GUIDELINES ON UROLOGICAL TRAUMA

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Renal Trauma

Background

Renal injuries (RI) account for 1-5% of all traumas.

Table 1: Injury severity scale for the kidney*#

Grade	Description
1	Contusion or non-expanding subcapsular haematoma, no laceration
2	Non-expanding perirenal haematoma, cortical laceration <1 cm deep without extravasation
3	Cortical laceration >1 cm without urinary extravasation
4	Laceration: through corticomedullary junction into collecting system **or** vascular: segmental renal artery or vein injury with contained haematoma
5	Laceration: shattered kidney **or** vascular: renal pedicle injury or avulsion

* *Adapted from the American Association for the Surgery of Trauma (AAST).*

\# *Advance one grade for multiple injuries up to grade III.*

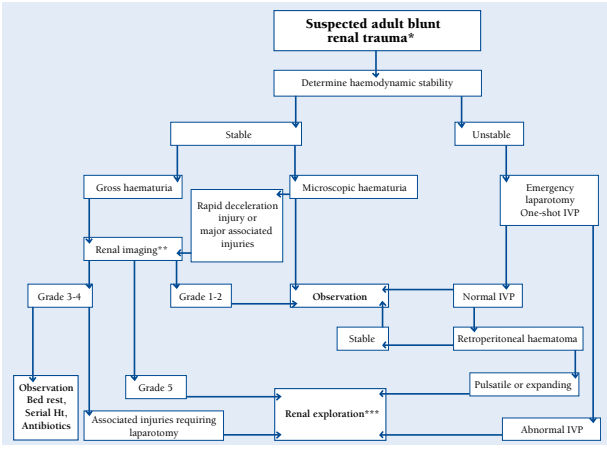
Diagnosis

- History: time and setting of incident, past renal surgery, known renal abnormalities.
- Exam: for non-genitourinary injuries:
  Lab: gross hematuria, dipstick urine analysis, serial haematocrit, baseline serum creatinine.
- Patient selection: blunt trauma with macroscopic or microscopic haematuria and hypotension, a history of rapid deceleration injury and/or significant associated injuries should undergo radiographic evaluation. Any degree of haematuria after penetrating abdominal or thoracic injury requires urgent imaging.
- Imaging: CT scan with and without intravenous contrast material in haemodynamically stable patients. Patients requiring exploration should undergo an intraoperative one-shot IVP with bolus intravenous injection of 2 mL/kg contrast. Ultrasonography may be helpful during the primary evaluation or follow-up of recuperating patients. Formal IVP, MRI and radiographic scintigraphy are second-line methods of imaging. Angiography can be used for diagnosis and simultaneous selective embolization of bleeding vessels if necessary.

Treatment

Indications for surgical management include haemodynamic instability, expanding or pulsatile perirenal haematoma, and main renal artery avulsion or thrombosis in a single kidney (figures 1 and 2).

Figure 1: Evaluation of blunt renal trauma in adults



* *Suspected renal trauma results from reported mechanism of injury and physical examination.*

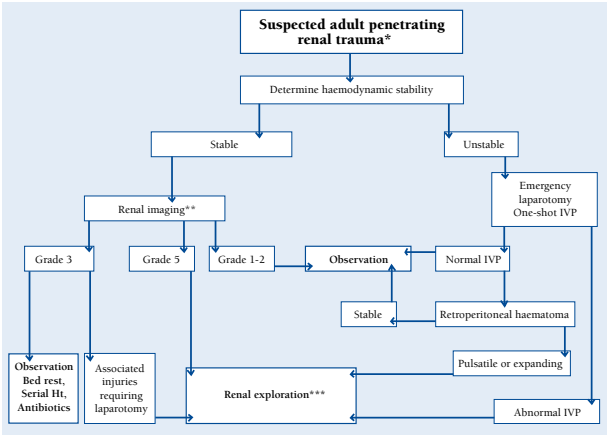
** *Renal imaging: CT scans are the gold standard for evaluating blunt and penetrating renal injuries in stable patients. In settings where the method is not available, the urologist should rely on other imaging modalities (IVP, angiography, radiographic scintigraphy, MRI).*

