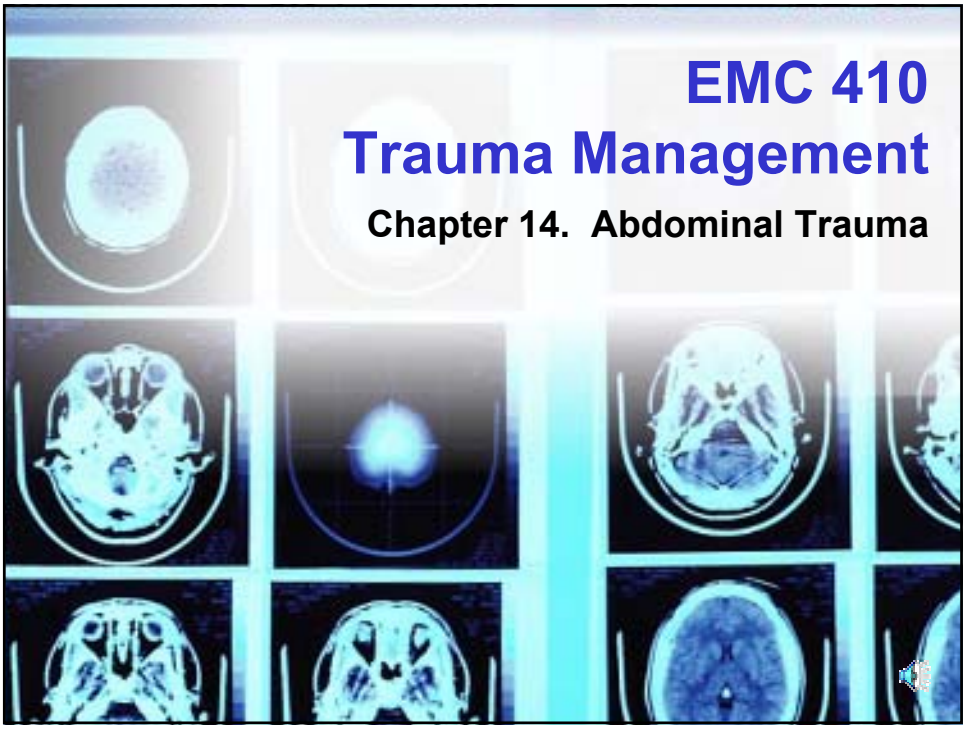
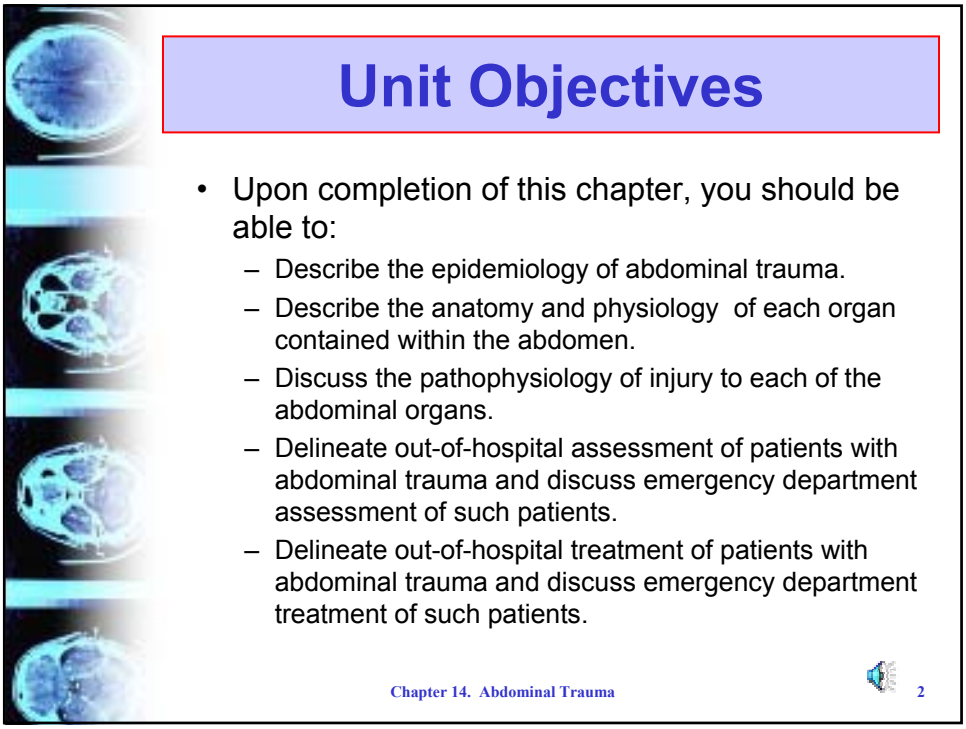


