Distal Ureteric Strictures: Current Concepts in Diagnosis and Management

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Objectives

1. Etiology of distal ureteric strictures
2. Clinical Presentation and Diagnosis
3. Treatment options
   • Focus on minimally invasive approach
Anatomy

- Ureter can be divided into proximal, middle, and distal segments
- Proximal ureter extends from renal pelvis to upper border of sacrum
- Mid ureter is from upper to lower border of sacrum
- Distal ureter is from lower border of sacrum to bladder

Anatomy

- Blood supply to abdominal ureter is medial, whereas pelvic ureter is lateral
- Distal ureter receives branches from internal iliac (superior vesical, uterine, middle rectal, vaginal)
- Vessels coarse longitudinally in periureteral adventitia and form plexus
Etiology

Benign
- Impacted ureteral calculus
- Ureteral perforation
- Endometriosis
- Abdominal Aortic Aneurysm
- TB
- Schistosomiasis
- Injury during pelvic surgery (esp gynecologic)
- Sarcoidosis
- Amyloidosis
- Retroperitoneal Fibrosis


Etiology

Malignant
- TCC
- Cervical cancer
- Colon cancer
- Bladder cancer
- Prostate cancer
- Radiation
- For pelvic malignancies

Clinical Picture

- History
  - Surgical history
  - Stone history
  - Radiation Therapy
  - Timing of symptoms
  - Infections

- Flank pain/fullness are the most common presenting symptoms

Imaging

- Renal ultrasound
  - Highly sensitive for hydronephrosis
  - Difficult to localize stricture

- CT IVP
  - Sensitive and specific for diagnosing hydronephrosis/hydrourerter and level of obstruction
  - Stones
  - Extravasation/perforation

- MR Urography\(^1\)
  - Contraindications to IV contrast

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Imaging

- Retrograde Pyelogram
  - Avoids IV contrast
  - Can analyze details of ureteral mucosa
  - Aid in diagnosis and various endoscopic treatment modalities

63 patients for a total of 67 ureters; observational study
- Useful in characterizing nature of stricture and response to endoscopic treatment
  - Normal architecture with wall edema (19%) and no fibrosis → no treatment necessary
  - Wall fibrosis with normal periureteral tissues (36%) → best response to endoscopic treatments
  - Ureteral wall scarring and periureteral fibrosis (12%) → poor response to endoscopic treatments
  - Segmental RPF (10%)

- Helpful in identifying vessels during endoscopic treatment to minimize blood loss
- Disadvantages → invasive for diagnostic modality
- May have role during treatment (limited) but not commonly used
Imaging

- Nuclear renogram
- Differential renal function
- Functional Obstruction

Wolf et al. 1997

- Looked at longterm results of endoureterotomy for benign and ureteroenteric strictures
- endourologic therapies need at least 25% function of the ipsilateral kidney for a successful outcome
- Function <15% leads to poor long term outcome
- Indication for observation versus nephrectomy


Treatment

- Observation
- Medical Management

- Surgical
  - Endoscopic
  - Laparoscopic
  - Open
Observation

- Asymptomatic
- Normal contralateral renal function
- Poor function in affected renal moiety
- Can temporize with NT or stent and reassess for recovered function

Surgical Therapy

- Indications for intervention
  - Recurrent pyelonephritis
  - Compromised renal function
  - Pain
  - Recurrent stone formation
  - Need to rule out malignancy

- Stricture characteristics
  - Length
  - Malignancy
  - Location
  - Renal Function
Open Surgical Treatment

- Ureteroneocystostomy
- Psoas hitch
- Boari Flap
- Transureteroureterostomy
- Intestinal ureteral interposition
- Renal mobilization
- Autotransplantation

Endoscopic Treatment

- Ureteral Stenting
- Retrograde/Antegrade Balloon Dilation
- Ureteroscopic Endoureterotomy
  - Cold knife
  - Cutting electrode
  - Holmium Laser
Endoscopic Treatment

- Ureteric Stenting
  - Temporizing measure until definitive treatment
  - Chronic treatment for patients not suitable for definitive therapy, terminal malignancy
  - Reported use of dual stenting
  - Caution with long term stenting for extrinsic obstruction


Ureteral Stents

- Wenzler et al 2008\(^1\) reviewed 38 patients (41 ureteral units) with intrinsic ureteral obstruction treated with indwelling ureteral stent
- Patients were analyzed as treatment success versus failure in an attempt to identify predictive factors for successful management

