Case Report

Laparoscopic ureteroureterostomy for benign non-passable upper ureteric stricture – A case report with review of literature

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ABSTRACT

Ureteral stricture (US) is not a very common condition. The etiology of US could be either benign or malignant. It is mostly due to long-standing ischemia causing inflammation and fibrosis that ultimately leads to stricture formation. In most cases, diagnosis is made incidentally under direct visualization at the time of the ureteroscopic procedure. Surgery for ureteral reconstruction aims to achieve adequate vascular supply, a tension-free anastomosis with mucosal apposition, and to ensure complete excision of stricture-laden ureteral segments. We herein present the case of a 42-year-old male patient who presented with a complaint of acute pain in his left flank, radiating from the loin to the front, for 10 days. The workup investigations revealed a tight stricture in the left upper ureter, a 2-mm calculus in the left upper ureter proximal to the stricture, and left proximal hydroureteronephrosis. The patient was successfully managed by laparoscopic ureteroureterostomy.

Key words: Anastomosis, Hydroureteronephrosis, Laparoscopic, Tension-free, Ureteral stricture, Ureteroureterostomy

Ureteral stricture (US) refers to a narrowing of the ureter, thereby causing obstruction which is a significant cause of morbidity and mortality. It is important to understand the cause of the US to decide the best course of treatment. More and more USs eligible for surgical repair are being managed by laparoscopy, in sync with the minimally invasive surgical revolution. The first successful laparoscopic ureteroureterostomy was performed and reported by Nezhat *et al*. [1].

We, herein, report the case of a 42-year-old male patient who was diagnosed with a short segment stricture in his upper third left ureter. An endourological intervention – double J (D-J) stent insertion was attempted initially but, the procedure failed as the stricture was tight and non-passable. He then successfully underwent a laparoscopic segmental excision of the stricture followed by end-to-end uretero-ureteric anastomosis, in the same sitting; immediately following the attempted D-J stenting. The rationale for reporting this case is to underscore the importance of laparoscopy in carefully selected cases in the US, as an important backup surgical therapeutic option; in patients who have tight impassable strictures that are not favorable for endotherapy.

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CASE REPORT

A 42-year-old male patient presented to the emergency department with a complaint of acute pain in his left flank, radiating from the loin to the front for 10 days. The pain was colicky in nature, got aggravated at night, and used to be momentarily relieved spontaneously after about 15–20 min. He did not have any other complaints. He had no medical co-morbidities.

On examination, his pulse rate was 80 beats/min, blood pressure was 130/80 mmHg, and respiratory rate was 16/min. His abdomen was soft and non-tender. He had initially visited his family physician for the above complaints. He was prescribed an antispasmodic (tablet cyclopam) and antacid (tablet pantocid). However, he did not get any symptomatic relief.

He was then advised to get an ultrasonography scan, which revealed a 1.4-mm calculus in the left upper ureter along with a hydroureter involving the upper one-third stretch of the left ureter. He was then referred to the consultant urologist for the same. He underwent computed tomography (CT) urography scan which revealed a tight stricture in the left upper ureter, a 2-mm calculus in the left upper ureter, and the left proximal hydroureteronephrosis (Fig. 1a).

He was then counseled to undergo left ureteroscopy (URS) with intracorporeal shock wave lithotripsy and D-J stenting after due investigational workup. Duly considering the tightness of

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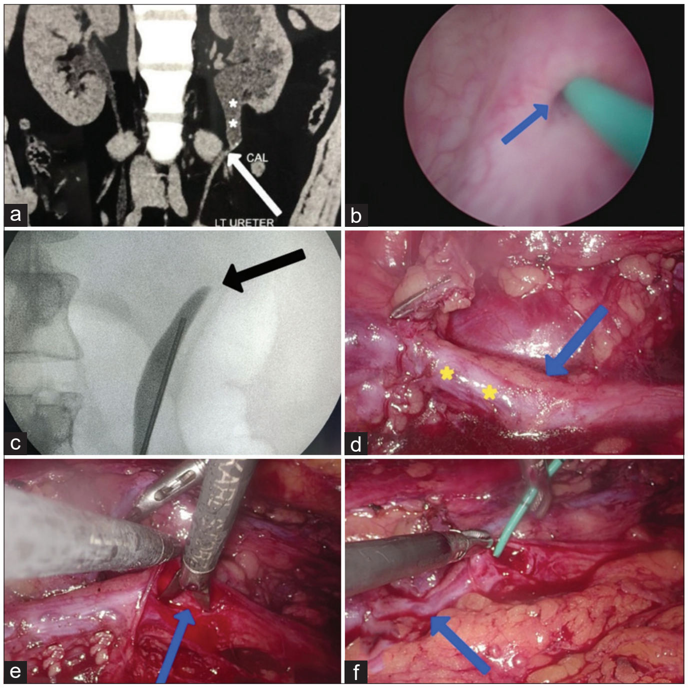

