Genitourinary Tract Trauma

Bladder, Urethra, Penis

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Classification of Bladder Trauma based on **mode of action**

Non-iatrogenic trauma
Blunt
Penetrating
Iatrogenic trauma
External
Internal
Foreign body

Location of bladder injury

- Intraperitoneal
- Extraperitoneal
- Combined intra-extreperitoneal

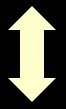
Etiology/ Pathophysiology of Bladder Trauma

Non-iatrogenic

- **Motor vehicle traffic collisions:**

the most common cause of blunt bladder injury (followed by falls, industrial trauma/pelvic crush injuries and blows to the lower abdomen)

- **60-90%** of patients with bladder injuries caused by blunt trauma: associated **pelvic fractures**.
- **44-68.5%** of patients with bladder injuries: at least one other intra-abdominal injury



- **Pelvic fractures**: associated with bladder injuries in only 3.6%.
  - **Extraperitoneal:** 22.4-61.1% VS **intraperitoneal:** 38.9-65.8%
  - A **combination of bladder and urethral injury** is present in **5-20%** of cases

Etiology/ Pathophysiology of Bladder Trauma

Non-iatrogenic

- **Extraperitoneal ruptures** are **almost always** associated with **pelvic fractures**.
  - caused by distortion of the pelvic ring, with shearing of the anterolateral bladder wall near the bladder base (at its fascial attachments), or by a 'counter-coup' that bursts opposite the fracture site.
  - Occasionally, the bladder is directly perforated by a sharp bony fragment
- **The highest risk of bladder injury**: in disruptions of the pelvic circle with displacement **> 1 cm**, diastasis of the pubic symphysis **> 1 cm**, and **pubic rami fractures**

Etiology/ Pathophysiology of Bladder Trauma

Non-iatrogenic

- **Intraperitoneal ruptures**:
  - caused by a sudden rise in intravesical pressure of a distended bladder, secondary to a blow to the pelvis or lower abdomen.
  - The **bladder dome is the weakest point** of the bladder and ruptures will usually occur there.

- Penetrating injuries: mainly gunshot wounds, rare except in conflict regions

Etiology/ Pathophysiology of Bladder Trauma

Iatrogenic

- **Bladder**: the urological organ that **most often** suffers iatrogenic injury!
  - External injury: **OBGYN** > GS > Uro surgery
    - Main risk factors: previous surgery, inflammation, and malignancy
  - Internal injury: TUR-BT
    - Extraperitoneal perforation: more frequent; rare for intervention (0.16-0.57%)

Diagnostic evaluation of Bladder Trauma

- Principle sign of bladder injury: **hematuria**

- Indication for **image study:**
  - **visible hematuria + pelvic fracture** (absolute)
  - **Non-visible hematuria** +

    - disruption of the pelvic circle with displacement **> 1 cm**, or

    - or diastasis of the pubic symphysis **> 1 cm**
  - in case of **posterior urethral injury**
  - Other symptoms/ signs

Table 4.3.3: Clinical signs and symptoms of bladder injury

Signs and symptoms	Remarks
Haematuria [191, 192]	Visible = cardinal sign
Inability to void [191]	
Abdominal tenderness [191, 192]	
Abdominal distension [191]	In the case of urinary ascites
Uraemia and elevated creatinine level [191]	Intraperitoneal rupture => re-absorption of urea nitrogen and creatinine
Inadequate urinary output [191]	
Entrance/exit wounds at lower abdomen, perineum or buttocks [197, 220]	In penetrating injuries

Diagnostic evaluation of Bladder Trauma

- **Cystography:**
  - preferred for **non-iatrogenic bladder injury**
  - both plain and CT cystography:

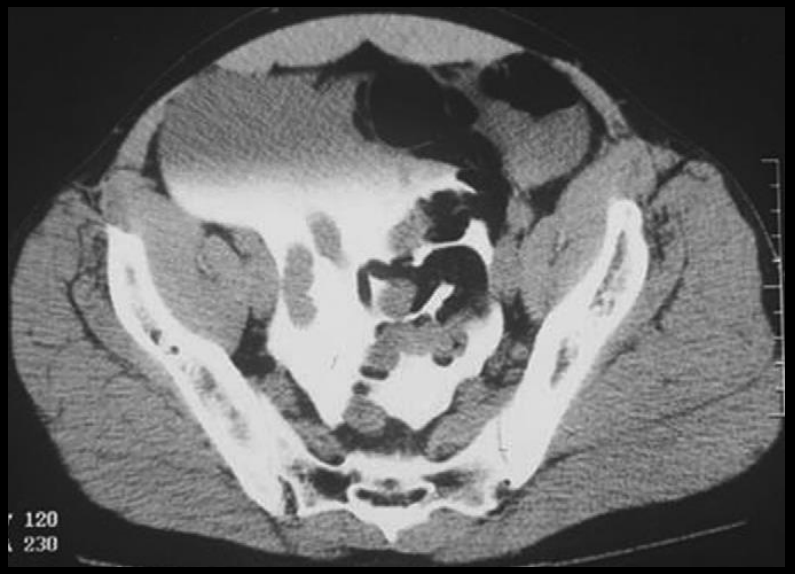
  a comparable **sensitivity (90-95%)** and **specificity (100%)**

  - **CT cystography**: better identification of bone fragments in bladder, BN injury, and other abdomen injury

  - Retrograde filling of 350ml dilute CM
  - **Intraperitoneal** extravasation: highlighting bowel loops and/or outlining abdominal viscera such as the liver
  - **Extraperitoneal** bladder injury: flame-shaped areas of contrast extravasation in the peri-vesical soft tissues.

