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Advanced Emergency Trauma Course

Gastrointestinal and Genitourinary Trauma

Presenter: Daniel Wachter, MD

Ghana Emergency Medicine Collaborative

Patrick Carter, MD • Daniel Wachter, MD • Rockefeller Oteng, MD • Carl Seger, MD

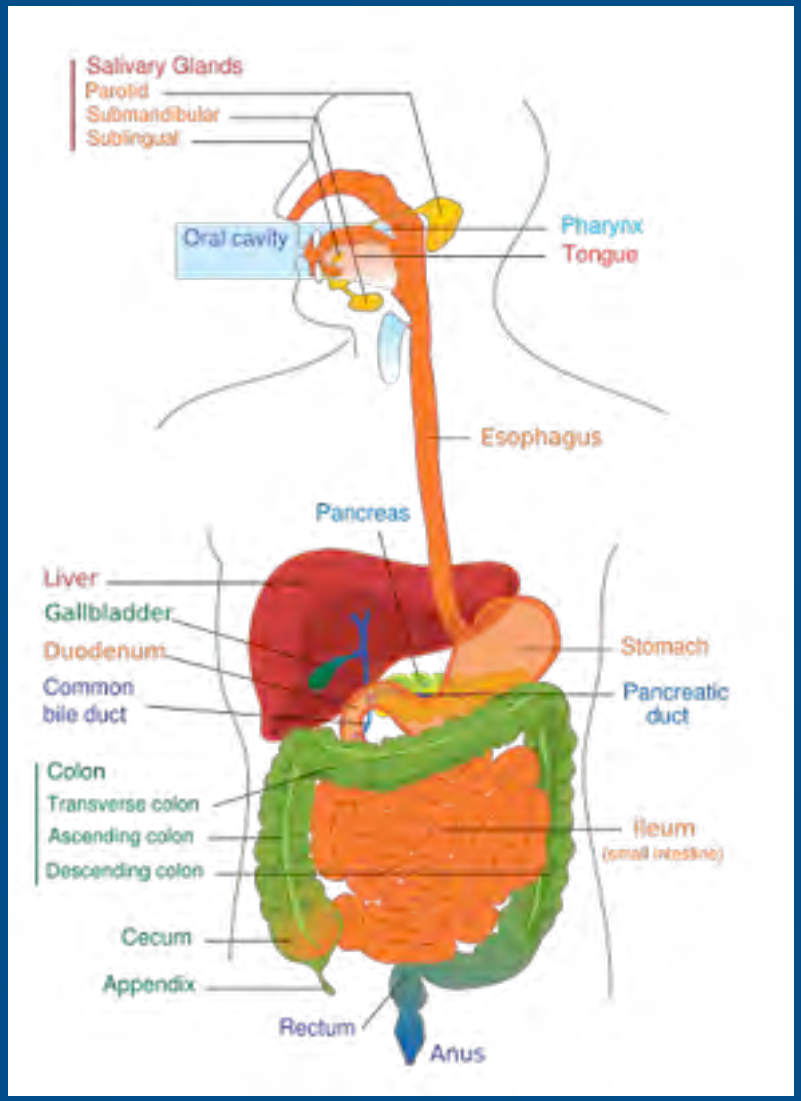
Lecture Objectives

- Review relevant GI and GU anatomy
- Understand patterns and pathophysiology of traumatic GI and GU injury
- Explain the diagnostic modalities appropriate for particular traumatic GI/GU conditions
- Describe an algorithmic approach to GI and GU traumatic injury evaluation and management

Potential Injury by Anatomic Region: (Most commonly injured organs in red)

- Intrathoracic Abdomen
  - Diaphragm, liver, spleen, stomach.
  - Cannot be palpated as it lies behind the ribs.
- Pelvic Abdomen:
  - Urinary bladder, urethra, rectum, small intestine,
  - Ovaries, fallopian tubes, and uterus in women
  - Consider extra-peritoneal injuries in this region.
- Retroperitoneal abdomen
  - Contains the kidneys, ureters, pancreas, aorta, and vena cava
  - Usually require advanced imaging to identify and diagnose these injuries.
- Abdomen (proper)
  - Contains the small and large intestines, gravid uterus, and the distended urinary bladder.
  - Physical exam, x-rays and DPL are useful and reliable in this area.

Gastrointestinal Anatomy



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LadyOfHats (Wikipedia)

Pathophysiology

- Blunt Traumatic Injury: Three injuries patterns
  - Rapid Deceleration – shearing injury
    - Injures hollow, solid, visceral organs or vascular structures
  - Crush
    - Abdominal anteriorly and vertebrae or ribs posteriorly.
  - External Compression
    - Can occur throughout the abdomen
    - May cause diaphragmatic or hollow viscous rupture
- Penetrating Injury –stabs and projectiles

Pathophysiology

- Solid visceral Injuries
  - Liver, Spleen, Pancreas, Kidney
- Gastrointestinal/Hollow viscus injuries
  - Duodenal injuries
  - Small Bowel
- Retroperitoneal Injuries
- Diaphragmatic Injuries

Diagnostic Evaluation of Penetrating Trauma: Stab Wounds

- Unstable patients or those with peritonitis should be considered emergently for laparotomy.
- Stable patients can undergo local wound exploration. If no peritoneal violation is detected, serial examinations are performed.

