

Trauma Service Guidelines

Title: Blunt Abdominal Trauma

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Background

Blunt abdominal Trauma in Australia accounts for 70-90% of all abdominal injuries; the most common causes are motor vehicle accidents, fall and assaults.

At The Royal Melbourne Hospital abdominal trauma accounts for 6% of all major trauma injuries, the most common mechanisms are motor vehicles, motor bike, pedestrians and high falls. 34% of these cases require an operation and 12% require angioembolisation¹. The most common blunt abdominal injuries at RMH are to the liver, spleen, kidney and mesentery.

Changes in the management of blunt abdominal trauma

Early in the twentieth century, abdominal trauma was associated with high mortality and a low threshold for laparotomy². A major change in the paradigm of the management of blunt abdominal trauma was the introduction of non-operative management.

This coincided with the widespread availability of CT scans and the introduction of angioembolisation as a common procedure for the management of solid organ injuries³⁻⁶. In combination this shift has resulted in the reduction in the morbidity associated with laparotomy⁷⁻¹⁰. However, non-operative management has its shortcomings with missed concomitant intraabdominal injuries, failed angioembolisation and missed high grade solid organ injuries may result.

The aim is to select patients who are most likely to benefit from non-operative management, to reduce non therapeutic laparotomy rates and to rationalise the use of computed tomography.

Diagnosis of an Abdominal Injury

Diagnosis remains a challenge in blunt abdominal trauma. Blunt abdominal injuries commonly occur as multi system injuries with no obvious external signs of trauma. Abdominal trauma management should be aimed at Identification of injury and determining the best course of treatment i.e. laparotomy/ angiography/observation.

Diagnostic peritoneal lavage (DPL) has a high sensitivity (95%) and specificity (99%) for the detection of intraperitoneal haemorrhage¹¹. However, DPL does not exclude retroperitoneal injury and is invasive with a 1% risk of complications¹³. CT scanning is seen as the "gold standard" in assessment, investigation and management of blunt abdominal trauma due to its sensitivity of 92-97.6% and specificity of 98.7%¹⁴. Advantages include non-invasive nature, the ability to exclude retroperitoneal injuries and the ability to grade solid organ injury. The negatives being radiation dose, questionable performance in detecting patient with hollow organ injuries¹⁵⁻¹⁷ and the difficulty of getting an unstable patient to the CT scanner.

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FAST (Focused Assessment with Sonography for Trauma) is an abbreviated search for intraperitoneal fluid which may indicate intraabdominal haemorrhage. A FAST examination can be completed in about 2.5 minutes, is non-invasive and earlier studies which evaluated the performance of FAST reported sensitivity and specificity comparable to that of DPL and CT^{18, 19}. However a FAST scan results are questionable in the haemodynamically stable patient.

Decision Making in Blunt Abdominal Trauma

Management of haemodynamically unstable patients SBP<90mmHg

A FAST scan in haemodynamically unstable patients should determine the need for laparotomy^{14, 20-26}. The sensitivity and specificity of FAST in the detection of haemoperitoneum in haemodynamically unstable patients has been reported as high as 100%^{56 61}, with the presence of intraperitoneal fluid outside the pelvic cavity strongly associated with intraabdominal injury⁵⁷⁻⁶⁰. The exception the this are in patients with isolated pelvic fluid in women of reproductive age and children^{58 59}.

A negative FAST in a haemodynamically unstable patient reliably excludes the abdomen as the source of haemodynamic instability (NPV= 93%, 90% for any intraabdominal injury, 99% for intraabdominal injuries requiring surgical intervention, 100% for fatal intraabdominal injuries²⁰). If FAST results are negative, other causes of haemodynamic instability must be searched during the secondary survey.

Management of haemodynamically stable patients

For haemodynamically stable patients, the key decision to make is whether the patient requires CT scan, or a period of observation with serial abdominal examination.

