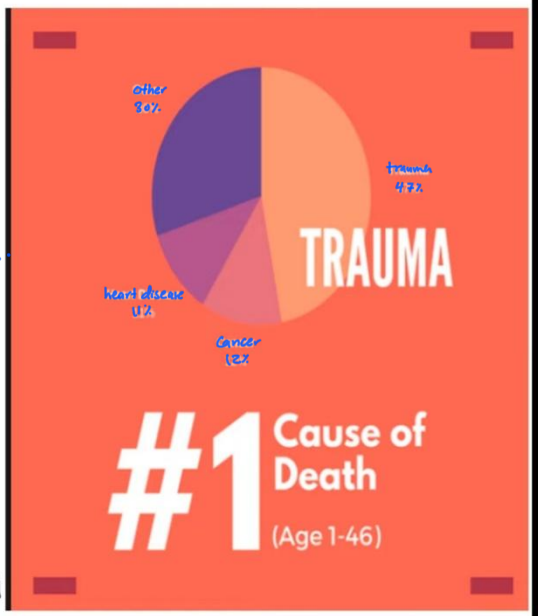

Abdominal Trauma
DR Elias Arteen
FRCSI

Background

- Trauma ,the *Fourth* leading cause of death in western and the leading cause of death in the first four decades of life
  - 4 6 year.
- The predominant mechanism is *Blunt injury 95%.* and 5% Pinterating injury.
  - in westren country..
- One fifth of patients has abdominal injury . → 20%
- *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 .
  - [VC - hepatic - commonilia - Aorta] major vessels in Bleeding



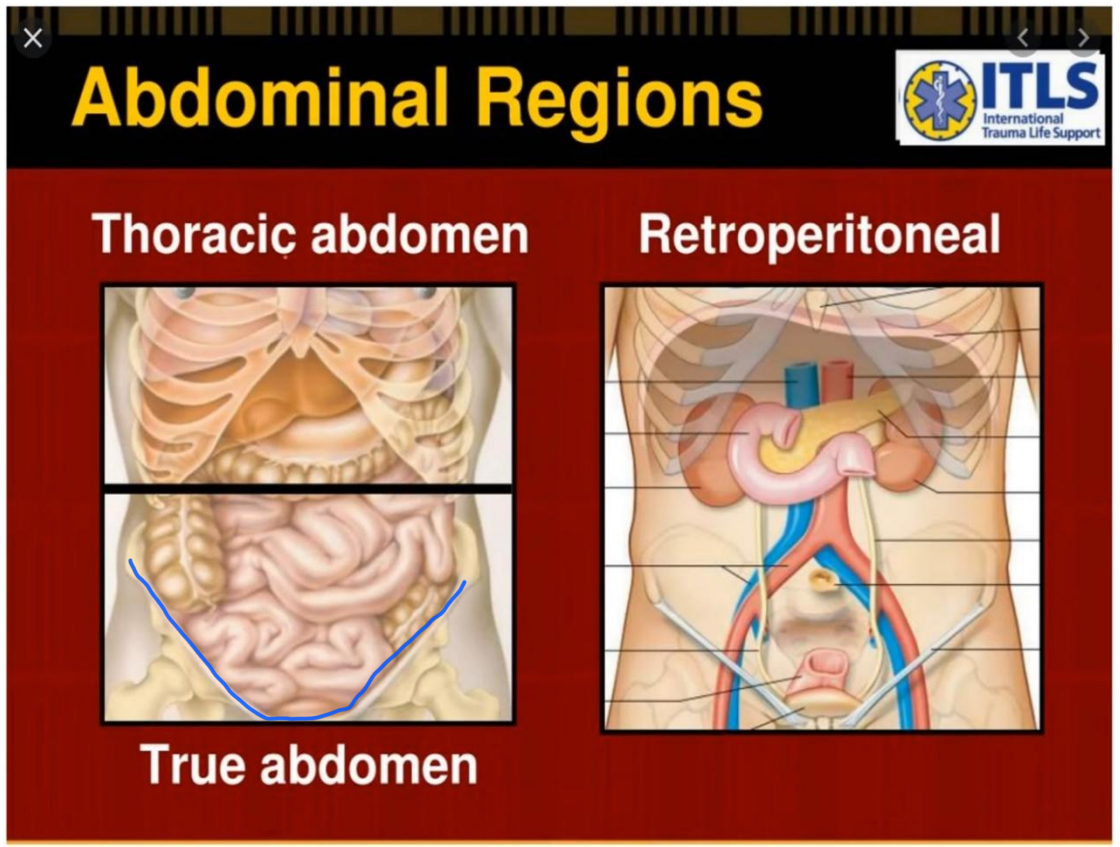
History

- ***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.** of shock..

Regions of the abdomen

- ~~Anterior~~ True abdomen ✓ from lower part of rib cage → to ASIS and inguinal lig. and symphysis pubis
  - There is colon - SI - major vessels
- Thoraco-abdomen ✓ above the rib cage.
  - There is liver - spleen - stomach - diaphragm..
- The flank ✓
- The back ✓
- The pelvis ✓

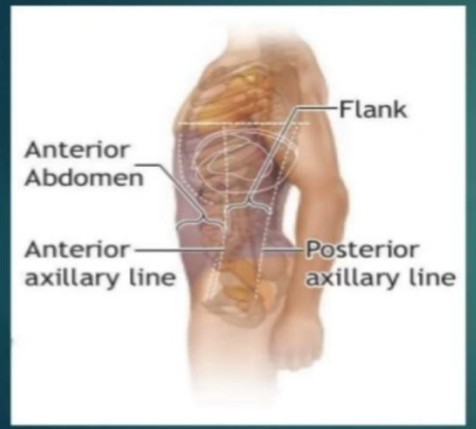
* The retroperitoneal structure
  - kidney
  - duodenum except the 1st inch of 1st part..
  - pancrease except the tail
  - ureter
  - Aorta..
  - IVC..



Flank

Regions of abdomen

5

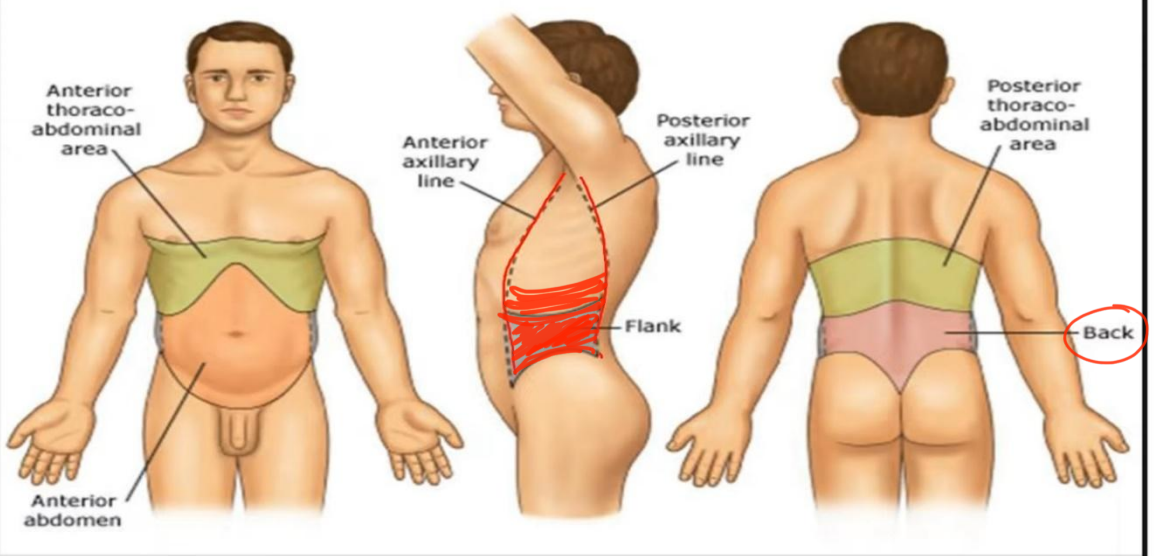


- Flank
- Anteriorly – Ant axillary line
- Posteriorly – Post axillary line
- Superiorly – 6th ICS [rib⁻] (inter costal space.
- Inferiorly – Iliac crest
- Thick musculature – partial barrier to penetrating wounds

* in the lf side there is → kidney. spleen.
* in the Rt side there is → kidney. liver..

Retroperitoneal Injury

- Anatomical boundaries.

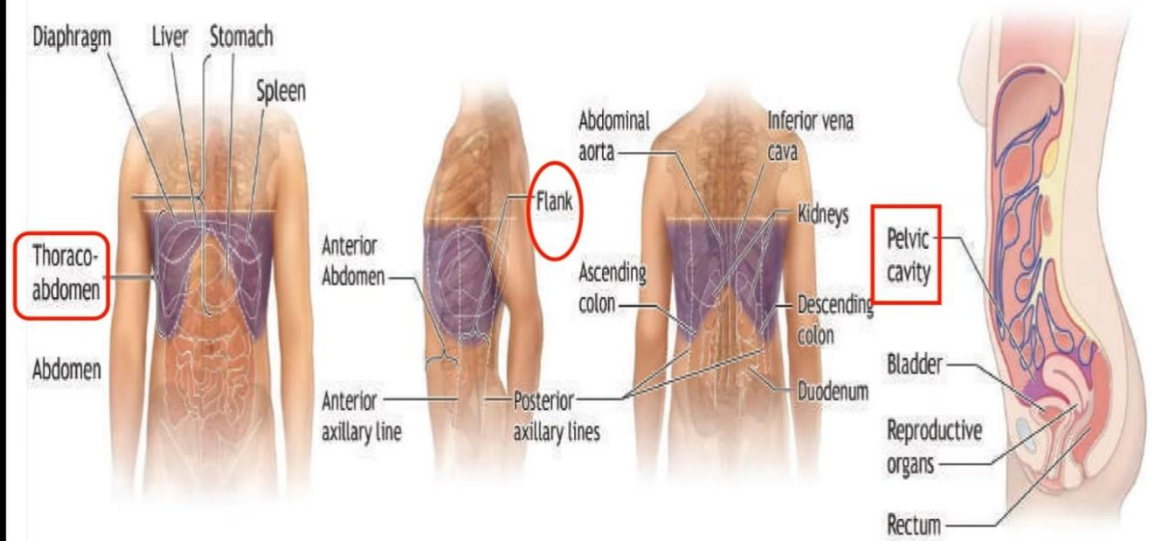


* The back below the costal cartilage to the iliac crest. and behind the post. axillary line.

