

Most Commonly Injured Solid Organs in Blunt Trauma: Diagnostic Imaging, Role of Interventional Radiology and Vascular Therapy, and Impact on Clinical Outcomes.

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Goal & Objectives

- Gain familiarity with the imaging appearance of vascular injuries of the three most commonly injured solid organs: liver, spleen, and kidneys
- Understand the critical role that Interventional radiology (IR) plays in treating blunt traumatic vascular injuries and its impact on clinical outcomes
- Understand the clinical and diagnostic imaging factors which influence the involvement of IR and the implications of treatment



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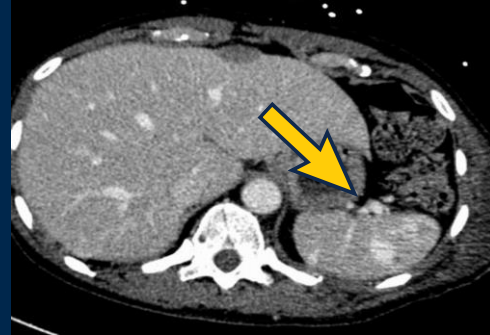
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Post-traumatic Pseudoaneurysms

Patient presents to IR with acute hemoglobin drop after nonoperative management (NOM) for American Association for the Surgery of Trauma (AAST) grade 2 laceration

- Trauma imaging needs both:
 - arterial - sensitive for pseudoaneurysms, and
 - portal venous -sensitive for parenchymal injury and uncontained bleeding.
- NOM is appropriate for AAST scores 1 to 3, although failure has been found to be as high as 20%.
- Pseudoaneurysms, AV fistulas and hemoperitoneum may increase rate of NOM failure.
- Angiography for higher grade AAST scores 4-5, evidence of bleeding on CT, evidence of ongoing bleeding or moderate hemoperitoneum.



Laceration and Extravasation



Active Extravasation

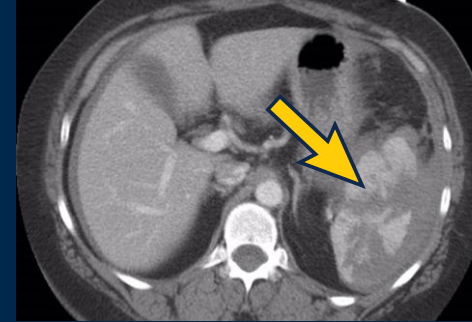


Gelfoam Embolization

Shattered Spleen

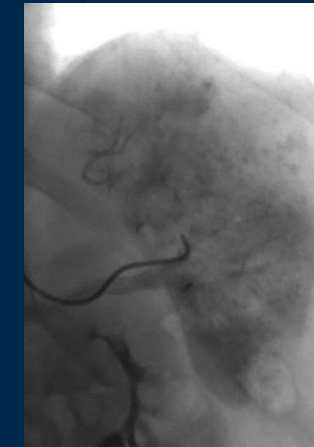
Blunt trauma leading to shattered spleen

- The spleen is the most commonly injured organ in blunt trauma!!!
- Remember: patient without spleen needs vaccines.

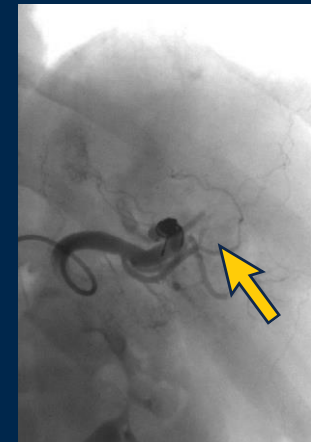


Shattered Spleen

- Distal embolization is more selective and uses gelfoam or small particles.
- Distal embolization has a higher chance of necrosis of the embolized region.
- Proximal embolization placing coils or vascular plugs.
- Proximal embolization reduces the pressure to the spleen as well as promotes hemostasis while allowing for collateral flow.
- Be sure to note the location of both the dorsal pancreatic artery and the pancreatica magna.



