



CT FINDINGS OF BLUNT BOWEL AND MESENTERIC INJURIES

From subtle to the specifics

Shi HY, Cheong SC, Lim SF, Ng P, Koh S, Teoh WC

Learning objectives

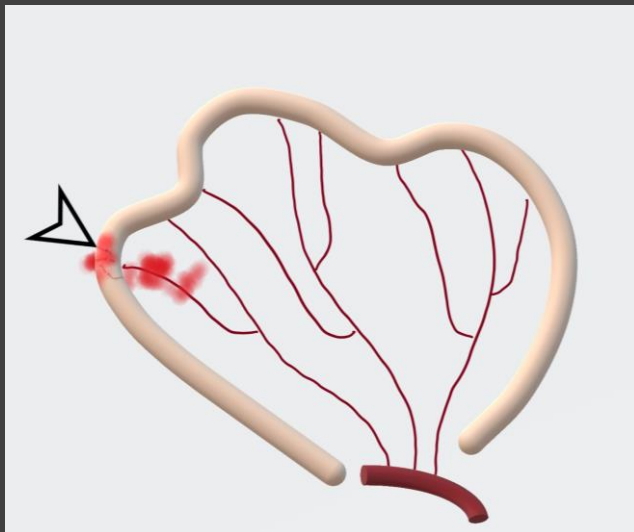
- *Understand the different mechanisms which result in blunt bowel and mesenteric injuries*
- *Recognizing the common injury sites and essential review areas on CT imaging*
- *Describe specific, indirect and subtle CT features of bowel and mesenteric injuries*

Background

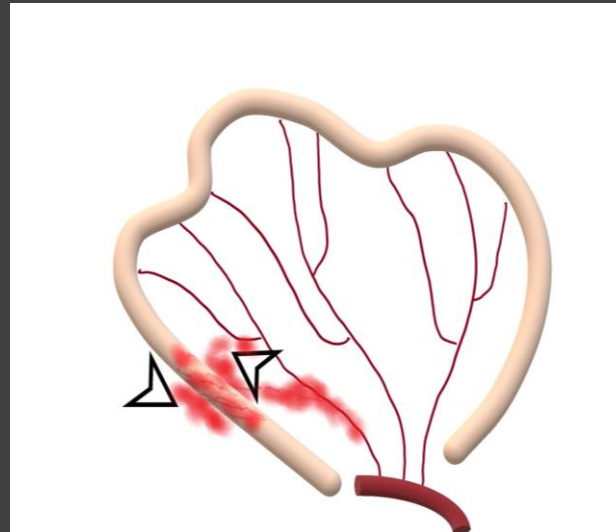
- Bowel and mesenteric injuries are not uncommon occurring in up to 5% of blunt abdominopelvic trauma.
- While the presenting CT findings can be specific, some are subtle and can be missed or not recognised by inexperienced readers.
- Recognising the signs of bowel injury is crucial as delayed diagnosis can result in poor outcomes and even deaths.

Background

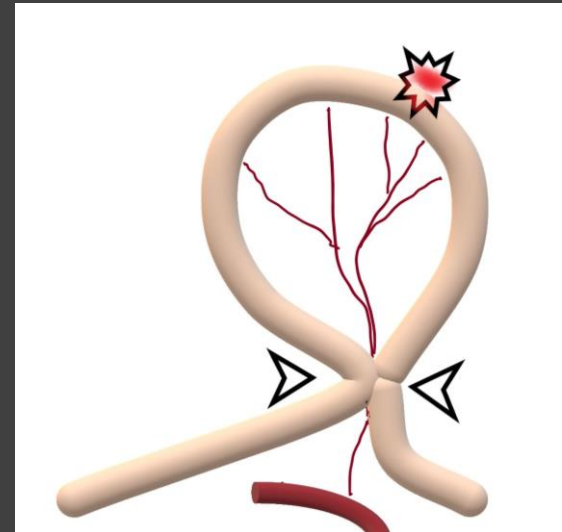
- Commonly encountered mechanisms include direct **crush** injuries, acceleration-deceleration **shear** injuries and **burst** injuries from rapid increased intraluminal pressure.



direct **crush** injury



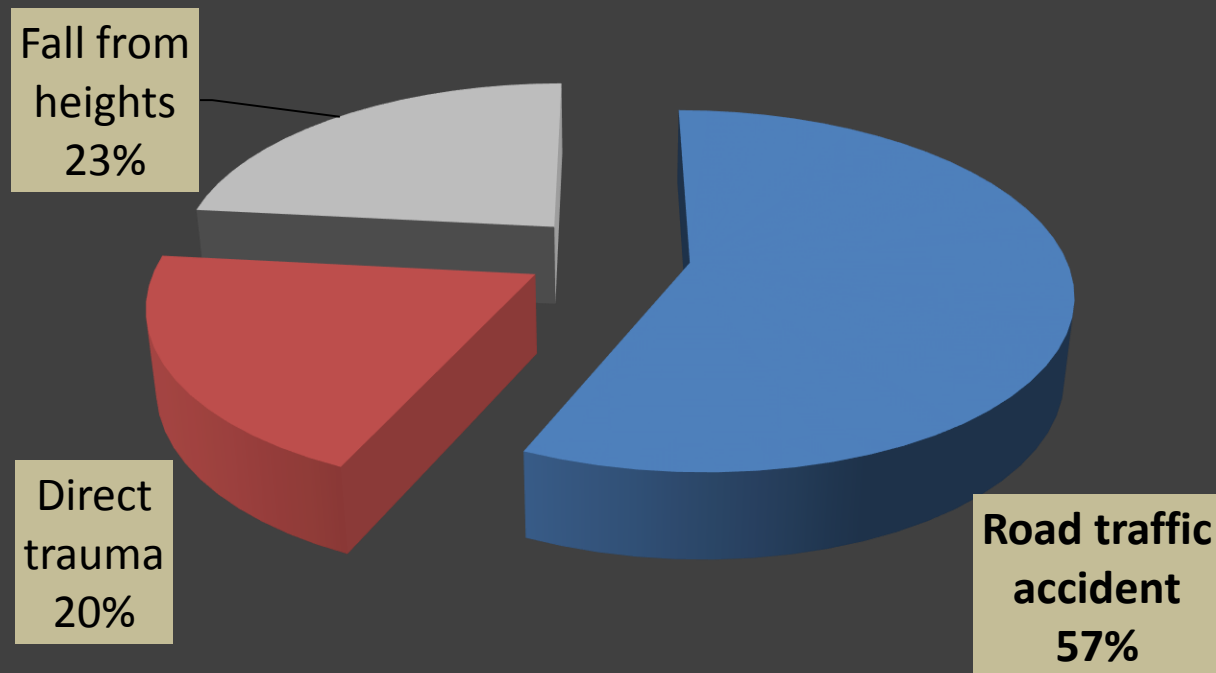
acceleration-deceleration
shear injuries



