INTRODUCTION AND TERMINOLOGY

Non-Traumatic Posterior Urethral Obstruction
- Urethral Stricture/Stenosis
- Bladder Neck Contracture
- Urorectal Fistula

Less common and not widely discussed

Interest in this pathology has grown over the last decade

Significantly more serious complications of prostate cancer treatments
INTRODUCTION AND TERMINOLOGY

Etiology of Non-Traumatic Posterior Urethral Obstruction
- Surgery
- Radiation

Most commonly due to prostate cancer treatments, but other pelvic malignancies too

Less often, surgery for BPH

Vesicourethral stenosis (BNC) is most common site of obstruction after rad. prost.

Bulbomembranous urethra is typically affected by radiation therapy

Devastated outlet (BN and Post Urethra): entity associated with refractory/recalcitrant stenosis, significant necrosis and/or end-stage incontinence deemed unreconstructable

Mundy 2012; Anderson 2015

INTRODUCTION AND TERMINOLOGY

Terminology should be according to SIU/ICUD – Strongly recommended to avoid confusion!!!

(Société Internationale d’Urologie/International Consultation on Urologic Diseases)

Stricture – anatomical definition; urethral narrowing/obliteration if surrounded by spongiosum

Stenosis – narrowing of BN, prostatic urethra and membranous urethra (not invested by spongiosum)

Posterior urethral stenosis (BNC) refers to stenosis from distal BN to proximal bulbar urethra
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

POSTERIOR URETHRAL STENOSIS
Prostate in Situ
- Bladder neck stenosis/contracture
- Prostatic urethral stenosis
- Bulbomembranous urethral stricture

POSTERIOR URETHRAL STENOSIS
Prostate Absent
- Vesicourethral anastomotic stenosis

ETIOLOGY, INCIDENCE AND RISK FACTORS

Most commonly due to prostate cancer treatments
- Nowadays, 10-year survival for PCa ~ 90%
- Potential for long-term morbidity

Overall incidence of “Posterior Urethral Obstruction” after PCa Rx/ ~ 5.2%

Common causes:
- Radical prostatectomy
- Energy ablation therapies (EBRT, brachytherapy, cryotherapy, HIFU, etc)
ETIOLOGY, INCIDENCE AND RISK FACTORS

Bladder Neck Stenosis (Prostate in Situ)
- Energy ablation therapy (EBRT, brachytherapy, cryotherapy, HIFU, etc), predominantly radiation therapy

Protatic Urethral Stenosis
- Radiation therapy and other form of energy ablation therapy

Bulbomembranous Urethral Stricture
- Transurethral instrumentation
- Energy ablation therapies

Vesicourethral Anasstomotic Stenosis (Prostate absent)
- Radical prostatectomy (abdominal, perineal, laparoscopic or robotic)

ETIOLOGY, INCIDENCE AND RISK FACTORS

RADICAL PROSTATECTOMY
- Reported incidence:
  - Overall → 1.4% - 32%
  - Historically → 32%
  - Most contemporary series <5%
  - Surya1990; Popken 1998; Menon 2004; Parihar 2014; Webb 2009; Breyer 2010

BPH SURGERY
- Reported incidence:
  - 3.3% - 5.3%
  - Serretta 2002; Varkarakis 2004; Helfand 2006
ETIOLOGY, INCIDENCE AND RISK FACTORS

RADICAL PROSTATECTOMY

- Risk factors
  - Disease factors
    - High-grade, advanced Pca
    - Non-nerve sparing technique
    - Wide resection
    - Adjuvant or salvage radiation therapy
  - Patient factors
    - Coronary artery disease, hypertension, DM, smoking, obesity, older age
  - Surgeon factors
    - Low volume, anastomotic urine leak, intravesical foreign body, ↑ operative time, ↑ blood loss

Surya 1990; Borboroglu 2000; Hu 2003; Erickson 2009; Sowerby 2014; Hershorn 2014; Yi 2010; Cho 2013

RADIOTHERAPY

- Progressive obliterative endarteritis leading to ischemia (free oxygen radicals)
- Incidence estimated in:
  - 2% for EBRT
  - 4% for Low-dose Brachytherapy / 32% for High-dose Brachytherapy
  - 11% for Combination EBRT + Brachytherapy
  - More pronounced if previous TURP or excessive dose to urothelium
  - > 90% of stenoses due to XRT involve BM urethra
  - Brachytherapy and Combination Rx/ → longer, obliterative stenoses, and more difficult to treat

