Urethral injury: operative management

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• When considering the operative management of urethral injury, take into account the following:
  – Anterior/posterior
  – Partial/complete
  – Blunt/penetrating

• The options are:
  – SPC/transurethral catheterization
  – Primary urethral repair
  – Internal urethrotomy
  – Endoscopic realignment
  – Urethroplasty
    • Anastomotic (<2cm stricture)
    • Graft (>2cm stricture)
    • Flaps
Anterior

Suspected urethral injury

Retrograde urethrography

Extravasation

Complete disruption
  - Penetrating
    - Primary urethral repair

Partial disruption
  - Blunt
    - Suprapubic cystostomy
  - Penetrating if associated with penile rupture
    - Primary urethral repair

Penetrating

No extravasation

Urethral contusion

Suprapubic cystostomy or Transurethral Foley catheter
Anterior, contusion
Anterior, complete/partial, penetrating
• Penetrating injury, often needs surgical exploration
• Might require subcoronal incision and degloving of penis, or perineal incision to approach the bulbar urethra
• **Small lacerations**, close with fine sutures, and overclosure of spongiosum and skin

• **Complete disruption**, spatulated and end-to-end anastomosis over 14-18F catheter
• Minimum debridement because spongiosum well-vascularized

• If >1.5cm defect, marsupialize the urethral ends, and insert SPC
• Urethroplasty after 3 months
• No role for graft/flap in acute phase
Anterior, complete/partial, blunt
Anterior, complete/partial, blunt

- Suprapubic cystostomy
- Stricture
  - if stricture is short (< 1 cm) and flimsy: Endoscopic optical incision
  - if failure
    - if stricture is long or denser: Formal urethral reconstruction
- No stricture: Follow-up
**Anterior, partial, blunt**

- SPC/CBD for 4 weeks
- Off if able to void, no contrast leak, no stricture

**Anterior, complete, blunt**

- Early/acute urethroplasty NOT indicated
- Difficult to evaluate urethra because of spongiosal contusion
- Subsequently,
  - Stricture <1cm, *internal urethrotomy* can be attempted with cold knife or laser
  - Almost all will require *urethroplasty* at 3-6 months
Internal Urethrotomy

- For short (<1cm) and flimsy urethral stricture
- Prophylactic antibiotics, insertion of guidewire across stricture
- Cold knife or Holmium laser via 200/365 micron fibre at 0.5-1J and 5-10Hz at the 12 o’clock position
- Size 16-22F catheter for 3-5 days then TOV
- CISC daily with 14F catheter for a few months, then weekly
- Reassess with uroflowmetry and CE in 3 months
Anastomotic Urethroplasty

- Exaggerated lithotomy position, inverted-Y perineal incision
- Bulbospongiosus muscles split in midline, mobilized off corpus spongiosum retracted laterally with hooks

- Urethra dissected off underlying corporeal bodies
- 20F catheter aid identification of distal location of stricture
- Urethra transected at tip of catheter
- Holding sutures placed at 3 and 9 o’clock of the cut ends
- Further mobilization in both directions until lumen 28F

- Urethra spatulated proximally and distally
- Dorsal wall interrupted 5-0 monofilament single layer
- Ventral wall 6-0 monofilament two layer over 16F catheter
Anastomotic Urethroplasty

- Exaggerated lithotomy position
Anastomotic Urethroplasty

- Bulbospongiosus muscle split in midline
- Urethra dissected off corporeal bodies
Anastomotic Urethroplasty

- Urethra transected at tip of Foley’s catheter
- Strictured urethra resected
- Healthy urethra spatulated
Anastomotic Urethroplasty

- Dorsal wall single layer repair

- Ventral wall repaired in 2 layers
• For strictures >2cm, to prevent penile shortening/curvature
• Buccal graft commonly used, may be placed ventrally or dorsally
• Urethra exposed as for anastomotic urethroplasty
• Distal location of stricture identified by passing urinary catheter
• Ventral midline incision made over the catheter
• Incision carried proximally and distally till urethra 28F caliber
• Fine sutures pre-placed in outside-in fashion
• Graft tailored to the defect and sewn in place
• Spongioplasty completed by closing adventitial layer over the graft
Graft Urethroplasty – ventral
Graft Urethroplasty – dorsal (Barbagli)

- A: Corpus spongiosum detached from triangular ligament and corpora cavernosa
- B: Dorsal urethrostomy performed
- B: Graft is spread and fixed to corpora cavernosa
- C: Edges of stricturotomy sutured to graft and corpora cavernosa
Flaps for penile urethra repair

- Anastomotic urethroplasty should be avoided in penile urethra
- This is to avoid tethering and chordee
- Blood supply of penile skin from external pudendal arteries
- At base of penis, these arteries split into dorsolateral and ventrolateral axial penile arteries
- Dorsal branches believed to be more robust
- Fasciocutaneous flaps from penile skin are raised on the dartos flap
Flaps for anterior urethra repair