Extra-P bladder rupture
(flame-shaped)

Intra-P bladder rupture
(outlining bowel loops)



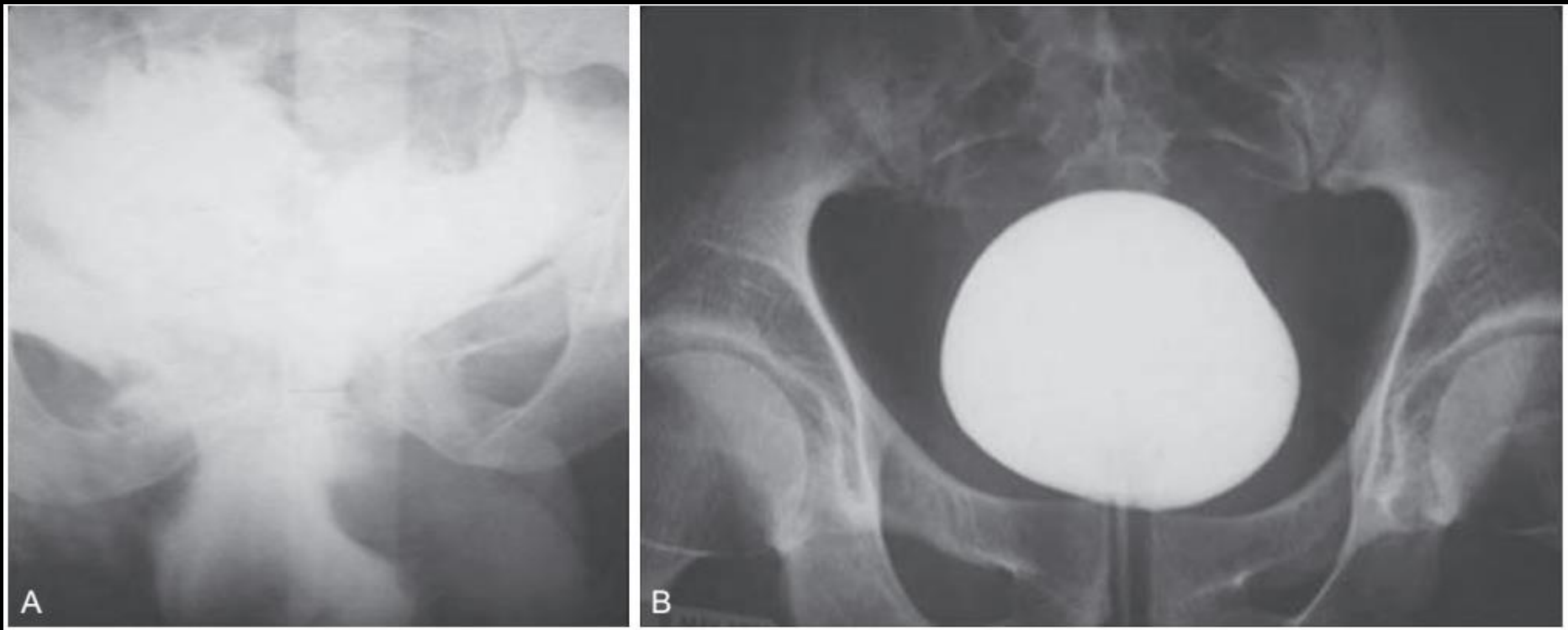


Figure 101-14. A, Dense flame-shaped pattern of contrast extravasation in the pelvis secondary to extraperitoneal bladder rupture. B, Repeat cystogram in the same patient after 2 weeks of catheter drainage shows a completely healed bladder.

Extra-P bladder rupture

with bone fragment in bladder

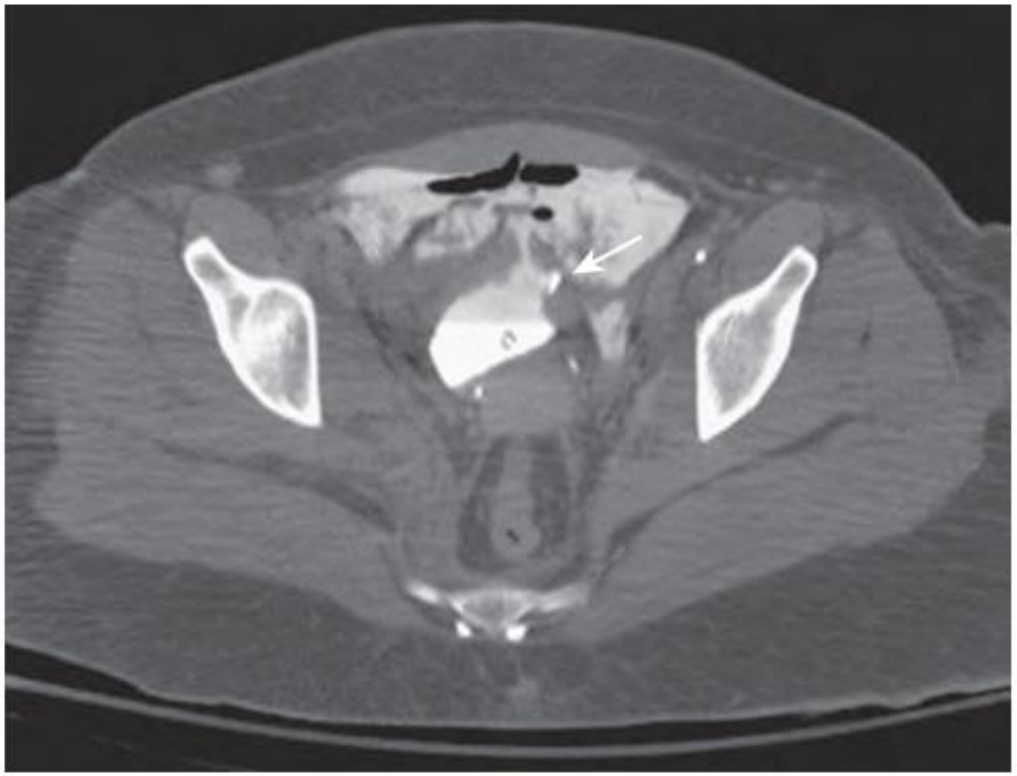


Figure 101-15. Computed tomography cystogram of a patient with extraperitoneal bladder rupture after a motor vehicle/pedestrian collision and extensive pelvic fracture. *Arrow* indicates a fragment of bone in the bladder, removed at the time of laparotomy and repair of the bladder.

Figure 101-12. Plain film cystogram reveals extraperitoneal bladder rupture with extravasation into the scrotum. Surgical exploration revealed anterior bladder neck and prostatic urethral laceration.

Diagnostic evaluation of Bladder Trauma

- **Cystoscopy:**
  - preferred for detection of intra-operative bladder injuries

- **Ultrasound:**
  - intraperitoneal fluid or an extraperitoneal collection suggests intraperitoneal or extraperitoneal perforation, respectively.

  → US **alone** is **insufficient** in the diagnosis of bladder trauma.

