

Low urinary tract trauma

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Bladder Trauma

Classification

- Bladder trauma is primarily classified according to the location of the injury: **intra-peritoneal, extra-peritoneal, and combined**
- Bladder trauma is categorized by etiology: **non-iatrogenic** (blunt and penetrating) and **iatrogenic** (external and internal).

Epidemiology, etiology and pathophysiology

- Motor vehicle accidents are the most common cause of blunt bladder injury, followed by falls and other accidents.
- The main mechanisms are pelvic crush and blows to the lower abdomen.
- Most patients with blunt bladder injury have associated pelvic fractures (60-90%) and other intra-abdominal injuries (44-68.5%).
- Pelvic fractures are associated with bladder injury in about 3% of cases .
- however, this can be as high as 26.5% in cases of severe pelvic injury .
- Bladder injury is associated with urethral injury in 5-20% of cases

- **Extraperitoneal injury** is almost always associated with pelvic fractures. It is usually 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 countercoup at the opposite side.
- Occasionally, the bladder is directly perforated by a sharp bony fragment .
- **Intraperitoneal injury** is 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, are rare except in conflict zones and violent urban areas .

- *Iatrogenic bladder trauma (IBT)*
- **External IBT** occurs most often during obstetric and gynecological procedures, followed by urological and general surgical operations .
- Main risk factors are previous surgery, inflammation and malignancy .
- Bladder perforations occur in up to 4.9% of mid-urethral sling (MUS) operations for stress urinary incontinence in women.

- **Internal IBT** mainly occurs during transurethral resection of the bladder (TURB).
- Reported risk factors are larger tumours, older age, pre-treated bladders (previous TURB, intravesical instillations) and location at the bladder dome.
- Tumours at the lateral wall pose a risk factor because of the obturator jerk .
- Extraperitoneal perforations are more frequent than intraperitoneal perforations and perforations requiring intervention are rare (0.16-0.57%)

Diagnostic evaluation

- The principal sign of bladder injury is visible haematuria.
- **Absolute indications for bladder imaging** include: visible haematuria and a pelvic fracture or non-visible haematuria combined with high-risk pelvic fracture or posterior urethral injury .
- Bladder trauma should also be suspected in patients with blunt urethral trauma and high Injury Severity Score (ISS) .

In the absence of these absolute indications, further imaging is based on clinical signs and symptoms including

- inability to void or inadequate urine output;
- abdominal tenderness or distension due to urinary ascites, or signs of urinary ascites in abdominal imaging;
- uraemia and elevated creatinine level due to intraperitoneal re-absorption;
- entry/exit wounds at lower abdomen, perineum or buttocks in penetrating injuries.

- Intra-operative signs of external iatrogenic bladder injury include: extravasation of urine, visible laceration, visible bladder catheter, and blood and/or gas in the urine bag during laparoscopy .
- Direct inspection is the most reliable method of assessing bladder integrity .
- Intravesical instillation of dye helps to detect smaller lesions .
- If bladder perforation is close to the trigone, the ureteric orifices should be inspected

- Internal bladder injury is recognized by cystoscopic identification of fatty tissue, dark space, or bowel .
- It may also be detected by the inability to distend the bladder, low return of irrigation fluid, or abdominal distension .
- Post-operatively, missed bladder trauma is diagnosed by haematuria, abdominal pain, abdominal distension, ileus, peritonitis, sepsis, urine leakage from the wound, decreased urinary output, or increased serum creatinine .
- An IBT during hysterectomy or caesarean delivery can result in vesico-vaginal or vesico-uterine fistulae .