burst injuries from rapid
increased intraluminal
pressure

Background

- Based on a review of the trauma cases in our institution from the period between January 2011 to June 2018, CT images of patients with blunt bowel and mesenteric injuries were reviewed and correlated with surgical findings when available, for this poster.
- The majority (57%) sustained significant bowel and mesenteric injury from high velocity road traffic accidents.



Imaging findings/CT protocol

- Multi-detector CT is the current diagnostic test of choice for evaluation of haemodynamically stable patients with blunt abdominal trauma. Reported sensitivity ranges from 69-95% and specificity from 94-100% for bowel injury.
- CT protocol used in our institution: intravenous contrast as per patient weight, generally between 80-120 mls (iohexol 350 mg I/ml or iopamidol 370 mg I/ml) Contrast injection rate of 3-4 ml/s
- CT parameters: 120 kVp, auto mA: 100 to 580 mAs, adaptive statistical iterative reconstruction: noise level SD 28, slice thickness: 2 to 3 mm, interval: 0.5 mm

Imaging findings/CT protocol

- Multiphasic acquisition (with automated bolus triggering): Arterial phase (generally 25-35 seconds) followed by a porto-venous phase (60-70 seconds).

Rationale: Arterial phase allows better detection of vascular injuries such as pseudoaneurysms. Dual phase imaging also allows better appreciation of other abdominal viscus injuries, such as splenic vascular injuries. We reconstruct our arterial phase at 2mm slice thickness for better delineation of fine vascular structures.

- All images are reviewed by a radiology resident right after the porto-venous phase and while the patient remains on table. A delayed phase is optional and if needed, acquired at the 3-5 minutes mark.

Rationale: Reduces radiation dose. Only acquired when necessary, for example to confirm active bleeding.

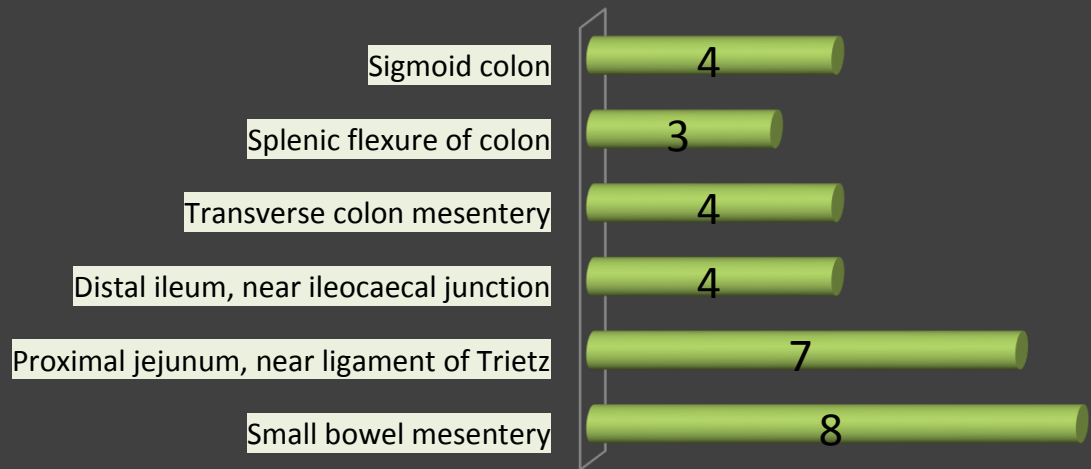
- No oral contrast is administered.

Rationale: Not timely and danger of aspiration in severely injured patients. Literature has also suggest that this does not affect the accuracy of CT in detection of bowel and mesenteric injuries.

Imaging findings (common sites of injury)

- Most of the injuries seen in our institution are near sites of fixation e.g. near the ligament of Trietz, which are susceptible to shear forces. This may be because most of the injuries presented to us are secondary to high impact road traffic accidents.
- The small bowel and small bowel mesentery are the most commonly injured (>50%) in our series. This is not dissimilar to most other published series in literature.

Pearl:
Knowledge of the commonly injury sites will remind the reader to review the “high-risk” regions. This is especially useful in a time sensitive emergency setting or in the detection of subtle injuries.



