

ABDOMINAL TRAUMA

Responsible for ~15-20% of trauma deaths, primarily due to haemorrhage, although can occur late due to complications of sepsis.

PATHOPHYSIOLOGY:

BLUNT TRAUMA:

- Diffuse injury pattern (most often in MVA) puts all abdominal organs at risk
- Injury can be to solid organs or hollow viscera.
- Injury is particularly common at areas of transition between FIXED AND MOBILE ORGANS
 - E.g. mesenteric tears (ligament of Treitz or junction b/w small bowel & right colon).
- Falls from a height produce unique pattern of injury dependent upon height fallen, landing surface and whether the fall is broken
 - Intra-abdominal injuries are rare, but hollow visceral rupture is more common.
 - Retroperitoneal injuries occur often due to force transmitted up the axial skeleton
 - Solid organs can be injured when a patient lands on their flank
 - Pedestrians struck by a car are completely unprotected

PENETRATING TRAUMA:

- Stab wounds directly injure tissue as the blade passes through the body
- External examination cannot predict internal damage or define trajectory.
- GSW injures in several ways:
 - Direct organ injury
 - Secondary missiles (bone/bullet fragments)
 - Transmission of kinetic energy = BLAST EFFECT

CLINICAL FEATURES:

- Abdominal injury often presents insidiously
 - Young patients may lose 50-60% of their blood volume & remain asymptomatic
 - Signs such as tenderness, distention or tympany may not be present until patients have suffered significant blood loss
- Relying on examination alone will lead to unacceptable rate of both non-therapeutic laparotomy and missed injuries

SOLID ORGAN INJURIES:

- Symptoms/signs are usu. due to BLOOD LOSS & may not manifest until ~30% blood volume lost
- Blunt solid organ injuries often BLEED SLOWLY

HOLLOW VISCERAL INJURIES:

- Produce symptoms & signs due to blood loss and peritoneal contamination
- GI contamination will produce examination findings over a period of time
- Symptoms from acid spill may occur early but often are delayed for those on PPI or H2RA
- Eventually patients develop *suppurative peritonitis* because of bacterial contamination, but this may take 6-8 hours to manifest

Patients w/ traumatic brain injury, intoxication or other extensive injuries may be distracted from their abdominal symptoms for some time...

RETROPERITONEAL INJURIES:

- Initial findings may be subtle or absent
- **DUODENAL INJURY:**
 - Haematomas can cause GASTRIC OUTLET OBSTRUCTION
 - Rupture is often contained within the retroperitoneum, especially when caused by blunt trauma
 - Can present late w/ abdominal pain, fever & tenderness (hours to days)
- **PANCREATIC INJURY:**
 - Often occur with rapid deceleration when pancreas is displaced against vertebral column
 - Consider in unrestrained drivers/handlebar mechanism
 - Release of enzymes can produce retroperitoneal autodigestion and retroperitoneal abscess formation
 - CAN BECOME SYMPTOMATIC DAYS LATER
 - Initial CT can be negative.
- **DIAPHRAGMATIC INJURIES:**
 - Relatively uncommon but notoriously difficult to diagnose

DIAGNOSTIC MODALITIES (Blunt Trauma):

NO TEST IS FOOLPROOF!

PHYSICAL EXAMINATION:

- Exam should include flank, back, lower chest and anterior abdomen.
- Single exam = INSENSITIVE. Repeated examination = better...
- Patient must be awake, alert and reliable
- Serial exams crucial

ULTRASOUND:

- FAST = Bedside screening tool
- Repeatable.
- Consensus suggests two FAST separated by six hours supplementing physical exam avoids missing an injury
- FAST has essentially supplanted DPL
- Decreases time to OT

