URETHRAL INJURY-
DIAGNOSIS AND INITIAL
MANAGEMENT

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ANATOMICAL

• The male urethra is divided into the anterior and posterior sections by the urogenital diaphragm.

• Only the posterior urethra exists in the female

Fig. 15.9.1. Anatomy of the male urethra (© Hohenfellner 2007)
URETHRAL INJURIES

• Posterior urethral injuries
• Anterior urethral injuries
• Urethral injury in Women & Children*
POSTERIOR URETHRAL INJURY

• Injuries to the posterior urethra occur with pelvic fractures, crush injuries, or falls from height

• Male posterior urethra is concomitantly injured in approximately 3.5%–19% and the female urethra in 0%–6% pelvic fractures
MECHANISM - POSTERIOR URETHRAL INJURIES

• With a crush or deceleration impact injury, the severe shearing forces necessary to fracture the pelvis are transmitted to the prostatomembranous junction, resulting in disruption of the prostate from its connection to the anterior urethra at the prostatic apex.

• Retrograde urethrography and magnetic resonance imaging have been correlated with this location of the injury (Colapinto and McCallum 1977; Dixon et al. 1992).

• Recent cadaveric anatomic studies suggest that in most cases the membranous urethra is torn distally to the urogenital diaphragm (Mouraview and Santucci 2005).
PELVIC FRACTURES

• In order to accurately diagnose and treat pelvic ring disruptions, the surgeon must have a concept of pelvic stability.

• Should be determined in both the horizontal and vertical planes.

• A mechanically stable pelvis is defined as one that can withstand normal physiological forces without abnormal deformation (Tile and Pennal 1980).

• Stable Vs unstable pelvic fractures.
In a stable pelvic fracture, urethral disruption can occur when the large external force, which has fractured two or all four pelvic rami (straddle fracture), propels the resultant butterfly fragment backward together with the prostate, which is fixed to the back of the pubic bone.

The shearing force that results disrupts the membranous urethra, as it passes through the perineum and inevitably destroys the distal urethral sphincter mechanism in almost all such cases.
UNSTABLE PELVIC FRACTURE

- Involve the anterior part of the pubic ring and the sacroiliac joint, ilium, or sacrum

- Cause injuries to the posterior urethra, either as a result of tears by bony fractures or, more commonly, as a result of disruptions of the urethra caused by distortions of the bony pelvis during major trauma
UNSTABLE PELVIC FRACTURE

- This distortion is thought to result in **lateral shearing forces**, acting on the **membranous urethra**, as the **puboprostatic ligaments and the membranous urethral area** are pulled in opposite directions.

- Unstable diametric pelvic fractures or bilateral ischiopubic rami fractures have the highest likelihood of injuring the posterior urethra. In particular, the combination of straddle fractures with diastasis of the sacroiliac joint has the highest risk of urethral injury.

| Table 15.9.1. Odds ratio of urethral injury with different types of pelvic fracture |
|--------------------------------------|---------------------|
| Type of fracture                     | Odds ratio |
| Single ramus                         | 0.64          |
| Ipsilateral rami                     | 0.76          |
| Malgaigne's                          | 3.40          |
| Straddle                             | 3.85          |
| Straddle plus sacroiliac             | 24.02         |

**Fig. 15.9.3.** Example of unstable pelvic fracture. Unstable fractures involve the anterior part of the pubic ring and the sacroiliac joint, ileum, or sacrum.
POSTERIOR URETHRAL INJURY

• Colapinto and McCallum (1977) classified posterior urethral injuries on the basis of radiographic appearance into three types, depending on the integrity of the membranous urethra and extension of the disruption into the bulbar and membranous urethra.

• The American Association for Surgery of Trauma (AAST) later proposed the classification

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Blood at the urethral meatus; normal urethrogram</td>
</tr>
<tr>
<td>II</td>
<td>Stretch injury</td>
<td>Elongation of the urethra without extravasation on urethrography</td>
</tr>
<tr>
<td>III</td>
<td>Partial disruption</td>
<td>Extravasation of contrast at injury site with contrast visualized in the bladder</td>
</tr>
<tr>
<td>IV</td>
<td>Complete disruption</td>
<td>Extravasation of contrast at injury site without visualization in the bladder; &lt;2 cm of urethral separation</td>
</tr>
<tr>
<td>V</td>
<td>Complete disruption</td>
<td>Complete transection with &gt;2 cm urethral separation, or extension into the prostate or vagina</td>
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</tbody>
</table>
URETHRAL INJURY IN CHILDREN

• Tend to follow the same mechanism of injury as in adults.

