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Excerpt

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A-Z OF ABDOMINAL RADIOLOGY

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Abdominal trauma

Clinical characteristics

- A general discussion, followed by organ-specific summaries, is given below.
- Abdominal trauma is managed as part of general trauma under the ATLS (advanced trauma life support) algorithm, where basic care of airway, breathing and circulation is followed by a secondary survey and simultaneous management.
- Abdominal trauma is usually divided into *blunt* and *penetrating* trauma.

Penetrating trauma

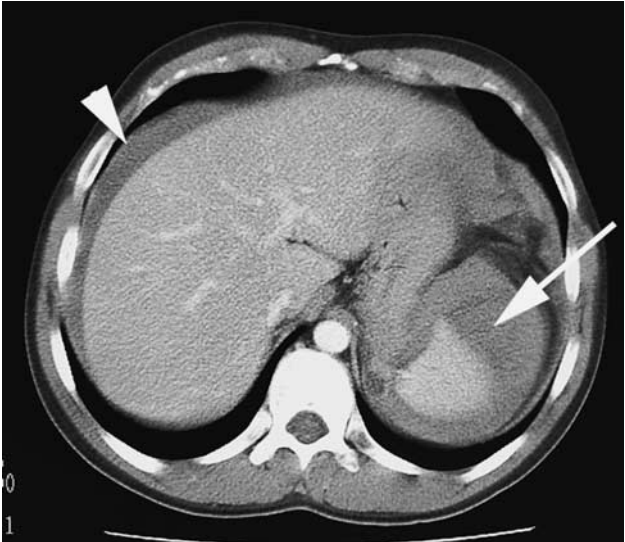
- Generally managed by surgical exploration and repair. Surgical repair may be primary or secondary (delayed) according to a multitude of factors, including degree of contamination, time since injury and general health of the patient.
- Where the patient is haemodynamically unstable, with signs of obvious massive intra-abdominal haemorrhage, many of the investigations below are suspended, and the patient is managed surgically on an emergency basis with coexistent haemodynamic monitoring and management.
- If the patient is haemodynamically stable, the usual radiological investigation is a contrast-enhanced computed tomography (CECT) scan. This is usually performed following a radiographic primary survey (lateral cervical spine, chest and pelvis radiographs).
- It is now generally considered that diagnostic peritoneal lavage is rarely indicated and has been superseded by CECT.
- Emergency ultrasound (US) of the abdomen and pelvis is sometimes performed and may be of use in determining the presence and location of intra-abdominopelvic blood. Vascularity of abdominal viscera (e.g. the kidneys) can also be assessed. US may also be used to monitor patients who are being managed conservatively. However, CECT is considered superior in the context of acute abdominal trauma.

Blunt trauma to the spleen

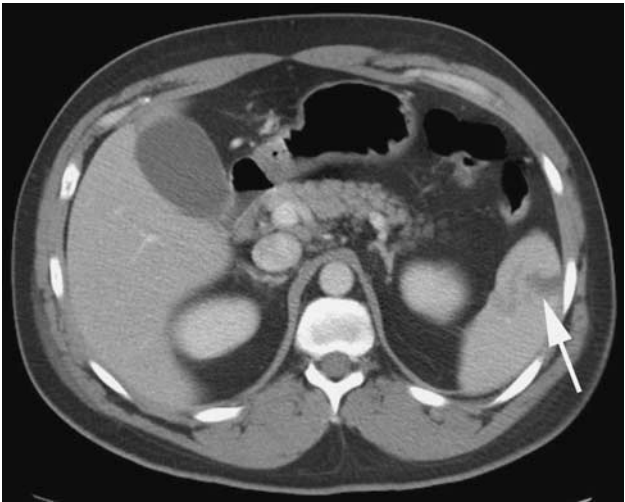
- Spleen is the most commonly injured solid intra-abdominal organ.
- Blunt trauma is the most common cause.
- Often (40%) associated with lower rib fractures and left renal injury.
- In 20% of patients with left rib fractures, there is a concomitant splenic injury.

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Abdominal trauma



Rupture of the spleen. Rupture of the anterior half of the spleen caused by blunt trauma in falling from a horse. Haemorrhage is seen within the splenic bed (arrow) along with free blood around the liver (arrowhead).



Splenic laceration (arrow).

- 25% of patients with left renal injuries also have splenic injuries.
- Damage ranges from subcapsular haematoma to total splenic laceration, potentially leading to exsanguination.