EMC 410
Trauma Management
Chapter 14. Abdominal Trauma



Unit Objectives

- Upon completion of this chapter, you should be able to:
  - Describe the epidemiology of abdominal trauma.
  - Describe the anatomy and physiology of each organ contained within the abdomen.
  - Discuss the pathophysiology of injury to each of the abdominal organs.
  - Delineate out-of-hospital assessment of patients with abdominal trauma and discuss emergency department assessment of such patients.
  - Delineate out-of-hospital treatment of patients with abdominal trauma and discuss emergency department treatment of such patients.

Unit Objectives continued

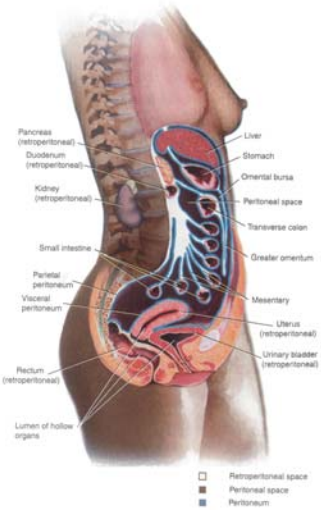
- Describe the epidemiology of genitourinary trauma.
- Define the anatomy and physiology of each organ included within the genitourinary system.
- Discuss the pathophysiology of injury to each of these organ systems.
- Delineate out-of-hospital assessment of patients with genitourinary trauma and briefly discuss emergency department assessment of such patients.
- Delineate out-of-hospital treatment of patients with genitourinary trauma and briefly discuss emergency department treatment of such patients.

Abdominal Trauma

- **Epidemiology**
  - Accounts for 7% - 15% of all trauma deaths
  - Mortality rates for blunt abdominal trauma range between 10% and 30%
  - Mortality rate for penetrating abdominal trauma is less than 5%
  - 75% of blunt abdominal trauma is MVC

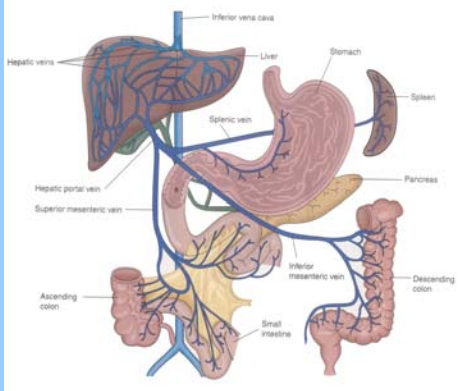
Abdominal Trauma continued

- Anatomy and physiology
  - Organs of the abdominal cavity are contained within the peritoneum
  - Retroperitoneal organs include the kidneys, pancreas, and portions of the small intestine
  - Abdominal organs covered by the omentum



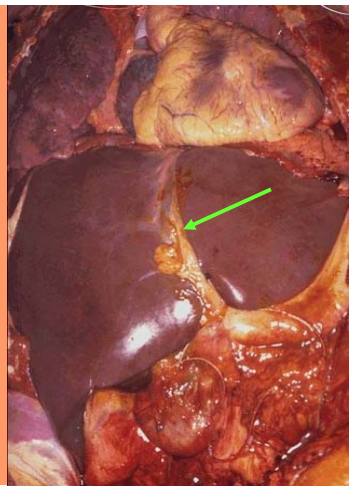
Abdominal Trauma continued

- **Anatomy and physiology**
  - **Liver**
    - Largest abdominal organ, located in RUQ
    - In direct contact with diaphragm
    - Partially protected by inferior ribs
    - Vascular structure with massive blood supply
    - Between the 2 lobes lies the porta hepatis, the entry port for the portal vein, hepatic arteries, nerves, lymph vessels, and the exit of the bile duct
    - Portal vein drains the nutrient-rich venous blood from the GI tract and dumps it into the liver
    - Once processed by the liver, the hepatic vein releases the blood into the inferior vena cava