Figure 1: (a) CT urography showing left ureteric stricture (white arrow), proximal hydroureter (white asterisks) and small stone within, (b) Cystoscopic attempt (blue arrow) at insertion of guide wire and stent across stricture, (c) Left ascending ureterogram showing abrupt cut off at level of stricture (black arrow), (d) 1st view of left ureter with initially thought to be stricture stretch (blue arrow) and proximal ureter (yellow asterisks), (e) Incision on the purported stricture (blue arrow), (f) Passage of ureteric catheter thru the purported stricture without resistance till lower end of actual stricture (blue arrow) beyond which catheter did not advance proximally

the stricture, the advanced laparoscopic surgeon was sounded off and requested to be on standby by the specialist consultant endo-urologist. The patient and his family agreed with this plan and got him admitted to the hospital.

The routine blood works (complete blood count and serum creatinine) were within normal limits. Urine – routine and microscopy showed 15–20 pus cells per high-power field. Prophylactic antibiotics cover as per the hospital's antibiotic policy (IV injection Ceftriaxone 1 g + injection Amikacin 500 mg) were duly started. He was then taken up for surgery. URS with DJ stenting was attempted first but despite repeated and multiple attempts, the stricture could not be negotiated even with the guide wire (Fig. 1b and c). Then, intraoperatively, the advanced laparoscopic surgeon was called in. He adopted a trans-peritoneal approach, in right lateral patient position. After gaining access and inserting the working trocars, the descending colon was reflected medially. After locating the left ureter, it was traced proximally. The upper ureter with the purported stricture was mobilized (Fig. 1d). A ureterotomy was performed through the purported stricture site and a ureteric catheter was passed into it proximally (Fig. 1e and f). Unexpectedly, it went in smooth for a small stretch and then encountered resistance and did not go beyond (Fig. 1f). Thus, the site of the actual stricture was confirmed intraoperatively (Fig. 2a and b). The strictured segment was resected, the calculus was retrieved, the distal cut end of the ureter was splayed, and an end-to-end ureteroureterostomy was

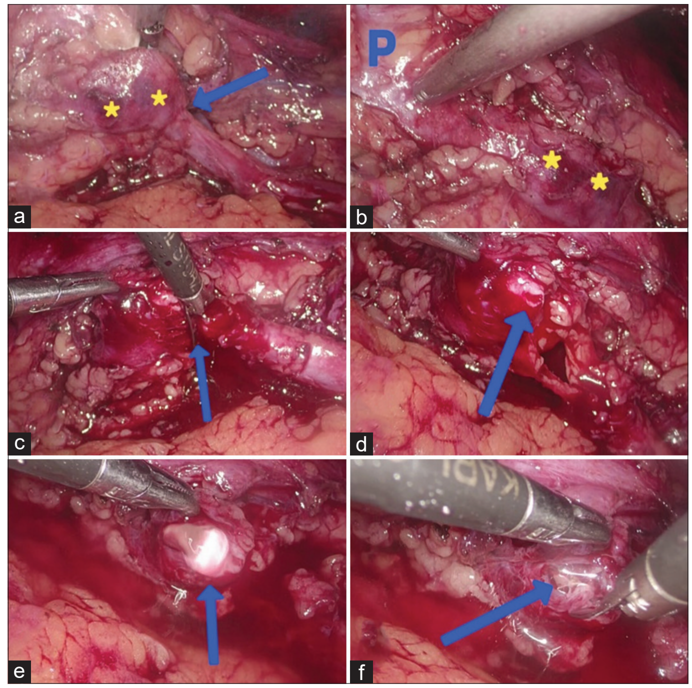

Figure 2: (a) The actual stricture (blue arrow) and dilated proximal left ureter (yellow asterisks), (b) Dilated proximal upper ureter (yellow asterisks) and pelvis(blue P), (c) Transection of stricture (blue arrow), (d) Proximal cut end of stricture(blue arrow), (e) Gush of proximally accumulated urine on opening up of stricture(blue arrow), (f) Small calculus seen in proximal dilated ureter (blue arrow)

