

Original Research Article

A clinical study of surgical management of benign ureteric stricture

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Abstract

Background: Although incidence of ureteric stricture, in general population, is not known, proper evaluation of and treatment is essential to preserve the renal function and rule out malignancy. Strictures of the upper urinary tract are either congenital or acquired. With the exception of primary UPJ obstruction, most ureteral strictures are acquired and usually are iatrogenic. Before the development of endourological instruments and techniques, ureteral strictures were managed by open repair. The management of ureteric stricture has changed dramatically over the last decade in conjunction with new developments in endourology.

Material and methods: This bi-directional study was performed on 30 patients, diagnosed as a benign ureteric stricture by various modalities of diagnosis, which underwent open or laparoscopy surgical procedures. Data, with respect to patient's demographic information, etiology, mode of presentation, stricture location and length, diagnostic modalities, operative procedures and their follow-up were recorded, analyzed and plotted on master chart. Various surgical treatment modalities are used according to length and location of strictures like: Upper and mid-ureteric stricture: Ureteroureterostomy 2-3 cm, Uretero calycostomy/ pyeloureterostomy for long upper ureteric stricture, 4-5 cm with intra renal or scarred pelvis, Buccal mucosal graft ureteroplasty. Lower ureter: Ureteroneocystostomy 4-5 cm, Psoas hitch 6-10 cm, Boari flap 12-15 cm, Ileal ureter replacement for long segment defect > 10-15 cm, in every patient, we keep closed drainage system. Usually, drain was removed after 72 hours. We were keeping double j stent in every patient, which were removed after 1 month. Follow up the patient after 21 days of double j stent removal and thereafter 6 monthly for 2 years, then every yearly for 5 years.

Results: Among 30 patients, main causes are genitourinary TB 8 (26.66%), Iatrogenic 8 (26.66%). 46% strictures involve, lower ureter with length >3-5 cm, which correlates with characteristics of tuberculosis, involving multiple sites and long segment of ureter, 54% stricture involving upper ureter are < 3-5 cm which correlates with iatrogenic and impacted ureteric calculus related strictures. Among

30 patients, with 33 renal units 2 patient's surgery failed, among which one required nephrectomy, and another required redo surgery, one patient who lost follow up was also considered as a failure.

Conclusion: In era of endourology and minimal invasive surgery, open reconstructive surgery has its own place.

Key words

Ureteric stricture, Endourology, Minimal invasive surgery, Open surgery.

Introduction

Ureteric stricture [1] means, narrowing of ureteric lumen, causing functional obstruction, caused by various etiologies. Although incidence of ureteric stricture, in general population, is not known, proper evaluation of and treatment is essential to preserve the renal function and rule out malignancy. Strictures of the upper urinary tract are either congenital or acquired. Congenital ureteral strictures are most commonly located at the UPJ. With the exception of primary UPJ obstruction, most ureteral strictures are acquired and usually are iatrogenic. The most common etiology of iatrogenic ureteral stricture disease is injury during endoscopic, open, or laparoscopic surgery [2]. Non-iatrogenic acquired ureteral strictures include those that follow spontaneous passage of calculi or chronic inflammatory ureteral involvement, as in tuberculosis and schistosomiasis. Although general surgical and gynecological procedures have generally been regarded as common causes of ureteral trauma and stricture formation, recent reports evaluating endourological procedures for treating stone, also contributes major etiological factor. The treatment of stone disease by either ureteroscopy or ureterolithotomy accounted for a significant number of strictures. Although the risk of stricture formation is low with ureteroscopy, the frequency of the procedure and its inherent learning curve has made it a prominent culprit in stricture formation. Other urologic procedures that have been implicated in ureteral stricture formation include transurethral resection, ureteral meatotomy, traumatic ureteral catheterization, ureterolysis, ureteroneocystostomy, and renal transplantation. More than isolated reports of benign ureteral strictures have been reported after cesarean sections, tubal ligations, and

hysterectomies for benign and malignant disease in the gynecological literature. General surgical procedures associated with reported ureteral trauma and stricture formation include abdominal aortic aneurysms, bowel resections, pelvic exenterations, and penetrating trauma. Lastly, an entity which will be considered separately from a urologic standpoint is stricture formation at ureteroenteral anastomoses after urinary diversion for both benign and malignant reasons.