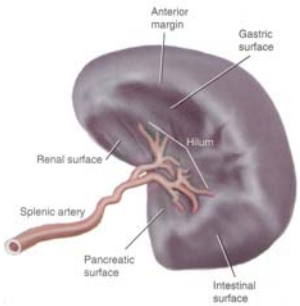


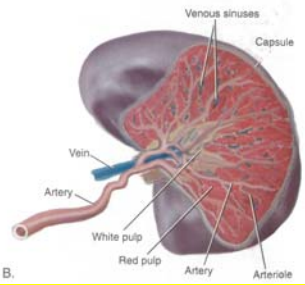
Abdominal Trauma continued

- Anatomy and physiology continued
  - **Liver continued**
    - Processes carbohydrates, fats, and proteins
    - Reprocesses broken down red blood cells
    - Produces bile which aids in the digestion process of fats
    - Bile drains from the liver via the hepatic duct into the gallbladder for storage



Abdominal Trauma continued

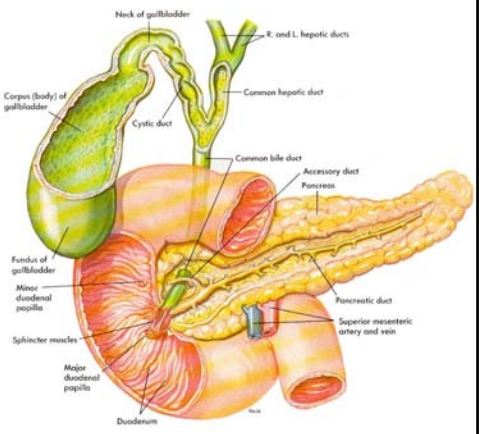




- **Anatomy and physiology continued**
  - **Spleen**
    - Highly vascular organ in the LUQ
    - Lies against the diaphragm and is protected by the most inferior ribs
    - Covered by a thick capsule which may contain hemorrhage
    - Functions as a filter removing old rbcs, bacteria taken up by wbcs, and particulate matter in the blood
    - 5% of circulating blood is filtered through the spleen each minute

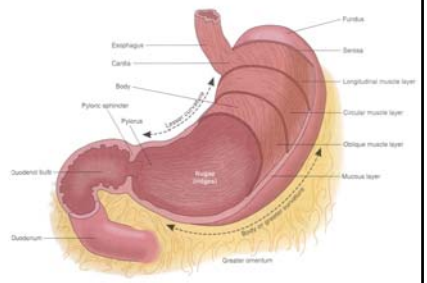
Abdominal Trauma continued

- **Anatomy and physiology continued**
  - **Pancreas**
    - Lies in mid-upper epigastric area of the abdomen
    - Segments include the head, body, and tail
    - Ductal network carries enzymes of the pancreas to the pancreatic duct which empties into the duodenum at the same location as the bile duct
    - Aids in digestion (exocrine) and secretes insulin (endocrine)



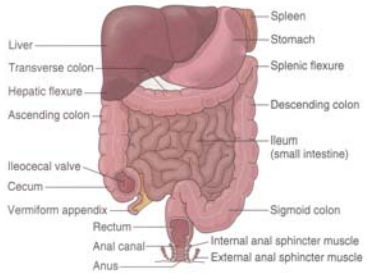
Abdominal Trauma continued

- **Anatomy and physiology continued**
  - **Stomach**
    - Lies in peritoneum mostly in the LUQ
    - When full, it can extend into the midline
    - 4 sections: cardia, fundus, body, and pyloris
    - Secretes mucus and hydrocholirc acid