N=30

Imaging findings (common sites of injury)

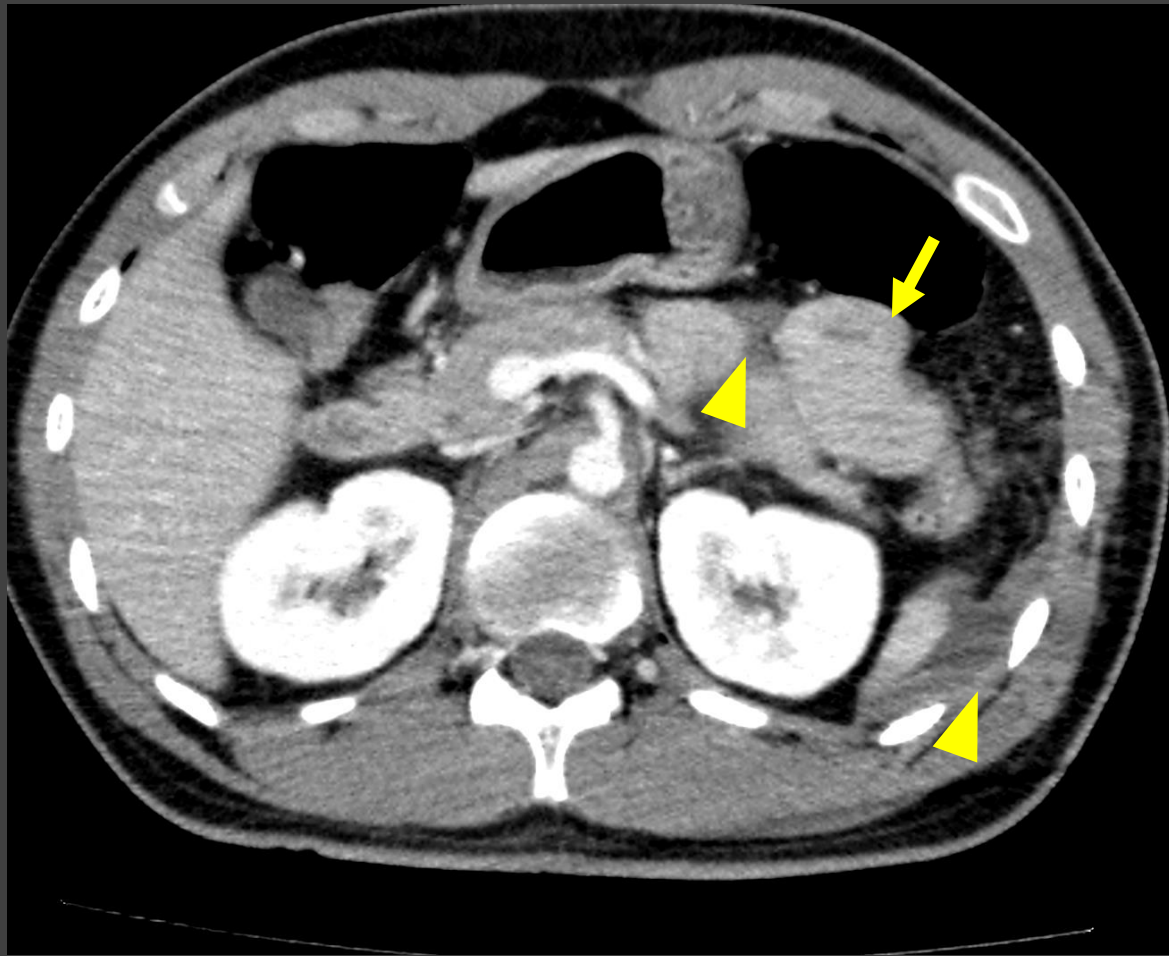
Case example 1:

(a) Around ligament of Trietz

Duodenojejunal junction, around the expected position of the ligament of Trietz, showing focal hyperdense bowel wall thickening (arrow).

Small amount of fluid and fat stranding are also noted (arrowheads) in the surroundings and left paracolic gutter.

Intra-operative finding –
duodenojejunal small bowel
laceration



Imaging findings (common sites of injury)

Case example 2:

(b) Sigmoid colon

Mesenteric haematoma (arrow) and free gas (arrowhead) located in the sigmoid mesentery, just adjacent to the mid-sigmoid colon

Intra-operative finding – sigmoid colon perforation



Imaging findings (CT features)

- CT features may be divided into those that are **specific** and those that are **subtle and/or indirect**.
- Specific CT features
 - (i) bowel wall defect, (ii) free extraluminal gas, (iii) significant vascular injuries (pseudoaneurysm and/or active bleed) of the mesenteric arteries.
- Subtle and/or indirect CT features
 - (i) focal bowel wall thickening, (ii) abnormal mural enhancement (both hyperenhancement and hypoenhancement, (iii) mesenteric haematoma/haemoperitoneum, (iv) mesenteric stranding and focal fluid pockets

Imaging findings (specific CT features)



Case example 3:

