Blunt Abdominal Trauma Evaluation

Emergency Department

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Patient presents after Blunt Abdominal Trauma Mechanism

Inclusion Criteria:
- Concern for blunt abdominal trauma <24 hours ago

Exclusion Criteria:
- Penetrating trauma
- Multisystem Injury if hemodynamically unstable

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Signs/Symptoms:
- Abdominal bruising
- Abdominal pain or tenderness
- Vomiting
- Evidence of thoracic wall trauma
- Decreased Breath Sounds

High Risk Mechanisms:
- MVC >25 mph or rollover
- Pedestrian Struck
- Motorized cycle or Dirt bike
- ATV
- Fall >20 feet
- Handlebar Injury

S/S or High Risk Mechanism for intra-abdominal injury? **

No → **Off Pathway**

If Level 2 Trauma Alert or non-alert, Upgrade to Level 1 Trauma Alert

*Refer to [Trauma Program Guideline T-037: Fluid Management of the Trauma Alert Patient]

Obtain labs as indicated by Trauma Alert Criteria, including AST/ALT/Lipase, Hgb/Hct, and UA

Transfusion Indications (If ANY are present):
- Unstable VS after 20 ml/kg bolus of isotonic IVF
- Hgb <7.0 gm/dl
- Signs of ongoing bleeding

OR Indications:
- Unstable VS despite PRBC transfusion

*Consider [Massive Transfusion Protocol (MTP) 45:16]

Yes

Suspected ongoing bleeding or hemodynamic derangement?

Yes → (Transfusion Indications above)

No

Obtain AST/ALT/Lipase, Hgb/Hct, UA if urine available

Decision for OR?

Yes → **Off Pathway** Treat according to surgical post-op plan

No

§
- For patients with suspected NAT, use a threshold of AST or ALT >80 per [Evidence Based Practice Guideline: Non-Accidental Trauma]
- Clinical exam should be considered most reliable, and lab values utilized when the decision for CT is borderline.

AST or ALT >200 Lipase >220, UA >50 RBC, or Clinical suspicion §

Yes → Consult Pediatric Surgery → CT abd/pelv w/IV contrast, delayed images per Radiology protocol

No

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- Presence of seatbelt sign, handlebar injury, or other high-risk mechanism
- Non-specific CT findings without solid organ injury (Peritoneal free fluid, bowel wall thickening, mesenteric stranding)

Solid Organ Injury present?

No → Discuss need for admission; Consider risk for bowel injury €

Yes

Admit to Pediatric Surgery
- Urology Consult if kidney injury
- SOI Non Operative Management Inpatient Pathway

IR Consult for Angioembolization if:
- Signs of ongoing bleeding despite PRBC transfusion
- NOT Indicated for CT contrast blush only
- Avoid IR for unstable patients

Admission warranted?

No
- PO challenge
- Ambulation with adequate pain control
- [Discharge Instructions]
- Discharge to Home

Yes → **Off Pathway** Admit to Pediatric Surgery

Solid Organ Injury
Non-Operative Management
Inpatient

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Hypotension, hypoxia or tachycardia with concern for deterioration and/or substantial clinical concern?

No

Admit to Floor
- Activity: No restrictions
- Labs: Repeat Hgb 6 hours after initial
- Diet: Advance as Tolerated
- Continuous Pulse Oximetry
- VS Q2 x3, then Q4 if stable

Yes

Admit to PICU
- Activity: Bedrest w/bathroom privileges
- Labs: Hgb Q6H until stable
- Diet: NPO until VS normal and Hgb stable
- Cardiac Monitor and Pulse Oximetry

Hgb drop >1 gm/dl or abnormal VS?

Yes

Hgb <7.0 gm/dl PEWS ≥7 or signs of clinical deterioration?

Yes

- Notify Attending/ Fellow
- ACT if PEWS ≥7
- Consider Intervention‡

PICU transfer warranted?

Yes

No

No

No

Repeat Hgb in 6 hours

No

OR warranted?

Yes

Off Pathway
Treat according to surgical post-op plan

Minimum 12 hour observation since admission

Patient meets discharge criteria? ¶

No

Off Pathway
- Consider bowel injury, pancreatic injury
- Repeat Hgb if clinically indicated by exam or VS

Yes

Discharge

Follow-up:
- Grade 1-2 Spleen/Liver: Phone follow-up in 2 weeks
- Grade 3-5 Spleen/Liver: Follow-up in trauma clinic in 2 weeks
- Kidney: Follow-up in Urology clinic in 2 months, if Grade ≥3 obtain RUS
- Utilize "TRAUMA" discharge instructions template

‡ Indications for Intervention

Transfusion:
- Unstable VS after 20 ml/kg bolus of isotonic IVF
- Hgb <7.0 gm/dl
- Signs of ongoing bleeding

Angioembolization:
- Signs of ongoing bleeding despite PRBC transfusion
- NOT Indicated for CT contrast blush only
- Avoid IR for unstable patients