Distal Embolization



Proximal Embolization

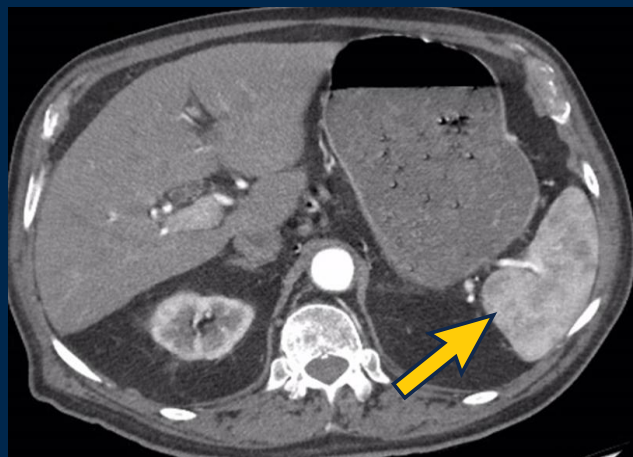
Don't Be Fooled!!



Splenic Cleft

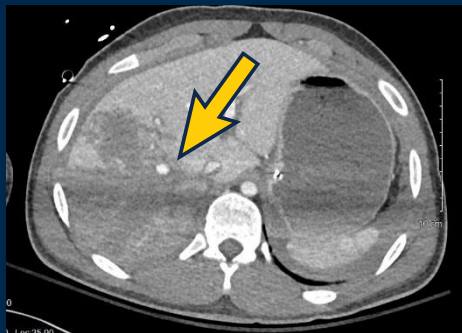
- Hypodense line in the splenic parenchyma is a cleft, not to be mistaken for a laceration.
- Splenic clefts arise from the splenic lobules incompletely aggregating during development, are linear appearance, and have a characteristic location along the posterior margin.

- Heterogeneous enhancement during arterial phase is due to perfusion differences between splenic cords and red pulp sinuses.
- The poorly enhancing areas should not be mistaken for lacerations.
- Active bleeding and vascular lesions such as PSA and AVF should be similar in attenuation to the aorta.



Normal arterial enhancement

Liver Laceration

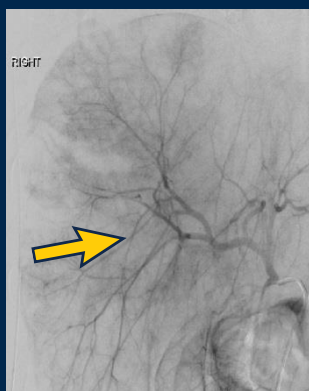


Liver Laceration

- Injuries to the liver are similar to the spleen in evaluation.
- It is essential to obtain multiphase imaging to fully evaluate and pick up less conspicuous bleeding.
- Higher ASST grade injuries are more likely to require intervention.
- Blunt injuries are more likely to cause venous than arterial injury in the liver
- Serious arterial injuries can occur such as active bleeding, pseudoaneurysm and aortoportal fistula.

Patient presents status post blunt abdominal trauma resulting in AAST grade 5 liver laceration and CT with concern for active extravasation.

- The liver is the second most commonly injured organ in blunt trauma
- Trauma is leading cause of death in patients < 45 y.o.



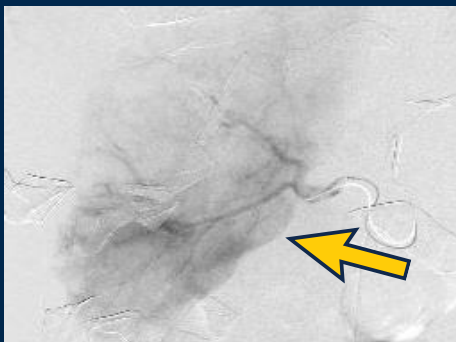
Active Extravasation



Gelfoam Embolization



Operative Failure



Active Extravasation *



Patient with grade 5 liver injury; FAST positive, and hemodynamic instability taken to the OR with failure to control bleeding.

