

Solid Organ Injury PMG

Liver Injury

Grading – AAST, updated 2018

Classification	Description
Grade 1	<ul style="list-style-type: none"> – Subcapsular hematoma <10% surface area – Parenchymal laceration <1 cm depth
Grade 2	<ul style="list-style-type: none"> – Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma <10 cm in diameter – Parenchymal laceration 1–3 cm in depth and <10 cm length
Grade 3	<ul style="list-style-type: none"> – Subcapsular hematoma >50% surface area; ruptured subcapsular or parenchymal hematoma – Intraparenchymal laceration >10 cm – Laceration >3 cm depth – Any injury in the presence of a liver vascular injury or active bleeding contained within liver parenchyma
Grade 4	<ul style="list-style-type: none"> – Parenchymal disruption involving 25–75% of a hepatic lobe – Active bleeding extending beyond the liver parenchyma into the peritoneum
Grade 5	<ul style="list-style-type: none"> – Parenchymal disruption >75% of hepatic lobe – Juxtahepatic venous injury to include retrohepatic vena cava and central major hepatic veins

****Advance one grade for multiple hepatic injuries up to grade 3.**

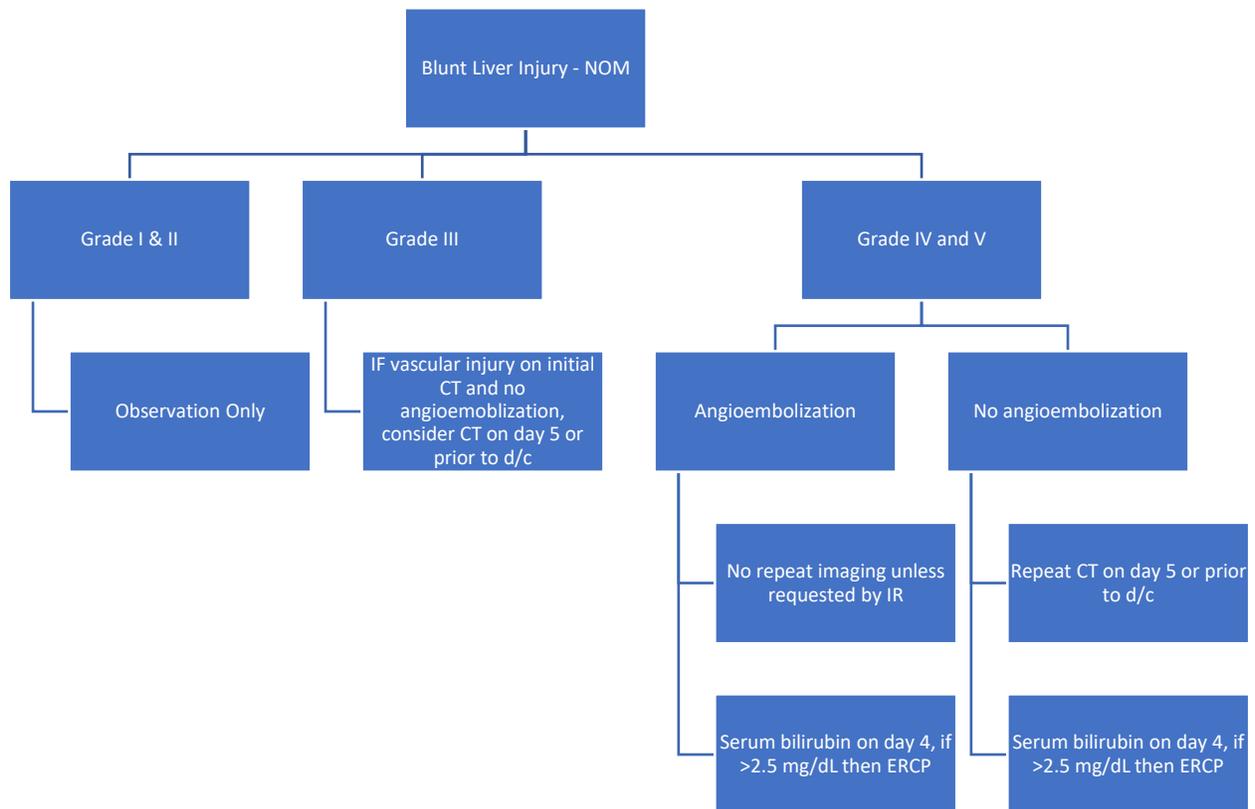
ERCP: Major bile leak after hepatic trauma has been reported 1-20%. Higher rates of major bile leak in higher grade liver injury (>IV) and those injuries managed operatively or with angioembolization

- Routine ERCP is not indicated for grades 1-3 of non-operative management (NOM) liver trauma
- ERCP potentially indicated for Grades IV – V NOM liver trauma if centrally located liver injury
- Recommend total serum bilirubin level sent on post—injury day 4 for patients with Grade IV — V liver injury and those that have been embolized
- If bilirubin greater than 2.5 mg/dL, then GI consult for ERCP indicated. MRCP or further imaging not necessary

*Repeat or surveillance imaging**

- No repeat imaging indicated for Grade 1 and 2 injuries
- **Consider** repeat CT on Grade 3 liver injuries with vascular component (contrast blush or pseudoaneurysm seen on initial CT scan) if no angioembolization performed, per Trauma Surgeon discretion
- **Recommend** repeat CT on post-injury day 5 for all Grade 4 & 5 liver injuries that do not undergo angioembolization.

