

Abdominal Trauma

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FRCSI



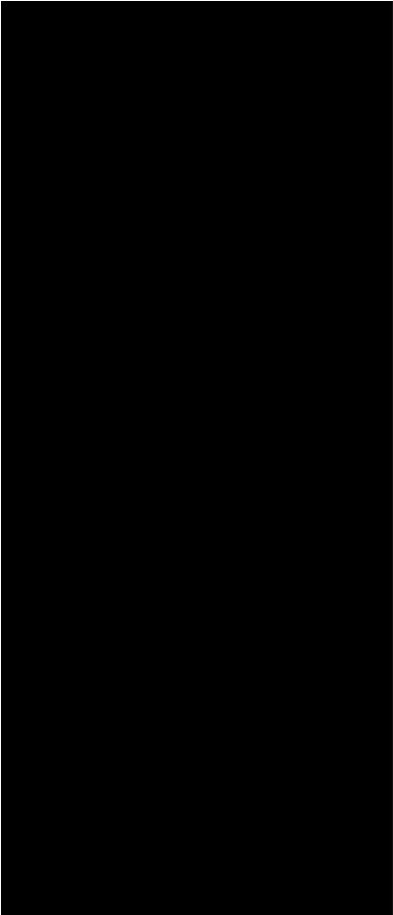
Background

- Trauma ,the **Fourth** leading cause of death in western and the leading cause of death in the first four decades of life
- The predominant mechanism is **Blunt injury 95%**.
- One fifth of patients has abdominal injury .
- **Intra Abdominal Hemorrhage** ,one of the commonest cause of death after trauma and missed abdominal injuries are a frequent cause of morbidity and late mortality .

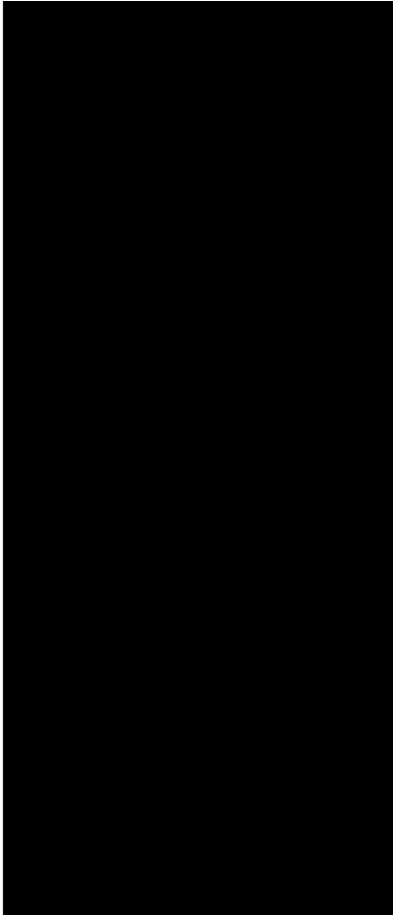


History

- ***Mechanism of injury is an important factor in developing a high index of suspicion; thus a detailed history is helpful if available.***
- **First step to recognize presence of shock.**
- **2nd step is to identify probable cause.**



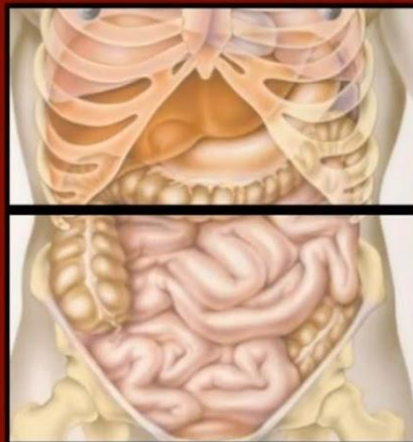
Regions of the abdomen

- Anterior abdomen
 - Thoraco-abdomen
 - The flank
 - The back
 - The pelvis
- 

Abdominal Regions

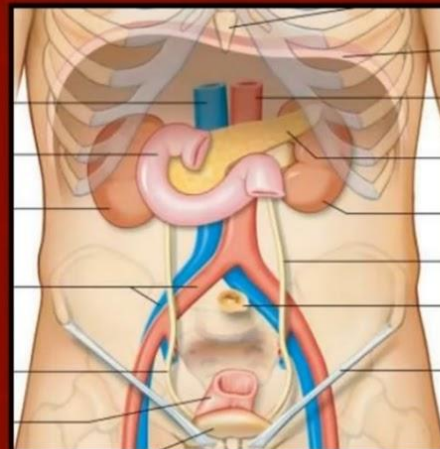


Thoracic abdomen



True abdomen

Retroperitoneal



Flank

Regions of abdomen

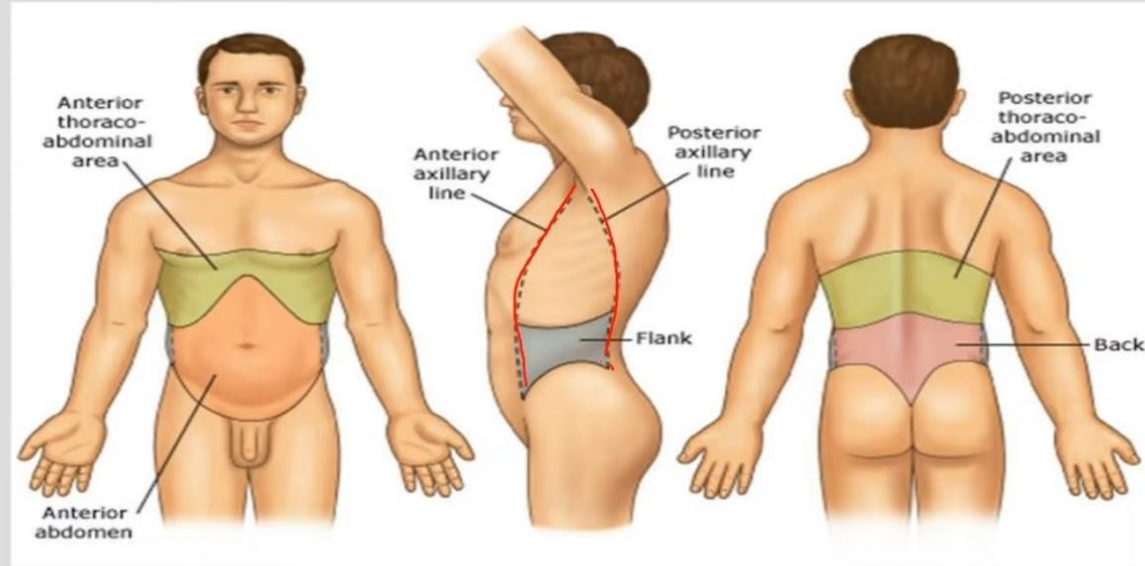
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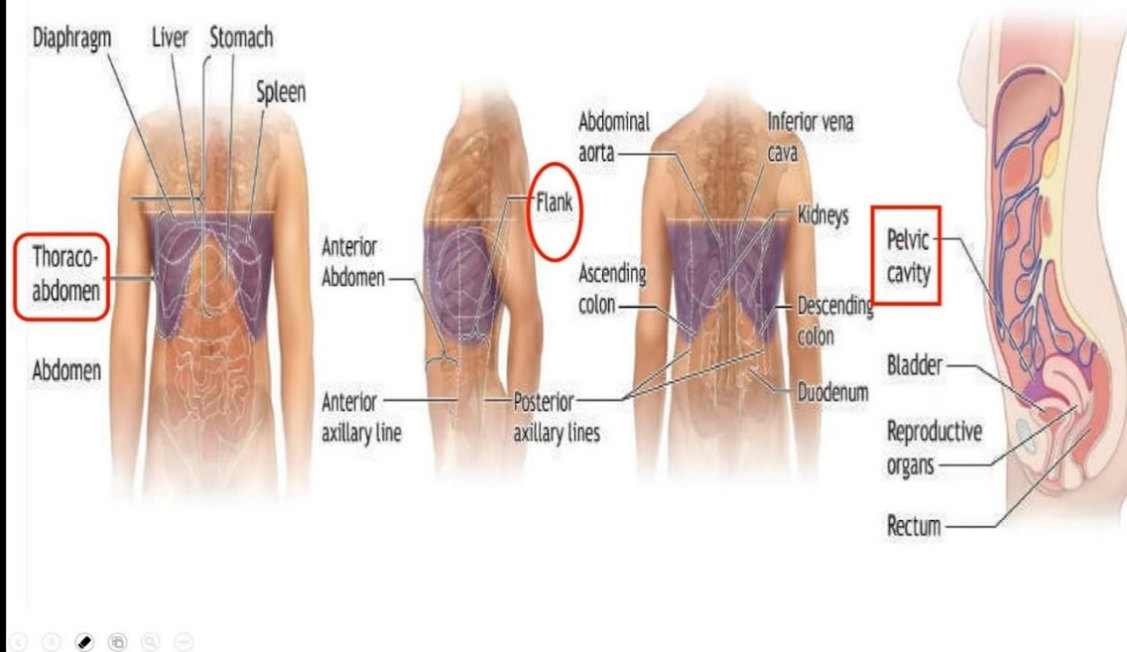
- ▶ Flank
- ▶ Anteriorly – Ant axillary line
- ▶ Posteriorly – Post axillary line
- ▶ Superiorly – 6th ICS
- ▶ Inferiorly – Iliac crest
- ▶ Thick musculature – partial barrier to penetrating wounds

Retroperitoneal Injury

- Anatomical boundaries.