Wenzler et al

- Treatment failure defined as any ureter that required an additional procedure (not including definitive management) or no resolution of symptoms
- Overall success rate was 36/41 ureteral units (88%) at mean followup of 25.5 months
- 3/5 patients that failed management were misdiagnosed (2 had neurogenic bladder, one had preexisting poor renal function); rest had stent failure

Wenzler et al

- Of patients successfully treated 13 ureters (36%) had definitive therapy
  - Mean time to therapy was 3.5 months
- 12 patients had resolution without need for further stenting
  - Mean number of stents used was 2.3
  - Mean time for resolution was 11.3 months
- 11 patients had ongoing stenting
  - Mean number of stents was 9
  - Mean time between stent change 5.2 months
  - Mean time of stenting was 43.6 months
Wenzler et al

- Univariate analysis performed to determine predictors of failures;
  - Male sex ($p=0.006$)
  - Increased serum Cr as presenting symptom ($p=0.002$)
  - Moderate or severe preoperative hydronephrosis ($p=0.042$); none or mild hydro associated w/ 100% resolution

- No information on stricture length

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Chung et al 2004

- Reported 15 year experience in 101 patients who underwent ureteral stenting for extrinsic compression

- Majority for cancer (colon, rectal, breast, lymphoma, prostate)
Chung et al 2004

- Mean follow up was 11 months
- 40.6% had stent failure (persistent hydronephrosis, flank pain, increasing serum Cr)
- Malignant cause of obstruction risk factor for stent failure ($p=0.02$)
- 50/90 (56%) of patients with malignancy were treated successfully
- Post stent systemic treatment ($p=0.02$) and baseline Cr > 1.30 mg/dl ($p=0.004$) associated with failure

### Table 1. Analysis of patient and stent specific categorical variables for all stent failures

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. Failures (%)</th>
<th>No. Successes</th>
<th>Odd's Ratio ($p$-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>27 (61.7)</td>
<td>27</td>
<td>1.16 (0.04)</td>
</tr>
<tr>
<td>Female*</td>
<td>24 (42.1)</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Diagnosis:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl*</td>
<td>40 (46.5)</td>
<td>56</td>
<td>0.89 (0.34)</td>
</tr>
<tr>
<td>N, Ca</td>
<td>1 (0.1)</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Symptom:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>31 (53.6)</td>
<td>27</td>
<td>0.51 (0.13)</td>
</tr>
<tr>
<td>Asymptomatic:</td>
<td>30 (46.2)</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Hydronephrosis:</td>
<td>10 (35.0)</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>2 (25.0)</td>
<td>4</td>
<td>1.77 (0.33)</td>
</tr>
<tr>
<td>Moderate</td>
<td>20 (23.9)</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Severe*</td>
<td>20 (30.3)</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal</td>
<td>24 (52.9)</td>
<td>24</td>
<td>0.47 (0.15)</td>
</tr>
<tr>
<td>Distal*</td>
<td>17 (32.1)</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Laterality:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>25 (38.5)</td>
<td>44</td>
<td>1.20 (0.77)</td>
</tr>
<tr>
<td>Bilateral*</td>
<td>10 (44.5)</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Ref (Fr):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>26 (36.1)</td>
<td>44</td>
<td>1.01 (0.62)</td>
</tr>
<tr>
<td>8*</td>
<td>10 (33.3)</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Post-stent systemic treatment:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>15 (39.0)</td>
<td>32</td>
<td>2.47 (0.07)</td>
</tr>
<tr>
<td>Yes*</td>
<td>25 (51.0)</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

* Treated as the exposure category for calculating the odd's ratio.
* Significant.