Mundy 2012; Mohammed 2012; Hindson 2013; Radge 1997; Merrick 2006
ETIOLOGY, INCIDENCE AND RISK FACTORS

CRYOTHERAPY AND HIFU

- Coagulative necrosis (no generation free oxygen radicals, no progressive tissue damage over time)
- Reported incidence:
  - 5% - 10% after salvage Cryoablation / 2.2% - 17% after primary Cryoablation
  - 8% - 15% after salvage HIFU / 3.6% - 22% after primary HIFU
  - Treatment of strictures resulting from HIFU not widely published

Mundy 2012; Kvorning 2015; de la Taille 2000; Kanthabalan 2017; Crouzet 2017

ETIOLOGY, INCIDENCE AND RISK FACTORS

CRYOABLATION / HIFU

Limited studies looking at risk factors!!!
CLINICAL EVALUATION

HISTORY
- Emptying problems
- Sometimes, almost asymptomatic
- Detected after failed attempt at Foley catheter placement or during cystoscopy
- Chronic pelvic pain (pts after multiple endoscopic procedures, or XRT)

CYTOSCOPY
- Identification of location of obstruction
- Presence of calcification, necrosis and tumor recurrence
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

CLINICAL EVALUATION

RUG / VCUG / MRI
- Length of stenosis/stricture
- Presence of associated fistula
- Assessment of typical landmarks of verymontanum and BN
- MRI is the most sensitive tool for urosymphysal fistula
  (XRT, chronic pelvic pain after multiple endoscopic procedures)

URODYNAMICS
- Determination of cystometric capacity, compliance and baseline incontinence
- If UDS not possible due to complete obliteration, “Capping SPT test”

NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

Radiated-BMUS Stenosis Pre-operatively

Completely obliterated bulbomembranous stenosis
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

Retrograde/Antegrade Urethrogram of Radiated-BMUS and Bladder Outlet Stenosis Pre-operatively

Completely obliterated bulbomembranous urethral and bladder outlet stenosis after brachytherapy and EBRT

NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

After Radiated-BMUS OMG dorsal onlay urethroplasty

Pericatheter urethrogram

Retrograde urethrogram

Voiding urethrogram
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

After radiated-BMUS OMG dorsal onlay urethroplasty

SURGICAL DECISION-MAKING

THERAPEUTIC OPTIONS
- Simple and endoscopic interventions (SPT, dilatation and DVIU)
- Injectables (steroids, MMC, novel scar-modulating agentes)
- Urethral stents
- Open, laparoscopic and robotic anasstomotic repair
- Y-V plasty
- T-plasty
- Subtrigonal inlay with OMG
- Dorsal onlay urethroplasty with OMG
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

SURGICAL DECISION-MAKING

SURGERY ACCORDING TO LOCATION OF OBSTRUCTION

Vesico-Urethral Anastomotic Stenosis
- Vesico-urethral anastomotic repair
- Abdominal (open or robotic)
- Perineal
- Abdominoperineal

BNC or Posterior Urethral Stenosis
- Bladder Neck Reconstruction
- Y-V plasty
- T-plasty
- Subtrigonal inlay with OMG

Bulbomembranous Urethral Stricture
- EPA Urethroplasty
- Dorsal Onlay Urethroplasty with OMG

ENDOUROLOGICAL MANAGEMENT

INDICATIONS:
- Bladder neck contracture (BNC)
- Bulbomembranous urethral stricture (BMUS)
- Vesicourethral anastomotic stenosis (VUAS)

THERAPEUTIC OPTIONS:
- Urethral dilatation
- Transurethral incision / resection
- Adjunctive antifibrotic therapy
- Urethral stents
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

ENDOUROLOGICAL MANAGEMENT

Urethral dilatation
- Blind passage of metallic sounds
- Coaxial dilation
- Balloon dilation
- Success rates ~ 59% - 100%

Ramchandani 1994, Ishii 2015

Transurethral incision or resection
- 2nd – line therapy after dilatation
- Aggressive incision
  - at 12 o'clock → uroveseal fistula; at 6 o'clock → risk rectal injury
- Success rates ~ 38% - 89%
- Risk of SUI on irradiated pts 😞😞