Stab Wound Diagnosis

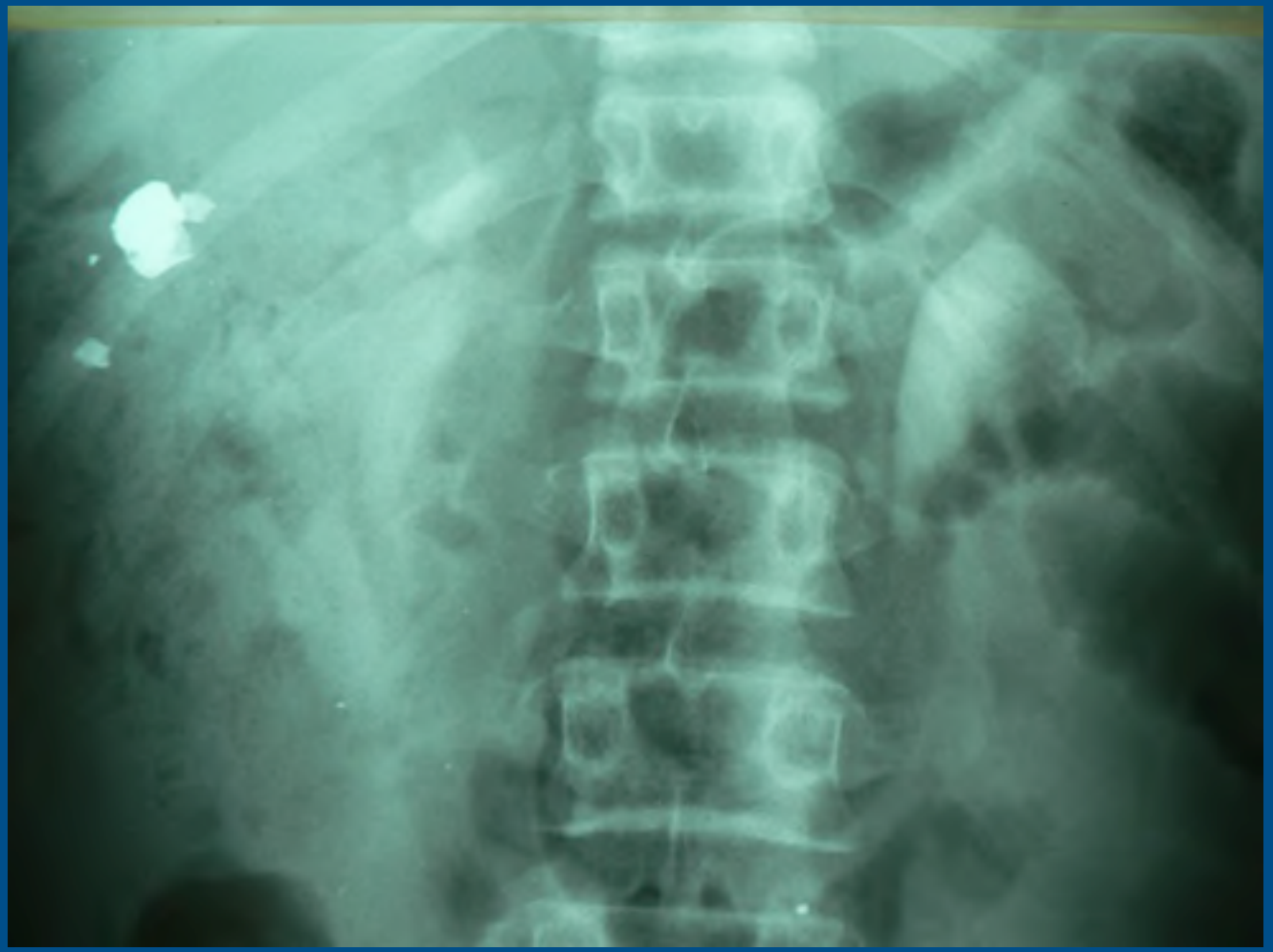
- Diagnostic Peritoneal Lavage (DPL) or Focused Abdominal Sonography for Trauma (FAST)
  - FAST scan is preferred due to higher positive predictive value, but both are acceptable.
  - Further discussion of DPL and FAST follows
- Perform AP/Lateral Chest x-ray for diaphragmatic, mediastinal or lung injury.
- CT scan can be considered, but is not always mandatory in anterior abdominal stab wounds

Stab wound

Diagnostic Evaluation of Penetrating Trauma: Projectile Wounds

- Unstable patients suffering projectile wounds to the abdomen should proceed emergently to the operating theater.
- The specific location of projectile fragments can be investigated after stabilization is achieved.
- Stable patients suffering projectile wounds to the abdomen should undergo CT scanning and serial examinations.

GSW to RUQ



www.trauma.org

Blunt Traumatic Injury

www.Trauma.org

Evaluation after Blunt Abdominal/Pelvic Injury

- Physical Examination
- Diagnostic Imaging
  - Plain radiography
  - Ultrasound
  - CT scan
- Diagnostic Procedures

Physical Exam: Abdomen

- Observe for distension
- Listen for bowel sounds
- Palpate for tenderness
- “Gray Turner” sign is ecchymosis of flank from retroperitoneal injury

Grey-Turner Sign

http://en.wikipedia.org/wiki/File:Hemorrhagic_pancreatitis_-_Grey_Turner%27s_sign.jpg

Physical examination: Pelvis

- Compress the Anterior Superior Iliac Crests to assess for pain or movement on PA compression.
- Compress the Anterior Superior Iliac Crests laterally for pain or movement.
- Palpate at the pubic symphisis for tenderness, step-off or crepitance.
- Pelvic fracture are painful and usually demonstrate tenderness.

Check the Back/Rectal

- Log-roll the patient while observing spinal precautions.
- Look and palpate for step-offs, abrasions
  - Bullet holes or stab wounds
- Perform rectal exam for gross blood bony pelvic fragments or “high-riding” prostate.