Cystography

- Cystography is the preferred diagnostic modality for non-iatrogenic bladder injury and for a suspected IBT in the post-operative setting.
- Both plain and CT cystography have a comparable sensitivity (90-95%) and specificity (100%) .
- However, CT cystography is superior in the identification of bony fragments in the bladder and bladder neck injuries, as well as concomitant abdominal injuries.
- Cystography must be performed using retrograde filling of the bladder with a minimum volume
- of 300-350 mL of dilute contrast material.
- Passive bladder filling by clamping the urinary catheter during the excretory phase of CT or IVP is not sufficient to exclude bladder injury .
- Intraperitoneal extravasation is visualized by free contrast medium in the abdomen outlining bowel loops or abdominal viscera
- Extraperitoneal bladder injury is typically diagnosed by flame-shaped areas of contrast extravasation in the peri-vesical soft tissues.
- Contrast medium in the vagina is a sign of vesico-vaginal fistula

Cystoscopy

- Cystoscopy is the preferred method for detection of intra-operative bladder injuries as it may directly visualize the laceration and can localize the lesion in relation to the position of the trigone and ureteral orifices .
- A lack of bladder distension during cystoscopy suggests a large perforation.
- Cystoscopy is recommended to detect perforation of the bladder (or urethra) following retropubic sub-urethral sling operations .

Ultrasound

- Ultrasound alone is insufficient in the diagnosis of bladder trauma, although it can be used to visualize intraperitoneal fluid or an extraperitoneal collection of fluid.

Prevention

- The risk of bladder injury is reduced by emptying the bladder by urethral catheterisation in every procedure where the bladder is at risk .
- Furthermore, the catheter's balloon can aid in identification of the bladder .
- For tumours at the lateral wall, obturator nerve block or general anaesthesia with adequate muscle relaxation can reduce the incidence of internal IBT during TURB .
- There is conflicting evidence whether bipolar TURB can reduce the risk for an obturator jerk .

Disease management

- ***1 Conservative management***
- comprises of clinical observation, continuous bladder drainage and antibiotic prophylaxis ,is the standard treatment for an uncomplicated extraperitoneal injury due to blunt or iatrogenic trauma .
- Conservative treatment can also be chosen for uncomplicated intraperitoneal injury after TURB or other operations, but only in the absence of peritonitis and ileus .
- Placement of an intraperitoneal drain is advocated, especially when the lesion is larger .
- Penetrating extraperitoneal bladder injuries (only if minor and isolated) can also be managed conservatively

Surgical management

- Bladder closure is performed with absorbable sutures .
- There is no evidence that two-layer is superior to watertight single-layer closure

Blunt non-iatrogenic trauma

- Most extraperitoneal ruptures can be treated conservatively, however bladder neck involvement, bone fragments in the bladder wall, concomitant rectal or vaginal injury or entrapment of the bladder wall necessitate surgical intervention .
- an extraperitoneal rupture should be sutured during surgical exploration for other injuries, in order to decrease the risk of complications and to
- reduce recovery time [162].
- Intraperitoneal ruptures should always be managed by surgical repair because intraperitoneal urine extravasation can lead to peritonitis, intra-abdominal sepsis and death
- Laparoscopic suturing of the intraperitoneal rupture is also possible

Penetrating non-iatrogenic trauma

- Penetrating bladder injury is managed by emergency exploration, debridement of devitalised bladder wall and primary bladder repair.
- A midline exploratory cystotomy is advised to inspect the bladder wall and the distal ureters .
- Most gunshot wounds are associated with two transmural injuries (entry and exit wounds) and the bladder should be carefully checked for these two lesions .
- antibiotic treatment is advised

Iatrogenic bladder trauma

- Perforations recognised intra-operatively are primarily closed.
- Bladder injuries not recognised during surgery or internal injuries should be managed according to their location.
- The standard of care for intraperitoneal injuries is surgical exploration and repair .
- If surgical exploration is performed after TURB, the bowel must be inspected to rule out concomitant injury .
- For extraperitoneal injuries, exploration is only needed for perforations complicated by symptomatic extravesical collections. It requires drainage of the collection, with or without closure of the perforation .
- If bladder perforation is encountered during midurethral sling or transvaginal mesh procedures, sling re-insertion and urethral catheterisation should be performed

Follow-up

- Continuous bladder drainage is required to prevent elevated intravesical pressure and to allow the bladder to heal .
- Conservatively treated bladder injuries (traumatic or external IBT) are followed up by cystography to rule out extravasation and ensure proper bladder healing. The first cystography is planned approximately ten days after injury .
- In case of ongoing leakage, cystoscopy should be performed to rule out bony fragments in the bladder, and a second cystography is warranted one week later .
- After operative repair of a simple injury in a healthy patient, the catheter can be removed after five to ten days without cystography .
- In cases of complex injury (trigone involvement, ureteric re-implantation) or risk factors of impaired wound healing (e.g. steroids, malnutrition) cystography is advised.
- For conservatively treated internal IBT, catheter drainage, lasting five days for extraperitoneal and seven days for intraperitoneal perforations, is proposed