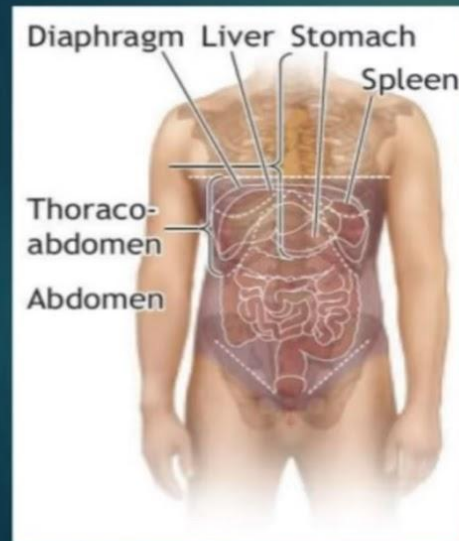
Regions of the abdomen



Thoraco-Abdomen

Regions of abdomen

4



▶ Thoraco Abdomen

▶ Inferior to

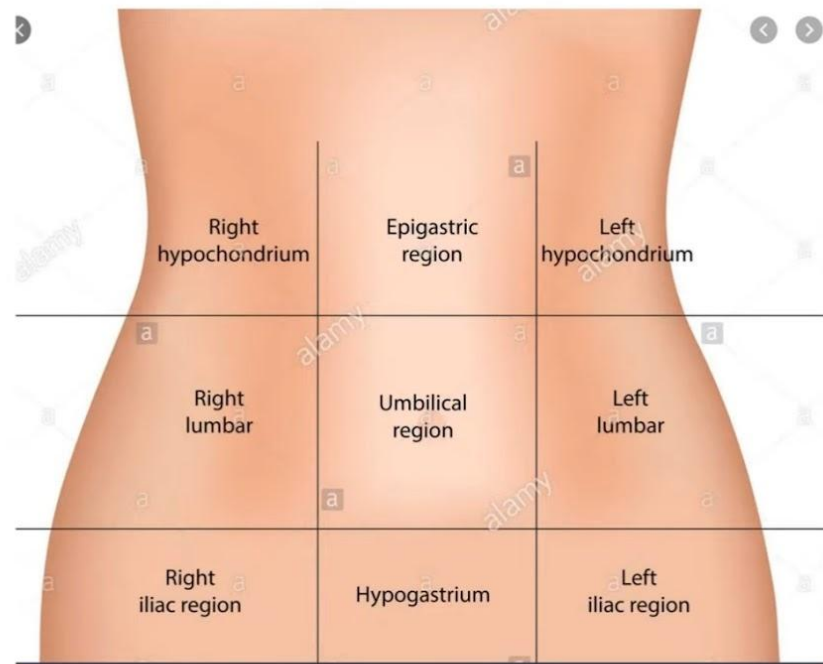
- ▶ Anteriorly: Trans-nipple line
- ▶ Posteriorly: Infra-scapular line

▶ Includes

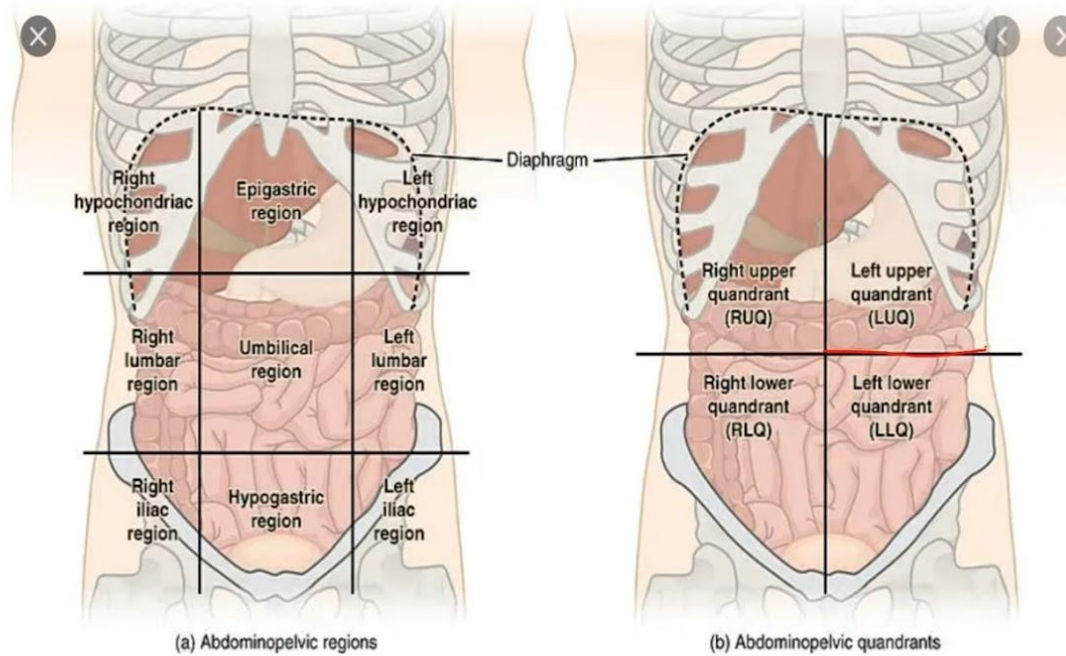
- ▶ Diaphragm, Liver, Spleen & Stomach

- ▶ Full expiration → diaphragm rises to 4th ICS → Abdo viscera may be injured by penetrating wounds/ # lower ribs

Nine regions of abdomen



Regions of abdomen



Abdominal Trauma

Mechanisms of Injury

Blunt trauma

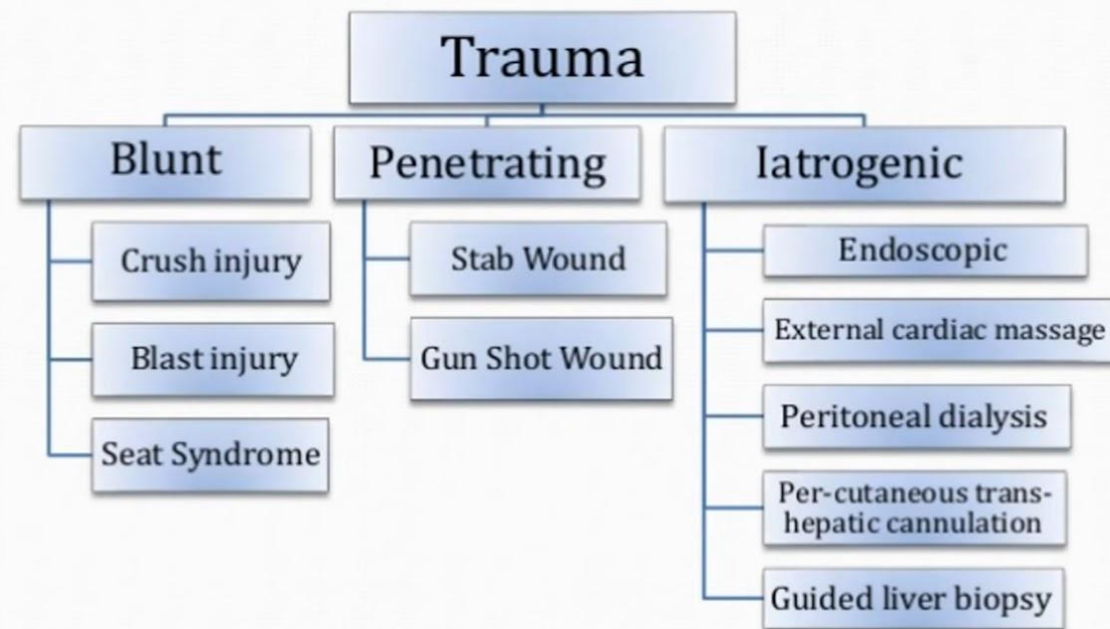
- *RTA (MVC)* 75%
- *Fall from height*
- *Crash injury* }
- *sport injury* }

Penetrating injuries

- Stab Wounds
- Gunshot Wounds 90% }
- Explosions with shrapnel }



Classification of Abdominal Trauma



Mechanisms of injury in BAT

Compression

Steering wheel/ seat belt injury

Solid Visceral Injury
(most common
(spleen)

hollow viscera
(less commonly)

combination
(pancreatico - duodenal
injury)

Deceleration → shear injury

**Organ & blood vessels stretching @
points of attachment**

Solid Organ injuries
(liver most common)

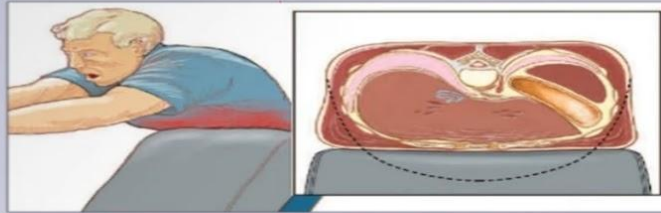
Mesenteric vessels
hemorrhage or
ischemia

**Intestinal perforation or
contusion**

Rare AA-dissection
with incomplete or
complete occlusion

Forces behind abdominal injury

Blunt trauma, a force to the abdomen that doesn't leave an open wound, commonly occurs with motor vehicle crashes (MVCs) or falls. Compression and shearing are examples.



Compression is the result of a direct blow, such as being thrust against a steering wheel or seat, or with pressure from a seat belt.

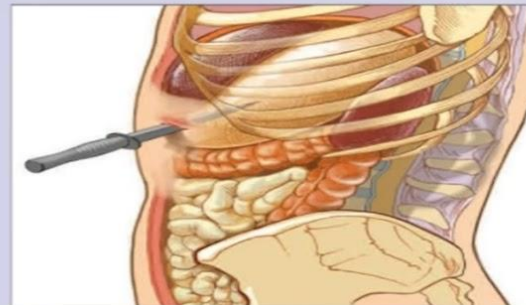


Shearing is common during rapid deceleration in an MVC as a portion of the tissue continues to move forward while another portion remains stationary. Here, the liver has torn away from the portal vein.

Penetrating trauma causes an open wound, such as from a gunshot or stabbing. The *solid organs*—diaphragm, spleen, liver, pancreas, and kidneys—can bleed profusely when injured. The *hollow organs*—stomach, gallbladder, large intestine, small intestine, and bladder—generally don't bleed significantly but damage to them is more likely to cause peritonitis.

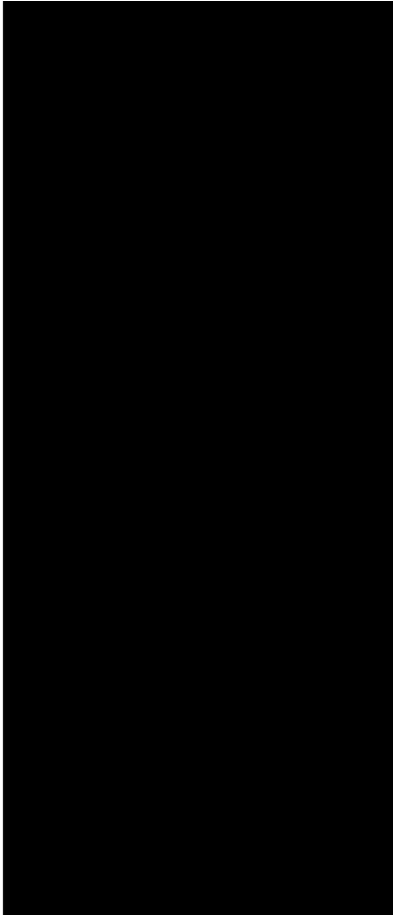


A gunshot can damage multiple organs because of high bullet velocity or fragmenting. The patient needs surgery to repair the injured tissues and remove bullet fragments.