CXR – Diaphragmatic Rupture

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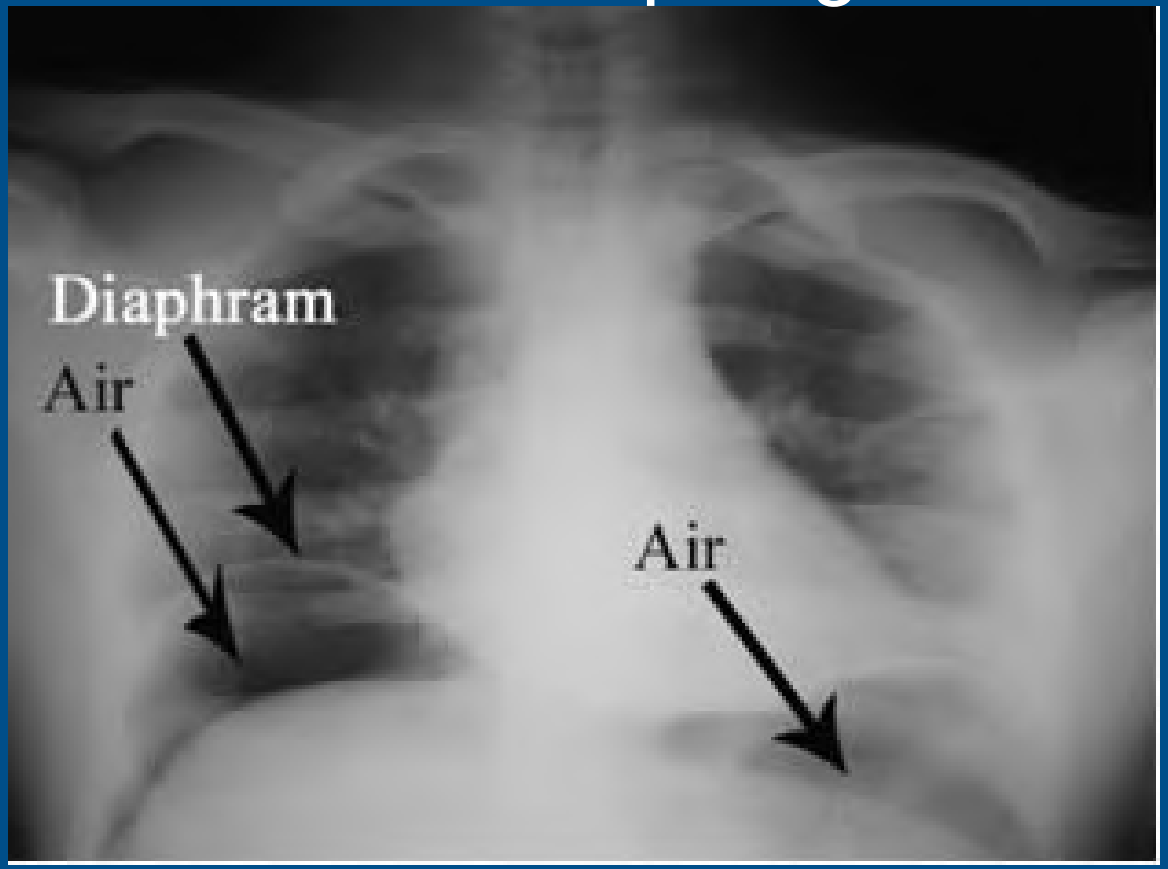
CXR – Viscus Rupture

- Free Air below the diaphragm



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FAST Exam

- Focused Abdominal Sonography in Trauma

- 4 views of the abdomen to look for fluid.
  - RUQ/Morrison's pouch
  - Subxiphoid – view of heart
  - LUQ – view of splenorenal junction
  - Bladder – view of pelvis

FAST

- Has largely replaced deep peritoneal lavage (DPL)
- Bedside ultrasound looking for blood collection in an unstable patient.
- If the patient is unstable and a blood collection is found, proceed emergently to the operating theater.

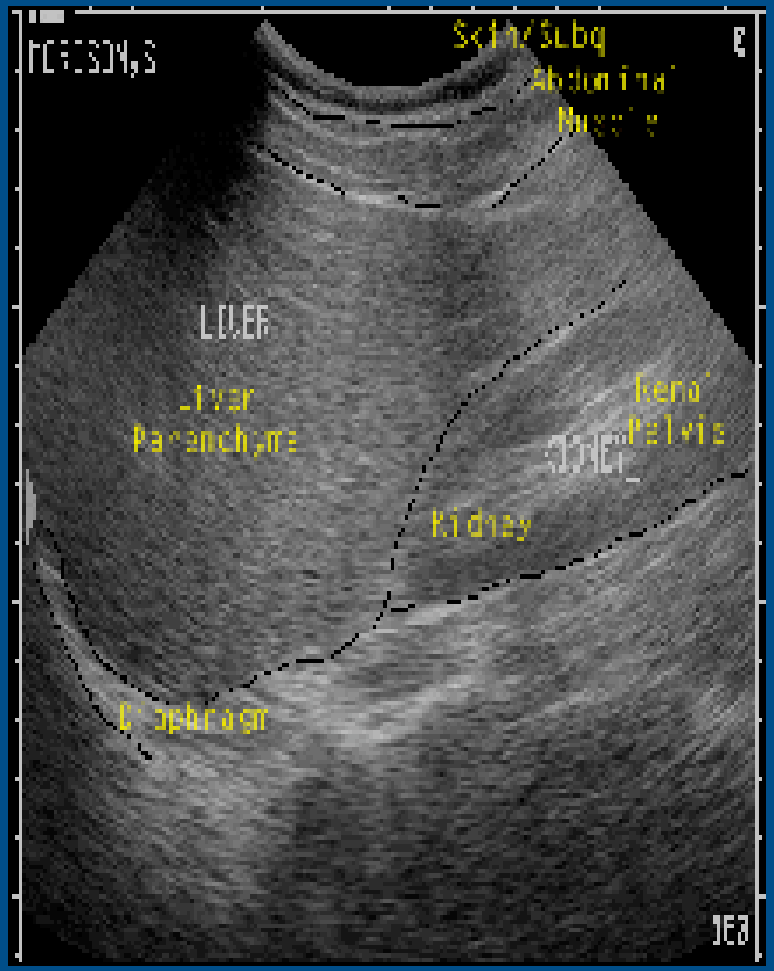
FAST

- Sensitivity of 94.6%
- Specificity of 95.1%
- Overall accuracy of 94.9% in identifying the presence of intraabdominal injuries.
  - Yoshil: J Trauma 1998; 45

FAST
Right Upper Quadrant -Morrison's Pouch

- Between the liver and kidney in RUQ.
- First place that fluid collects in supine patient.

