Renal and Pelvic Trauma

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Etiology and Pathophysiology:

- **Renal Injury**
- Etiology
  - Account for 1-5% of all traumatic injuries
  - Blunt renal trauma is caused primarily by MVC's, pedestrian versus car events, assaults, and sports injuries
  - Penetrating renal trauma is caused by GSW's, knives, and impalement injuries
  - Majority of renal injuries are contusions, whether from blunt or penetrating trauma
- Pathophysiology
- Laceration
  - Injury where there is a tear in the kidney that leads to bleeding or leaking of urine into the abdominal cavity and collects in the retroperitoneum; results from blunt or penetrating trauma; blunt trauma, when the body collides with an object that does not enter the body and penetrating trauma, when an object breaks the skin and enters the body
- Contusion
  - A bruise to the kidney resulting from trauma or a forceful impact to the posterior side of the body
- Kidney is prone to acceleration and deceleration injuries due to its positioning and placement held by the renal pelvis and pedicle
- Lacerations and contusions typically occur from direct trauma and renal artery avulsions occur from deceleration mechanisms
- Renal artery thrombosis can occur when the renal artery is compressed between the anterior abdominal wall and the vertebral bodies
- Blunt injuries can cause trauma to the ureter from compression against the fractured bony structures or by deceleration mechanisms, which can cause a disruption at the ureteropelvic and ureterovesical junctions
- Penetrating injuries are typically unilateral
- Gunshot wounds tend to cause more devascularization and potential ureteral necrosis than stab wounds which usually only involve a short segment of the ureter
- **AAST Kidney Injury Scale**
- Grade I
  - Contusion: Microscopic or gross hematuria
  - Hematoma: Subcapsular, non-expanding without parenchymal laceration

- Grade II
  - Hematoma: Non-expanding peri-renal hematoma confined to renal retroperitoneum

    - Laceration: <1 cm parenchymal depth of renal cortex with no urinary extravasation

- Grade III
    - Laceration: >1cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation
- Grave IV
    - Laceration: Parenchymal laceration extending through the extending through the renal cortex, medulla, and collecting system
    - Vascular: Main renal artery or vein injury with contained hemorrhage
- Grade V
    - Laceration: Completely shattered kidney
    - Vascular: Avulsion of renal hilum de-vascularizing the kidney

➢ **Pelvic Trauma**

- Etiology
    - Majority of pelvic ring injuries are caused by MVC's, motorcycle crashes, pedestrians hit by cars, and falls
        - Lateral impact collision most common mechanism, side impact airbags have reduced the risk of death by lateral impact by 30-40% but have limited protection on thoracic and pelvic injuries
    - Pelvic fracture is shown to be a risk factor for death and patients with a pelvic fracture that develop shock have a mortality rate of up to 50%
- Pathophysiology
    - The Tile Classification: stresses biochemical stability of the pelvic ring
        - Type A: stable, posterior arch intact; includes avulsion fractures, isolated iliac wing fracture, pubic rami fractures, minimally displaced ring fracture, and transverse fractures of the sacrum and coccyx
        - Type B: partially stable, incomplete disruption of the posterior arch; includes anteroposterior injuries and lateral compression injuries; may be unilateral or bilateral; injuries are rotationally unstable but vertically stable
        - Type C: unstable, complete disruption of the posterior arch; includes iliac, sacroiliac, and vertical sacral injuries that result from vertical shearing forces; unilateral or bilateral; both rotationally and vertically unstable
    - The Young Burgess Classification: emphasizes the mechanism of injury
        - Anteroposterior Compression:
            - I. Symphysis diastasis <2.5cm
            - II. Symphysis diastasis >2.5cm, sacrospinous and anterior sacroiliac ligament disruption, results in rotational instability
            - III. Symphysis diastasis >2.5cmx, with complete disruption of the anterior and posterior sacroiliac ligament, results in complete rotational and vertical instability
        - Lateral Compression