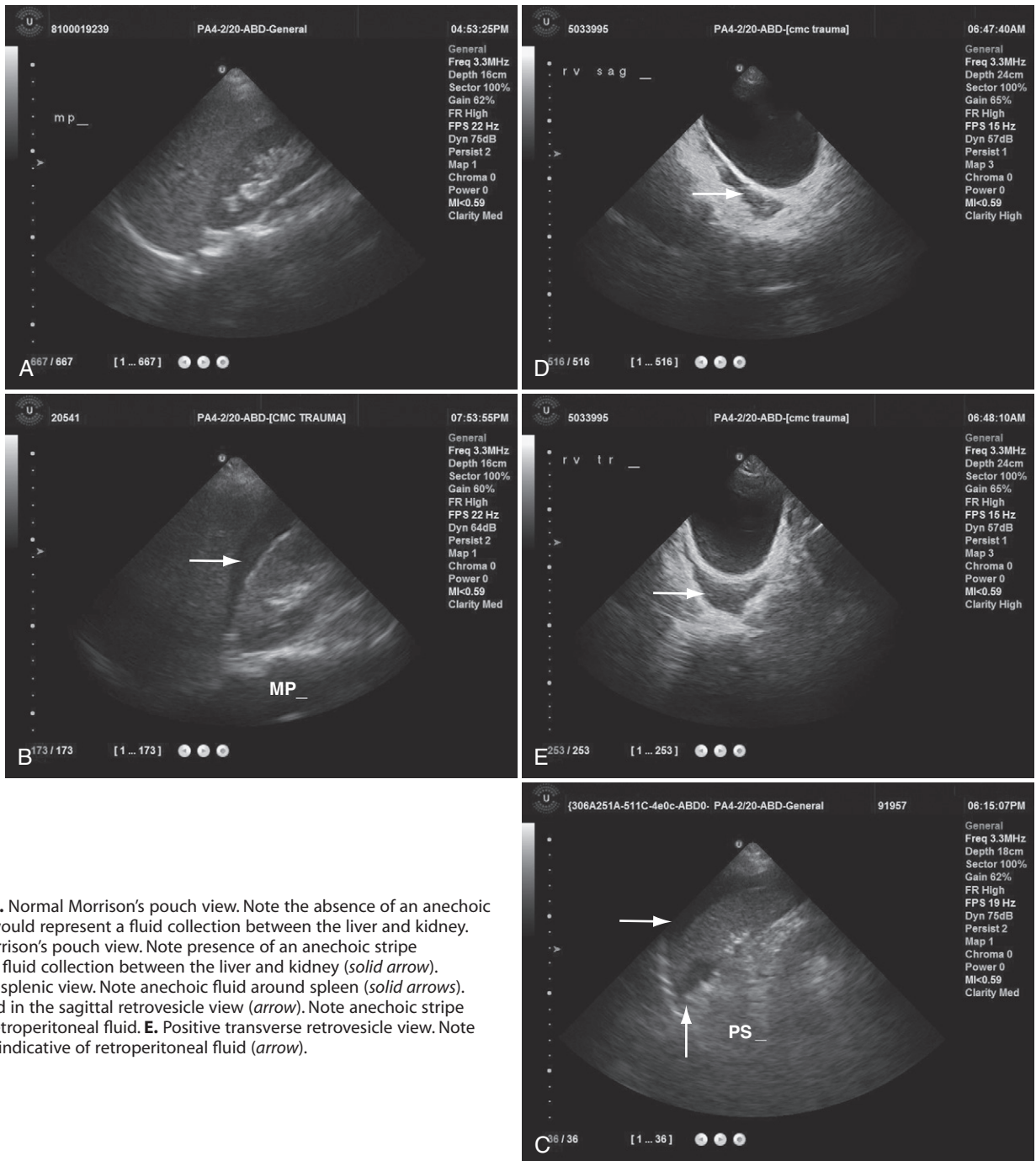


Figure 43-8. **A.** Normal Morrison's pouch view. Note the absence of an anechoic stripe, which would represent a fluid collection between the liver and kidney. **B.** Positive Morrison's pouch view. Note presence of an anechoic stripe representing a fluid collection between the liver and kidney (*solid arrow*). **C.** Positive perisplenic view. Note anechoic fluid around spleen (*solid arrows*). **D.** Positive fluid in the sagittal retrovesicle view (*arrow*). Note anechoic stripe indicative of retroperitoneal fluid. **E.** Positive transverse retrovesicle view. Note anechoic area indicative of retroperitoneal fluid (*arrow*).