- 10/11 (91%) patients who had benign disease were treated successfully
- Majority of patients had intervention of benign disease process
- No correlation with stent size (6 Fr and 8Fr) and failure
- No correlation between degree of hydronephrosis and stent failure
Metallic Ureteral Stent

- Liatsikos et al 2009 studied the use of metallic Resonance™ (Cook) stent for extrinsic ureteral obstruction
- Nickel-cobalt-chromium-molybdenum alloy
- Continuous coil
- Inner safety wire (solid)
- Flow is intraluminal

50 patients prospectively analyzed
- Malignant extrinsic obstruction (n=25)
- Benign obstruction (n=18)
- Previously obstructed metal mesh stents (n=7)
- All patients treated with Resonance stent
- Failure defined as increased hydronephrosis on CT

Table 1 - Summary of disorders treated by the Resonance stent

<table>
<thead>
<tr>
<th>Groups</th>
<th>Underlying disease</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(group A)</td>
<td>Prostate cancer</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Colorectal cancer</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Stomach cancer</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Gynecologic cancer</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Bladder cancer</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Lymphoma</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Ureterosigmoidal</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>strictures (group B)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Stone disease (group C)</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Ureterosigmoidal strictures</td>
<td>4</td>
</tr>
<tr>
<td>Benign disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous obstructed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>metal stent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Liatsikos et al

- Patency rate in patients with malignant obstruction was 100% with mean follow up of 11 months
- Patency rate for benign obstruction was 44% with mean follow up of 6.8 months
- Stent failure due to encrustation and hyperplastic reaction invading stent coils leading to obstruction

### Table 2 - Results of stenting among studied groups

<table>
<thead>
<tr>
<th>Stricture etiology</th>
<th>No. of patients</th>
<th>Follow-up</th>
<th>Patency rate</th>
<th>Resistance (no of cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malignant Group A</td>
<td>23</td>
<td>11 mo</td>
<td>100%</td>
<td>0</td>
</tr>
<tr>
<td>Bacterial</td>
<td>23</td>
<td>11 mo</td>
<td>100%</td>
<td>0</td>
</tr>
<tr>
<td>Group B</td>
<td>9</td>
<td>6.8 mo</td>
<td>100%</td>
<td>3</td>
</tr>
<tr>
<td>Group D</td>
<td>4</td>
<td></td>
<td>100%</td>
<td>4</td>
</tr>
<tr>
<td>Benign, pseudoasis</td>
<td>follow-up: 3 6</td>
<td></td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Medial stents</td>
<td>Group E</td>
<td>7</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Group F</td>
<td>7</td>
<td>Ge (failure)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Retrograde Balloon Dilation

- Indications
  - Short strictures (<2cm)
  - “Soft” Strictures
- Contraindications
  - Active infection
  - Strictures >2cm
- Ureteral stenting 2-4 weeks post-operatively
Retrograde Balloon Dilation

- Goldfischer et al. 1997
  - Reviewed literature on balloon dilation
  - Success rates from 50-76%
  - Favorable results
    - Iatrogenic non-anastomotic strictures
    - Short stricture length
    - Duration of stricture <3 months


Retrograde Balloon Dilation

- Reviewed 8 published series
- Follow up of 10-29 months
- Success rate 48-88% with mean rate of 55%; 280 strictures treated
- Balloon dilation best suited for short non-ischemic strictures
Retrograde Balloon Dilation

Richter et al 2000; looked at benign strictures (both ischemic and nonischemic) in any segment of ureter

- Series of 114 patients
- Min 2 years follow up (mean 6.3 years)

### TABLE I. Benign ureteral strictures defined by etiology

<table>
<thead>
<tr>
<th>Etiology</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital</td>
<td>30</td>
</tr>
<tr>
<td>Complication of abdominal surgery (n = 65)</td>
<td>39</td>
</tr>
<tr>
<td>Focal pyelonephritis</td>
<td>13</td>
</tr>
<tr>
<td>Aorto-bifemoral bypass graft</td>
<td>9</td>
</tr>
<tr>
<td>Renal artery bypass</td>
<td>1</td>
</tr>
<tr>
<td>Lumbar spine fusion</td>
<td>2</td>
</tr>
<tr>
<td>Dissectiony</td>
<td>1</td>
</tr>
<tr>
<td>Pancreas surgery (pseudocyst drainage)</td>
<td>2</td>
</tr>
<tr>
<td>Ureterotomy for calculus</td>
<td>56</td>
</tr>
<tr>
<td>Bowel resection (Crohn’s disease)</td>
<td>2</td>
</tr>
<tr>
<td>Traumatic injuries (n = 9)</td>
<td></td>
</tr>
<tr>
<td>Gunshot wounds</td>
<td>5</td>
</tr>
<tr>
<td>Stab wounds</td>
<td>5</td>
</tr>
<tr>
<td>Blunt abdominal trauma</td>
<td>1</td>
</tr>
<tr>
<td>Nephroureteroscopy (calculus)</td>
<td>16</td>
</tr>
<tr>
<td>Flexible ureteroscopy (calculus)</td>
<td>2</td>
</tr>
<tr>
<td>Flexible ureteroscopy (franko)</td>
<td>1</td>
</tr>
<tr>
<td>Injury after basketing attempt</td>
<td>7</td>
</tr>
<tr>
<td>Periureteral infection/wikiness</td>
<td>12</td>
</tr>
<tr>
<td>Diverticulitis/Crohn’s disease</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>114</td>
</tr>
</tbody>
</table>