Urethral Trauma

Epidemiology, aetiology and pathophysiology

- 1 Anterior male urethral injury
- The bulbar urethra is the most common site affected by **blunt** trauma. In bulbar injuries, the bulb is compressed against the pubic symphysis, resulting in rupture of the urethra at the site of compression.
- Possible mechanisms are straddle injuries or kicks to the perineum.
- A penile fracture can be complicated by a urethral injury in approximately 15% of cases .
- Penetrating anterior injuries are rare and are usually caused by gunshot wounds, stab wounds, dog bites, impalement or penile amputations .

- **Iatrogenic** injury is the most common type of urethral trauma .
- The incidence of urethral injury during transurethral catheterisation is 6.7 per 1,000 catheters inserted ,and can occur due to creation of a false passage by the tip of the catheter, inadvertent inflation of the anchoring balloon in the urethra or removal of the catheter with the anchoring balloon not fully deflated .
- Preliminary data suggests that guidewire led catheter insertion, or use of a safety valve for balloon inflation may prevent urethral trauma in difficult catheterisation cases .
- Instrumentation of the urethra (TURP, cystoscopy, etc.) can traumatize all segments of it .
- During penile prosthesis insertion (PPI), the risk of urethral perforation is 0.1-4%.
- Proximal urethral injuries are more common than distal ones

Posterior male urethral injuries

- **Blunt** injuries are almost related to pelvic fractures with disruption of the pelvic ring .
- These injuries are referred to as pelvic fracture urethral injuries (PFUI) .
- Pelvic fracture urethral injuries are divided into partial or complete ruptures .
- In complete ruptures, there is a gap between the disrupted ends of the urethra, which fills up with scar tissue.
- There is no urethral wall in the scarred space and any lumen represents a fistulous tract between the urethral stumps

- Injuries of the bladder neck and prostate are rare and mostly occur at the anterior midline of both the bladder neck and prostatic urethra .
- It is highly uncommon to find a complete transection of the bladder neck or an avulsion of the anterior part of the prostate.
- Concomitant injuries to the head, thorax, abdomen and/or spine are frequent (up to 66%)

- **Penetrating** injuries of the pelvis, perineum or buttocks (mainly gunshot wounds) can also damage the posterior urethra, but are extremely rare ,
- There is a high probability of associated injuries (80-90%), mainly intra-abdominal .
- Delayed morbidities of posterior urethral injuries include strictures, incontinence and erectile dysfunction, all of which may have a detrimental effect on the patient's quality of life .
- erectile dysfunction following PIFU is 34% .

Female urethral injuries

- **Birth related injuries** to the female urethra are rare and consist of minor (peri)urethral lacerations during vaginal delivery.
- Pelvic fractures are the main cause of **blunt** trauma
- however, PFUIs in females are rare and less common than in males. This is usually attributed to the flexibility provided by the vagina and the greater inherent elasticity of the female urethra [
- Female urethral injuries are classified into two types:
- longitudinal or partial (most frequent) injuries and transverse or complete injuries.
- Concomitant bladder or vaginal injury is possible; therefore, females are at risk of developing urinary incontinence and urethrovaginal fistula .
- Insertion of a synthetic sub-urethral sling is complicated by an intra-operative urethral injury in 0.2-2.5% of cases and is an important cause of **iatrogenic** urethral injury.

