Original Article

Thermoexpandable Memokath stent: Usage and efficacy in ureteral and urethral strictures in Saudi Arabia

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Abstract

Objectives: Double J (DJ) stent is widely used in cases of ureteric strictures as a temporary solution; however, it has certain limitations, such as the need for frequent exchange. Alternatively, a long-lasting thermoexpandable stent (Memokath™ 051) has been used to relieve ureteral obstructions in comorbid patients with multiple reported advantages, such as longer durability which avoids the need of frequent exchanges. In addition, it can be used in certain cases of urethral strictures. Our study is the first in the region to report the experience and outcome of Memokath stent with ureteral and urethral strictures.

Materials and Methods: After local IRB approval, we retrospectively reviewed records of 21 patients who underwent insertion of Memokath 051 stent in the ureter and Memokath 045 in the urethra between 2013 and 2021. Indications of insertion, indwelling duration, and causes of removal were collected and analyzed by SPSS.

Results: Twenty-one patients received 21 Memokath stents for 11 ureteral strictures and 10 urethral strictures. Fifty-five percent of ureteral strictures were malignant, and 27.3% of the benign ureteric strictures were transplant ureters. Ureteric memokath stents remained functioning for a mean of 16.1 months. Mean indwelling time for transplant ureteric memokath stents was 24.3 months. Total 4 ureteric stents had migrated, 4 stents blocked, and 2 stents were removed as planned and 1 stent removed due to febrile urinary tract infection (UTI). Ten urethral stents remained in place for mean of 14 months. Three stents were removed as planned with resolution of stricture, two were removed due to blockage, three stents had UTI, one was removed due to pain, and one stent remained functioning until the patient expired.

Conclusion: Our outcome is comparable to other published studies, suggesting that ureteric Memokath stent is a better option with adequate indwelling time, especially in transplant ureters, in comparison with DJ stents. In addition, Memokath stents can be used in selected recurrent urethral strictures where surgical reconstruction is not feasible.

Keywords: Memokath stent, ureteral strictures, urethral strictures

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Received: 31.12.2022, **Accepted:** 11.08.2023, **Published:** 25.01.2024.

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/ua.ua_160_22

How to cite this article: Buksh O, Jar A, Khogeer A, Alzahrani H, Akram R, Taher M, *et al*. Thermoexpandable Memokath stent: Usage and efficacy in ureteral and urethral strictures in Saudi Arabia. Urol Ann 2024;16:98-103.

INTRODUCTION

Multiple different causes exist for ureteral obstruction, varying from benign or malignant strictures, internal causes, or external causes such as iatrogenic injuries.[1] Patients' presentation varies depending on the cause of ureteral stricture, as they might be asymptomatic with an incidental finding on radiographic workup, or symptomatic in acute cases.

Ideal management of ureteral strictures is surgical repair and reconstruction, which can be done through open surgery or utilizing minimally invasive methods such as laparoscopic or robot-assisted repair, but even those minimally invasive techniques carry a significant risk to comorbid patients with complex strictures, rendering high failure rate and unacceptable risk to the patients.[2]

And so, in such unfit and high-risk patients, temporary ureteral stents are widely used to bypass the obstruction; however, the temporary and most commonly used classic double J (DJ) stents have certain limitations, such as their need for frequent exchange every 3–6 months, which greatly reduces the quality of life of such comorbid patients, and stent-related symptoms and complications such as urinary tract infections (UTIs), stent-related lower urinary tract symptoms (LUTS), hematuria, infection, and stent occlusion.[3,4]

Alternatively, a long-lasting thermoexpandable nickel–titanium alloy stent (Memokath™ 051) has been used to relieve ureteral obstructions in highly comorbid patients, with multiple reported advantages, such as longer durability compared to the regular DJ stents reaching up to a year, which avoids the need of multiple admissions for DJ stent exchanges.[4]

Furthermore, Memokath 045 has been used in specific cases of urethral strictures.

Urethral strictures are caused by a complex scarring process within the urethra which eventually narrows the urethral lumen and causes a variety of clinical presentations.[5]

Multiple diseases may cause urethral strictures; however, trauma by pelvic fracture remains the most common cause of posterior urethral strictures.[6]

Although management of urethral stricture depends on the site, specifically whether it is located in the anterior or posterior urethra, severity, and cause, most of these strictures are initially and repetitively treated with endoscopic optical urethrotomy and urethral dilatation, despite the well-reported high failure rate of those procedures.[7]

However, definite repair with the highest success rate of urethral strictures remains surgical correction by urethroplasty. Moreover, in cases of complex strictures that have failed surgical repair, Memokath 051 stent has recently emerged as an alternative for such scenarios.[6] Our article is the first in the region to report the experience of Memokath 051 stent with ureteral and urethral strictures.