Dorsal transverse island of penile skin, elevated on dartos fascia
Flaps for anterior urethra repair

Penile longitudinal skin island
Posterior urethral injury

- Distraction injury associated with pelvic fractures
- Essentially injury to the membranous urethra – anywhere between bulbar urethra and apex of prostate
- Pre-pubescent male more likely than post-pubescent patients to have injury involving the prostatic urethra

- Repair usually done 4-6 months after trauma
- Need to consider concurrent orthopedic injuries – positioning
Posterior
Posterior, contusion

Suspected urethral injury

- Retrograde urethrogram
  - Prostatomembranous disruption
    - Complete rupture
      - Penetrating: Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy
  - Partial rupture
    - Blunt: Suprapubic cystostomy
    - Penetrating: Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy

- Normal
  - Urethral contusion
    - Treat with suprapubic or transurethral catheter
Posterior, partial/complete, penetrating

Suspected urethral injury

Retrograde urethrogram

Prostatomembranous disruption

Complete rupture

Penetrating

Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy

Partial rupture

Blunt

Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

Blunt

Suprapubic cystostomy

Penetrating

Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy

Urethral contusion

Treat with suprapubic or transurethral catheter
• Posterior, complete/partial, penetrating
• Penetrating injury, often needs surgical exploration
• Principles might be similar to anterior penetrating injury
• However associated non-urological injuries or an unstable patient will necessitate that SPC be in placed and urethral injury be repaired later
Posterior, partial, blunt

Suspected urethral injury

Retrograde urethrogram

Prostatomembranous disruption

Complete rupture

Penetrating
Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy

Blunt
Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

Partial rupture

Blunt
Suprapubic cystostomy

Urethral contusion

Treat with suprapubic or transurethral catheter

Penetrating
Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy
Posterior, partial, blunt

- Suspected urethral injury
  - Retrograde urethrogram
    - Prostatomembranous disruption
      - Complete rupture
        - Penetrating: Primary open repair. If patient unstable or important associated nonurological injuries, suprapubic cystostomy
    - Partial rupture
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    - Urethral contusion
      - Treat with suprapubic or transurethral catheter
Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

Posterior, partial, blunt

Suprapubic cystostomy

Suprapubic tube + endoscopic re-alignment. Open if rectal or bladder injury.

Stricture

Stricture

Urethrotomy

No stricture

Follow-up

Delayed urethroplasty

if stricture is short (< 1cm) and flimsy

if stricture is long or denser

Delayed endoscopic optical incision

Salvage urethroplasty in referral centre

Option: Endoscopic realignment if patient is stable (< day 14)
Posterior, partial, blunt

Suprapubic cystostomy

- Stricture
  - Urethrotomy
    - Stricture
    - Follow-up
- No stricture

Delayed urethroplasty

or
Posterior, partial, blunt

- Suprapubic cystostomy
  - Stricture
  - Urethrotomy
    - Stricture
    - Follow-up
  - No stricture
- Delayed urethroplasty
Posterior, partial, blunt

- SPC/CBD
- Urethrography at 2-weekly intervals until healing has occurred
- Partial tears might heal without significant scarring or obstruction
- Internal urethrotomy for short strictures as described earlier
- Delayed urethroplasty if dense and long stricture
- Urethroplasty for posterior distraction injury will be described later
Posterior, complete, blunt
Posterior, complete, blunt

Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

- **Suprapubic cystostomy**
  - No
  - Option: Endoscopic realignment if patient is stable (< day 14)
  - Delayed endoscopic optical incision

- **Suprapubic cystostomy**
  - Yes
  - Suprapubic tube + endoscopic realignment. Open if rectal or bladder injury.
  - Stricture
    - Delayed urethroplasty
      - Stricture
        - if stricture is short (< 1cm) and flimsy
          - Delayed endoscopic optical incision
        - if stricture is long or denser
          - Salvage urethroplasty in referral centre
      - No stricture
        - Follow-up
  - Urethrotomy
    - Stricture
    - No stricture
Posterior, complete, blunt

Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

Yes

Suprapubic tube + endoscopic re-alignment. Open if rectal or bladder injury.

Stricture

Delayed urethroplasty

if stricture is short (<1cm) and flimsy

Delayed endoscopic optical incision

if stricture is long or denser

Salvage urethroplasty in referal centre

No stricture

Follow-up
Posterior, complete, blunt

Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

Yes

Suprapubic tube + endoscopic re-alignment. Open if rectal or bladder injury.