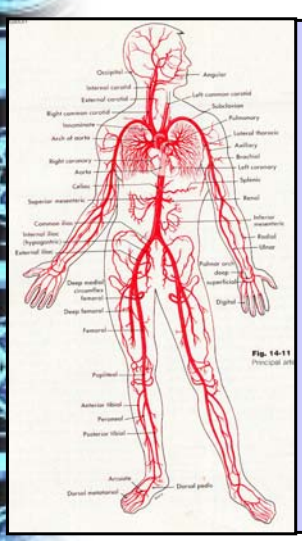


Abdominal Trauma continued

- **Anatomy and physiology continued**
  - **Small intestine**
    - 3 sections: duodenum (retroperitoneal), jejunum, and ileum
    - Duodenum secretes digestive enzymes and serves as a receptacle for bile and pancreatic enzymes
    - Jejunum and ileum absorb nutrients as they are broken down and regulate fluids and electrolytes
  - **Large intestine**
    - Composed of 3 sections: cecum, colon, and rectum (retroperitoneal)
    - Cecum and colon also maintain fluid and electrolyte balance
    - Serves as conduit for feces

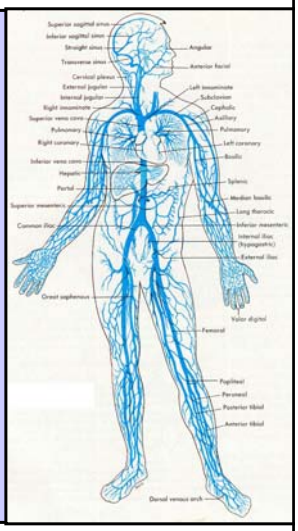


Abdominal Trauma continued



Anatomy and physiology continued

- **Vasculature**
  - Aorta courses through abdomen in the retroperitoneal space alongside the vertebrae
  - At L-4 the aorta bifurcates into the iliac arteries
  - The external iliac arteries then become the femoral arteries
  - The vena cava travels alongside the aorta and divides into the common iliac veins at L-5

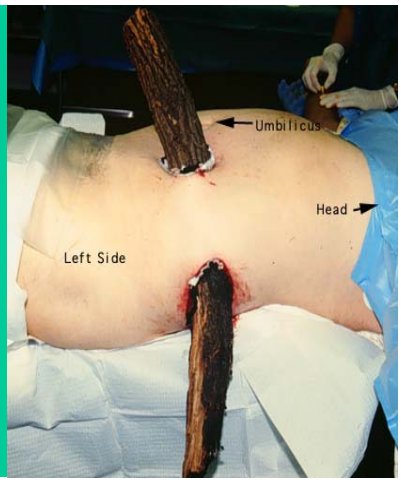


Abdominal Trauma continued

- **Pathophysiology**
  - **Factors affecting mortality**
    - Length of time to definitive care
    - Treatment at a trauma center
    - Rarely involves only a single organ
- **Blunt trauma**
  - Spleen (20% - 25%)
  - Liver (20% - 29%)
  - Large bowel (15%) and small bowel (10%)
  - All other organs together account for remaining 30%
  - 11% exsanguinating hemorrhage

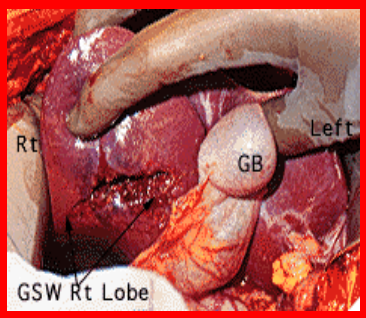
Abdominal Trauma continued

- Pathophysiology continued
  - Penetrating trauma
    - Typically affects hollow organs because they occupy the greatest space
    - 99% survival for single organ injury
    - 0% survival in injury to 8 or more organs



Abdominal Trauma continued

- **Pathophysiology continued**
- **Liver**
  - Produces profound hemorrhage when injured
  - 45% co-morbidity involving the spleen
  - Right lobe injured more frequently because of its relatively unprotected position
  - Overall mortality of 10% (25% in blunt trauma)
  - Grades I - VI (III and higher are life-threatening)
  - Ligamentum teres

