Female Urethral Reconstruction

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Disclosures

- Investigator – Allergan
- Investigator – Astellas
- Investigator - Medtronics
- Chair of Education, American Urological Association
Urethral Reconstruction

• Urethral Strictures
• Bladder Neck Closure
• Urethral Diverticulum
• Urethrovaginal Fistula
Female Urethral Stricture: Etiology

- Idiopathic (42-49%)
- Iatrogenic (39-42%)
- Traumatic (7-15%)
- Infectious
- Inflammatory (vulvar dystrophy, lichen sclerosis)
- Congenital
- Radiation
- Atrophy (meatal stenosis)
Incidence

• True incidence unknown
• 0.9% of 587 women with “abnormal voiding”\(^1\)
• 4–13% of the causes of BOO in women \(^1,2\)
• 4.9% of women with LUTS at a tertiary care center \(^3\)

Despite its relative rarity, the diagnosis and appropriate treatment of true female urethral stricture may be under reported and under utilized

Diagnosis

- **History** – raises suspicion, prompts further testing
  - Poor flow, hesitancy, incomplete emptying, dysuria

- **Physical exam**

- **Uroflow / PVR**

- ** Attempt at catheterization**
  - No standardized definition for size of catheter
Diagnosis

• VCUG

• Trans labial US

• Endoscopy

• Urodynamics (select cases)

• If malignancy suspected – biopsy, MRI
Sono-Urethrogram
# A Systematic Review of Surgical Techniques Used in the Treatment of Female Urethral Stricture

Nadir I. Osman, Altaf Mangera, Christopher R. Chapple *  

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**Table 1 – Investigational modalities used in the diagnosis of female urethral strictures**

<table>
<thead>
<tr>
<th>Investigation modality</th>
<th>No. of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uroflowmetry and PVR estimation</td>
<td>8</td>
</tr>
<tr>
<td>Urodynamics or videourodynamicies</td>
<td>9</td>
</tr>
<tr>
<td>Urethrosopy</td>
<td>10</td>
</tr>
<tr>
<td>Voiding cystourethrogramy</td>
<td>10</td>
</tr>
<tr>
<td>MRI</td>
<td>2</td>
</tr>
<tr>
<td>IV urography with voiding cystourethrogramy phase</td>
<td>1</td>
</tr>
</tbody>
</table>

PVR = postvoid residual; MRI = magnetic resonance imaging; IV = intravenous.
Female Urethral Stricture Disease
Utility of UDS / VUDS

• Assess for obstruction when not obvious

• Assess bladder function
  – Contractility
  – DO
  – Compliance

• Assess continence
  – Presence of SUI
  – Anatomic level of continence
58 year old Women with Midurethral Stricture

Tests for SUI

Cough / Valsalva BN closed

High pressure

Low Flow Voiding

Localization of stricture
Female Urethral Strictures: Categorization by Location

• Distal
  – Meatus to up to 1 cm proximal

• Mid
  – Middle 2 cm

• Proximal
  – Bladder neck to 1 cm distal
Treatment

- Urethral dilatation
- Self catheterization
- Urethrotomy
- Urethroplasty

Evidence base is limited for various treatments
Urethral Dilation

• Historically done for recurrent UTI, urethritis, frequency/urgency syndrome in the absence of true stricture
  – Mostly unnecessary
  – Mostly abandoned (I hope)

Santucci, et al J Urol 2008;180: 2068-75
Urethral Dilatation for True Stricture

• The data is limited, poor and uncontrolled
  – No significant info on location, size, etiology
  – Dilatation caliber variable (some up to 41 Fr.)
  – ? If CIC included

• Metanalysis: 47% success rate at 43 months
  (Osman, et al 2013)
  – 58% if no prior dilatation
  – 27% if prior dilatation
Urethroplasty Techniques

• Distal urethroplasty
  – Circumferential distal urethrectomy and advancement
  – Proximally-based ventral flap urethroplasty (Blandy)
  – Vestibular or labial Flap urethroplasty
Urethroplasty Techniques