FAST cannot be used to rule out intraabdominal injury due to its low sensitivity²⁶⁻³²

If intraabdominal injury is suspected, a more definitive assessment such as CT scans is required.

Equivocal or positive results from FAST or abdominal exam warrant further investigation and management according to the patients clinical and physiological status

Predictive Factors of intraabdominal injury requiring CT evaluation

The purpose of these evidence-based predictive factors is to assist in the identification of patients who may benefit from abdominal CT evaluation, while reducing the number of unnecessary CT scans³³. In the case where the patient's haemodynamic stable deteriorates but FAST is negative and no extraabdominal sources of bleeding are identified, an urgent abdominal CT scan is required to identify any active arterial bleeding associated with intraabdominal injury^{14, 34-37}.

Therefore, the predictors must be utilised with the clinical judgement to rationalise the use of CT scanning. The practical utility of some laboratory measurements assessed as predictive factors of intraabdominal injury may also be limited, depending on the institution's practice (e.g. clinicians of the multidisciplinary panel advised that haematuria > 24RBC/HPF and haematocrit < 30% were not practical measurements to be utilised for clinical practice).

The presence of any of the predictive factors of intraabdominal injury requiring CT evaluation, in conjunction with the clinician's judgement, recommends that obtaining an abdominal CT scan is strongly considered.

Predictive Factors of intraabdominal injury may require CT evaluation:

<ul style="list-style-type: none"> Abnormal chest, abdo/pelvis x-rays Abnormal abdominal, pelvis examination Abnormal FAST Intubation and/or GCS< 14 SBP < 980mmHg Multiple Injuries 	<ul style="list-style-type: none"> Long Bone Fractures Costal Margin Tenderness Seatbelt sign Haematuria Haemocrit <30% AST >110 IU/L and ALT > 63 IU/L Base Deficit <-3 WBC > 10, 000/mm³
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Patients who do not present with any of the predictive factors of intraabdominal injury requiring CT evaluation, and have no other presenting problems requiring further investigation or management may be observed with serial abdominal examination and discharged if no reason for admission is found.

Serial Abdominal Examinations

Evaluation of the abdomen includes inspection, looking for external signs of injury such as open wounds, or significant bruising and/or abrasions of the abdominal wall. Palpation of the abdomen is used to assess for tenderness, rigidity, and guarding and / or peritoneal signs. Many, although not all, patients with an abdominal injury complain of tenderness, and peritoneal signs may be present if there is injured bowel. Auscultation to assess for presence or absence of bowel sounds.

CT Results

Patients with no findings on CT

The negative predictive value for CT for diagnosis of intraabdominal injuries is 99.8%, therefore the majority of haemodynamically stable patients with no findings on CT may be discharged after a period of observation and serial abdominal examination^{38, 39}.

Hollow organ injury is a rare event (1-3.2 % of blunt trauma admissions⁴⁰). Missed hollow organ injuries account for up to 58% of delayed laparotomy due to blunt trauma.

The sensitivity of CT in the diagnosis of small intestine injury has been reported by as low as 75%¹⁶ and 64% for bowel or mesenteric injury¹⁷ therefore serial abdominal examination is of high importance.

Patients who are not clinically evaluable (GCS < 15) should be admitted with suspicion of hollow organ injury. Patients with equivocal physical examination, neurologic injury or multiple extraabdominal injuries, should also be admitted for observation because these are all factors that can reduce the reliability of abdominal examination^{14, 41}.

Patients with isolated intraperitoneal fluid found on CT

CT findings of unexplained free fluid in the absence of significant solid organ injuries was present in 93.5% of patients with confirmed hollow organ injury⁴². Isolated intraperitoneal fluid findings raise a high suspicion of hollow organ injury. Management decisions for these patients can be aided by determining the amount of free fluid on CT scans.