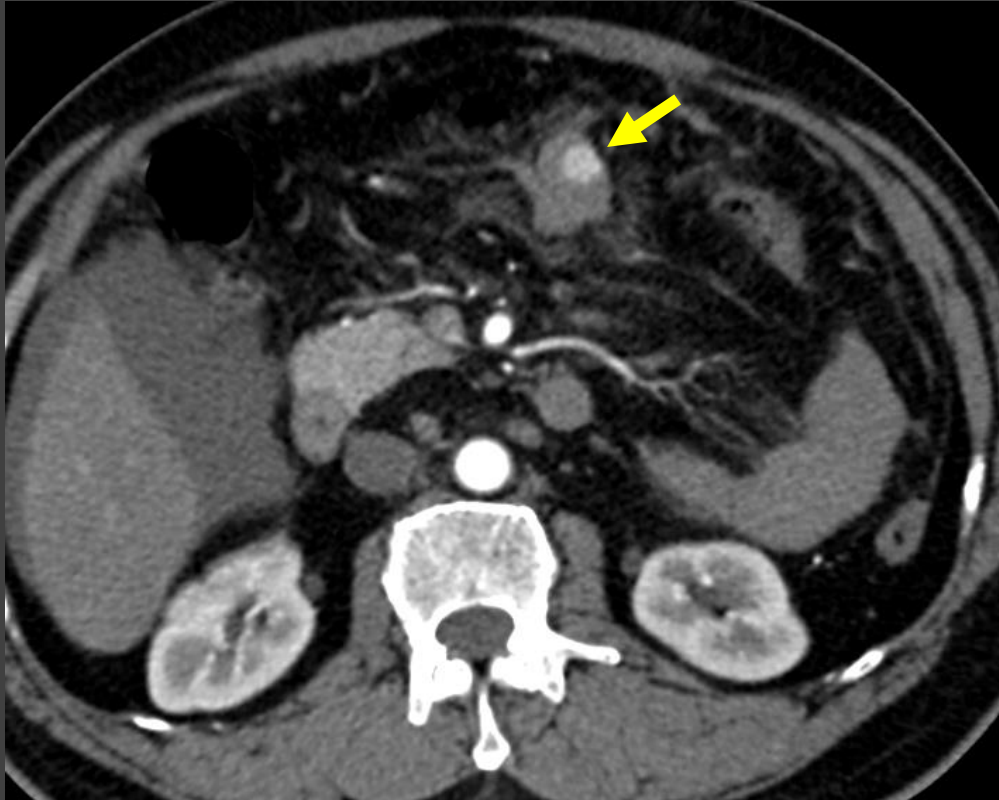
- Focal jejunal mural thickening with slight discontinuity of bowel wall (arrowhead)
- Adjacent pockets of extraluminal gas (arrows)

Intra-operative finding: jejunal haematoma with focal full-thickness and perforation

In our series:

- Extraluminal gas ~27% (8/30)
- Bowel wall defect ~ 3% (1/30) (*bowel wall defect is reported as uncommon in literature. This particular case was only picked up on retrospective review)

Imaging findings (specific CT features)



Case example 4:

Mesenteric haematoma surrounding a focal arterial blush, suspicious for a pseudoaneurysm (arrow).

In our series:

- Significant mesenteric vascular injuries ~23% (7/30) of cases

Imaging findings (specific CT features)



Case example 4

Findings were confirmed on subsequent selective catheter angiography of the superior mesenteric artery (arrow).

This was treated with coil embolization.

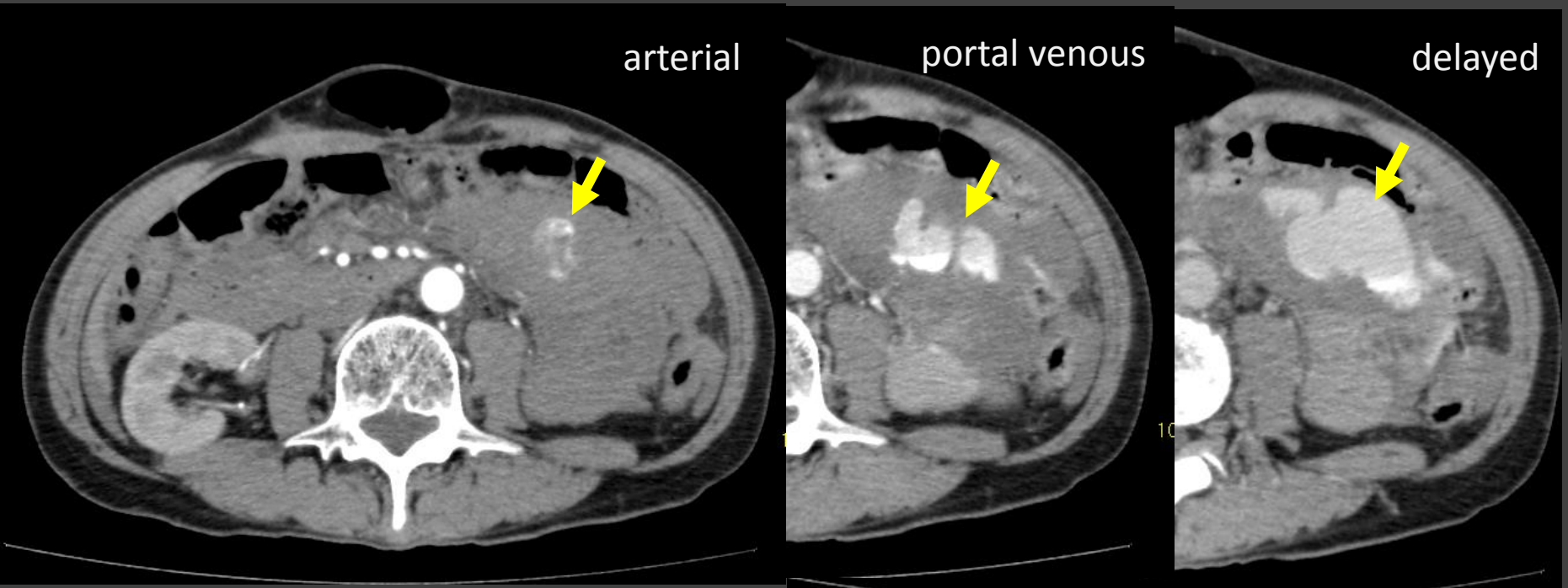
In our series:

- Significant mesenteric vascular injuries ~23% (7/30) of cases

Imaging findings (specific CT features)

Case example 5:

Mesenteric laceration with active bleed and progressive pooling of extra-vascular contrast on the arterial, portal venous and delayed phases (arrows).