Richter et al 2000

- Strictures assessed by IV Urogram pre and post treatment or renogram (if IVU was inconclusive)
- IVU performed 3-6 days after removal of stent
- Treatment success was unchanged IVU or maintenance of baseline renal plasma flow on renogram
- Balloon dilatation in 81 patients, endoureterectomy in 27 patients, stents in 6 patients
Richter et al 2000

- Identified patients with compromised vascular supply
  - Stripping of lymphatics from ureter during abdominal surgery (e.g., Hysterectomy)
  - Aortic bypass grafts
  - Long standing periureteric abscesses
  - Blast injuries
  - After impacted calculi (>8mm) impacted for >2 weeks
- All patients stented post treatment, up to 4 weeks

Richter et al 2000

- Balloon dilation successful in 33/37 (89.2%) of patients with short stricture and intact vascular supply within 2 year follow up period
- 2/5 patients (40%) with short stricture and compromised vascular supply had successful treatment with balloon dilation
- 3/8 patients (37.5%) with long stricture (>2cm) had adequate lumen after balloon dilation
- 1/6 patients (16.7%) with long stricture (>2cm) had resolution with vascular compromise
Richter et al 2000

- 4 patients with short stricture and intact vascular supply were treated with endoureterotomy had resolution and no evidence of obstruction at two years
- 3/4 (75%) of patients with long stricture and intact vascular supply had resolution with endoureterotomy and 5/6 (83.3%) had resolution with compromised vascular supply
- Concluded balloon dilation best for short strictures with intact vascular supply

Endoureterotomy

- Retrograde pyelography and direct visualization of the stricture
- Cold knife
- Cutting electrode
- Holmium laser
- Cautery wire balloon
Endoureterotomy

- Retrograde access with safety wire
- Incision made from ureteral lumen out periureteral fat (full thickness)
- Include 2-3mm of normal ureteral tissue proximally and distally

Lane BR et al 2006 looked at long term efficiency of holmium laser endoureterotomy for benign strictures

- 19 patients underwent laser endoureterotomy for iatrogenic ureteral stricture
- All patients had 14/7 Fr or 10/7 Fr stent for 4-6 weeks
- Mean stricture length was 0.9cm (0.2-3cm)
- Mean follow up was 3 years
Lane et al 2006

- Successful treatment was resolution of symptoms and radiographic resolution (IVP or diuretic renography)
- 13/19 (68.4%) of patients had treatment success at 3 years
- Patients who failed treatment had longer stricture length (1.5 +/- 0.9 cm vs 0.7 +/- 0.7 cm, p = 0.049)
- Concluded their results similar to those previously quoted in the literature with overall success rate of 75%

Endoureterotomy

- Strictures with complete obliteration of lumen can be treated with a “cut to the light” approach
- Combined antegrade/retrograde approach
- Light on one ureteroscope turned off; pass stiff end of guidewire through or laser; fluoroscopic and direct vision; balloon segment once opened
Laparoscopic Approach

- Laparoscopic ureteroneocystotomy
- Laparoscopic Psoas Hitch
- Laparoscopic Boari Flap
- Robotic assisted laparoscopic ureteral reimplantation
  +/- Psoas Hitch

Laparoscopic Ureteroneocystostomy

- First described in 1993 for treatment of VUR
- Transperitoneal approach
- Intracorporeal suturing or devices (ie. EndoStitch)
- Technically challenging but improvements in technology and technique have made this more feasible
Laparoscopic Ureteroneocystostomy

- Lima et al. 2005 described dome advancement technique
- Minimized extensive bladder dissection
- Can reach ureter transected above iliac vessels
- Incision made 1/3 of distance from dome to base on anterior surface
- Suture midpoint of incision to spatualted ureter
- Bladder closed in Heineke-Mikulicz fashion; avoids need for ligation of contralateral pedicle