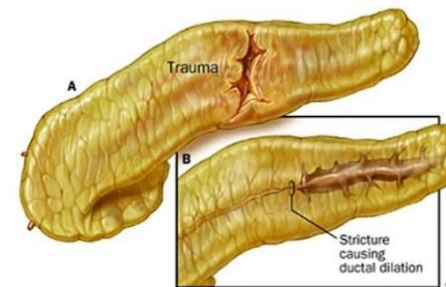
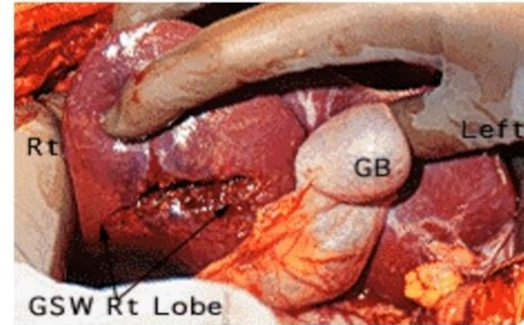


A stab wound is typically more localized and may be less damaging.

100

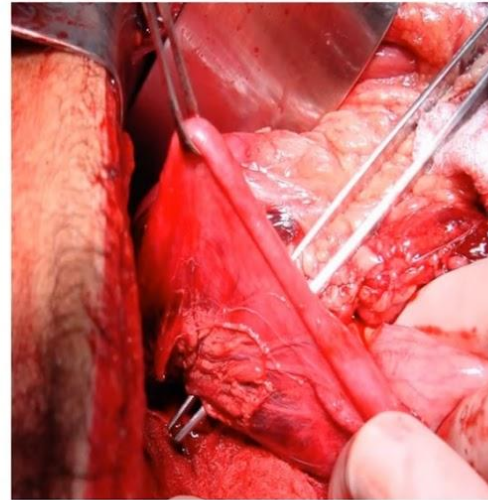


Compression injury in Blunt trauma



Bowel rupture secondary to BAT

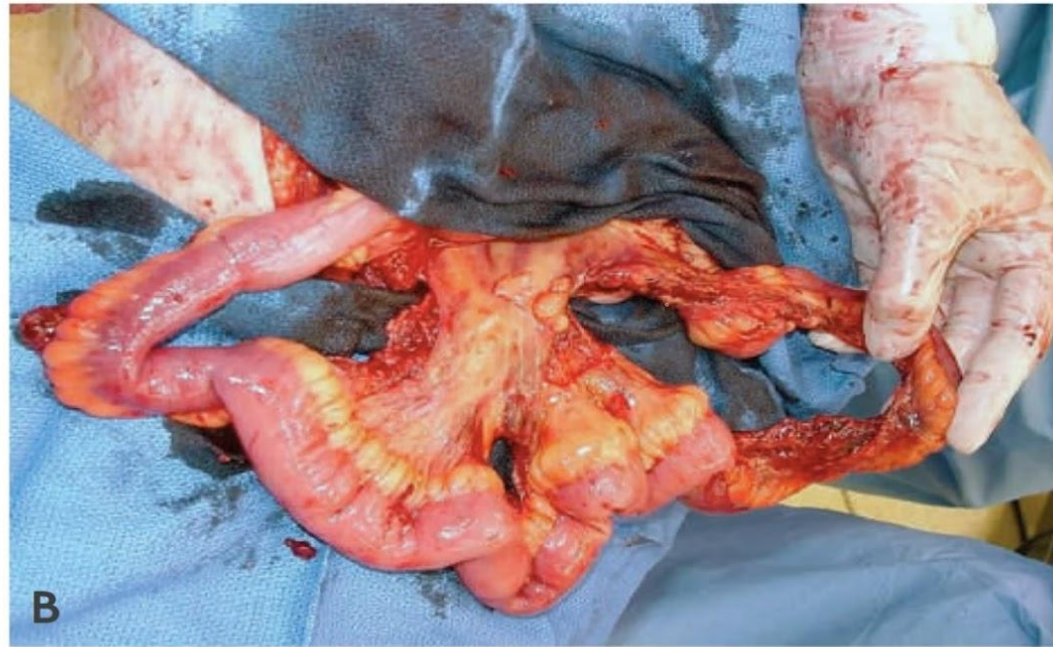
Shear injury in Blunt trauma



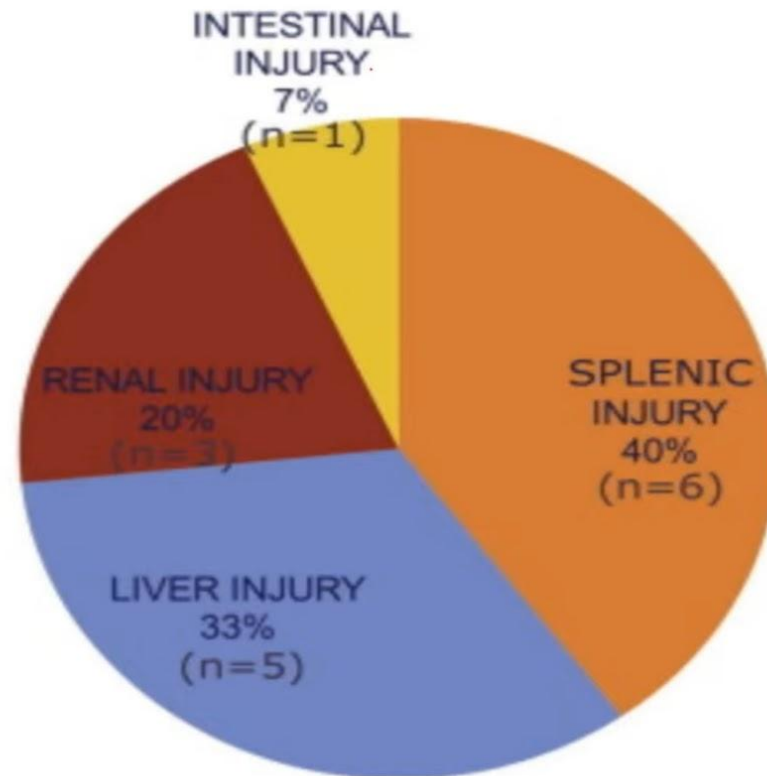
Bucket Handle Injuries.



Lap Belt and Bucket Handle Injuries.



Patients with Intra-abdominal Injury following Blunt Abdominal Trauma



Mechanisms of injury in PAT

Stab injury

Low energy, lacerations

The incidence of organ damage varies with the direction of entry into the peritoneal cavity)

- Most stab wounds do not cause an intraperitoneal injury. 70%
- multiple in 20% of cases
- involve the chest in up to 10%

Gunshot injury

Degree of injury depends on

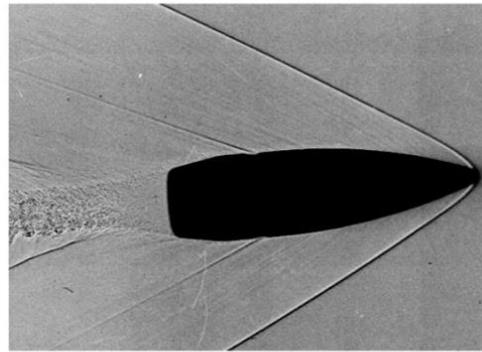
- Amount of kinetic energy released by the bullet
- Mass of the bullet
- Distance .

- multiple organ injuries are sustained,
- perforations to bowel (most commonly)

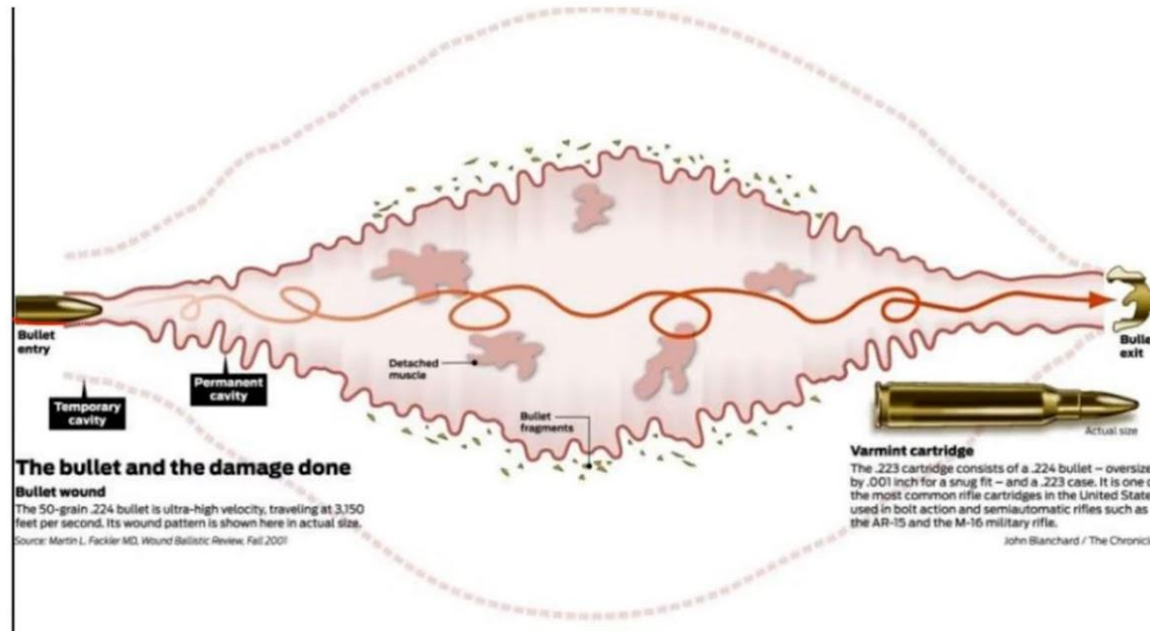
Mechanisms of injury in PAT

Penetrating injury occurs

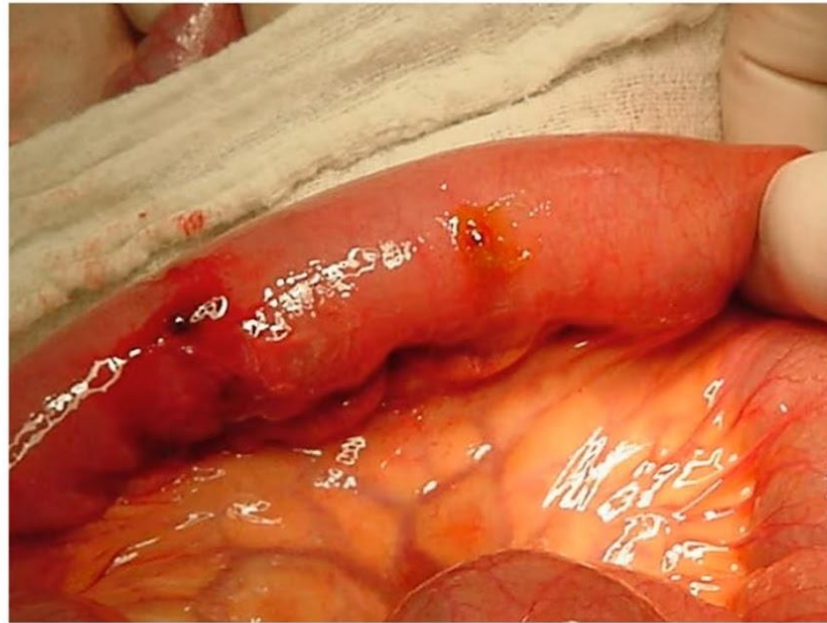
- Directly from the object causing the injury
- Or from kinetic energy released by the object. This can cause cavitation.