MATERIALS AND METHODS

After receiving the approval of the institutional review board, we retrospectively reviewed the medical charts of 21 patients who had received a 21 Memokath stent 051 and 045 between January 2013 and December 2020 – 10 patients had the Memokath inserted for urethral strictures and 11 inserted for ureteral obstructions. Five patients were excluded from the study due to deficient data and loss of follow-up. Patient demographics and perioperative data were then collected and analyzed through Statistical Packages for the Software Sciences (SPSS) version 26 (Armonk, New York, USA) software.

Ten patients for ureteral memokath stent insertion were chosen due to their highly comorbid disease which rendered them poor candidates for surgical correction. Table 1 lists the indications for insertion. Patients for urethral Memokath were selected based on their advanced age, multiple comorbidities, low life expectancy, and prior failed urethral repairs. All 21 patients had informed consent signed for the procedure, and all the cases had the Memokath stent placed by cystoscopy under general anesthesia. All of our patients who had ureteral stricture had a DJ stent placed prior to the Memokath 051 in the past, and all the patients with urethral strictures had undergone multiple dilatations and visual internal urethrotomy (VIU) in the past.

Procedure

The insertion of Memokath stent 051 technically differs from insertion of DJ ureteric stents due to multiple reasons, such as the absence of holes which precludes its insertion over a guidewire, and its flexibility which also precludes its forcible passage through a narrow stricture, for which it is placed through an outer sheath.

First, the length and site of stricture were determined using retrograde pyelogram and/or antegrade pyelogram. The stricture length was then measured by passing a ureteric catheter through the entire stricture length, while confirming its position using X-ray. The stricture is then dilated over a guidewire if needed. The Memokath 051

stent is then placed on the introducer and placed across the stricture, and the guidewire is subsequently removed. Then, 10 ml of heated 50°C sterile water is flushed through the insertion sheath to expand the proximal end of the alloy into a funnel shape that anchors the stent throughout the stricture. In order to ensure the correct positioning of the stent, a retrograde pyelogram study is performed through the insertion sheath prior to its removal. Care is taken to avoid protrusion of the distal end of the stent below the ureteral orifice. All patients with ureteric strictures had a Foley's catheter inserted after the procedure, which was removed the next day, and were discharged on oral antibiotics for 5–7 days.

For urethral strictures, direct VIU was performed at 12 o'clock direction, and then, Memokath 045 stent was placed across the stricture. No Foley's catheter was inserted for cases of urethral strictures.

The patients were then followed up after 1 month, and for at least 1 year, with blood tests, urine analysis and culture, and imaging studies as indicated. For cases of urethral stent, a uroflowmetry and flexible cystoscopy were performed afterward.

The mean follow-up duration was 38.75 months (range: 3–72 months).

RESULTS

A total of 21 patients received 21 Memokath stents by cystoscopy, and all insertion procedures were uneventful. The mean age was 52.42 years. Eleven cases (52.4%) had ureteral stricture, and 10 cases (47.6%) had urethral stricture. Of the 21 cases that had the Memokath stent inserted, 16 (76.2%) had benign strictures, and 5 cases (23.8%) had malignant causes of stricture. The stricture length mean was 4.70 cm (range: 2–10 cm). Of the stents placed for benign strictures, the stent remained *in situ* for a mean of 14.33 months (range: 0.300–62.370) and a mean of 18.7 months (range: 6.54–33.14) for malignant strictures.

Of all the 21 cases that had the Memokath stent placed, 4 strictures (20%) were resolved after the removal of the Memokath stent, while 16 strictures (80%) persisted afterward, and 1 patient deceased with the Memokath stent remaining *in situ*.

Complications

Twelve patients (57.1%) experienced a UTI at some point while the stent was indwelling; however, the majority did not require stent removal. Two patients (9.5%) developed urosepsis with the stent *in situ* and needed admission and antibiotic administration, and had recovered well. One patient (4.8%) developed pyelonephritis with the stent in place.

Ureter

Of the 11 ureteric strictures, 8 (72.7%) were native ureters, and 3 (27.3) were transplanted kidney ureteric strictures. Eight strictures were in the right ureter and three in the left ureter. The causes of ureteric strictures and location on the ureter are outlined in Figure 1.

