African Urology 2024;4:71-74
https://doi.org/10.36303/AUJ.0142

AFRICAN UROLOGY
ISSN 2710-2750 EISSN 2710-2750

ORIGINAL RESEARCH

Single-sitting endourological management of retained ureteral stents at Groote Schuur Hospital: a four-year retrospective study

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Introduction: Double-J stents have become essential for endourological and open urological procedures. Removing severely encrusted and retained ureteral stents poses a management challenge for urologists, as multiple procedures are often required to remove them.

Objectives: The main objective is determining the proportion of patients with retained stents who can be rendered stent-free with single-sitting endourological management. Other objectives are to describe the number of procedures required to render patients with retained stents stone- and stent-free and to describe the demographical and clinical variables of patients with retained ureteral stents at Groote Schuur Hospital (GSH).

Materials and methods: A retrospective study was conducted between 1 February 2018 and 31 January 2022. The files of 30 patients who met the inclusion criteria with retained and encrusted stents were reviewed. All patients were initially evaluated with radiographic imaging to assess stone burden. Treatment decisions were based on the FECal (forgotten-encrusted-calcified) classification of retained stents. Multimodal endourological procedures were performed to render the patients stone- and stent-free.

Results: The average age of the participants was 39.4 years, while the male participants were the most common (66%; *n* = 19). A total of 87 urological procedures were performed to render all 30 patients stone- and stent-free. The average duration of stent indwelling time was 20.35 months, with a range of 4–70 months. The main indication for stent placement was stone obstruction (55.56%). Of the patients, 41% (*n* = 12) had percutaneous nephrolithotomy (PCNL), while 48% (*n* = 14) received ureteroscopy and laser lithotripsy. The most common FECal classification was IV at 59% (*n* = 17). Stent encrustation most commonly affected the right side (55.56%).

Conclusion: The endoscopic combined approach is a safe and feasible technique that removes retained and encrusted stents in a single procedure.

Keywords: FECal, retained, stent, encrusted, endourological, management, stone

Introduction

Ureteral stents have become a fundamental part of many urological procedures. They are mainly indicated after ureteral surgery to manage obstruction secondary to stone, ureteropelvic junction obstruction, strictures, congenital anomalies, and malignancy (Table I, Figure 1). They are also placed during complex abdominal pelvic surgeries to identify ureters and after iatrogenic ureteral injuries.[1] Urolithiasis accounted for 69.7% of cases that required stent insertion.[2]

On the contrary, if the stents are left for a prolonged time, the patients start experiencing complications, necessitating endourological techniques to resolve them. Retained stents were a common challenge among the low socioeconomic status, low education, and patients from rural areas.[3,4] Physician-related factors, like the lack of proper counselling of patients, also contributed to "forgotten" retained stents.[4]

Table I: Indication for stent insertion

Indication for stent insertion	Frequency	Percentage
Post-surgery endoscopic	7	23
Post-surgery open	1	3
Stone obstruction	17	57
Ureteric stricture	5	17
Total	30	100

Complication rates have increased due to the increased rate of stent insertion globally. If left unmanaged, retained stents pose real morbidity and mortality.[5] Stent encrustation is recorded as one of the most common and severe complications of these indwelling stents, mostly in polyurethane double-J stents compared to silicone double-J stents. The encrustation of stents is the process by which mineral crystals are deposited onto the lumen and surface of ureteral stents. The exact aetiology of encrustation is unclear.[6] Multiple procedures may be required to remove encrusted stents, and up to 16% of endourology lawsuits are related to stents.[7]

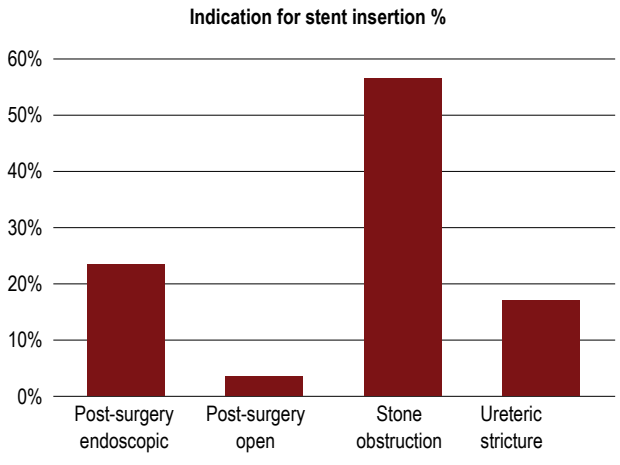

Figure 1: Bar chart for Indication for stenting

Methodology

Study design

This study is a retrospective folder review describing the management of all retained ureteral stents over the last four years at GSH. It was conducted at GSH, a large state-funded teaching and referral hospital situated on the slopes of Devil's Peak in Cape Town City, South Africa. Founded in 1938, the hospital is affiliated with the University of Cape Town and has a bed capacity of 893. The hospital has a dedicated stone clinic, and hence manages stone cases in its drainage areas of referral facilities.