In our series:

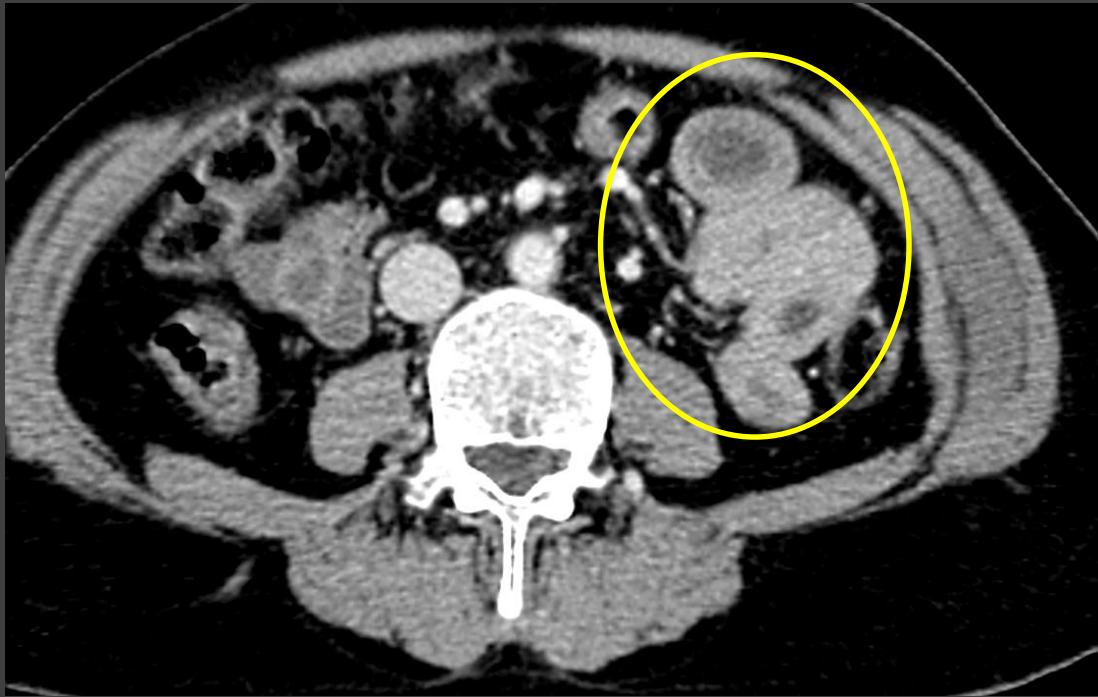
- Significant mesenteric vascular injuries ~23% (7/30) of cases

Imaging findings (subtle/indirect CT features)

Case example 6:

Localised segment of mid-jejunal mural oedema and thickening (circles).

Intra-operative finding – partial thickness jejunal laceration.



In our series:

- Focal bowel wall thickening ~27% (8/30) of cases

Imaging findings (subtle/indirect CT features)

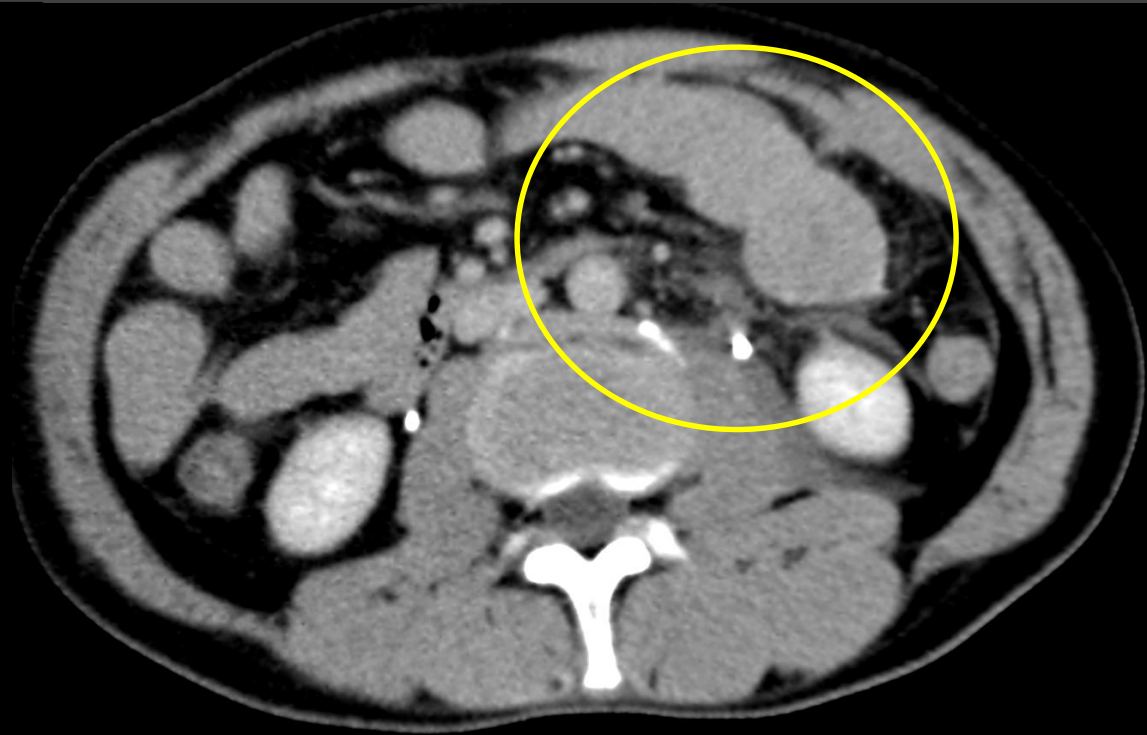
Case example 7:

Segment of slightly hyperdense jejunal mural thickening (circle), suspicious for intra-mural haematoma.