*Imaging modality of preference is CTA of liver with arterial and venous phase

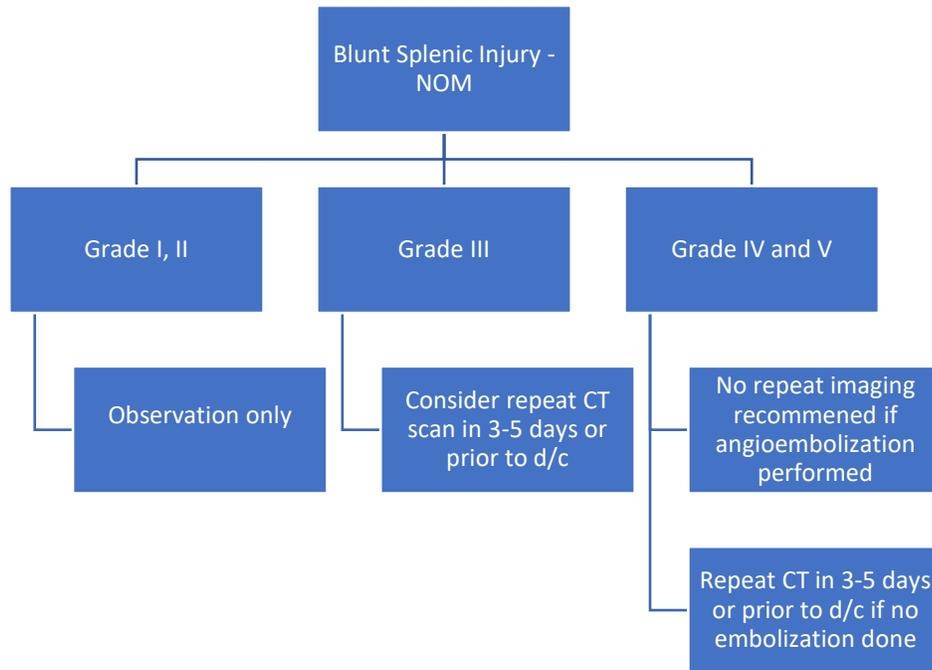


Splenic Injury

Grading, AAST updated 2018

Classification	Description
Grade 1	<ul style="list-style-type: none"> – Subcapsular hematoma <10% surface area – Parenchymal laceration <1 cm depth – Capsular tear
Grade 2	<ul style="list-style-type: none"> –Hematoma: Subcapsular, 10-50% surface area – Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma <5 cm – Parenchymal laceration 1–3 cm
Grade 3	<ul style="list-style-type: none"> – Subcapsular hematoma >50% surface area; ruptured subcapsular or intraparenchymal hematoma ≥5 cm – Parenchymal laceration >3 cm depth
Grade 4	<ul style="list-style-type: none"> – Any injury in the presence of a splenic vascular injury or active bleeding confined within splenic capsule – Parenchymal laceration involving segmental or hilar vessels producing >25% devascularization
Grade 5	<ul style="list-style-type: none"> – Any injury in the presence of splenic vascular injury with active bleeding extending beyond the spleen into the peritoneum

Treatment Algorithm

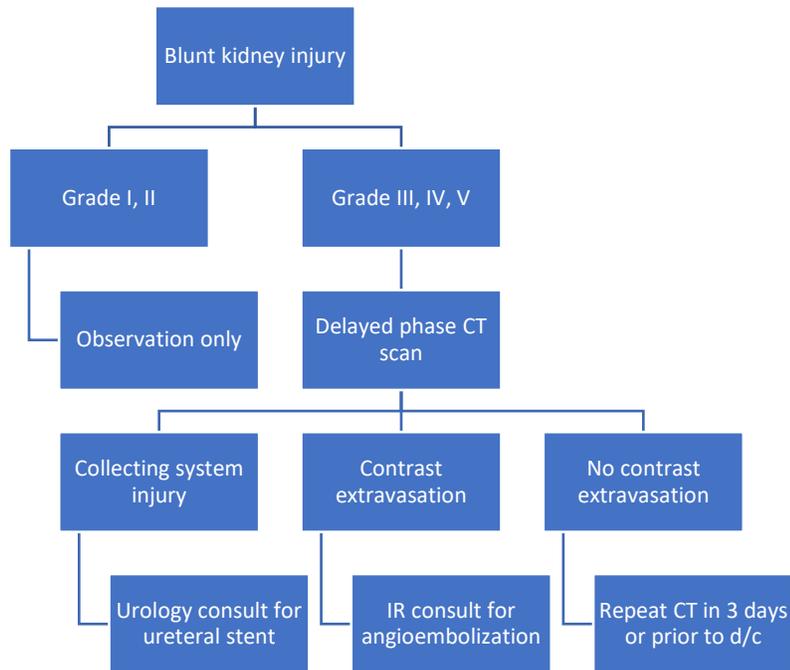


*Repeat Imaging modality of preference is CT Angio with arterial and venous phase