- Mid urethroplasty
  - Dorsal / ventral onlay graft (buccal mucosa)
  - Labial flap onlay
  - Orandi-type vaginal flap urethroplasty
  - U-shaped vaginal flap urethroplasty
  - Tubularized vaginal flap urethroplasty
  - Anastomotic repair
Urethroplasty Techniques

• Proximal urethroplasty
  – Dorsal / Ventral onlay graft (buccal mucosa)

• Salvage
  – Bladder neck closure
Circumferential Distal Urethrectomy with Meatal Advancement

- Ideal for meatal stenosis
- Circumferential incision and mobilization of the urethra to a point proximal to the stricture
- Excise the distal urethra with at least a 2 mm margin of healthy urethral mucosa
- Advance the urethra and circumferentially close
Meatal Stenosis with Fibrotic Ring
Circumferential Distal Urethrectomy with Meatal Advancement

Circumferential incision around the urethra with proximal mobilization
Circumferential Distal Urethrectomy with Meatal Advancement

Place stay sutures in 4 quadrants, about 1 cm deep
Circumferential Distal Urethrectomy with Meatal Advancement

After excision of the distal urethra – place quadrant sutures through the vaginal epithelium.
Circumferential Distal Urethrectomy with Meatal Advancement

Circumferential mucosal to epithelial advancement
Keep catheter 1-3 days
Proximally-Based Ventral Flap Urethroplasty (Blandy)

- Best for strictures from that are $\leq 1$ cm from the meatus
- Inverted U incision and raise a proximally-based flap
Ventral Incision through the stricture

Advanced apex of flap to proximally extent of incision
Keep catheter for 5-7 days
Vestibular Flap Urethroplasty
Outcomes for Distal Urethroplasty

• Distal urethrectomy – minimal data in literature though thought to have very high success rates (90%)

• Proximally-based ventral flap urethroplasty
  – 83-100% success
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## Table 3 – The outcomes of vaginolabial flap urethroplasty reported in the literature

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of patients</th>
<th>Previous intervention</th>
<th>Technique</th>
<th>Concomitant procedure</th>
<th>Postop ISC</th>
<th>Success %</th>
<th>Mean follow-up, mo</th>
<th>De novo incontinence</th>
<th>Other complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blavas et al., 2012</td>
<td>10</td>
<td>Dilatation (all)</td>
<td>Ventral approach U-shaped inlay Vaginal flap</td>
<td>Pavosogal sling (5) Martius flap (4) Diverticulectomy (1)</td>
<td>No</td>
<td>80</td>
<td>53</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Onol et al., 2011</td>
<td>10</td>
<td>Dilatation (5) Urethrotomy (3)</td>
<td>Ventral approach U-shaped inlay Vaginal flap</td>
<td>No</td>
<td>Yes</td>
<td>100</td>
<td>36</td>
<td>No</td>
<td>Inward urinary stream (2)</td>
</tr>
<tr>
<td>Gormley 2010</td>
<td>12</td>
<td>Dilatation or urethrotomy (all)</td>
<td>Ventral approach U-shaped inlay Vaginal flap</td>
<td>Pavosogal sling (2)</td>
<td>Yes</td>
<td>83%</td>
<td>30</td>
<td>Urgency incontinence (1)</td>
<td>Recurrent UTIs (2)</td>
</tr>
<tr>
<td>Simonato et al., 2010</td>
<td>6</td>
<td>Urethrotomy (all)</td>
<td>Ventral approach C-shaped inlay Vaginal flap</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>58.5</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Montorsi et al., 2002</td>
<td>17</td>
<td>No</td>
<td>Dorsal approach U-shaped inlay Vaginal flap</td>
<td>No</td>
<td>No</td>
<td>87</td>
<td>12</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Tannello et al., 2002</td>
<td>2</td>
<td>Dilatation (all)</td>
<td>Ventral approach Labial flap</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>24</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>All: individual patient data mean</td>
<td>57</td>
<td>–</td>
<td>–</td>
<td>Yes (12)</td>
<td>91</td>
<td>32.1</td>
<td>Urgency incontinence (1)</td>
<td>4</td>
<td>No</td>
</tr>
</tbody>
</table>

*Postop ISC* – postoperative intermittent self-catheterisation; UTI – urinary tract infection.