*** *Renal exploration: although renal salvage is a primary goal for the urologist, decisions concerning the viability of the organ and the type of reconstruction are made during the operation.*

Post-operative care, follow-up and complications

The role of repeat imaging is unknown. Some experts recommend repeat imaging within 2-4 days of injury. Nuclear scintigraphy may be useful for documenting functional recovery. Patient follow-up: physical examination, urinalysis, individualized radiological investigation, serial blood pressure measurement and serum determination of renal function. Long-term follow-up should include monitoring for renovascular hypertension.

Figure 2: Evaluation of penetrating renal trauma in adults



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Complications (bleeding, infection, perinephric abscess, sepsis, urinary fistula, hypertension, urinary extravasation, urinoma, hydronephrosis, calculus formation, chronic pyelonephritis, arteriovenous fistula and pseudoaneurysms) require a thorough radiographic evaluation. Medical management and minimally invasive techniques should be the first choice, while renal salvage should be attempted when exploration is necessary. Nephrectomy may be required.

Ureteral Trauma

Background

External trauma to the ureter is rare. Seventy-five percent of ureteral injuries are iatrogenic, 18% from blunt trauma, and 7% from penetrating trauma. The most common site of injury is the lower third (74%).

Table 2: Injury severity scale for the ureter*

Grade	Description
1	Haematoma only
2	Laceration < 50% of circumference
3	Laceration > 50% of circumference
4	Complete tear < 2 cm of devascularization
5	Complete tear > 2 cm of devascularization

** Adapted from the AAST.*

Diagnosis

The *sine qua non* is extravasation of radiological contrast material. The diagnosis is most often made with intraoperative one-shot IVP and CT. If the CT scan is non-diagnostic, then do IVP or retrograde pyelography.

Treatment

Minimal injury can be managed with ureteral stenting or by placement of a nephrostomy tube. Ureteral injury complicating vascular graft procedures are controversial: best evidence is to save the kidney by judicious ureteral repair but older citations suggest immediate nephrectomy.

In complete injuries the type of reconstructive repair procedure depends on the nature and site of the injury. The options are:

1. Upper third: uretero-ureterostomy.

2. Middle third: uretero-ureterostomy or Boari flap and reimplantation (staged, do not do acutely).
3. Lower third: direct reimplantation or psoas hitch or Blandy cystoplasty.
4. Complete ureteral loss: ileal interposition (delayed) or autotransplantation (delayed). Damage control first: tie off ureter, place percutaneous nephrostomy.

Bladder Trauma

Background

Blunt trauma accounts for 67-86% of bladder ruptures (BR), is primarily caused by motor vehicle accidents and may be classified as extraperitoneal or intraperitoneal.

Table 3: Injury severity scale for the bladder*

Grade	Description	
1	Haematoma-	Contusion, intramural haematoma
	Laceration-	Partial thickness
2	Laceration-	Extraperitoneal bladder wall laceration < 2 cm
3	Laceration-	Extraperitoneal (> 2 cm) or intraperitoneal (< 2 cm) bladder wall laceration
4	Laceration-	Intraperitoneal bladder wall laceration > 2 cm
5	Laceration-	Intraperitoneal or extraperitoneal bladder wall laceration extending into the bladder neck or ureteral orifice (trigone)

** Adapted from the AAST.*

Diagnosis

The most common signs and symptoms are:

- Gross haematuria, abdominal tenderness, inability to void, suprapubic bruising, and abdominal distension.
- Extravasation of urine may result in swelling in the perineum, scrotum and/or anterior abdominal wall.
- The combination of pelvic fracture and gross haematuria constitutes an indication for cystography. In patients with pelvic fracture and microhaematuria, imaging should be reserved for those with anterior rami fractures (straddle fracture) or Malgaigne type severe ring disruption (figure III).
- Retrograde cystography is the standard diagnostic procedure. The bladder must be distended by the instillation of 350 mL of contrast media. A post-drainage film must be obtained. CT cystography is an excellent alternative.
- Routine cystoscopy is recommended after major gynecological operations and/or incontinence surgery.