FAST Exam - RUQ



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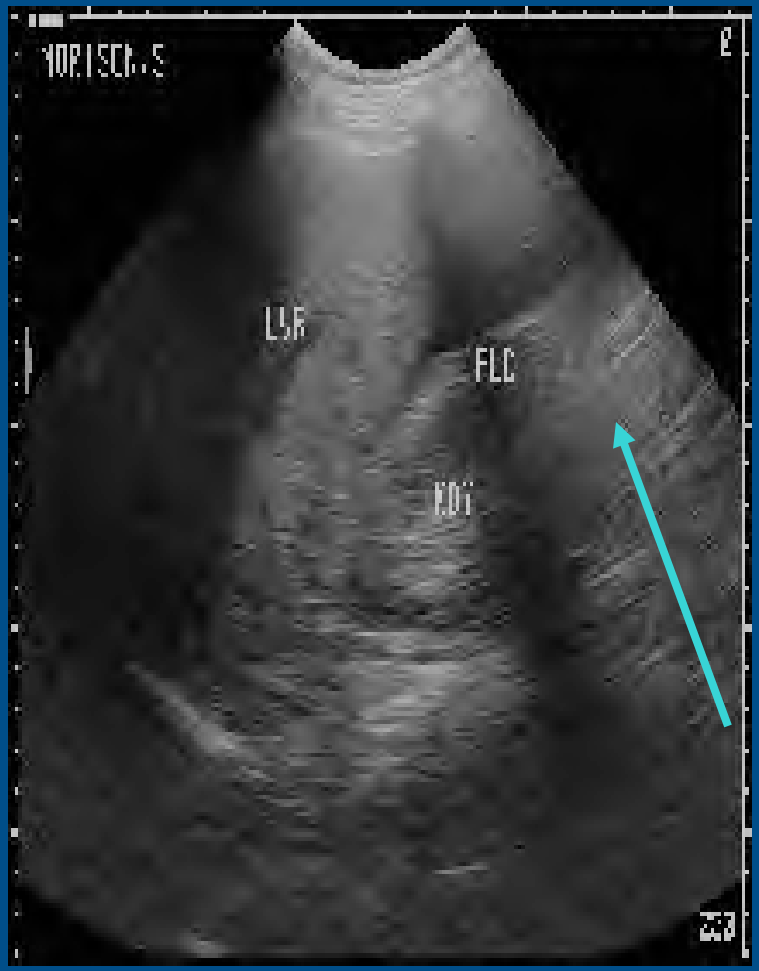

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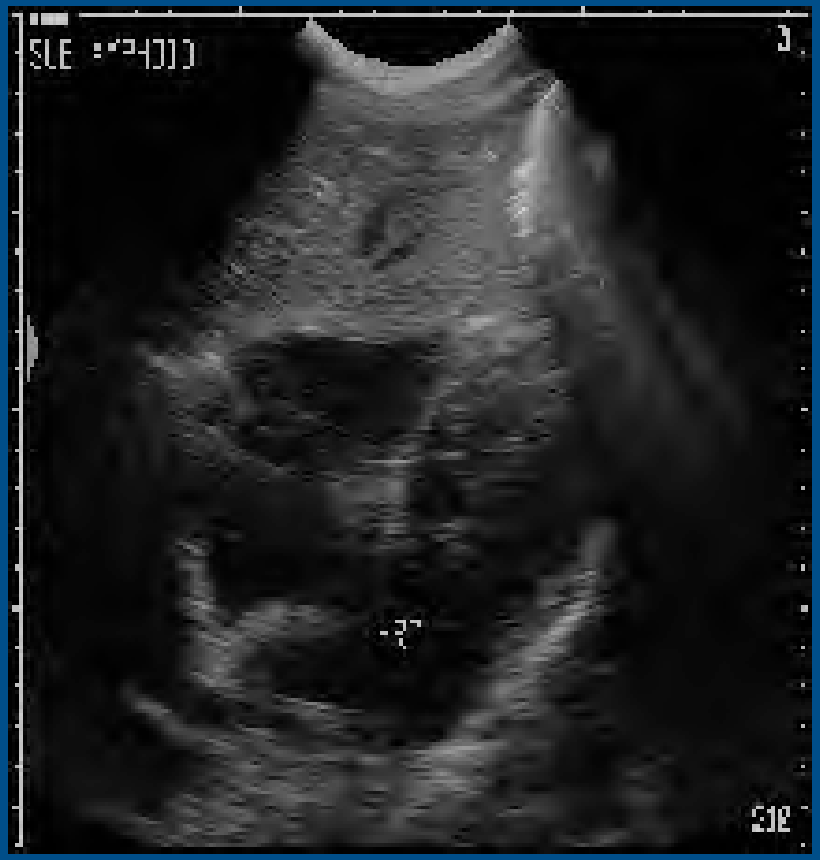
Source: University of Louisville ED website www.louisville.edu/medschool/emergmed/ultrasoundfast.htm

FAST - Subxiphoid

- Evaluate for pericardial fluid
- View through liver
  - Transhepatic or Parasternal
- Searches for fluid between heart and pericardium