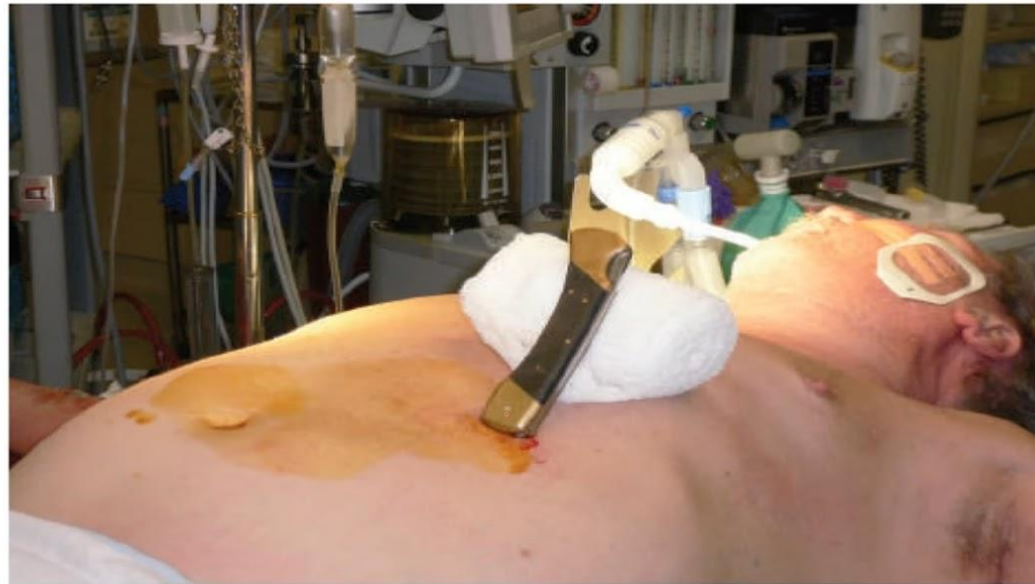


Cavitation



Multiple small bowel perforations





■ **FIGURE 5-3** Stab wounds most commonly injure the liver, small bowel, diaphragm, and colon.

***CLINICAL ASSESSMENT OF PT
WITH ABDOMINAL TRAUMA .***

PHYSICAL EXAMINATION

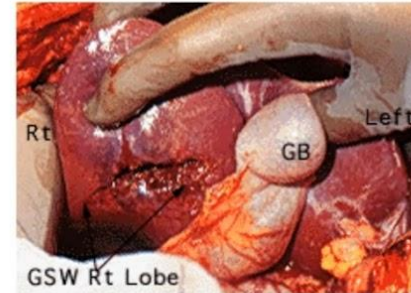
- The abdominal examination is conducted in a systematic sequence:
 - Inspection.
 - Auscultation.
 - Percussion.
 - palpation.
- ❖ This is followed by examination of the pelvis and buttocks, as well as; urethral, perineal, and, if indicated, rectal and vaginal exams.

Abdominal Trauma Physical Exam

Inspection – look for:

- Abrasions / lacerations (Abd, flank, or back)
- Ecchymosis, Cullen and Gray-Turner signs
- Abdominal distension May signify bowel obstruction or bleeding
- Penetrating wounds (log roll pt) & assess back also
- Evisceration

***Extra-abdominal injury is important in
identifying the risk of abdominal injury***
Bruise in the Rt hypochondrium

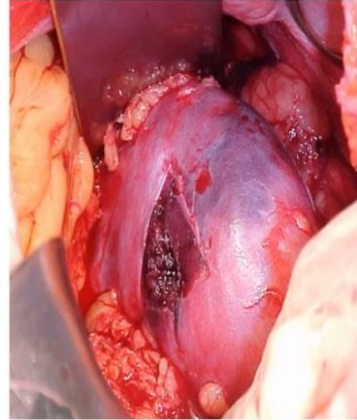


- Liver 2nd most common injured organ in BAT
- Most common fatal abdominal injury
- Mortality 10-20%

Extra-abdominal injury is important in identifying the risk of abdominal injury

Flank ecchymosis

- Renal Injuries.
- Most common injury is a contusion, then lacerations or fractures.
- Deceleration forces may injure the renal artery.



***Extra-abdominal injury is important in
identifying the risk of abdominal injury***
Bruise in the lt hypochondrium



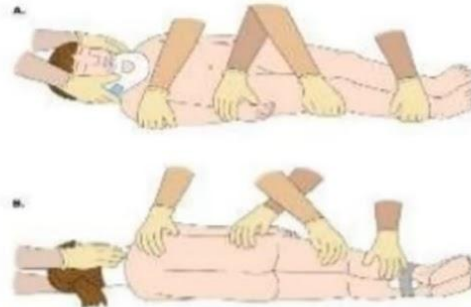
***Ecchymosis
(Gray-Turner sign, Cullen's sign)***



Grey Turner's Sign and Cullen's Sign ~ 12 hours or later
Hemorrhage usually from pelvic or lumbar fractures

EXPOSURE

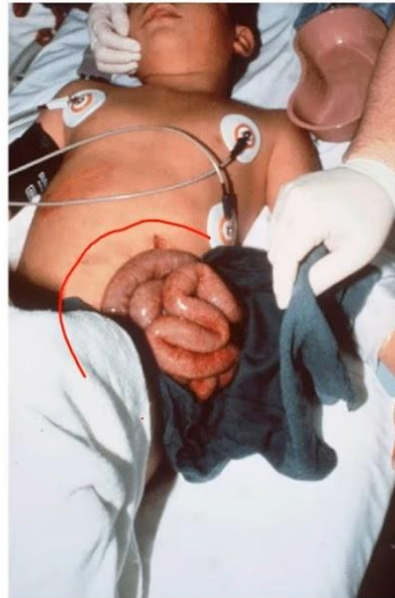
- ✦ Primary assessment is incomplete without thorough examination of total body surface area
- ✦ **Log roll** should be done in all unconscious patients
- ✦ Inspect & palpate entire spine & back, P/R for anal tone, blood & prostate
- ✦ Meatal bleed S/O urethral rupture, **DO NOT CATHETERIZE**



Penetrating wounds
(Log Roll Pt) and assess back also



Evisceration



Abdominal Trauma Physical Exam (con't.)

- ***Inspection of genitalia (UB & Urethral Injuries)***
 - Important to do in all patients
 - Majority are caused by blunt trauma
 - Bladder ruptures associated with pelvic trauma
- Look for**
- Blood at urethral meatus.
 - Perineal or scrotal hematomas.



*Extra-abdominal injury is important in
identifying the risk of abdominal injury*
A seat belt bruise



Figure 2: Telltale seatbelt sign of bruising across the abdomen

Abdominal Trauma Physical Exam (con't.)

Palpation:

- Assess for tenderness, guarding, mass, crepitus
- Differentiate lower rib tenderness from true abdominal tenderness.
- Palpate back .
- Palpate Lumbar or Thoracic Spine for tenderness.
- Assess pelvic wings for stability & tenderness

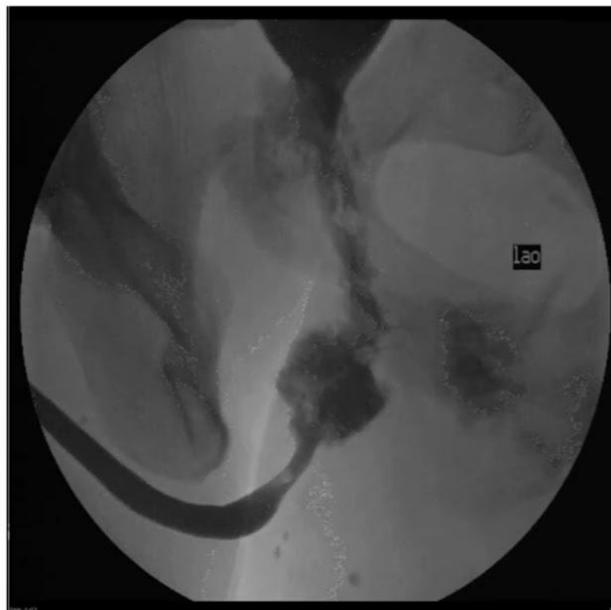
Pelvic fractures



Figure 1: Firm end points at distraction or compression indicates that there is no gross instability



Retrograde Urethrogram



Abdominal Trauma Reliability of Physical Exam

- Clinical examination less reliable for Diagnosing and excluding intra-abdominal injury
- 20% of patients with major blunt abdominal trauma *have benign abdominal exams on initial presentation.*

Abdominal Trauma Physical Exam (con't.)

Rectal Exam

- Is Important to do in almost all patients
- Check for:
 - Sphincter muscle tone.
 - Blood and bony fragments.
 - Prostate position (“high-riding”?)
 - Should be done before placing Foley catheter.