Treatment

- Extraperitoneal ruptures can be managed by catheter drainage only.
- Bladder neck involvement, the presence of bone fragments in the bladder wall, or entrapment of the bladder wall necessitates open repair.
- Intraperitoneal ruptures are managed by surgical repair.

Urethral Trauma

Background

Injuries to the posterior urethra (PU) occur with pelvic fractures, mostly as a result of motor vehicle accidents. The male PU is injured in 4-19% of pelvic fractures, and the female urethra in 0-6% of all pelvic fractures. The combination of straddle fractures with diastasis of the sacroiliac joint has the

highest risk of urethral injury. Injuries can vary from simple stretching to partial rupture to complete disruptions. Urethral injuries in women are rare. For children, urethral injuries tend to follow the same mechanism of injury as in adults, although injuries to the prostate and bladder neck may be more common.

Injuries to the anterior urethra (AU) are caused by intercourse (penile fracture), penetrating trauma and placement of penile constriction bands.

Table 4: Injury severity scale for the urethra*

Group	Description	
1	Contusion	- Blood at the urethral meatus; normal urethrogram
2	Stretch injury	- Elongation of the urethra without extravasation on urethrography
3	Partial disruption	- Extravasation of contrast at injury site with contrast visualized in the bladder
4	Complete disruption	- Extravasation of contrast at injury site without visualization in the bladder; < 2 cm of urethral separation
5	Complete disruption	- Complete transection with > 2 cm urethral separation, or extension into the prostate or vagina

* *Adapted from the AAST.*

Diagnosis

- In the absence of blood at the meatus or penile haematoma, urethral injury is less common. Exclude by catheterization.

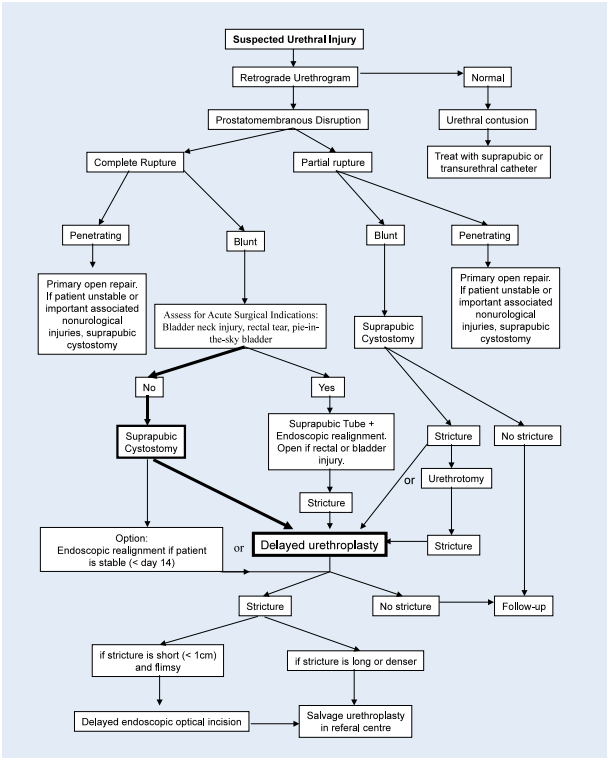
Blood at the meatus is present in 37-93% of patients with PU injury, and in at least 75% of patients with AU injury. A high-riding prostate is an unreliable finding. Avoid urethral instrumentation until the urethra is imaged. In an unstable patient, alternatively, an attempt can be made to pass a urethral catheter, but if there is any difficulty a suprapubic catheter is inserted and a retrograde urethrogram performed later.

