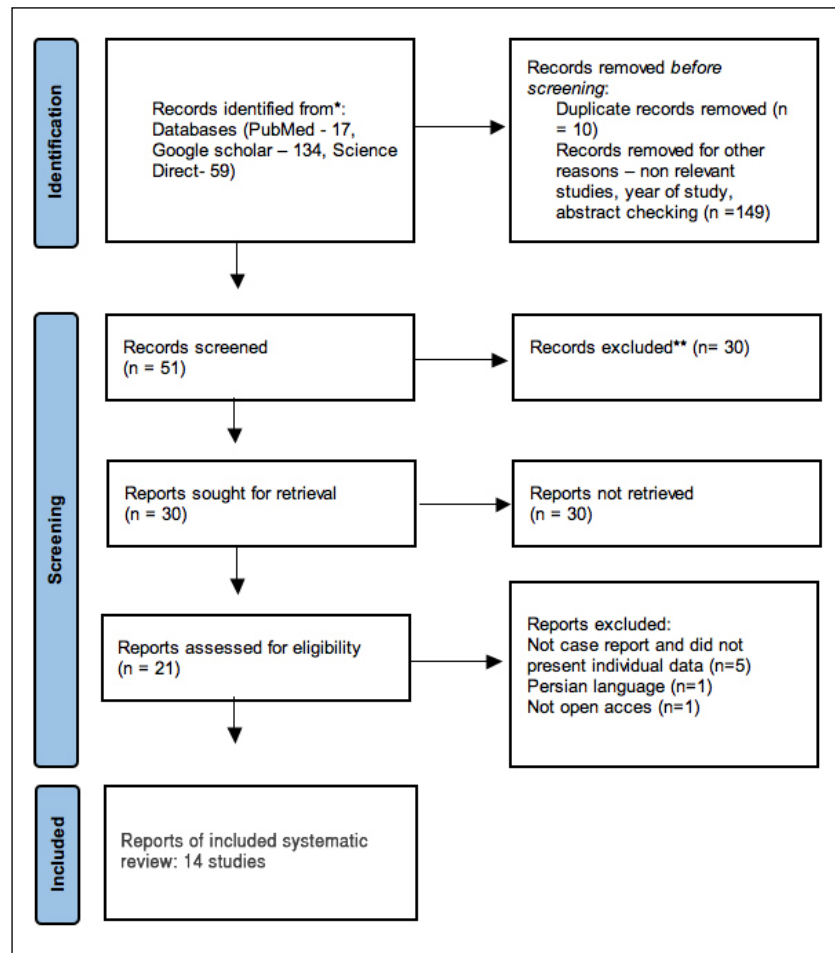
Nevertheless, the use of DJ stents can cause some complication (2). Forgotten DJ stent is one of the problems associated with the use of DJ stents which have become a challenging problem for urologists. As a consequence of widespread use of stents, in association to lack of information and compliance with routine follow up visits, patients may forget for years that they have had the placement of a DJ stent in the pelvic-ureteral system. Hematuria, stent occlusion, migration, fragmentation, encrustation, stone formation, recurrent urinary tract infections (UTI), obstruction of the urinary tract, kidney failure, fistula formation in the iliac arteries, and even fatal complications can result from a forgotten DJ stent (3).

Management of the forgotten DJ stent varies depending on the complications experienced and differs from patient to patient (1). This management requires an individual approach in view of possible long-term and short-term complications secondary to the use of DJ stents. Comparison of complications and assessment of outcomes of management in different cases can provide new insights into managing forgotten DJ stents. Managing a forgotten DJ may be time-consuming, complex, complicated, risky, and expensive, so the treatment choice must be precise and accurate (4).

METHODS

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were adhered to in the present study (5).

Figure 1.
Flowchart study selection.



Ethics statement

Ethical approval was not crucial for this study, as it did not involve direct patients, and all included data were previously published.

The Protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) by PRISMA-P guidelines (PROSPERO CRD42024577367).

Eligibility

A systematic search focused on case reports and a series about forgotten double J stents, which featured information on individual patients. Case reports published in 2013-2023 having complete individual data, written in English, discussing appropriate topics, namely management and complications of forgotten DJ stents, were included in the analysis. Exclusion criteria were being not case report manuscript, lack of individual data, not written in English and not open access. Article duplication were eliminated prior to the screening of titles and abstracts.