FAST - Subxiphoid



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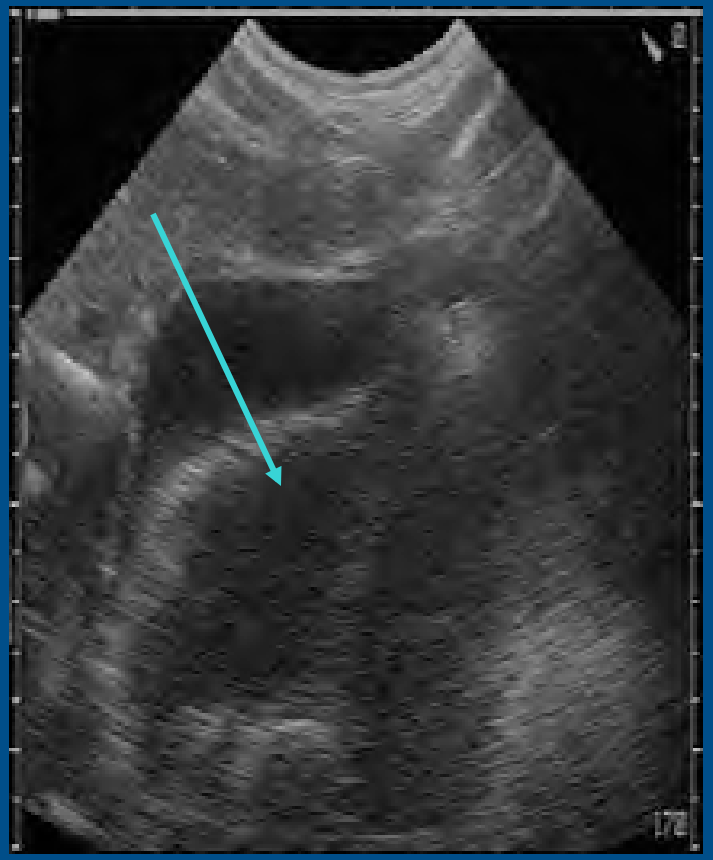

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FAST – Left Upper Quadrant

- View between the spleen and kidney
- Another dependent place that fluid collects
- Also see diaphragm in this view

FAST - LUQ

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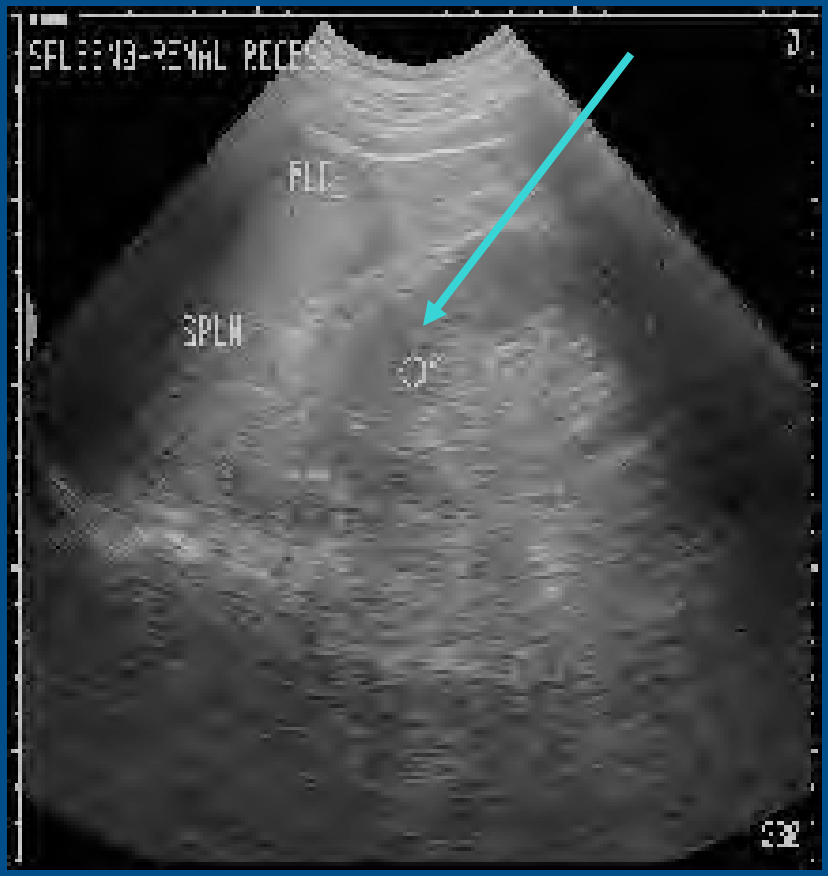

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Source: University of Louisville ED website
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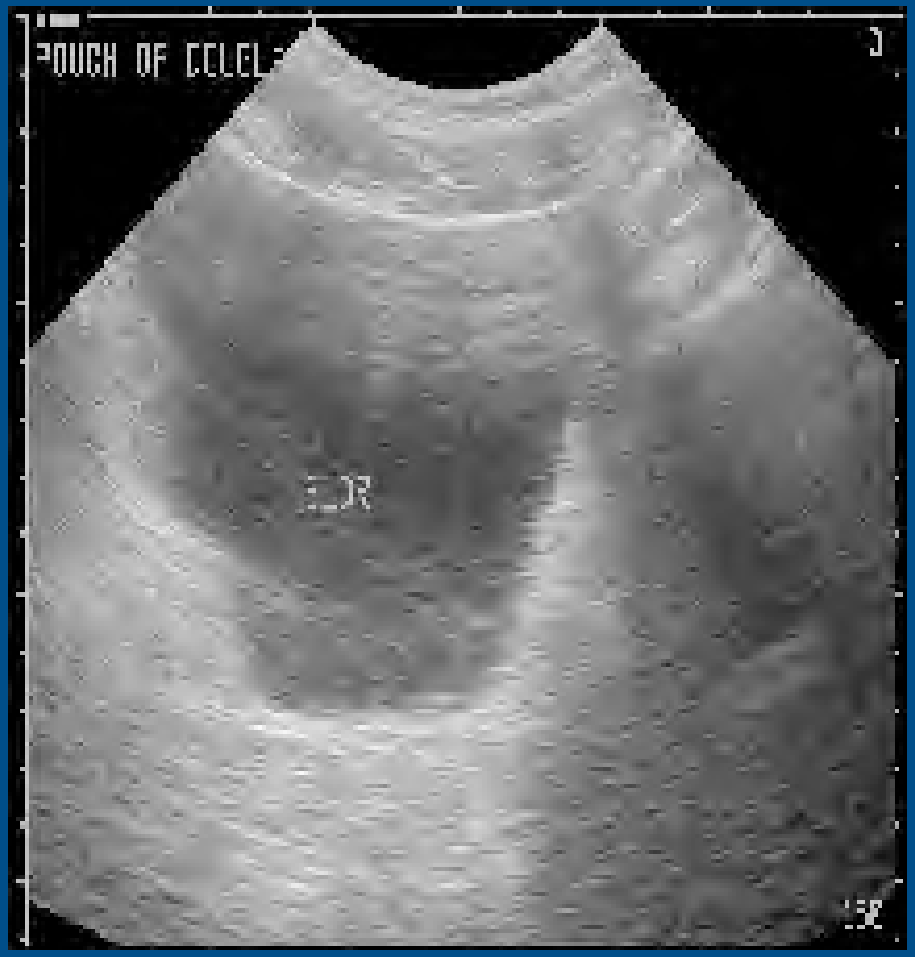
FAST – Bladder View

- Evaluates for fluid in the pouch of Douglas
  - Posterior to bladder.
- Dependent potential space.