*The definition of success was adapted to the requirement for surgical intervention because all patients were performing postop ISC.*

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NYU Langone Health
Vaginal Flap Urethroplasty

- Can be used for midurethral stricture, distal urethral loss and short urethra with vaginal voiding

- In cases urethral stricture, a longitudinal midline incision is made in the anterior vaginal wall covering the urethra
  - The urethra is then incised on its ventral surface through the stricture into healthy mucosa and a dorsal plate is created
Vaginal Flap Urethroplasty for Wide Female Stricture Disease

Alchide Simonato,* Virginia Varca, Marco Esposito and Giorgio Carmignani

From the Clinica Urologica “L. Giuliani,“ Ospedale San Martino, Genova, Italy

J Urol 2010; 184:1381-5

- 6 patients - “normal micturition” in all
- Mean f/u 70.8 months
U-Shaped Vaginal Flap Urethroplasty

Inverted U incision 1.0-1.5 cm wide and 2-3 cm long

Flap is then rotated up and sutured to the vaginal wall or dorsal plate

From: Vaginal Surgery for The Urologist
Tubularized Vaginal Flap Urethroplasty

From: Vaginal Surgery for The Urologist
Tubular Vaginal Flap Urethroplasty

From: Vaginal Surgery for The Urologist
Tubular Vaginal Flap Urethroplasty
Tubular Vaginal Flap Urethroplasty
Vaginal Flap Urethroplasty

• May be combined with PV sling in cases of urethral insufficiency
• Foley catheter for 10-14 days
• Outcomes:
  – 87% success with a 25% risk of de novo SUI
    • Flisser AJ and Blaivas JG: J Urol 2003;169:2246-9
• Complications
  – Recurrent urethral stricture/meatal stenosis, vaginal flap necrosis, de novo stress or urgency incontinence, vaginal shortening, dyspareunia
Dorsal Onlay Urethroplasty

From: Vaginal Surgery for The Urologist
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## Table 5 – The outcomes of oral mucosal graft urethroplasty in women reported in the literature

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of patients</th>
<th>Previous intervention</th>
<th>Technique</th>
<th>Concomitant procedure</th>
<th>Postop ISC</th>
<th>Success, %</th>
<th>Mean follow-up, m</th>
<th>De novo incontinence</th>
<th>Other complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tsvian and Sidi, 2006 [25]</td>
<td>1</td>
<td>Dilatation and urethrotomy</td>
<td>Dorsal approach Buccal mucosa</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>27</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Migliari et al., 2006 [22]</td>
<td>3</td>
<td>Dilatation and urethrotomy (2)</td>
<td>Dorsal approach Buccal mucosa</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>6</td>
<td>No</td>
<td>Storage LUTS (resolved at 1 wk post-TWOC; 2)</td>
</tr>
<tr>
<td>Berglund et al., 2006 [24]</td>
<td>2</td>
<td>Dilatation</td>
<td>Ventral approach Buccal mucosa</td>
<td>No</td>
<td>No</td>
<td>50</td>
<td>24</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Blaivas et al., 2012 [17]</td>
<td>3</td>
<td>Flap urethroplasty (2) Dilatation (1)</td>
<td>Dorsal approach Buccal mucosa</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>25</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Onol et al., 2011 [20]</td>
<td>6</td>
<td>Dilatation (2)</td>
<td>Dorsal (2) Ventral (2) Circumferential (tubularised; 2) Buccal mucosa</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>17</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Sharma et al., 2000 [23]</td>
<td>15</td>
<td>Dilatation or urethrotomy (all)</td>
<td>Dorsal approach Lingual mucosa</td>
<td>No</td>
<td>No</td>
<td>93</td>
<td>12</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Castillo et al., 2010 [30]</td>
<td>2</td>
<td>Dilatation (all)</td>
<td>Dorsal approach Buccal mucosa</td>
<td>No</td>
<td>No</td>
<td>100</td>
<td>18</td>
<td>No</td>
<td>Graft donor site haematoma (1)</td>
</tr>
<tr>
<td>All: individual patient data mean</td>
<td>32</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>No</td>
<td>No</td>
<td>94</td>
<td>15</td>
<td>No</td>
</tr>
</tbody>
</table>