* Lack of opacification of the superior liver is due to packing

- Hemodynamic instability and involvement of the hepatic veins are markers of more severe injury.
- This patient was found to have hepatic vein injury
- Unlike the spleen, a more selective distal embolization is used.

Gelfoam Embolization

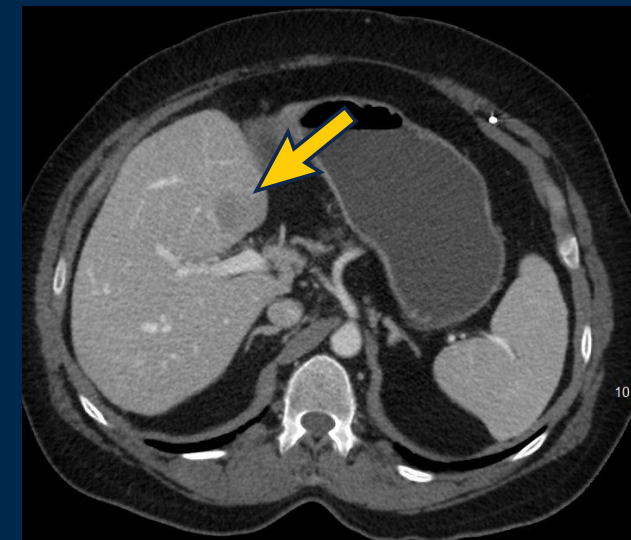
- After injury and embolization, continued follow up to evaluate for complications.
- Direct damage to the biliary tree or secondary to necrosis may result in a biliary leak or biloma.



Post Embolization

Don't Be Fooled x 2!!

- Low attenuation area of focal fat may be confused for injury.
- Evaluate for classic location such as the gallbladder fossa or stability over time.
- Look for associated traumatic injuries such subcapsular hematoma or rib fracture to help distinguish true injury.



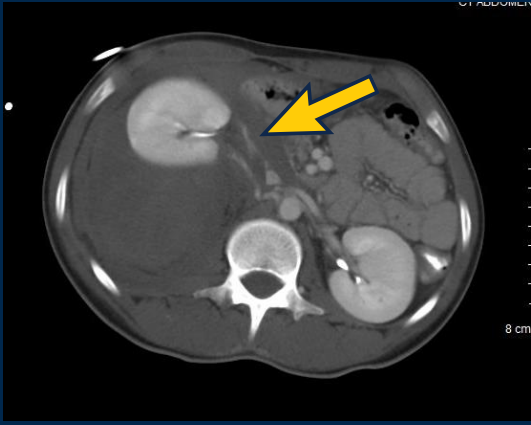
Focal Fat

- Low attenuation lesion near the periphery of the liver may represent injury.
- Subcapsular crescent shaped lesion is concerning for subcapsular hematoma.
 - Look for bleeding
- Triangular peripheral lesion such as this may represent infarct.



Chronic Infarct

Post-traumatic Hemorrhagic Contusions



Patient with direct abdominal blunt trauma and active extravasation.

- Due to location, kidneys are less commonly injured.

Hematoma with Active Extravasation

- Renal injuries are often low grade and therefore usually amenable to NOM.
- It is important to evaluate the renal pedicle; injury to this area may lead to arterial thrombosis.
- Distal embolization is preferred to preserve partial renal function.
- Arterial bleeding, arterial bleeding, and grade 5 injuries involving complete ureteropelvic disruption require intervention



CO2 Extravasation



Coil Embolization

Summary

- The use of the appropriate CT phases and knowledge of pitfalls aids in the prompt and accurate diagnosis of vascular injury in blunt solid organ trauma.
 - Make sure to note grade of injury and any extravasation
- There are a number of factors that determine the management and if indicated the type of IR treatment.
 - Proximal vs distal
 - Possible complications and clinical considerations

Select References

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4. Poletti, PA, et.al. CT Criteria for Management of Blunt Liver Trauma: Correlation with Angiographic and Surgical Finding. *Radiology*. 2000;216(3):418-27.