FAST – Bladder View



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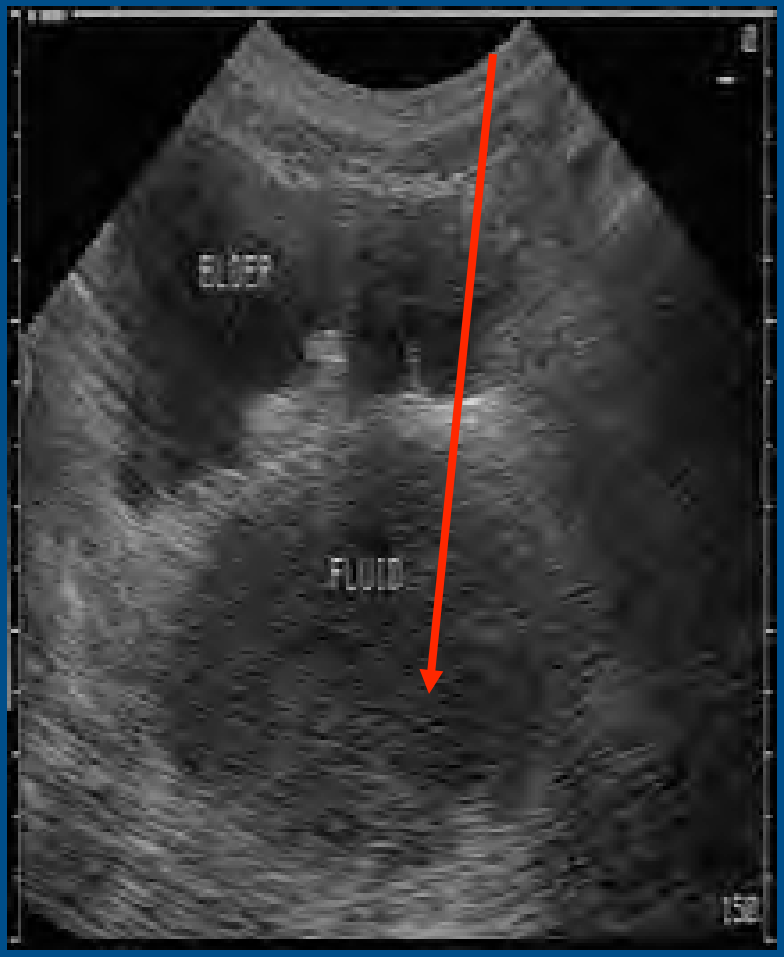

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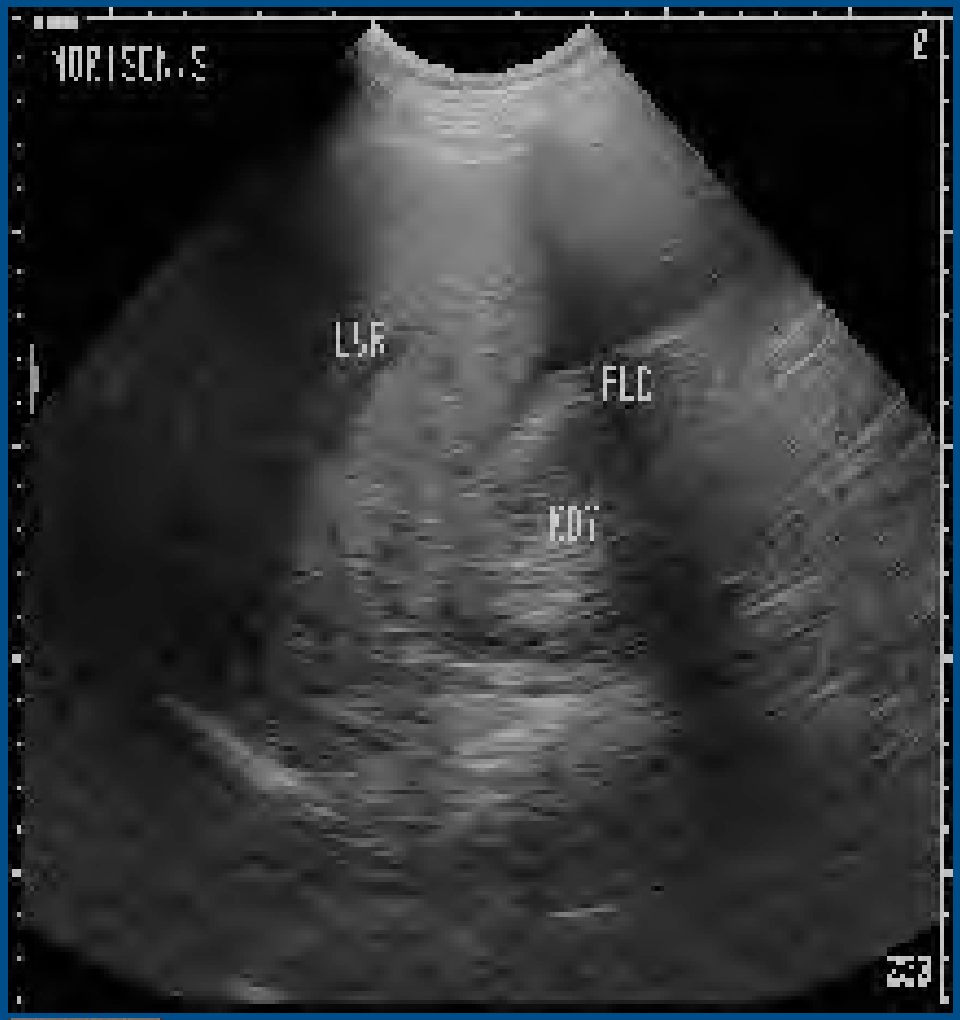
Interpret this FAST Image:



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www.louisville.edu/medschool/emergmed/ultrasoundfast.htm

Diagnostic Procedures

- Diagnostic peritoneal lavage
  - Bedside test for expeditious discovery of free peritoneal blood.
  - Used in multiply injured, altered mentation or to more closely investigate those whose exam is confounded by pelvic or thoracic injuries.
  - Semi-open technique is preferable to percutaneous technique
  - Performed at infraumbilical site unless the patient is pregnant or a large pelvic hematoma is suspected.

Diagnostic Peritoneal Lavage

- DPL must not delay transport to the operating theater when emergent laparotomy is needed regardless of DPL findings.
- Complications of DPL include:
  - Bleeding,
  - Infection
  - Intra-abdominal injuries
  - False-positive leading to unnecessary exploratory laparotomy.

DPL: Findings Mandating Surgery

- Greater than 10mL gross blood on catheter insertion, or greater than 15-20mL on aspiration
- Following peritoneal lavage with one liter (1L) crystalloid:
  - Greater than 100,000 RBC/mm3, or
  - Greater than 500 WBC/mm3, or
  - Bile, food matter, high amylase, bacteria

Pelvic Fractures

- Can be stable or unstable.
- If unstable, they must be repaired by orthopedics.
- May have significant bleeding from vessels on pelvic floor.
- Pelvic fractures should be stabilized with a sheet wrapped tightly around the pelvis.

Pelvic Fracture

- Pelvic Ring Fractures have a high association with abdominal/pelvic injuries
- Pelvic F

PD-INEL http://emedicine.medscape.com/article/394515-overview

Pelvic Fracture

www. Trauma.org

Improvised Pelvic Binder

- Maximal compression is at the height of the greater trochanters

PD-INEL http://www.aaos.org/news/aaosnow/jul09/clinical8-3.gif

After Binder Application

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Management Algorithm

- ABC, IV , O2, monitor
- Primary and secondary survey while 2L of crystalloid infuses
- If remains unstable after bolus, transfuse blood
  - Start with 2 Units of packed red blood cells
- FAST Scan for intraperitoneal, pericardiac hemorrhage
- If FAST is negative and patient is unstable consider DPL
- If FAST is negative and patient is stable, consider serial exams and/ or CT scan
- If FAST is positive and patient is unstable, proceed to emergent exploratory laparotomy
- If FAST is positive and patient is stable, perform CT scan
- If CT scan is negative and patient is hypotensive, consider arteriography or laparotomy

When to Consult Surgery Following Abdominal Trauma

- Clinically unstable
  - Abnormal vital signs or poor general appearance without external hemorrhage to account for instability
- Peritoneal findings on exam
  - Severe tenderness, rebound or guarding
- High risk of associated signs and injuries
  - Pelvic fractures, lumbar spine fractures, lower rib fractures, “Grey-Turner” or “Cullen” Sign, Seat-Belt Sign
- Patient cannot be adequately evaluated:
  - Altered mental status, language barrier, age (young or advanced), significant head or neck injury.
- Positive DPL, FAST scan or free-air on plain radiographs

Penetrating Abdominal Trauma Miscellaneous Points

- Evisceration
  - Proceed to the operating theater or reduce the omentum with emergent surgical consultation.
- Penetrating objects should not be removed except in proximity to definitive care.
  - Pre-maturely removing the object may lead to exsanguination if it is tamponading a potential vascular disaster.

Genitourinary Trauma

- General Anatomy Review
  - Upper GU: kidneys, pelvocaliceal system, and ureters
  - Lower GU: bladder, urethra, external genitalia
- Pathophysiology of Traumatic Injury
  - Blunt Traumatic Injury
    - Rapid Deceleration Consideration
    - Pediatric Considerations
  - Penetrating Injury

GU Trauma Physical Examination

- Examine for blood at the urethral meatus.
- Blood present should raise concern for pelvic fracture.
- Foley should not be placed until a retrograde urethrogram has been performed.
- A retrograde urethrogram or cystogram in a stable patient who has blood at the urethral meatus or evidence of urethral or bladder injury from penetration.

Evaluation for Traumatic GU Injury

- Physical exam for GU injuries is of limited value in obtaining detailed or operative-planning information
  - Urine dip and microscopy
  - Rectal Exam for bony protrusion, tenderness, high-riding prostate, boggy prostate
  - Examine for blood at the urethral meatus, scrotal hematoma and perineal ecchymosis
- Indications for imaging
  - Gross hematuria
  - Microscopic hematuria with hemodynamic instability
  - Persistent microscopic hematuria (serial urine analysis)
  - Hemodynamic instability with history of significant deceleration mechanism
  - However, microscopic hematuria in a clinically stable patient is rarely associated with findings on imaging.