has vertebral column + strong muscle

[penetrating injury] gun shoot اطلاق نار so the injury not severe

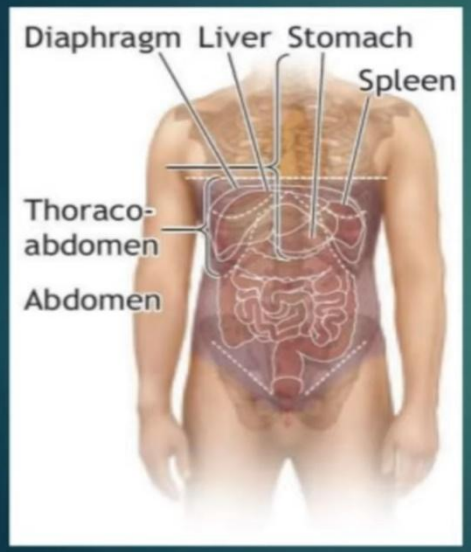
Regions of the abdomen



Thoraco-Abdomen

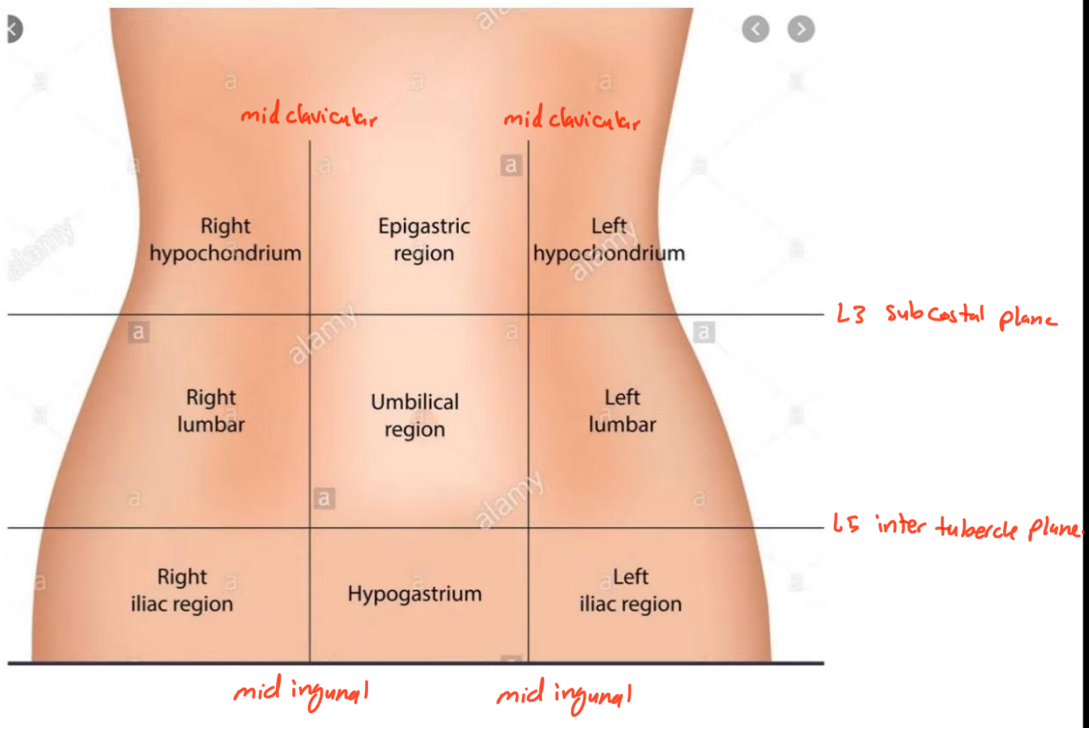
Regions of abdomen

4

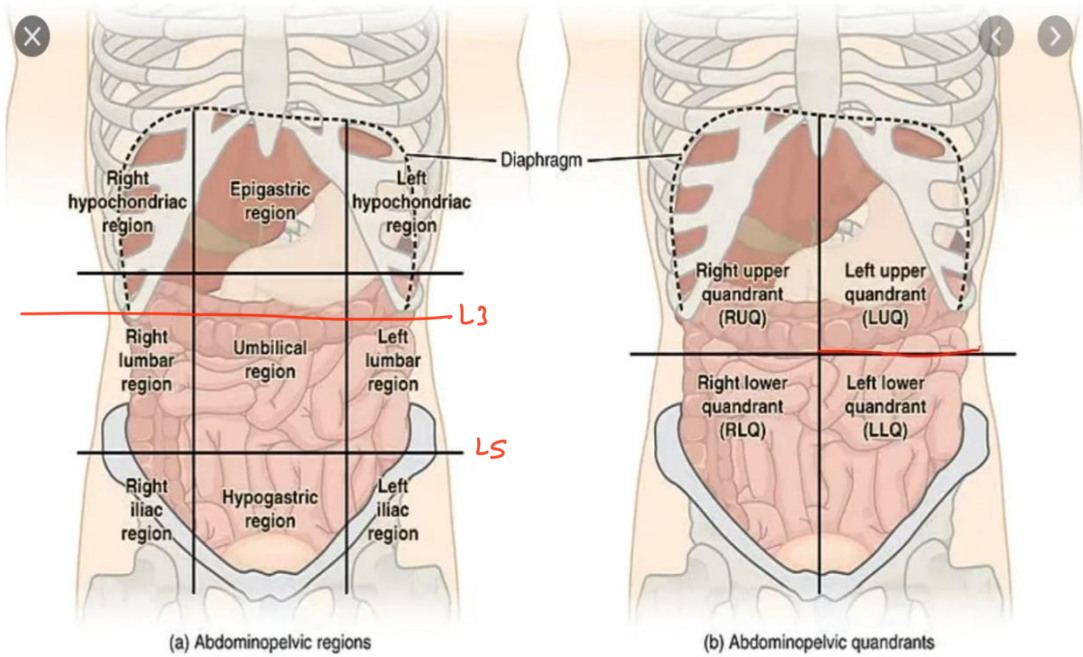


- Thoraco Abdomen
- Inferior to (the line below the 2 nipples)
  - Anteriorly: Trans-nipple line
  - Posteriorly: Infra-scapular line
  - * Inferior → to the rib cage. [end of costal cartilage]
- Includes
  - Diaphragm, Liver, Spleen & Stomach
- Full expiration → diaphragm rises to 4th ICS → Abdo viscera may be injured by penetrating wounds/ # lower ribs

Nine regions of abdomen



Regions of abdomen



Abdominal Trauma

Mechanisms of Injury

Blunt trauma

no external wound

- RTA (MVC) 75%
  - motor vehicle crashes
- Fall from height
- Crash injury
- sport injury

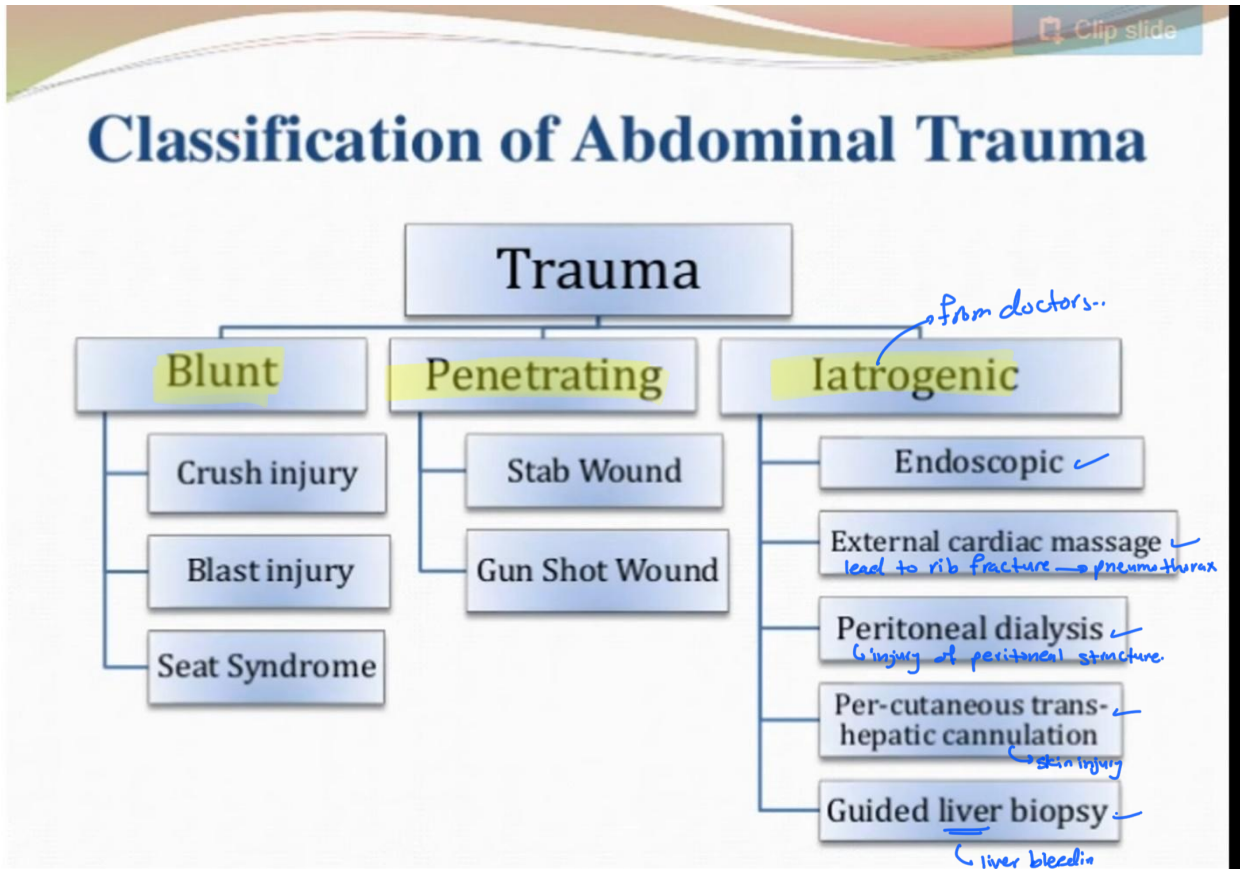


Penetrating injuries

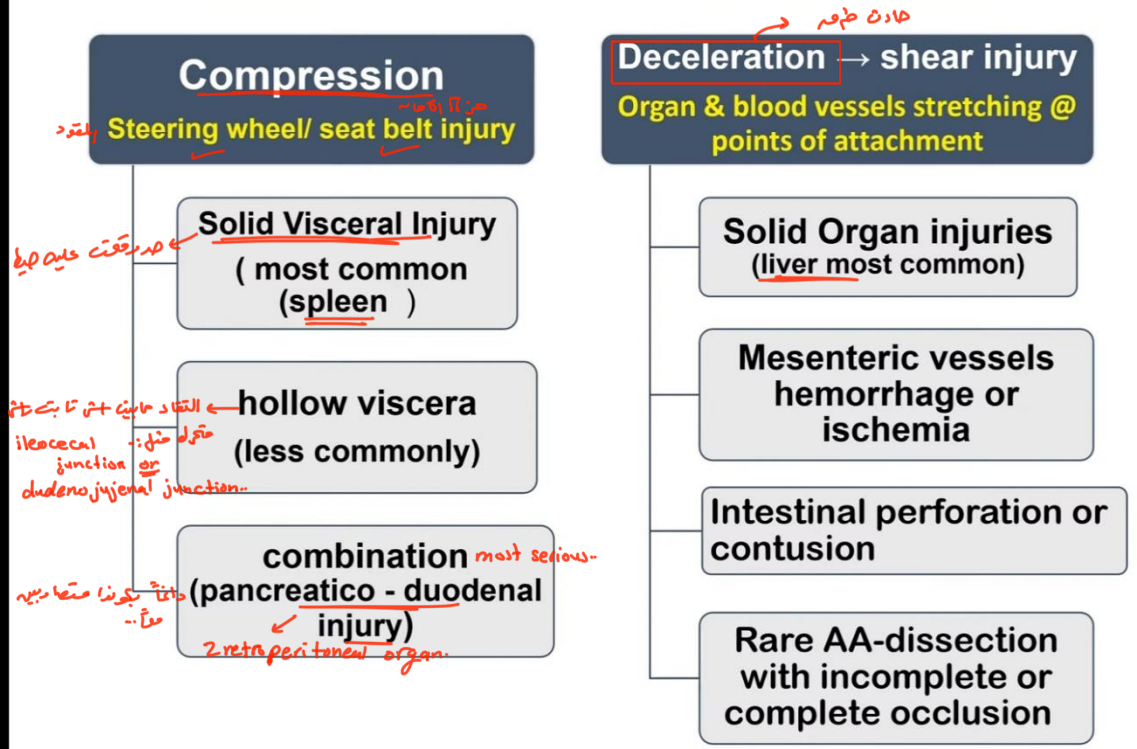
- Stab Wounds
- Gunshot Wounds 90%
- Explosions with shrapnel





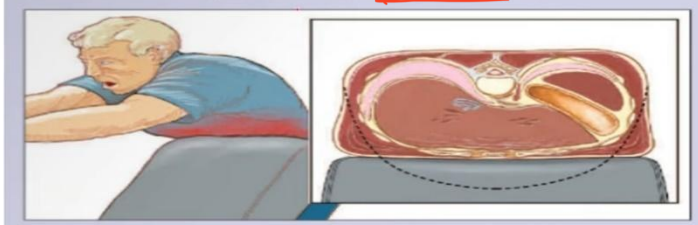

Clip slide
Classification of Abdominal Trauma
Trauma
Blunt
Penetrating
Iatrogenic
from doctors..
Crush injury
Blast injury
Seat Syndrome
Stab Wound
Gun Shot Wound
Endoscopic
External cardiac massage
lead to rib fracture → pneumothorax
Peritoneal dialysis
↳ injury of peritoneal structure
Per-cutaneous trans-hepatic cannulation
↳ skin injury
Guided liver biopsy
↳ liver bleeding

Mechanisms of injury in BAT



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.