This finding may be subtle and difficult to appreciate.
(Hyperdense thicken bowel wall can be difficult to recognize in collapsed bowel)

Pearl:

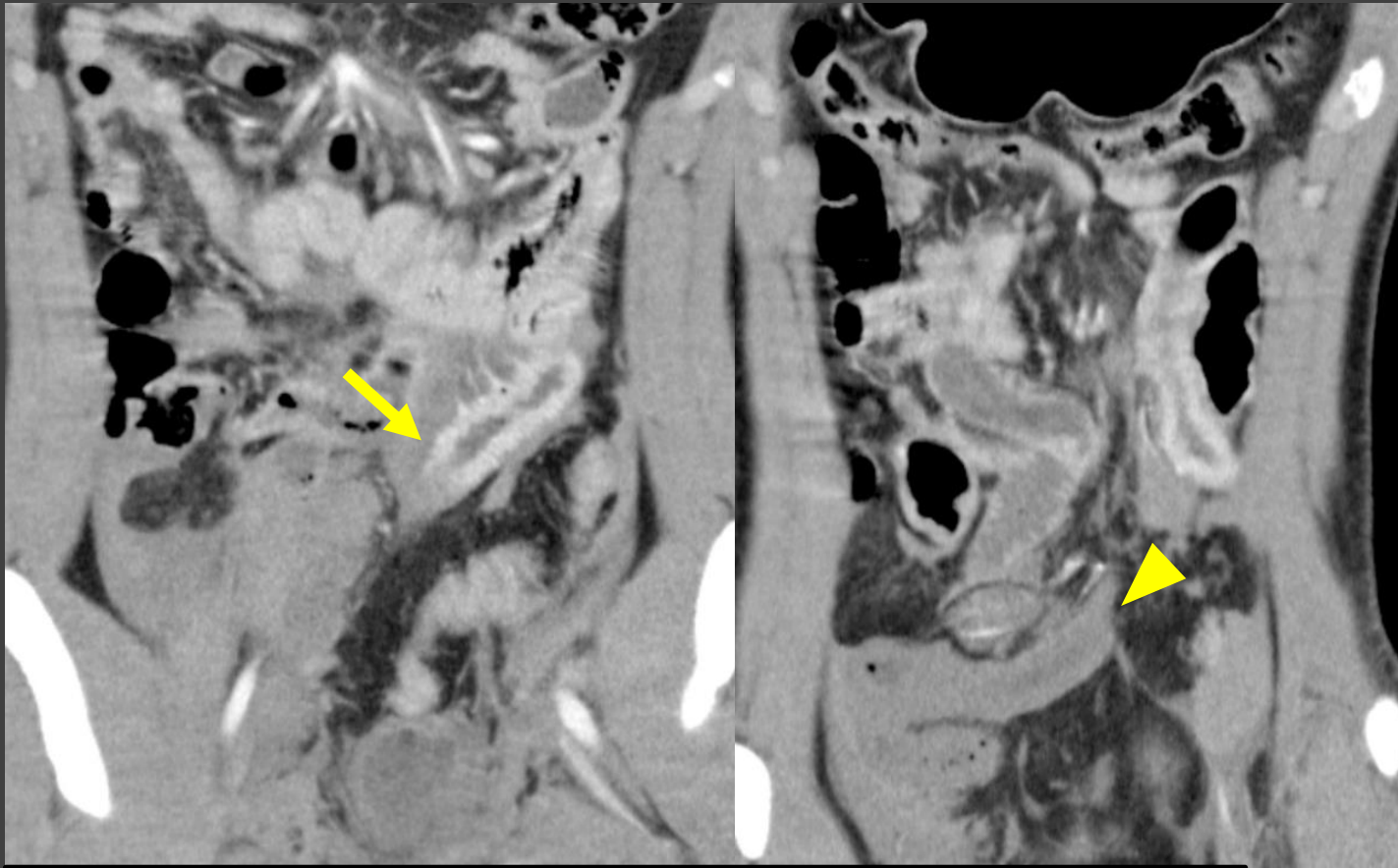
The small amount of adjacent fat stranding in this case is a very helpful adjunct finding



In our series:

- Focal bowel wall thickening ~27% (8/30) of cases

Imaging findings (subtle/indirect CT features)



Case example 8:

Hyperenhancing bowel loop proximal to site of bowel transection (arrow) and hypoenhancing bowel loop distally (arrowhead).

Pearl: Enhancement changes are related to ischaemic changes.

In our series:

- Abnormal bowel wall enhancement ~17% (5/30) of cases

Imaging findings (subtle/indirect CT features)