Benign strictures

Benign ureteral strictures can be ischemic or non-ischemic. Wolf and coworkers define a stricture as ischemic when it follows open surgery or radiation therapy, whereas the stricture is considered non-ischemic if it is secondary to stone passage or a congenital abnormality. Ischemic strictures tend to be associated with fibrosis and scar formation and thus are less likely to respond endoureterotomy. Post-endoscopy strictures may be either ischemic or non-ischemic, depending on the mechanism of injury (i.e., mechanical or thermal trauma).

Malignant strictures

Ureteral strictures that are caused by recurrence of a primary malignancy or extrinsic mechanical compression by a tumor are a special subgroup of strictures that do poorly with endoscopic incision. They are best treated with open surgery, indwelling stents, or percutaneous nephrostomy tubes.

Management

Before the development of endourological instruments and techniques, ureteral strictures were managed by open repair. Davis reported successful clinical results with ureteral

anastomosis and ureteral stenting [3]. Despite the introduction of balloon dilation of the ureter by Dourmashkin in 1926, less invasive techniques for the management of ureteral strictures were received with increased enthusiasm very late. The management of ureteric stricture has changed dramatically over the last decade in conjunction with new developments in endourology. Various open surgical repair techniques have definite role.

Aim and objectives

- Mode of presentation and diagnosis of benign ureteric stricture.
- Evaluate, interpret and study, causes of benign ureteric stricture.
- Surgical management of benign ureteric stricture.
- Assess effectiveness of open and laparoscopy procedures for benign ureteric stricture.

Material and methods

This bi-directional study was performed on 30 patients, diagnosed as a benign ureteric stricture by various modalities of diagnosis, which underwent open or laparoscopy surgical procedures. Data, with respect to patient's demographic information, etiology, mode of presentation, stricture location and length, diagnostic modalities, operative procedures and their follow-up were recorded, analyzed and plotted on master chart. Proximal and distal ureteral strictures were classified by anatomic location relative to the sacroiliac joint. This study includes the patients with failed endourology treatment received previously, with long stricture not amenable to endourology treatment like more than 2 cm length, dense fibrotic stricture, extrinsic causes, e.g. crossing vessel, retroperitoneal fibrosis, endometriosis. All patients, underwent imaging study based on an individualized patient basis, in the form of renal ultrasonography, intravenous urography retrograde urography, contrast CT scan to confirm diagnosis and details related to length, location of stricture and functional status of both

ipsilateral and contralateral kidney. Nuclear renography was not routinely performed in all patients but was reserved to assess renal function in patients who may be better served with major reconstructive surgery. After diagnosis of stricture by imaging study, patients underwent ureteroscopic guided cold cup biopsy or brush biopsy. For tuberculous stricture was diagnosed on clinical, radiological, laboratory investigations which were confirmed, later on by histopathological specimen sent after surgery. All malignant strictures were excluded from this study.

- Successful stricture management was defined as the absence of clinical symptoms (flank pain, nausea, vomiting, costovertebral angle tenderness) and resolution of hydronephrosis on, follow-up radiographic imaging at the time of last follow up first at 1.5 month, 15 days after Double J stent removal and then at 6 months.
- Follow-up imaging was based on an individualized patient basis.
- Patients, who lost to follow up were considered as a failure.
- Pelvi-ureteric junction obstruction, being separate entity and malignant strictures are excluded from this study.

Various surgical treatment modalities are used according to length and location of strictures like Upper and mid-ureteric stricture

- Ureteroureterostomy 2-3 cm,
- Uretero calycostomy/pyeloureterostomy for long upper ureteric stricture, 4-5 cm with intrarenal or scarred pelvis,
- Buccal mucosal graft ureteroplasty

Lower ureter

- Ureteroneocystostomy 4-5 cm,
- Psoas hitch 6-10 cm,
- Boari flap 12-15 cm,
- Ileal ureter replacement for long segment defect > 10-15 cm,
- In every patient, we keep closed drainage system.

- Usually, drain was removed after 72 hours. We were keeping double j stent in every patient, which were removed after 1 month.
- Follow up the patient after 21 days of double j stent removal and thereafter 6 monthly for 2 years, then every yearly for 5 years.

Results

Among 30 patients, main causes are genitourinary TB 8 (26.66%), Iatrogenic 8 (26.66%) as per **Table - 1**. Another major portion includes, iatrogenic ureteric injury, due to large stone burden (number and size), impacted calculus and rigid/ semirigid endourology instrument, learning curve of resident, O'Brien reviewed a five year experience and found that 31 patients had been treated for ureteral strictures caused by the following: ureteroenteral anastomotic strictures (23%), open ureterolithotomy (19%), ureteroscopy (19%), other urologic procedures (16%), general surgical and gynaecological procedures (13%), and miscellaneous cause (7%).