- **COMPUTED TOMOGRAPHY:**
- THE GOLD STANDARD OF DIAGNOSIS FOR ABDOMINAL INJURY
- Images abdomen & retroperitoneum to make “organ-specific diagnosis”
- Can identify injuries that may be managed non-operatively
- One study reported 28% patients with negative FAST had solid organ injury without haemoperitoneum
- PELVIC FRACTURES and THORACOLUMBAR FRACTURES mandate CT regardless of the FAST result

DIAGNOSTIC MODALITIES (Penetrating Trauma):

STAB WOUNDS:

- Mandatory surgical exploration for stab wound to the abdomen has largely been abandoned due to high rates of non-therapeutic laparotomy
- LOCAL WOUND EXPLORATION:
 - Only appropriate in the anterior abdomen NOT FLANK OR BACK !
 - Digital probing or radiographic TRACJECTOGRAMS inaccurate
 - If local exploration demonstrates no violation of the anterior fascia, the patient can safely be discharged
- CT SCANNING:
 - 97-100% accurate

GUNSHOT WOUNDS:

- The most important consideration is whether the missile traversed the peritoneal cavity

Patients with transabdominal gunshot wounds virtually all have intra-abdominal injury requiring surgery

- If CT clearly demonstrates a subcutaneous trajectory or minimal retroperitoneal violation, the patient can safely be discharged home after a period of observation

THE ROLE OF FAST IN PENETRATING TRAUMA:

- **> 90% POSITIVE PREDICTIVE VALUE**
- However, negative FAST does not exclude injury, as up to one third have injuries requiring laparotomy
- Further diagnostic investigation is still necessary.

ED MANAGEMENT AND DISPOSITION:

LAPAROTOMY:

- **GOLD STANDARD THERAPY**
 - Definitive & rarely misses injury; complete assessment of abdomen & retroperitoneal contents.
- Generally speaking, all patients with hypotension, abdominal wall disruption or peritonitis need surgical exploration
- Often the safest course is surgical exploration to avoid late diagnosis of GI perforation or ischaemia

Table 260-5 Indications for Laparotomy

| | Blunt | Penetrating |
|----------|--|--|
| Absolute | Anterior abdominal injury with hypotension | Injury to abdomen, back, and flank with hypotension |
| | Abdominal wall disruption | Abdominal tenderness |
| | Peritonitis | GI evisceration |
| | Free air under diaphragm on chest radiograph | High suspicion for transabdominal trajectory after gunshot wound |
| | Positive FAST or DPL in hemodynamically unstable patient | CT-diagnosed injury requiring surgery (i.e., ureter or pancreas) |
| | CT-diagnosed injury requiring surgery (i.e., pancreatic transection, duodenal rupture, diaphragm injury) | |
| Relative | Positive FAST or DPL in hemodynamically stable patient | Positive local wound exploration after stab wound |
| | Solid visceral injury in stable patient | |
| | Hemoperitoneum on CT without clear source | |

NON-OPERATIVE MANAGEMENT OF BLUNT TRAUMA:

- GREATLY ADVANCED BY THE EVOLUTION OF CT AS A DIAGNOSTIC TOOL
- However, CT is a SINGLE-SNAPSHOT in time, not a dynamic assessment
 - Does not always agree w/ intraoperative findings *NOR* predict the success of non-operative management.
- As patients age, the capsule of the spleen and liver weakens and the consequences of rebleeding increase and the failure rates of non-operative management increase in older populations
- Percutaneous embolisation can prevent need for open surgery.

NON-OPERATIVE MANAGEMENT OF HEPATIC INJURY:

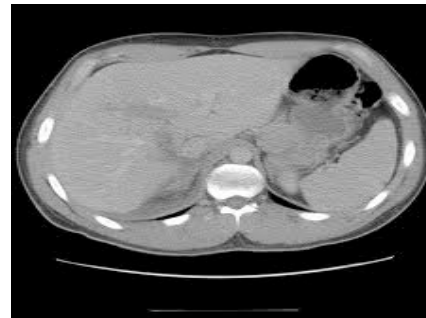
- The norm for low-grade injuries (I-III)
- Patients who become unstable should undergo prompt laparotomy
 - Angiography as an adjunct especially in those with large haemoperitoneum or a vascular blush on CT
 - If injury “juxta-vena-caval” consider hepatic vein stenting
- See below for Liver Injury Scale