Search strategy and selection of studies

On August 23, 2023, we performed a systematic database search in *PubMed*, *ScienceDirect*, and *Google Scholar*.

An exhaustive exploration was also accomplished through a manual or bibliography search of relevant papers.

The keywords "*forgotten/neglected double J stent, complication, case report*" were used in the search. The titles and abstracts of the articles were assessed independently for prospective eligibility as studies for the full-text review.

Article extraction

We independently extracted essential information from the included studies using a structured and standardized form. The extracted information includes author, year, country, number of patients, age, sex, symptoms, history, forgotten DJ stent time duration, complication, management and outcome.

Quality assessment

We independently assessed the risk of bias in included studies by implementing *Joanna Briggs Institute* (JBI) checklist, that is used for critical appraisal of case studies. We categorized the results as 'yes, cannot tell, and no' (6).

Statistical analysis

A meta-analysis was not feasible because this systematic review evaluated a rare condition which relies on pub-

lished case reports. Similar findings of variables, such as symptoms, are grouped to evaluate their frequency.

RESULTS

Study selection

Ten of the 210 records returned by the search were duplicates. After sifting through titles and abstracts, we eliminated 149 articles. Following the full-text assessment, we included 14 published articles in this systematic review. The PRISMA flow diagram (Figure 1) presents the procedure for selecting studies and the exclusion justifications.

Quality assessment

We evaluated each included case report using the JBI critical appraisal checklist (Table 1). The summarized critical appraisal checklist shows that the studies were generally of moderate to good quality.

Study and demographic characteristics

This systematic review of published cases included 14 case reports (Table 2). Most research was conducted in developing countries, including India (4 studies). Forgotten DJ stent sufferers range in age from 7 to 88. Male gender predominated in most of the studies (10 studies).

Table 1.
Article quality assessment.

No	Author	Were patient's demographic characteristics clearly described?	Was the patient's history clearly described and presented as a timeline?	Was the current clinical condition of the patient on presentation clearly described?	Were diagnostic tests or assessment methods and the results clearly described?	Was the intervention(s) or treatment procedure(s) clearly described?	Was the post-intervention clinical condition clearly described?	Were adverse events (harms) or unanticipated events identified and described?	Does the case report provide takeaway lessons?
1	Aboutaleb, et al, 2021, UAE (12)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	Ahmed, et al, 2021, Yemen (13)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Sigdel et al, 2021, Nepal (14)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Hee lee et al, 2022, Republic of Korea (15)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Prihadi et al, 2018, Indonesia (16)	Yes	Yes	Yes	No	Yes	Yes	No	Yes
6	Alwesali et al, 2022, Saudi Arabia (17)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	Sharma, 2018, India (18)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	Ghorai et al, 2022, India (19)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Kandemir et al, 2019, Turkey (20)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	Nihal Er et al, 2023, Turkey (21)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	Aamiir, et al, 2022, India (22)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	Gupta et al, 2017, India (23)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	Yan Gu et al, 2016, China (24)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	Kumsa, et al, 2022, Ethiopia (25)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2.
Research characteristics.

NAuthor, year, country	Number of patient	Age	Sex	Symptoms									
				Flank ache disorders	Micturition pain	Abdominal limb swelling	Lower	Fever	Hematuria	Diarrhea	Nocturia	Duration of symptoms	
Aboutaleb, et al, 2021, UAE (12)	1	49 yo	male	Yes	Yes	No	No	No	No	No	No	No	1 month
Ahmed, et al, 2021, Yemen (13)	1	32yo	male	yes	Yes	No	No	No	No	No	No	No	3 days
Sigdel et al, 2021, Nepal (14)	1	35 yo	female	No	Yes	Yes	Yes	No	No	No	No	No	3 days
Hee lee et al, 2022, Republic of Korea (15)	1	56 yo	female	No	No	Yes	No	Yes	No	No	No	No	4 days
Prihadi et al, 2018, Indonesia (16)	1	40 yo	female	Yes	Yes	No	No	No	Yes	No	No	No	NA
Alwesali et al, 2022, Saudi Arabia (17)	1	13 yo	male	No	No	Yes	No	No	No	Yes	No	No	3 days
Sharma, 2018, India (18)	1	38 yo	male	Yes	Yes	No	No	Yes, low grade	No	No	No	No	1 year
Ghorai et al, 2022, India (19)	1	65 yo	male	No	Yes	No	No	No	No	No	Yes	No	2 years
Kandemir et al, 2019, Turkey (20)	1	30 yo	male	Yes	Yes	No	No	No	No	No	No	No	NA
Nihal Er et al, 2023, Turkey (21)	1	7 yo	female	No	Yes	No	No	No	No	No	No	No	10 days
Aamiir, et al, 2022, India (22)	1	28 yo	male	Yes	No	No	No	No	No	No	No	No	5 months
Gupta et al, 2017, India (23)	1	32yo	male	Yes	No	No	No	No	No	No	No	No	NA
Yan Gu et al, 2016, China (24)	1	88 yo	male	No	Yes	No	No	Yes	No	No	No	No	1 week
Kumsa, et al, 2022, Ethiopia (25)	1	22 yo	male	Yes	Yes	No	No	No	No	No	No	No	3 years