Table - 1: Etiology.

Etiology	No. of patients (total n=30)	%
Congenital	1	3.33
Calculus	4	13.33
Genitourinary TB	8	26.66
Idiopathic/nonspecific inflammation	6	20.00
Iatrogenic	8	26.66
Retroperitoneal fibrosis	1	3.33
Endometriosis	1	3.33
Traumatic	1	3.33

Flank pain was most common symptomatic presentation as per **Table - 2**. Again, recurrent flank pain was the commonest indication of surgery as per **Table - 3**. 46% strictures involve,

lower ureter with length >3-5 cm, which correlates with characteristics of tuberculosis, involving multiple sites and long segment of ureter, 54% stricture involving upper ureter are < 3-5 cm which correlates with iatrogenic and impacted ureteric calculus related strictures as per **Table - 4** and **Table - 5**. Surgical procedures were as per **Table - 6**. Among 30 patients, with 33 renal units, 2 patient's surgery failed, among which one required nephrectomy, and another required redo surgery, one patient who lost follow up was also considered as a failure.

Table - 2: Mode of presentation.

Symptoms of presentation	No. of patients (%)
Pain flank/abdominal	15 (50%)
Fever	4 (13.3%)
Urinary tract infection/ pyelonephritis	9 (30%)
Symptoms of azotemia	2 (6.6%)
Non specific symptoms like malaise, weakness voiding symptoms etc.	4 (13.3%)
Palpable mass	1 (3.3%)

Table - 3: Indication of surgery.

Indications	No. of patients (%)
Recurrent flank pain	18 (60%)
Recurrent febrile urinary tract infection	6 (20%)
Obstruction/ deterioration of renal function	10 (33.3%)
Urinoma/ perinephric-ureteric collection	1 (3.3%)
Pyonephrosis	4 (13.3%)
Failed endourology procedure	5 (16.6%)

Table - 4: Stricture location (in relation to iliac vessel).

Location	No. of renal unit n=33 (%)
Upper	18 (54.54%)
Lower	15 (45.45%)

Table - 5: Stricture length.

Length of stricture	Location of stricture in relation to iliac vessel (n=33)	
	Upper ureter	Lower ureter
< 2cm	9 (27.2%)	1 (3.03%)
3-5cm	5 (15.1%)	6 (18.1%)
5-10cm	3 (9.0%)	7 (21.2%)
>10cm	1 (3.03%)	0 (0%)
Total	18 (54.5%)	15 (45.5%)

Table - 6: Surgical procedures.

Surgical procedures	No. of renal unit underwent surgery (n=33) (%)
Pyeloureterostomy	4 (12.12%)
Ileal ureter replacement with ileal uretero-calycostomy ileal ureter replacement	3 (9.9%)
Uretero ureterostomy	9 (30%)
Boari flap	8 (24.4%)
Psoas hitch buccal mucosal graft ureteroplasty	2 (6.6%)
Ureteroneocystostomy	7 (21.21%)

Discussion

Mean age of presentation is 35.73 years from 3 years to 57 years. This correlates with prevalence of Gutb, iatrogenic, calculus diseases related stricture, usually affect middle age group. Ratio of male: female 1.7:1. Amongst 30 patients, main causes are genitourinary TB 8 (26.66%), iatrogenic 8 (26.66%), idiopathic/ non-specific inflammation 6 (20%), calculus 4 (13.33%), congenital 1 (3.33%), retroperitoneal fibrosis 1 (3.33%), endometriosis 1 (3.33%), traumatic 1 (3.33%). Which is comparable with study, held by Anthony T. Corcoran (2009), the etiology of stricture were previous endoscopic surgery for calculi 56% (19), rigid ureteroscopy 38% (13), flexible ureteroscopy 18% (6), previous abdominal or pelvic surgery 24% (8), gynecological surgery 9% (3), colon resection