Management of Bladder Trauma

- **Conservative treatment**
  - clinical observation, continuous bladder drainage and antibiotic prophylaxis
  - Indication:
    - **Uncomplicated extraperitoneal injury** (due to blunt trauma, after TURB or after other operations in which the injury was not recognized during surgery)
    - **Option** for **uncomplicated intraperitoneal injury** (after TURB or after other operations in which the injury was not recognized during surgery), but only in the absence of peritonitis and ileus

Management of Bladder Trauma

- **Surgery**
  - **Blunt** non-iatrogenic trauma:
    - **Extra-peritoneal rupture +**
      - BN involvement

      (unrepaired BN injury → incontinence & infection of pelvic fr.)
      - bone fragments in the bladder wall
      - concomitant rectal or vaginal injury
      - Internal fixation with osteosynthetic material (↓↓ the risk of infection)
      - Surgical exploration for other injury
      - Extra-peritoneal rupture (↓complication/ recovery time)

    - **Intra-peritoneal rupture** (lead to peritonitis, sepsis, death): laparoscopic / open

Management of Bladder Trauma

- **Surgery**
  - **Penetrating** non-iatrogenic trauma:
    - Standard treatment: emergency exploration, debridement of devitalised bladder muscle and primary
    - midline exploratory cystotomy
    - gunshot wounds: a strong association with intestinal and rectal injuries, requiring fecal diversion
    - **Not sterile in penetrating agent** (bullet/ knife): Abx Tx
  - **Iatrogenic** bladder trauma: primarily closed

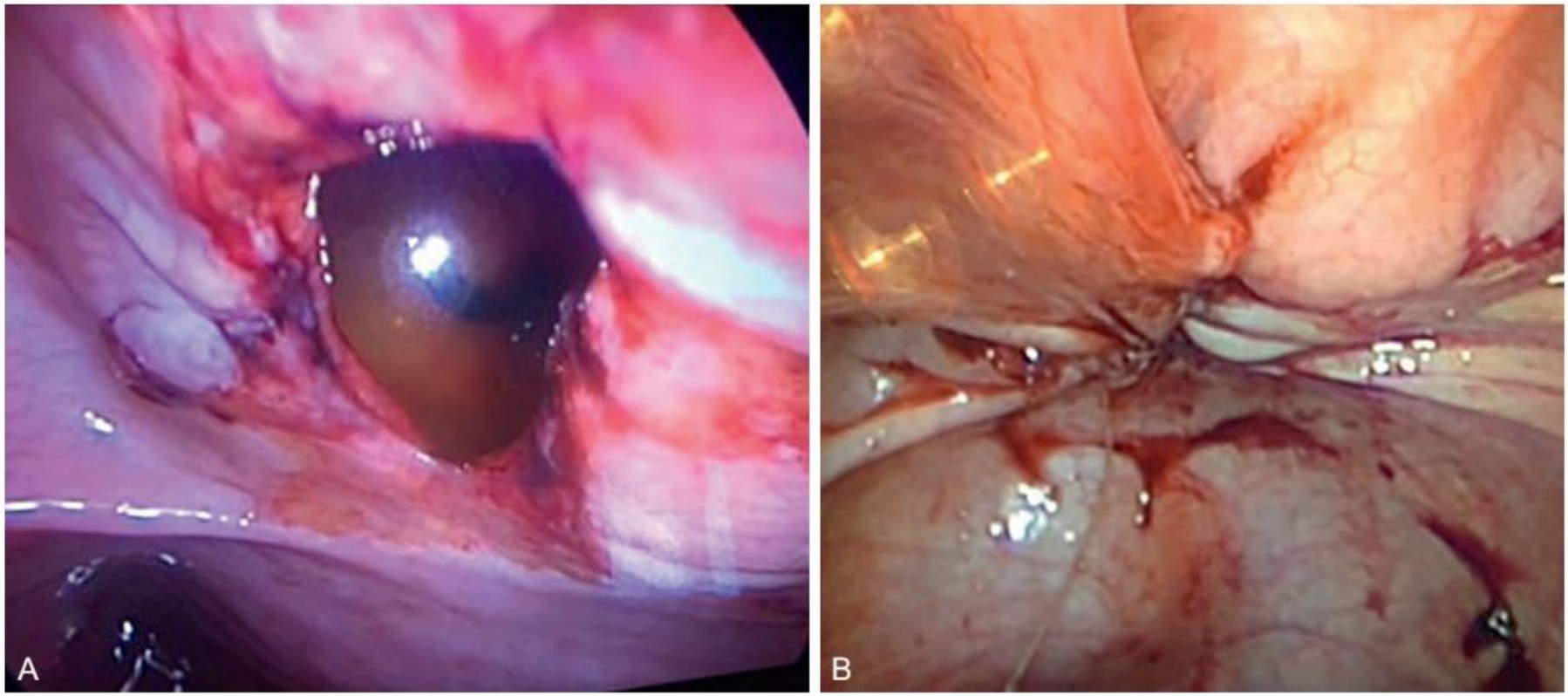


Figure 101-16. A, Intraoperative image of laparoscopic bladder repair, with a flexible cystoscope inside the bladder. B, Appearance of bladder after two-layer closure.

Follow-up of Bladder Trauma

- Conservatively treated bladder injury
  - **Cystography: 10 days after injury**
    - Ongoing leakage: cystoscopy to rule out bony fragments in the bladder
    - Repeat cystography after 1 week

- Surgical repair
  - **A simple injury** in a healthy patient: remove Foley at 7-10 days w/o need for cystoography

  - **Complex injury** (trigone involvement, ureter implant, poor wound healing factor): cystography

2022 EAU Recommendations of bladder trauma

Recommendations	Strength rating
Perform cystography in the presence of visible haematuria and pelvic fracture.	Strong
Perform cystography in case of suspected iatrogenic bladder injury in the post-operative setting.	Strong
Perform cystography with active retrograde filling of the bladder with dilute contrast (300-350 mL).	Strong
Perform cystoscopy to rule out bladder injury during retropubic sub-urethral sling procedures.	Strong
Manage uncomplicated blunt extraperitoneal bladder injuries conservatively.	Weak
Manage blunt extraperitoneal bladder injuries operatively in cases of bladder neck involvement and/or associated injuries that require surgical intervention.	Strong
Manage blunt intraperitoneal injuries by surgical exploration and repair.	Strong
Manage small uncomplicated intraperitoneal bladder injuries during endoscopic procedures conservatively.	Weak
Perform cystography to assess bladder wall healing after repair of a complex injury or in case of risk factors for wound healing.	Strong

Etiology/ Pathophysiology of Urethra Trauma

Iatrogenic

- Most common type of urethral injury in practice
- **Due to Catheterization**
  - Most **bulbar urethra**
  - Silicone catheter and small caliber Foley catheter: less morbidity

- **Due to Surgery (TUR-P)**
  - Urethral stricture after TURP
  - Predisposing factors: increased prostate volume, prostate cancer and the surgeon's experience
  - **Meatus stricture**: mismatch between the size of instrument and the meatus diameter
  - **Bulbar stricture:** insufficient lubricants causing monopolar current to leak