• The only significant difference is that straddle pelvic fractures, or the association of straddle plus sacroiliac joint fracture are more common in children than in adults.

• In addition, posterior urethral injuries can involve the prostatic urethra and the bladder neck, as well as the membranous urethra.

• The tear is often in the prostatic urethra or at the bladder neck because of the rudimentary nature of the prostate and is more likely to be a complete rupture.

• Urethral stretching is less common than in adults.

• It has been shown that the more proximal the injury, the greater the risk of incontinence, impotence, and stricture formation in the long term.
URETHRAL INJURY IN WOMEN

- These are rare events since the female urethra is short and mobile, without any significant attachments to the pubic bone.

- They usually occur in children and are accompanied by severe pelvic fractures, where bony fragments of the fractured pelvis provoke lacerations of the urethra, frequently extending into the bladder neck or vagina, and disrupting the normal continence mechanism.

- Injury to the female urethra is usually a partial tear of the anterior wall and is rarely a complete disruption of the proximal or distal urethra.
ANTERIOR URETHRAL INJURY

Table 15.9.3. Different types of blunt trauma of the posterior and anterior urethra, their radiographic appearance and different treatment alternatives

<table>
<thead>
<tr>
<th>Description</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Stretch injury. Elongation of the urethra without extravasation on urethrography</td>
<td>No treatment required</td>
</tr>
<tr>
<td>II Contusion. Blood at the urethral meatus; no extravasation on urethrography</td>
<td>Conservative management with suprapubic cystostomy or urethral catheterization</td>
</tr>
<tr>
<td>III Partial disruption of anterior or posterior urethra. Extravasation of contrast at injury site with contrast visualized in the proximal urethra or bladder</td>
<td>Conservative management with suprapubic cystostomy or urethral catheterization</td>
</tr>
<tr>
<td>IV Complete disruption of anterior urethra. Extravasation of contrast at injury site without visualization of proximal urethra or bladder</td>
<td>Conservative management with suprapubic cystostomy. Open or endoscopic treatment, primary or delayed</td>
</tr>
<tr>
<td>V Complete disruption of posterior urethra. Extravasation of contrast at injury site without visualization of bladder</td>
<td>Conservative management with suprapubic cystostomy. Open or endoscopic treatment, primary or delayed</td>
</tr>
<tr>
<td>VI Complete or partial disruption of posterior urethra with associated tear of the bladder neck or vagina</td>
<td>Primary open repair</td>
</tr>
</tbody>
</table>

Penetrating Injuries to the Perineum

These can occur involving the urethra, as well as being iatrogenic injuries caused by endoscopic instrumentations or during surgery for vaginal repair. In developing countries, urethral and bladder neck damage occur quite often as a result of ischemic injury during obstructed labor.

Table 15.9.4. Etiology of anterior urethral injuries

<table>
<thead>
<tr>
<th>Causes</th>
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</thead>
<tbody>
<tr>
<td><strong>Blunt trauma</strong></td>
</tr>
<tr>
<td>Vehicular accidents</td>
</tr>
<tr>
<td>Fall astride</td>
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<tr>
<td>Kicks in the perineum</td>
</tr>
<tr>
<td>Blows in the perineum from bicycle handlebars, tops of fences, etc.</td>
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<tr>
<td><strong>Sexual intercourse</strong></td>
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<tr>
<td>Penile fractures</td>
</tr>
<tr>
<td>Urethral intraluminal stimulation</td>
</tr>
<tr>
<td>Constriction bands</td>
</tr>
<tr>
<td><strong>Penetrating trauma</strong></td>
</tr>
<tr>
<td>Gunshot wounds</td>
</tr>
<tr>
<td>Stab wounds</td>
</tr>
<tr>
<td>Dog bites</td>
</tr>
<tr>
<td>External impalement</td>
</tr>
<tr>
<td>Penile amputations</td>
</tr>
<tr>
<td><strong>Constriction bands</strong></td>
</tr>
<tr>
<td>Paraplegia</td>
</tr>
<tr>
<td><strong>Iatrogenic injuries</strong></td>
</tr>
<tr>
<td>Endoscopic instrumentations</td>
</tr>
<tr>
<td>Urethral catheters, dilators</td>
</tr>
</tbody>
</table>
ANTERIOR - BLUNT TRAUMA

- Most anterior urethral injuries are caused by vehicular accidents, falls, or blows.

- They are rarely associated with pelvic fractures.

- They are usually straddle-type injuries caused by blows of blunt objects against the perineum, such as bicycle handlebars or the top of a fence.

