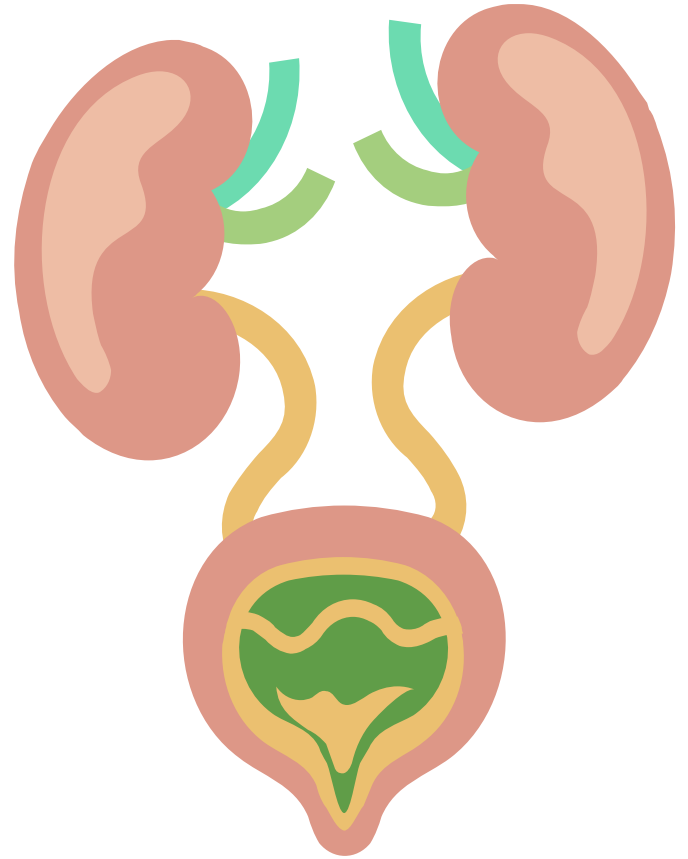
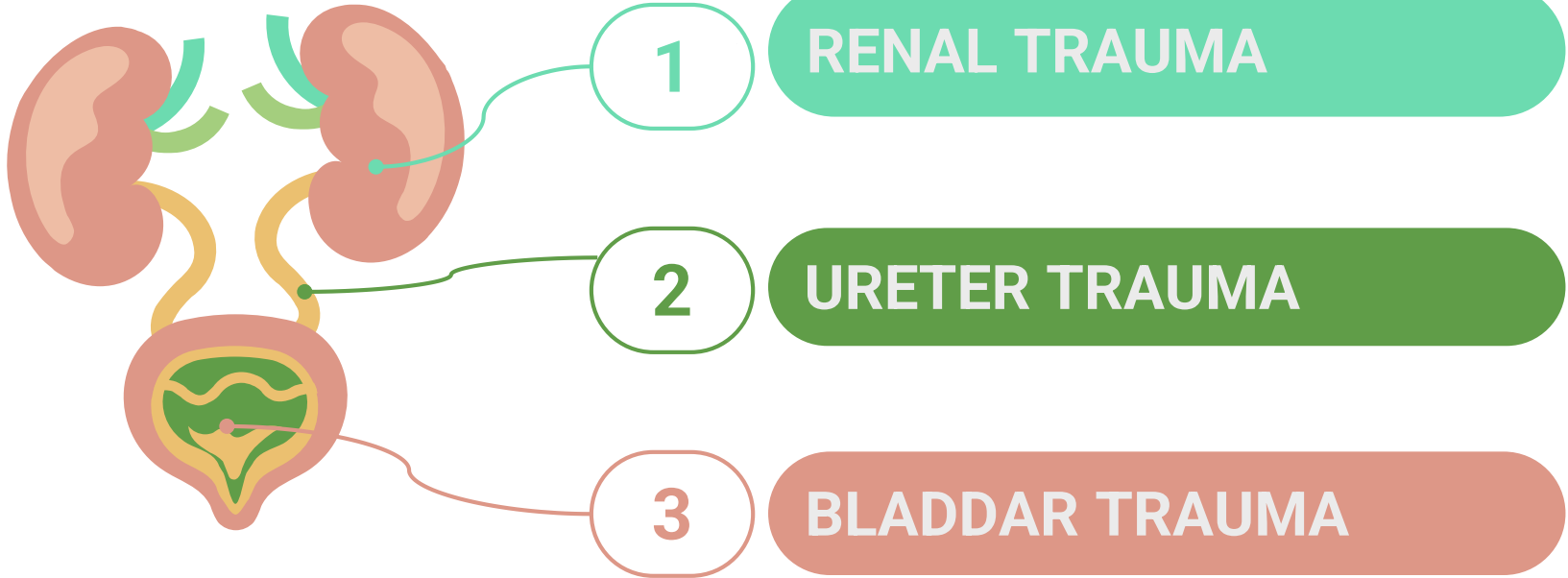


UROLOGICAL TRAUMA

**LANA M FRAIJAT
TALA ALSHAHATEET
WAQAR MAHAMEED**



UROLOGICAL TRAUMATIC ORGANS



Based on what ?!!!!

Urological Trauma Classification

Urologic trauma is classified according to the **location of injury**:

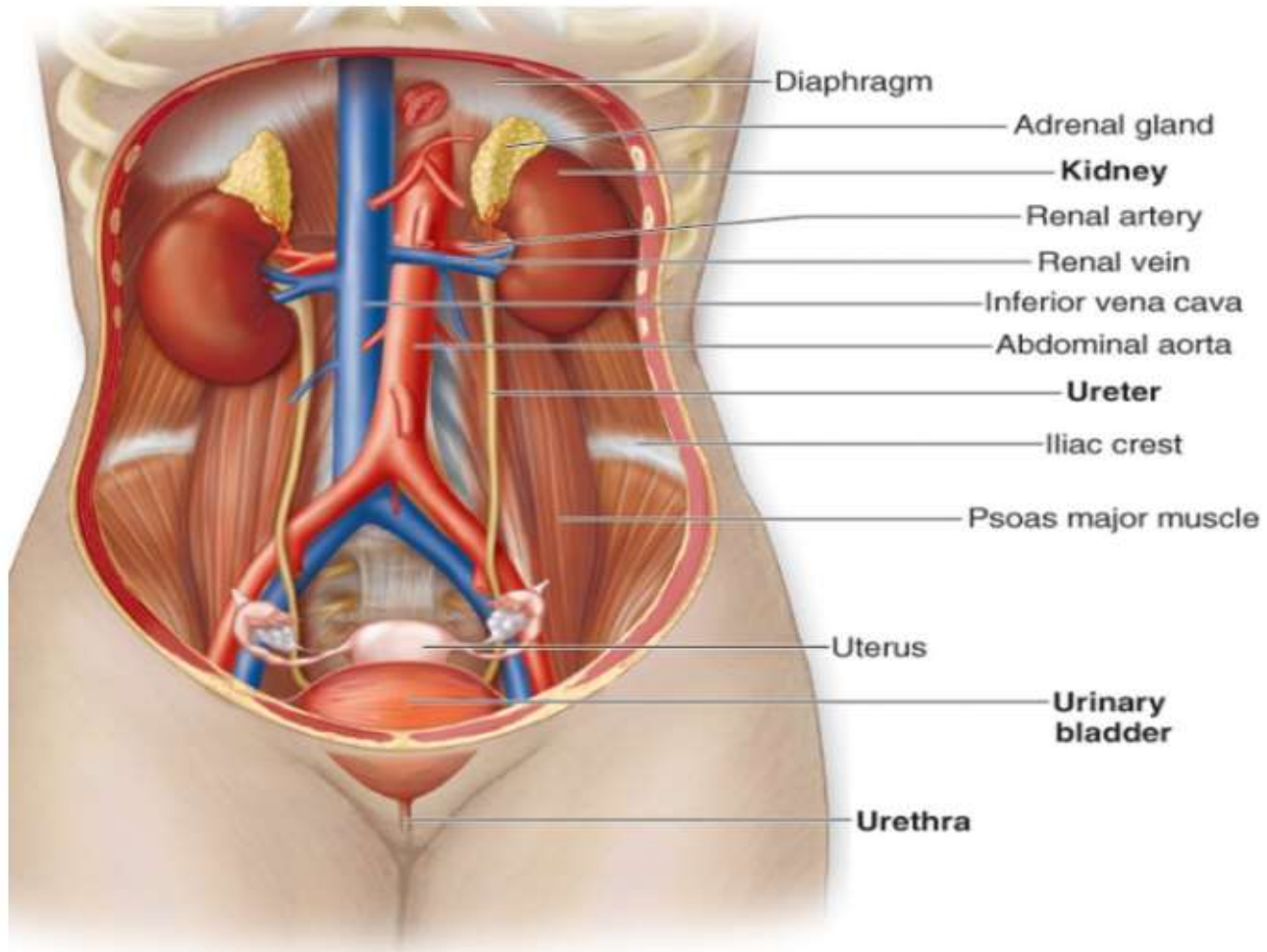
1- **Upper Urinary Tract** (kidneys and ureters).

