Diagnostic Imaging Pathways - Abdominal Blunt Trauma

Population Covered By The Guidance

This pathway provides guidance for imaging adult patients with blunt abdominal trauma. The initial steps depend on the haemodynamic stability of the patient.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

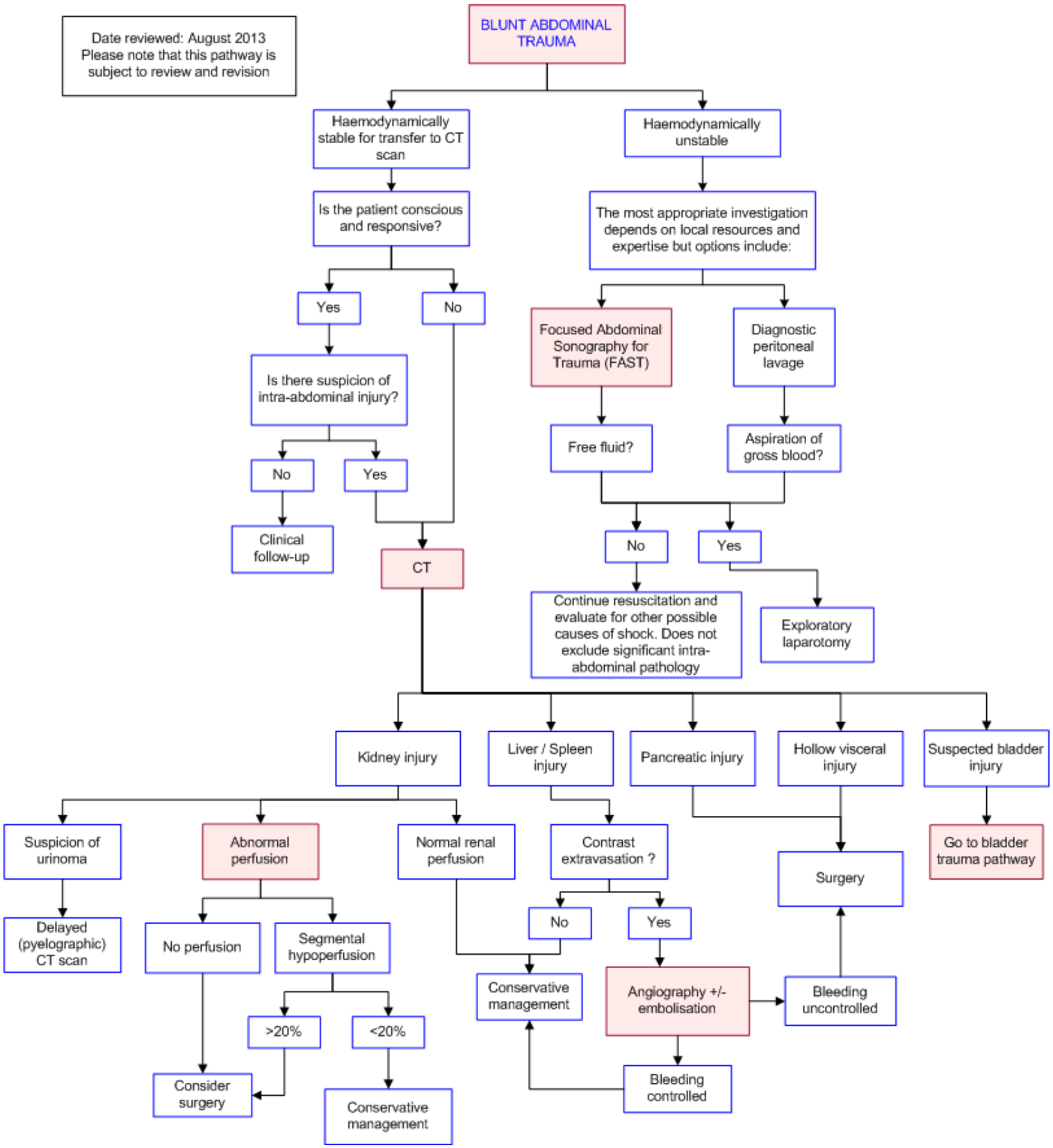
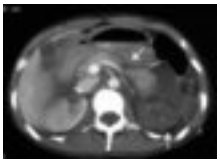


Image Gallery

Note: These images open in a new page

1a

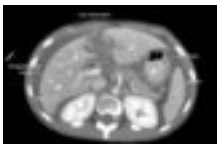
1b



Blunt Abdominal Trauma

Image 1a and 1b (Computed Tomography): Traumatic lacerations to the right and left liver lobes (arrows, Image 1a) and pancreas (Image 1b, arrow) with left renal pedicle injury (lack of enhancement of the left kidney, arrow, Image 1b)

2a



Blunt Abdominal Trauma

Image 2a (Computed Tomography): Traumatic laceration to the liver. Note extensive free intra-peritoneal blood.