Ozturk 2015, LaBrossiere 2016, Brousil 2015

NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

ENDOUROLOGICAL MANAGEMENT

Adjuvant antifibrotic therapy
- Recalcitrant contractures
- Steroids (triamcinolone, methylprednisolone)
- Mitomycin C
- Success rates ~ 75% - 89%

Eltahawy 2008, Vanni 2011, Kravchick 2013,…

Urethral stents
- Initially promoted for minimally invasive management of detrusor sphincter dyssynergia, US and BNC
- High rates of complications (stent encrustation, migration and obstruction)
- Despite prior negative experience (UroLume), interest still remains (Memokath, Allium)
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

LOWER URINARY TRACT RECONSTRUCTION

THREE SCENARIOS:

▪ VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION (after Rad Prostatectomy)
▪ BULBOMEMBRANOUS URETHROPLASTY (for Radiation Strictures)
▪ RECONSTRUCTION OF POSTERIOR URETHRAL STENOSIS (after PCa Therapy)

Flynn 2003, Anger 2005

NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

LOWER URINARY TRACT RECONSTRUCTION

VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION

▪ Discouraged in most patients after irradiation
▪ Transperineal approach (Urethral Pull-Through Procedure)
▪ Abdominal approach
▪ Combined abdominoperineal approach Robotic approach
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSSES

LOWER URINARY TRACT RECONSTRUCTION

VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION

▪ TRANSPERINEAL APPROACH
  ▪ Complete excision of scar tissue + repeat VU anastomosis
  ▪ Implies crural separation and inferior pubectomy
  ▪ Success rates ~ 82% - 100%
  ▪ Only 35% maintained continence!
  ▪ It’s a “2-stage operation” (1st stage VUA recon > > 2nd-stage AUS implantation)


LOWER URINARY TRACT RECONSTRUCTION

VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION

▪ TRANSPERINEAL APPROACH
  ▪ URETHRAL PULL-THROUGH PROCEDURE
  ▪ Reconstruction of the devastated posterior urethra and bladder neck after radiation
  ▪ Tissue vascularity and quality is poor
  ▪ Patients have often had multiple endoscopic treatments done prior to referral
  ▪ Patients are often concurrently incontinent
  ▪ The urethral pull-through urethroplasty combined with placement of an AUS offers most patients an excellent QOL
  ▪ Maintains anatomical voiding by achieving urinary continence and durable urethral patency

Patil and Boyd 2015
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

LOWER URINARY TRACT RECONSTRUCTION

VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION

▪ TRANSPERINEAL APPROACH

URETHRAL PULL-THROUGH PROCEDURE

A. After resection of obliterated tissue and dilation, urethra follows path (red arrow) through urogenital diaphragm into pelvis

B. Anastomosis completed between pull-through urethra and orthotopic ileal neobladder

Patil and Boyd 2015

NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

LOWER URINARY TRACT RECONSTRUCTION

VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION

▪ ABDOMINAL APPROACH

▪ Allows partial pubectomy for better exposure of VUAS

▪ Success rates ~ up to 92%

▪ Majority will need AUS!

Nikolavsky 2014
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

LOWER URINARY TRACT RECONSTRUCTION

VESICOURETHRAL ANASTOMOTIC RECONSTRUCTION

- **COMBINED ABDOMINOPERINEAL APPROACH**
  - If additional dissection/mobilization needed
  - For complete scar excision and tension-free anastomosis
  - Recently, robotic abd-perin VUAS reconstruction
  - VUAS Recon performed only by experienced surgeons (regardless of type of approach)

Dinerman 2017

Vesicourethral Anastomosis Reconstruction – Robotic Approach
LOWER URINARY TRACT RECONSTRUCTION

BLADDER NECK RECONSTRUCTION

- Success rates (various approaches) ~ 83% - 100%
  - T-shaped anterior bladder flap for BPH → 100% success! (Reiss 2016)
  - Robotic approach for classic Y-V plasty → 83% success (Much 2017)
  - Recently, BMG ventral inlay via open transvesical approach → 92% success (da Silva 2017)

BULBOMEMBRANOUS URETHROPLASTY

- Once contraindicated, urethroplasty for BMUS after radiation is viable and successful ~ 70% - 90% (Elliott 2006; Meeks 2011; Mundy 2012; Hofer 2014; Blakely 2016; Rourke 2016; Fuch 2017)