Etiology/ Pathophysiology of Urethra Trauma

Non-iatrogenic

Male ant. Urethral injury

- Most-common: blunt trauma; bulbar stricture
- Mostly "**straddle injury**" or **kicks in the perineum** (bulb compressed against PS)
- Penetrating injury: gunshot

Male post. Urethral injury

- Most related to **pelvic fractures** (with disruption of the pelvic ring)
- Injuries of BN and prostate are rare
  - mostly occur at the anterior midline of both BN and prostatic urethra
- Delayed morbidity of posterior urethral injuries includes **strictures, incontinence and ED** → a detrimental effect on QoL

Etiology/ Pathophysiology of Urethra Trauma

Non-iatrogenic

Female Urethral injury

- **Rare**
- **Pelvic fracture**: main etiology
- Usually a partial longitudinal tear of the anterior wall associated with vaginal laceration
- Extending into BN: disrupt continence mechanism

Diagnosis of Urethra Trauma

- **Clinical signs:**
  - Cardinal sign: **blood at the meatus! (≠ hematuria)**

    (Absence dose not rule out urethral injury!!)

  - **Inability to void** (with palpable distended bladder): complete rupture
  - Hematuria with pain on urination
  - Urinary extravasation and bleeding: resulting in scrotal/ penile/ perineal swelling and ecchymosis.
  - Difficulty / inability to pass urethra catheter

  - **Rectal exam:**
    - Exclude associated rectal injury (5%)
    - High riding prostate: **unreliable**

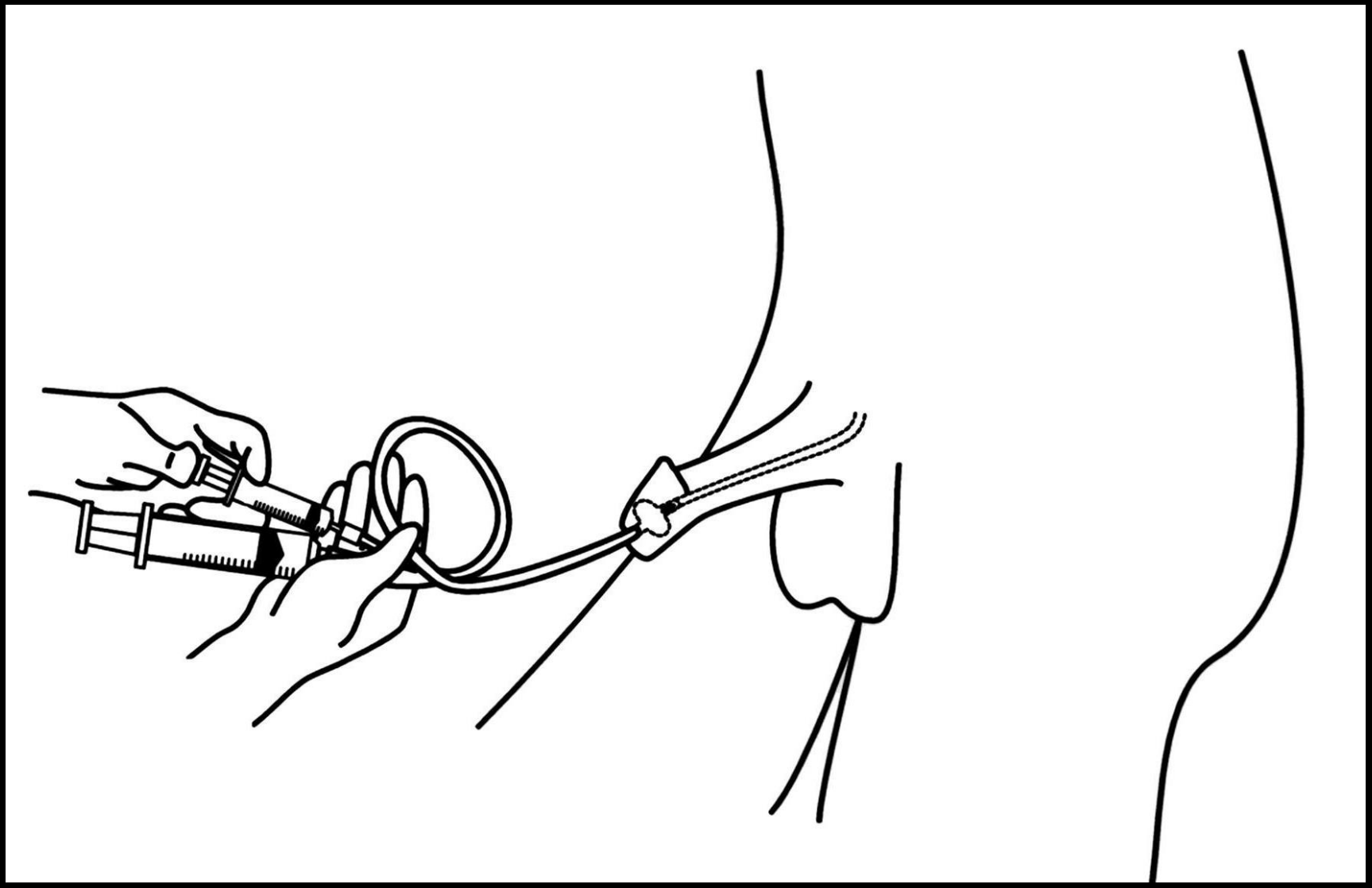
Diagnosis of Urethra Trauma

- **Retrograde urethrography**
  - **STANDARD diagnostic investigation** for the acute evaluation of a male urethral injury!
  - 20-30 mL of contrast material while occluding the meatus, with a balloon of a Foley catheter inflated in the fossa navicularis.
    - Extravasation outside the urethra:

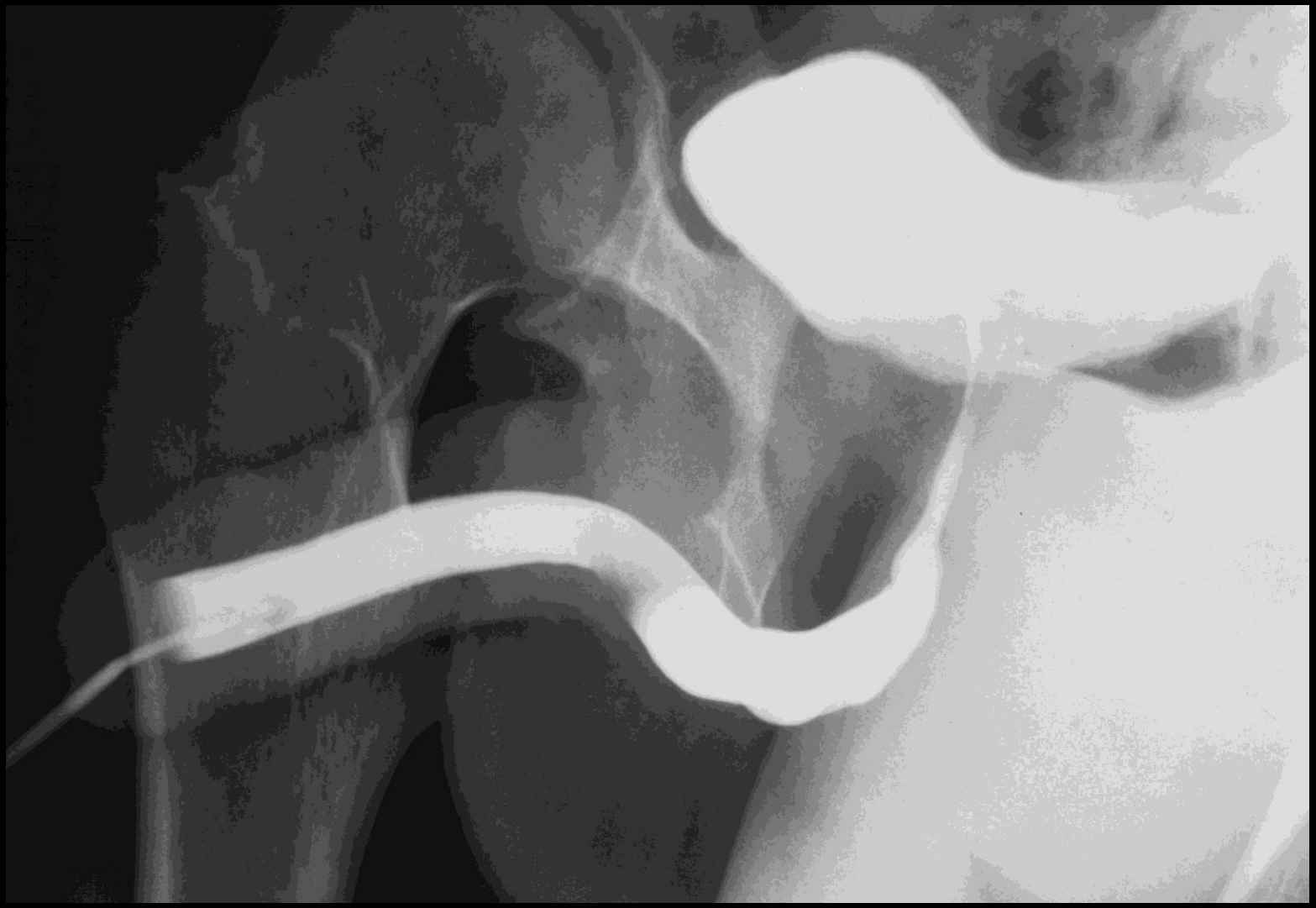
      Pathognomonic for urethral injury
    - Typical: incomplete rupture with bladder filling

      (without bladder filling→ complete rupture)
  - **Combined antegrade cystourethrography!**
  - Postpone urethrography in unstable patients