Inclusion criteria were patients with retained double-J ureteral stents and surgery for removal performed at GSH. Exclusion criteria included Resonance® metallic stents, stents not retained, missing records, ureteral stents in cutaneous ureterostomies, and not retained double-J ureteral stents such as ureteral catheters. All patients meeting the inclusion criteria managed for retained stents at GSH over the last four years, between 2018 and 2022, were included.

The convenience sampling method was used. The principal researcher was the primary person involved in examining patient records and doing data entry for patients managed with retained stents at GSH. The data collection tool was a structured form with the following details: age, gender, indication for stent insertion, stent dwell time to first procedure, laterality of stent, FECal classification, number of procedures to stent removal, and number of procedures to stone-free. Data was entered into Microsoft Access Data. Statistical Package for the Social Sciences (SPSS) software was used for data analysis. Continuous variables were reported with the appropriate measures of central tendency, and categorical variables were presented as proportions/percentages.

The Surgical Division Research Ethics Committee and the University of Cape Town Human Research Ethics Committee granted authorisation for this study, with approval number 109/2022.

Results

We retrospectively analysed the data of 30 patients (19 males, 11 females) who required management for retained ureteral stents between 1 February 2018 and 31 January 2022. All 30 patients had functioning kidneys after standard evaluation with non-contrast computed tomography (CT) and scintigraphy in suspicious cases. The average age of the participants was 39.4 years, with more men