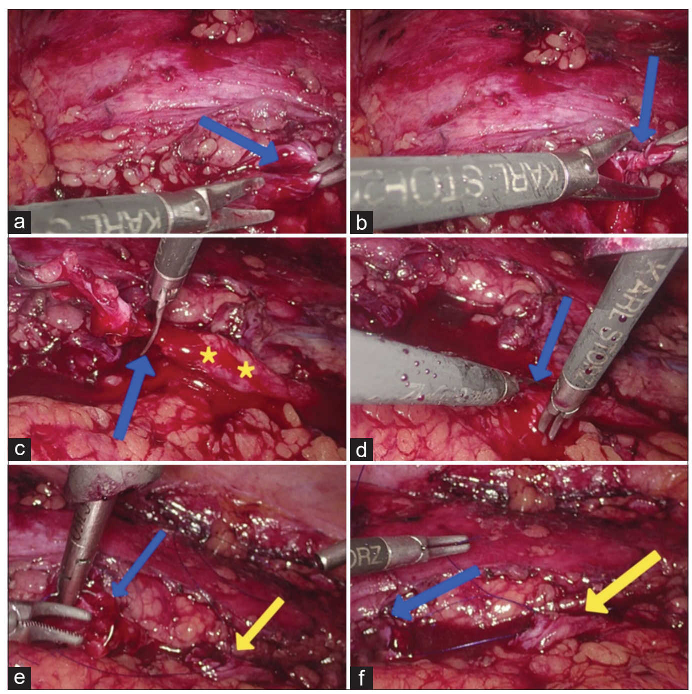

Figure 3: (a) Longitudinal incising & opening up of proximal part of stricture(blue arrow), (b) Excision of strictured stretch(blue arrow) frm the proximal cut end of ureter, (c) Excision of strictured stretch(blue arrow) frm the distal cut end of ureter(yellow asterisks), (d) Splaying of the distal cut end of ureter(blue arrow), (e & f) 1st approximating suture being taken betn proximal(blue arrow) & distal(yellow arrow) cut ends of ureter

fashioned using 3-0 polydioxanone (Figs. 2c-f, 3a-f, and 4a-d). After completion of the posterior suture line, a D-J stent was passed distally and then proximally; intraoperatively (Fig. 4e

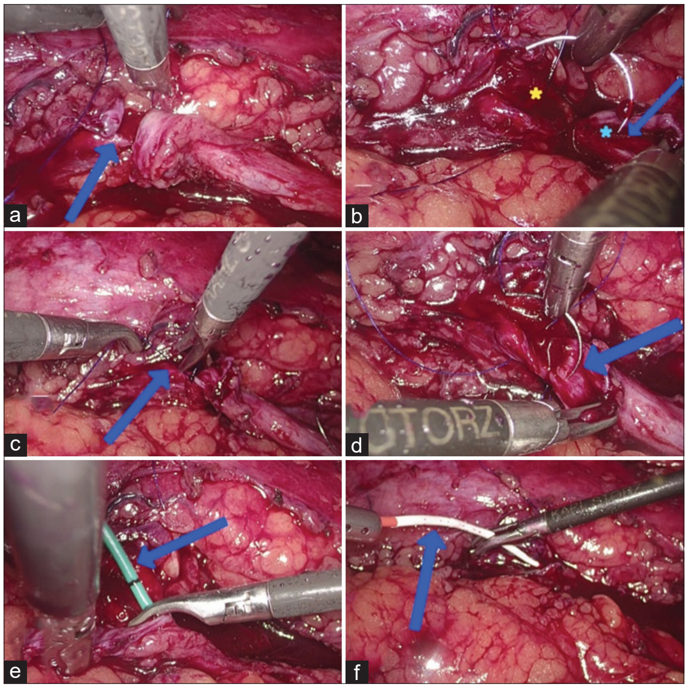

Figure 4: (a) End to end approximation of 2 cut ends of ureter (blue arrow), (b) More posterior layer sutures being taken (blue arrow) betn proximal (yellow asterisk) and distal (blue asterisk) cut ends of ureter, (c and d) Further suture approximation in progress (blue arrows), (e and f) Passage of DJ stent across anastomosis in progress (blue arrows) after completion of posterior suture line