Abdominal Trauma Reliability of Physical Exam

Physical findings (Tenderness or Guarding) may be absent, reduced, or masked if:

- Head trauma / Altered mental status(alcohol).
- Uncooperative Patient.
- Hypotension.
- Spinal cord injury.
- Distracting injuries.
- Hypoxia from associated Thoracic injuries.



**A missed Abdominal
Injury can cause a
Preventable Death.**

Four essential components

- Rapid primary survey
- Resuscitation +adjunct interventions.
- Detailed secondary survey (evaluation)
- Re-evaluation

- **Primary survey**

- A** Airway maintenance with cervical spine protection
- B** Breathing and ventilation
- C** Circulation with hemorrhage control
- D** Disability : Neurological status
- E** Exposure/Environmental control : completely undress the patient, but prevent hypothermia

RESUSCITATION

- Protect/Secure airway & protect C-spine
- Breathing/Ventilation/Oxygenation
- Vigorous shock therapy
 - At least two large - caliber IV line
 - Crystalloid solution (Ringer's lactate 2~3 liter)
 - Type-specific blood
 - Surgical intervention
- Protect from Hypothermia : 39°C warm IV fluid
- Urinary/gastric catheters unless contraindication

Goals for early resuscitation

- Maintain SBP at 80-100 mmHg
- Maintain hematocrit at 25-30%
- Maintain the PT & PTT in normal ranges
- Maintain the platelet count at >50000/ HPF
- Maintain normal serum ionized calcium
- Maintain core temp higher than 35 C
- Maintain function of the pulse oximeter
- Prevent an increase in serum lactate
- prevent acidosis from worsening
- Achieve adequate anaesthesia and analgesia

		Class I	Class II	Class III	Class IV	
	Blood loss (mL)	Up to 750	750-1500	1500-2000	>2000	
	Blood loss (% blood volume)	Up to 15%	15%-30%	30%-40%	>40%	
	Pulse rate (BPM)	<100	100-120	120-140	>140	
	Systolic blood pressure	Normal	Normal	Decreased	Decreased	
	Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased	
	Respiratory rate	14-20	20-30	30-40	>35	
	Urine output (mL/hr)	>30	20-30	5-15	Negligible	
	CNS/mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic	
	Initial fluid replacement	Crystalloid	Crystalloid	Crystalloid and blood	Crystalloid and blood	

TABLE 3-1 SIGNS AND SYMPTOMS OF HEMORRHAGE BY CLASS

PARAMETER	CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
Approximate blood loss	<15%	15–30%	31–40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓	↓
Base deficit ^a	0 to –2 mEq/L	–2 to –6 mEq/L	–6 to –10 mEq/L	–10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion Protocol

^a Base excess is the quantity of base (HCO_3^- , in mEq/L) that is above or below the normal range in the body. A negative number is called a base deficit.

TABLE 3-2 RESPONSES TO INITIAL FLUID RESUSCITATION^a

	RAPID RESPONSE	TRANSIENT RESPONSE	MINIMAL OR NO RESPONSE
Vital signs	Return to normal	Transient improvement, recurrence of decreased blood pressure and increased heart rate	Remain abnormal
Estimated blood loss	Minimal (<15 %)	Moderate and ongoing (15%–40%)	Severe (>40%)
Need for blood	Low	Moderate to high	Immediate
Blood preparation	Type and crossmatch	Type-specific	Emergency blood release
Need for operative intervention	Possibly	Likely	Highly likely
Early presence of surgeon	Yes	Yes	Yes

^a Isotonic crystalloid solution, up to 1000 mL in adults; 20 mL/kg in children

Abdominal Trauma Investigations: Lab Studies

- Blood Type and cross match.
- CBC .
- Urinalysis.
- Serum amylase.
- Liver function tests (LFT's).
- Electrolytes, BUN , creatinine.
- Glucose.

Abdominal Trauma Usefulness & Interpretation of Lab Results

CBC

- HCT can be normal initially even with acute hemorrhage

WBC: ↑ can be from:

- ✓ General stress of trauma
- ✓ Fractures
- ✓ Liver or splenic injury
- ✓ Concurrent infections
- Elderly or immunocompromised patients may not increase the WBC count appropriately.

Abdominal Trauma

Usefulness & Interpretation of Lab Results

Serum amylase

- May be normal with pancreatic injury.
- May be elevated from trauma to salivary glands.
- Height of elevation not correlated with injury severity.

Urinalysis

- Dipstick for hemoglobin just as accurate as full microscopic exam for hematuria.
- Can be normal even with some types of GU tract injury.

Abdominal Trauma Usefulness & Interpretation of Lab Results

LFT's

- AST & ALT elevated with liver injuries.
- SGOT increased also with muscle injuries.
- Not needed on most trauma cases.

Glucose

- Important emergently if altered mental status (to rule out hypoglycemia).

Electrolytes / BUN / Creatinine

Usually not needed unless patient has known renal failure or is on diuretics

Radiological studies

Diagnostic studies

- Confirmation of the presence or absence of blunt abdominal injury, relies largely on the use of diagnostic studies .

■ FAST, CT, DPL

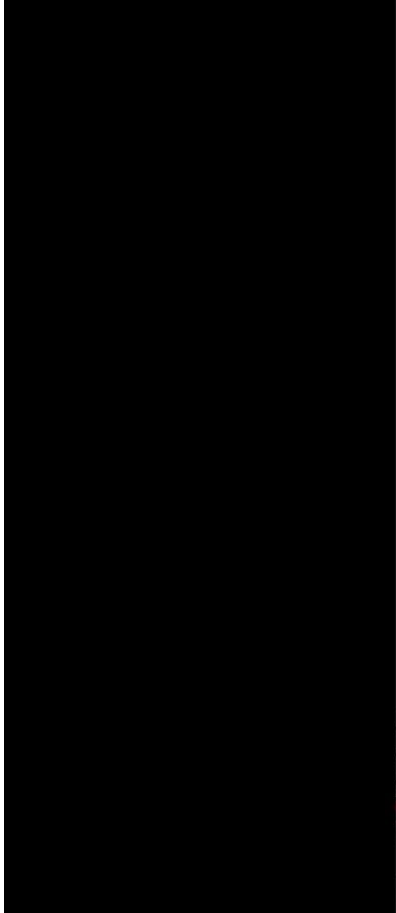
Abdominal Trauma Investigation

Chest and pelvic X rays

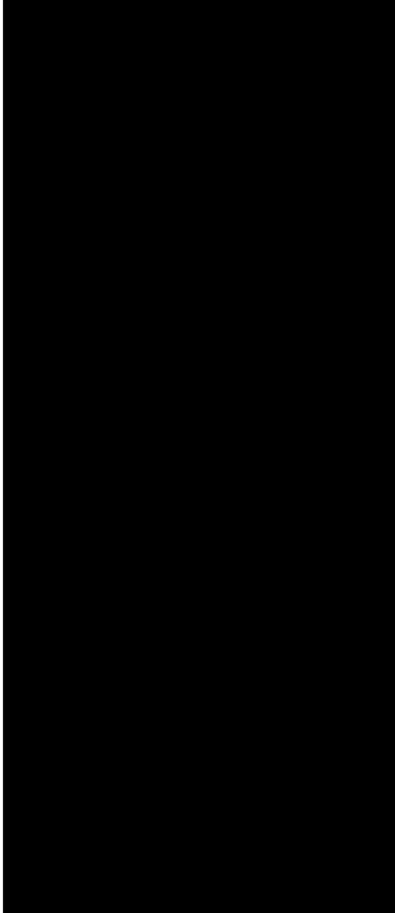
- Should be done routinely for major BAT
- Have an important role as adjuncts to the primary survey of trauma patients.
- Cannot rule out intra-abdominal bleeding or visceral injury.
- Look for position of NG tube.

Plain abdominal X rays

- ☐ ***Has No Role***
- ☐ May provide indirect evidence of hollow viscus injury , but lacks sensitivity & specificity.



- ✓ Laser Pointer
- ✓ Pen
- ✓ Highlighter
- Eraser
- ✓ Erase All Ink on Slide

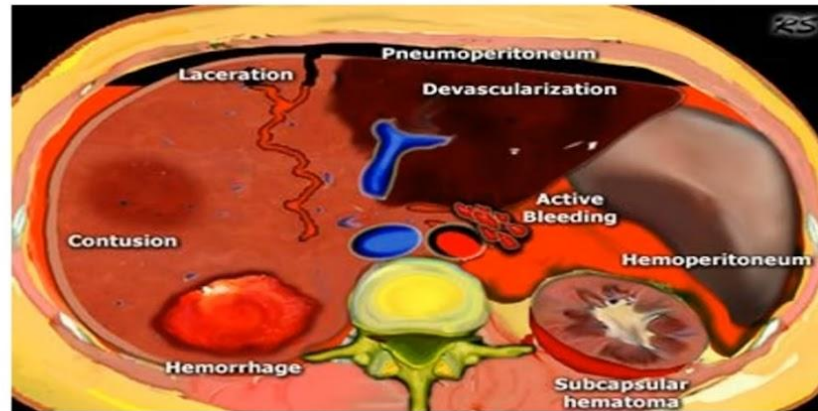


abdominal trauma ***Investigation***

The presentation of BAT

Hemodynamic Instability
(major hemorrhage)

Hemodynamic Stability
(hollow viscus injury)



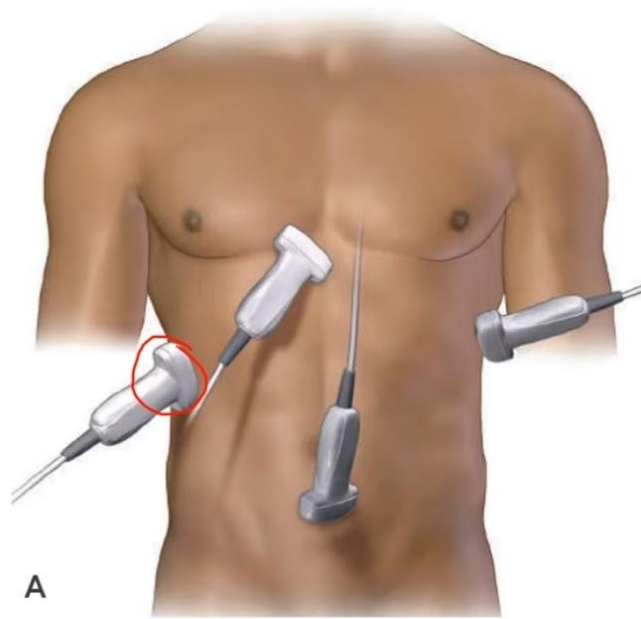
FAST
(Focused Assessment with Sonography for Trauma)

- Performed rapid and without moving the patient from ER.
- Good for solid organ injury.
- Demonstrate presence of free intraperitoneal fluid.