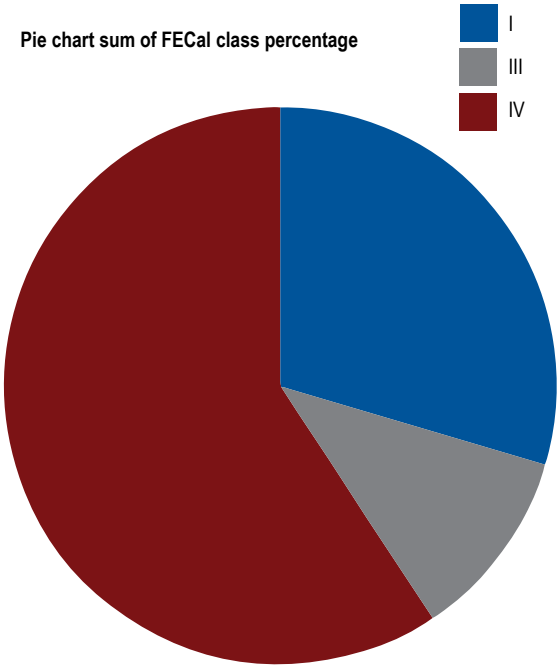

Figure 3: FECal classification distribution

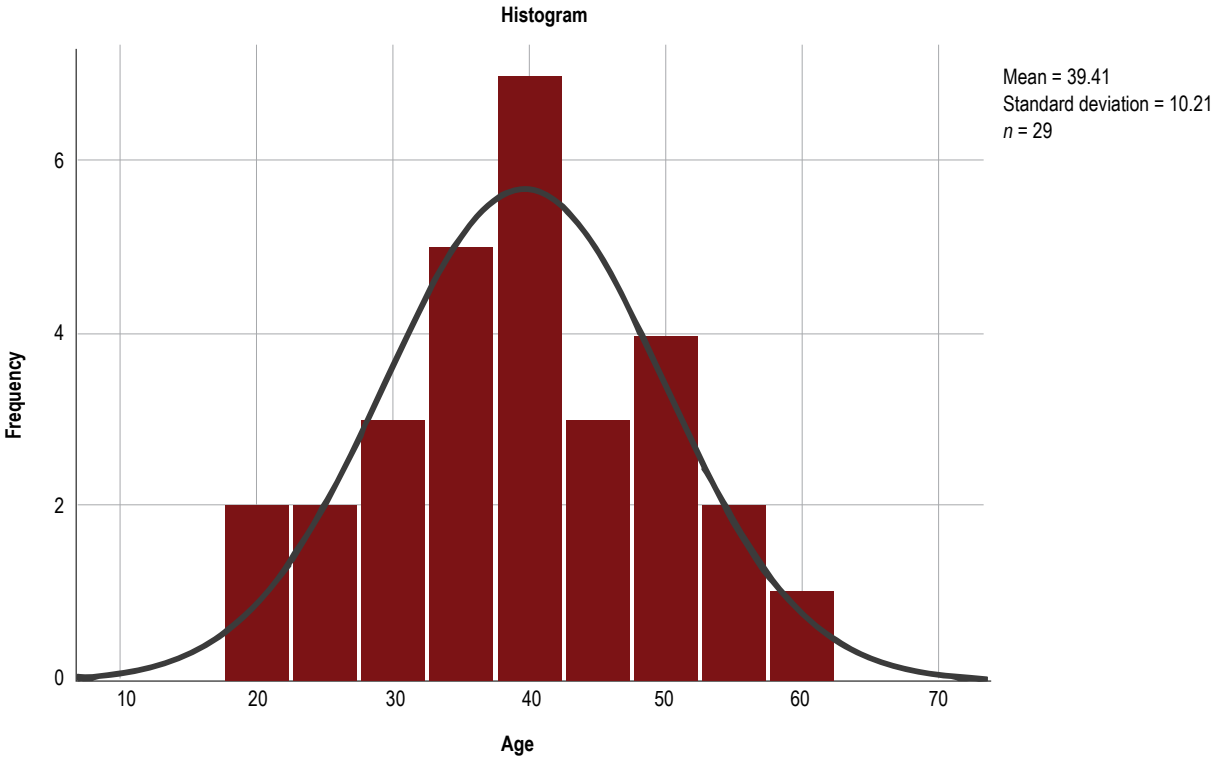

Figure 2: Histogram for age distribution

Table II: Demographic data

	FECal class			
	I	II	III	IV
Number of patients	10	0	3	17
Age (mean)	39.68	0	38.89	37.94
Gender (M : F)	7 (70%) : 3 (30%%)	0	2 (66.67%) : 1 (33.33%)	10 (58.82%) : 7 (41.18%)
Laterality				
Left	4 (44.44%)	0	3 (100%)	11 (64.71%)
Right	5 (55.56%)		0	6 (35.29%)
Indwelling time (months)	19.3	0	11.7	16
Reasons for stents				
Urolithiasis/stone				
Obstruction	5 (55.56%)	0	2 (66.67%)	10 (58.82%)
Post-surgery endoscopic	4 (44.44%)		0	3 (17.65%)
Ureteric stricture Post-surgery open	0 1		1 (33.33%)	4 (23.53%)
Procedures performed				
URS + RIRS	4 (44.44%)	0	2 (66.67%)	1 (5.88%)
PCNL + RIRS	0		1 (33.33%)	3 (17.65%)
PCNL + URS + RIRS	0		0	0
CLT + URS + RIRS	5 (55.56%)		0	5 (29.41%)
CLT + PCNL + RIRS	0		0	8 (47.06%)
	0		0	0

CLT – Cystolitholapaxy
PCNL – Percutaneous nephrolithotomy
URS – Ureterorenoscopy
RIRS – Retrograde intrarenal surgery

affected than women. The age range of the patients was 20–58 years (Figure 2).

Table II presents the patient demographics, indications for primary stenting, FECal classification (Table III, Figure 3), laterality, indwelling time, and type and number of procedures performed to render the patient stone- and stent-free. Of the 30 patients, 27 had combined endourological approaches, except three patients who had open cystolithotomy to remove bladder stent encrustations. One combined operative session was sufficient for 90% of the patients.

The team performed a total of 87 urological procedures to render all 30 patients free of stones and stents. The records show that an average of 2.9 procedures were necessary to make the patients stone- and stent-free. The range was 1–9 procedures per patient. The range of ureteral stent indwelling time was 4–70 months. Of the patients, 41% had PCNL, while 48% (*n* = 14) underwent cystolitholapaxy (CLT). PCNL was the most cited intervention for grade IV. PCNL was not offered to FECal grade I and II encrustations. Ureterorenoscopy (URS) laser lithotripsy and electrokinetic lithotripsy (EKL) were commonly used for ureteral stent encrustations, especially in groups with a lower stone burden (grade I–III). Retrograde intrarenal surgery (RIRS) was performed in all cases after stone and stent removal to check for clearance. In addition, radiography via plain X-ray and CT scan was used in select cases to check for stone clearance. Most (57%) patients with encrusted stents had a history of urolithiasis.

