Guideline for the Management of Blunt Liver and Spleen Injuries

Background:

Children are more vulnerable to blunt abdominal injury than adults. In children with blunt trauma to the torso, intraabdominal injury occurs in 5-10% of patients, and up to 25% of pre-pubescent children who have multisystem injury who undergo further testing are found to have significant abdominal injury. The most common structures injured in pediatric blunt abdominal trauma are the solid organs — with the liver and spleen being the most commonly injured followed by the kidneys.

Non-operative management should be achievable in 95% of children with blunt liver and spleen injuries.

Purpose:

The following guideline has been established to facilitate standardized, evidence-based management of the physiologically stable pediatric trauma patient with isolated abdominal solid organ injury. The plans of care as outlined below are intended to supplement the ongoing assessment and management of injured patient's treating physician. They do not supersede clinical judgment and ought to be adjusted as necessary for the care of an individual patient. Hemodynamic status, rather than CT grade, should guide patient care.

Definitions:

Spleen: The spleen is the most commonly injured abdominal organ in children. Children with splenic injuries may present with LUQ abdominal pain, Left shoulder pain (“Kehr’s sign), abdominal distention and ecchymosis/abrasions to the LUQ.

Criteria for staging splenic injury (based on American Association for the Surgery of Trauma (AAST) splenic injury scale):

Grade I — Subcapsular hematoma of less than 10% of surface area or capsular tear of less than 1 cm in depth

Grade II — subcapsular hematoma of 10-50% of surface area, intraparenchymal hematoma of less than 5 cm in diameter or laceration of 1-3 cm in depth and not involving the trabecular vessels
**Grade III** – subcapsular hematoma of more than 50% of surface area or expanding and ruptured subcapsular or intraparenchymal hematoma, intraparenchymal hematoma of more than 5 cm or expanding, or laceration of more than 3 cm in depth or involving trabecular vessels

**Grade IV** – laceration of segmental or hilar vessels with devascularization of more than 25% of spleen

**Grade V** – shattered spleen or hilar vascular injury

Liver: The liver is the second most commonly injured intra-abdominal organ. Patients who sustain a liver injury frequently complain of abdominal pain and right shoulder pain. Additionally, elevated transaminases are highly suggestive of liver injury.

Criteria for staging liver injuries (based on AAST liver injury scale):

- **Grade I** - subcapsular non-expanding hematoma of less than 10% of surface area or capsular tear of less than 1 cm in depth parenchymal disruption
- **Grade II** - subcapsular non-expanding hematoma of 10-50% of surface area, intraparenchymal non-expanding hematoma of less than 2 cm in diameter, or laceration of less than 3 cm in parenchymal depth and < 10 cm in length
- **Grade III** - subcapsular hematoma of more than 50% of surface area or expanding and ruptured subcapsular or parenchymal hematoma, intraparenchymal hematoma with active bleeding, or laceration of more than 3 cm in parenchymal depth
- **Grade IV** - ruptured central hematoma or parenchyma destruction involving 25%-75% of hepatic lobe
- **Grade V** - parenchymal destruction > 75% of hepatic lobe of juxtahepatic venous injuries (retrohepatic cava/major hepatic veins)
- **Grade VI** – hepatic avulsion

**Procedure:**

1. All patients with blunt abdominal trauma should be have a thorough physical examination and be evaluated per ATLS guidelines.
   a. Hemodynamically stable patients should be evaluated per CHOG Pediatric Imaging Guidelines.
   b. There is limited evidence to support FAST in the pediatric population, and provider discretion is advised.
   c. Hemodynamically unstable patients should not be taken to CT scan. The role of interventional radiology in the management of solid organ blunt trauma in children is currently evolving. IR consult will be placed at the discretion of the Trauma surgeon in pediatric trauma patient with ongoing hemorrhage.
2. A baseline hemoglobin and hematocrit (H & H) and a Type and Screen should be obtained.
3. Grading of the splenic/liver injury should be done by the radiologist or surgeon.

Management:

The following are recommendations based on current literature, but are not meant to take the place of clinical judgement. Care should be adjusted for the individual patient to best meet their needs.

**Pediatric Solid Organ Injury Guideline**

<table>
<thead>
<tr>
<th>Grade I</th>
<th>Grade II</th>
<th>Grade III</th>
<th>Grade IV</th>
<th>Grade V or higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admit to</td>
<td>Floor</td>
<td>Floor</td>
<td>Floor</td>
<td>PICU</td>
</tr>
<tr>
<td>Min Hospital Days</td>
<td>One</td>
<td>One</td>
<td>Two</td>
<td>Two</td>
</tr>
<tr>
<td>Bedrest</td>
<td>24 hours</td>
<td>24 hours</td>
<td>24 hours</td>
<td>48 hours</td>
</tr>
<tr>
<td>Lab Studies</td>
<td>Admission and 4 hours after admission</td>
<td>Admission and 4 hours after admission</td>
<td>Admission and 4 hours after admission</td>
<td>H&amp;H Q8 hours until stable then Q12 hours x 24 hours, then Q 24 hours. Only check post activity if hemodynamically unstable</td>
</tr>
<tr>
<td>Treatments</td>
<td>MIVF, IS Q 2H</td>
<td>MIVF, IS Q2H</td>
<td>MIVF, IS Q2H, Continuous cardio/resp monitoring with SpO2</td>
<td>Maintenance plus ½ IVF as indicated, NGT to LCS as indicated, Foley as indicated, IS Q 2H, Continuous monitoring with SpO2, Consider PICC</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Clears AAT</td>
<td>Clears AAT</td>
<td>Clears AAT</td>
<td>NPO for first 24H</td>
</tr>
<tr>
<td>Discharge Criteria</td>
<td>Hemodynamic stability</td>
<td>Hemodynamic stability</td>
<td>Hemodynamic stability</td>
<td>Hemodynamic stability</td>
</tr>
</tbody>
</table>
### Discharge Instruction

<table>
<thead>
<tr>
<th>Duration</th>
<th>Activity</th>
<th>Clinic</th>
<th>Instructions</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>x 2 weeks</td>
<td>Restricted</td>
<td>Trauma</td>
<td>Return to play may take longer. Review appropriate discharge instructions per age.</td>
<td>-</td>
</tr>
<tr>
<td>x 3 weeks</td>
<td>Restricted</td>
<td>Trauma</td>
<td>Return to play may take longer. Review appropriate discharge instructions per age.</td>
<td>-</td>
</tr>
<tr>
<td>x 5 weeks</td>
<td>Restricted</td>
<td>Trauma</td>
<td>Return to play may take longer. Review appropriate discharge instructions per age.</td>
<td>-</td>
</tr>
<tr>
<td>x 6 weeks</td>
<td>Restricted</td>
<td>Trauma</td>
<td>Return to play may take longer. Review appropriate discharge instructions per age.</td>
<td>-</td>
</tr>
<tr>
<td>6-8 weeks</td>
<td>Restricted</td>
<td>Trauma</td>
<td>Return to play may take longer. Review appropriate discharge instructions per age.</td>
<td>-</td>
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</tbody>
</table>

**NOTE:** Consider transfusion for hgb < 7. If transfused, reset bedrest at zero and start again.

### ATOMAC Guidelines

**1.** Management of pediatric BLSI can be based on hemodynamic status rather than injury grade.

**2.** A shortened period of bedrest of 1 day or less for stable children with unchanged hemoglobin levels.

**3.** A transfusion threshold of 7.0 g/dl is reasonable for children undergoing non-operative management.

**4.** Unstable patients should be considered for surgery, urgent embolization, or controlled non-operative management, depending on other injuries.

### References