2b

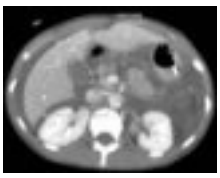
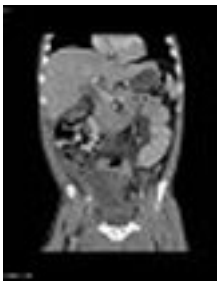


Image 2b (Computed Tomography): Traumatic laceration to the pancreas. Note extensive free intra-peritoneal blood.

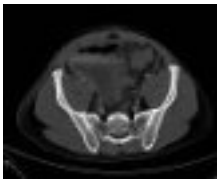
3a



Blunt Abdominal Trauma

Image 3a and 3b (Computed Tomography): Coronal and axial views showing small bowel perforation with adjacent collection (arrow).

3b



Teaching Points

- In a patient who is haemodynamically unstable 'FAST' (Focused Abdominal Sonography for Trauma) ultrasound is useful to assess for intraperitoneal bleeding
- In stable patients, CT is the investigation of choice

Angiography and Embolisation

- Depending on local facilities, angiography may be used as an adjunct to non-operative management of splenic and liver injuries in haemodynamically stable patients with high success rates
- Findings on CT which are prective of the need for splenic angiography and embolisation (or surgical intervention) include the presence of devascularisation or laceration involving more than 50% of the splenic parenchyma, contrast extravasation of more than 1cm in diameter and haemoperitoneum. 38,39 The sensitivity and specificity of these findings are 100% and 88% respectively 40

- The current indication for hepatic artery angiography and embolisation is active bleeding (contrast extravasation) in the liver parenchyma on CT in a haemodynamically stable patient 47
- Aggressive use of angiography for splenic injuries is associated with high rates of non-operative management (>80%) and failure rates of less than 5%. 41-45 However, some studies have found no difference in failure rates compared to conservative management without angiography 46
- Based on limited data, reported success rates for hepatic artery embolisation range from 85% to 100% 47
- There is also emerging evidence to support the safe and successful use of angiography and embolisation in haemodynamically unstable patients responsive to initial resuscitation 48,49
- Controversy currently surrounds whether main splenic artery or super-selective embolisation or both represent optimal management 44
- There is limited evidence evaluating the usefulness of routine follow-up CT scans to prevent late complications of non-operative management of splenic injuries, particularly delayed rupture of pseudoaneurysms 44
- Disadvantages
    - Some series report up to a 30% major complication rate for splenic artery embolisation including failure to control bleeding, missed injuries, delayed pseudoaneurysm rupture, splenic infarction, atrophy and abscess formation 42-44,50
    - Complications for liver embolisation include massive liver ischaemia and gallbladder infarction
    - Cannot be used for juxtahepatic venous injury 51
    - Labor intensive requiring continuous monitoring

Computed Tomography (CT)

- Imaging modality of choice in the initial evaluation of haemodynamically stable blunt trauma injury 1-5
- Most accurate (>95% sensitivity and specificity) and cost effective modality for localisation and grading of specific organ injuries which helps decide if a patient needs a period of close observation or urgent therapeutic intervention 6-8
- Initial CT of the abdomen should be performed with intravenous contrast to facilitate the diagnosis of hollow viscus injuries 1
- Universal agreement does not exist on the use of oral contrast, but it has been shown to assist the diagnosis of bowel injury
- Direct signs of free intraperitoneal or retroperitoneal perforation as well as signs of a vascular mesenteric lesion usually mandate exploratory laparotomy, whereas other, more indirect signs may raise the suspicion of a bowel injury and usually warrant further investigation or close observation 9
- High negative predictive value of spiral CT and repeat standardised abdominal examination can help decide which patients can be safely discharged home 5-10
- Advantages 11
    - Gives complete visualisation of the intra-abdominal solid organs
    - Sensitive for the detection of intra-abdominal or retroperitoneal haematoma and pneumoperitoneum, which may result from a bowel injury
- Limitations 11
    - Not appropriate for haemodynamically unstable patients
    - Less sensitive in detection of bowel injury 12
- Helical CT or MDCT is the imaging technique of choice in patients with blunt renal trauma 9
- Multidetector CT (MDCT) has a higher speed of data aquisition and is able to obtain thinner imaging sections compared to single slice helical CT, resulting in increased contrast opacification in the vasculature and parenchyma 27