        - I. Sacral crush injury on ipsilateral side
        - II. Sacral crush injury with disruption of posterior sacroiliac ligaments; iliac wing fracture may be present; rotationally unstable
        - III. Severe internal rotation of ipsilateral hemipelvis with external rotation of contralateral side, rotationally unstable
    - Vertical Shear
        - Vertical displacement of symphysis and sacroiliac joints resulting in complete rotational and vertical instability
- Stable Injuries (Tile Type A)
    - Undisplaced or Minimally Displaced Fractures of the Pelvic Ring
        - Normal pelvis is not completely rigid due to the slight mobility at the sacroiliac joints and symphysis pubis and inherent elasticity of the bone
        - Possible to sustain a single break in the ring, but the pelvis is not forgiving, be sure to search for second disruption
        - Fractures involving the superior or inferior pubic ramus
        - Straddle fracture is a four pillar injury involving fractures of pubic rami on both sides of the symphysis pubis, creating a “butterfly” segment and is produced by a direct blow with a straddle mechanism
            - can occur without posterior arch disruption, but are common with lateral compression or vertical shear forces (can cause concomitant injuries to the posterior pelvic arch)
    - Transverse Fractures of the Sacrum
        - Does not compromise the pelvic ring
        - Fractures below or at S4 are unlikely to be accompanied by neurologic injury
        - Reports pain in the buttocks, perirectal area, and posterior thighs; possible swelling, local pain, and bruising overlying the sacrum
    - Avulsion Fracture
        - result of a sudden and forceful muscular contraction or excessive muscle stretch
    - Stress Fractures
    - Pathologic and Insufficiency Fractures
        - Related to neoplasms, Paget’s disease, or dietary osteomalacia
- Partially Stable and Unstable Injuries (Tile Types B and C)
    - Most of the partially stable and unstable injuries are caused by high energy impact
    - Anteroposterior Compression
        - Disruption at or near the symphysis pubis
    - Lateral Compression

    - Results in varying degrees of internal rotation of the affected hemipelvis, causes buckling of the sacrum and horizontal pubic rami fractures
    - Rami fractures can be ipsilateral or contralateral
    - Overlapping pubic bones with any significant displacement should prompt a search for a posterior injury
    - In the most severe lateral compression trauma, the ipsilateral pelvis rotates internally to a degree that could cause the contralateral pelvis to externally rotate (windswept pelvis)
    - Lateral compression injuries are associated with a lesser degree of blood loss due to the internal rotation decreasing blood volume
- Vertical Shear
    - Most unstable injuries affecting the pelvic ring and are associated with violent axial loading of the hemipelvis
    - Anteriorly the symphysis and rami could be disrupted
    - Posteriorly, gross displacement and instability in the rotational and vertical planes may present through the sacrum, the sacroiliac joint, or the ilium
    - Avulsion of the ischial spine, the lower lateral lip of the sacrum and the transverse process of the fifth lumbar vertebra are indicative clues of the presence of a vertical shear fracture
    - Vertical shearing forces are transmitted through the bony pelvis, through the rich vasculature and nerve plexus adjacent to the bone, accounting for the major hemorrhage and neurologic injuries
- Vertical Sacral Fractures
    - Involve the pelvic ring
    - Caused by high energy injuries classified into 3 groups based on whether the fracture line extends:
        - Laterally to the sacral foramina
        - Through the foramina
        - Medially into the foramina and involving the central spinal canal
    - High risk for neurological complications and can manifest as bowel, bladder, or sexual dysfunction
- Open Pelvic Fractures
    - Present when there is direct communication between the fracture site and a skin, vaginal, or rectal wound
    - Lethal injuries if not recognized early
        - Hemorrhage accounts for early mortality, followed by infection, sepsis, ARDS, and MSOF
- Penetrating Pelvic Trauma

        - Vascular injuries can involve the aorta, common iliac artery, and external, internal, and common iliac vein or a combination of vessels
        - Genitourinary structures and hollow viscera could be injured
        - Fecal contamination from colorectal injury is a serious complication
        - Blood on a digital rectal exam is indicative of a rectal injury

On-Scene Treatment:

- Correctly identify signs and symptoms
- Maintain spinal stabilization if trauma suspected
- Keep a patent airway
    - Be alert for vomiting and potential for aspiration
- Maintain adequate oxygenation
    - If SpO2 is greater than 94% with no signs of respiratory distress, no supplemental oxygen is required
    - If SpO2 is less than 94%, or any signs of respiratory distress such as hypoxia, hypoxemia, or poor perfusion apply supplemental oxygen via nasal cannula or nonrebreather is severe signs of distress
- Control any major bleeding and prevent hemorrhage
    - Early packing can reduce mortality
- Calm and reassure the patient
- Initiate a quick and efficient transport
- Pelvic stabilization using splinting
- Provide analgesia if client is conscious