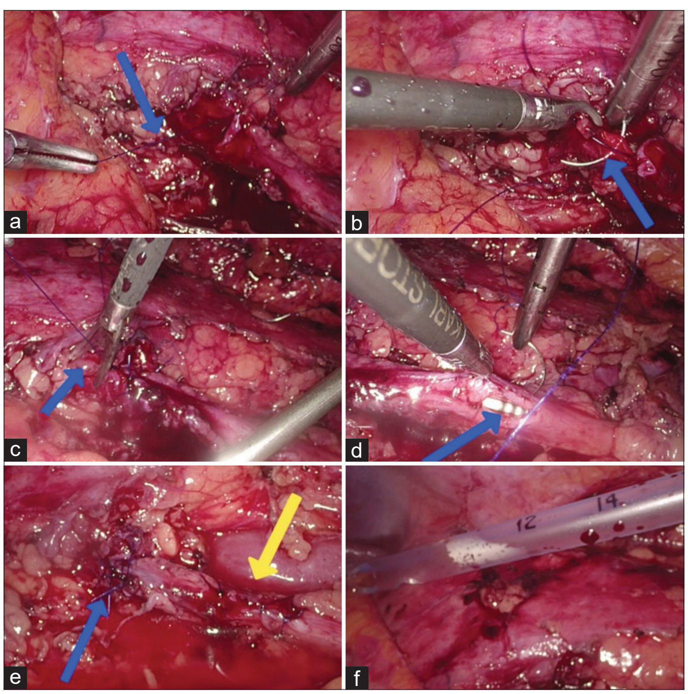

Figure 5: (a-c) Anterior suture approximation in progress (blue arrows), (d) Suture closure of ureterotomy over DJ stent (blue arrow), (e) Completed uretero-ureteric anastomosis (blue arrow) and ureterotomy suture closure (yellow arrow), (f) Tube drain left *in situ*

and f). The anterior approximating sutures were then taken, followed by suture closure of the check ureterotomy (Fig. 5a-e). After giving the peritoneal toilet, a 32 French tube drain was introduced through the lowermost trocar site and kept *in situ* (Fig. 5f). He had an uneventful post-operative recovery. The per urethral catheter was removed on post-operative day (POD) 3. The drain was removed and he was discharged from the hospital on POD 4. On his POD 10 outpatient department visit, all his trocar sites had healed well and he was asymptomatic.

The patient was readmitted 2 months after the surgery for D-J stent removal and also underwent a check retrograde ascending ureterogram. It revealed a smooth passage of contrast across the ureteroureteric anastomosis, good uniform opacification of the pelvicalyceal system, and prompt clearance of the contrast. At the time of writing this paper, the patient was interviewed telephonically, 5 months after his surgery. He continues to be asymptomatic.

DISCUSSION

The etiology of US could be either benign or malignant. One of the most common malignant causes is urothelial carcinoma, or metastases from prostatic, cervical, ovarian, colon, and breast cancer. Lower USs usually develop as a result of undergoing treatment for pelvic malignancies. Upper USs are rare and typically represent about 2% of iatrogenic USs, they are related to treatment for malignancies and mostly present after partial nephrectomy or radiofrequency ablation [2].

Benign causes of USs are usually infection, radiation, trauma, aortic aneurysms, nephrolithiasis, and the use of ureteral instruments [3]. Infections such as tuberculosis and schistosomiasis could also result in the formation of USs [3]. Radiation therapy and retroperitoneal fibrosis are known to result in slowly developing microvascular injury and stromal fibrosis. Stricture formation in these patients is mostly due to hypoperfusion [3]. The time taken for the formation of a US after radiation therapy is variable; a recent prospective study found it to be approximately 2.75 years [4]. Irrespective of the cause, USs mostly form as a result of long-standing ischemia causing inflammation and fibrosis that ultimately leads to stricture formation [3].

USs are more common in females, especially in those with pre-operative hydronephrosis, and are known to have renal calculi. The passing of stones is also associated with the formation of US, particularly in patients with an impacted calculus for at least 2-month duration [3]. Taş *et al*. found that US was observed in 13.3% of patients with impacted calculi and in 5% of patients who did not have impacted calculi [5].