- Using MDCT, active haemorrhage in patients with blunt abdominal trauma may be visualised as a jet of extravasated contrast media which is an indication for immediate intervention 28
- Advantages of MDCT compared to single slice helical CT 27-30
    - Larger volume scanned per breath hold
    - Increased spatial resolution with improved identification and evaluation of vasculature and parenchymal organs
    - Reduced scanning times due to faster scanning speeds
    - Significantly lower doses of IV contrast medium required for similar enhancement

CT Cystogram

- Conventional CT of the abdomen/pelvis has a poor sensitivity of 50-60% for detecting blunt bladder injuries. 32,33 Its role in this setting is to identify other abdominal injuries.
- The accuracy of CT for detecting and categorising bladder injuries can be greatly improved with a CT cystogram.
- Indications for this study include gross haematuria, pelvic fractures or high clinical suspicion of bladder injury.34
- Recent studies support the use of retrograde filling of the bladder with dilute iodinated contrast. Using this technique, the reported sensitivity for detecting bladder rupture ranges from 95% to 100% and the specificity is 100%. 34-37 These figures are comparable to conventional retrograde cystography. 34
- For categorising the type of bladder injury, the accuracy of a CT cystogram for identifying extraperitoneal injury is similar to conventional cystography. However, the sensitivity is slightly lower for intraperitoneal injury (94% versus 100%). 34
- Multidetector CT with multiplanar reformation may help better localise the site of bladder rupture. 37
- In order to minimise exposure to radiation, time and costs, CT cystograms can be performed as part of the screening abdominopelvic CT without the need for postvoid images. 34, 55, 56
- Disadvantages:
    - Conventional cystography may still be required for equivocal results
    - Differentiating intra and extraperitoneal injury may be difficult and requires expertise in this field

CT Angiography

- CT Angiography is an effective technique for assessment of the vascular system and the detection of active haemorrhage in patients with blunt abdominal trauma. 29,31
- Multidetector CT Angiography is more efficient than single slice helical CT Angiography with faster scanning times, increased spatial resolution and less IV contrast required. 27
- Advantages compared to intra-arterial digital subtraction angiography: 27
    - More readily available than conventional angiography
    - Less invasive

Coventional Cystography

- Previously considered the reference standard for non-operative diagnosis of traumatic blunt bladder injuries. However, recent studies have demonstrated similar accuracy for CT cystograms.

34

- Should be considered if CT cystograms are equivocal for the diagnosis or categorisation of bladder rupture.
- For classifying the type of injury, conventional cystography and CT cystograms have comparable accuracy for diagnosing extraperitoneal injury. Conventional cystography has a slightly higher sensitivity for intraperitoneal injury (100% verses 94%). 34
- Disadvantages:
    - May be difficult in trauma patients requiring spinal precautions
    - Does not provide detailed information on surrounding structures
    - May be limited by overlying fracture fragment or fixation devices
    - Involves additional exposure to ionising radiation in addition to screening abdominopelvic CT
    - Requires postvoid films to avoid missing small extravasations obscured by contrast-filled bladder

Focused Abdominal Sonography in Trauma (FAST)

- Particularly useful for the evaluation of haemodynamically unstable patients with blunt abdominal trauma 13-15
- Enables the identification of patients with significant haemoperitoneum who require immediate exploratory laparotomy 13-15
- A number of studies support the routine use of abdominal US in the evaluation of patients with blunt abdominal trauma, but the sensitivity of FAST for the detection of intra-abdominal injuries has varied considerably from 42% to over 90% 6,14-19,21-23
- Advantages 11
    - Rapid, non-invasive
    - No patient preparation
    - No exposure to ionising radiation
    - Does not interfere with resuscitation
    - Allows serial imaging to reassess the patient should there be interval change in the patient's haemodynamics or condition
- Limitations 4,11,16
    - False-negative results 20,21
    - Much more operator dependent than other imaging modalities
    - Very poor for evaluation of the retroperitoneum (kidneys, duodenum and pancreas)
    - Inability to detect bowel injury or active bleeding
    - Lack of sensitivity for directly demonstrating organ injury 23

Abnormal Renal Perfusion

- No renal perfusion on CT suggests renal pedical avulsion which is considered an absolute indication for prompt surgical exploration 52-54
- Large segmental hypoperfusion of more than 20%, particularly when combined with parenchymal laceration and contrast extravasation, may be an indication for surgical exploration 52

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