2- **Lower Urinary Tract** (bladder and urethra) and external genitalia (penis, scrotum, and testes).

RENAL SYSTEM ANATOMY – KIDNEY

The kidneys are **retroperitoneal** organs on each side of the vertebral column (**T12-L3**), at about the level of the twelfth rib.

- The left kidney is slightly higher in the abdomen than the right.
- On an average, each kidney weighs **150 g**.
- The superior aspect of the kidneys is somewhat protected by the lower ribs.
- The lower poles are inferior to the 12th ribs.
- The parenchyma of the kidney has a **segmental arterial supply**.
- The kidneys have the following coverings:
 1. Fibrous capsule
 2. Perirenal fat
 3. Renal fascia (GEROTA'S)
 4. Pararenal fat
- There is numerous **anatomical variations**, including pelvic kidneys; horseshoe kidneys; and multiple renal arterial, venous, and ureteral duplications

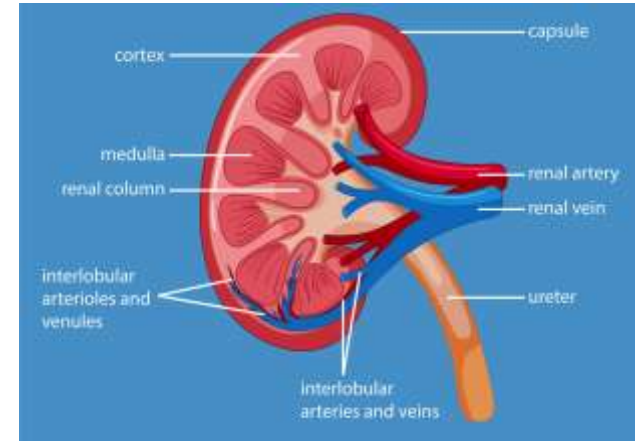


RENAL TRAUMA FACTS

The kidney is the **most commonly injured structure** in the urinary tract, accounting for **1%** of all traumatic injuries.

Nevertheless, operative intervention is pursued in only approximately **10%** of renal injuries.

SO,,,,, The majority of renal injuries are mild and can be **managed conservatively**



Mode of injury :

The mechanisms of renal injuries are classified as **blunt (closed)** or **penetrating (open)**.

BLUNT TRAUMA

Blunt injuries are **less severe** and **more predictable**, tend to fracture along the planes between the segmental vessels

Blunt trauma (**90%**) can be the result of direct compression or deceleration.

Caused by :

- Motor vehicle accidents
- falls
- direct blows to the flank
- Deceleration injuries are particularly dangerous because they may lead to renal vascular injuries. (**deceleration** : the body is forcibly stopped but the content of cavities remain in motion .)

PENETRATING TRAUMA

Penetrating trauma are **more severe** and **less predictable** , tend to cross the segmental vessels.

Penetrating wounds(**10%**) are ones open to the external environment.

Caused by :

Gunshots
Stab wounds

Initial Emergency Assessment :

1. ABC

Controlling any external bleeding and resuscitation of shock as required, and securing of the airway , Hemodynamic stability should be decided upon admission

2. History

History should be taken carefully from conscious patients, witnesses, and rescue team personnel regarding the time and setting of the incident. , a history of past renal surgery, and known pre-existing renal abnormalities (large cysts, stones) should be recorded.

3. Physical exam

Is usually carried out during stabilization of the patient, **FINDINGS** : Abnormal kidneys are more liable to injury thus ::: In penetrating wounds Do examination of thorax, abdomen, flanks and back for should be obtained (e.g. Bruises, rib fractures...etc)

4. Further evaluation

When is suspected, further evaluation is required for a prompt diagnosis. There indications :

- | | | | | |
|-------------------------|-------------------|-------------------------|-------------------|------------------|
| 1- Hematuria | 2- flank pain | 3- flank ecchymosis | 4- flank abrasion | 5- fractured rib |
| 6- abdominal distention | 7- abdominal mass | 8- abdominal tenderness | | |

FURTHER EVALUATION :

1- Laboratory study :

Urinalysis:

- It is the single most important laboratory test in the evaluation of renal injuries.
- **Hematuria** is an important indicator of injury to the kidney ,yet the presence or absence of hematuria should be viewed in the clinical context and not used as the sole decision point in the assessment of a patient with a possible renal laceration.
- The degree of hematuria, does not precisely correlate with the severity of injury.

2- Imaging study :

- The goal of radiographic assessment is to provide complete and accurate **staging** of renal injuries in order to determine the need for and to plan operative management.
- **Indications:**
 1. Gross hematuria
 2. Microscopic (>5 RBCs per high-powered field [hpf]) or dipstick hematuria in a hypotensive patient (systolic blood pressure of <90 mmHg recorded at any time since the injury)
 3. History of rapid deceleration with evidence of multisystem trauma (e..g., fall from a height, high-speed MVA).
 4. Penetrating chest and abdominal wounds (knives, bullets) with any degree of hematuria or suspicion of renal injury based on wound location

NOTE : These criteria do not apply to pediatric trauma patients; in this population, significant renal injury can occur even in the setting of microscopic hematuria without hypotension.

	Advantages	Disadvantages
Ultrasonography	<ol style="list-style-type: none"> 1. It is noninvasive 2. It may be performed in real time in concert with resuscitation 3. It may help define the anatomy of the injury. 	<ol style="list-style-type: none"> 1. Optimal study results related to anatomy require an experienced sonographer 2. Bladder injuries may be missed.
Computed tomography <u>(GOLD STANDARD)</u>	<ol style="list-style-type: none"> 1. It allows unsurpassed functional and anatomic assessment of the kidneys and urinary tract 2. It allows for the diagnosis of concurrent injuries. 	<ol style="list-style-type: none"> 1. It requires intravenous contrast in order to maximize information about functionality, hematoma, and, possibly, bleeding. 2. The patient must be stable enough to go to the scanner 3. Full urinary assessment is dependent on the timing of contrast and scanning in order to view the bladder and ureters.
Intravenous pyelogram	<ol style="list-style-type: none"> 1. It allows functional and anatomic assessment of both kidneys and ureters, 2. It may be performed in the emergency department or operating room. 	<ol style="list-style-type: none"> 1. It requires multiple images for maximal information. 2. The radiation dose is relatively high. 3. Findings do not reveal the full extent of injury.
Angiography	<ol style="list-style-type: none"> 1. It has the capacity to aid in both the diagnosis and treatment of renal injuries 2. It may further define injury in patients with moderate IVP abnormalities or with vascular injuries. 	<ol style="list-style-type: none"> 1. It is invasive 2. It requires contrast 3. It requires mobilization of resources to perform the study, which may be time-consuming 4. The patient must travel to the radiology

Box 10.1 Staging of the renal injury

Using CT, renal injuries are staged according to the American Association for the Surgery of Trauma (AAST) Organ Injury Severity Scale. Higher injury severity scales are associated with poorer outcomes.