Retrograde Urethrography

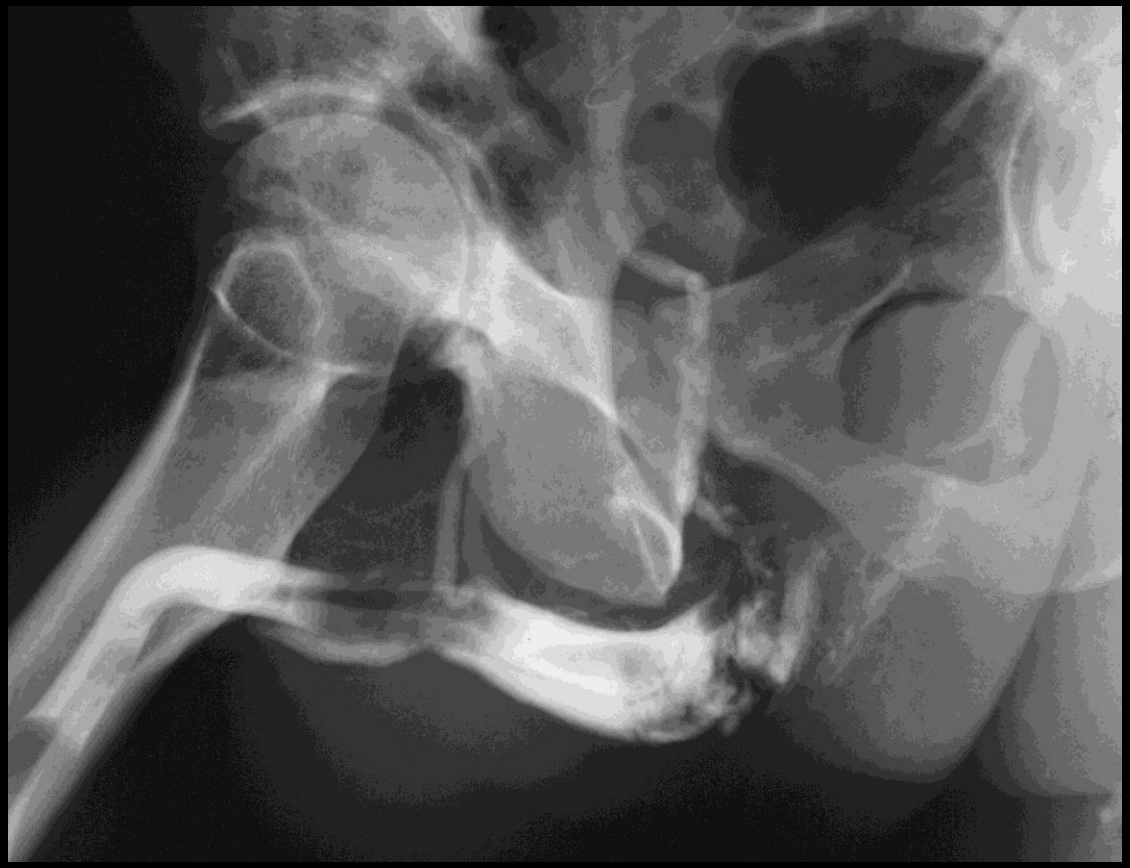


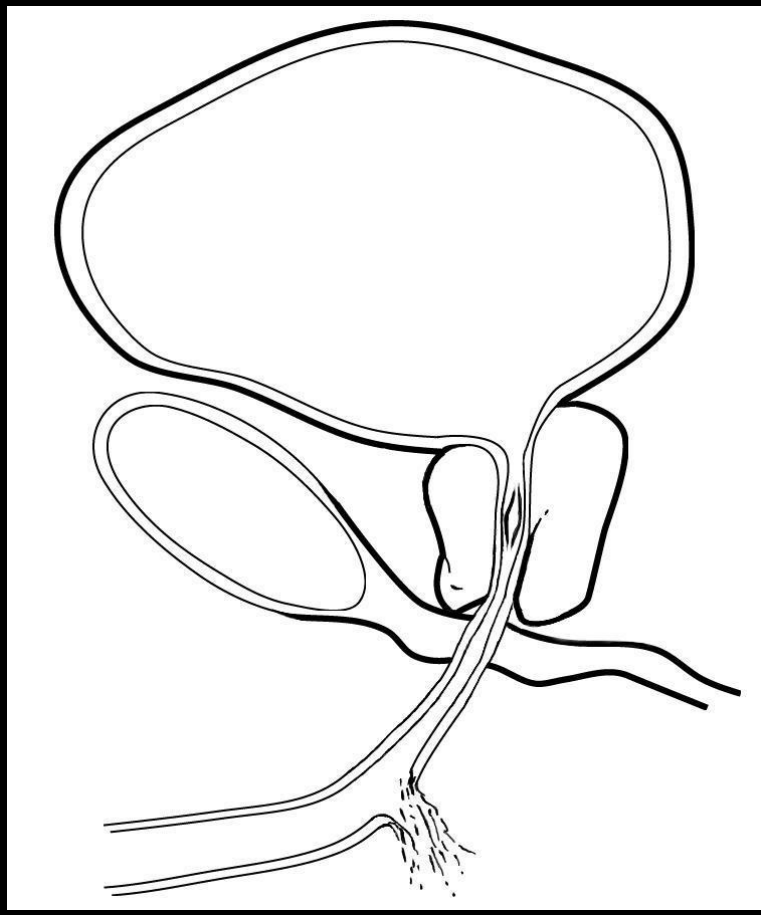
Normal retrograde urethrography



Retrograde urethrography

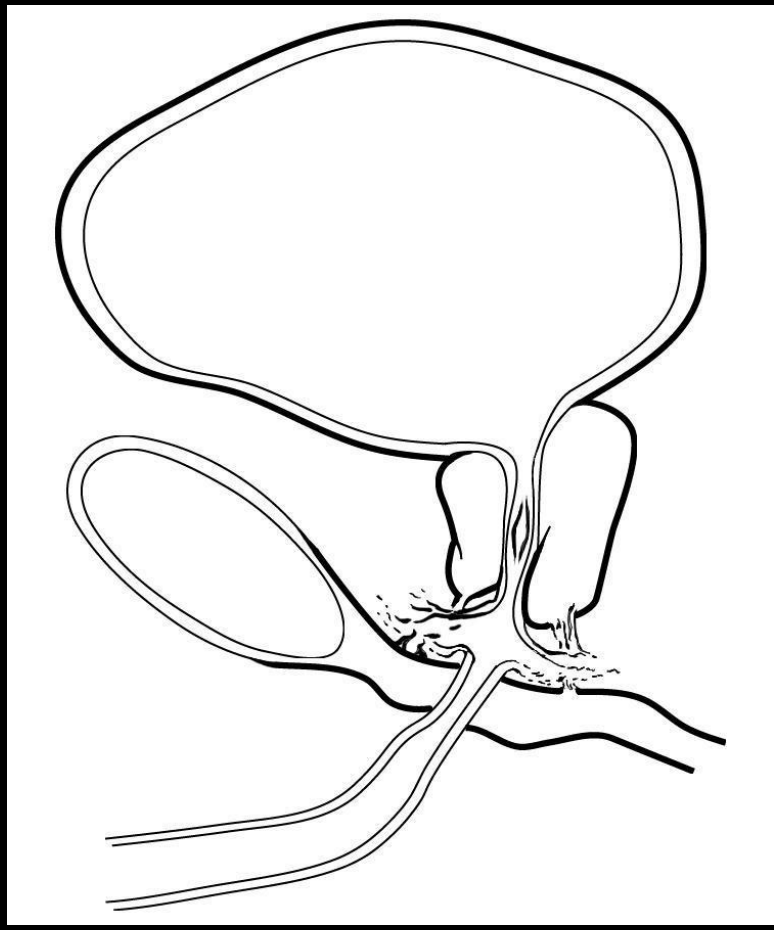
Ant. Urethral injury





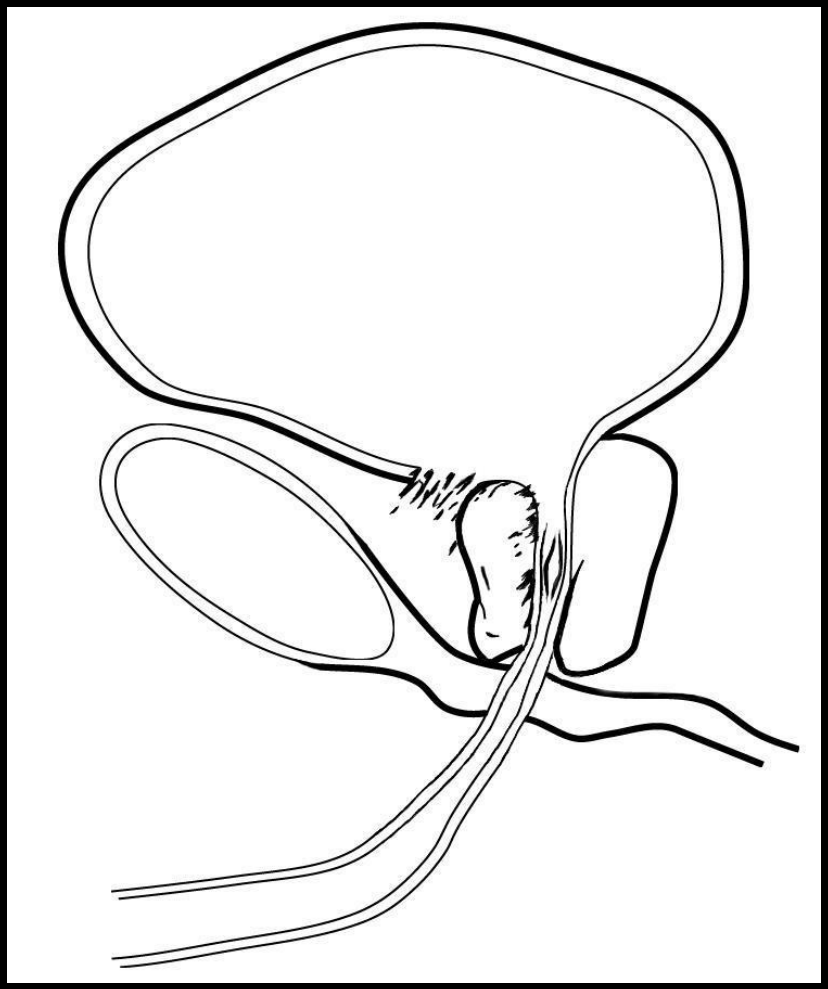
Retrograde urethrography

Post. Urethral injury

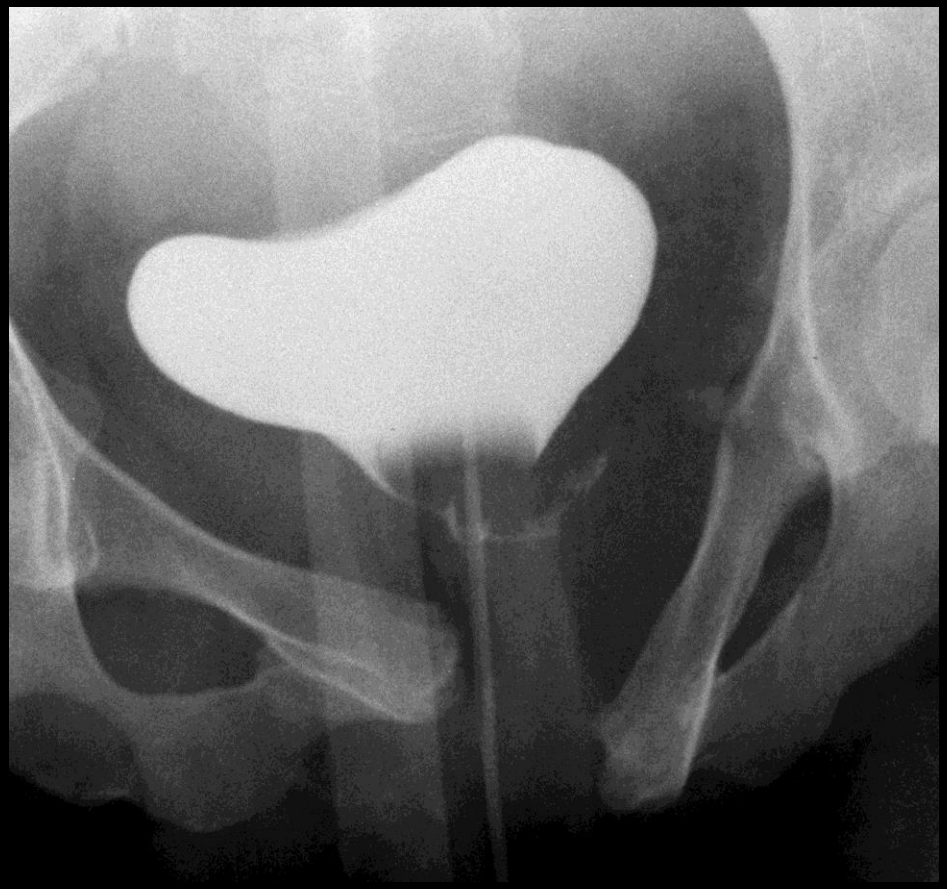


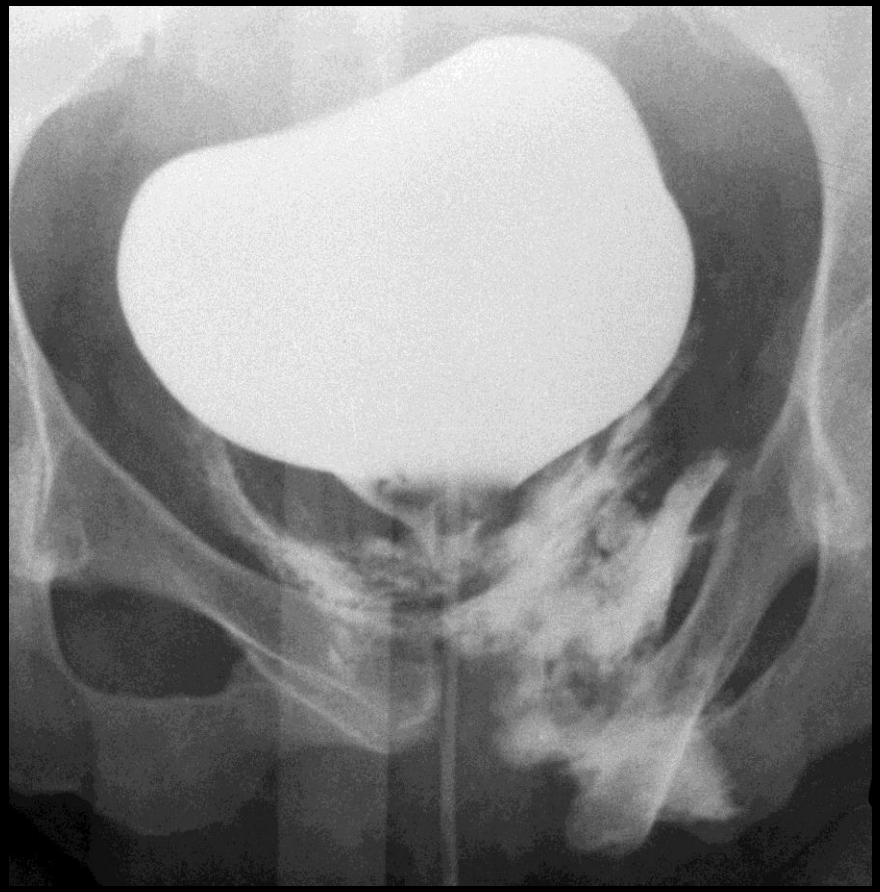
Retrograde urethrography

Post. Urethral injury & Extra-P Bladder rupture



Female BN injury





Diagnosis of Urethra Trauma

- **Staging** of urethral injury in **retrograde urethrography**

Anterior urethra
Partial disruption
Complete disruption
Posterior urethra
Stretched but intact
Partial disruption
Complete disruption
Complex (involves bladder neck/rectum)

**According to the 2004 Consensus Panel on Urethral Trauma [264].*

Diagnosis of Urethra Trauma

- **Cystoscopy**
  - Flexible cystoscopy: **optional** in **male** patients
  - **Female patients**: cystoscopy/ urethroscopy/ vaginoscopy- **diagnostic modalities of choice !**