- Blood at the vaginal introitus is present in more than 80% of female patients with pelvic fractures and co-existing urethral injuries.
- Although non-specific, haematuria on a first voided specimen may indicate urethral injury. The amount of urethral bleeding correlates poorly with the severity of injury. Pain on urination or inability to void suggests urethral disruption.
- Retrograde urethrography is the gold standard for evaluating urethral injury.
- If delayed primary repair is contemplated, and when the proximal urethra in a simultaneous cystogram and urethrogram is not visualized, either magnetic resonance imaging (MRI) of the posterior urethra or endoscopy through the suprapubic tract can be used to define the anatomy of the posterior urethra. In females, urethroscopy may be an important adjunct for the identification and staging of urethral injuries.

Treatment

While intervention should be guided by the clinical circumstances, the following algorithms are suggested for the treatment of urethral injuries in males and females (figures 3-5).

Figure 3: Management of posterior urethral injuries in men



Iatrogenic urethral trauma

The most common form of iatrogenic urethral trauma is that caused by instruments. Most of the relevant urethral lesions caused by iatrogenic trauma are strictures. These strictures are of variable location and severity. They often require different management strategies.

Symptoms of iatrogenic urethral injury

The symptoms of urethral injury caused by improper catheterisation or use of instruments are:

- penile and/or perineal pain (100%)
- urethral bleeding (86%)

Recommendations for treatment: algorithms (figures 4-6).

Figure 4: Flow diagram of treatment for iatrogenic urethral injury caused by improper insertion of a catheter.

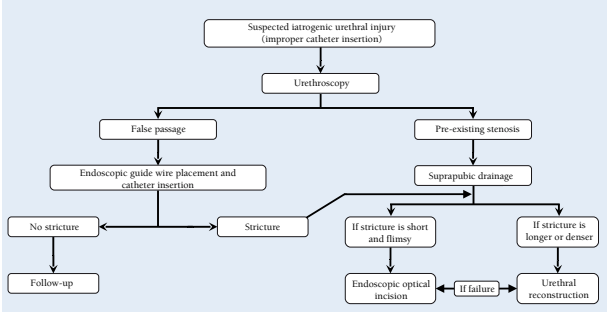


Figure 5 Flow diagram of treatment for stricture after radical prostatectomy.

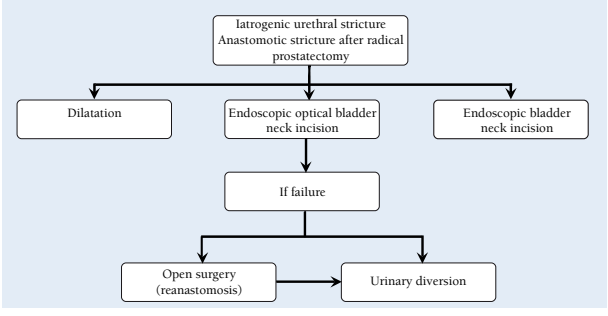


Figure 6: Flow diagram for treatment for stricture after major abdominal surgery or radiotherapy.