Postop ISC = postoperative intermittent self-catheterisation; LUTS = lower urinary tract symptoms; TWOC = trial without catheter.
• 26 women with urethral stricture (2007-2014)
  – All confirmed by cystourethroscopy
  – VCUG for all treated surgically
    • Obstruction confirmed radiographically and urodynamically
  – 1st treatment - dilatation or urethrotomy
  – Recurrent stricture – dilatation or urethrotomy plus weekly ISD or urethroplasty
8 treated with dilatation (6 new, 2 recurrent)
  - All required further dilatations or ISD

1 urethrotomy, 1 meatatoplasty

16 treated with urethroplasty
  - 14 buccal graft, 2 vaginal flap
# Female urethral stricture: a contemporary series

M. Spilotros¹ · S. Malde¹ · E. Solomon¹ · M. Grewal¹ · B. M. Mukhtar¹ · M. Pakzad¹ · R. Hamid¹ · J. L. Ockrim¹ · T. J. Greenwell¹


<table>
<thead>
<tr>
<th>Procedure</th>
<th>Vaginal flap</th>
<th>Meatoplasty</th>
<th>Urethrotomy</th>
<th>Dilatation</th>
<th>BMG urethroplasty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cure of pain N (%)</td>
<td>1 (100)</td>
<td>0 (0)</td>
<td>/</td>
<td>0 (0)</td>
<td>4 (67)</td>
</tr>
<tr>
<td>Cure of stricture</td>
<td>2 (100)</td>
<td>0 (0)</td>
<td>1 (100)</td>
<td>0 (0)</td>
<td>13 (93)</td>
</tr>
<tr>
<td>Cure of OAB</td>
<td>1 (100)</td>
<td>1 (100)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>1 (20)</td>
</tr>
<tr>
<td>Cure of UTIs</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>/</td>
<td>0 (0)</td>
<td>7 (88)</td>
</tr>
<tr>
<td>Further urethral dilatations</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>4 (50)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>Need of ISD</td>
<td>0 (0)</td>
<td>1 (100)</td>
<td>0 (0)</td>
<td>5 (63)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>New-onset SUI</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>3 (23)</td>
</tr>
</tbody>
</table>
Female Urethral Stricture: Summary

• True female urethral stricture is a real entity

• A high index of suspicion helps with diagnosis

• Reasonable to offer urethral dilatation as an initial treatment, but failure rate is high and patients may require intermittent self dilation/catheterization
Female Urethral Stricture: Summary

• There are many options for female urethroplasty

• No comparative studies

• The ideal technique for each stricture type and location has not been determined, but adherence to sound reconstructive techniques appears to produce good short and intermediate term results that are superior to urethral dilatation
Bladder Neck Closure

• Indicated in cases of extensive urethral destruction, usually due to a chronic indwelling urethral catheter in cases of neurogenic bladder or severe trauma
  – Progressive urethral dilatation leads to chronic, intractable incontinence around an indwelling catheter, with associated perineal excoriation and chronic urinary tract infection
Bladder Neck Closure

• Can be accomplished via a transvaginal approach combined with creation of a continent catheterizable stoma, incontinent ostomy (ileovesicostomy) or an indwelling suprapubic catheter
BN Closure Vaginal Approach