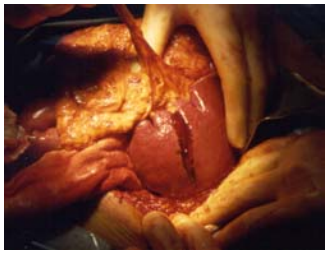


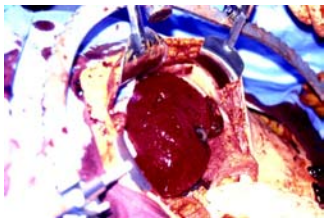
Abdominal Trauma continued

- Pathophysiology continued
- Gallbladder
  - Injured in 5% of patients with abdominal trauma
  - Rarely is the gallbladder injured alone
  - Alcohol associated with injury due to high pressures within the biliary tract
  - Perforation or blow-out secondary to compression is most common injury

Abdominal Trauma continued

- **Pathophysiology continued**
- **Spleen**
  - Most commonly injured abdominal organ in blunt trauma
  - 70% of splenic injuries are from blunt trauma
  - Mortality is low when only the spleen is injured
  - Rarely, however, is the spleen the only injured organ
  - 8% - 10% mortality rate with co-morbidity
  - Grade I - VI injuries





Abdominal Trauma continued

- **Pathophysiology continued**
- **Pancreas**
  - Rare injury with incidence of 2% to 12%
  - More frequently the result of penetrating trauma
  - Because of its retroperitoneal location, frequently associated with liver, spleen, and major vessel injury
  - 50% mortality in blunt trauma, 25% for GSW, and 8% for stab wounds
  - Grade I - V injuries

Abdominal Trauma continued

- Pathophysiology continued
- Stomach
  - Rare injury in blunt trauma (<2%)
  - Accounts for 19% of all penetrating abdominal injuries
  - Usual MOI is compression of distended stomach with rupture
  - Greater curvature is the most common site of rupture

Abdominal Trauma continued

- **Pathophysiology continued**
- **Small intestine**
  - Most frequently injured in penetrating trauma (77%)
  - May be contused or ruptured in blunt trauma (particularly MVC)
  - Duodenum, because of its retroperitoneal structure, has low incidence of injury (3% - 5%)
  - Duodenal injuries rarely occur in isolation
  - Jejunum and ileum are usually injured in penetrating trauma and is frequently injured (80%)
  - Bowel evisceration is a relatively rare event

Abdominal Trauma continued

- **Pathophysiology continued**
- **Large intestine**
  - Account for 5% of all abdominal injuries
  - Relatively high mortality rate (2% - 12%)
  - Results in fecal contamination of peritoneal cavity and sepsis
  - 96% of bowel injuries are the result of penetrating trauma
  - Isolated bowel injury only 25% of the time
  - Transverse colon most commonly injured segment

Abdominal Trauma continued

- **Pathophysiology continued**
- **Vascular injuries**
  - 30% - 60% mortality rates
  - Penetrating trauma is the most common MOI
  - Arterial bleeding may actually stop spontaneously due to muscular nature of vessels
  - Venous bleeding is difficult to stop, particularly when it is emptying into an open cavity
  - Pathologies include transection, laceration, aneurysm, contusion, and hematoma

Abdominal Trauma continued

- **Focused assessment**
  - Physical exam in blunt abdominal trauma is notoriously unreliable
  - MOI is very important
  - Inspect for visible wounds, seat belt sign, Kehr's sign, Grey-turner's sign, penetrating injury, distension, scaphoid abdomen, Cullen's sign
  - Auscultate for presence of bowel sounds
  - Palpate for tenderness, guarding, rebound, masses, inferior rib fractures, rebound tenderness, quality of femoral pulses
  - In the ED, ultrasonography, CT scan, MRI, DPL, radiographs, and rectal exam may all be used to assess abdominal trauma

Abdominal Trauma continued

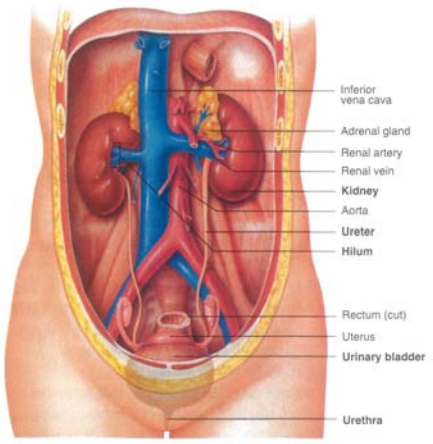
- **Treatment**
  - Rapid assessment, stabilization, and transport is the goal
  - ABCs
  - IV fluids?
  - MAST?
  - Cover eviscerations with moist occlusive dressing
  - Stabilize impaled objects
  - Oxygen