Symptoms

Most people complain of flank pain and micturition disorders as their initial symptoms. Diarrhea and nocturia are sporadic. The duration of symptoms varies depending on their appearance.

History and forgotten DJ stent time duration

The patient's medical history varies, including procedures related to ureteric/pelvic/kidney stone treatment, ureteral stricture with UTI, a surgical procedure to remove a giant uterine myoma, renal transplant, muscle-invasive bladder

tumour, sigmoid colon cancer, partial resection of the bladder and nonspecific flank surgery. In addition, there were patients with a history of previously forgotten DJ stent treatment. DJ stents were forgotten per periods ranging from 1 to 17 years.

Complications

The complications experienced were encrustation, multiple stones formation, emphysematous pyelonephritis, emphysematous perinephric abscess, fragmentation, and vesical calculus.

Management and outcome

Procedures used for treatment were based on the patient's situation. Sometimes procedures differed from those initially planned.

For example, a *percutaneous nephrolithotomy* (PCNL) was performed in a patient who was originally scheduled for ureterorenoscopy lithotripsy, that was not effective in

removing the DJ stent. In another case, the planned cystoscopic laser lithotripsy was not feasible because the preoperative endoscopic examination showed a bladder stone with a radius of about 2 cm at the tip of the double-J catheter from the right kidney.

All the patients remained alive after treatment for DJ stent removal.

Table 3.
Management and outcome.