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Radiological features

- **Abdominal X-ray (AXR):**
 - Poor sensitivity in identifying both the site and presence of intra-abdominal haemorrhage.
 - May show associated fractures, displaced air-filled bowel caused by intra-abdominal blood or free air from associated bowel perforation.
- **CECT:**
 - In nearly all cases of abdominal trauma, a CECT of the abdomen and pelvis is performed to ensure adequate coverage of injuries.
 - Mottled splenic parenchymal enhancement may represent contusion.
NB. The spleen in the arterial phase of a CECT may normally appear mottled.
 - Splenic fracture may present as complete separation of unenhancing splenic fragments.
 - Subcapsular haematoma is shown by a crescentic region of low attenuation compressing normal parenchyma.
 - Intracapsular haematoma is demonstrated by a hypodense inhomogeneous region within the spleen.
 - Splenic laceration is revealed as a hypoattenuating line connecting opposite visceral surfaces. Associated with perisplenic fluid.
 - Multiple lacerations represent a shattered spleen.
 - Disruption of the splenic capsule with high-density fluid within abdomen represents splenic rupture with free intraperitoneal haemorrhage.

Complications

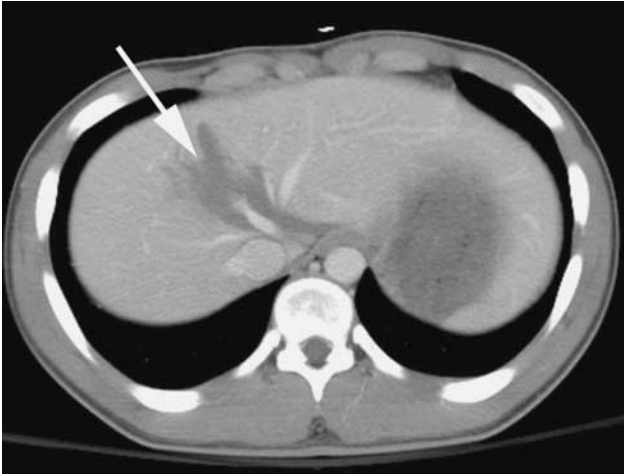
- Splenic pseudocyst formation.
- Delayed rupture – up to 10 days later.
- Infected subcapsular haematoma.
- Splenic artery pseudoaneurysm.

Blunt trauma to the liver

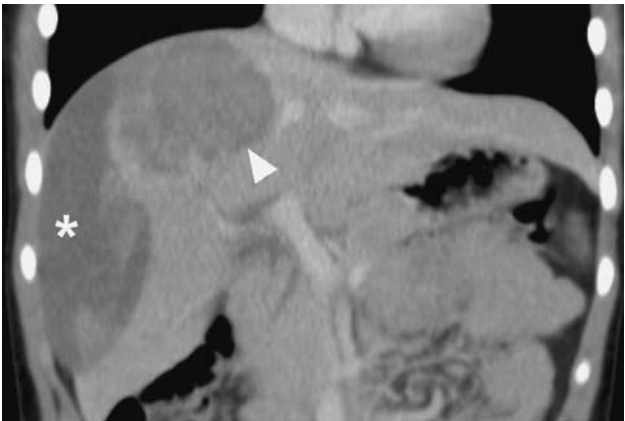
- Second most frequently injured intra-abdominal organ.
- Associated with splenic injury in 45%.
- Right lobe more frequently injured.
- When left lobe is involved, there may be associated injury to the duodenum, pancreas and transverse colon.

Radiological features

- **AXR:**
 - Increased density in RUQ, displacement of neighbouring organs, e.g. right kidney displaced downwards and medially.



Large liver laceration (arrow).



Liver haematoma. Large haematoma within the superior aspect of the right lobe of liver (arrowhead) with an additional subcapsular haematoma (asterisk).

- **CECT:**
 - Subcapsular haematoma – hypoattenuating lenticular configuration, usually resolves in 6–8 weeks and generally managed conservatively.
 - Hepatic laceration – irregular linear branching, single or multiple stellate configurations of low density relative to enhancing parenchyma.
 - Focal hepatic devascularisation – focal hypodense wedge lesion extending to liver surface.
 - Active haemorrhage – focal hyperdense area.
 - Hepatic necrosis – intrahepatic or subcapsular gas.

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Complications

- Occur in up to 20%.
- Haemobilia.
- Pseudoaneurysm/arteriovenous fistula formation.
- Biloma.
- Infection/necrosis.
- Delayed hepatic rupture – unusual.

Blunt trauma to the kidneys

- Occurs in 10% of blunt abdominal injury.
- Often caused by a direct blow (80%).
- Usually caused by laceration by lower ribs or devascularisation of the renal pedicle in acceleration–deceleration injuries.
- Associated with other abdominal organ injury in 20%.
- Almost always presents with some degree of haematuria (over 95%).
- Main exception is with renal pedicle injuries, where 25% have no haematuria due to devascularisation of kidney.
- Not usually accompanied by lower renal tract injury.
- Four degrees of injury, ranging from contusion and corticomedullary laceration (grade I) to renal pedicle avulsion (grade IV).