- The relatively immobile bulbar urethra is trapped and compressed by a direct force on it against the inferior surface of the symphysis pubis. These injuries are more common in children than adults.
ANTERIOR - INTERCOURSE RELATED

• Another less frequent cause of blunt anterior urethral trauma occurs in association with ruptures of the corpora cavernosa, which usually occur with an erect penis, often during intercourse.

• In these injuries, the urethra is involved in 20% of the cases.

• Intraluminal stimulation of the urethra with foreign objects has also been reported to cause anterior urethral trauma.

• Most are short and in-complete and occur in the distal penile urethra.

• Surgery is rarely indicated and depends on the degree and extent of injury to the urethra.
ANTERIOR - PENETRATING TRAUMA

• Penetrating injuries to the anterior urethra usually occur from *gunshot wounds* and involve the *penile and bulbar urethral segments equally*; these injuries are often found with penetrating penile or testicular trauma, depending on the missile tract.

• These *can involve the rectum*, which may result in pelvic abscesses and fistulae formation.

• Other less frequent causes of external anterior urethral injuries include *stab wounds, animal bites, penile amputation, and external impalement*. 
Fig. 15.9.4. a Typical aspect of genitalia after rupture of corpora cavernosa during sexual intercourse. b In 20% of the cases, the urethra is involved, suffering partial or complete rupture.

Fig. 15.9.5a, b. Gunshot wound to the genitalia. Penile urethra was involved with only a few pellets and was managed conservatively.
URETHRAL INJURY - DIAGNOSIS

• The initial management of all urethral injuries is **resuscitation** of the patient as a result of associated possibly life-threatening injuries.

• **In the absence of blood at the meatus or hematoma, a urological injury is very unlikely and will be rapidly excluded by catheterization.**

• Complete history, physical examination, laboratory, and radiographic evaluations in order to identify all injuries accurately.
URETHRAL INJURY - DIAGNOSIS

• For penetrating injuries, the **type of weapon** used, including the caliber of the bullet with gunshot wounds, is **helpful in assessing potential tissue damage**.

• In the conscious patient, a **thorough voiding history should be obtained** to establish the time of last void, force of urinary stream, painful urination, and presence of hematuria.
URETHRAL INJURY - DIAGNOSIS

• The following clinical indicators of acute urethral trauma warrant a complete urethral evaluation:
  
  • Blood at meatus
  
  • Blood in vaginal introitus
  
  • Haematuria
  
  • Haematoma
  
  • Painful voiding
  
  • High-riding prostate
BLOOD AT MEATUS

• Blood at the meatus is **present in 37%–93% of patients with posterior urethral injury** and **at least 75% of patients with anterior urethral trauma** (Lim and Chng 1989; McAninch 1981).

• Its presence **should preclude any attempts at urethral instrumentation**, until the entire urethra is adequately imaged.

• In an unstable patient, **an attempt can be made to pass a urethral catheter**, but if there is any difficulty a **suprapubic catheter is inserted and a retrograde urethrogram performed when appropriate**.

• **It is extremely unlikely that gentle passage of a urethral catheter will do any additional damage** to that caused by a fracture of the pelvis, although it has been suggested that this may convert a partial tear into one that is complete.
IMAGING

• Retrograde urethrography

• Contrasted CT Scan & MRI
RETROGRADE URETHROGRAPHY

• Considered the **gold standard** for evaluating urethral injury.

• A **scout film** should be taken first to assess the radiographic technique and to detect pelvic fractures, as well as the presence of any foreign bodies such as bullets or stones.

• This is taken using a 12- or 14-F Foley catheter in the fossa navicularis, with the **balloon inflated using 1 – 2 ml of saline** to occlude the urethra.

• Then, **20 – 30 ml of undiluted contrast material is injected and films taken during the injection in a 30°oblique position.**

• When severe pelvic fractures and associated patient discomfort are present, the oblique position may not always be possible.

• **Radiographic appearance of the urethra permits classification of the injury** and facilitates subsequent management.
• If posterior urethral injury is suspected, a suprapubic catheter is inserted.

• A simultaneous cystogram and ascending urethrography can be carried out at a later date to assess the site, severity, and length of the urethral injury.

• This is usually done within 1 week of injury, if primary repair is contemplated, or after 3 months if a delayed or late repair is considered.
Computed tomography and MRI have no place in the initial assessment of urethral injuries. However, they are useful in defining the distorted pelvic anatomy after severe injury and assessing associated injuries of penile crura, bladder, kidneys, and intraabdominal organs (Dixon et al. 1992; Kane et al. 1989).
ENDOSCOPIC EXAMINATION

• Urethroscopy has **no role in the initial diagnosis of urethral trauma in males**.