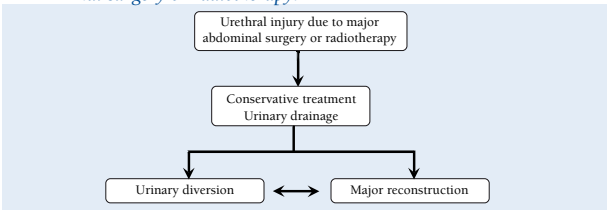


Figure 7: Management of anterior urethral injuries in men

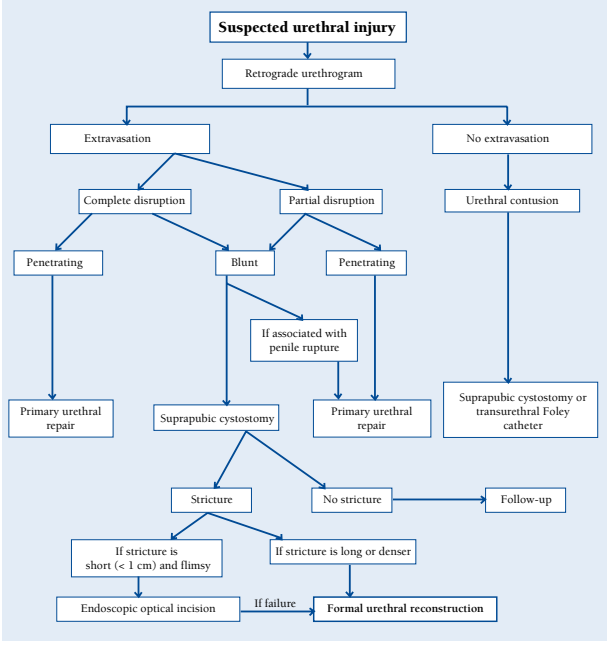
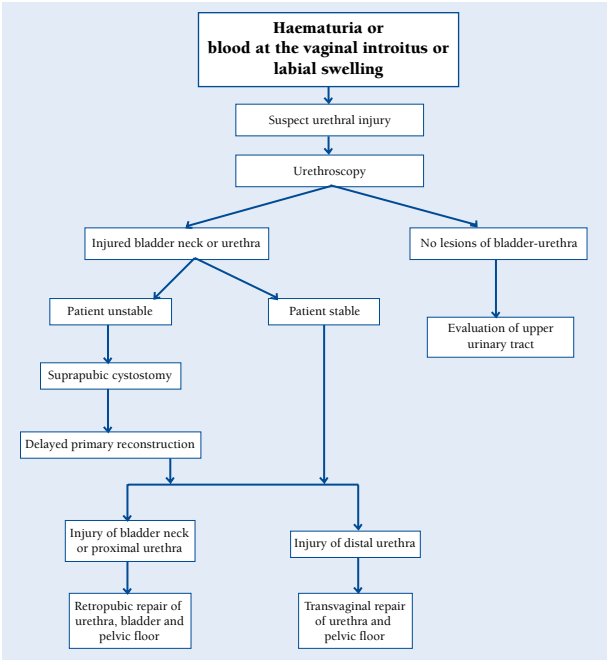


Figure 8: Management of urethral injuries in women



Complications

The risk of impotence caused by delayed urethroplasty is about 5% and the rate of incontinence is about 4%.

Genital Trauma

Background

A direct blow to the erect penis may cause penile fracture. Blunt trauma to the scrotum can cause testicular dislocation, testicular rupture and/or subcutaneous scrotal haematoma.

Traumatic dislocation of the testicle occurs mostly in victims of car or motorcycle accidents, or in pedestrians run over by a vehicle. Testicular rupture is found in approximately 50% of direct blunt traumas to the scrotum.

In females, blunt trauma to the vulva is rare. Penetrating trauma to the external genitalia is frequently associated with injuries to other organs.

Diagnosis

- Information about the accident should include: involved persons, animals, vehicles and weapons. Trauma to external genitalia may be due to abusive assault. In suspicious cases, a sexual assault forensic exam is necessary (photo-documentation).
- Presence or macro- and or microhaematuria requires a retrograde urethrogram; in females cystoscopy is recommended
- In women with genital injuries and blood at the vaginal introitus, gynaecologic investigation is indicated
- Patients with penile fracture report a sudden cracking or popping sound associated with local pain and immediate detumescence.

Table 5: Injury severity scale for the penis*

Group	Description
1	Cutaneous laceration/contusion
2	Buck's fascia (cavernosum) laceration without tissue loss
3	Cutaneous avulsion/laceration through glans/meatus/cavernosal or urethral defect < 2 cm

4	Cavernosal or urethral defect > 2 cm/partial penectomy
5	Total penectomy

** Adapted from the AAST.*

Table 6: Injury severity scale for the scrotum*

Group	Description
1	Contusion
2	Laceration < 25% of scrotal diameter
3	Laceration ≥ 25% of scrotal diameter
4	Avulsion < 50%
5	Avulsion ≥ 50%