Stricture

Delayed urethroplasty

Stricture

if stricture is short (<1cm) and flimsy

Delayed endoscopic optical incision

if stricture is long or denser

Salvage urethroplasty in referral centre

No stricture

Follow-up
Posterior, complete, blunt

Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

No

Suprapubic cystostomy

Option: Endoscopic realignment if patient is stable (< day 14)

or

Delayed urethroplasty

Stricture

if stricture is short (< 1 cm) and flimsy

Delayed endoscopic optical incision

if stricture is long or denser

Salvage urethroplasty in referral centre

No stricture

Follow-up
Posterior, complete, blunt

Posterior, complete, blunt

Assess for acute surgical indications: Bladder neck injury, rectal tear, pie-in-the-sky bladder

No

Suprapubic cystostomy

Option: Endoscopic realignment if patient is stable (< day 14)

Delayed urethroplasty

Stricture

if stricture is short (< 1cm) and flimsy

Delayed endoscopic optical incision

if stricture is long or denser

Salvage urethroplasty in referral centre

No stricture

Follow-up
Posterior, complete, blunt

• Assess for **rectal or bladder neck injuries, or bone fragments** – for immediate open repair to reduce risk of incontinence/infections
• Insert SPC and do **endoscopic realignment** at the same time
• Will likely require **delayed urethroplasty** later

• If not indication for immediate surgery, **insert SPC**
• **Optional** to do endoscopic realignment if patient stable <14 days
• Otherwise, proceed to do **delayed urethroplasty**
Delayed urethroplasty, 3 months after trauma is gold standard

- Delayed primary urethroplasty, within 2 weeks of trauma, mainly for female patients, only about 50 cases reported – tries to preserve urethral length, NOT for male patients
- Immediate open urethroplasty experimental and NOT indicated

Posterior, complete, blunt

- If strictures occur after delayed urethroplasty, options are
  - Internal urethrotomy for short <1cm and flimsy strictures
  - Salvage urethroplasty if long and dense strictures
Primary endoscopic realignment

- Primary endoscopic realignment vs SPC alone + delayed urethroplasty is debatable.
- Usually performed when immediate surgery e.g. bladder/rectal injury, or within 10-14 days of trauma when patient is stable.

“Open urethral realignment or blind realignment with interlocking sounds or metallic sounds are inappropriate because of their low success rate and high complication rate…..endoscopic realignment has been shown to at least decrease the length of the rupture defect...” – Jack McAninch in Hinman’s Atlas of Urologic Surgery.
Primary endoscopic realignment

- Benefits of realignment:
  - Reduced stricture rate 64% vs 100% stricture in SPC alone
  - Subsequently stricture more easily treated with internal urethrotomy or dilatation
  - If urethroplasty needed, technically easier as anatomy aligned
• DVT prophylaxis e.g. low dose anticoagulant 10 days-OP-2 weeks
• Position and exposure same as anastomotic urethroplasty
• On-table rigid CE via SPC to inspect bladder neck and for stones

• Urethra encircled and dissected off corporeal bodies
• Posterior attachments to perineal body divided
• Bulbar arteries usually obliterated, can be suture ligated if needed
• 20F catheter inserted, urethra transected at distal obstruction

• Van Buren sound or flexible cystoscope passed via SPC
• Scar tissue excised until sound/scope is met
• Both ends of urethra dissected till lumen calibrates to 28F
Delayed urethroplasty

- Distal urethra mobilized off underlying corpora cavernosa toward the penoscrotal junction till tension-free anastomosis can be done
- If prostatobulbar gap >2-3cm, do **progressive perineal approach** to bridge up to 8cm gap:
  - Midline separation of corporeal bodies
  - Inferior pubectomy
  - Supracorporeal urethral rerouting
- Urethral stumps spatulated in opposite sides
- 12 absorbable 6/0 monofilament sutures preplaced in prox stump
- Sutures then passed inside-out through distal stump, full-thickness
- Urethral catheter passed into bladder midway when suturing
Delayed urethroplasty
Delayed urethroplasty

- 18 F Van Buren sound

- Van Buren sound exiting proximal urethral stump
Delayed urethroplasty

- Distal urethral mobilized off the corpora cavernosa
Delayed urethroplasty

- Corporeal bodies split in the midline
- Inferior pubectomy
Delayed urethroplasty

- Supracorporeal urethral rerouting
Delayed urethroplasty

- Post-op management
- Silicone urethral catheter as stent, urine diverted via SPC
- Patient kept in bed for 24-48 hours post-op
- Discharged with SPC, urethral catheter, anticholinergics, antibiotics

- Stop anticholinergics 1 day before TOV
- TOV day 21 if straightforward repair, day 28 if complicated
- Remove urethral catheter, fill bladder with contrast, void
- Urine C+S taken, SPC plugged
- Allow to void through urethra for 5-7 days before removing SPC
- Off antibiotics only when tube free

- Evaluate with flexible cystoscope at 6 and 12 months
## Comparison of different approaches

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<th>Primary suturing</th>
<th>SPC and delayed urethroplasty</th>
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When considering the operative management of urethral injury, take into account the following:

- Anterior/posterior
- Partial/complete
- Blunt/penetrating

The options are:

- SPC/transurethral catheterization
- Primary urethral repair
- Internal urethrotomy
- Endoscopic realignment
- Urethroplasty
  - Anastomotic (<2cm stricture)
  - Graft (>2cm stricture)
  - Flaps
Thank you