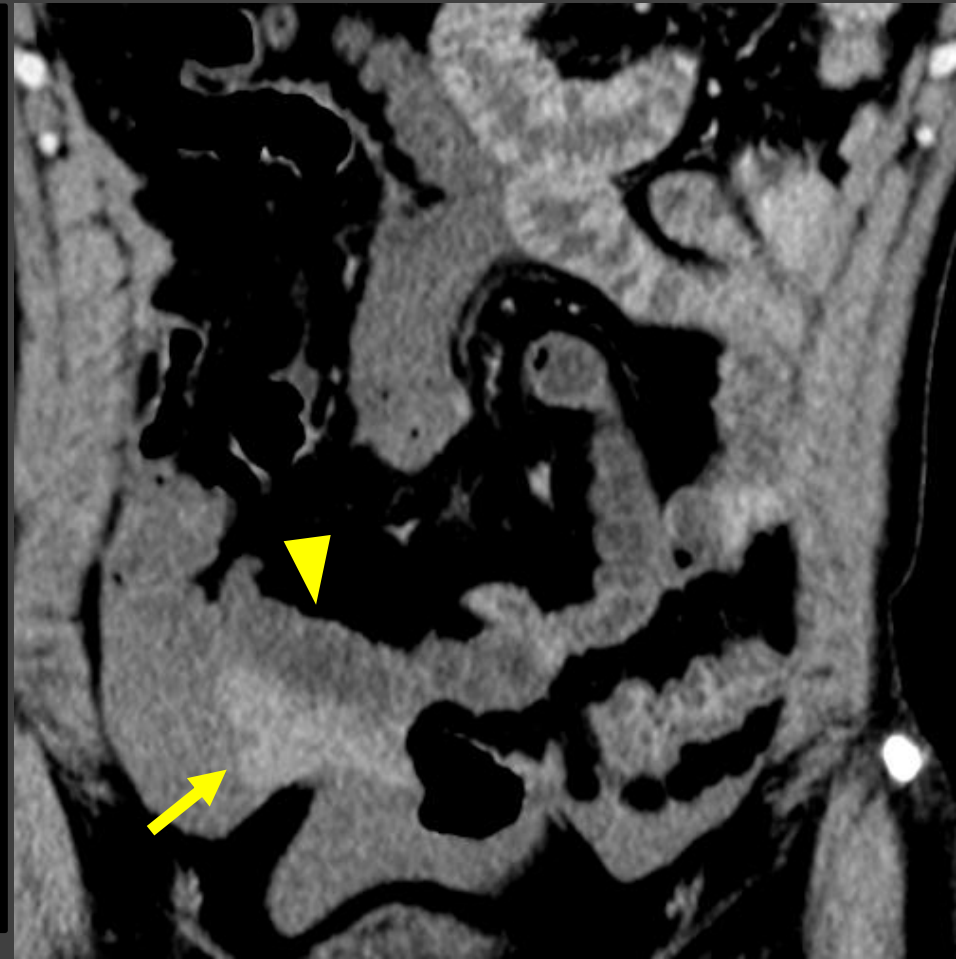
Case example 9:

Haemoperitoneum with a focal area of increased density (around 60HU) i.e. the “sentinel clot” (arrow) localized to the right iliac fossa

Intra-operative finding – distal ileal mesenteric laceration with associated serosal tear of the distal ileum

Pearl:

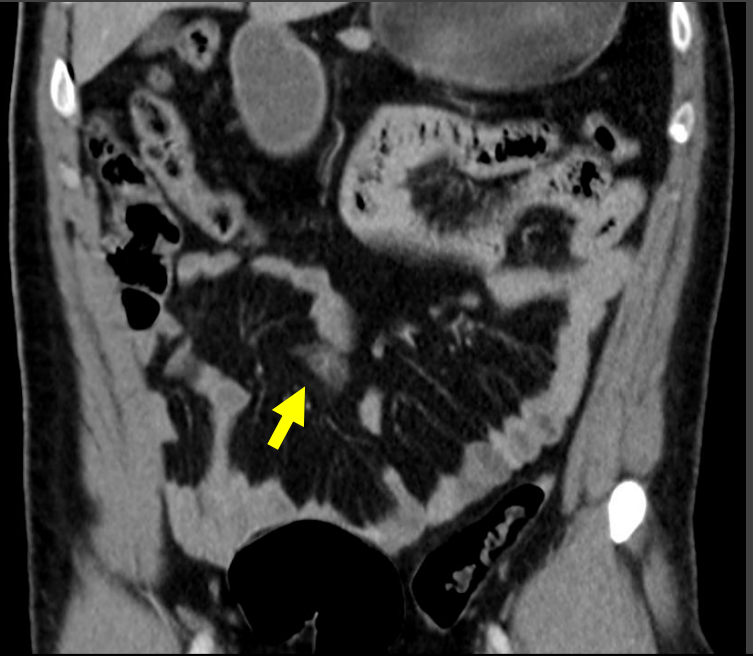
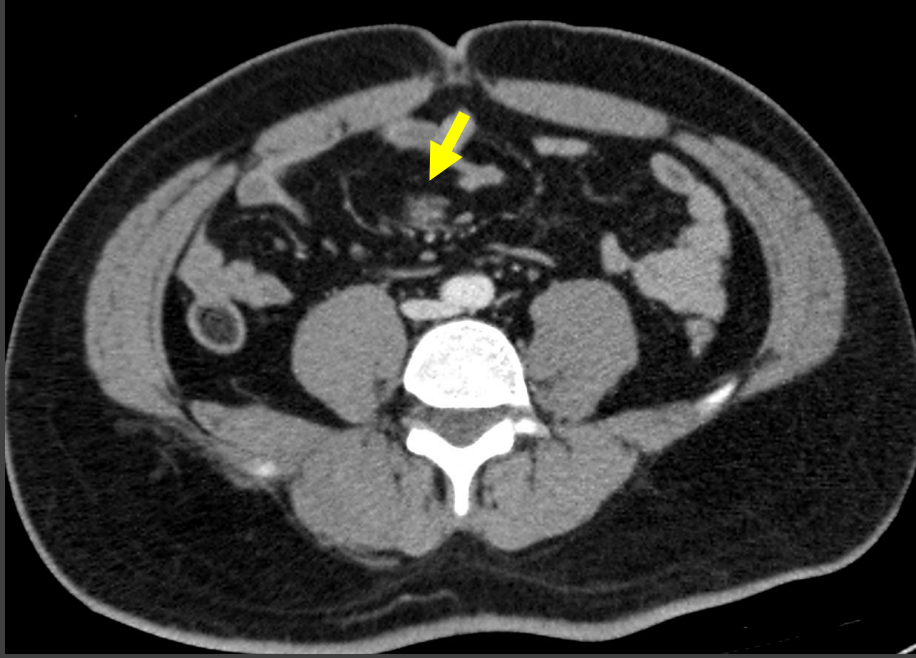
The bowel loop adjacent to the clot is hypoenhancing (arrowhead)



In our series:

- Mesenteric haematoma ~27% (8/30) of cases

Imaging findings (subtle/indirect CT features)



Case example 10:

Small mesenteric haematoma (around 40 HU) in the ileal mesentery (arrow). This was very subtle and missed on initial review.