The amounts of fluid were determined as

Size	Definition & Space	Management
Small	fluid limited to one: Perisplenic, perihepatic space, Morrison's pouch, right/left paracolic gutter volume: 100-200ml	Normal GCS, no abdominal tenderness Low Risk
Medium	fluid in one: perisplenic, perihepatic space, Morrison's pouch, right/left paracolic gutter AND in the pelvis volume: 200-500ml	High risk, patients should be admitted regardless of abdominal assessment.
Large	fluid in two or more locations: perisplenic, perihepatic space, Morrison's pouch, right/left paracolic gutter AND in the pelvis volume: >500ml	

Patients with signs of hollow organ injury found on CT

CT is still considered the “modality of choice” for diagnosing small bowel perforation because of its high sensitivity to extraluminal air (100% sensitivity when CT was obtained more than 8 hours after injury) ^{42, 43}.

Other signs of hollow organ injury include:

- High density ascites (sensitivity 100%, >8 hours after injury) and mesenteric fat obliteration (sensitivity 100% >12 hours) in the absence of other visceral injury have also been described as sensitive CT findings demonstrating hollow organ injury.
- Bowel thickening has also been described as a significant CT finding, found in 29% of patients with hollow organ injury. However, these values were derived from a study with a population of only 12 patients with confirmed hollow organ injury and further studies are required with larger population sizes to validate the sensitivity of these CT signs.

The successful use of oral contrast for the detection of hollow organ injuries has also been described. Some studies have described high sensitivity (82-95%)^{44, 45, 46, 47} of CT without oral contrast in the detection of hollow organ injuries, but the injuries described were major injuries, and less obvious injuries may still be missed.

When CT evaluation indicates the presence of hollow organ injury, exploratory laparotomy for surgical management of the injury is required. Otherwise, patients are observed with serial abdominal examination. When hollow organ injury is suspected based on clinical signs without CT findings, it is recommended that exploratory laparotomy is considered with a low threshold to reduce complications resulting from delayed treatment of hollow organ injuries. Oral contrast may be valuable in the detection of hollow organ injuries that may be missed by CT scan without oral contrast.

Patients with active contrast extravasation found on CT

Contrast extravasation found on CT is a sign of active bleeding, and patients who present with this sign may require immediate surgical or angiographic intervention especially if they become unstable. The sensitivity of multidetector CT in the detection of active intraabdominal bleeding has been reported to be 87.5-100% and specificity 99.5-100%^{48, 49}.

The decision is between nonoperative management (including angioembolisation) and surgical management of haemodynamically stable patients with intraperitoneal contrast extravasation

Predictors of failed conservative management

High Risk for failed non-operative management in liver, spleen and pancreas ^{9, 50, 51, 52}

- High Grade Injury
- Exceeding one unit of blood/ and or increasing transfusion requirements
- Presence of other abdominal injuries