** Adapted from the AAST.*

Table 7: Injury severity scale for the testis*+

Group	Description
1	Contusion or haematoma
2	Subclinical laceration of tunica albuginea
3	Laceration of tunica albuginea with < 50% parenchymal loss
4	Major laceration of tunica albuginea with ≥ 50% parenchymal loss
5	Total testicular destruction or avulsion

** Adapted from the AAST.*

+ Advance one grade for bilateral lesions up to grade 5

Table 8: Injury severity scale for the vulva*#

Group	Description
1	Contusion or haematoma
2	Laceration, superficial (skin only)

3	Laceration, deep into fat or muscle
4	Avulsion; skin, fat or muscle
5	Injury into adjacent organs (anus, rectum, urethra, bladder)

** Adapted from the AAST.*

 # Advance one grade for bilateral lesions up to grade 5

Table 9: Injury severity scale for the vagina*#

Group	Description
1	Contusion or haematoma
2	Laceration, superficial (mucosa only)
3	Laceration, deep into fat or muscle
4	Laceration, complex, into cervix or peritoneum
5	Injury into adjacent organs (anus, rectum, urethra, bladder)

** Adapted from the AAST.*

+ Advance one grade for bilateral lesions up to grade 5

Treatment

Penile trauma

- Subcutaneous haematoma, without rupture of the cavernosal tunica albuginea and no immediate detumescence of the erect penis can be managed with non-steroidal analgesics and ice-packs.
- Penile fracture: immediate surgical intervention with closure of the tunica albuginea.
- Penetrating penile trauma: surgical exploration and conservative debridement of necrotic tissue is recommended with primary closure in most cases.

Scrotal trauma

- Blunt trauma with subcutaneous haematoma: conservative management.
- Large haematocele or testicular rupture: surgical exploration with excision of necrotic tubules and closure of the tunica albuginea.
- Traumatic dislocation of the testis: can be manually replaced but secondary orchidopexy is recommended. (If manual reposition cannot be performed, *in situ* orchidopexy is indicated).
- Extended laceration of scrotal skin: surgical closure.
- Penetrating injuries to the scrotum: surgical exploration with conservative debridement of non-viable tissue.
- Extensive destruction of the tunica albuginea: tunica vaginalis flap can be mobilised for testicular closure.
- Complete disruption of the spermatic cord: realignment without vaso-vasostomy.

Female genital trauma

- Blunt trauma to the vulva commonly presents as haematomas: non-steroidal antirheumatics and cold packs relieve pain.
- Extended vulvar haematoma or haemodynamically unstable patients: surgical intervention may be indicated.
- Vulvar laceration: repair after conservative debridement.
- Vaginal lesion: abdominal CT scan for exclusion of additional injuries.

Mass casualty events, triage and damage control

Definition

A mass casualty event is one in which the number of injured

people is significantly higher than the number of healthcare providers available.

Causes of mass casualty events

Potential mass casualty events include:

- The collapse of buildings or bridges
- earthquakes
- floods
- tsunamis
- train collisions
- aircraft catastrophes
- civilian terrorism.

Triage divides patients into four groups:

1. Patients with life-threatening injuries that require immediate intervention, presenting with Airway compromise, Breathing failure and/or Circulatory compromise from ongoing external haemorrhage.
2. Patients with severe but non-life-threatening injuries, in whom treatment can be acceptably delayed: major fractures, vascular injuries of the limbs and large soft tissue wounds.
3. 'Walking wounded' with minimal injuries.
4. Patients who are so severely injured that treatment would require allocation of resources and time that would deny other, more salvageable patients, timely care. These patients are given minimal or no treatment, and re-evaluated when resources become available. There is no absolute definition for this group because triage is individualised according to the number and severity of casualties related to the available resources.