Laparoscopic Ureteroneocystostomy

Table 1. Patient demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (range)</td>
<td>42.1 (1-85)</td>
</tr>
<tr>
<td>No. women/men</td>
<td>15/10</td>
</tr>
<tr>
<td>Mean cm stricture length (range)</td>
<td>3 (1-6)</td>
</tr>
<tr>
<td>Mean preop serum creatinine (mg/dl)</td>
<td>0.9</td>
</tr>
<tr>
<td>Mean ASA score (range)</td>
<td>2 (1-3)</td>
</tr>
<tr>
<td>No. 1/t side</td>
<td>75/23</td>
</tr>
</tbody>
</table>

Table 2. Stricture etiology

<table>
<thead>
<tr>
<th>Etiology</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic</td>
<td>15 (22)</td>
</tr>
<tr>
<td>Pelvic mass</td>
<td>11 (24)</td>
</tr>
<tr>
<td>Distal ureter transitional cell Ca</td>
<td>5 (11)</td>
</tr>
<tr>
<td>Stone disease</td>
<td>4 (9)</td>
</tr>
<tr>
<td>Congenital</td>
<td>4 (9)</td>
</tr>
<tr>
<td>Unknown</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
</tr>
</tbody>
</table>

* Gynecological surgery in 9


Seideman et. Al. 2009 have largest series on Laparoscopic ureteral reimplantation
- 45 patients with distal ureteric strictures
- Ureteroneocystostomy in 53% (n=24) and Boari flap in 47% (n=21)
- 8 patients had undergone previous attempt at repair (balloon dilation, open repair, ureterolysis)
Seideman et al

- Success rate was 96% (no residual obstruction, no subsequent procedure, no renal deterioration, no symptoms) at 24.1 months
- 2 patients had recurrent strictures with 1 having nephrectomy for chronic flank pain and pyelonephritis
- Mean intraoperative blood loss = 150cc
- Mean LOS = 3 days
- No OR time quoted
- 3 patients had high drain outputs post-op with documented leak but were managed conservatively

Laparoscopic Ureteroneocystostomy

- Benefit seen versus open approach
- Rassweiler et al. 2007¹
  - Laparoscopic (n=10) versus open reimplantation (n=10) for ureteral stricture disease
  - 8/10 distal ureteric strictures in lap group vs 9/10 in open group
  - In the laparoscopic group 4 patients had psoas hitch with Boari flap and 6 patients just had psoas hitch
  - Open group 8 had psoas hitch and 2 had Boari flap

Rassweiler et al

Table 1 – Comparison of laparoscopic and open groups

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Laparoscopic group</th>
<th>Open group</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of female/male</td>
<td>275</td>
<td>8/2</td>
<td></td>
</tr>
<tr>
<td>Mean age (yr) (range)</td>
<td>52.2 (23-76)</td>
<td>65.3 (29-84)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.6 (22.2-31.1)</td>
<td>27.6 (22.9-31.4)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Mean stricture length (mm)</td>
<td>28.5 (24-35)</td>
<td>25 (22-30)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Mean operative time (min)</td>
<td>238 (160-345)</td>
<td>187 (66-405)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Mean estimated blood loss (cc)</td>
<td>175 (75-410)</td>
<td>435 (103-605)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Mean days to oral intake</td>
<td>1.5 (0-7)</td>
<td>1.9 (0-4)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Mean hospital stay (d)</td>
<td>5.7 (6-16)</td>
<td>9.1 (7-17)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Mean analgesic (mg piritramid)</td>
<td>4.8 (0-26)</td>
<td>21.5 (5-41)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Success rate</td>
<td>100%</td>
<td>83%</td>
<td></td>
</tr>
<tr>
<td>Convalesence (wk)</td>
<td>2.3 (0-3)</td>
<td>4.2 (0-7)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Complications</td>
<td>–</td>
<td>2/30</td>
<td></td>
</tr>
<tr>
<td>Major complications</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

BMI: body mass index.