Blunting so the mc organ affected is spleen..

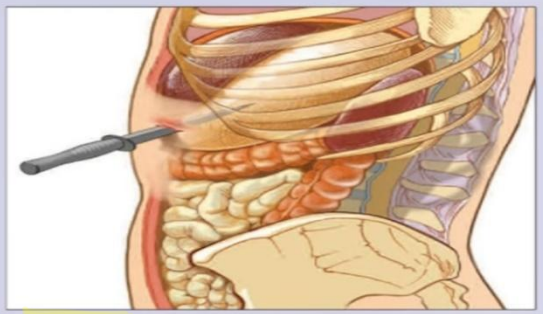


Shearing is common during rapid deceleration in an MVC as a portion of the tissue continues to move forward while another portion remains stationary. Here, the liver has torn away from the portal vein.

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.

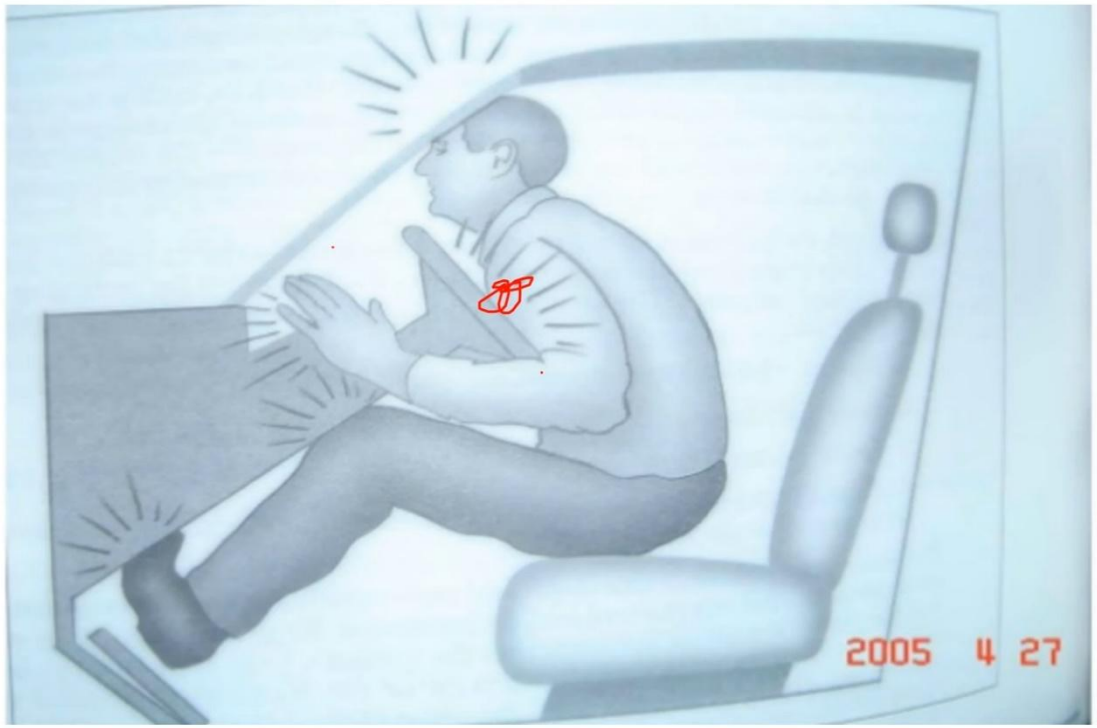


A gunshot can damage multiple organs because of high bullet velocity or fragmenting. The patient needs surgery to repair the injured tissues and remove bullet fragments.

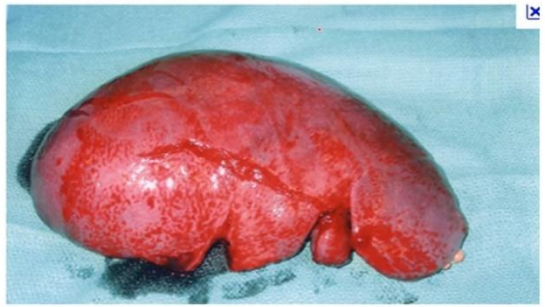


A stab wound is typically more localized and may be less damaging.

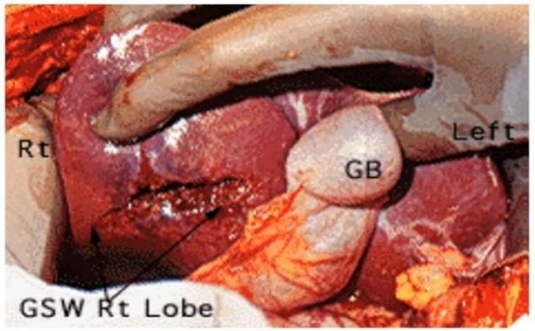
Compression



Compression injury in Blunt trauma



spleen injury

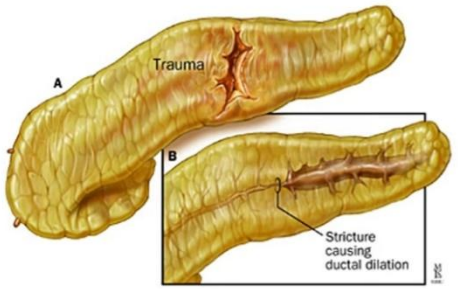


liver injury



Bowel rupture secondary to BAT

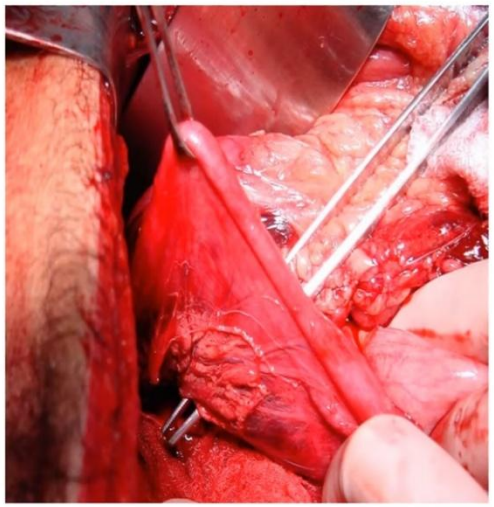
SI injury.



pancreas injury.

Shear injury in Blunt trauma





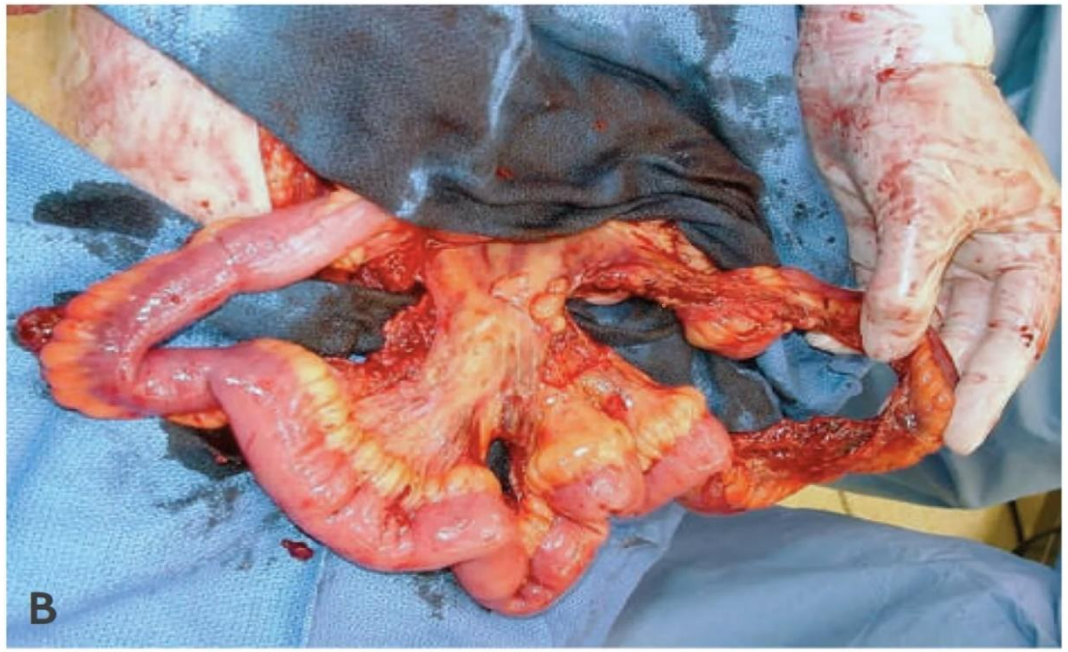
Bucket Handle Injuries.

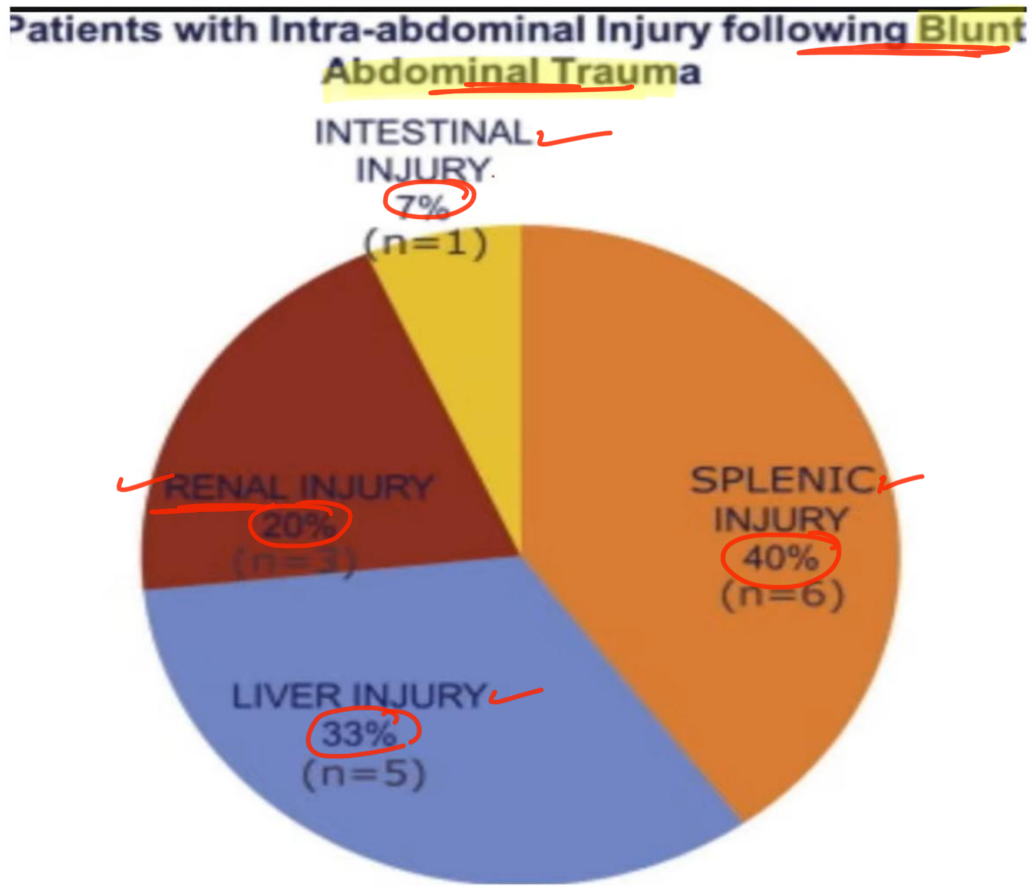
* seat belt lead to
- intestine perforation
- bucket handle injury
- lumber vertebrae fracture [L1]



Lap Belt and Bucket Handle Injuries.

intestine rupture – shearing in the mesentry.