Author, year, country	History	Forgotten DJ stent timeduration	Complication	Management	Outcome
Aboutaleb, et al, 2021, UAE	Post ureteric stone treatment	10 years	The whole stent was covered with a thick layer of encrustation with multiple stones formation	Endorse cystolithotripsy with Holmium YAG laser for the bladder calculus and semirigid/flexible ureteroscopy with Holmium YAG laser lithotripsy for ureteral stones and encrusted stent	Alive
Ahmed, et al, 2021, Yemen	Right open nephrolithotomy with double j stent placement due to obstructed right renal pelvis stone	1 year	Double-J stent was separated into four parts. and the stones were observed in the total parts of the right urinary tract system from the renal pelvis to the bladder with a 20 x 15 mm stone impacting the left renal pelvis. huge radiolucent bladder stone around the double j stent	The left ureteroscopic ureterolithotomy and double j stent placement were done under spinal anesthesia during the first operation. Then, right open nephro-ureterolithotomy with open cystolithotomy were performed after 1 month of previous surgery to remove the stone and forgotten double j stent	Alive
Sigdel et al, 2021, Nepal	History of extracorporeal shock wave lithotripsy (ESWL)	5 years	Emphysematous pyelonephritis	Surgical drainage to control the sepsis. Few days later after control of sepsis and optimization, left nephrectomy and removal of retained DJ stent was done	Alive
Hee lee et al, 2022, Republic of Korea	Ureteral stricture with UTI	10 years	Encrustation, Emphysematous perinephric abscess	Retained DJS removal and vesicolitholapaxy. A piece of fractured stent was removed via open ureterolithotomy	Alive
Prihadi et al, 2018, Indonesia	Surgical procedure to remove a giant uterine myoma	4 years	No	Ureterorenoscopic lithotripsy, but it failed to remove the remaining encrusted double-J stent. As a result, percutaneous nephrolithotomy was performed successfully	Alive
Alwesali et al, 2022, Saudi Arabia	Renal transplant 13 years ago in India for end stage renal disease of unknown etiology	13 years	No encrustation	Nephrostomy was performed and antegrade pyelogram. Two weeks later, the patient became hemodynamically stable and underwent a DJ stent removal without any stenting due to stricture	Alive
Sharma, 2018, India	History of right-sided laparoscopic Anderson-Hynes dismembered pyeloplasty with double J (DJ) stenting performed for right pelviureteric junction obstruction 5 years back	5 years	Right DJ stent without encrustation and radiopaque shadow in left renal region	Ureteric stent removal followed by placement of right-sided percutaneous nephrostomy (PCN). He underwent right nephrectomy followed by left percutaneous nephrolithotomy	Alive
Ghorai et al, 2022, India	ureterolithotomy with left sided DJ stenting elsewhere 17 years ago for a ureteral stone	17 years	An abdominal X ray revealed an encrusted left sided DJ stent with its lower end showing a large radio opacity suggestive of a vesical calculus	underwent percutaneous cystolithotomy using pneumatic lithotripsy along with removal of the forgotten DJ stent under intravenous antibiotic cover	Alive
Kandemir et al, 2019, Turkey	Endoscopic stone surgery due to right ureteral stone and kidney stone 11 years ago		fragmented and severely encrusted ureteral	Cystoscopy was made under general anesthesia. The foreign object was removed with forceps. Then with ureterorenoscope, the stones integrated with the stent at the end of the piece of DJ stent in the ureter were fragmented with pneumolithotripter. Stone pieces and the second removed part of the stent were extracted with foreign object forceps. Then using nephroscope through percutaneous intervention, the stones at the end of the third torn piece of DJ stent were fragmented with pneumolithotripter. They were extracted with forceps	Alive
Nihal Er et al, 2023, Turkey	A history of kidney stones, and a double-j catheter was placed in her right kidney as a treatment for kidney stones	11 years	A bladder stone about 2 cm in size was formed around the double-J catheter	The patient was planned cystoscopic laser lithotripsy. After the pre-operative examinations and follow-up results came out normal, the patient was taken to operation. Because a bladder stone with a radius of approximately 2 cm on the end of a double-J catheter from the right kidney was spotted, It was decided that it was no suitable for lithotripsy because of the size of the stone. Therefore, transition to open surgery was decided	Alive
Aamiir, et al, 2022, India	The stent placed 11 years back as a part of Percutaneous Nephrolithotomy (PCNL) for right renal stone, had forgotten	1 year	Large urinary bladder stone with encrusted Double J stent and calculus deposits along the entire length of the stent	The patient was then managed in two sittings, as an open cystolithotomy, followed a few months later by a combination of ureteroscopic lithotripsy and percutaneous lithotomy	Alive

	it for 6 years, underwent open cystolithotomy for the encrusted DJ stent and concomitant urinary bladder stone, was again lost to follow up				
<i>Gupta et al, 2017, India</i>	Passage of tube like structure (lower end of right DJ stent) through ileal conduit 15 days back. He had undergone radical cystectomy with ileal conduit for muscle invasive bladder tumor six years back in another hospital	5 years	Bilateral Staghorn Calculus with Forgotten Double J Stent in Ileal Conduit Patient	Patient was successfully treated with minimally invasive therapy in the form of combined bilateral PCNL (Percutaneous Nephrolithotomy) and ESWL (Extracorporeal Shock Wave Lithotripsy) therapy	Alive
<i>Yan Gu et al, 2016, China</i>	Approximately 6 years prior, the patient had undergone simultaneous radical resection of sigmoid colon cancer and partial resection of the bladder	6 years	Presence of an entire coiled double-J stent with calculi from the kidney to the bladder	A computed tomography scan revealed mild hydronephrosis of the left kidney and one J end of the stent in the bladder. The stent was removed successfully by cystourethroscopy and holmium laser lithotripsy	Alive
<i>Kumsa, et al, 2022, Ethiopia</i>	Nonspecific flank surgery 15 years ago	6 years 15 years	Severe stent encrustation at the presentation. He also had a solitary bladder stone and many pelvic stones discovered	Cytolithotripsy and semirigid ureteroscopy with laser lithotripsy were performed, and the encrusted stent was removed. Subsequently, an open cytolithotomy was done. Followed by an ultrasound-guided PCNL at which time the remaining stones were removed	Alive