- | | |
|------------------|--|
| Grade I | Contusion or subcapsular hematoma with no parenchymal laceration |
| Grade II | Parenchymal laceration of cortex <1 cm deep, no extravasation of urine (i.e., collecting system intact) (Fig. 10.1) |
| Grade III | Parenchymal laceration of cortex >1 cm deep, no extravasation of urine (i.e., collecting system intact) |
| Grade IV | Parenchymal laceration involving cortex, medulla, and collecting system OR segmental renal artery or renal vein injury with contained hemorrhage |
| Grade V | Completely shattered kidney OR avulsion of renal hilum |

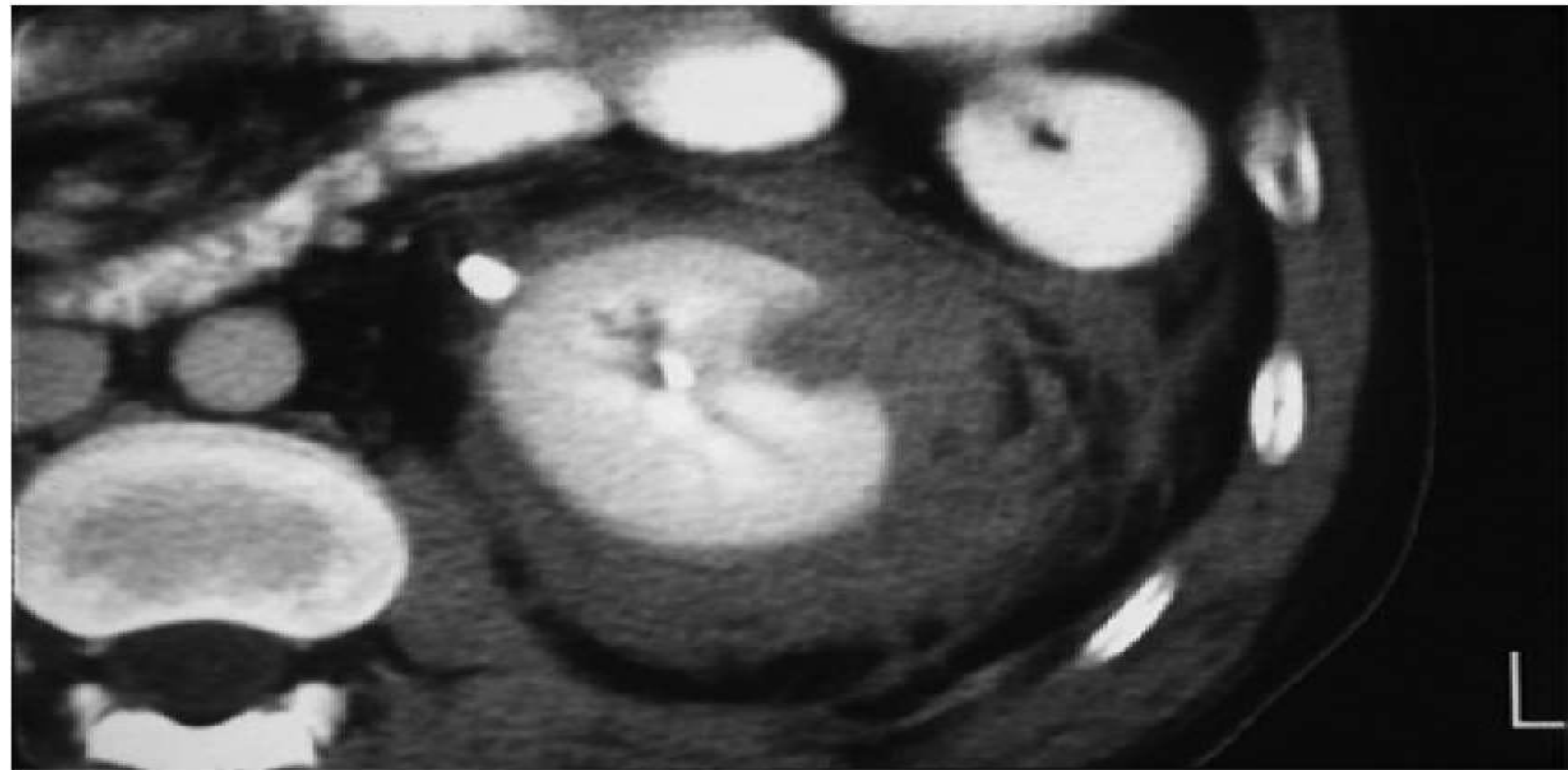


Figure 10.1 Renal CT with IV contrast in blunt trauma patient shows a superficial (grade 2) laceration amenable to nonoperative management.



Abdominal CT scan demonstrating **multiple kidney lesions** of varying radiographic densities



On the left a typical **subcapsular hematoma**, which is also a **grade I renal injury**.

Management And Treatment :

CONSERVATIVE

Stable patients, following grade 1-4 blunt renal trauma, should be managed conservatively with bed-rest, prophylactic antibiotics, and continuous monitoring of vital signs until hematuria resolves.

SURGERY

Indications for surgical management include:

1. Haemodynamic instability
2. Exploration for associated injuries
3. Expanding pulsatile retroperitoneal haematoma during laparotomy
4. grade IV (in haemodynamically unstable patient) and, especially, grade V injuries often require nephrectomy to control bleeding (grade V injuries function poorly if repaired).

Patients with **penetrating trauma** to the kidney require **renal exploration** unless radiographic imaging clearly delineates injury that can be managed safely nonoperatively in a hemodynamically stable patient.

FOLLOW UP

*** **Repeated imaging** is recommended for all hospitalized patients within **2 to 4 days** following renal trauma

- Within **3 months** of major renal injury, patients' follow-up should involve:

1. Physical examination
2. Urinalysis
3. Individualized radiological investigation
4. Serial blood pressure measurement
5. Serum determination of renal function

- Long-term follow-up should be decided on a **case-by-case basis**

COMPLICATIONS :

EARLY

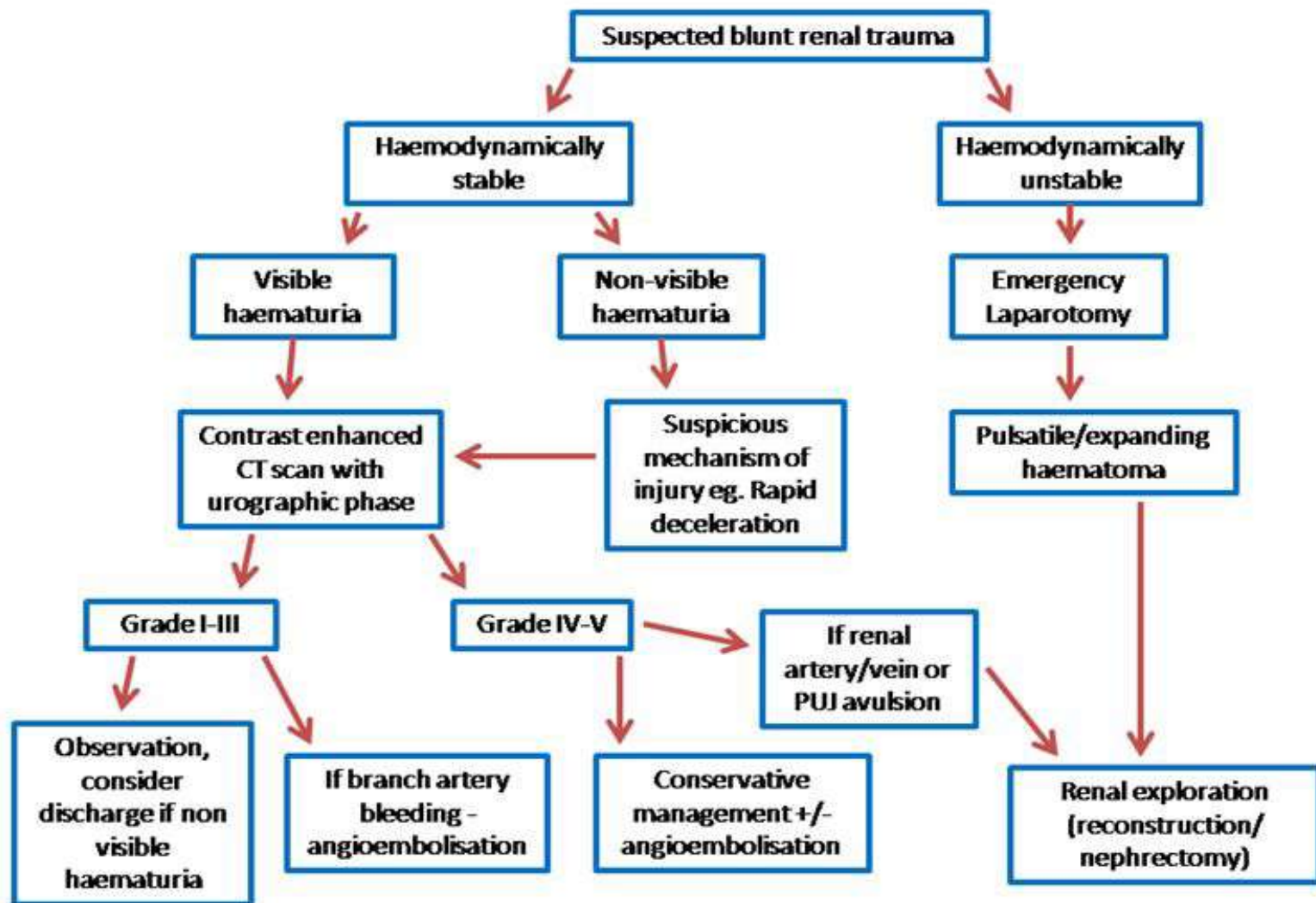
+ occur within the first month after injury , include:

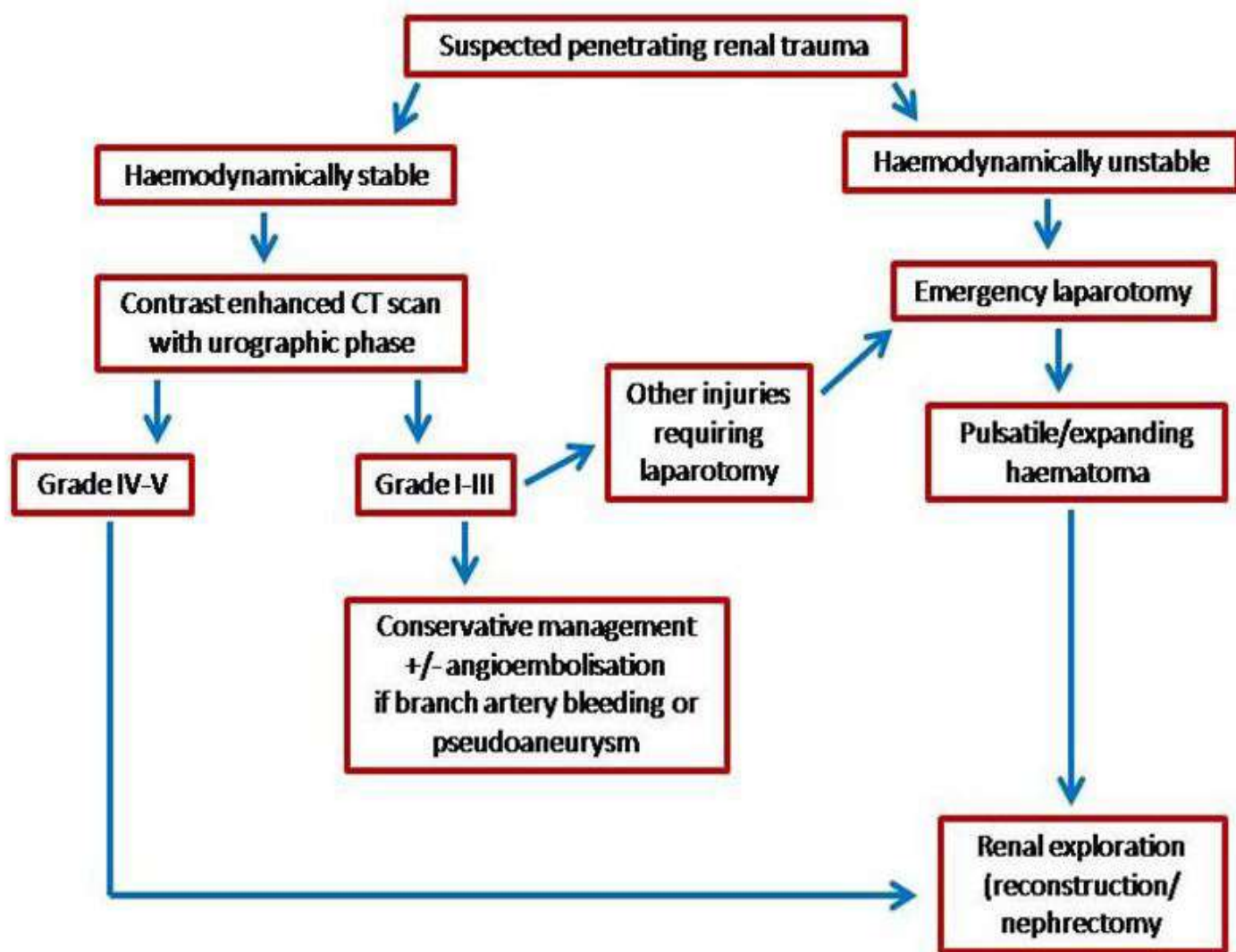
- 1-bleeding
- 2- infection
- 3-perinephric abscess
- 4-sepsis
- 5-urinary fistula
- 6-hypertension
- 7-urinary extravasation
- 8-urinoma.

LATE

+occur after 1 month , include :

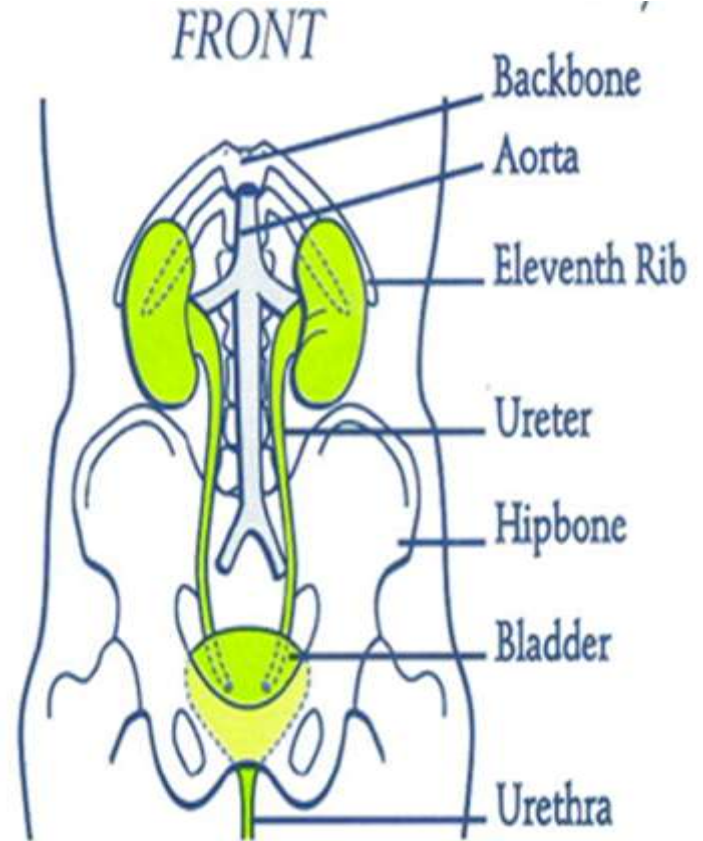
- 1- bleeding
- 2- hydronephrosis
- 3-calculus formation
- 4-chronic pyelonephritis
- 5-hypertension
- 6-arteriovenous fistula
- 7- pseudoaneurysms





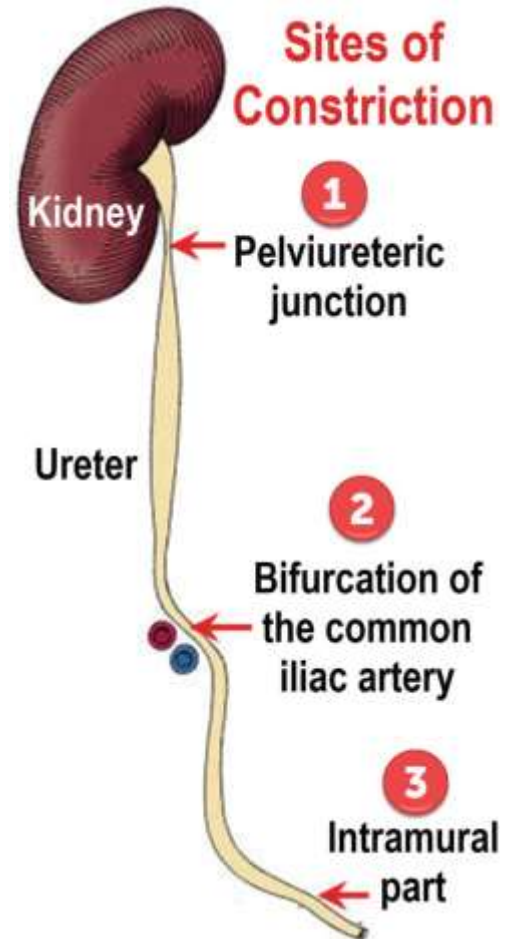
Ureteral Anatomy

- The ureters are **retroperitoneal** tubes measuring each about 25 cm long and about 3 mm in diameter.
- They descend with an inclination medially on the posterior abdominal wall opposite the tips of the lumbar transverse processes. They continue following the contour of the pelvis.
- They pass **obliquely** in the wall of the bladder of 1 inch before they open at the sides of the trigone.



Narrowest parts of ureter :

- i. uretero-pelvic junction.
- ii. near the brim of pelvis where the iliac vessels cross over the ureter.
- iii. uretero-vesical junction.



Ureteral Trauma

- Trauma to the ureter is relatively **rare** and accounts for only 1% of all urinary tract trauma.
- The ureters may be injured as a result of external violence (penetrating or blunt trauma) or by iatrogenic injury (**most common**) during an operation.

