Clinical Pathways

Blunt Liver and Spleen Injury

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What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.
Objectives of Pathway

• Standardize care to decrease variability in the management of patients with blunt spleen and/or liver injury
• Decrease length of stay to conform with current evidence-based guidelines
• Decrease unnecessary laboratory testing
• Avoid unnecessary PICU admissions
Why is this pathway necessary?

- Blunt abdominal trauma causing liver and/or spleen injury is one of the most common indications for hospital admission for injured children.
- In the late 1990s, the American Pediatric Surgery Association (APSA) Trauma Committee developed non-operative management guidelines for blunt trauma to the abdomen to help standardize care.
- In 2012, a pediatric trauma consortium, ATOMAC, developed a practice management guideline for blunt liver or spleen injury that is evidence-based and used at many pediatric trauma centers.
- More recently in 2019, the American Pediatric Surgery Association (APSA) Trauma Committee expanded these guidelines and developed non-operative management guidelines for blunt trauma to the abdomen to help standardize care.
Background

Spleen Injury Scaling

<table>
<thead>
<tr>
<th>GRADE</th>
<th>INJURY DESCRIPTION</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subcapsular hematoma, &lt;10% surface area; capsular tear, &lt;1 cm parenchymal depth</td>
<td></td>
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<tr>
<td>2</td>
<td>Subcapsular hematoma, 10%-50% surface area; intraparenchymal, &lt;5 cm in diameter; laceration 1-3 cm parenchymal depth, &lt;10 cm in length which does not involve a trabecular vessel</td>
<td></td>
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<tr>
<td>3</td>
<td>Subcapsular hematoma, &gt;50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma &gt;5 cm or expanding; laceration &gt;3 cm parenchymal depth or involving trabecular vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Laceration involving segmental or hilar vessels producing major devascularization (&gt;25% of spleen)</td>
<td>865.04</td>
<td>855.14</td>
</tr>
<tr>
<td>5</td>
<td>Completely shattered spleen; hilar vascular injury which devascularizes spleen</td>
<td>5</td>
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A radiologist will grade the liver and/or spleen injury using these scales.
This is the Blunt Liver/Spleen Injury Clinical Pathway.

We will be reviewing each component in the following slides.
The pathway is modeled after the ATOMAC Guideline for the management of pediatric blunt liver spleen injury.

Initial care:

- Pediatric surgery and trauma team should be consulted immediately
  - Contact team via Voalte or by calling/texting 860-578-5071
- Work up includes:
  - History and physical
  - Trauma Labs including amylase/lipase
  - CXR
  - Other exams should be considered based on presentation
- Establish early IV access

Inclusion Criteria:
Blunt trauma to abdomen or torso with concern for liver/spleen injury

Exclusion Criteria:
Penetrating injury to chest or abdomen, clinically significant CNS or thoracic injury, suspected physical abuse (see Suspected Physical Abuse Pathway)

Initial Care in the ED:

- Consult Pediatric Surgery/Trauma via Voalte or call/text 860-578-5071
- History and physical exam
- Trauma labs (CBC, type and cross), amylase/lipase, “trauma panel”
- CXR
- Consider pelvis X-ray
- Consider Focused Assessment with Sonography for Trauma (FAST) exam
- Establish reliable IV access

*Signet ring mandates a hospital admission*
Seatbelt sign

- Seatbelt sign = linear abdominal wall ecchymosis across the abdomen in patients injured in a motor vehicle collision
- Seatbelt sign mandates a hospital admission as it is associated with increased risk of significant intra-abdominal injury

Inclusion Criteria: Blunt trauma to abdomen or torso with concern for liver/spleen injury
Exclusion Criteria: Penetrating injury to chest or abdomen, clinically significant CNS or thoracic injury, suspected physical abuse (see Suspected Physical Abuse Pathway)

Initial Care in the ED:
- Consult Pediatric Surgery/Trauma via Voalte or call/text 860-578-5071
- History and physical exam
- Trauma labs (CBC, type and cross), amylase/lipase, “trauma panel”
- CXR
- Consider pelvis X-ray
- Consider Focused Assessment with Sonography for Trauma (FAST) exam
- Establish reliable IV

*Seatbelt sign mandates a hospital admission*
If the patient is hemodynamically unstable and/or has peritonitis:

- Patient should go immediately to the operating room (OR) for laparotomy
  - Notify OR and anesthesia STAT
- Initiate blood transfusion and activation of the Massive Transfusion Protocol
- OR should not be delayed for imaging
Stable patients:

- Obtain CT scan of Abdomen and Pelvis with Contrast
- CT scan is read by a Radiologist who then Grades the injury
  - Grade I-V, higher the grade the more significant the injury
  - Further management will depend on the grade of injury

1. Consider IR embolization for recurrent hypotension or Hgb <7
2. "Blush" on CT scan is not necessarily an indication for IR embolization in pediatric patients
Grade I, II, or III Injuries:

- Patients are admitted to the Med/Surg unit
- A CBC is repeated 6hrs after admission
  - Then again at the discretion of the surgeon
- Pain control with acetaminophen; additional options are available if acetaminophen is insufficient
- Miralax is started once patient starts clears

There are no longer restrictions on bed rest for Grade I-III injuries, but SCD should be started if ≥12 years old
Grade IV or V Injuries:

- Patients may require PICU level of care, although this is not required.
- Labs, diet, and activity orders are all dependent on the patients vital signs
  - Orders are advanced as vital signs normalize for age
- Pain control with acetaminophen; additional options are available if acetaminophen is insufficient
- Activity can begin once vitals have normalized

Consider Admission to PICU:

<table>
<thead>
<tr>
<th>Labs:</th>
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<tbody>
<tr>
<td>Hct q6hr until vitals are normal for age</td>
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<table>
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<tr>
<th>FEN/GI:</th>
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</thead>
<tbody>
<tr>
<td>NPO until vitals are normal for age and Hct stable</td>
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<table>
<thead>
<tr>
<th>Pain:</th>
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</thead>
<tbody>
<tr>
<td><strong>Acetaminophen</strong> 15 mg/kg PO q6hr (max 1000 mg/dose, not to exceed 4000 mg/day)</td>
</tr>
<tr>
<td>Consider <strong>oxycodeine</strong> 0.1 mg/kg/dose (max 5 mg/dose) PO q4hr or <strong>morphine</strong> 0.05 mg/kg/dose (max 5 mg/dose) IV q3hr or <strong>hydromorphone</strong> 0.015 mg/kg/dose (max 0.5 mg/dose) q3hr PRN if acetaminophen is insufficient</td>
</tr>
<tr>
<td>Consider <strong>morphine</strong> or <strong>hydromorphone</strong> PCA – Please see PCA policy</td>
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</tbody>
</table>

<table>
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<tr>
<th>Other:</th>
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<tr>
<td>Vital signs q2hr x24 hrs, then q4hr if stable</td>
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<tr>
<td>Bedrest until vitals normal for age, then activity as tolerated</td>
</tr>
<tr>
<td>Sequential compression devices (SCD) if age ≥12 years</td>
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<tr>
<td>Foley catheter (remove prior to transfer to MS floors)</td>
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</tbody>
</table>

Consider transfusion for:

- Unstable vitals after 20 mL/kg bolus of isotonic IVF
- Hemoglobin <7 g/dL
- Signs of ongoing or recent bleeding
Grade IV or V Injuries:

- Transfusion should be considered with unstable vitals after a bolus, Hgb <7 g/dL, or signs of ongoing/recent bleeding

Consider Admision to PICU:

Labs:
- Hct q6hr until vitals are normal for age

FEN/GI:
- NPO until vitals are normal for age and Hct stable

Pain:
- Acetaminophen 15 mg/kg PO q6hr (max 1000 mg/dose, not to exceed 4000 mg/day)
- Consider oxycodone 0.1 mg/kg/dose (max 5 mg/dose) PO q4hr or morphine 0.05 mg/kg/dose (max 5 mg/dose) IV q3hr or hydromorphone 0.015 mg/kg/dose (max 0.5 mg/dose) q3hr PRN if acetaminophen is insufficient
- Consider morphine or hydromorphone PCA – Please see PCA policy

Other:
- Vital signs q2hr x 24 hrs, then q4hr if stable
- Bedrest until vitals normal for age, then activity as tolerated
- Sequential compression devices (SCD) if age ≥12 years
- Foley catheter (remove prior to transfer to MS floors)

Consider transfusion for:
- Unstable vitals after 20 mL/kg bolus of isotonic IVF
- Hemoglobin <7 g/dL
- Signs of ongoing or recent bleeding
### Grade IV or V Injuries:

- If patient remains clinically stable for 12 hours they may then transfer to MS units when appropriate.
**Grade IV or V Injuries:**

- However, if the patient is not hemodynamically stable, then there may have been a failure of non-operative management.
- Further management will be at the discretion of the attending pediatric surgeon.
Discharge Planning:

- Medications for home include Miralax and acetaminophen
- Duration of activity restriction is based on grade of injury + 2 weeks
- Follow up for blunt liver spleen injuries should be done with the pediatric surgery team in 4-6 weeks

Discharge Criteria:
- Hgb/Hct stable x3; afebrile; normal HR & UOP; tolerating diet; minimal abdominal pain

Discharge Medications:
- Miralax 1 g/kg/day PO once daily (max 17 g/day) PRN constipation
- Acetaminophen 15 mg/kg/dose q6hr PRN pain (max 75 mg/kg/day or 4000 mg/day)

Discharge Instructions:
- No strenuous activity or contact sports for grade of injury + 2 weeks. Only activities that keep 2 feet on the ground (no trampolines, no bikes, no dirt bikes, no horseback riding, no ATV, no skiing, etc)
- Follow up with pediatric surgery in 4-6 weeks after discharge
Review of Key Points

- Blunt Liver/Spleen injuries are graded by a Radiologist who reviews the CT scan.
- CBCs are not routinely drawn after 6hrs for Grade I-III injuries, and can be stopped once a patient's vital signs normalize for age for Grade IV-V injuries.
- Pain is mainly controlled with acetaminophen. Oxycodone, morphine or hydromorphone can be given if acetaminophen is not sufficient.
- There is no longer an activity restriction for patients with Grade I-III injuries. Patients with Grade IV-V injuries remain on bed rest until their vital signs and CBC are stable.
- Discharge is based on stable hematocrit and clinical picture, not by grade of injury.
- Duration of activity restriction at discharge is based on grade of injury + 2 weeks.
Quality Metrics

- % Patients with pathway order set
- % Patients transfused
- Grade of injury
- ALOS by grade of injury
- Average time (minutes) arrival to request for interventional radiology
- Average time (minutes) from interventional radiology request to procedure (arterial puncture)
Pathway Contacts

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  o Department of Pediatric Surgery and Trauma

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  o Department of Pediatric Surgery and Trauma

• Jen Tabak, RN, MSN
  o Trauma Program Coordinator


About Connecticut Children’s Pathways Program

Clinical pathways guide the management of patients to optimize consistent use of evidence-based practice. Clinical pathways have been shown to improve guideline adherence and quality outcomes, while decreasing length of stay and cost. Here at Connecticut Children’s, our Clinical Pathways Program aims to deliver evidence-based, high value care to the greatest number of children in a diversity of patient settings. These pathways serve as a guide for providers and do not replace clinical judgment.