• In **females**, however, **where the short urethra precludes adequate retrograde urethrography**, urethroscopy is an **important adjunct** to the physical examination for the **identification and staging of urethral injuries** (McAninch 1992).
INITIAL MANAGEMENT

- Stabilize patient - poly trauma
- Diagnose - Retrograde urethrogram
- Catheterize or SPC
- Primary or Delayed reconstruction later
  - Primary endoscopic realignment
Figure 3: Management of anterior urethral injuries in men

Suspected urethral injury → Retrograde urethrography

Extravastion

Complete disruption
  Penetrating → Primary urethral repair
  Blunt

Partial disruption
  Penetrating

If associated with penile rupture
  If stricture is short (< 1 cm) and flimsy → Endoscopic optical incision if failure
  If stricture is long or denser → Formal urethral reconstruction

Gentle catheterisation

Normal

Stricture

No stricture → Follow-up
Figure 4: Management of posterior urethral injuries in men

- Suspected urethral injury
  - Retrograde urethrogram
    - Prostatomembranous disruption
      - Complete rupture
      - Partial rupture
        - Penetrating
          - Primary open repair. If patient unstable or important associated non-urological injuries, suprapubic cystostomy
        - Blunt
          - Assessed 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 non-urological injuries, suprapubic cystostomy
  - If patient unstable or important associated non-urological injuries, suprapubic cystostomy

- Stricture
  - Suprapubic tube + endoscopic re-alignment. Open if rectal or bladder injury.
  - Stricture
  - No stricture
    - Urethroscopy
    - Delayed urethroplasty
      - Stricture
Immediate anastomotic reconstruction of posterior urethral disruption injuries in men has been abandoned because of its association with unsatisfactory outcomes, such as impotence and incontinence, stricture formation, and operative blood loss (Webster et al, 1983; Koraitim, 1996).

In cases of female urethral disruption related to pelvic fracture, most authorities suggest immediate primary repair, or at least urethral realignment over a catheter, to avoid subsequent urethrovaginal fistulas or urethral obliteration (Koraitim et al, 1996; Dorairajan et al, 2004, Black et al, 2006).
• Concomitant vaginal lacerations also must be closed acutely to prevent vaginal stenosis.

• Delayed reconstruction is problematic because the female urethra is too short (about 4 cm) to be amenable for mobilization during an anastomotic repair when it becomes embedded in scar (Podesta, 2001)
IMMEDIATE MX - POSTERIOR

- **Immediate SPC placement** remains the standard of care in men with posterior urethral injuries.

- This may be accomplished through a small infraumbilical incision, which allows inspection and repair of the bladder and proper placement of a large-bore catheter at the bladder dome.

- **Trocar suprapubic tube placement is both safe and expedient when the bladder is obviously distended and no other indications for surgery exist.**

- SPC can be safely placed with minimal risk of implant infection when patient with pelvic fracture require early orthopaedic fixation.
Primary endoscopic realignment - An attempt at primary realignment of the distraction with a urethral catheter is reasonable in patients whose condition is stable (Elliott and Barrett, 1997), either acutely or within several days of injury.
The proposed benefits of primary alignment are:

- **A lower stricture rate** than with suprapubic catheter placement alone (69% vs. 10%), which avoids a second operation for urethral reconstruction in about one-third of patients.

- If scarring occurs, **restoration of urethral continuity is simplified** and may be accomplished by endoscopic procedures or dilatation.

- If **urethroplasty** is required later, it is **technically easier** when the prostate and urethra are well aligned.
INITIAL MX - ANTERIOR

- Contusions and incomplete injuries can be treated with urethral catheter diversion alone.

- Initial suprapubic cystostomy is the standard of care for major straddle injuries involving the urethra; however, primary anterior urethral realignment has shown promising results with respect to stricture rate and erectile dysfunction in patients with straddle injuries of lesser magnitude.

- Primary surgical repair is recommended for low-velocity urethral gunshot injuries—catheter alignment alone is associated with a far worse stricture rate (Husmann et al, 1993).

- Debridement of the corpus spongiosum after trauma should be limited because corporeal blood supply is usually robust, enabling spontaneous healing of most contused areas (Kiracofe et al, 1975; Husmann et al, 1993).

- Initial suprapubic urinary diversion is recommended after high-velocity gunshot wounds to the urethra, followed by delayed reconstruction.
THANKS