9% (3), abdominal aortic aneurysm repair 6% (2), idiopathic 20% (7) [4]. O'brien reviewed a five year experience and found that 31 patients had been treated for ureteral strictures caused by the following ureteroenteral anastomotic strictures (23%), open ureterolithotomy (19%), ureteroscopy (19%), other urologic procedures (16%), general surgical and gynecological procedures (13%), and miscellaneous cause (7%) [5]. In the era of endourology, rate of iatrogenic stricture are increased, which is reconfirm by above mentioned two studies. By selecting small size of URS scope, proper technique of ureteroscopy, limiting duration of surgery, prevention of perforation, proper follow up patient with impacted and or large size calculus, use of laser energy for lithotripsy all associated with reduce occurrence of stricture associated with endourology management of large and impacted calculus. In our hospital, patients are from lower socio-economic class and tropical areas, so prevalence of Gutb is much more compared to other classes. In this study, investigation of choice for diagnosis of ureteric stricture management is contrast enhanced CT scan in comparison to conventional IVU [6]. CECT gives anatomical details related to urinary tract. It also gives information regarding, the extrinsic causes for stricture formation like endometriosis, retroperitoneal fibrosis, pelvic mass/ gynecology malignancy or lymphadenopathy etc. In case of Gutb, it also gives information regarding parenchymal calcification, intramural calcification, information regarding ureteric wall, cavitations or cut off calyces, perinephric collection, abscess, urinoma etc. If calcification is present, it is more suggestive of tuberculosis. CT is also an excellent substitute for retrograde pyelogram, because in many situations due to an inflamed or contracted bladder, the ureteric orifice could not be identified. Poor bowel preparation is not a factor in interpreting the findings accurately. Moreover, CT also helps to identify multiple ureteric lesions and calcifications more accurately. It also provides information on the functional status of the affected kidney. Among 30 patients, 5 patients were underwent

endourology management in form of balloon dilatation, but ultimately required surgical management, indications of surgery are recurrent flank pain 18 (60%), recurrent febrile urinary tract infection 6 (20%), obstruction of renal function 10 (33.3%), urinoma/ perinephric-ureteric collection 1 (3.3%), pyonephrosis 4 (13.3%). Among 30 patients with 33 renal unit upper ureteric stricture found in 18 (54.5%) and in lower ureter in 15 (45.5%), lower ureter is more affected in tuberculosis, where upper ureter mostly involved in case of impacted ureteric calculus and due to endourology procedures. Out of 30 patients, 11 patients were required emergency diversion procedures, in form of double J stents or percutaneous nephrostomy for various reasons like for pyonephrosis, persistent fever, vomiting, signs of azotemia or perinephric collection, electrolyte and acid-base imbalance etc. after stabilization of patient's condition, they underwent definitive procedures. Among 30 patients, 4 patients had pyonephrosis, 2 patients had obstructive uropathy, 10 patients had obstruction to urinary system leading to renal function deterioration. Among patients, who were diverted in form of double J stent, required nephrostomy insertion due to improper drainage. Various surgical procedures like, Uretero-ureterostomy 9 (33.3%), Boari flap [7] 8 (24.4%), Ureteroneocystostomy 7 (21.21%), Pyeloureterostomy 4 (12.12%), Psoas hitch [8] 1 (3.3%), Ileal treter replacement with ileal ureterocalycostomy 1 (3.3%) done with good success rate of 90.90%. Amongst the 30 patients, with 33 renal units, 2 patient's surgery failed among which one required nephrectomy, one patient redo surgery and one patient lost follow up. Among 30 patients and 33 renal units, 3 (9%) patients developed DJ stent related symptoms, two relieved by alpha blocker and culture specific antibiotics but one patient required early stent removal. Two (6%) patients with ileal ureter replacement developed complication in form of paralytic ileus requiring prolong ryle's tube aspiration and correction of electrolytes and requirement of total parental nutrition. One patient develops small leak at vesico ileal anastomosis so he required prolong DJ stenting

for 2 month and percutaneous aspiration and cultures specific antibiotics and prolong hospitalization. One patient (3%) with boari flap developed storage symptoms, which required anticholinergic for prolong period. Another 1 patient (3%) ureteroneocystostomy required restenting, with redo surgery. One (3%) patient with uretero ureterostomy developed pyelonephritis which required culture specific antibiotics. The success rate of ureteroneocystostomy with a psoas hitch is greater than 85% in recent reports, Ahn and Loughlin, et al., 2001 [9]. According to study by Carlton, et al. [10], 1975 and Bagley, et al. [11], 1985, the success rate for a tension-free, watertight ureteroureterostomy is more than 90%. Patients treated with a Boari flap is small, yet the results are good if a well-vascularized flap is used, Motiwala, et al., 1990 [12]. Thus this study reconfirm that, even in era of endourology and minimal invasive surgery, open reconstructive surgery have their own place in case of failed endourology procedures and long segment ureteric stricture like genitourinary tuberculosis, endometriosis, idiopathic and or iatrogenic causes with approximately 90.90% success rate with acceptable morbidity.

Conclusion

In era of endourology and minimal invasive surgery, open reconstructive surgery has its own place.

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