Kidney Injury

Classification	Description
Grade 1	– Subcapsular hematoma and/or parenchymal contusion without laceration
Grade 2	– Perirenal hematoma confined to Gerota’s fascia – Renal parenchymal laceration ≤1 cm depth without urinary extravasation
Grade 3	– Renal parenchymal laceration >1 cm depth without collecting system rupture or urinary extravasation – Any injury in the presence of a kidney vascular injury or active bleeding contained within Gerota’s fascia
Grade 4	– Parenchymal laceration extending into urinary collecting system with urinary extravasation – Renal pelvis laceration and/or complete ureteropelvic disruption – Segmental renal vein or artery injury – Active bleeding beyond Gerota’s fascia into the retroperitoneum or peritoneum – Segmental or complete kidney infarction(s) due to vessel thrombosis without active bleeding
Grade 5	– Main renal artery or vein laceration or avulsion of hilum – Devascularized kidney with active bleeding – Shattered kidney with loss of identifiable parenchymal renal anatomy

Treatment Algorithm



*Imaging modality of preference is CT angio with arterial and venous phase

References

Furlan et al (2017) 4 year retrospective cohort analysis of patients who suffered blunt splenic trauma without evidence of vascular injury on initial CT scan and managed nonoperatively. 100 patients with repeat CT scan 2-3 days post injury. Follow up CT scan found delayed vascular injury in 23% (pseudoaneurysm).

Leeper et al (2014) 17 year retrospective cohort analysis of patients with blunt splenic trauma. Follow-up CT imaging (48h) found vascular lesions in 6%, of those 80% where on grade III or higher splenic trauma.

Crichton et al (2017) meta-analysis of angioembolization for non-operative management of blunt splenic injury. Grade IV or V splenic injuries had significant lower failure rates when treated with angioembolization compared with observation alone.

Zarzaur et al (2017) multicenter retrospective review of patients with blunt splenic injury. Patients with a bleeding vascular injury are at high risk of nonoperative failure.

Haan et al (2007) 4 year retrospective review of single center patients who suffered blunt splenic trauma. No benefit of follow up CT scan in patients with low grade splenic injury (grade I, II).

Velmahos et al (2010) multicenter retrospective studies from 14 trauma centers. Non-operative failure of high grade splenic injury (grade IV, V) was of 64%.

Bala et al (10 year single center retrospective review, only 46 patients, 22 patients (48%) with liver related complications). High operative intervention rates (94% in grade 5, 56% in grade 4). Bile leak was most common complications (24%). 83% of grade 4 injuries with bile leak, 75% of Grade V injuries. Mean detection of bile leak was 8 days . Recommend CT scan at 7-10 days.

Kozar et al (2005) 40 month retrospective review of 2 Level 1 Trauma Centers with grade 3 to 5 blunt liver injuries. Only 1 complication in Grade 3 injury. 230 patients managed nonoperatively. 19/92 (21%) of Grade 4 injuries developed complications. 5/8 (63%) of grade 5 injuries had complications. 2 most common complications are biliary and bleeding. *No routine followup CT imaging or ERCP done.* Authors proposed routine CT follow up for patients with “cleft” injuries.

Cuff, Cogbill and Lambert (2000) 8 year retrospective review, single institution of liver trauma. Adult and pediatric patients, all grades (mostly grade 3). 60% had follow up CT imaging, only 3/31 (9%) had change in management. Later follow up CT in 13 patients with no additional useful information. Do not recommend follow up imaging

Mebert et al (2018) REVIEW 18 studies of NOM blunt hepatic and splenic injuries. 2725 patients. No protocol on imaging modality or timing. Those with complications had other signs/symptoms. Do not recommend routine surveillance or follow up imaging for low grade (1-3) hepatic and splenic injuries. Acknowledge limitations for high grade injuries.

Yuan KC, Wong YC, Fu CY, Chang CJ, Kang SC and Hsu YP. Screening and management of major bile leak after blunt liver trauma: a retrospective single center study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2014, 22:26

Stassen NA et al. Nonoperative management of blunt hepatic injury: An Eastern Association for the Surgery of Trauma practice management guideline. *J Trauma Acute Care Surg* 2012 Nov;73(5 Suppl 4):S294-300

Petrone et al (2020) meta-analysis. Non-operative analysis usually sufficient. If intervention required, usually angioembolization.

Oversight:

Multidisciplinary Trauma Conference (1/27/2021)

Dept. of Surgery, Division of Trauma, Trauma Program Operational Process Performance (1/27/2021)

Revision Team:

Jill Streams, MD

Brad Dennis, MD

Oscar Guillamondegui, MD

Rodrigo Rodriguez Grazioso, MD

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