- Standard vaginal surgery prep
- Suprapubic tube insertion if desired
  - Percutaneous
  - Open
BN Closure Vaginal Approach

From: Vaginal Surgery for The Urologist
Nitti VW, Rosenblum N, Brucker BM Elseiver, 2012
BN Closure Vaginal Approach

- Pubourethral ligaments cut
- Urethra excised
Two Layer Closure of BN

Identify ureteral orifices and evert BN

From: Vaginal Surgery for The Urologist
Nitti VW, Rosenblum N, Brucker BM Elseiver, 2012
May place Martius flap prior to closure
Transvaginal BN Closure

• Although there are not a large number of reports on bladder neck closure in the literature, success rates are high

• Complications:
  – Bleeding from retropubic vessels, which can be difficult to control
    • Case should be completed expeditiously
  – Ureteral injury (can be minimized with IV indigo carmine)
  – Vesico-vaginal fistula
Video 12.5

Transvaginal Bladder Neck Closure
Urethral Diverticulum: Etiology

- Acquired
  - Infectious
    - result of obstruction of the periurethral gland ducts causing retention of secretions with subsequent infection, abscess formation and eventual rupture into the urethral lumen
  - Traumatic
    - instrumentation, surgery or childbirth
- Congenital
Periurethral glands:
- Secrete mucins, which protect the urethra from the irritative and potentially toxic effects of urine
- Located primarily between 3 o’clock and 9 o’clock within the submucosa of the urethra
- Adjacent to a rich network of vascular spongy tissue, mostly within the distal 2/3 of the urethra
- Terminate in the paraurethral (Skene’s) glands which empty via 6–30 paraurethral ducts into the distal 1/3 of the urethra

Presentation

• “Classic triad”
  – Dysuria (55%)
  – Dyspareunia (16%)
  – Dribbling (26%)

• More the exception than the rule

• Recurrent UTI’s - 40%
• Frequency - 56%
• Painful mass - 35%
• Stress and/or urge incontinence
• Pus per urethra
• Hematuria
• Obstructive voiding
• Urinary retention
Diagnosis

- **Physical exam**
  - Confirm
  - Raise suspicion

- **Urethroscopy**
  - Ostium seen in 78% of cases
  - No info on number, size or complexity
Diagnosis

Radiography

• VCUG
• PPU

• Studies comparing the two show a 49-51% sensitivity for VCUG vs. 85-100% for PPU

• VCUG easier
• PPU can be painful

• Both can underestimate the size, complexity and number of tics
Diagnosis

Ultrasound

- Highly accurate in diagnosing urethral diverticulae
  - Also in identifying neck
  - Does not give the same detail as MRI
Diagnosis

MRI

• Increased diagnostic accuracy

• Exquisite anatomic detail which can help plan surgical approach
  – Raises suspicion of malignancy

• Non-invasive and painless

• Currently the test of choice
  – Urethrography is no longer routinely done
“Saddlebag Diverticulum”
Circular Diverticulum
Stones in Diverticulum
Diagnosis

Urodynamics

• Urodynamic evaluation may be helpful if there is coexisting incontinence or voiding dysfunction

• Urgency incontinence
• Stress incontinence
  – ALPP
  – Hypermobility
  – Paradoxical incontinence

• Incomplete emptying
Treatment Options

• Observation
• Transurethral incision
• Fulguration
• Marsupialization (Spence-Duckett)
  – Distal lesions
  – Creates hypospadiac meatus
• Diverticulectomy and reconstruction
• Urethral transection and excision (Rovner, 2000)
Urethral Diverticulectomy

Step 1: Inverted U- incision, proximally-based vaginal flap
Periurethral Fascia
Urethral Diverticulectomy

Step 2: Open periurethral fascia transversally and raise proximal and distal flaps
Urethral Diverticulectomy