Mode of Injury:

- **Simple:** Perforation (iatrogenic)
- **Complex:** Transection (extensive surgeries, RTA)

Diagnosis

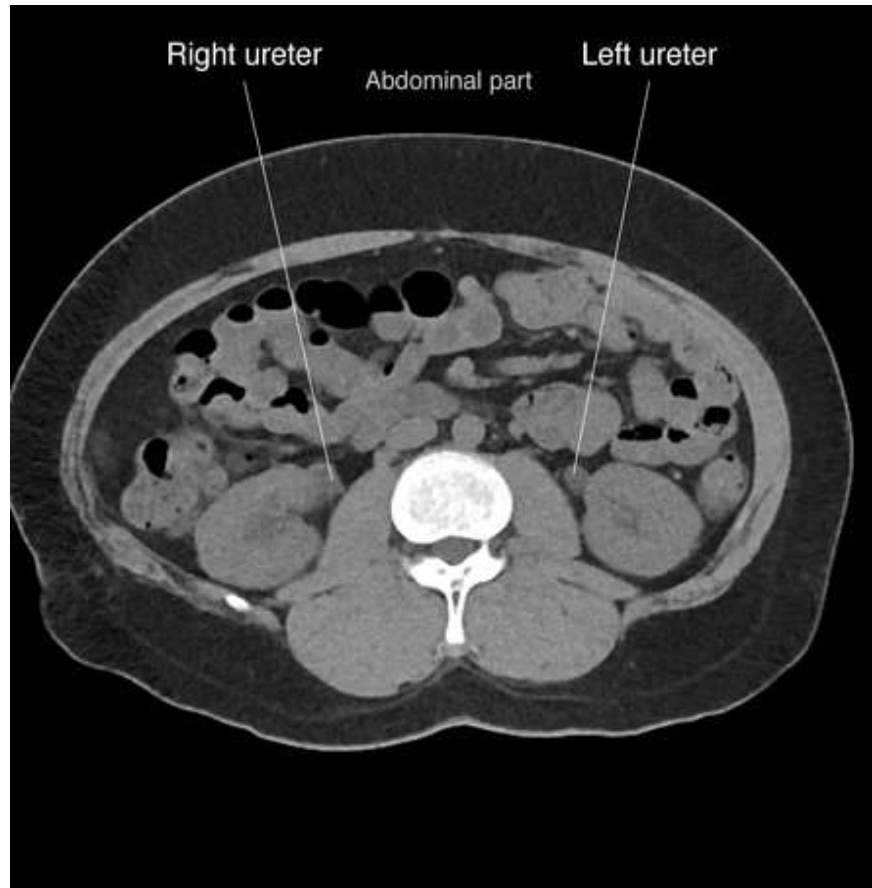
- No classic clinical symptoms and signs associated with acute ureteral trauma caused by external injury. (**EASY TO MISS**)
- Ureteral trauma should be **suspected in:**
 1. Penetrating abdominal injury and blunt deceleration trauma, in which the kidney and renal pelvis can be torn away from the ureter.
 2. Isolated ureteral injuries if missed: subsequent evidence of upper tract obstruction, urinary fistula formation and sepsis.
 3. Gynecological pelvic surgery: complaints of flank pain, vaginal leakage of urine or become septic.

Laboratory Studies

- Laboratory evaluation should include **urinalysis, urine culture, complete blood count, and creatinine determination from the serum and drainage.**
- Interestingly, hematuria is not a reliable finding in ureteral injuries, as only 74% of cases involve gross or microscopic hematuria.
- A failure to observe hematuria may be seen with a completely transected ureter or partial transection of an adynamic segment.

Imaging Studies

- **CT:** It is the **critierion standard** for evaluating abdominal injuries due to blunt trauma in stable patients. **Contrast-enhanced CT scanning** is highly sensitive in detecting urine extravasation and thus can be considered the primary imaging modality to evaluate for ureteral integrity in the stable patient.
- **IVP:** used in patients who must undergo **immediate** exploratory laparotomy for a **penetrating injury to the abdomen.**



- **Retrograde pyelography:** it is the **most sensitive radiographic study** for the diagnosis of ureteral injury. It may be used in the stable patient as an adjunct to other imaging modalities when other clinical information is needed. It also has the added advantage of facilitating the placement of a ureteral stent in the same session, if indicated.
- **Antegrade ureterography:** it is **not** routinely used in diagnosing ureteral injuries. It is **useful** in conjunction with percutaneous nephrostomy tube placement or placement of an antegrade ureteral stent.

A**B**

Classification of ureteral lesions

Grade	Description of Injury
I	Hematoma only
II	Laceration < 50% of circumference
III	Laceration > 50% of circumference
IV	Complete tear < 2 cm of devascularization
V	Complete tear > 2 cm of devascularization

Management

- **Contusion**

Although a contusion may be considered a minor injury, it can result in a stricture if left untreated. Extensive areas of contusion may even result in ureteral necrosis secondary to microvascular damage. **Minor injuries can be treated with internal ureteral stenting**, while severe or large areas of contusion should be excised and **ureteroureterostomy performed**.

- **Partial transection**

Partial ureteral transections can be repaired with **primary closure**. Instead, the injured segment should be resected, with 2-cm margins, and the edges reapproximated. For non-ballistic injuries, the defect may be closed primarily by closing the longitudinal laceration transversely in order to avoid narrowing of the lumen).