Memokath placed in ureters had remained functioning *in situ* for a mean of 16.153 months (range: 0.300–62.37), and the three Memokath stents placed in transplant ureters remained functioning for a mean of 24.33 months. One ureteric stricture had resolved after removal of the Memokath stent, which was a transplant ureteric stricture, and resolution of the stricture was confirmed clinically and by radiological images as well. When assessing the causes of ureteric Memokath stent removal, of the 11 stents, 4 stents (36.4%) were removed due to stent migration, 4 stents (36.4%) were removed due to stent blockage/encrustation, 2 stents (18.2%) were removed as planned, and 1 stent (9%) was removed due to febrile UTI.

Urethra

Ten patients had urethral Memokath 045 inserted, all cases had bulbar urethral stricture, and all cases had either complex stricture that had filed the previous urethroplasty, or were poor surgical candidates with short life expectancy. The mean age is 57.4 years. Of those ten patients with urethral stricture, 50% (N: 5) had undergone urethroplasty previously, and of those, two patients had undergone urethroplasty twice. Memokath stents placed in urethra had remained *in situ* and functioning for a mean of 14.54 months (range: 1.12–33.14). On assessing the cause of removal, three stents were removed as planned

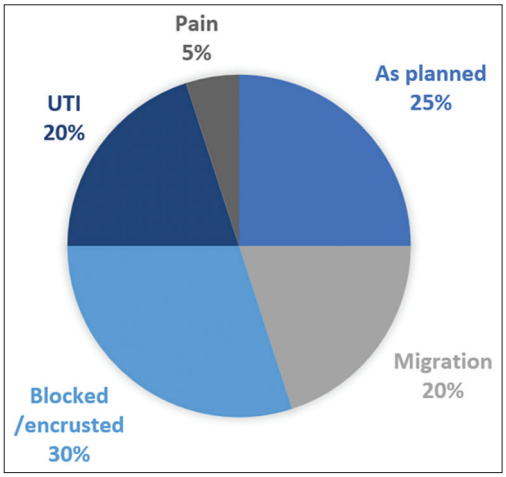

Figure 1: Causes of Memokath stent removal

Table 1: Memokath stents insertion indications

Stricture cause	*n* (%)
Benign	
Iatrogenic trauma	2 (13.3)
Postcesarean section	1 (6.7)
PUJ obstruction	1 (6.7)
Motor vehicle accident	2 (13.3)
Idiopathic	6 (40)
Transplant ureteric stricture	3 (20)
Total	15 (100)
Malignant	
Transitional cell carcinoma	1 (14.3)
Colorectal cancer	2 (28.6)
Lymphoma	1 (14.3)
Cervical cancer	1 (14.3)
Renal cell carcinoma	1 (14.3)
Testicular cancer	1 (14.3)
Total	7 (100)

PUJ: Pelvic ureteric junction

in advance, four stents were removed due to symptomatic UTI that was proven by urine culture and two stents were removed due to stent blockage, and a patient had passed away with the stent *in situ*. Three patients had their urethral stricture resolved after removal of the stent, which was confirmed clinically by uroflowmetry, and they did not require any further interventions on subsequent follow-up.

Stent-related symptoms

The majority of our patients with Memokath stents did not complain of significant sent related symptoms, such as LUTS or flank pain, and stents were well tolerated. Of note, all of our patients with ureteric strictures received a DJ stent in the past prior to Memokath insertion, and subjectively reported better tolerance and symptoms with the Memokath stent as compared to the DJ stent. However, we did not formally assess the quality of life in this study.

DISCUSSION

The relief of ureteric obstruction by stenting the ureter has been of interest since the 19th century, then by 1978, first DJ stent was built and described and since then, there was a rapid progression in the development and usage of ureteric stents, with improved variable designs to further enhance the stents' durability, efficacy against the obstruction, and to reduce complications.[8]

The first use of metallic stents to bypass a stricture was described by Milroy. Initial experience of metallic stents in ureteric obstructions was disappointing due to endothelial and tumor in-growth through the metallic meshwork of the stents. This was improved with the introduction of thermoexpandable Memokath 051 stent to the field of endourology, as a promising minimally invasive long-term solution for both benign and malignant ureteric obstructions with low complication rate.[9,10]

Memokath 051 emerged as an attractive treatment for ureteral obstructions that are deemed nonoperable, with an important presumed advantage of its ability to stay for long periods, and render regular exchange unnecessary, which highly benefits particularly fragile and palliative patients. With some advantages when compared to other metallic stents.[10]

However, despite its multiple suggested advantages, various reports on its use and outcome have been conflicting with mixed results.[11]

In addition, our data show an impressive rate of stricture resolution in four patients, who did not need further intervention on subsequent follow-ups, and stricture resolution in cases of urethral stricture was confirmed by uroflowmetry, minimal postvoid residual in addition to the patient's well-reported voiding habits.