Table 260-6 American Association for the Surgery of Trauma Liver Injury Scale

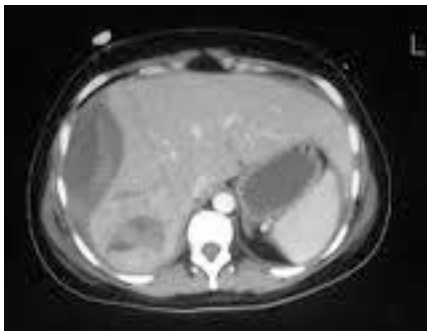
| Grade* | Injury Description |
|---------------|---|
| I. Hematoma | Subcapsular, nonexpanding, <10 cm surface area |
| Laceration | Capsular tear, nonbleeding, <1 cm parenchymal depth |
| II. Hematoma | Subcapsular, nonexpanding, 10%–50% surface area; intraparenchymal, nonexpanding, <10 cm in diameter |
| Laceration | Capsular tear, active bleeding; 1–3 cm parenchymal depth, <10 cm in length |
| III. Hematoma | Subcapsular, >50% surface area or expanding; ruptured subcapsular hematoma with active bleeding; intraparenchymal hematoma, >10 cm or expanding |
| Laceration | >3 cm parenchymal depth |
| IV. Hematoma | Ruptured intraparenchymal hematoma with active bleeding |
| Laceration | Parenchymal disruption involving 25%–75% of hepatic lobe or 1–3 Couinaud segments within a single lobe |
| V. Laceration | Parenchymal disruption involving >75% of hepatic lobe or more than 3 Couinaud segments within a single lobe |
| Vascular | Juxtahepatic venous injuries (i.e., retrohepatic vena cava/central major hepatic veins) |
| VI. Vascular | Hepatic avulsion |



Grade I liver laceration = capsular tear, non-bleeding



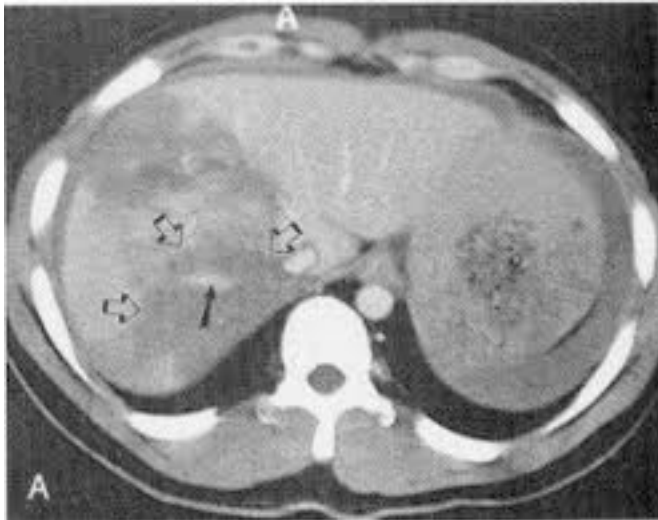
Grade II liver laceration → 1–3cm parenchymal depth <10cm length, capsular tear with active bleeding



Grade III liver laceration → >3cm parenchymal depth. Ruptured subcapsular haematoma with active bleeding



Grade IV liver laceration → parenchymal disruption involving 25–75% of hepatic lobe or 1–3 segments within a single lobe



Grade V liver laceration. Juxtahepatic venous injuries → i.e. retrohepatic vena cava or central major hepatic veins. Parenchymal disruption involving >75% of hepatic lobe or >3 segments within a single lobe.

- REMEMBER TO ADVANCE ONE GRADE FOR MULTIPLE INJURIES (UP TO GRADE III)
- Grade IV and V normally need surgery.
- If lower grade injuries deteriorate --> LAPAROTOMY

NON-OPERATIVE MANAGEMENT OF SPLENIC INJURY:

- The spleen is the *most commonly injured visceral organ* in blunt trauma in both adults and children
- Non-operative management in adults has a failure rate of approximately 10-15%
 - Some therefore advocate non-operative management to patients <55 years and those with CT injury grade no higher than III
- DETERMINING FACTORS:
 - Haemodynamic status on presentation
 - Grade of injury
 - Amount of haemoperitoneum seen on CT
- ANGIOGRAPHY is another addition to our armamentarium. Proximal embolisation, decreases the pressure head, thus allowing for spontaneous haemostasis with retention of immune function and splenic viability via collateral vessels from the pancreatic branches of the splenic artery.

Table 260-7 American Association for the Surgery of Trauma Spleen Injury Scale

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