Patients with Intra-abdominal Injury following Blunt Abdominal Trauma
INTESTINAL INJURY
7%
(n=1)
RENAL INJURY
20%
(n=3)
SPLENIC INJURY
40%
(n=6)
LIVER INJURY
33%
(n=5)

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 to10% thoracoabdomen.

Gunshot injury

98% there is intraperitoneal injury..

Degree of injury depends on
- Amount of kinetic energy released by the bullet
- Mass of the bullet
- Distance . short distance → more damage..

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

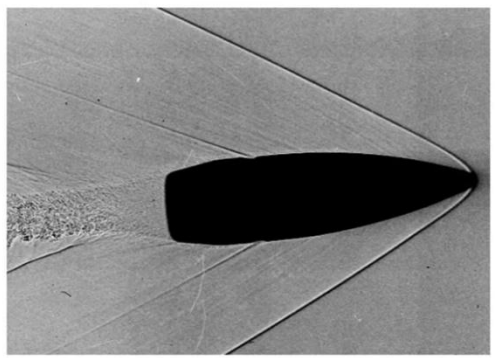
* most of spleen, liver, renal injury ttt is Conservative.. [Blunt injury].
* if the penterating injury is stable the ttt is Conservatie or local wound exploration

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.



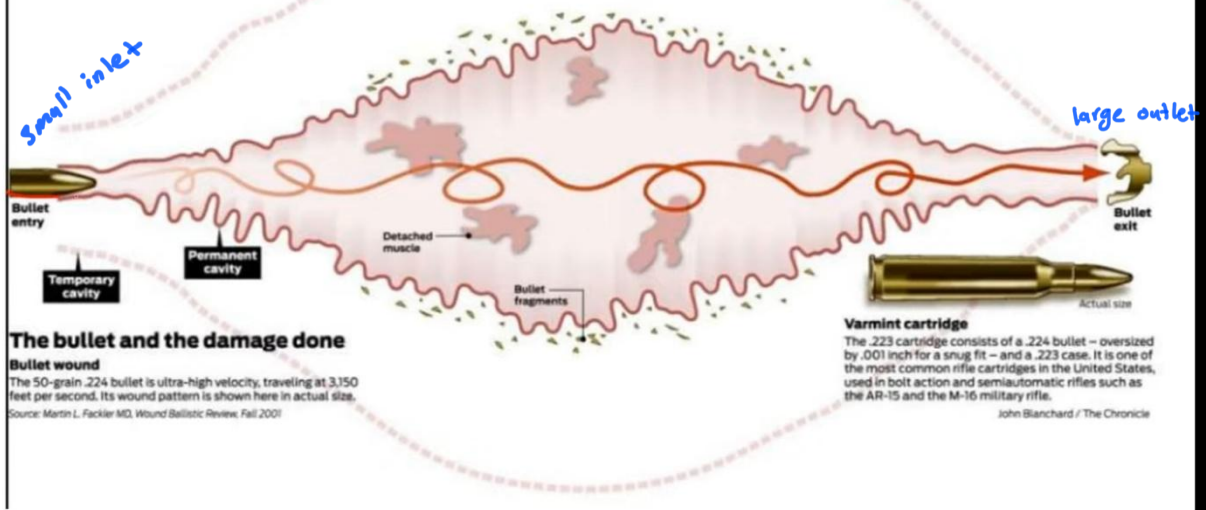


Cavitation

due to kinetic injury.
بسبب الطاقة تبع الـ bullet الـ spiral...

small inlet

large outlet



The bullet and the damage done

Bullet wound

The 50-grain .224 bullet is ultra-high velocity, traveling at 3,150 feet per second. Its wound pattern is shown here in actual size.

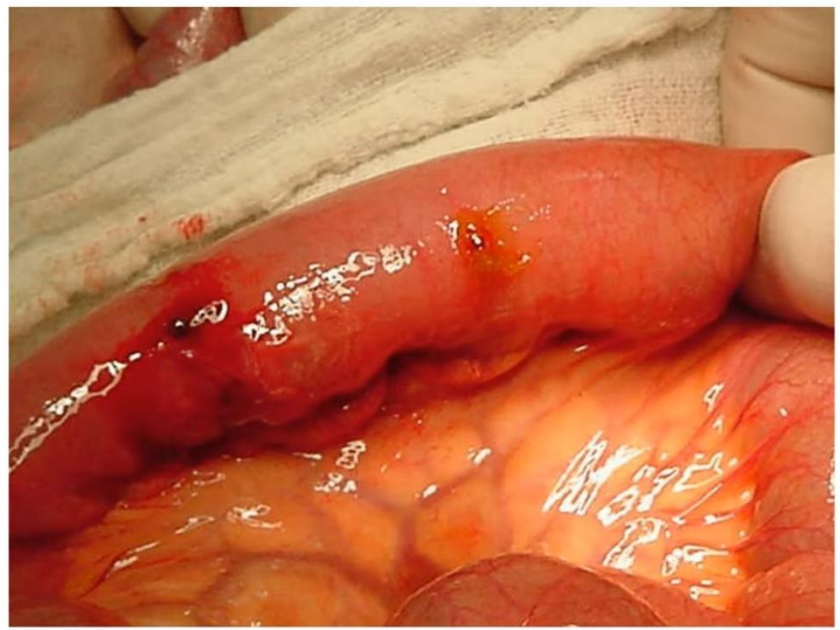
Source: Martin L. Fackler MD, Wound Ballistic Review, Fall 2001

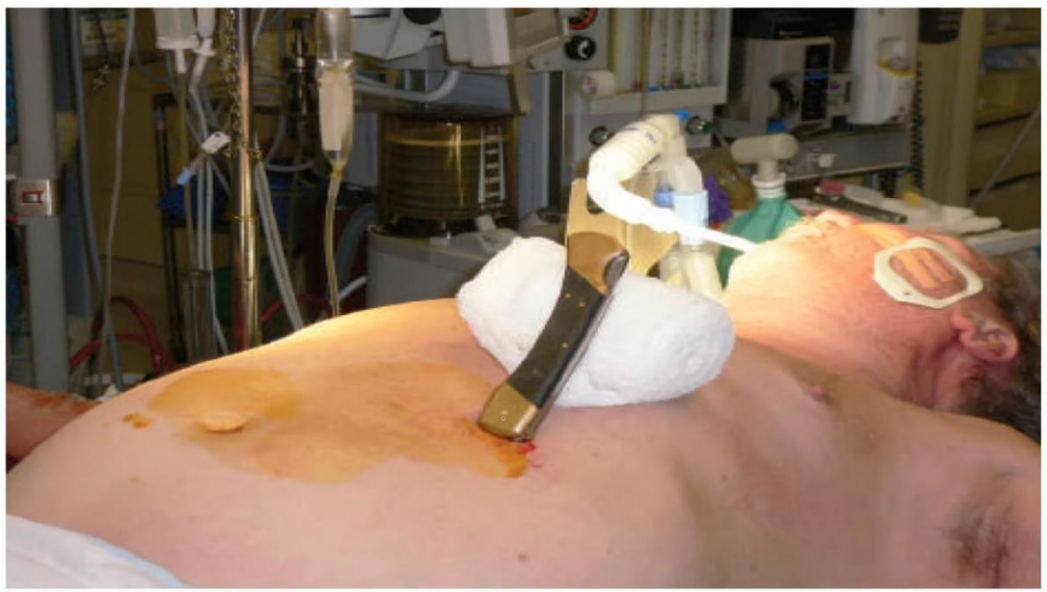
Varmint cartridge

The .223 cartridge consists of a .224 bullet – oversized by .001 inch for a snug fit – and a .223 case. It is one of the most common rifle cartridges in the United States, used in bolt action and semiautomatic rifles such as the AR-15 and the M-16 military rifle.

John Blanchard / The Chronicle

Multiple small bowel perforations





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

بعده ما يخلص العمليات
بيشيلوا الخشب

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 (back), as well as; urethral, perineal, and, if indicated, rectal and vaginal exams. (and PR ...)

Abdominal Trauma Physical Exam

Inspection – look for:

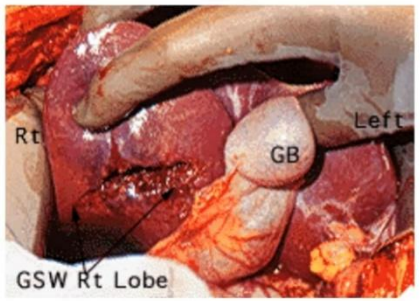
- Abrasions / lacerations (Abd, flank, or back)
- Ecchymosis, Cullen and Gray-Turner signs
- Abdominal distension May signify bowel obstruction or bleeding
- Penetrating wounds (log roll pt) & assess back also
- Evisceration

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

Bruise in the Rt hypochondium

↳ most likely liver injury.





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

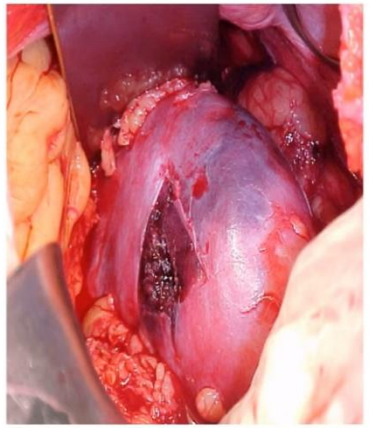
if we can't stop bleeding we put bags in the abdomen and close it by clips
liver injury بسبب
then after 48 - 72 h. we open and remove the bags.

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

Flank ecchymosis — indicate renal injury.

- **Renal Injuries.** — 98% tt is conservative — lead to hematuria..
- Most common injury is a contusion, then lacerations or fractures.
- Deceleration forces may injure the renal artery. (rare) — lead to shock







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

Bruise in the lt hypochondium [thoraco abdominal]

↳ indicate splenic injury..







* in blunt trauma → if the spleen injured alone :- managed conservative..

but in penetrating trauma the spleen injured with other structure → need surgical resiction.

[multiple]

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

indicate pancrease trauma and need 1-2 day..





Grey Turner's Sign and Cullen's Sign ~ 12 hours or later

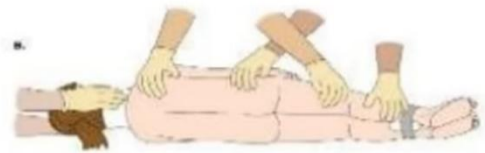
Hemorrhage usually from pelvic or lumbar fractures

has 40% mortality rate.. in pancreatitis

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







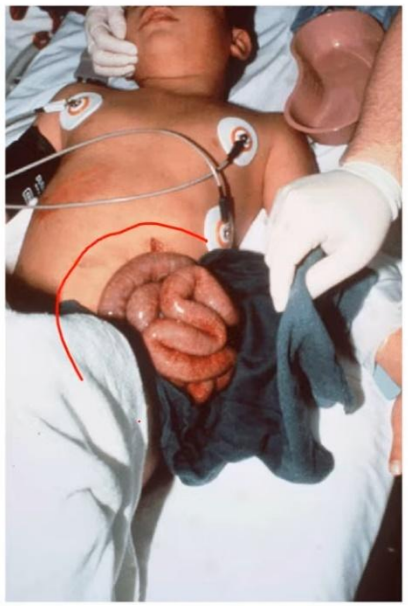
Penetrating wounds

(Log Roll Pt) and assess back also



الـ CT طالعة لبرا

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** or fracture

Look for

- **Blood at urethral meatus.** so the catheter is contraindicated..
- **Perineal or scrotal hematomas.**

urinary tract ال injury لعمل شوف

urethrogram.