Urinary System Trauma

- Epidemiology
  - 10%-15% of all patients with abdominal trauma have GU injuries
  - The kidney is the most frequently injured organ of the GU system, followed by the bladder and urethra.
  - GU trauma rarely occurs as an isolated injury.
  - Pelvic fractures, rib fractures, lumbar fractures, and injuries to abdominal organs frequently accompany GU trauma.
  - Mortality rate is 6%-12% in patients with both GI and GU trauma.

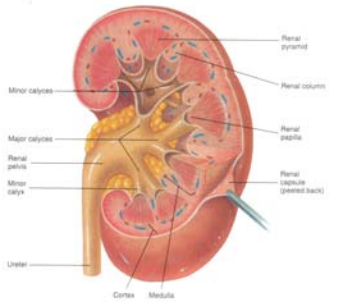
Urinary System Trauma

- **Anatomy and physiology**
  - **Kidneys**
    - Lie in retroperitoneal space between T-12 and L-3
    - Left kidney positioned slightly higher than the right
    - Upper half of right kidney lies behind the liver and protected by the 12th rib
    - Lower half of right kidney protected by bowel
    - Upper portion of left kidney is protected by the 11th and 12th ribs and is covered by the stomach and spleen
    - Lower portion of left kidney is covered by bowel
    - Hilum is composed of renal vessels, lymphatics, and nerves



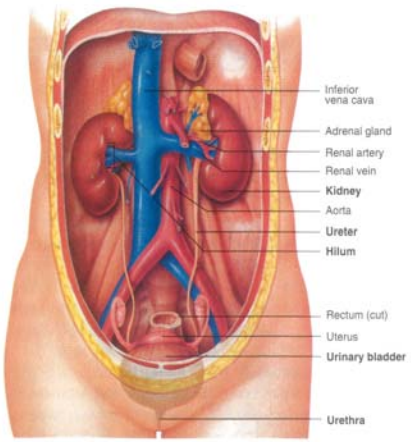
Urinary System Trauma

- **Anatomy and physiology continued**
  - **Kidney continued**
    - Cortex is outer layer and consists of renal corpuscles and portions of the renal tubules
    - Inner medulla contains the descending and ascending portions of the renal tubules and the collecting tubules
    - Filter blood, reabsorption of needed elements, and secretion of urine
    - Secrete a variety of hormones which regulate blood pressure
    - Secrete erythropoietin which regulate red blood cell synthesis



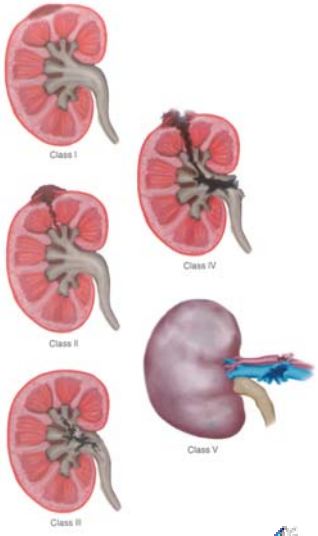
Urinary System Trauma

- **Anatomy and physiology continued**
  - **Ureters**
    - Traverses vertically from kidneys to bladder
    - Function as a conduit for urine
  - **Bladder**
    - Contained entirely within the bony pelvis when empty
    - When full, extends into the abdomen
  - **Urethra**
    - Travels from bladder to urethral meatus
    - More frequently injured in men than women