- Hofer et al (2014) → EPA ~ 70% success

- However, EPA after XRT → de novo urinary incontinence ~ 19% - 35% (↑ than non-radiated BMUS) (Hofer 2014; Fuch 2017)
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

LOWER URINARY TRACT RECONSTRUCTION

BULBOMEMBRANOUS URETHROPLASTY
- Ventral BM graft onlay urethroplasty → Success in 71% and de novo SUI in 10.5% (Ahyai 2015)
- Dorsal BM graft onlay urethroplasty → Success in 93.7% (15/16 pts) (Blakely 2016; Rourke 2017)
- Occasionally, gracilis muscle flap necessary for a long radiated BMUS and poor graft bed
- Urethroplasty for radiated BMUS is:
  - technically demanding
  - > risk of SUI, ED, pain and fistulation

A. Proximal bulbar/BMUS after EBRT

B. Urethral mobilization and exposure of the dorsal aspect of the BM urethra to be grafted
NON-TRAUMATIC POSTERIOR URETHRAL STRICTURES / STENOSES

After radiated-BMUS OMG dorsal onlay urethroplasty

![Images of urethra surgery](image)

EXTIRPATIVE SURGERY WITH URINARY DIVERSION

- Rarely LUT reconstruction is not possible due to:
  - Necrosis
  - Calcification
  - Severe pain

- Options for reconstruction of devastated posterior urethra depend on:
  - Feasibility of bladder preservation!
  - If bladder suitable for reconstruction, BN closure + continent catheterizable channel

Pisters 2000; Ullrich 2002; De 2007
Fibrotic and necrotic bulbomembranous tissue with calcifications caused by radiation. This may be missed without imaging if necrotic tissue is visible on urethroscopy.

RUG in an irradiated patient demonstrating a necrotic cavity, contraindicating reconstruction. This may be missed without imaging if necrotic tissue is visible on urethroscopy.
A. Combined retrograde and antegrade imaging of lower urinary tract after brachytherapy and adjuvant external beam radiotherapy.

B. Endoscopic view of a completely obliterated posterior urethral stenosis

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**EXTIRPATIVE SURGERY WITH URINARY DIVERSION**

- Options for reconstruction of devastated posterior urethra depend on:
  - Good bladder capacity
  - Otherwise, bladder augmentation should be considered to offset incontinence per stoma
    
    Spahn 2010
  
  - If severe necrosis, pain, recurrent cancer, urosymphyseal fistula and impaired bladder capacity/compliance
    - Cystectomy and Urinary Diversion
CONCLUSIONS

- Prostate cancer treatments (surgery and energy ablation therapies) can result in posterior urethral strictures (PUS)
- In some instances, PUS can be managed by endoscopic procedures
- Refractory cases have been traditionally managed with chronic catheterization
- More recently, there has been growing interest in lower urinary tract reconstruction if bladder is salvageable
- Urinary diversion +/- cystoprostatectomy in cases of radiation-related PUS with associated necrosis and calcification
3:00 pm - 4:00 pm ORAL PRESENTATIONS - 9 patients: 5 min presentation, 2 min questions and answers
Moderators: Nathi Rous, Jil Bolley, Dorothy Mrksich

- ED X 1. INTRAOPERATIVE SLACK BONUS OR RECONSTRUCTION OF SUTURE
Moderators: Peter Sewerb, Anthony Decker, John Staff (3:00 - 3:50 pm)
1. Robert Smith (450A) - 7 min
2. Neoreconstruction: Juan Greco (450B) - 7 min
3. Surgeon: Jeremy Vans (450C) - 7 min
4. Q&A/Discussion - 10 min

- ED X 1. ORTHOTOPIC NEobladder RECONSTRUCTION: OPEN, LAP OR KETO
Moderators: Shashik Singh, Peter Sewerb, Lee Zhao (3:50 - 4:50 pm)
1. Open/Seal/Seal (451A) - 7 min
2. In-P4 Reoperative: Rachel Gherman (451B) - 7 min
3. Robotics: Neil Shanam (451C) - 7 min
4. Q&A/Discussion - 10 min

5:00 pm - 6:00 pm WINNERS FOR BEST IDEAS AND POSTER
Winners: Spiniello, Juan Carlos, Aart Manger, Jeremy Vans

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