* male urinary tract 8 inch
  - prostatic [1.5 inch]
  - membrance [0.5 inch]
  - penile urethra.. [6 inch]

* female urethra:- 1.5 inch.

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

A seat belt bruise

lumber spine fracture

bucket handle injury in the intestine.

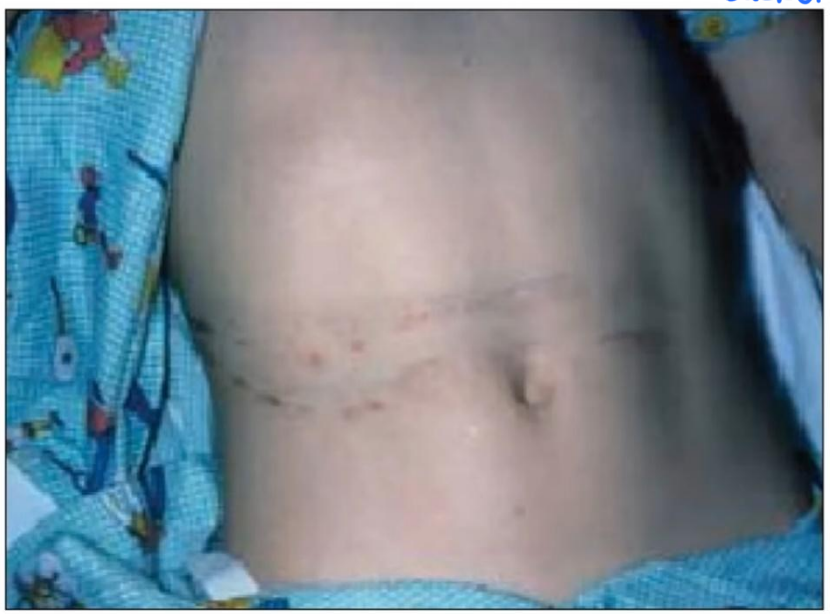


Figure 2: Telltale seatbelt sign of bruising across the abdomen

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

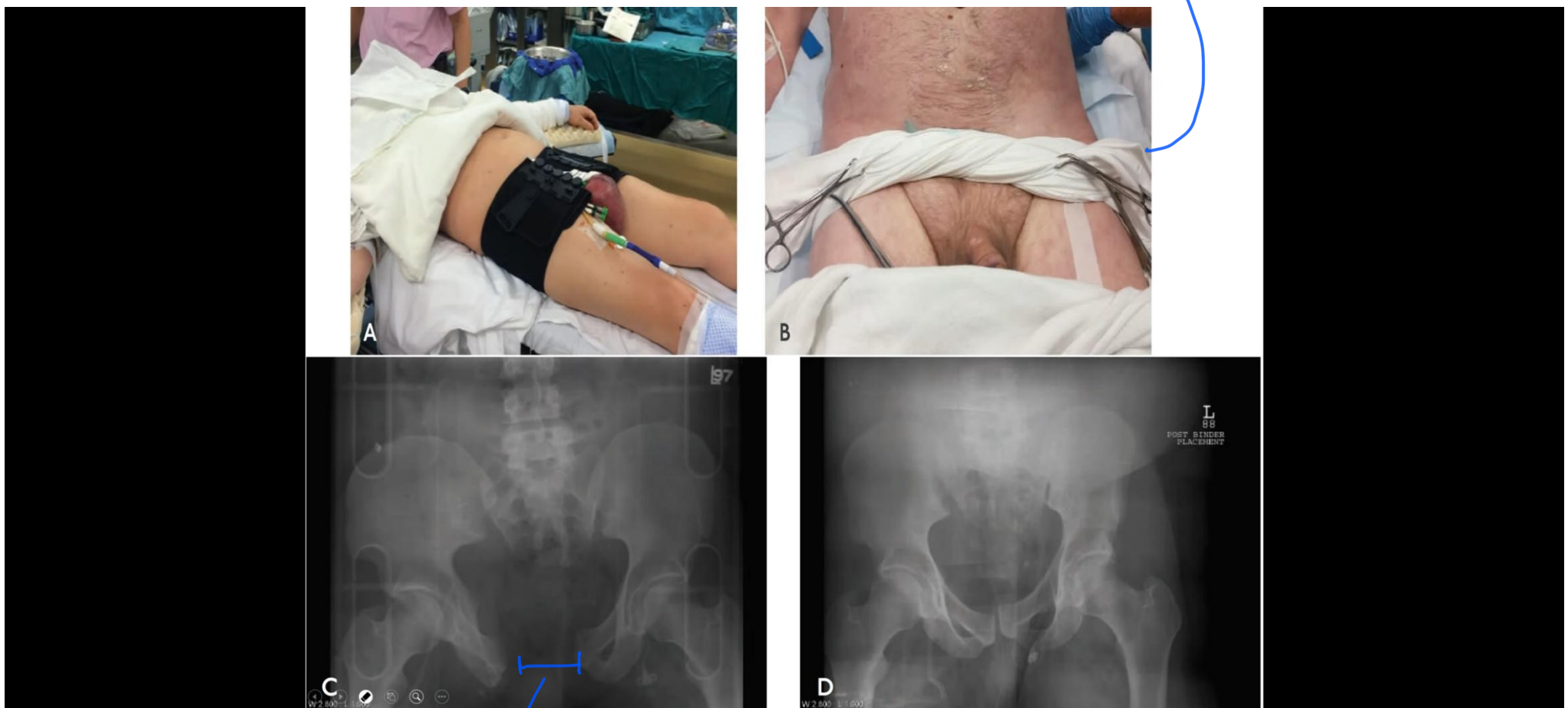
Pelvic fractures



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

* if there is pelvic fracture this mean there is 4-5 unit of blood loss..
[serious condition]

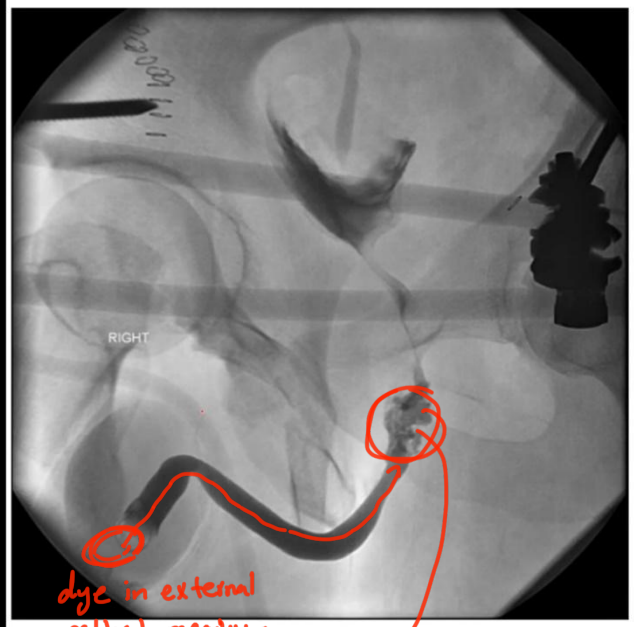
lead to stop or decrease the bleeding..



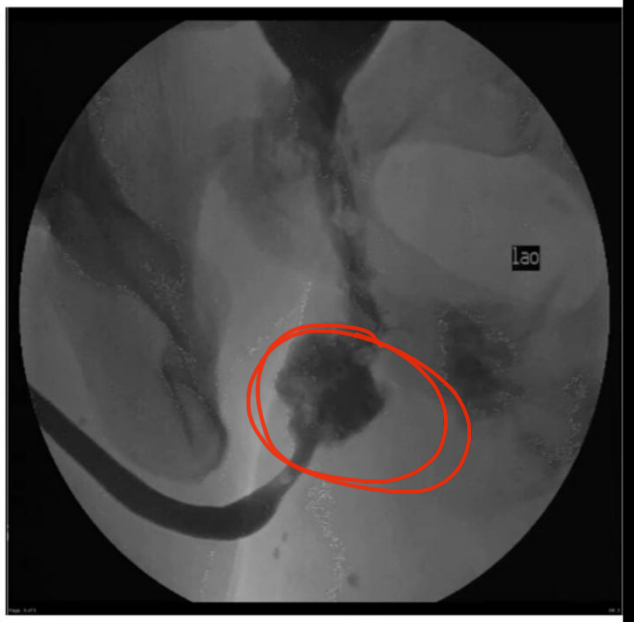
open book fracture تستخدم مرآة كوبه رشة لـ pelvis طبا لوحايا لـ support sheet
[separation of symphysis pubis] متن تجمع لـ symphysis بـ يجيب

يضع صبغة بسبب تشوه في urethra external urethra

Retrograde Urethrogram



dye in external urethral meatus..



extravasation of the dye indicate to rupture of urethra..
so don't put catheter
complete rupture حتى ما تعمل

Abdominal Trauma
Reliability of Physical Exam

* maybe the abdomen complete soft and lax but there is problem...

- 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.* So you should reexamin your pt..

Abdominal Trauma
Physical Exam (con't.)

Rectal Exam PR

- Is Important to do in almost all patients

- Check for:
- Sphincter muscle tone.
  - anal sphincter tone if it weak this indicate spinal cord injury...
- Blood and bony fragments.
  - in rectum indicate pelvic fracture.. or retroperitoneal pelvic injury..
- Prostate position ("high-riding"?)
- Should be done before placing Foley catheter.
  - but do retrograde urethrogram...

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 [A BCDE]
- Resuscitation +adjunct interventions.
  - put 2 canula atleast
  - and give crystaloid [Ringer lactate or hartman solution]
  - put foley cather - NG tube - chest or pelvic xray if he needed..
- Detailed secondary survey (evaluation)
  - complete head to toe exam..
- 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

لا يعني أنو لما خلصت الـ exam نرجع نلبس المريض
في منع heat isolation, warm blanket materials...

RESUSCITATION

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

Goals for early resuscitation

- Maintain SBP at 80-100 mmHg SBP >90..
- 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 above 90%
- Prevent an increase in serum lactate
- prevent acidosis from worsening
- Achieve adequate anaesthesia and analgesia

* hemorrhage classes → 3 in children..
→ 4 in adult..

	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) Systole - Diastole	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	↔ normal	↓ narrowing	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓ comatose state..	↓
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

risk of acidosis بیشتر ← class of hemorrhage کلاس خونریزی

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

for epigastrum blunt trauma as in acute pancreatitis..

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

Urinalysis

to see hematuria..

- 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
we do it if we think about liver injury..

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

Glucose
if DM pt..

- 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 .

* The abdominal exam + radiological tests are important ...

- **FAST, CT, DPL**
  - FAST → focal assesment with sonography for Trauma
  - DPL → diagnostic peritoneal lavage

→ fracture pelvis indicate massive bleeding [may reach to 4 unit blood loss]...

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. [abdominothoracic trauma more serious than abdominal trauma alone]...
- Cannot rule out intra-abdominal bleeding or visceral injury.
- Look for position of NG tube. to see if there is rupture diaphragm ...chest لا تجيب NG tube إلا وتنظر

Plain abdominal X rays [PFA]

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

ما بنغلط كتير بتاخد وقت stable كان pt ولكن لو إ وحشت فاريه سفنا العرشت ممكن نغلطها...