How much fluid can FAST detect?

- ✓ 250 cc total
- ✓ 100 cc in Morison's pouch

FAST



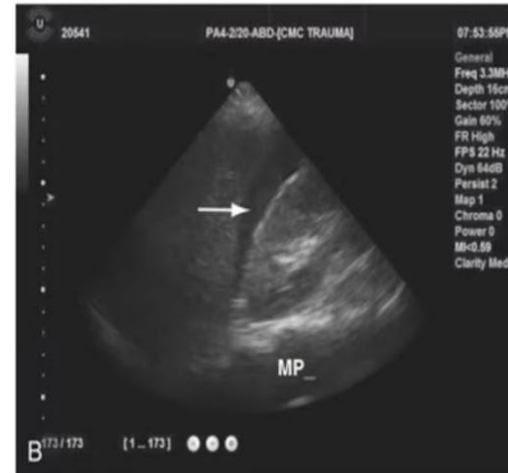
FAST



■ **FIGURE 5-4** Focused Assessment with Sonography for Trauma (FAST). In FAST, ultrasound technology is used to detect the presence of hemoperitoneum.

FAST

- Perihepatic & (Morrison's pouch)



FAST

Peri splenic



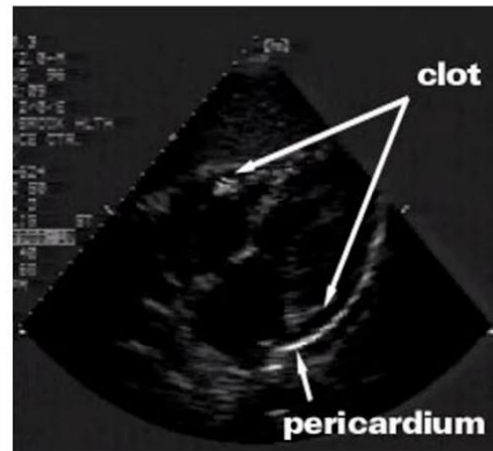
FAST

- Retro vesicle (Pouch of Douglas)



FAST

- Pericardium (sub-xiphoid)



FAST

Limitation

- Obesity, bowel gas.
- Can't distinguish blood from ascites.
- Cannot assess hollow visceral perforation.
- Operator dependent.
- Retroperitoneal structures and diaphragm are not visualized.

FAST

Limitation

- Obesity, bowel gas.
- Can't distinguish blood from ascites.
- Cannot assess hollow visceral perforation.
- Operator dependent.
- Retroperitoneal structures and diaphragm are not visualized.

Approaches to investigation HS patient

CT is the investigation of choice

- Highly accurate , 98% sensitive in detecting intraperitoneal bleeding.
- Modality of choice for retroperitoneum, diaphragmatic injuries.
- ***Highly Accurate in Detecting and Grading Solid Organ Injuries(Liver and Spleen).***
- ***less Sensitive for Hollow Viscus Injuries .***
- If oral (via NG) & IV contrast used, CT can readily identify GI tract perforations & GU injuries.

Approaches to investigation

CT versus US in HS patient

- No evidence in favor of US in blunt trauma, US lacks the degree of sensitivity and specificity required in this setting .
- Because Up to 25% of hepatic and splenic injuries ,most renal injuries and virtually all pancreatic, mesenteric, bladder, and gut injuries may be missed by US.

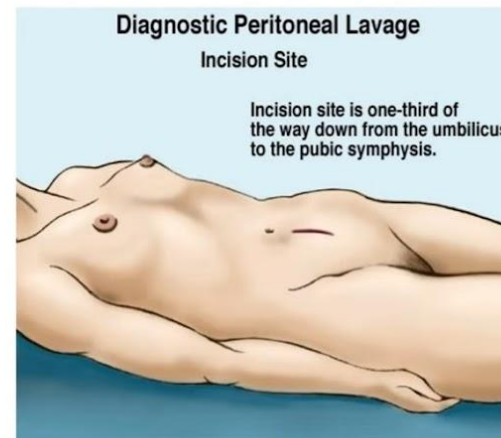
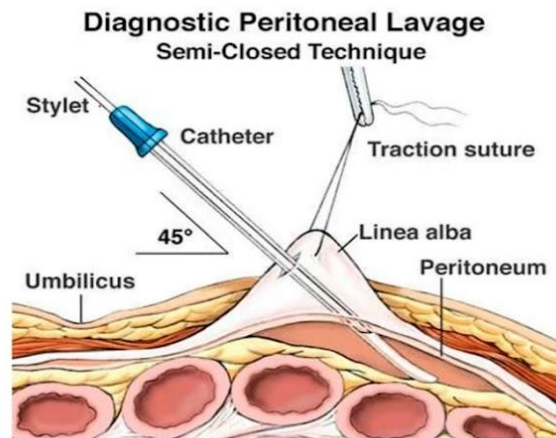
Diagnostic peritoneal lavage DPL

- Highly accurate , 98% sensitive in detecting intraperitoneal bleeding. but low specificity for bleeding source.
- Largely replaced by FAST and CT .
- More sensitive than CT or US for detection of hollow viscus injury

Diagnostic peritoneal lavage

Preferred Site

- Standard adult and pediatric :Infra-umbilical midline
- 2nd & 3rd trimester pregnancy : Supraumbilical (Suprauterine)
- Midline scarring :Left lower quadrant
- Pelvic fracture: Supraumbilical



DPL



■ **FIGURE 5-6** Diagnostic Peritoneal Lavage (DPL). DPL is a rapidly performed, invasive procedure that is sensitive for the detection of intraperitoneal hemorrhage.



Positive criteria for assessing DPL

Any of these indicate need for laparotomy:

- ***Blood*** > ***10*** mls blood on opening abdomen.
- ***RBC*** count > 100,000 / ul
- ***WBC*** count > 500 /ul.
- Amylase > 175 U/ml.
- presence of fecal matter or bile.
- Lavage fluid exits via chest tube, NG tube, foley.
- ***If unable to get fluid return, may need to consider as positive***

Contraindications to DPL

Absolute

- Need for laparotomy already known (Peritonitis, Injured diaphragm, Free air, Gunshot wound, Evisceration).

Relative :

- Previous laparotomy scar (adhesions)
- Morbid obesity
- Advanced pregnancy (*II- or III-trimester*)
- Advanced cirrhosis (because of portal hypertension and the risk of bleeding).
- Coagulopathy.

Limitation of DPL

- Invasive procedure (risk of visceral injury 0.6%)
- Does not detect Diaphragmatic / Retroperitoneal injuries.
- High false-positive rate in presence of pelvic #
- **DPL : Resulting a high non-therapeutic laparotomy of up to 36% (Not all patient with intraperitoneal blood require laparotomy).**

	<u>DPL</u>	<u>FAST</u>	<u>CT SCAN</u>
Indications	Document bleeding if hypotensive	Document fluid if hypotensive	Document organ injury if BP normal
Advantages	•Early diagnosis •All patients •Rapidly performed •Sensitivity 98% •Detects bowel injury •Transport : No	•Early diagnosis •All patients • Rapidly performed •Non invasive •86- 97% accurate •Transport: No	•Most specific for injury •Sensitive 92-98%
Disadvantages	•Invasive •Low specificity •Misses injury to diaphragm and retroperitoneum	•Operator dependant •Bowel gas and subcutaneous air distortion •Misses injury to diaphragm ,bowel and pancreas	•Increased cost and time •Transport required •Misses injury to diaphragm ,bowel and sometimes pancreas

Free fluid, But No Solid Organ injury, on CT

- Is a concern, particularly in neurologically compromised patients.
- In the majority, the fluid is blood and of no further consequence, however , *in 25% the fluid is GI-content.*
- Awake patients managed according to clinical examination findings, whereas neurologically compromised patients should undergo DPL
- The exclusion of hollow viscus injuries by imaging alone can be difficult

Abdominal Trauma Other Diagnostic Studies

Intravenous Pyelogram (IVP): If contrast CT not available:

- Suspected GU tract injury ? IVP for hematuria
- Not as accurate as CT for renal trauma



Abdominal Trauma Other Diagnostic Studies

Retrograde Urethrogram



Blood at the meatus

Scrotal Ecchymoses

High riding prostate

Approaches to investigation

- The primary aim is to arrest bleeding and this usually require laparotomy .
- The investigation of choice is limited US (FAST).
- *“Death begins with a CT.”* Never send an unstable patient to CT. FAST, however, can be performed during resuscitation.

Abdominal Trauma Other Diagnostic Studies

Laparoscopy

- Increasingly used in assessing trauma.
- Useful in determining peritoneal penetration and identifying diaphragmatic injuries.
- Also can be used for treating certain injuries.

Abdominal Trauma

Other Diagnostic Studies

- Lumbar spine AP & lateral depends on the type of injury
- LS CT or MRI especially in patients with Neuro. Deficit.



Figure 2: Telltale seatbelt sign of bruising across the abdomen



Abdominal Trauma Management

- The complexity of abdominal trauma management is the result of the almost infinite variety of possible injuries and combination of injuries.



Abdominal Trauma Treatment Priorities

First: Recognize presence of shock / bleeding .

Second : Start resuscitation for shock / bleeding.

Third: Decide if abdomen is source for shock or bleeding.

Fourth: Decide if emergency laparotomy needed.

Fifth : Complete secondary survey, lab, and radiographic studies to determine if “occult” abdominal injury is present.

Sixth : Frequent Reassessments.

CIRCULATION AND HEMORRHAGE CONTROL

- **ASSESS-**

- PULSE RATE AND CHARACTER
- SKIN COLOUR AND TEMPERATURE
- CONSCIOUS LEVEL(GCS)
- CAPILLARY REFILL TIME
- DECREASED URINE OUTPUT
- HYPOTENSION-A LATE SIGN WHEN $\geq 30\%$ BLOOD VOLUME LOST.