Although ureteric injury is not very frequent, it occurs most often during gynecological and urological surgery. The distal one-third of the ureter is the most common site of injury (91%) and the middle and proximal third are rarely affected (7% and 2%, respectively) [6]. Most injuries remain undiagnosed until the patient presents with symptoms postoperatively. Iatrogenic causes of stricture formation include ligation or suture kinking, partial or complete transection, clamp crushing, thermal injury, or ischemia due to devascularization. Gynecologic procedures are responsible for most of the ureteral injuries. Incidences of ureteral trauma in gynecologic surgery have been reported to range between 0.3% and 2.5% [7]. With regard to general surgery, the most common causes for ureteral injuries are low anterior and abdominal perineal resection, resulting in incidences of development of USs ranging between 0.24% and 5.70% [7]. As a serious complication of URS, it is reported to have variable rates of occurrence, ranging from 0.2% to 24% [8].

Diagnosing a patient to have USs is quite challenging. Presenting symptoms may include intermittent flank pain and fullness, marked at the time of micturition; other non-specific symptoms include fever, abdominal pain, nausea and vomiting, low back pain, hematuria, ileus, peritonitis, and even sepsis. Persistent flank or abdominal pain, flank mass, prolonged ileus, urinary tract infection, or hydronephrosis point toward a delay in diagnosis. Elevated serum creatinine, blood urea nitrogen levels, and hypertension may occur secondary to obstructive uropathy.

In most cases, diagnosis is made incidentally under direct visualization at the time of the ureteroscopic procedure. A retrograde pyelogram along with being a diagnostic tool with high sensitivity, also allows to place an indwelling stent for adequate dilation of the ureter and free passage of urine, hence is regarded as the diagnostic modality of choice. If a retrograde pyelogram is not available, CT with intravenous urography should be performed with a percutaneous nephrostomy placed along with the placement of an indwelling stent in an antegrade fashion. CT urography remains the gold standard for the diagnosis in the US. This diagnostic tool is not only effective in delineating a patient's anatomy but also shows the location of a US. Dynamic or gadolinium-enhanced magnetic resonance urography, especially in the pediatric population, has the advantage of providing functional and anatomical information on the genitourinary tract, without the risk of radiation exposure.

For establishing the degree of function of the affected kidney, nuclear medicine diuretic imaging is used. Measurement of clearance of an isotope tracer over time provides the estimate of renal blood flow and hence tells us about the degree of renal function. At least, 20% function is required in the ipsilateral kidney to get a good result from endoluminal repair, and <15% is associated with a poor outcome [9].

Surgery for ureteral reconstruction aims to achieve adequate vascular supply, a tension-free anastomosis with mucosal apposition, and to ensure complete excision of stricture-laden ureteral segments. In case of short defects (≤2.5 cm), the placement of an indwelling stent placed either retro- or antegradely which is removed after 2–6 weeks is an adequate approach to treat the condition. Upon failure of endourological therapy, surgical reconstruction (open/laparoscopic/robotic) is indicated with temporary urinary diversion, if required.

Ureteroureterostomy is indicated for short strictures (<2–3 cm long) that involve the proximal or mid-ureter. This technique preserves the natural anti-reflux mechanism of the urinary bladder. Ureteroneocystostomy, which refers to the reimplantation of the ureter into the urinary bladder, is used to manage strictures of the distal ureter of length 4–5 cm or less. A psoas hitch, in which, the bladder is pulled up and secured to the psoas muscle, to reduce the distance between the distal ureter and the bladder, may be useful in managing defects in the distal ureter, measuring up to 8 cm from the ureteral orifice. A Boari flap is a useful adjunct when the diseased segment of the ureter is too long or ureteral mobility is limited to perform a primary ureteroureterostomy. It is basically the construction of a bladder flap, which is then used to replace the lost lower ureteral tissue. In circumstances where adequate ureter length is not left for reconstruction, a transureteroureterostomy in which a water-tight anastomosis is performed over a JJ ureteral stent using absorbable sutures, intestinal (ileal) interposition, or renal mobilization and autotransplantation, in which the kidney is removed from its normal location and moved into the pelvis, may be used to achieve adequate results. Transureteroureterostomy is useful in cases in which the length of a healthy ureter is not adequate to create a tension-free anastomosis and psoas hitch or Boari bladder flap cannot be used such as in case of prior pelvic radiation or known cases of bladder cancer. It is also useful in situations involving chronic/recurrent pelvic pathology, or if the pelvis has been subjected to radiation therapy. Regarding intestinal interposition, Waldner *et al.* found that using ileal segments measuring more than 15 cm in length reduces the reflux reaching the renal pelvis. Renal autotransplantation should be considered when the strictured segment is very long or there are many strictures thus resulting in insufficient ureteral length for reconstruction, the contralateral kidney is either non-functioning or absent, and other methods of ureteral repair/substitution is contraindicated.