Evaluation

- *Clinical signs*
- Blood at the meatus is the cardinal sign, but the absence of it doesn't rule out a urethral injury .
- Inability to void (with a palpable distended bladder) is another classic sign and is often associated with a complete rupture .
- Haematuria and pain on urination may be present in incomplete ruptures.
- Urinary extravasation and bleeding may result in scrotal, penile and/or perineal swelling and ecchymosis, depending on the location and extent of the trauma. The presentation of these clinical symptoms may be delayed (> 1 hour)
- Rectal examination should always be done to exclude an associated rectal injury , and may reveal a 'high-riding' prostate, which is an unreliable finding .
- A rectal injury is suggested by blood on the examining finger and/or a palpable laceration [156].
- Another sign of urethral injury is difficulty or inability to pass a urethral catheter .
- A female urethral injury should be suspected from the combination of a (unstable) pelvic fracture with blood at the vaginal introitus, vaginal laceration, haematuria, urethrorrhagia, labial swelling, urinary retention or difficulties passing a urethral catheter.
- Vaginal examination is indicated to assess vaginal lacerations

Urethrography

- Retrograde urethrography (RUG) is the standard in the early evaluation of a male urethral injury
- is conducted by injecting 20-30 mL of contrast material while occluding the meatus.
- Films should be taken in a 30° oblique position.
- During RUG, any extravasation outside the urethra is pathognomonic for urethral injury .
- A complete rupture is suggested by massive extravasation without bladder filling .
- Although RUG is able to reliably identify the site of injury (anterior vs. posterior), the distinction between a complete and partial rupture is not always clear
- In females, the short urethra and vulvar oedema makes adequate urethrography nearly Impossible Prior to deferred treatment, a combination of RUG and antegrade cysto-urethrography is the standard to evaluate site and extent of the urethral stenosis, and to evaluate the competence of the bladder neck

Cysto-urethroscopy

- Flexible cysto-urethroscopy is a valuable alternative to diagnose an acute urethral injury and may distinguish between complete and partial rupture .
- Flexible cysto-urethroscopy is preferred to RUG in suspected
- penile fracture-associated urethral injury .
- In females, where the short urethra often precludes adequate radiological visualisation, cysto-urethroscopy and vaginoscopy are the diagnostic modalities of choice .
- If, prior to deferred treatment, the competence of the bladder neck is not clear upon antegrade cysto-urethrography, a suprapubic cystoscopy is advised

Ultrasound and magnetic resonance imaging

- In the acute phase, US scanning is used for guiding the placement of a suprapubic catheter .
- In complex PFUIs, MRI before deferred treatment provides valuable additional information,
- This information includes a better estimation of the length of the distraction defect, degree of prostatic displacement and presence/absence of a false passage

Disease Management

Male anterior urethral injuries

Immediate exploration and urethral reconstruction

- This is indicated for penile fracture related injuries and non-life threatening penetrating injuries .
- Small lacerations can be repaired by simple closure .
- Complete ruptures without extensive tissue loss are treated with anastomotic repair .
- In the case of longer defects or apparent infection a staged repair with urethral marsupialisation is needed .
- The role of immediate urethroplasty in blunt injuries is controversial. Patients (88.3% complete ruptures), who underwent immediate
- urethroplasty had a failure rate that was not significantly different compared to those who underwent delayed
- urethroplasty after initial suprapubic diversion (11.7% vs. 18.6%; $p = 0.71$).

- Urinary diversion
- Blunt anterior urethral injuries are associated with spongiosal contusion. Evaluation of the limits of urethral debridement in the acute phase might be difficult and as a consequence, it is reasonable to start with urinary diversion only [232]. If urinary diversion is performed, the therapeutic options are suprapubic diversion or a trial of early endoscopic re-alignment with transurethral catheterisation [232], there is conflicting evidence as to which intervention is superior [239, 241]. Urinary diversion is maintained for one to two weeks for partial ruptures and three weeks for complete ruptures [232, 241]. Satisfactory urethral luminal re-canalisation may occur in up to 68% after partial ruptures, but is rare (14%) after complete ruptures [241]. A review of 49 Chinese studies (1,015 patients), reported a 57% (range: 0-100%) success rate for endoscopic re-alignment of blunt anterior injuries [239]. The wide range in success rate most likely reflects a mix of partial and complete ruptures which was not further specified in the review. Transurethral or suprapubic urinary diversion are treatment options for iatrogenic or life-threatening penetrating injuries [228, 242]. Minor iatrogenic urethral injuries and urethral contusions do not require urinary diversion

Male posterior urethral injuries

- Emergency room management
- As these injuries are usually associated with other severe injuries, resuscitation and immediate treatment of life-threatening injuries
- Penetrating injuries especially have a very high likelihood of associated injuries requiring immediate exploration
- There is no urgency to treat the urethral injury and urinary diversion is not essential during the first hours after trauma
- however, it is preferable to establish early urinary diversion to:
 - monitor urinary output, since this is a valuable sign of the haemodynamic condition and the renal function
- treat symptomatic retention if the patient is still conscious;
- • minimise urinary extravasation and its secondary effects, such as infection and fibrosis .