Discussion

The use of ureteral stents for relieving ureteral obstruction was first reported and recorded in 1967[8]. Stent encrustation remains among the most severe complications of double-J ureteral stents. Stents play a pivotal role in managing various urological conditions; however, without timely change, they are prone to various complications, such as haematuria, stent occlusion, migration, fragmentation, encrustation, urinary tract infection, and renal impairment [9,10] .It has been shown that stent encrustation is directly related to the duration of indwelling time [8].

In our study, a stent's verified mean indwelling time was approximately 20 months (80 weeks). These findings are comparable to the 22.7 months reported by Monga et al.[5] El-Faqih et al.[16] showed that when stents stayed more than 12 weeks, they had more than 76.3% chance of encrustation. Prolonged indwelling periods are the most critical factor for encrustation. Other factors also implicated are a history of stone disease, pregnancy, urinary sepsis, chronic kidney disease, and congenital or metabolic abnormalities.[11,12] In our series, the majority (60%) of the patients had a recorded history of stone disease as a risk factor for stent encrustation.

Some researchers have reported good success rates in managing stent encrustation by employing endourological procedures in a single setting.[13,14] However, more than one operative session is often required to successfully make the patients stone- and stent-free. Our series recorded an average of 2.9 urological procedures for every patient to render them stone- and stent-free. This average

is similar to the results reported in other studies of 2.7 and 2.28 procedures to remove stents and clear associated stones.[15,16] Only three patients required open cystolithotomy due to a large bladder stone burden, making endourological intervention unsuccessful. Three patients required more than one operative session to render them stone- and stent-free.

In our hospital, patients with a reduced glomerular filtration rate underwent a renogram to quantify renal function objectively. It is prudent to offer and administer a nephrectomy instead of performing multiple procedures and processes to remove all stones from a non-functional kidney.[17]

At GSH, retrograde removal of a stent is attempted under fluoroscopy guidance if a lack of encrustation is seen on plain radiography. If resistance is encountered and the proximal curl fails to uncoil, ureteroscopy is done after the insertion of two guidewires, leaving one in place as a safety guidewire. Bladder encrustations are treated first with CLT. Our series dealt with ureteric encrustations by electrokinetic lithotripsy or laser lithotripsy. Proximal encrustations were managed by laser lithotripsy and PCNL for larger stone burdens.

Solving the ureteric and bladder components of stent encrustations always preceded PCNL. PCNL was done via the Galdakao-modified supine Valdivia position after ultrasound-guided puncture. The main advantage of this position is the ability to simultaneously address both encrustations in the proximal and distal ends[18]. Additionally, the anaesthetist has better control of the airway, and the surgeon can operate while sitting. This technique is similar to a single surgeon's sizeable experience described by Roberto Iglesias et al., who managed 50 patients in a combined single-session endourological approach.[19] All the procedures were conducted without intraoperative complications, and no significant postoperative complications occurred.

The FECal classification system, created and developed by Acosta-Miranda et al., is simple to use.[20] It incorporates stone location and size despite being limited by a small sample of nine patients during its development.

Recommendations

Patients with retained ureteral stents can be rendered stone- and stent-free in a single combined endourological sitting whenever possible. Endourological techniques should be attempted instead of open surgery. This study can be replicated in other centres to manage similar complications.

Limitations

This is a retrospective folder review study; hence, it is limited by the inability to obtain some information from patients and occasionally missing data that could not be captured in the data collection tool.

Conclusion

Forgotten/retained stents pose a management challenge, often requiring multiple staged endourological procedures to render the patient stone- and stent-free. This retrospective series showed that combining endourological methods in one sitting is feasible to achieve this outcome. We found the FECal classification to be essential in surgical decision-making.

Conflict of interest

The authors declare no conflict of interest.

Funding source

No funding source to be declared.

Ethical approval

Before the study commenced, ethical approval was obtained from the ethical review board of the Surgical Division Research Ethics Committee and the University of Cape Town Human Research Ethics Committee, approval number 109/2022.

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