Step 3: Isolate diverticulum

Periurethral Fascia

Urethra

Periurethral Fascia
Urethral Diverticulectomy

Step 4: Excise Diverticulum
Urethral Diverticulectomy
Step 5: Define the Defect and Close Urethra with 4-0 PGA Longitudinally
Video 10.1
Urethral Diverticulectomy with Urethral Reconstruction
Urethral Diverticulectomy

Step 6: Close periurethral fascia transversely with 3-0 PGA
Urethral Diverticulectomy
Step 7

• Close vaginal lap with 2-0 PGA

• 3 non-overlapping suture lines
The size of the urethral defect can vary.
Post Operative Care

• Vaginal packing overnight if admitted
• Foley catheter x 7-14 days
• Antimuscarinics
• Antibiotics (suppressive)
  – Often pre treat as well
• VCUG at catheter removal
MRI Helps Define Anatomy
Circular Diverticulum – Operative Approach: Complete Mobilization
Circular Diverticulum – Operative Approach: Harvest Martius Flap
Diverticulectomy and SUI

• Concomitant PVS is safe and effective, and avoids a second operation without adding additional morbidity
  – Swierzewski and McGuire (J Urol 1993;149:1012-14)

• No patients experienced retropubic infection

Autologous fascia preferred material – NO SYNTHETICS!!
Simultaneous Pubovaginal Sling

- Harvest sling first
- Excise diverticulum
- Place PV sling and keep out of field
- Cystoscope
- Repair urethra
- Put sling in place
Infected Skene’s Gland Cyst

Meatus Displaced
Urethral Diverticulectomy
Historical Results

- Incontinence – 20%
  Improved with pre operative evaluation and operative treatment
- Recurrence 4 – 10 %
  Improved with preoperative imaging
- Stricture < 1 %
- Fistula < 1%

- Detrusor overactivity - 3 - 5 %
Long Term Results

  - Single surgeon experience over 26 years
  - 68 women
    - 45 no prior surgery
    - 15 prior diverticulectomy (1-6)
    - 8 other prior urethral surgery
  - 11/64 (17%) had a recurrence
Long Term Complications of Urethral Diverticulectomy

- New-onset stress urinary incontinence: 8–49%
- Persistence of dysuria: 0–26%
- Persistence of recurrent UTI: 0–23%
- Recurrence: 0–22%
- New-onset urgency: 0–13%
- Urethrovaginal fistula: 0–8%
- Urethral stricture: 0–2%
Urethrovaginal Fistula: Etiology

- Iatrogenic
  - Following mid-urethral synthetic sling
    - Unrecognized perforation
    - Inadvertent dissection into the periurethral fascia resulting in sling placement in the urethral wall
    - Unrecognized placement of a sling through the urethra
    - Late urethral erosion
  - Other urethral surgeries (e.g. urethral diverticulectomy)
- Trauma
- Radiation
Urethrovaginal Fistula: Symptoms

• Depends on location:
  – Total incontinence (proximal urethra)
  – Sporadic incontinence or post void dribble (distal urethra)
  – Vaginal voiding without incontinence
  – Recurrent UTI
  – Asymptomatic
Urethrovaginal Fistula After Midurethral Sling
Keys to Successful Repair

• Adequate exposure and mobilization
  – catheterize if possible
• Mucosal approximation to ensure a watertight closure
• Tension-free suture lines
• Closure of the periurethral fascia if possible
• Adequate diversion of urine in post-operative period to allow complete healing
• May need to place simultaneous sling
  – Autologous fascia makes an excellent additional layer
A. The fistula is circumscribed so that the vaginal wall can be mobilized off of it

B. The fistula is fully exposed

C. The full thickness of the urethra including the mucosa, is closed with a continuous 4-0 PGA suture

D. The periurethral fascia is closed with interrupted 3-0 PGA sutures

E. A pubovaginal sling cab be placed if necessary

Note: if eroded mesh is present, then decision to do a combined vs. staged PV sling must be made
Video 14.1

Urethrovesical Fistula with PVS