Post-mortem finding – mesenteric laceration.

In our series:

- Mesenteric haematoma ~27% (8/30) of cases

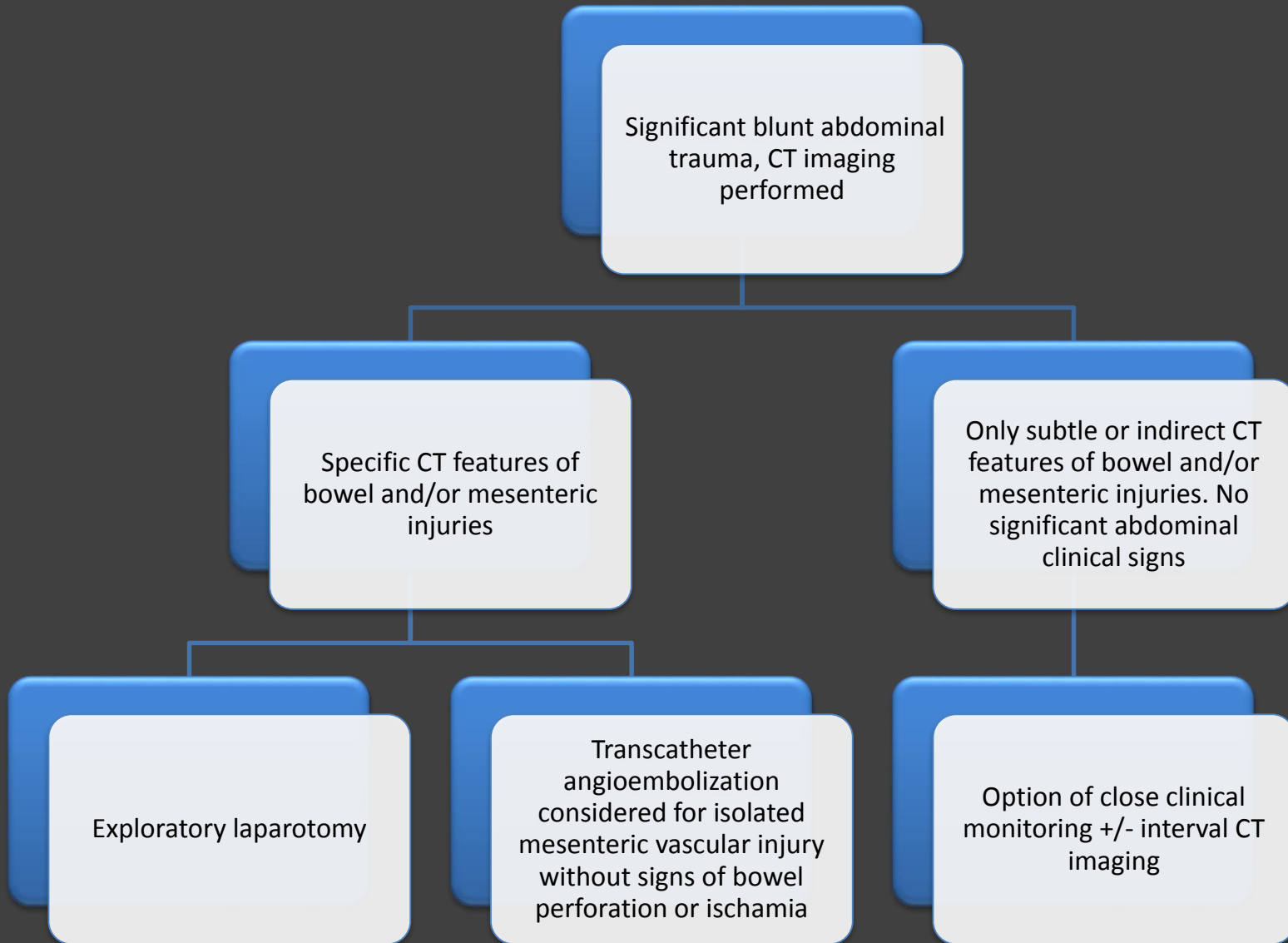
Conclusion/Management

- For blunt traumatic injuries of solid organs such as the liver and spleen, the trend is to manage them conservatively when possible. In comparison, blunt bowel and mesenteric injuries will usually necessitate surgical intervention with exploratory laparotomy.

In our centre:

- When specific CT signs are present, surgical exploration will be imminent.
- When only indirect/non specific CT signs are detected and the patient has no significant clinical signs such as peritonitis or hypotension, surgeons may opt for close monitoring +/- interval CT imaging.
- In certain selected cases, isolated mesenteric arterial injuries without significant bowel injury may be treated with transcatheter angioembolization follow by close monitoring.

Conclusion/Management flow chart



Conclusion

- Delayed diagnosis of bowel and mesenteric injuries may lead to significant bowel related morbidity or even mortality.
- Accuracy in reporting these injuries between residents and expert radiologists can be comparable, if there is adequate training to ensure recognition of the presenting signs.
- The reader should have knowledge of common injured sites (for example around sites of bowel fixation) and include these in their review areas.
- The reader should also recognise the spectrum of imaging findings, from the subtle, indirect to the specifics to ensure timely and appropriate intervention.

References

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