- Insertion of a suprapubic catheter is an accepted practice in urgent situations
- However, insertion of a suprapubic catheter is not without risk, especially in the unstable trauma patient where the bladder is often displaced by a pelvic haematoma or because of poor bladder filling due to haemodynamic shock or concomitant bladder injury.
- In these circumstances, an attempt at urethral catheterisation can be carried out by experienced personnel
- If there is any difficulty, a suprapubic catheter should be placed under US guidance or under direct vision,

Early urethral management (less than six weeks after injury)

- For partial injuries, urinary diversion (suprapubic or transurethral) is sufficient as these injuries can heal without significant scarring or obstruction
- A complete injury will not heal, and formation of an
- obliterated segment is inevitable in case of suprapubic diversion alone
- To avoid this obliteration and a long period of suprapubic diversion followed by deferred urethroplasty, the urethral ends can be sutured (urethroplasty) or approximated over a transurethral catheter (re-alignment).

Immediate urethroplasty

- Urethroplasty within 48 hours after injury is difficult because of poor visualisation and the inability to accurately assess the degree of urethral disruption, due to extensive swelling and ecchymosis and the risk of severe bleeding following entry into the pelvic haematoma .
- In addition, with high rates of impotence (23%), incontinence (14%) and strictures (54%), urethroplasty within 48 hours is not indicated

Early urethroplasty

- Urethroplasty can be performed after two days and up to six weeks after the initial injury, if associated injuries have been stabilised, the distraction defect is short, the perineum is soft and the patient is able to lie down in the lithotomy position
- As the results (complications, stricture recurrence, incontinence and impotence) are equivalent to delayed urethroplasty
- Lacerations (blunt or penetrating) at the bladder neck and prostatic urethra are a specific entity: they will never heal spontaneously, will cause local cavitation and compromise the intrinsic sphincter mechanism (with increased risk of urinary incontinence) They must be reconstructed as soon as possible.
- For penetrating injuries with severe lesions to the prostate, prostatectomy
- (bladder neck sparing) must be performed

- Early re-alignment
- In a partial injury, re-alignment, and transurethral catheterisation avoids extravasation of urine in the surrounding tissues reducing the inflammatory response.
- In complete injuries, the aim of re-alignment is to correct severe distraction injuries rather than to prevent a stricture .
- Re-alignment can be done by an open or endoscopic technique
- Endoscopic re-alignment is now preferred Using a flexible/rigid cystoscope,
- The duration of catheterisation is three weeks for partial and six weeks for complete ruptures with voiding urethrography upon catheter removal
- With contemporary endoscopic re-alignment procedures, stricture formation is reduced to 44-49% compared to a 89-94% stricture rate with suprapubic diversion.
- There is no evidence that early re-alignment increases the risk of urinary incontinence (4.7-5.8%) or erectile dysfunction (16.7-20.5%)

Deferred management (greater than three months after injury)

- The standard treatment remains deferred urethroplasty .
- In the case of a complete rupture, treated with an initial period of three months suprapubic diversion, obliteration of the posterior urethra is almost inevitable
- Endoscopic treatment of a complete obliteration is not successful .
- After at least three months of suprapubic diversion, the pelvic haematoma is nearly always resolved, the prostate has descended into a more normal position, the scar tissue has stabilised and the patient is clinically stable and able to lie down in the lithotomy position .
- Perineal anastomotic repair is the surgical technique of choice, but a combined abdominoperineal approach is necessary in rare cases of concomitant bladder neck injury or recto-urethral fistula .