Radiological features

- **AXR:** Plain film findings commonly seen in renal trauma include:
 - Absent psoas shadow.
 - Enlarged/distorted kidney and pelvicalyceal system (following administration of IV contrast).
 - Fractures of the 10th, 11th and 12th ribs.
 - Fractures of the transverse processes of the 1st, 2nd or 3rd lumbar vertebra.
 - Scoliosis, concave towards the injured side, due to associated muscle spasm.
 - Localised small-bowel/colonic ileus.
- **US:**
 - May show devascularisation, renal swelling from a diffuse haematoma, peri- or pararenal haematoma, renal laceration or ureteric obstruction from a ureteric clot.
- **CECT:**
 - Renal contusion – focal areas of decreased contrast enhancement or striated nephrogram.
 - Renal laceration – irregular linear hypodense parenchymal areas.
 - Renal fracture – laceration connecting two cortical surfaces.
 - Shattered kidney – multiple separated renal fragments.
 - Subcapsular haematoma – crescentic superficial hypodense area.
 - Wedge infarction – wedge-shaped perfusion defect.



Closed blunt right renal trauma. There is asymmetry between the two renal outlines, with distortion of the left pelvicalyceal system and left renal outline. In addition there is a scoliosis of the thoracolumbar spine, concave towards the injured side, and a localised ileus of the splenic flexure. Normal contrast excretion seen from the right kidney.



Kidney trauma. Multiple fractures of the right kidney (arrowheads) caused by blunt trauma from a kick by a horse. Extensive surrounding perinephric haemorrhage.

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- Renal vein thrombosis – persistent delayed nephrogram.
- Delayed scans are also often performed to check for a ureteric leak.

Blunt trauma to pancreas

- Usually caused by compression against the vertebral column; often associated with seat belt compression injuries.
- Usually associated with upper abdominal visceral injury.
- Graded from minor contusion and capsular haematoma (grade I) to severe devascularising crush injury (grade IV).
- Usually damage occurs at most vulnerable segment of pancreas: the junction of the body and tail.

Radiological features

- **CECT:**
 - Laceration – area of intrapancreatic low attenuation, often difficult to see.
 - Direct evidence of haemorrhage – fluid around superior mesenteric artery and pancreas.
 - Indirect evidence – thickening of anterior pararenal fascia.
- Often requires delayed scans to exclude/monitor complications of pancreatitis and devascularised pancreas.

Complications

- Post-traumatic pancreatitis, with:
 - peripancreatic fat stranding
 - diffuse or focal pancreatic enlargement
 - irregular pancreatic contour.
- Splenic vessel fistula or arterial pseudoaneurysm.
- Pancreatic abscess.
- Pancreatic pseudocyst.

Blunt Trauma to the gastrointestinal tract

- The proximal jejunum is most commonly affected, followed by the duodenum and ascending colon at the ileocaecal valve region. The descending colon is only rarely involved.

Radiological features

- **CECT:**
 - Appearances range from mesenteric or intramural haematoma to frank colonic laceration and perforation.

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Abdominal trauma



Pancreatic trauma. Laceration of the pancreas within the proximal body (arrowheads).



Duodenal haematoma. Diffuse thickening of the third part of duodenum secondary to a post-traumatic duodenal haematoma (arrowheads).

- Subtle helpful signs include streaky hyperdense mesentery, sentinel clot sign adjacent to local bowel injury, and hyperdense enhancement of bowel wall in delayed venous phase caused by mesenteric vascular damage.

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Less-common abdominal trauma injuries

- Gallbladder.
- Ureter.
- Stomach.
- Adrenals.

Trauma to the bladder

Aetiology and frequency

The probability of bladder injury varies according to the degree of bladder distension; a full bladder is more likely to be injured than an empty one.

- Approximately 10–25% of patients with a pelvic fracture also have urethral trauma. Conversely, 10–29% of patients with posterior urethral disruption have an associated bladder rupture.
- **External trauma:** 80%.
 - Blunt injury: 60–85%:
 - road traffic accident (RTA), 85%.
 - fall, 10%.
 - assault, 5%.
 - Penetrating trauma: 15–40%:
 - gunshot wound, 85%.
 - stabbing, 15%.
- **Iatrogenic:** 15%.
 - Includes gynaecological (post-hysterectomy), urological (after trans-urethral resection of prostate (TURP) or bladder tumour (TURBT)) and orthopaedic (post-fixation of pelvic fractures) procedures.
- **Intoxication:** 4%.
- **Spontaneous:** <1%.

Classification of bladder rupture

- Extraperitoneal rupture: 50–75%.
- Intraperitoneal rupture: 25–45%.
 - Incidence higher in children because of the predominantly intra-abdominal location of the bladder prior to puberty.
 - The bladder descends into the pelvis usually by the age of 20 years.
- Combined extraperitoneal and intraperitoneal rupture: 5–10%.

Extraperitoneal bladder rupture

- Traumatic extraperitoneal ruptures are usually associated with pelvic fractures in up to 90% of patients. Conversely, approximately 10% of patients with pelvic fractures also have significant bladder injuries.