Rassweiler et al

- No difference in mean length of stricture between two groups (28.5 vs 25 mm)
- No intra-operative or postoperative complications in laparoscopic group
- 2 patients in open group had postoperative complications
  - Urinary extravasation and hematoma
  - Anastamotic stricture (early)
- All patients had postoperative imaging
  - All patients in laparoscopic group had resolution of their stricture
- Two patients in open group had recurrent stricture on IVU and required stenting and balloon dilation; eventual resolution
Laparoscopic Ureteroneocystostomy

- Simmons et al 2007
  - Laparoscopic ureteral reimplantation (n=12) versus open approach (n=34)
  - Patients were similar at baseline
  - All patients stented for 4-6 weeks
  - All patients assessed at 2-3 months with serum creatinine, IV Urography, and renal U/S


### Table 2. Relationship of stricture location to procedure selection and etiology

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Open</th>
<th>Laparoscopic</th>
</tr>
</thead>
<tbody>
<tr>
<td>UU</td>
<td>9 (26)</td>
<td>5 (45)</td>
</tr>
<tr>
<td>UC</td>
<td>23 (68)</td>
<td>0</td>
</tr>
<tr>
<td>Boari</td>
<td>2 (6)</td>
<td>0</td>
</tr>
<tr>
<td>Stones</td>
<td>8 (24)</td>
<td>4 (60)</td>
</tr>
<tr>
<td>Iatrogenic</td>
<td>24 (70)</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (6)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>34 (100)</td>
<td>5 (15)</td>
</tr>
</tbody>
</table>

UU = ureteroureterostomy; UC = ureteroneocystostomy.
Data presented as numbers, with percentages in parentheses.

### Table 3. Stricture length

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Stricture Length (cm)</th>
<th>Overall</th>
<th>UU</th>
<th>Boari</th>
<th>UC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td>Mean ± SD (cm)</td>
<td>1.9 ± 1.2 (1-4)</td>
<td>9</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>Laparoscopic</td>
<td>Mean ± SD (cm)</td>
<td>1.0 ± 0.9 (1-3)</td>
<td>11</td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

Abbreviations as in Table 2.
Data in parentheses are ranges.
Simmons et al

- 100% (n=12) of patients in laparoscopic group had resolution of their stricture at mean followup of 23 months vs 96% (n=30) in the open group (p=0.544)
- Overall complication rate in lap vs open was 8.3 and 14.7% respectively (p=0.225)
- One patient in the open group had anastomotic restricture treated with balloon dilation
- One patient in the lap group had post-op urinoma after Boari flap; treated with bladder decompression x 2 weeks with resolution
Robotic Assisted Reimplantation

- First described in 2004 following ureteric injury during radical prostatectomy
- Uberoi J et al 2007 described Robotic assisted laparoscopic ureteral reimplantation with psoas hitch
- Patil et al 2008¹ performed multi-institutional evaluation of experience with Robotic assisted reimplantation with psoas hitch
  - 12 patients, 10 had distal ureteric strictures
  - Conversion rate was 0%
  - No complications w/ mean follow up of 15.5 months


Patil et al

- Mean operative time was 208 minutes (80-260 minutes)
- EBL 48 cc (45-100cc)
- Mean length of stay 4.3 days (2-8 days)
- All patients stented for 3-8 weeks
- All patients asymptomatic at F/U
- F/U IVU or MAG3 was normal in 10; 2 patients had mild hydronephrosis
Conclusions

- Variety of causes of distal ureteric strictures

- Important characteristics include
  - Extrinsic versus intrinsic
  - Benign versus malignant
  - Stricture length and location
  - Renal Function (ie. >25%)

- Strictures < 2cm consider endoscopic management
- Strictures >2 cm or complex strictures (long or obliterated) consider open or laparoscopic management

Conclusions

- Ureteral stenting useful as a temporary solution or reasonable option for short strictures without increased serum creatinine or moderate→ severe hydronephrosis

- No clear evidence for stent change intervals

- Metal stents more effective for malignant extrinsic compression

- Balloon dilation effective for patients with short (<2cm) soft stricture without compromised vascular supply
Conclusions

- Holmium laser endoureterotomy is effective treatment for short (<2cm) strictures with or without compromised vascular supply with an overall success rate of 70% but prospective data is limited.

- Laparoscopic reimplantation +/- psoas hitch or Boari flap is technically feasible with improvements in technique, equipment etc.

- Associated with decreased intraoperative blood loss, shorter hospital stay, and faster return to work.

- Robotic assisted technique promising but further studies are required; so far no worse than conventional laparoscopy.

Thankyou for your attention

- Thanks to Dr. Ben Chew for his help with this presentation.