Management of Urethra Trauma

- **Anterior urethral injury**
  - **Blunt injury** (associated with spongiosal contusion)
    - Suprapubic diversion
    - (a trial of) early endoscopic re-alignment with transurethral catheterisation
      - Satisfactory urethral re-canalization: in 68% partial rupture, rare after complete rupture
  - **Penile fracture-related**
    - penile fractures require **early exploration**

      → concomitant repair
  - **Penetrating injury**
    - **Immediate exploration**
      - Staged repair with suprapubic catheter in the case with longer defects or apparent infection (bite wounds)

Management of Urethra Trauma

- **Posterior urethral injury**
  - **Blunt injury**: incomplete VS partial rupture
    - Immediate Tx (<48hr)
    - Delayed primary (2days~2weeks)
    - Deferred (>3mo)

Management of Urethra Trauma

- **Posterior urethral injury**
  - Reasons for **early urinary diversion**
    - monitor UO: valuable sign of the haemodynamic condition
    - treat symptomatic retention
    - minimize urinary extravasation and its secondary effects, such as infection and fibrosis.

→ **Suprapubic catheter**: good solution in urgent situation

(difficulty in pelvic hematoma/ poor bladder filling due to shock or bladder injury)

→ **An attempt at urethral catheterization by experienced hands**

Management of Urethra Trauma

- **Posterior urethral injury (blunt)**
  - **Immediate treatment**
    - **Partial rupture**
      - **Suprapubic catheter + 2-weekly interval urethrography**
        - May heal without scarring or obstruction
        - Stricture
          - internal urethrotomy (short & non-obliterative)
          - Urethroplasty (long/ dense scar, complete obliteration)

Management of Urethra Trauma

- **Posterior urethral injury (blunt)**
  - **Immediate treatment**
    - **Complete rupture**
      - **Immediate re-alignment (endoscopic):**
        - Aim: to correct severe distraction injuries rather than to prevent a stricture
        - Avoid traction on Foley catheter (damage remaining sphincter mechanism at BN)
        - **stricture formation (14-79%),**

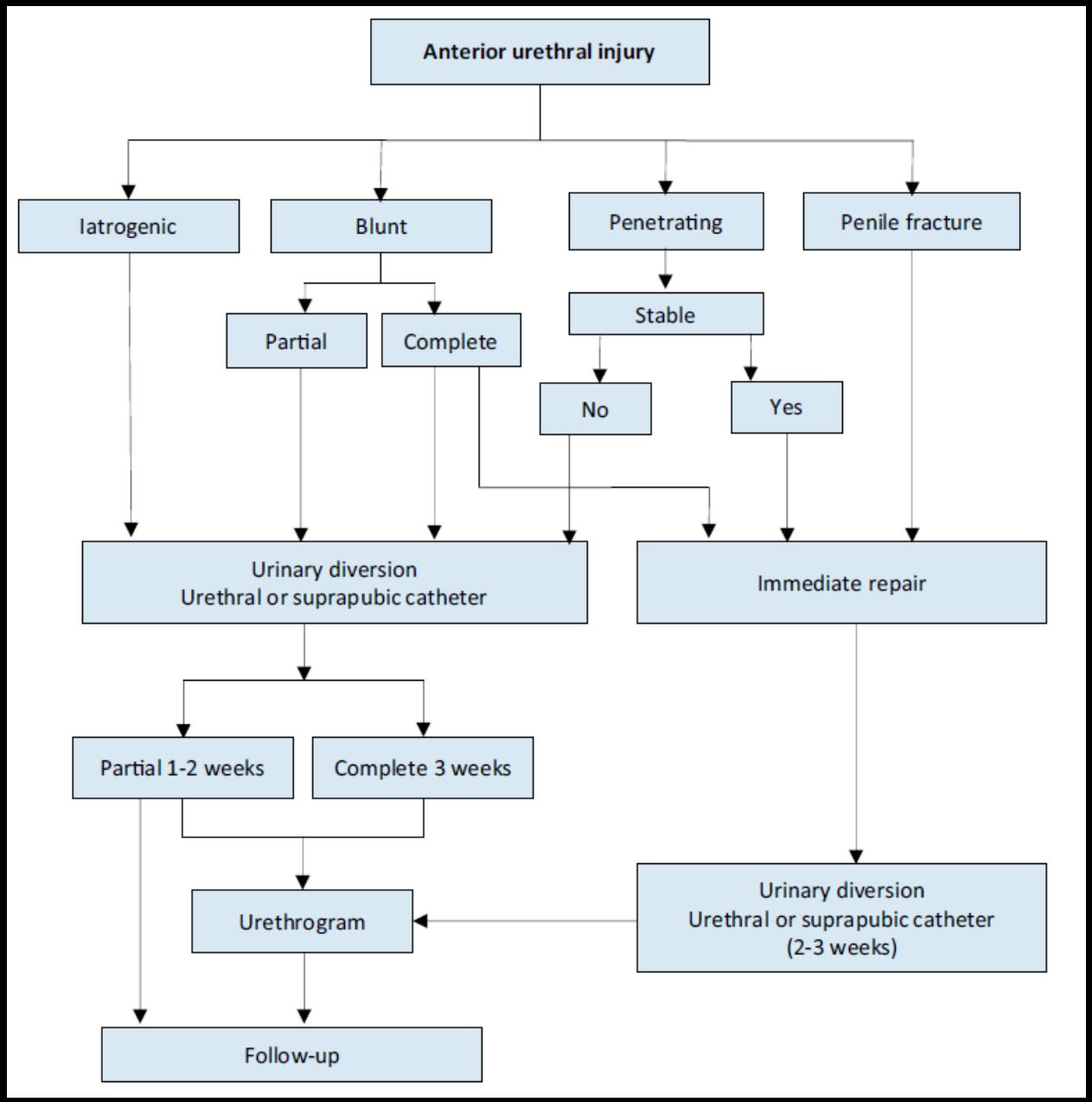
          incontinence (< 5%)

          impotence (10-55%)

Management of Urethra Trauma

- **Posterior urethral injury (blunt)**
  - **Immediate treatment**
    - **Complete rupture**
      - **Immediate urethroplasty**
        - Difficult procedure due to poor visualization, risk of controlled bleeding following entry into pelvic hematoma
        - Surgical indication: **BN injury, rectal injury, pie in the sky bladder**
        - **high rates of impotence (56%), incontinence (21%) and strictures (69%)**
        - **Not recommended** outside experienced center

2022 EAU: Management of male anterior urethral injury



2022 EAU: Management of male posterior urethral injury