DISCUSSION

Demographic characteristics

Most cases were observed in developing countries, including India (4 cases). A forgotten DJ stent is frequent in developing nations, with patients from lower socioeconomic classes being more susceptible (7). In fact, patients from lower socioeconomic backgrounds may have less access to quality healthcare. They need to receive adequate counselling, to avoid misunderstandings about their treatment. Individuals from lower socioeconomic classes often face financial constraints that can affect their ability to seek medical care or to attend follow-up appointments. Delays in stent removal can increase the risk of complications (26).

The age of patients with forgotten DJ stent ranged from 7 to 88. Male gender predominated in most studies (10 studies). A review of hospital data from 2000 to 2013, including 28 cases of forgotten DJ stents, revealed that the average age of patients was 37.7 ± 14 years (3). A retrospective study on forgotten DJ stent patients between January 2009 and December 2019 reported an average age of 32.1 years (1). *Patil et al.* reported an average age of 56.66 years (2) and *Adanur et al.* of 38.2 ± 25.06 years (range from 2 to 86 years) (4). *Ali* observed an average age of 59.12 ± 9.8 years, ranging from 34 to 70.8. The majority of these cases involved men. In *Adanur's* study, 39 out of 54 patients were men, while 15 were women (4). This contrasts with the findings on another study, where the majority were women, with 9 out of 16 patients (56.25%) (8). *Lin et al.* observed that patients over 60 were 3.6 times more likely to forget their DJ stent than younger patients (27).

Symptoms

Most patients complained of flank pain and micturition disorders as their initial symptoms. Diarrhea and nocturia are sporadic. The duration of symptoms was variable. A study identified urinary irritation and hematuria as the most frequent complaints (3). In another study, pain and dysuria

were the most common issues (1). *Patil et al.* reported that patients typically presented with low back pain, dysuria, hematuria, and fever (2). Additionally, another study indicated that pelvic pain with lower urinary tract symptoms were reported by most patients, with 9 out of 16 (56.25%) experiencing these symptoms. Recurrent urinary tract infections were found in 2 patients (12.5%), while 4 cases (25%) showed no symptoms (8).

History and forgotten DJ stent time duration

The medical history of patients varies, including procedures related to ureteric/pelvic/kidney stone treatment, ureteral stricture with UTI, surgical removal of a giant uterine myoma, renal transplant, muscle-invasive bladder tumour, sigmoid colon cancer, partial resection of the bladder and nonspecific flank surgery. In addition, there are patients with a history of previously forgotten DJ stent treatment. DJ stents remained forgotten for a period ranging from 1 to 17 years. Other studies reported an average stent indwelling time of 38.96 months¹, 22.6 ± 30.3 (6-144) months (4) and 1.73 ± 0.9 (0.11-3.4) years (8). DJ stents generally must be replaced or removed within six weeks to 6 months to avoid complications (2).

Complications

The complications observed were encrustation, multiple stones formation, emphysematous pyelonephritis, emphysematous perinephric abscess, fragmentation, and vesical calculus (1). The study of *Hajjaj* reported several complications occurring during or after stent removal, including stent fragmentation (20%), fever (16%), sepsis (8%), and hematuria requiring a transfusion (4%) (9). In a series of 16 cases, severe stent encrustation was seen in ten cases; two cases involved urinary tract obstruction, one involved stent migration, and two involved stent fragmentation⁸. Another study reviewed 50,000 procedures performed on 36,688 patients between 1996 and 2021. Complications were related to malposition of the DJ stent, migration and obstruction of the ureteral stent, and symptoms of bladder irritation; hematuria was detected in 5,213 cases,

demanding blood transfusion in 7 instances 10. The severity of symptoms depends on the duration of stent indwelling time and the degree of encrustation and stone formation. Longer forgotten stents are more likely to cause significant morbidity (28).

The treatment of case reported in our review yielded the encouraging result that every patient survived, whereas three of the twenty-eight patients involved in another investigation passed out due to complications following the intervention for stent removal (3).