Quick Reference Guide

Indications for immediate laparotomy

- SBP < 90mmHg & +ve Fast
- Active extravasation of oral contrast

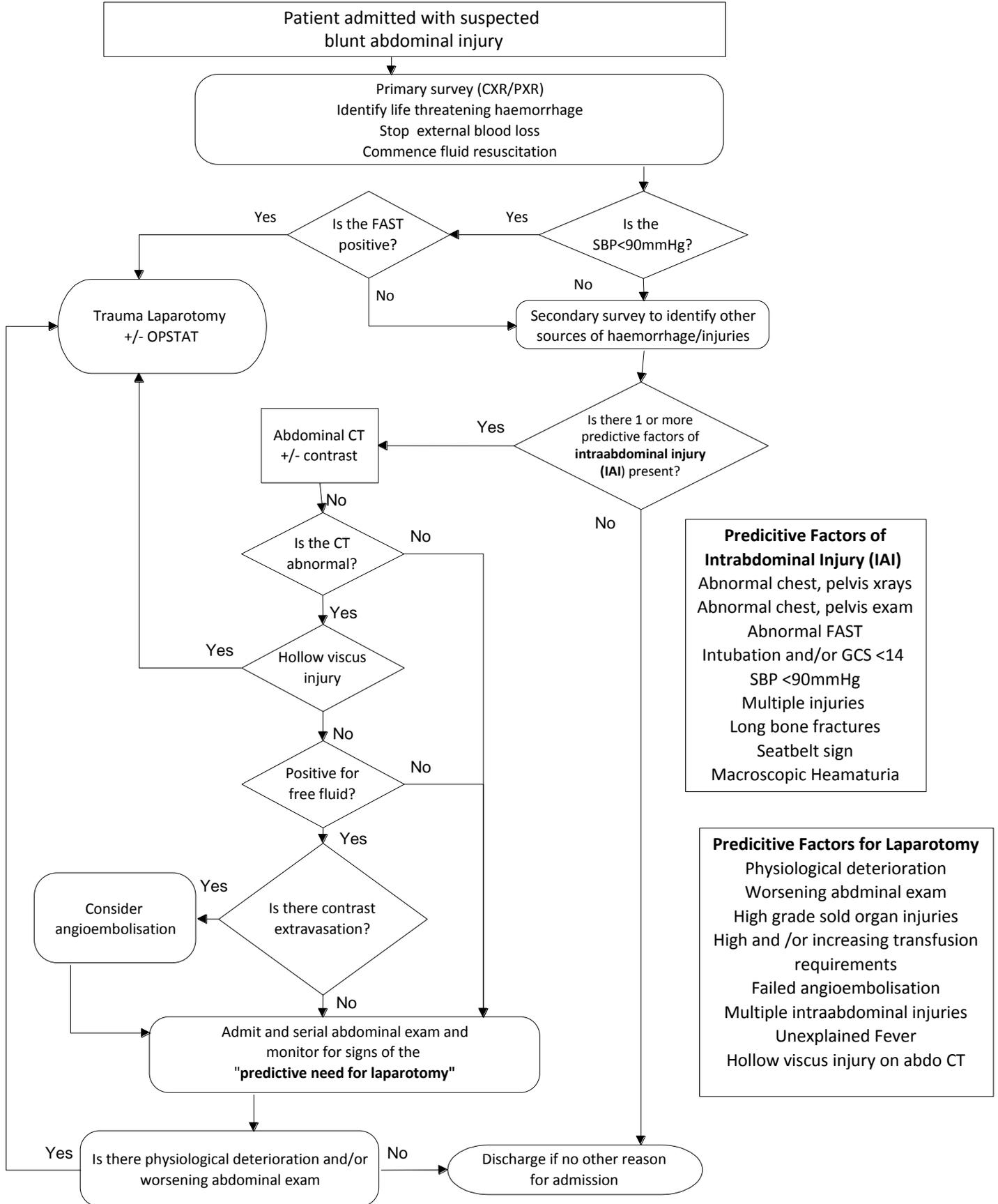
Predictors for CT scanning

- Abnormal chest, pelvis, lumbar x-ray
- Abnormal abdominal, pelvis or lumbar examination
- Abnormal FAST
- Intubation and/or GCS < 14
- SBP < 90mmHg
- Multiple Injuries
- Long Bone Fractures
- Costal Margin Tenderness
- Seatbelt sign
- Haematuria
- Haemocrit < 30%
- AST > 110 IU/L and ALT > 63 IU/L
- Base Deficit < -3 WBC > 10, 000/mm³

Predictors for laparotomy

- *Physiological deterioration*
- *Worsening abdominal examination*
- *High grade solid organ injuries*
- *High/ increasing transfusion requirements*
- *Failed angioembolisation*
- *Multiple intrabdominal injuries*
- *Unexplained fever or leukocytosis*
- *Hollow viscous signs on CT abdomen*
- *Signs of hollow viseral injury on abdominal CT scan*

BLUNT ABDOMINAL TRAUMA GUIDELINE



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