- **Stopping the bleeding : most important priority**

Hypotensive unstable patient

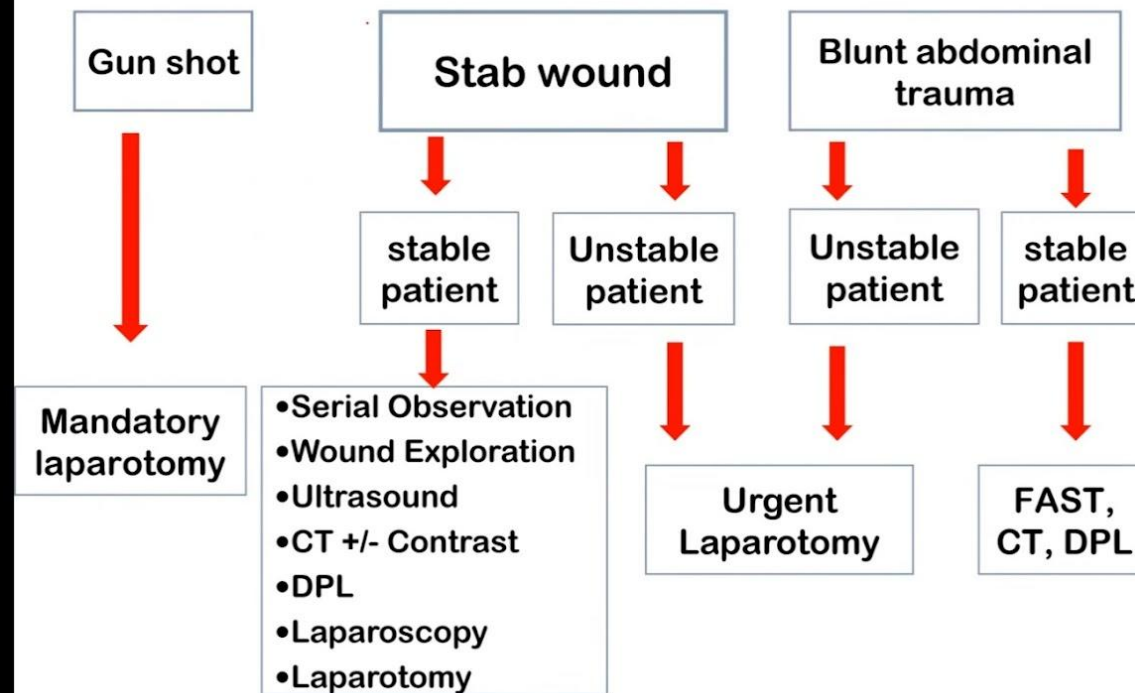
- Start in the Neck (distended veins) .
- FAST for Abdominal Cause.
- Spinal cord injury .
- External blood loss .
- Internal blood loss from associated fractures.

“Golden Hour”

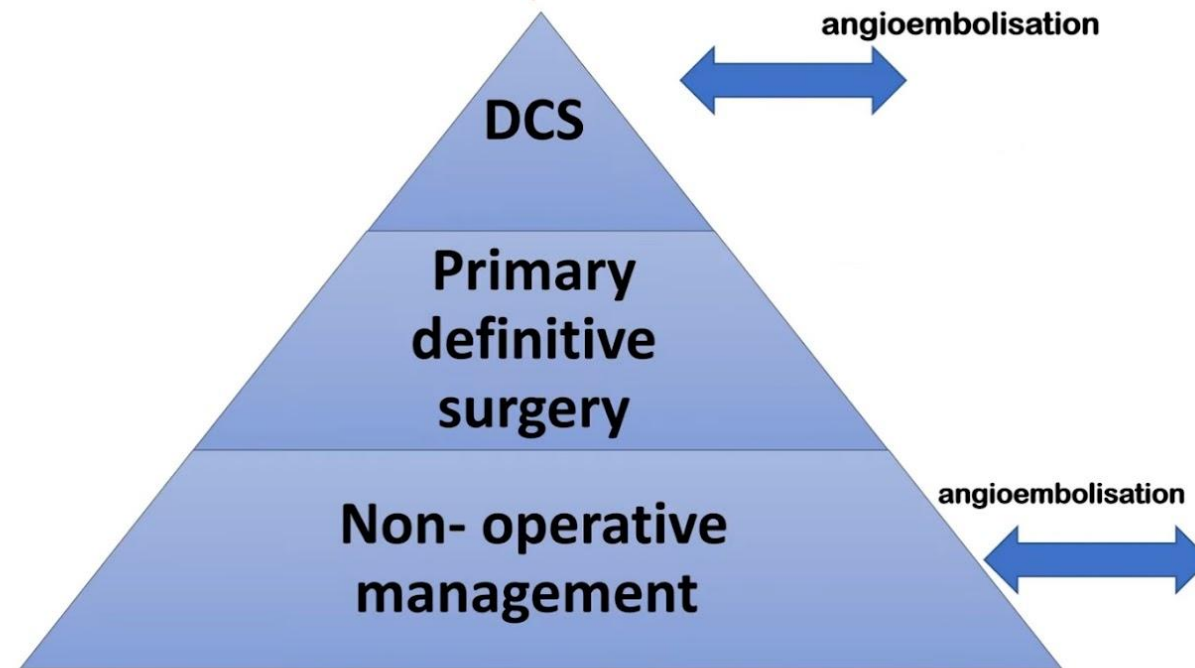
ACS concept that

- ❖ Deaths & complications are reduced when trauma victims receive definitive treatment within the 1st hour after injury.

Strategies for management of abdominal trauma



Strategies for Management of Abdominal Trauma



Non-Operative Management of Solid Organ Injury

- ICU monitoring.
- Frequent F.U. physical exams
- Frequent HCT required

TIP

Decision to treat is base on
the patient stability
& absence of associated
injury necessitating
laparotomy

❖ About 60-80% of blunt splenic injuries/ 85-98% of hepatic injuries and 95% of renal injury can be managed non-operatively with success rates about 95% .

Non-Operative Management of Solid Organ Injury

- The Non-operative management of liver injuries is associated with higher morbidity than splenic injuries.

Complications

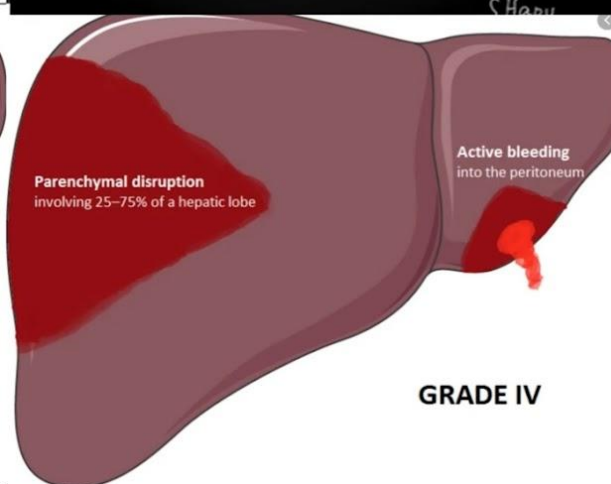
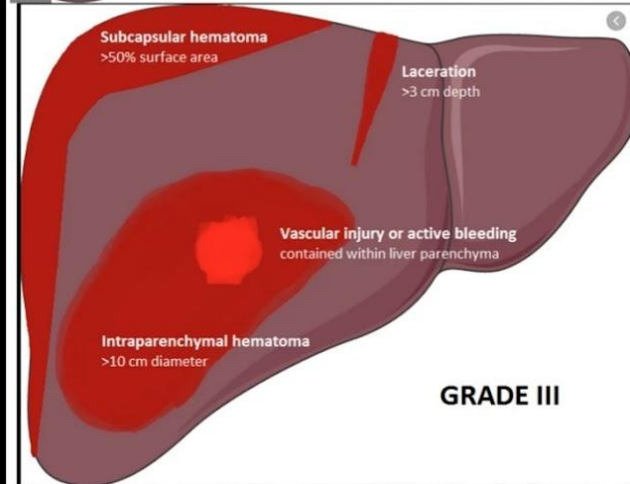
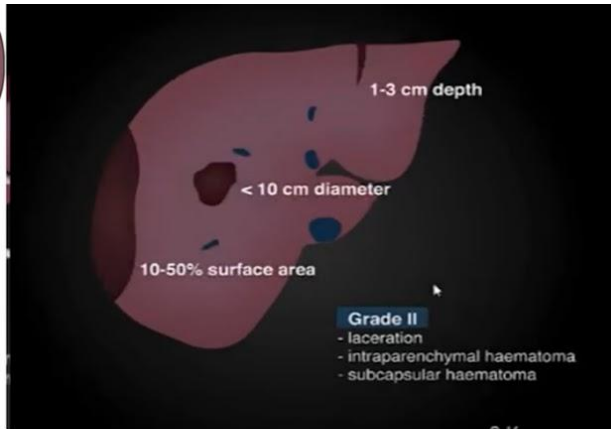
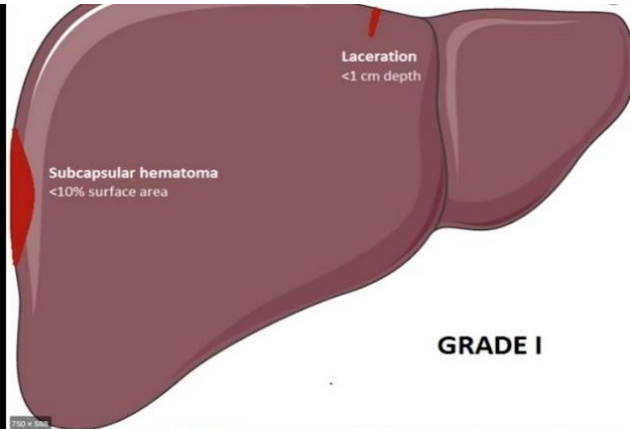
- Delayed hemorrhage.
- hepatic abscess.
- Biloma .
- Haemobilia.