Management and outcomes

The treatment should be multimodal and individualized and often the initial planned treatment has to be changed due to unexpected situations. Sometimes the DJ stent cannot be removed with the planned procedure, so a different procedure has to be performed. In addition, during the examination, other unexpected problems, such as stones, can be found requiring making adjustments. The procedure performed also depends on the patient's condition.

Many procedures can be performed for the removal of forgotten stents, such as cystoscopic extraction of the stent, *percutaneous cystolithotomy* (PCLT), *percutaneous nephrolithotomy* (PCNL), *ureterorenoscopy lithotripsy* (URSL), *extracorporeal shock wave lithotripsy* (ESWL) with cystoscopic stent removal (1). The choice of procedure depends on variables such as location and extent of calcification and associated stent injury. All patients with stents should receive counseling regarding potential long-term complications. Especially if stents are forgotten for more than a year, they may have a very thick layer of deposits on their surface and may require additional procedures such as shock wave lithotripsy, *ureteroscopy* (URS), and PCNL, alone or in combination, with great caution to prevent related morbidities (2).

The procedure to be carried out requires accurate preoperative evaluation. Preoperative evaluation is critical, involving a thorough history and physical examination, evaluation through urine culture and sensitivity tests, appropriate radiological imaging, such as *Kidney Ureter Bladder* (KUB) X-ray, ultrasound, or *non-contrast CT* (NCCT), and serum creatinine assessment (26-28).

Sohrab *et al.* described removal of stent using endourology techniques and extracorporeal shock wave lithotripsy (ESWL) (3). Mahmood *et al.* reported ureteroscopy as the most common primary surgery (1). Another paper reported that 14 children experienced retention of DJ stent retention that were removed using ESWL, *cystolithotripsy* (CLT), and PCNL (11). In Nawaz Ali's study, four patients underwent cystoscopic stent removal, four CLT, three had CLT followed by PCNL, two had their fragmented stents removed by ureteroscopy and one by open pyelolithotomy (8).

Prevention

Prevention remains a critical aspect of managing forgotten stents, emphasizing the importance of proper patient counseling regarding the stent's indwelling time and the necessity of follow-up. Establishing a stent registry with patient details and scheduled removal dates coupled with automated reminders via social media to patients and healthcare providers can significantly reduce the inci-

dence of forgotten stents. Additionally, engaging patients and relatives in the follow-up process is essential to prevent complications and mitigate the associated morbidity and healthcare costs. The effective management of forgotten DJ stents hinges on a comprehensive approach that integrates timely intervention, meticulous follow-up, and proactive prevention strategies (26-28).

Limitation of the study

This review considered case report data, so further research needs to be carried out prospectively. This research also has not been able to explore long-term complications from stent removal management due to forgotten DJ Stent. Future research is recommended to investigate complications from stent removal management.

CONCLUSIONS

A forgotten DJ stent can lead to significant consequences, necessitating a management approach that combines various endourological procedures while carefully considering potential complications. Urologists must exercise caution when deciding on the appropriate technique. Healthcare providers must inform all patients with an implanted stent about the long-term risks of prolonged stenting and stress the need for timely removal or replacement.

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DECLARATIONS

Ethical approval: Ethical approval was not crucial for this study, as it did not involve direct patients, and all included data were previously published.

Availability of data and material: Availability of Data and Materials Data and materials used in our study are open to access by request.

Competing interests: No conflict of interest was declared by the authors.

Funding: -.

Authors' contributions: Y.A.A, S.W, N.R, A.G.P.P, A.J.N.D.N and K.M.S; **Methodology:** Y.A.A, S.W, N.R, A.G.P.P, A.J.N.D.N and K.M.S; **Investigation:** Y.A.A, S.W, N.R, A.G.P.P, A.J.N.D.N, A.S.W, and K.M.S; **Writing Original Draft:** Y.A.A, S.W, N.R, A.G.P.P, A.J.N.D.N, A.S.W, and K.M.S; **Writing review & editing:** Y.A.A, S.W and K.M.S; **Resources:** Y.A.A, S.W, N.R, A.G.P.P, A.J.N.D.N and K.M.S; **Visualization:** N.R, and A.G.P.P; **Supervision:** Y.A.A and S.W.

Acknowledgments: None.

Conference presentation: This article has never been presented at any conference before.

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