In the case of ureteral strictures, stricture resolution was confirmed by a retrograde pyelogram and serial creatinine level with a renogram mag3 scan.

In addition, as all of our ureteral stricture patients had received a DJ stent prior to Memokath 051 stent insertion, they subjectively reported much better tolerability and LUTS when compared to the time when they had DJ stents, although this matter was not formally assessed in our study.

However, multiple studies indeed do conclude better quality of life of Memokath 051 when compared to DJ stents.[12]

Furthermore, our study shows a high rate of UTI which occurred in 12 of the patients (57.1%) but did not always necessitate Memokath stent removal as most of the cases were treated by IV antibiotics, and patients were discharged after symptom resolution and confirming a negative urine culture; however, the Memokath stent had to be removed in five of our patients due to UTI.

Ureteric Memokath stents remained patent for a mean of 16.153 months, which indeed poses an advantage over regular DJ stents, which may require exchange as early as 2 months after insertion.[12]

Memokath placed in ureters had remained functioning *in situ* for a mean of 16.153 months (range: 0.300–62.37), and the three Memokath stents placed in transplant ureters remained functioning for a mean of 24.33 months.

Our results on transplant ureteric Memokath stent show similar high efficacy when compared to other studies that specifically assessed Memokath sent outcome in transplant ureters.[13,14]

Regarding our outcome on Memokath stents placed for urethral strictures, the stent was placed in ten patients who were diagnosed to have a bulbar urethral stricture; all of the cases underwent VIU and urethroplasties prior to the consideration of inserting the Memokath; all cases were assessed by uroflowmetry and postvoid residual, retrograde urethrogram, and cystoscopy.

Urethral strictures are caused by a scarring process within the urethral lining, followed by spongiofibrosis and narrowing of the urethral lumen, which usually causes the patients to present with obstructive voiding symptoms; however, presentation can vary considerably with others presenting with acute retention, recurrent UTIs, and even bladder failure due to chronic obstruction.[5]

There are various causes for urethral strictures, and are better classified into inflammatory, Iatrogenic, idiopathic, and importantly traumatic. Inflammatory urethral strictures were more common in the past due to gonorrheal infections, and have become less common in recent times. Iatrogenic are usually caused transurethral/endoscopic procedures. Traumatic strictures are the main cause of posterior urethral strictures in young males, usually resulting from a pelvic fracture.[6]

Urethral stents were initially introduced to overcome obstruction caused by benign prostatic hyperplasia, later thermoexpandable urethral stents were described and studied.[15,16]

In our series, 11 patients diagnosed to have urethral strictures received a Memokath stent; all of the strictures were located in the bulbar urethra, which is similar to multiple other studies, stating that bulbar urethra is the most common site for placing a Memokath stent.[17]

In the present study, Memokath stents placed in urethra had remained *in situ* and functioning for a mean of 14.54 months (range: 1.12–33.14), and all patients were able to void immediately after placement of the stent.

On assessing the cause of removal, three stents were removed as planned in advance, four stents were removed due to symptomatic UTI that was proven by urine culture and two stents were removed due to stent blockage, and a patient had passed away with the stent *in situ*.

Interestingly, three patients had their urethral stricture resolved after removal of the stent, which was confirmed clinically by uroflowmetry, and they did not require any further interventions on subsequent follow-up.

Urethral hyperplasia over the stent remains one of the most commonly reported issues related to urethral stents and may occur as high as 40%; in our study, this occurred in 2 cases (20%) and eventually led to stent removal.

Gross hematuria was not reported by any of the patients, and only one patient complained of bothersome LUTS that were conservatively managed, although our study did not formally assess international prostate symptom score (IPSS) and quality of life.

Our data show an adequate functioning duration of Memokath stent when placed in urethra in complicated cases that underwent previous interventions and failed, and the rate of success in our study is similar to multiple other studies.[6,18]

Study limitations

The relatively small number of patients limits our study, in addition to the retrospective nature as well. Further randomized studies will be significantly valuable to the topic of thermoexpandable stents. However, this study is the first in Saudi Arabia that assessed the outcomes of Memokath stent in both urethral and ureteral strictures. We hope further studies will follow.

CONCLUSION

Our experience reports a favorable outcome of the stent in ureteric strictures, especially in transplant ureters. The stents remained functioning for an adequate time, favoring its use over the regular DJ stents. We also report similar complication rates as compared to other published studies. Additionally, our study shows that Memokath stent is a reliable alternative to urethroplasty in complex urethral stricture cases, as it remained in place for an adequate duration, with smiliar rates of complications as reported in other studies.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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