* There is elevation of diaphragm [stomach become in chest]...
This indicate rupture of diaphragm...

abdominal trauma
Investigation

The presentation of BAT

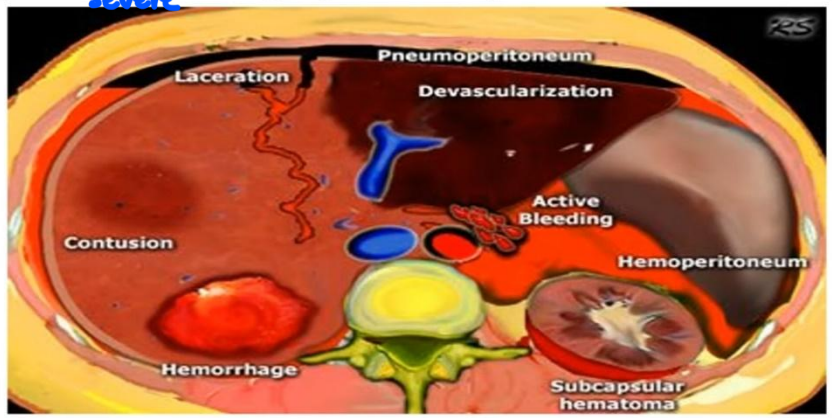
عالسريع بنوديه ع العمليات

Hemodynamic Instability
(major hemorrhage)

بنعمله CT scan قبل العمليه [مفاضلة]

Hemodynamic Stability
(hollow viscus injury)

severe



FAST [US]

(Focused Assessment with Sonography for Trauma)

↳ The investigation of choice in initial work up...

- Performed rapid and without moving the patient from ER.

لـ حتى نتجنب بأذ ER..

- Good for solid organ injury.

لـ ولكننا بقدر نحكم grading

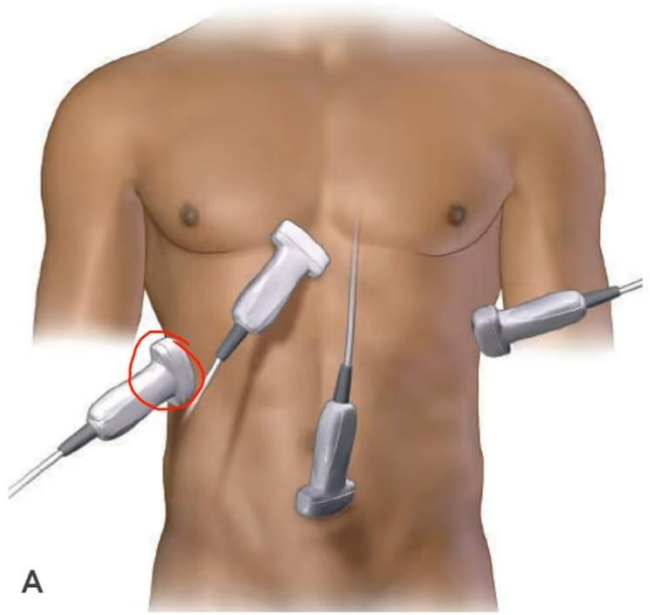
- Demonstrate presence of free intraperitoneal fluid. [mainly Blood]

How much fluid can FAST detect?

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

↳ between the liver and Rt kidney...

FAST [done in 4 depndant region
- Morison pouch...
- Pelvis region...
- around the spleen...
- epigastric region...



* we see the epigastric region to see if there is :- pericardial effusion - Cardiac tamponade - Blood in the heart...

FAST

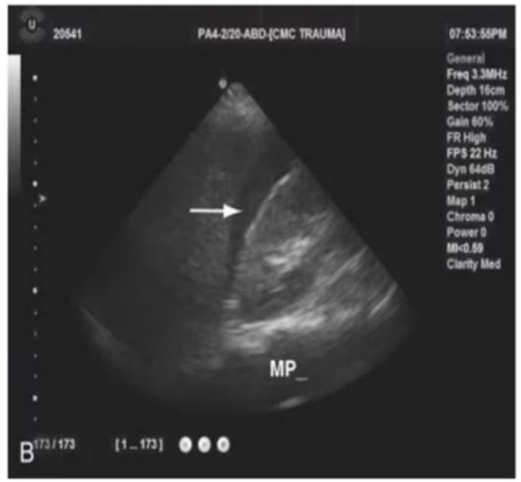


■ **FIGURE 5-4 Focused Assessment with Sonography for Trauma (FAST).** In FAST, ultrasound technology is used to detect the presence of hemoperitoneum.

FAST

- Perihepatic & (Morrison's pouch)





FAST

Peri splenic





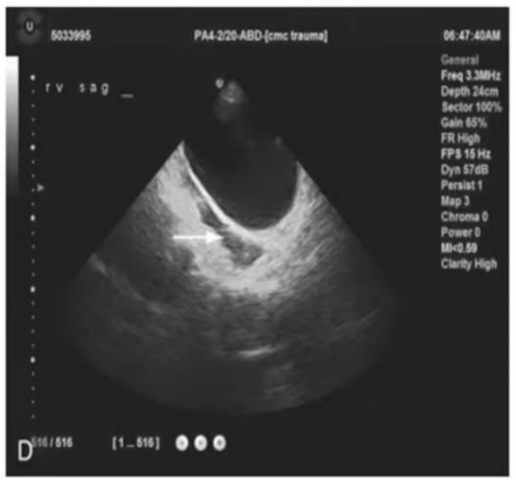
FAST

- Retro vesicle (Pouch of Douglas)

Lo pelvic area...

G in female

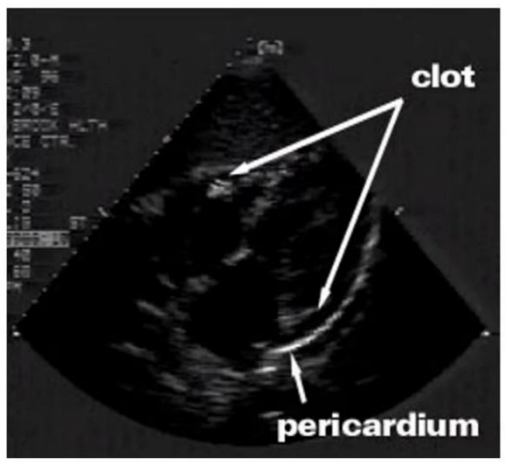




FAST

- Pericardium (sub-xiphoid)





* There is extended-FAST for tranma we see the 4 region + the plenral spaces to detect if there is hemothorax...
and cavity...

FAST

Limitation of FAST = US

- Obesity, bowel gas. → لذلك بتقلل جودة الصورة
- Can't distinguish blood from ascites. or rupture viscus [SB or gastric content]...
- Cannot assess hollow visceral perforation. → SB or LB
- Operator dependent.
- Retroperitoneal structures and diaphragm are not visualized.

← غير CT و US

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 ← Hemodynamic stable

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.

Better in CT than US
The best choice for diaphragm is laboroscope...

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 .
  - The initial investigation is US...
  - The investigation of choice is CT...
- 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 → used in head trauma + low level of concious more than abdomen trauma... + has fluid in the abdomen..

- Highly accurate , 98% sensitive in detecting intraperitoneal bleeding. but low specificity for bleeding source. → بندخل Cannula من عند السرة وبنشوف هل فى Blood ولا لا..

Bowel لا accuret حتى فيه

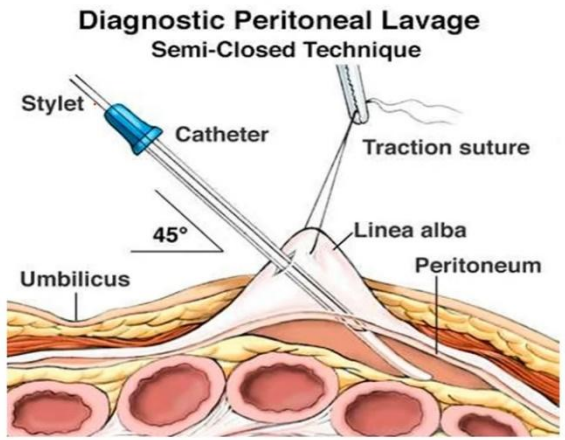
- Largely replaced by FAST and CT .

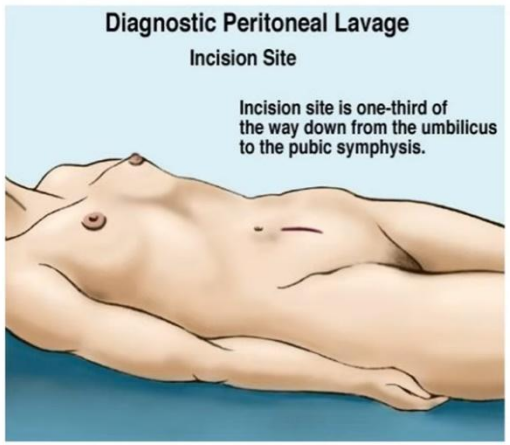
- More sensitive than CT or US for detection of hollow viscus injury

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.

→ we put the Cannula below the umblicus + aspirate if we Aspirate 10cm of Blood :- +ve test



→ if there is Bile or stomach content Aspirated indicate:- Bowel rupture

Positive criteria for assessing DPL

Any of these indicate need for laparotomy: [+ve DPL]

- 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%)
  may lead to pesitoneal injury...
- 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).

بعض لعتينا بال DPL دا خرج غديه لد surgery ولكن هذا ست هم وفه الـ stable ما بيحتاج عمليات بنقابه conservative

	DPL	FAST	CT SCAN
Indications	Document bleeding if hypotensive	Document fluid if hypotensive	Document organ injury if BP normal The investigation of choice in stable pt...
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.

→ indication for DPL:- low level of concious - severe head trauma...

- In the majority, the fluid is blood and of no further consequence, however , *in 25% the fluid is GI-content.*

...DPL يتم تاكيده بـ

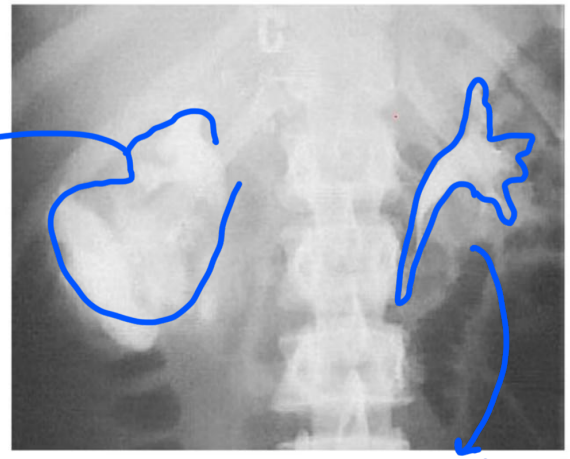
- Awake patients managed according to clinical examination findings, whereas neurologically compromised patients should undergo *DPL*

- The exclusion of hollow viscus injuries by imaging alone can be difficult

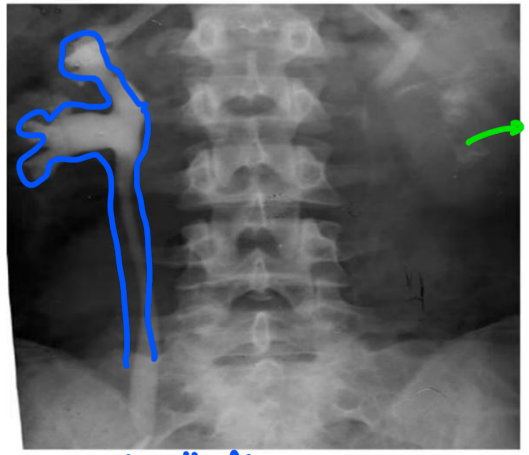
Abdominal Trauma
Other Diagnostic Studies

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

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



normal kidney



normal collecting system

Abdominal Trauma
Other Diagnostic Studies

used if there is Blood in the external urethral meats or scrotal bruising...

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

gun shot or Penterating یا خنجر کوکتنت single organ injury ما بتکون

- 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≥ 30% BLOOD VOLUME LOST.

- Stopping the bleeding : most important priority

most important

rapid pulse - weak volume → indicate hemorrhage...

[in children = 2sec and in adult = 3sec]...