ED Treatment:

- **Renal Injury**
- Obtain a urinalysis, CBC, and chemistry panel to assess for hematuria, baseline hematocrit, and renal function
- Assess for other abdominal injuries through the use of a CT scan
    - CT scan provides detailed information regarding the extent of hemorrhage, extravasation, and devascularization
- Assess for injuries to the renal artery through an arteriography
- Identify the grade of suspected renal injury
    - Grades I-III typically do not require surgical management
    - Higher grade renal injuries may require possible nephrectomy
- Renal contusion and laceration can be managed conservatively and rarely require surgical intervention
- Urology consult
- **Pelvic Trauma**

- Stabilize the pelvis
- Identify sites of blood loss
- Identification of other major injuries
- Identification of laparotomy verses angiography
- Noninvasive ways to stabilize the pelvis
    - Wrap the pelvis tightly with a sheet and towel clamps, can reduce and open book pelvic injury (anteroposterior compression fracture)
    - Splinting the pelvis to reduce movement for a lateral compression injury
- Prepare patient for possible surgical procedures including formal external fixation, angiography and embolization, and laparotomy
- Formal External Fixation
    - Done for stable anteroposterior and lateral compression fractures
- Angiography and Embolization
    - Manages hemorrhage associated with pelvic fractures
    - Angiography should be considered earliest for patients with posterior arch disruptions as they have the most severe risk of hemorrhage
- Hemodynamically Unstable Patients with Pelvic and Intra-Abdominal Hemorrhage
    - Laparotomy verses angiography
    - A positive FAST prioritizes laparotomy over angiography
- Stable Pelvic Injuries
    - Treat conservatively with rest and analgesia

<u>Role of the ED Nurse:</u>

➢ **Renal Injury**
- Good assessment skills!
- Serious signs suggesting a GU injury include:
    - Flank, abdominal, rib, back, or scrotal pain
    - Inability to void spontaneously
    - Hemodynamically unstable
    - Hematuria or blood at the urethral meatus or vaginal introitus
    - Perineal ecchymosis
    - High riding prostate
    - Pelvic fracture
- Assess for pain or tenderness over the abdomen
    - Possible to see flank ecchymosis, Grey Turner's sign
    - Palpable mass
    - Hematoma

➢ **Pelvic Trauma**
- Pain management
- CT scan to determine extent of injuries is gold standard
- Maintaining stabilization of pelvis

- Most severe and fatal complication following a pelvic trauma is hemorrhage
    - Provide supplemental O2
    - Monitor ScvO2
    - Rapid fluid replacement using 2 large bore IV's
    - Restore fluid volume or blood products
    - Correct the cause
    - Monitor vital signs, level of consciousness, peripheral pulses, capillary refill, and skin
- Foley Catheter Insertion Criteria
    - Urinary Catheter should be inserted in all patients with major trauma to monitor urinary output
    - Prior to insertion, a rectal exam needs to be performed to check position of the prostate, look for any rectal blood, and check sphincter tone
    - Foley catheter insertion needs a retrograde urethrogram prior to insertion if the following are suspected:
        - Damage to the urethra as evidenced by blood at the urethral meatus
        - Penile or perineal hematoma
        - Displaced prostate
        - Severe anterior pelvic fracture
    - If the retrograde urethrogram imaging study is abnormal, a urology consult is required prior to foley insertion
    - If foley catheter insertion is contraindicated, a suprapubic catheter may be placed

<u>Discharge/Prevention Instructions:</u>

- Renal Injury
    - Adequate hydration
    - Avoiding nephrotoxic drugs
    - Be aware of surroundings
    - Follow up appointment with urologist
- Pelvic Trauma
    - Wear a seat belt
    - Obey the speed limit
    - Look both ways before crossing the street
    - Continue with PT and OT
    - Pain management education
    - Hip precautions if applicable
    - Education on fall prevention in the home setting

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