CT Scanning in GU Trauma

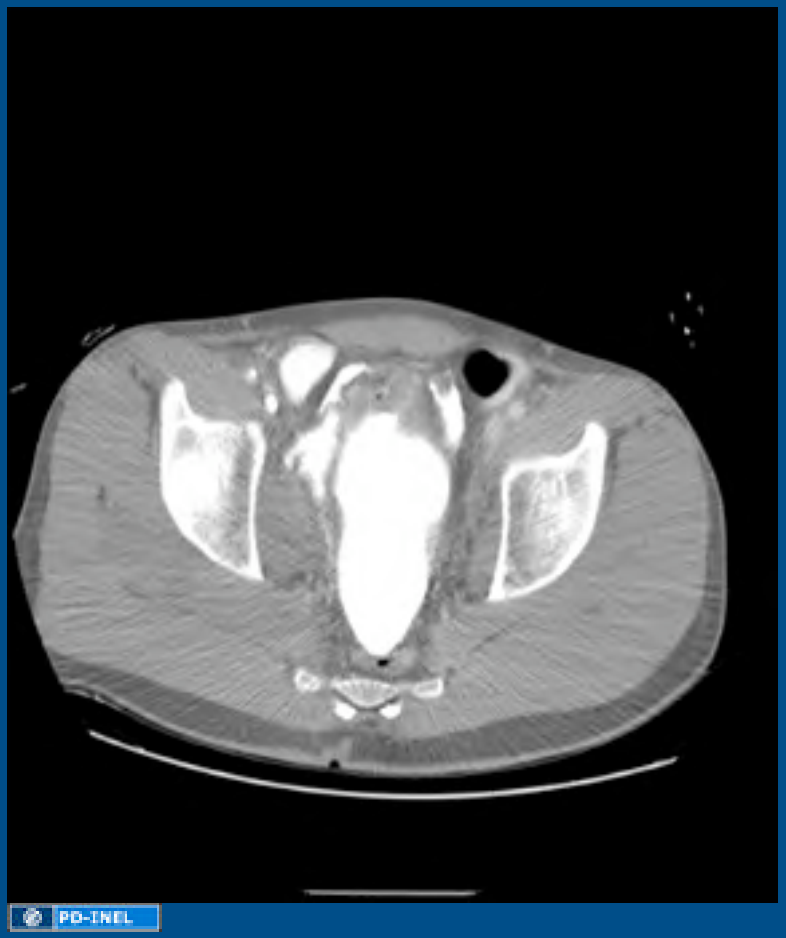
- CT scan of the abdomen and pelvis with IV contrast
  - CT scan is preferred over intravenous pyelogram (IVP) in renal injuries
  - Imaging is more detailed, sensitive and may detect other intraabdominal injuries or urine collections
- In the presence of penetrating flank trauma IV/PO/PR, “triple contrast” CT scan is the preferred modality

Further GU Trauma Imaging

- Intravenous pyelogram (IVP)
  - Contrast dye cleared via the kidneys provides a good indication of bilateral renal function if ureteral injury is considered.
  - Can be used when renal injury is suspected and CT scan is not available, but test characteristics are inferior to CT scanning.
  - Abnormal IVP is an indication for CT scan, angiography or surgery.
- Ultrasonography
  - Ultrasonography is often readily available but does not offer the sensitivity of CT scanning
  - Renal imaging is performed roughly by the FAST examination but might detect renal lacerations with hematoma formation or urinomas.
- Radionuclide imaging is not indicated in the initial evaluation for renal damage.
- Retrograde ureterogram is not performed in the emergency setting.

Normal Bladder vs. Ruptured Bladder

http://img.medscape.com/pi/emed/ckb/emergency_medicine/756148-821994-828251-1374998.jpg



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Genitourinary Injuries

- Urethral Injuries
  - Almost exclusively in males
  - Anterior urethra injury usually caused by straddle injury
  - Posterior urethra injury usually caused by pelvic fracture
  - Urology consultation, bladder drainage with suprapubic catheter and delayed repair
- Testicular and Scrotal Injuries – radionuclide study for testicular viability. Consider surgical exploration
- Penile Injuries – associated with urethral injuries, caused by ruptured Bucks' fascia and corpus callosum from trauma during erection
  - 90% resolve spontaneously
  - 10% require surgery for hematoma evacuation

Genitourinary injuries

- Renal Injuries – frequently diagnosed by CT and likely not an isolated injury
  - Management involves surgery, urology and angiography
  - Renal Contusion
  - Renal Laceration
  - Pedicle Injury
  - Renal Rupture
  - Renal Pelvic Rupture
- Ureteral Injuries – rare due to well-protected location

Bladder Injuries

- If imaging is unavailable, can be suspected by inability to aspirate after bladder irrigation
  - CT cystoscopy is replacing traditional cystoscopy as the imaging modality of choice
  - Usually the result of blunt abdominal trauma
  - Bladder contusion – conservative management as hematuria resolves

Bladder Rupture

- Intraperitoneal
  - Less common
  - Not usually associated with pelvic fractures
  - Requires surgical repair
- Extraperitoneal
  - More common
  - Associated with pelvic fractures
  - Initial conservative management is acceptable
  - Delayed cystogram in 7-10 days as long as patient is able to void with or without foley catheter
    - Unless hematuria continues or pelvic hematoma forms

Key Points of GU Trauma

- GU injuries are highly associated with additional abdominal/pelvic injuries
- Look for lower abdominal/flank/genital/back ecchymosis or edema
- Elicit a history of inability to void following injury
- Explore for hematuria
- Consider advanced imaging
- Involve general and specialist surgeons for definitive management and to guide the diagnostic evaluation

Special Cases

- Penetrating Trauma to the Flank
  - Scapular tip to iliac crest, between anterior and posterior Axillary lines
  - Pathophysiology – can violate retro- and intra-peritoneal spaces
  - Clinical Features –
    - Flank ecchymosis, hematuria, abdominal tenderness, CVA tenderness, or UNDIFFERENTIATED HYPOTENSION
  - Diagnosis – triple contrast CT (IV/PO/PR contrast)
  - Treatment –
    - Surgery, angiography or conservative measure are all possible.

Special Cases

- Penetrating Trauma to the Buttocks
  - Pathophysiology
    - Can violate retro-, intra- and extra-peritoneal spaces and structures
    - GI/GU, vascular, neurological and musculoskeletal structures are all at risk
  - Diagnosis – Negative rectal exam does not exclude the diagnosis
    - CT scan should be strongly considered
    - Endoscopy should be avoided due to possible hollow viscus injury worsening in the face of insufflation
  - Management –
    - Surgical consultation
    - Angiography may also be required.

Questions?