Hypotensive unstable patient

- Start in the Neck (distended veins) . indicate Cardiac temponade or tension pneumothorax...
- FAST for Abdominal Cause. (for Hypotension..)
- Spinal cord injury . [neurogenic shock lead to Hypotension]
- External blood loss → compression to stop it..
- Internal blood loss from associated fractures.
  - fracture tibia there is 0.5 unit of Blood lost...
  - fracture femur there is 2 unit of Blood lost...
  - fracture pelvis there is 4 unit of Blood lost...

"Golden Hour"

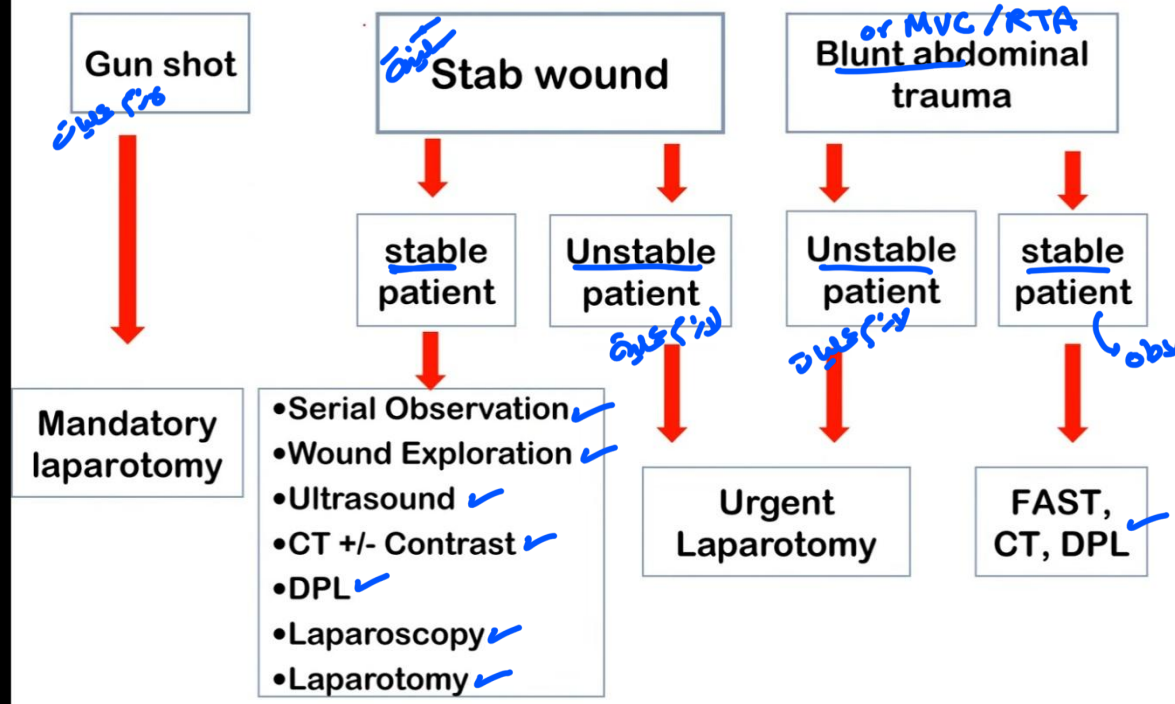
American College Surgen.

ACS concept that

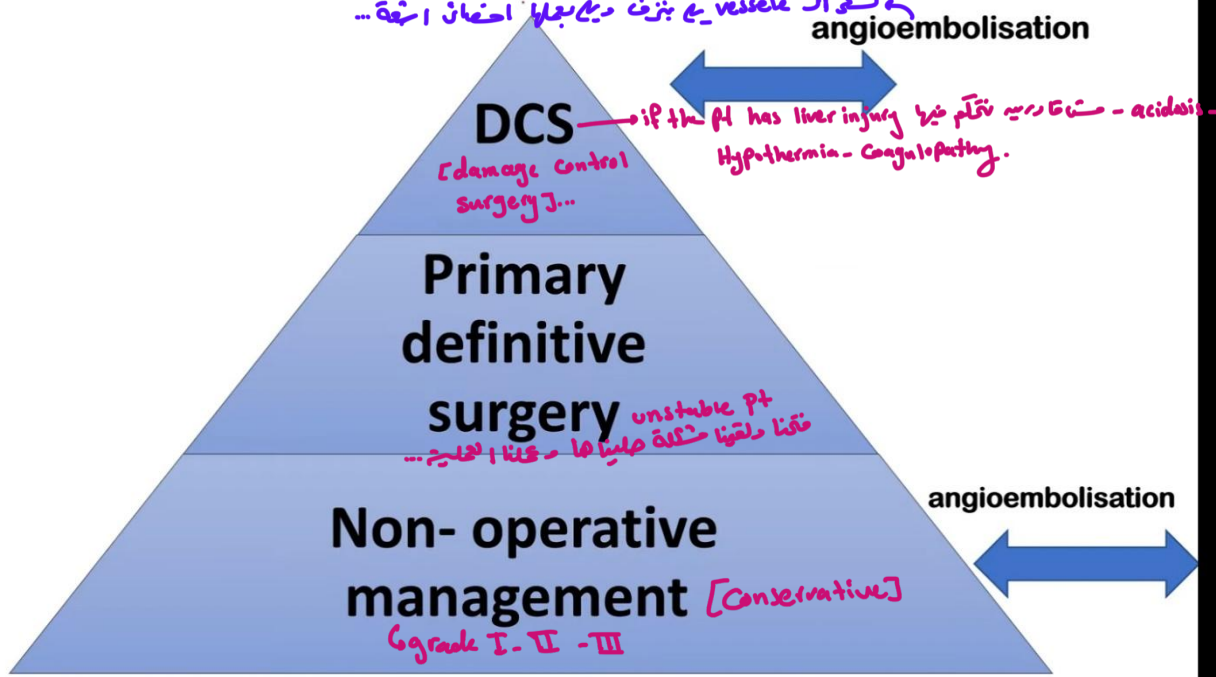
- Deaths & complications are reduced when trauma victims receive definitive treatment within the 1st hour after injury the golden hour.

[20 mint. الوقت بيتحسب]

Strategies for management of abdominal trauma



Strategies for Management of Abdominal Trauma in Blunt trauma-



Non-Operative Management of Solid Organ Injury

- ICU monitoring. ← if the pt grade I - II - III
- Frequent F.U. physical exams ← follow up
- Frequent HCT required

← غالباً لاحتاج هذا المريض عملية تكون في أول ... 12 hour
← ... skill حتاجه conservative ## for trauma

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%.*

← conservative عكن نتاجهم liver or spleen injury في معظم الحالات
... angio embolization عكن نعمل

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.
  - Blood in the Bile...

Hepatic CT Injury Grading Scale

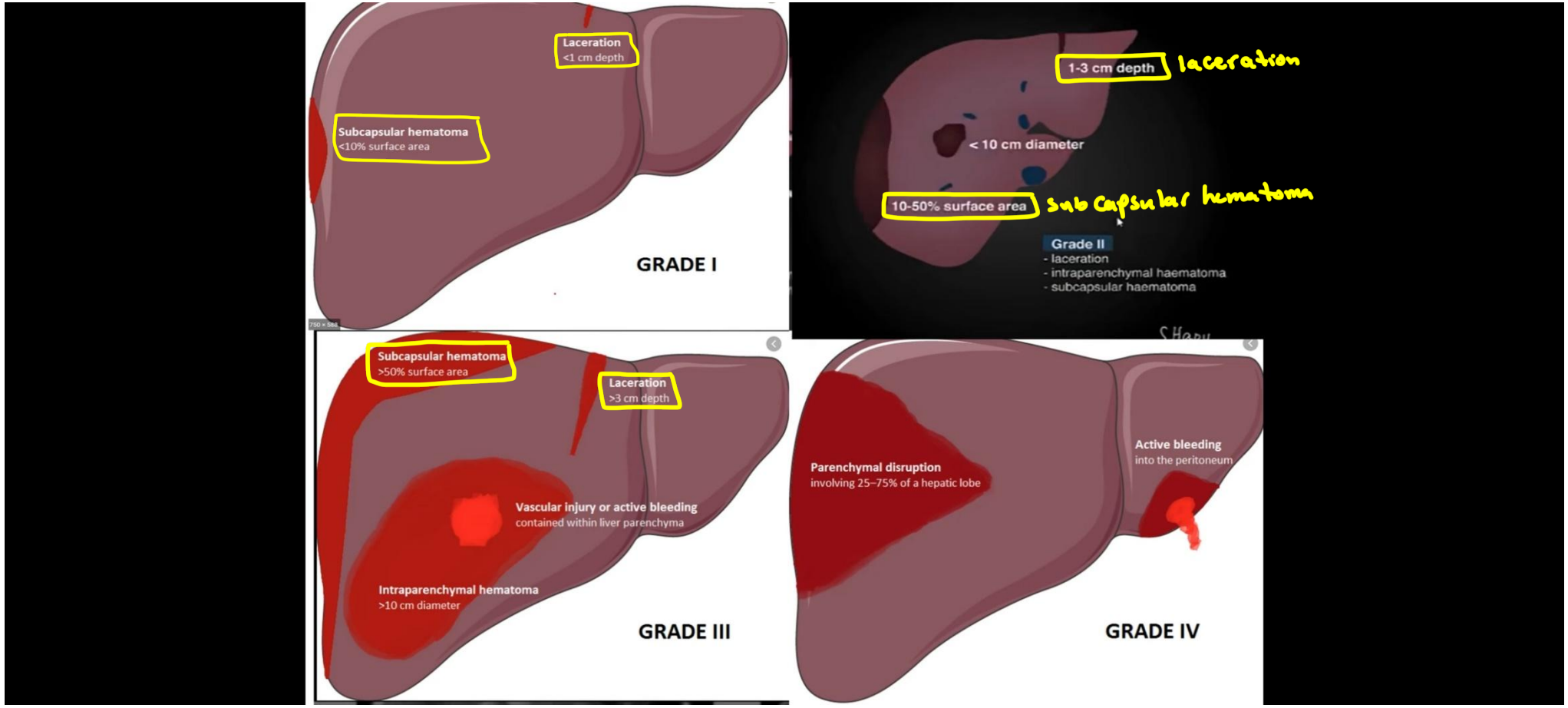
مش صفط

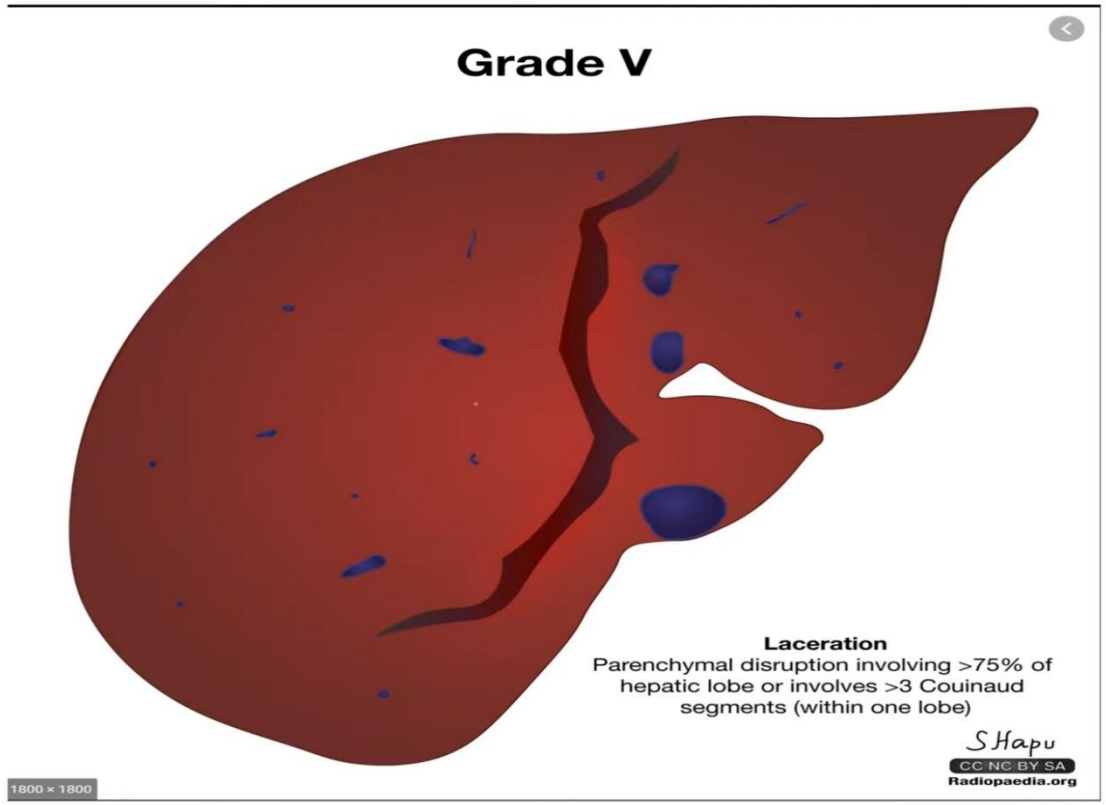
Grade I	Laceration(s) < 1 cm deep Subcapsular hematoma < 1cm diameter
Grade II	Laceration(s) 1-3 cm deep Subcapsular or central hematoma 1-3cm diam
Grade III	Laceration(s) 3-10 cm deep Subcapsular or central hematoma 3-10 cm diam
Grade IV	Laceration(s) > 10 cm deep Subcapsular or central hematoma > 10cm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