- Deferred urethroplasty does not significantly affect erectile function
- Incontinence is rare with deferred urethroplasty (approximately 5%), and is usually due to incompetence of the bladder neck

Female urethral injuries

- Emergency room management of PFUIs in females is the same as in males
- however, subsequent management differs.
- Treatment options are :
 - **Early repair (less than or equal to seven days):** Complication rate is the lowest with early repair;
 - **Delayed repair (greater than seven days):** Delayed repair often requires complex abdominal or combined abdominal-vaginal reconstruction with elevated risk of urinary incontinence and vaginal stenosis

Genital Trauma

Epidemiology, aetiology and pathophysiology

- Of all urological injuries, 33-66% involve the external genitalia .
- Genital trauma is much more common in males than in females,
- The risk of associated injuries to neighbouring organs (bladder, urethra, vagina, rectum and bowel),
- Genital trauma is commonly caused by blunt injuries (80%). In males, blunt genital trauma frequently occurs unilaterally with approximately 1% presenting as bilateral scrotal or testicular injuries [
- Penetrating injuries are most commonly caused by firearms (75.8%)

- Accidents during sexual intercourse can also cause genital trauma; men of younger age are the
- most affected.
- The most important presentation of blunt penile trauma is penile fracture. The most common causes are sexual intercourse, forced flexion , masturbation and rolling over
- The usual mechanism of injury is when the penis slips out of the vagina and strikes against the symphysis pubis or perineum.
- Sixty per cent of cases occur during consensual intercourse, with penile fracture more likely when the partner is on top.
- Penile fracture is caused by rupture of the cavernosal tunica albuginea, and may be associated with subcutaneous haematoma and lesions of the corpus spongiosum or urethra in 10-22%
- Although animal bites are common, bites injuring the external genitalia are rare.

- Gunshot injuries to the external genitalia are relatively uncommon
- In males, penetrating scrotal injuries affect both testes in 30% of cases compared with 1% in blunt injuries
- Genital burns are rare in isolation

- Testicular rupture is found in approximately 50% of cases of direct blunt scrotal trauma . It may occur under intense compression of the testis against the inferior pubic ramus or symphysis, resulting in a rupture of the tunica albuginea.
- Most penile avulsion injuries are selfinflicted, but some are a result of industrial accidents or assault.

- Blunt trauma to the vulva is rarely reported and usually presents as a large haematoma.
- The incidence of traumatic vulvar haematomas after vaginal deliveries has been reported as 1 in 310 deliveries
- Blunt injuries of the vulva and vagina are associated with pelvic trauma in 30%, after consensual intercourse in 25%, following sexual assault in 20%, and other blunt trauma in 15%

Diagnostic evaluation

- ***Patient history and physical examination***

- **Penile fracture** is associated with a sudden cracking or popping sound, pain and immediate detumescence. Local swelling of the penile shaft develops quickly, due to enlarging haematoma. Bleeding may spread along the fascial layers of the penile shaft and extend to the lower abdominal wall if Buck's fascia is also ruptured.
- Sometimes, the rupture of the tunica may be palpable. Less severe penile injuries can be distinguished from penile fracture, as they are not usually associated with detumescence .
- **Testicular rupture** is associated with immediate pain, nausea, vomiting, and sometimes fainting. The hemiscrotum is tender, swollen, and ecchymotic. The testis itself may be difficult to palpate.
- **Blunt vulvar** or perineal trauma in women may be associated with bleeding, pain and voiding problems, bladder catheterisation is usually required.
- In genital trauma, a urinalysis should be performed. The presence of visible haematuria requires a retrograde urethrogram in males. In females, flexible or rigid cystoscopy is recommended to exclude urethral and bladder injury.
- In women with genital injuries and blood at the vaginal introitus, further gynaecological investigation is needed .

- ***Imaging***
- In cases of suspected penile fracture cavernosography, US or MRI can identify lacerations of the tunica albuginea in unclear cases
- Magnetic resonance imaging is superior to US in diagnosing penile fracture.