Some unpopular methods for reconstruction include buccal mucosal grafts which seem to be an attractive option for ureteral substitution due to their thick, non-keratinized epithelial layer, and vascular lamina propria and their histological similarity to ureteral mucosa [3]. Both acellular and cellular biological grafts are also being explored for the treatment of USs. Human dura mater and amniotic membrane allografts have been explored with promising results at long-term follow-up [3]. A brief overview

Table 1: An overview of various therapeutic options for ureteral stricture

Stricture segment	Length of affected ureter	Treatment options
Proximal 1/3rd	≤2–3 cm	1. Endoscopic balloon dilatation 2. Endoscopic ureterotomy 3. Uretero-ureterostomy
	Involving pelviureteric junction	Ureterocalicostomy
	4–6 cm	Buccal mucosa graft
Middle 1/3rd	≤2–3 cm	Ureteroureterostomy
	4–6 cm	Buccal mucosa graft
	10–15 cm	1. Transureteroureterostomy 2. Ileal mucosa graft
Distal 1/3rd	4–6 cm	Ureteroneocystostomy
	8 cm or less	Psoas hitch
	10–15 cm	1. Boari flap 2. Transureteroureterostomy 3. Ileal mucosa graft

of various treatment options for ureteric strictures depending on their lengths and locations is summarized (Table 1).

CONCLUSION

As seen in this report, a laparoscopic therapeutic intervention is a sound backup option for non-passable ureteric strictures; in an advanced setup ably complimented by the presence of requisite advanced minimally invasive surgical skills.

REFERENCES

1. Nezhat C, Nezhat F, Green B. Laparoscopic treatment of obstructed ureter due to endometriosis by resection and ureteroureterostomy: A case report. J Urol 1992;148:865-8.
2. MacLennan S, Imamura M, Lapitan MC, Omar MI, Lam TB, Hilvano-Cabungcal AM, *et al*. Systematic review of oncological outcomes following surgical management of localised renal cancer. Eur Urol 2012;61:972-92.
3. Vasudevan VP, Johnson EU, Wong K, Iskander M., Javed S, Gupta N, *et al*. Contemporary management of ureteral strictures. J Clin Urol 2019;12:20-31.
4. Orchard J, Tward JD, Lenherr S, Hotaling JM, Brant WO, Myers JB. Surgical management of ureteral strictures arising from radiotherapy for prostate cancer. Urol Case Rep 2016;6:47-9.
5. Taş S, Tuğcu V, Mutlu B, Karadağ S, Bitkin A, Yücel M, *et al*. Incidence of ureteral stricture after ureterorenoscopic pneumatic lithotripsy for distal ureteral calculi. Arch Ital Urol Androl 2011;83:141-6.
6. Brandes SB, Coburn M, Armenakas NA, McAninch JW. Diagnosis and management of ureteric injury: An evidence-based analysis. BJU Int 2004;94:277-89.
7. Gild P, Kluth LA, Vetterlein MW, Engel O, Chun FK, Fisch M. Adult iatrogenic ureteral injury and stricture-incidence and treatment strategies. Asian J Urol 2018;5:101-6.
8. Darwish AE, Gadelmoula MM, Abdelkawi IF, Abdellatif AM, Abdel-Moneim AM, Hammouda HM. Ureteral stricture after ureteroscopy for stones: A prospective study for the incidence and risk factors. Urol Ann 2019;11:276-81.
9. Wolf JS Jr., Elashry OM, Clayman RV. Long-term results of endoureterotomy for benign ureteral and ureteroenteric strictures. J Urol 1997;158:759.

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