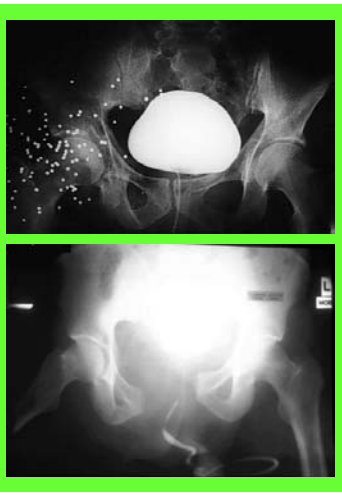
Urinary System Trauma

- **Pathophysiology**
  - **Kidneys**
    - Majority of renal injuries (80% - 95%) are the result of blunt trauma
    - Pedicle attachment predisposes kidney to shear injury
    - Penetrating injury less frequent but most likely to result in nephrectomy
    - Stab wounds rarely involve the kidney
    - Grade I - V injuries
  - **Ureters**
    - Uncommon injury
    - Usually the result of penetrating trauma
    - High rate of co-morbidity



Urinary System Trauma

- Pathophysiology continued
  - **Bladder**
    - Well protected from injury when empty
    - Can be injured when pelvis is fractured
    - Blunt trauma responsible for 75% of bladder injuries
  - **Urethra**
    - Rare in women, but when present, usually the result of straddle injury or pelvic fracture
    - Usually associated injury of vagina is present

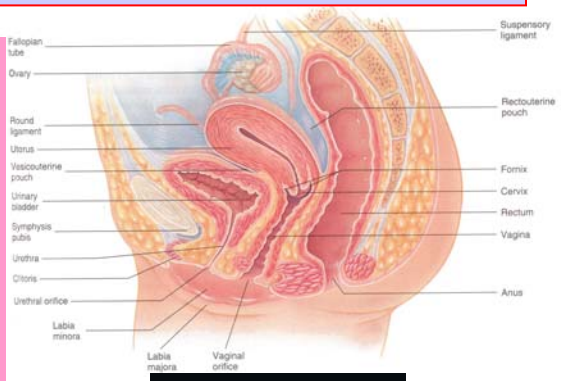


Urinary System Trauma

- **Focused assessment**
  - MOI
  - Inspect, palpate, auscultate, and percuss the abdomen, pubis, and flank area
  - Grey-turner's sign
  - Hematuria
  - Penetrating injury
  - Urethral meatus bleeding
- **Treatment**
  - MOI
  - ABCs
  - IV
  - Oxygen
  - Stabilize pelvis

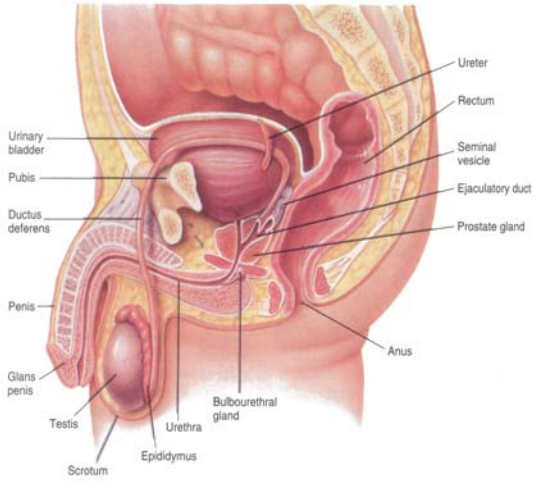
Genital Trauma

- **Anatomy and physiology**
  - **Female**
    - Ovaries
    - Fallopian tubes
    - Uterus situated between bladder and rectum
    - Vagina
    - Vulva



Genital Trauma

- **Anatomy and physiology**
  - **Male**
    - Scrotum
    - Testes
    - Penis



Genital Trauma

- **Pathophysiology**
  - Ovarian and fallopian tube injuries are rare and can range from contusion to avulsion
  - Non-gravid uterus rarely injured, but usually the result of penetrating trauma
  - Vaginal injuries may occur with straddle injury or sexual assault
  - Vulva typically injured during blunt trauma
  - Scrotal and testicular injuries usually result from blunt trauma
  - Testicles rarely injured due to their mobility but can be avulsed or ruptured
  - Blunt trauma to the penis may result in hematoma, avulsion, or fracture

Genital Trauma

- **Assessment**
  - Maintain patient's dignity
  - Inspect for penetrating and blunt external injury
  - Note any external bleeding, hematomas, abrasions, or avulsions
- **Treatment**
  - ABCs
  - Recovery and preservation of avulsed tissue or amputated parts
  - Control hemorrhage
  - IV if necessary
  - Pain control
  - Psychological support