Principles urological consultations during a mass casualty scenario:

- Rule out under-triage by the surgeon in charge, and perform a rapid primary survey of every patient.
- Avoid unnecessary imaging procedures such as CT scans and retrograde urethrography. These procedures are performed later, after mass casualty protocols have been suspended.
- Treat unstable patients who are to have surgery using damage control principles.
- Stable patients with suspected renal injuries should be transferred to the surgical ward without imaging procedures. Re-evaluate if there is any change in their haemodynamic status, or when possible as dictated by the constraints of the mass casualty event. Patients managed in this delayed fashion should be treated according to traditional trauma management protocols.
- 'Minimal acceptable' procedures should be performed in order to transfer patients to the surgical wards, e.g. suprapubic drainage of the bladder when bladder or urethral injuries are suspected, clamping and ligation of bleeding vessels from wounds to the external genitalia, etc.

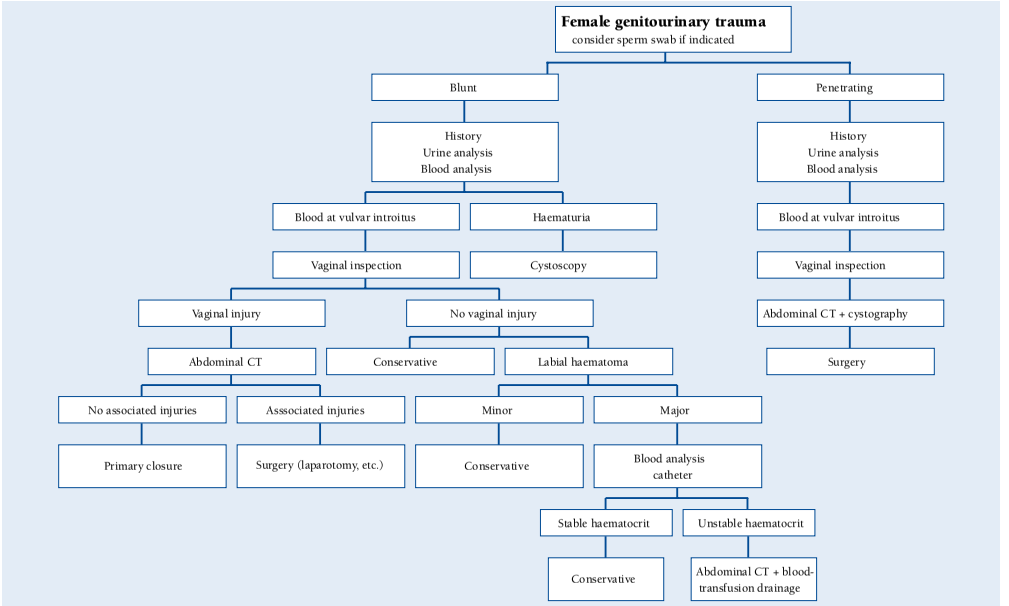


Figure 9: Female genitourinary trauma

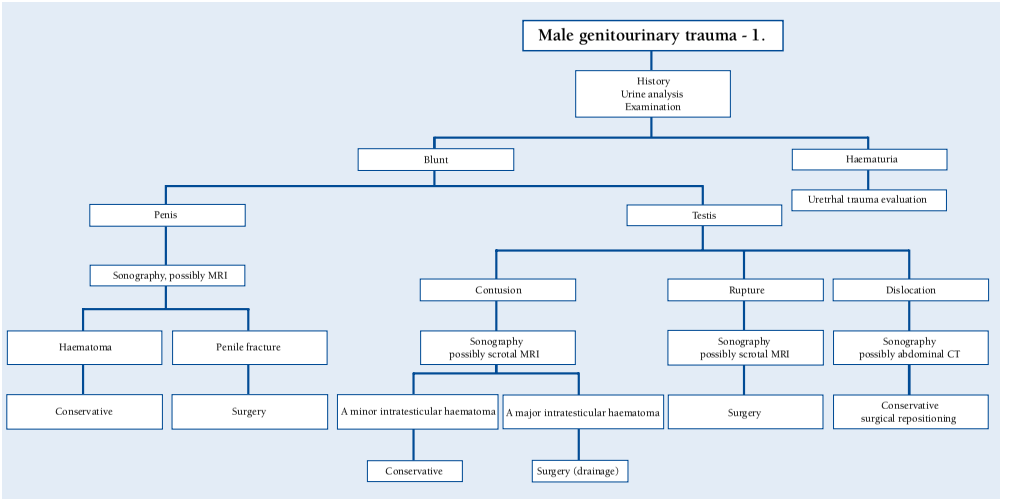


Figure 10: Male genitourinary trama 1

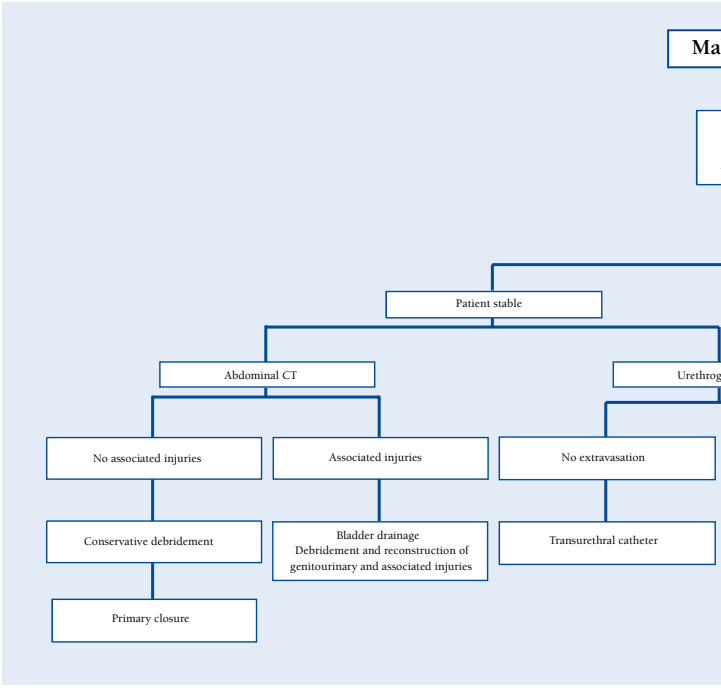
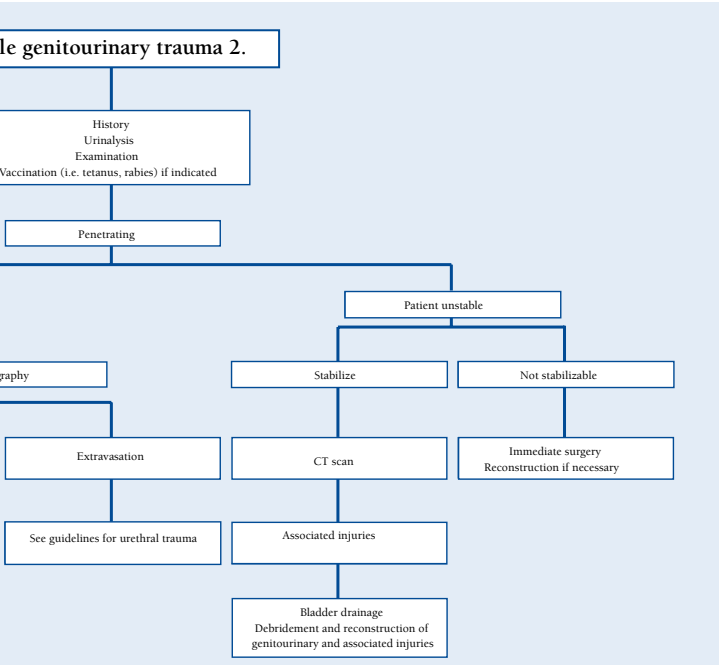


Figure 11: Male genitourinary trauma 2



This short booklet is based on the more comprehensive EAU guidelines (ISBN 978-90-79754-09-0), available to all members of the European Association of Urology at their website - http://www.uroweb.org.