- Complete transections**

upper, middle and distal ureteral injuries

Ureteroureterostomy

Ureteropyelostomy

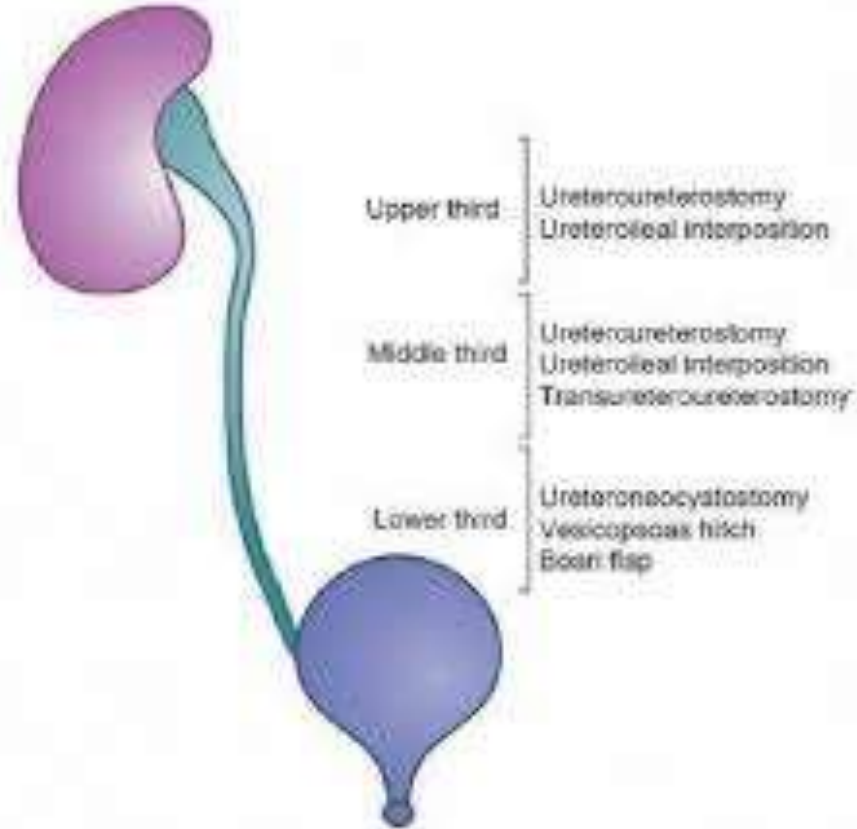
Ureterocalicostomy

Transureteroureterostomy

Ureteroneocystostomy

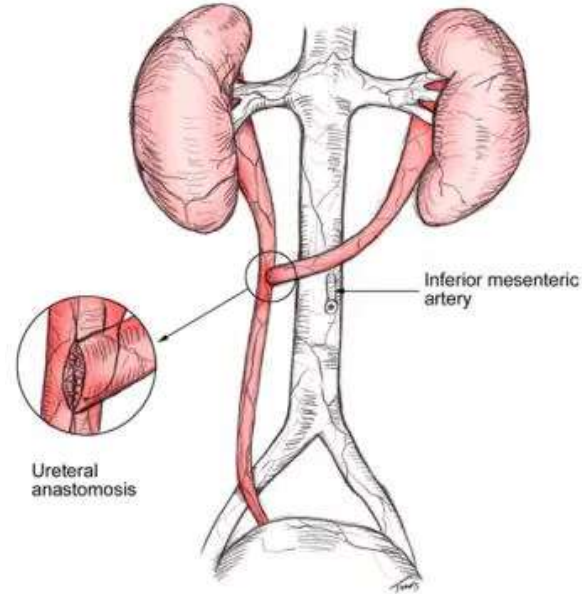
Vesicopsoas hitch

Boari bladder flap



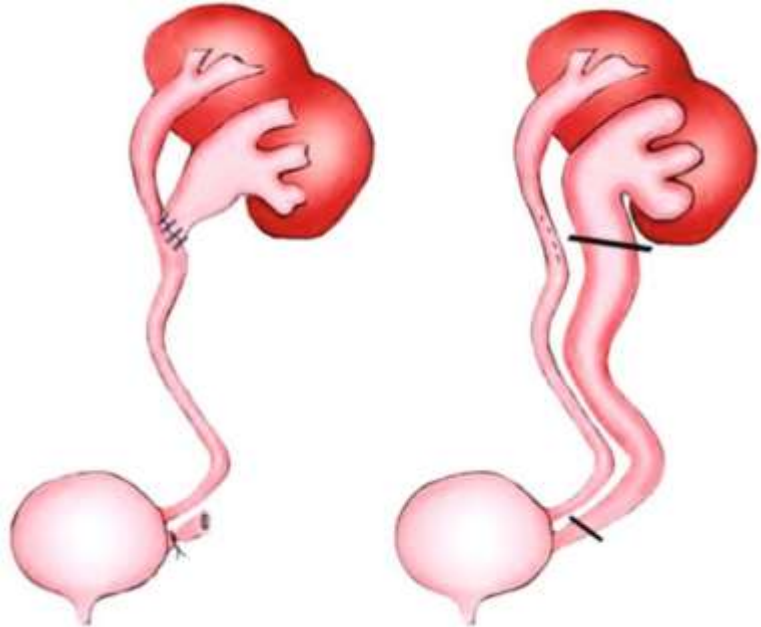
Ureteroureterostomy

involves an end-to-end repair of ureteral defects **smaller than 3 cm** .This is mostly performed in the **upper and mid** ureter.



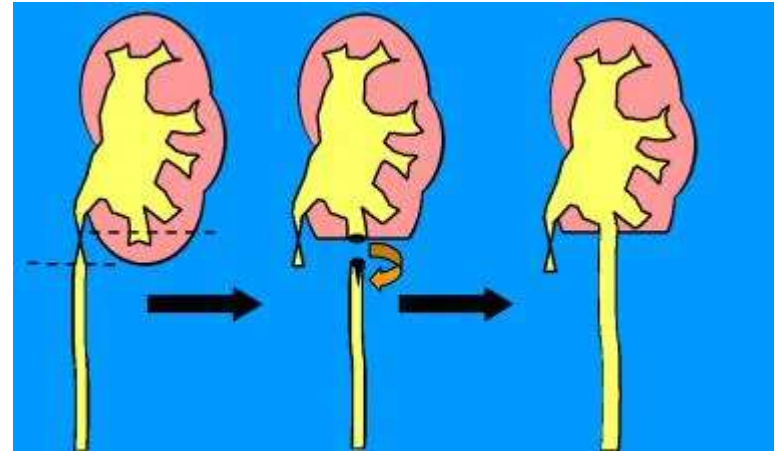
Ureteropyelostomy

the ureter may be **anastomosed directly into the renal pelvis**, this is done in case of **proximal** ureteral injury.



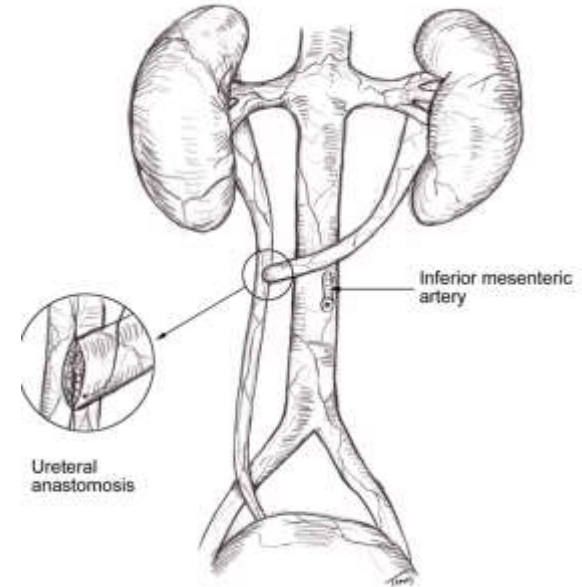
Ureterocalicostomy

If the **renal pelvis or ureteropelvic junction** is damaged beyond repair the ureteral stump may be sewn end-to-side into an exposed **renal calyx**.



Transureteroureterostomy

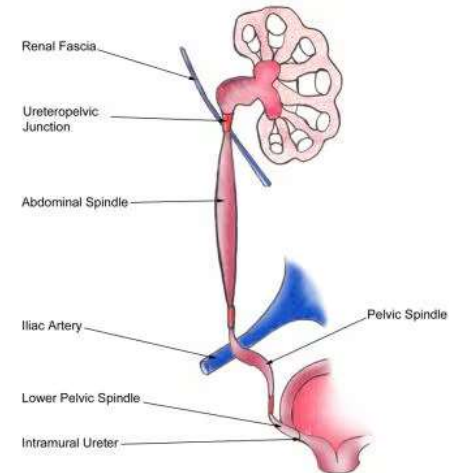
this can be performed to manage an **extensive defect that involves the mid or upper ureter** if the length for anastomosis to the bladder is insufficient. This involves bringing the injured ureter across the midline to the recipient ureter in an end-to-side anastomosis



Ureteroneocystostomy

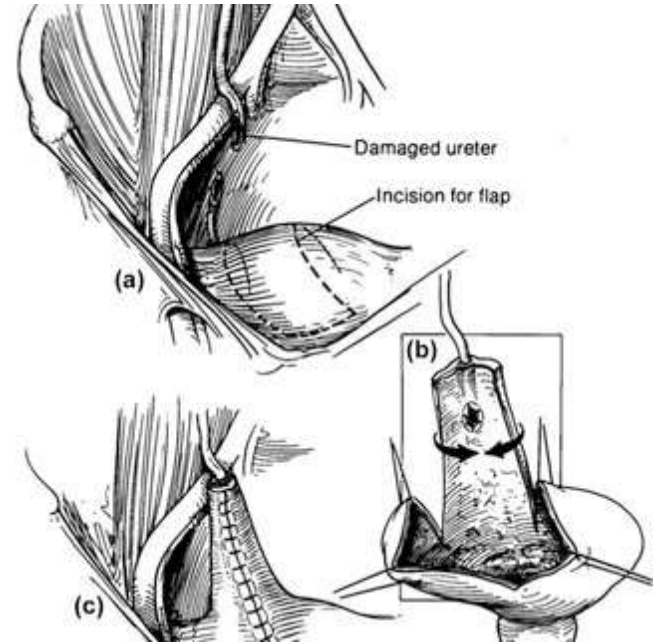
neo:
Reimplantation of
ureter into the
bladder

Injuries to the **lower ureter** are usually associated with disruption of its blood supply from the iliac vessels. Therefore, these injuries are **best repaired with ureteroneocystostomy**. The principles of repair include debridement and spatulation of the ureter, tunneling in the bladder wall toward the bladder neck in a 3:1 ratio of tunnel length to diameter of ureter.