Hepatic CT Injury Grading Scale

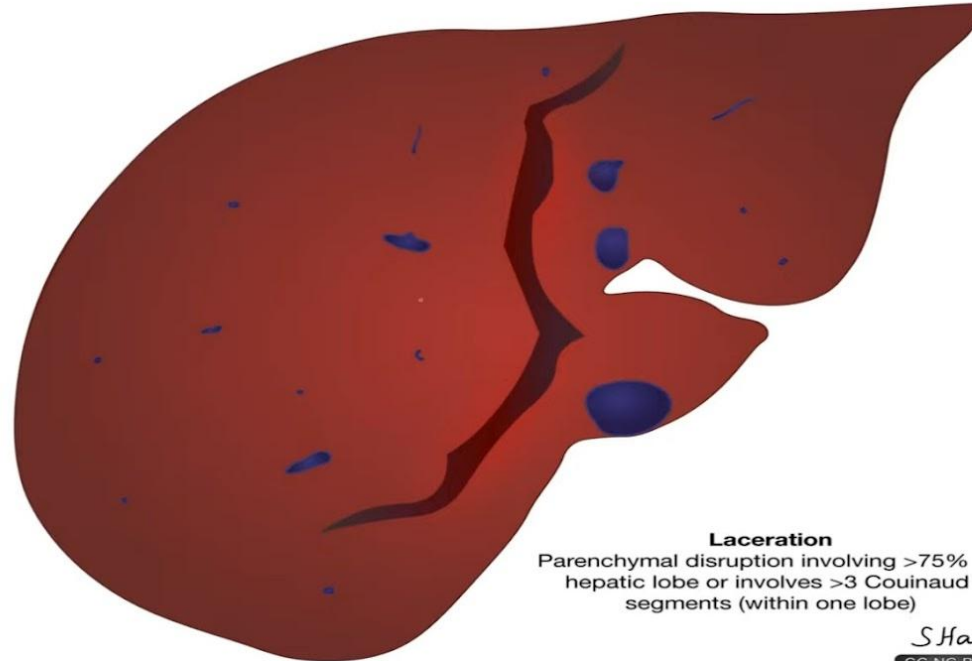
- | | |
|-----------|--|
| Grade I | Laceration(s) < 1 cm deep
Subcapsular hematoma < 1cm diameter |
| Grade II | Laceration(s) 1-3 cm deep
Subcapsular or central hematoma 1-3cm diam |
| Grade III | Laceration(s) 3-10 cm deep
Subcapsular or central hematoma 3-10 cm diam |
| Grade IV | Laceration(s) > 10 cm deep
Subcapsular or central hematoma > 10cm diam
Lobar maceration or devascularization |
| Grade V | Bilobar tissue maceration or devascularization |

CT Grading of splenic injury

	Grade*	Injury Description
I	Hematoma	Subcapsular, <10% surface area
	Laceration	Capsular tear, <1 cm parenchymal depth
II	Hematoma	Subcapsular, 10-50% surface area; intraparenchymal, <5 cm in diameter
	Laceration	1-3 cm parenchymal depth which does not involve a trabecular vessel
III	Hematoma	Subcapsular, >50% surface area or expanding; ruptured subcapsular or parenchymal hematoma Intraparenchymal hematoma >5 cm or expanding
	Laceration	>3 cm parenchymal depth or involving trabecular vessels
IV	Laceration	Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
V	Laceration	Completely shattered spleen
	Vascular	Hilar vascular injury which devascularizes spleen



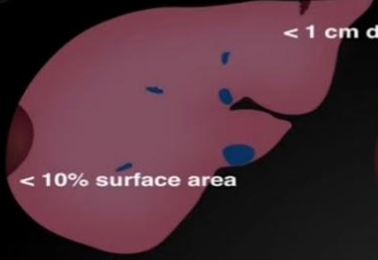
Grade V



Laceration
Parenchymal disruption involving >75% of
hepatic lobe or involves >3 Couinaud
segments (within one lobe)

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1800 x 1800

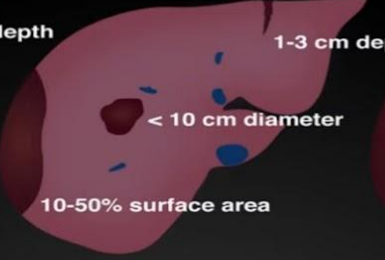


< 1 cm depth

< 10% surface area

Grade I

- laceration
- subcapsular haematoma



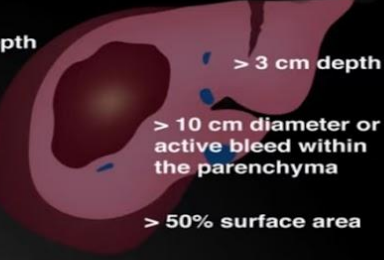
1-3 cm depth

< 10 cm diameter

10-50% surface area

Grade II

- laceration
- intraparenchymal haematoma
- subcapsular haematoma



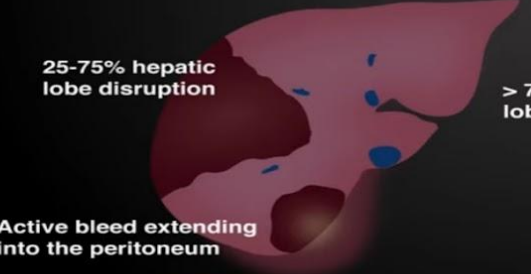
> 3 cm depth

> 10 cm diameter or active bleed within the parenchyma

> 50% surface area

Grade III

- laceration
- intraparenchymal haematoma
- contained active bleed
- subcapsular haematoma
- vascular injury
e.g. pseudoaneurysm or AV fistula



25-75% hepatic lobe disruption

Active bleed extending into the peritoneum

Grade IV

- parenchymal disruption
- active bleeding



> 75% hepatic lobe disruption

Caval and central major hepatic vein injury

Grade V

- parenchymal disruption
- juxtahepatic venous injury

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***Advance one grade for each additional injury upto grade III.**

Angiographic embolisation as an adjutant to non-operative management

❖ is increasingly used particularly in Hepatic-, Splenic-, Renal injuries HS- patients.



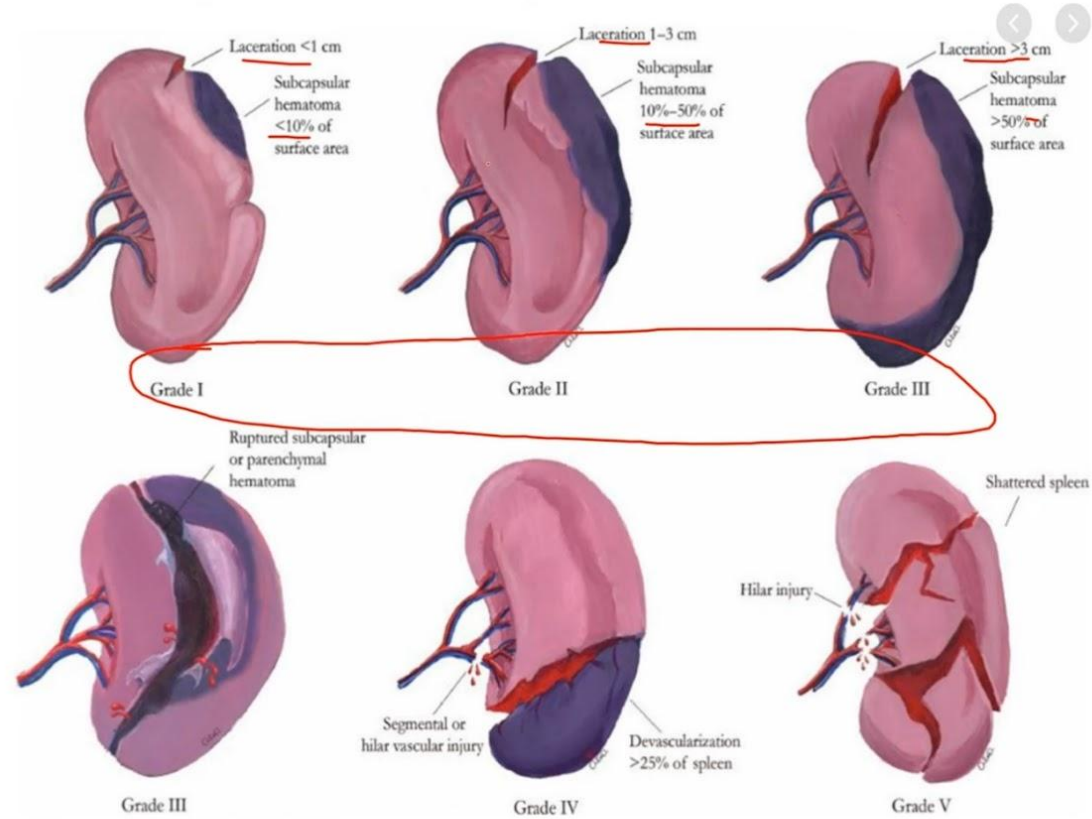


Figure 170.1. AAST grades of splenic injury.

***Damage Control Resuscitation and
Damage Control Surgery***



Damage control resuscitation and damage control surgery

- Severe Hemorrhage leads to lethal triad (Coagulopathy, Metabolic acidosis & Hypothermia) .
- Surgical haemostasias should be viewed as an extension of managing the lethal triad .
- Damage control resuscitation is a multimodal strategy for the restoration of normal physiology.

Damage Control

0. Initial Resuscitation

1. Control of Hemorrhage & Contamination.

- Abdominal packing, Shunting of vascular injuries and GI-resection without anastomosis.

2. Back to the ICU for Resuscitation.

- Correction of Hypothermia, Acidosis, Coagulopathy

3. Definitive repair of injuries & Definitive closure of the abdomen.

Angiographic embolisation as an adjuvant to DCS

- patients with complex hepatic injuries which diagnosed intra-operatively may benefit from this strategy .
- Perihepatic packing is used to control parenchymal bleeding followed by angiography and embolisation .
- Again this is in a combined operating/ interventional radiology

Primary Definitive Surgery

- Is appropriate in most abdominal injuries requiring operative treatment .
- DCS reserved for the most severely injured only.
- DCS is also associated with considerable potential morbidity .

POSTOPERATIVE ICU CONSIDERATION

1

- ABDOMINAL COMPARTMENT SYNDROME

2

- DEEP VENOUS THROMBOSIS

3

- SEPSIS

Conclusion

- Both the investigation and management of blunt abdominal trauma have undergone marked changes in recent years .
- **CT** is the investigation of choice
- **US** remains a useful tool for the diagnosis of intra-abdominal hemorrhage in the critically unstable patient.
- **DPL** has become virtually obsolete .

Conclusion

- *Interventional radiology* is likely to play an increasing role in the future. treatment will be provided by intensivists and radiologist and the surgeon's role will be changed to co-ordination of management.
- *Non-operative management* of solid organ injury has become the standard of care in hemodynamically stable patients in whom hollow viscus injury can be excluded with reasonable confidence.

Conclusion

- Immediate and skilled surgical intervention combined with expert resuscitation required in a small number of patients with catastrophic intra-abdominal injuries.

Thanks