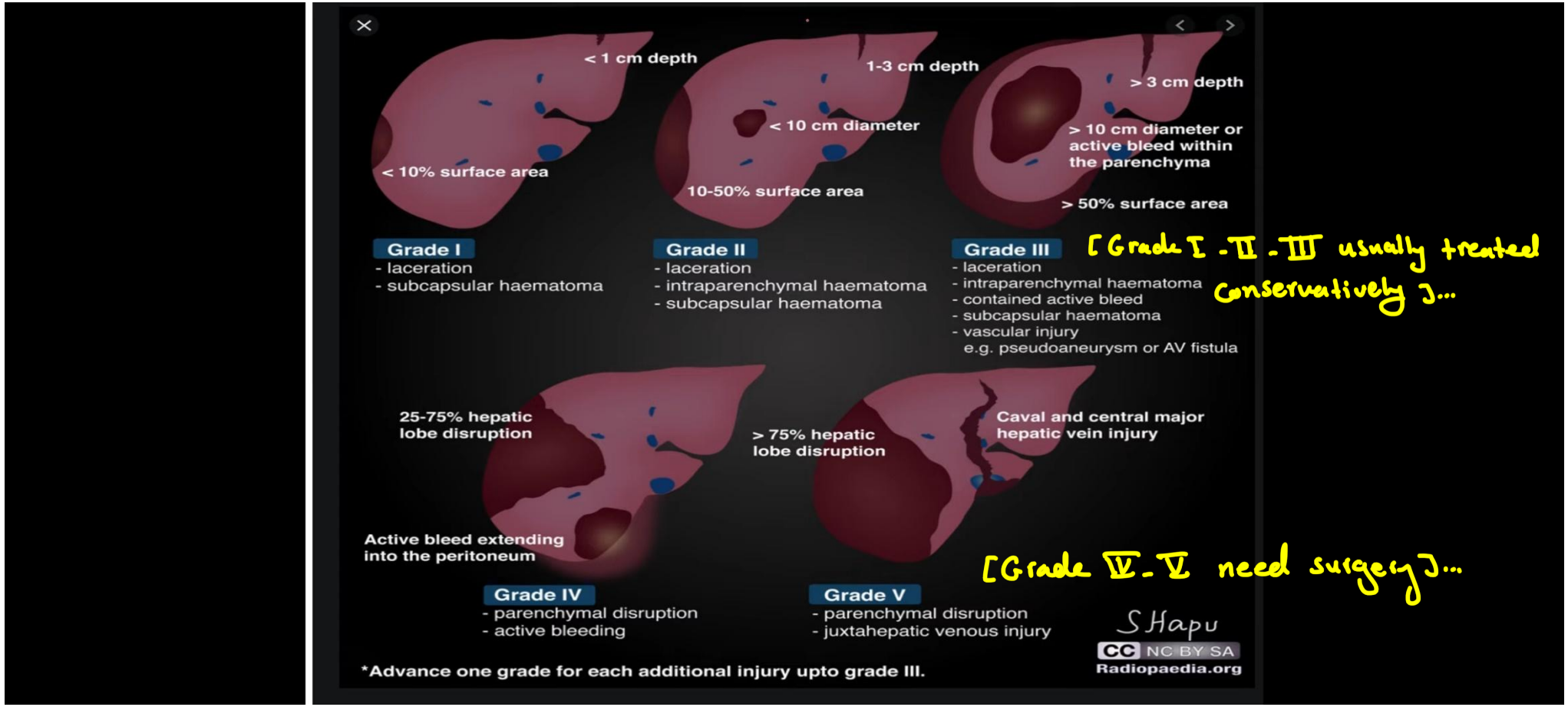
CT Grading of splenic injury

مستاصفط

	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

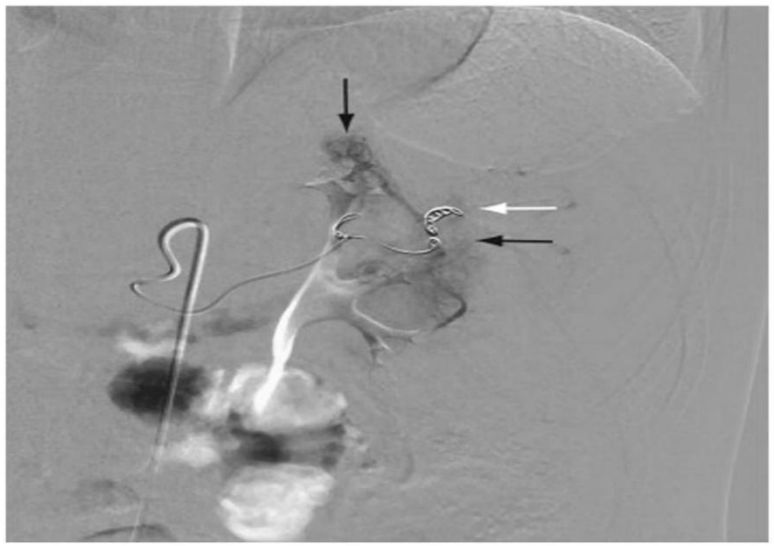

Laceration
<1 cm depth
Subcapsular hematoma
<10% surface area
GRADE I
1-3 cm depth
laceration
< 10 cm diameter
10-50% surface area
subcapsular hematoma
Grade II
- laceration
- intraparenchymal haematoma
- subcapsular haematoma
Subcapsular hematoma
>50% surface area
Laceration
>3 cm depth
Vascular injury or active bleeding
contained within liver parenchyma
Intraparenchymal hematoma
>10 cm diameter
GRADE III
Parenchymal disruption
involving 25–75% of a hepatic lobe
Active bleeding
into the peritoneum
GRADE IV


Grade V
Laceration
Parenchymal disruption involving >75% of hepatic lobe or involves >3 Couinaud segments (within one lobe)
S Hapu
CC NC BY SA
Radiopaedia.org
1800 × 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
[Grade I-II-III usually treated conservatively]...
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
[Grade IV-V need surgery]...
S Hapu
CC NC BY SA
Radiopaedia.org
*Advance one grade for each additional injury upto grade III.

Angiographic embolisation as an adjuvant to non-operative management

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



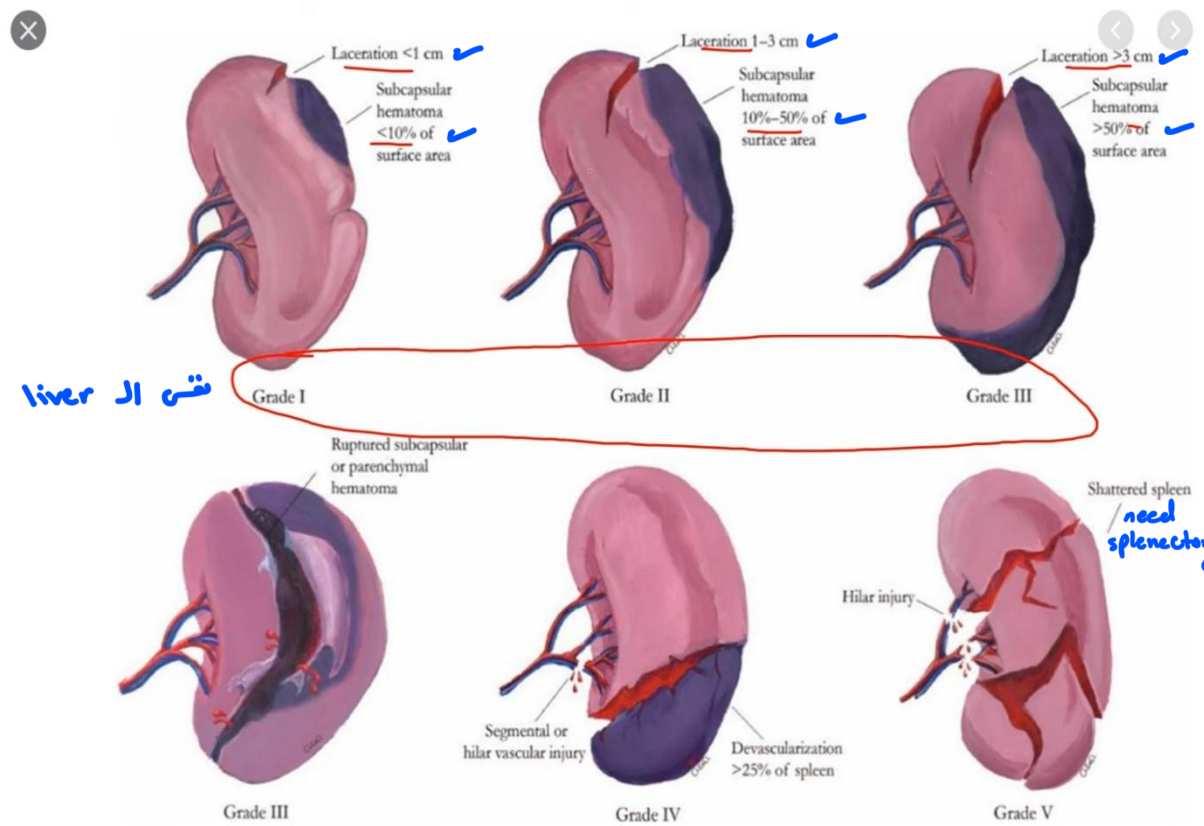


Figure 170.1. AAST grades of splenic injury.

بنسيب البطن مفتوح ونغلق فريضا بال ICU وبعدما نعطوا وصفه منسكو

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

contraindication of DCS:-

1. • ABDOMINAL COMPARTMENT SYNDROME ✓
2. • DEEP VENOUS THROMBOSIS DVT ✓
3. • SEPSIS ✓

Conclusion

- Both the investigation and management of blunt abdominal trauma have undergone marked changes in recent years .

...↑risk of bleeding ← ↑BP نقل في حالة unstable trauma الـ fluid خطأ ← ممنوع نعطي

- CT is the investigation of choice

- US (FAST) remains a useful tool for the diagnosis of intra-abdominal hemorrhage in the critically unstable patient.

- DPL has become virtually obsolete .

Conclusion

- *Interventional radiology* [Angioembolisation] 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* especially grade I - II - III of liver - spleen - kidney injury without viscus injury... 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. in Blunt trauma...

[فتح البطن] exploration هتكون نفسرح بال


Thanks