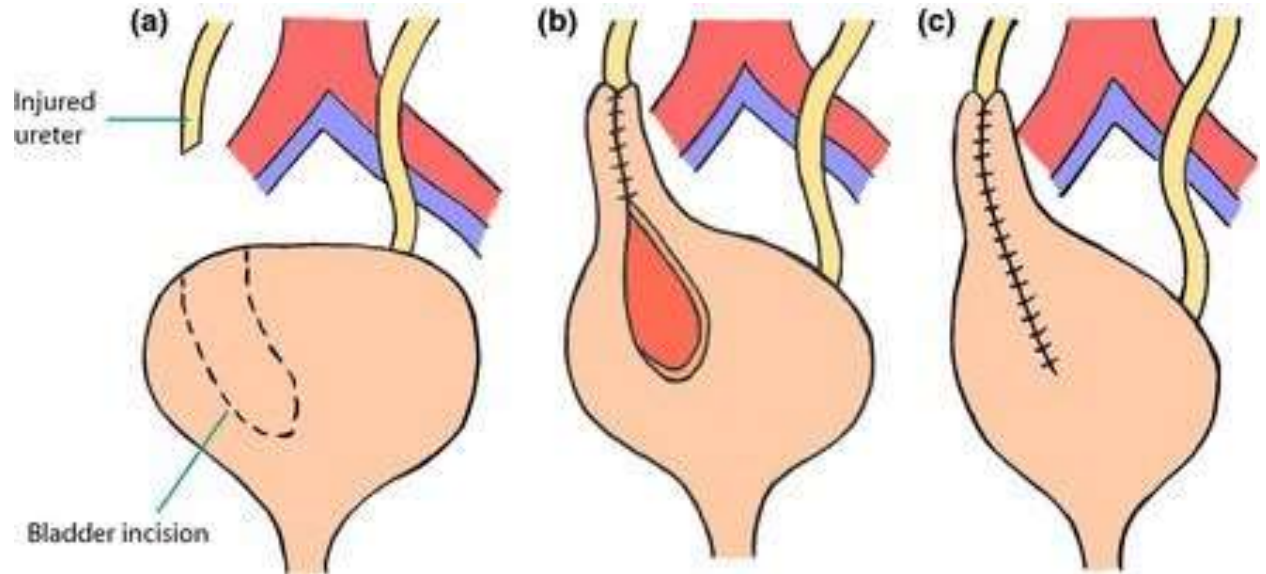
Vesicopsoas hitch

This procedure involves mobilizing the bladder and pulling it **superiorly and laterally by fixing it to the psoas tendon.**



Boari bladder flap

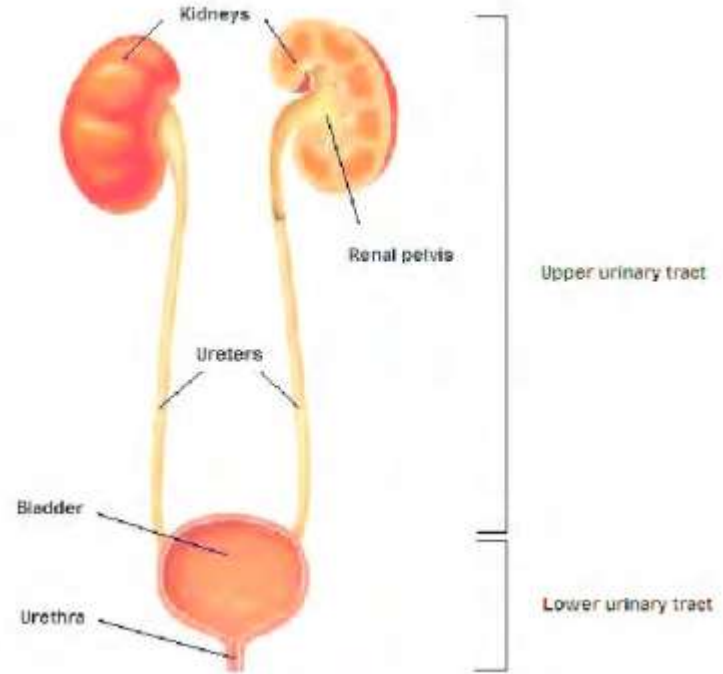
For injuries **too long** to be bridged with the psoas hitch procedure alone, a **Boari flap** can be created to **provide an additional 12-15 cm of length**.



Lower Urinary System Injuries :

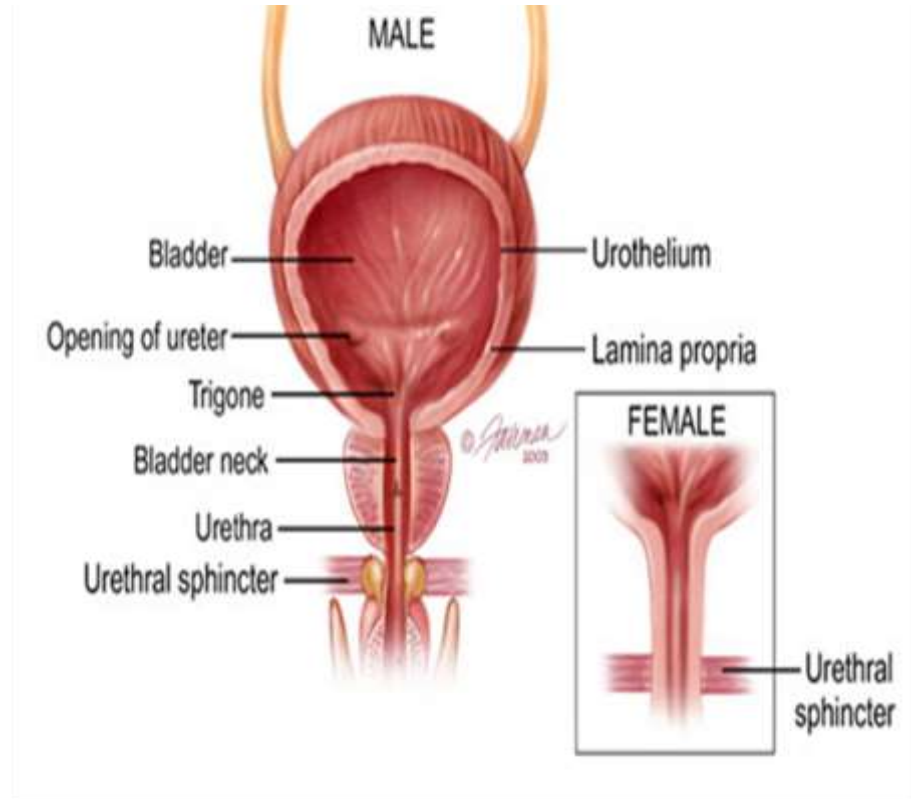
Bladder

Urethra



Bladder Anatomy

The adult bladder is located in the anterior pelvis and is enveloped by extraperitoneal fat and connective tissue. It is separated from the pubic symphysis by an anterior prevesical space known as the space of Retzius. The dome of the bladder is covered by peritoneum, and the bladder neck is fixed to neighboring structures by reflections of the pelvic fascia and by true ligaments of the pelvis



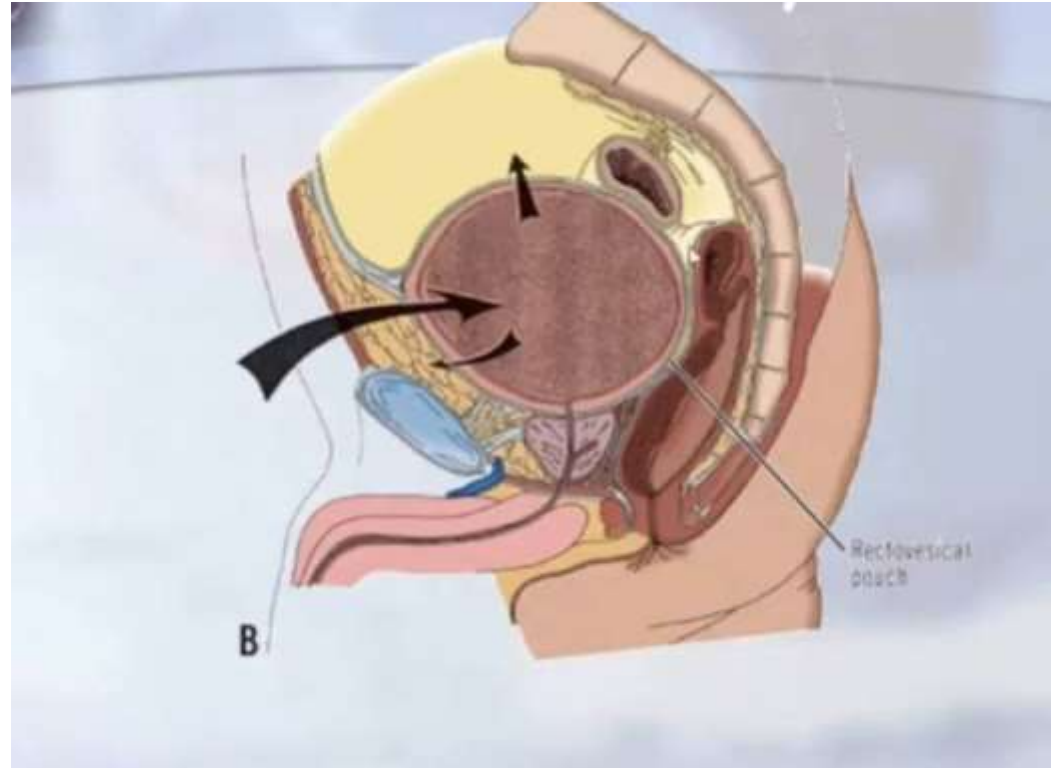
The type of extravasation depends upon the location of the laceration and its relationship with the peritoneal reflection.