- Ultrasound should be performed to determine intra- and/or extra-testicular haematoma, testicular contusion, or rupture
- Colour Doppler-duplex US may provide useful information when used to evaluate testicular perfusion.
- If scrotal US is inconclusive, testicular CT or MRI may be helpful

- ***Disease management***
- *Animal bites*
- Local wound management
- Antibiotics
- The possibility of rabies infection must be considered

- *Blunt penile trauma*
- Blunt trauma to the flaccid penis does not usually cause tearing of the tunica. Subcutaneous haematoma after sexual intercourse, without associated rupture of the cavernosal tunica albuginea, does not require surgical intervention. In these cases, non-steroidal analgesics and ice-packs are recommended

Penile fracture

- The thickness of the tunica albuginea in the flaccid state (approximately 2 mm) decreases in erection to 0.25-0.5 mm, and is therefore more vulnerable to traumatic injury
- When a penile fracture is diagnosed, surgical intervention with closure of the tunica albuginea is recommended;
- The approach is usually through a circumferential incision proximal to the coronal sulcus which enables complete degloving of the penis. Increasingly, local longitudinal incisions centred on the area of fracture or ventral longitudinal approaches are currently used .
- Further localisation may be gained with a flexible cystoscopy performed prior to incision, if urethral trauma is suspected and eventually proven.
- Surgical closure of the tunica should be carried out using absorbable sutures.

Penetrating penile trauma

- In penetrating penile trauma non-operative management is recommended for small superficial injuries with intact Buck's fascia
- In more significant penetrating penile injuries, surgical exploration and debridement of necrotic tissue is recommended.
- The principles of care are debridement of devitalised tissue, with the preservation of as much viable tissues as possible, haemostasis, diversion of urine in selected cases and the removal of foreign bodies.
- If a delayed repair is needed, depending on the type of injury and the extent of tissue damage, it usually takes place four to six weeks after the trauma has occurred.

- *Testicular dislocation*
- It can be either a subcutaneous dislocation with epifascial displacement of the testis or an internal dislocation.
- In the latter, the testis is positioned in the superficial external inguinal ring, inguinal canal or abdominal cavity.
- Traumatic dislocation of the testis is treated by manual replacement and secondary orchidopexy. If primary
- manual reposition cannot be performed, immediate orchidopexy is indicated.

Haematocoele

- Conservative management is recommended in haematocoeles smaller than three times the size of the contralateral testis
- In large haematocoeles, non-operative management can fail, and delayed surgery (more than three days) is often required.
- Patients with large haematocoeles have a higher rate of orchiectomy than patients who undergo early surgery, even in non-ruptured testes.
- Early surgical intervention results in preservation of the testis in more than 90% of cases compared to delayed surgeries which result in orchiectomy in 45-55% of patients
- At the very least, the blood clot should be evacuated from the tunica vaginalis sac to relieve disability and hasten recovery.

- *Testicular rupture*
- It is essential to surgically explore equivocal patients whenever imaging studies cannot definitively exclude
- testicular rupture. This involves exploration with evacuation of blood clots and haematoma, excision of any
- necrotic testicular tubules and closure of the tunica albuginea, usually with running 3.0-absorbable sutures.

- **Penetrating scrotal trauma**

- Penetrating injuries to the scrotum require surgical exploration with debridement of non-viable tissue.
- Depending on the extent of the injury, primary reconstruction of the testis and scrotum can usually be performed.
- In complete disruption of the spermatic cord, re-alignment without vaso-vasostomy may be considered
- Staged secondary microsurgical vaso-vasostomy can be performed after rehabilitation,
- . If there is extensive destruction of the tunica albuginea, mobilisation of a free tunica vaginalis flap can be performed for testicular closure.
- If the patient is unstable or reconstruction cannot be achieved, orchiectomy is then indicated.

Complications

- psychological effects,
- erectile dysfunction,
- urethral stricture,
- and infertility, is high. In patients with a history of penile fracture post-operative complications were reported in up to 20% of cases, development of plaques or nodules following surgery, post-operative curvature formation and erectile dysfunction occur in 13.9%, 2.8% and 1.9% of patients, respectively .
- Conservative management of penile fracture increases complications, such as penile abscess, missed urethral disruption, penile curvature, and persistent haematoma requiring delayed surgical intervention .
- Late complications after conservative management were fibrosis and angulations in 35% and impotence in up to %62

- ***Follow up***
- In patients with genital trauma follow up should focus on diagnosis of and therapy for late complications.
- Erectile dysfunction, urethral stricture and assessment of fertility are the main concerns