If the perforation is above the peritoneal reflection, the extravasation is intraperitoneal.

If the injury is below the peritoneal reflection, the extravasation is extraperitoneal.

With an anterosuperior perforation, urinary extravasation may be intraperitoneal, extraperitoneal or both.

If the tear is posterosuperior, fluid can spread intraperitoneally and/or retroperitoneally.



Bladder Trauma

Lower urinary tract injury may be caused by either blunt, penetrating, or iatrogenic trauma.

70-97% of patients with bladder injuries from blunt trauma have associated pelvic fractures.

An exceedingly light blow may rupture the fully distended bladder, but the empty bladder is seldom injured except by crushing or penetrating wounds

Classification

Type	Description
1	Bladder contusion
2	Intraperitoneal rupture (dome is most weak part of the bladder)
3	Interstitial bladder injury
4	Extraperitoneal rupture
a.	Simple
b.	Complex
5	Combined injury

Diagnosis

The two most common sign and symptoms are **gross haematuria** and **abdominal tenderness** in patients with major bladder injuries.

Other findings may include the **inability to void**, bruises over the suprapubic region and **abdominal distension**.

Extravasation of urine may result in **swelling in** the perineum, scrotum and thighs, as well as along the anterior abdominal wall within the potential space between the transversalis fascia and the parietal peritoneum. (if left undiagnosed → abscess may occur)

Intraperitoneal extravasation may lead to **referred shoulder pain** and respiratory distress.

Laboratory studies and Imaging studies

Macro / Microscopic haematuria (95%)

Cystography: standard diagnostic procedure; most accurate.

CT: method of choice for evaluation of blunt or penetrating abdominal / pelvic injury.

IVP: high false negative results

U/S: not routinely used for evaluation of bladder injury





Management

The first priority in the treatment of bladder injuries is **stabilization of the patient and treatment of associated life-threatening injuries.**

Blunt trauma:

- **Extraperitoneal rupture:** catheter drainage.
- **Intraperitoneal rupture:** surgical exploration.

Penetrating injuries: All bladder perforations due to a penetrating trauma should undergo **emergency exploration and repair**

The **perivesical hematoma** should be **left undisturbed** to avoid introducing bacteria.

Urethral Injury

Male urethra:

Canal for the discharge of urine and seminal fluid. It is 18-20 cm in length. The male urethra may be divided into 2 portions.

The posterior urethra includes the prostatic urethra and the membranous urethra, **The anterior urethra** includes 3 segments. The bulbar urethra courses through the proximal corpus spongiosum and ischial cavernosus-bulbospongiosus muscles to reach the penile urethra. The penile urethra then extends through the pendulous portion of the penis to the final segment, the fossa navicularis. The fossa navicularis is invested by the spongy tissue of the glans penis

• Female urethra:

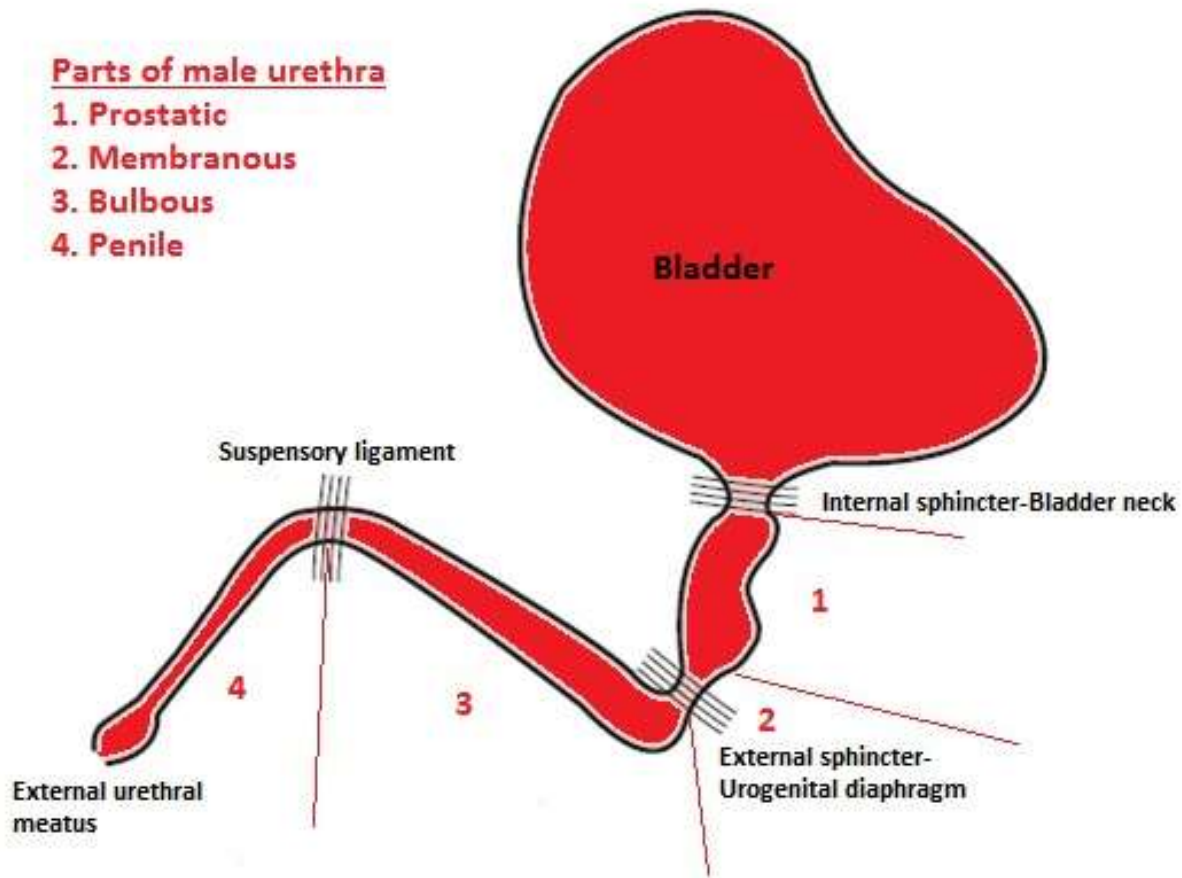
Canal for discharge of urine that is 4 cm in length.

It corresponds to the prostatic and membranous urethra in the male (posterior urethra).

The anterior urethra corresponds to the labia minora

Parts of male urethra

1. Prostatic
2. Membranous
3. Bulbous
4. Penile



**The membranous urethra is prone to injury from pelvic fracture
The bulbar urethra is susceptible to blunt force injuries because of its path along the perineum**

Straddle-type injuries from falls or kicks to the perineal area can result in bulbar trauma.

Conversely, the penile urethra is less likely to be injured from external violence because of its mobility, but iatrogenic injury from catheterization or manipulation can occur, which is also possible in the fossa navicularis

Diagnosis

A diagnosis of acute urethral trauma **should be suspected from the history.**

A **pelvic fracture**, or any **external penile** or **perineal trauma**, can be suggestive of urethral trauma.

In conscious patient, a thorough voiding history should be obtained to **establish the time of last urination, force of urinary stream, painful urination and presence of haematuria.**

On **digital rectal examination**, the so-called **high-riding prostate** may be identified, or the **prostate may appear to be absent** (*a large pelvic hematoma causes superior displacement of the prostate when the urethra is disrupted*)

The following clinical indicators of acute urethral trauma warrant a complete urethral evaluation:

- 1. *Blood at the meatus* / *Blood at the vaginal introitus***
- 2. *Haematuria*:** although non-specific, haematuria on a first voided specimen may indicate urethral injury.
- 3. *Pain on urination* or *inability to void* (disruption)**
- 4. *Haematoma or swelling***

Retrograde urethrography is the radiographic imaging study of choice for evaluation the patient with suspected urethral injury.
This study should precede any attempts to pass a urethral catheter.

Retrograde urethrography



Retrograde urethrography



Management

Anterior urethral injury

Blunt trauma

Partial tears: suprapubic cystostomy to divert urine away from site of injury, and this is maintained for 4 weeks to allow healing.

- Complete tear: end to end anastomosis
- Open injury: surgical exploration and repair

- **Posterior urethral injury**

Partial tear : cystostomy

Complete tear: urethroplasty later on

THANK YOU !