OR:
- Unstable despite PRBC transfusion
- Consider massive transfusion protocol

Urology: consultant to determine need for stent or nephrostomy tube

- Transfer to Floor when clinically stable per PICU and Ped Surg discussion
- Hgb >7.0 gm/dl, VS age-appropriate and PEWS <5

¶ Discharge Criteria:
- Tolerating diet
- Minimal abdominal pain
- Age-appropriate vital signs

After Care (Based on highest grade injury if multiple SOI):
- Grade 1-2 may return to light weight lifting, jogging, non-contact/collision and non-fall risk activities as tolerated
- Grade 3-5 light activity only until trauma clinic appointment
- Restrict heavy lifting and risk of falling/collision for Injury Grade + 2 weeks
- Consider follow-up Imaging for symptomatic patients with prior high grade (3+) injuries

Diagnosis & Definition

- Solid Organ Injury (SOI) includes any radiologic evidence or intraoperative findings of injury to the liver, spleen, or kidneys. SOI is graded using The American Association for the Surgery of Trauma, Injury Scoring Scales.[1] Each organ injured is graded on a scale from I to V.
- High Risk Mechanisms for solid organ injury include: motor vehicle crash >25 mph or rollover, pedestrian struck by a moving vehicle, Motorized cycle or dirt bike crash, ATV crash, fall >20 feet, handlebar injury or other mechanism of significant impact to the abdomen.
- Signs and symptoms of solid organ injury include: presence of abdominal bruising, abdominal pain or tenderness, vomiting, evidence of thoracic wall trauma, and decreased breath sounds.[2]

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Differential Diagnoses

- Pancreatic Injury
- Gastric/Bowel Injury
- Mesenteric Injury
- Abdominal Wall Contusion
- Pelvic fracture(s) or hematoma
- Spinal fracture or injury
- Diaphragm rupture
- Abdominal aorta injury

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Testing

- Clinical exam should be considered most reliable, and lab values utilized when the decision for CT is borderline.
- Labs: AST, ALT, Lipase and UA are to be obtained as screening labs for the identification of risk for intraabdominal injury when a patient presents after high-risk mechanism or has clinical signs or symptoms of intraabdominal injury.
- We recommend using a threshold of AST or ALT ≥200 U/L, Urinalysis ≥ 50 RBC/HPF, and lipase >220 U/L as indication for CT scan.[3,4]
- For patients with suspected NAT, use lab threshold of AST or ALT >80 per Evidence Based Practice Guideline: Non-Accidental Trauma Clinical Pathway
- Imaging: CT abdomen/pelvis with IV contrast. Delayed images will be obtained by the performing technologist if any findings for kidney injury are identified during the CT acquisition per radiology trauma protocol.
- FAST exam may be performed as a screening exam for free fluid, but CT scan remains the standard for solid organ injury identification

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Severity Assessment

Patient stability should be based on abnormal vital signs after initial volume resuscitation. Any patient with hypotension, hypoxia or tachycardia with concern for deterioration and/or substantial clinical concern should be admitted to the PICU.

- Grade of injury is not a strong indicator for patient stability, and clinical condition can vary.
- Grade of injury does guide aftercare in regards to follow-up and return to activity recommendations.

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Admission Criteria

- Refer to **Trauma Program Guideline T-017: Trauma Service Admission Matrix**
- All patients with solid organ injury should be admitted to Pediatric Surgery utilizing the SOI non-operative management pathway.
- Patient without solid organ injury, but with high risk mechanisms (ie., handlebar, seatbelt sign), non-specific CT findings (free fluid, bowel thickening, mesenteric stranding, etc.), or signs/symptoms of possible intra-abdominal injury should be admitted to Pediatric Surgery for observation and serial clinical examination.[5]
- After initial volume resuscitation, patients with hypotension, hypoxia or tachycardia with concern for deterioration and/or substantial clinical concern should be admitted to the PICU under Pediatric Surgery service.

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Assessment & Monitoring

- ED: Follow **Trauma Program Guideline T-027: Trauma Team Expectations (Main ED)** for patient assessment and monitoring
- Inpatient: Pulse Ox, VS Q2H x3 then Q4H if stable, Repeat Hgb Q6 hours after initial until stable (<1gm/dl decrease and no hemodynamic instability)
- PICU: Continuous Cardiac Monitor and Pulse Ox, VS Q1H or as directed by PICU/ Trauma teams, Repeat Hgb Q6 hours until stable

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Recommended Treatments

- ED fluid resuscitation will be per **Trauma Program Guideline T-037: Fluid Management of the Trauma Alert Patient**
- Transfusion Indications: Unstable VS after 20 ml/kg bolus of isotonic IVF, Hgb <7.0 gm/dl, or signs of ongoing bleeding[5]
- Angioembolization Indications: Signs of ongoing bleeding despite PRBC transfusion[5]
- Indications for operation: Unstable VS despite PRBC transfusion[5]
- Consider **Massive Transfusion Protocol (MTP) 45:16**
- Decisions for ureteral stent and nephrostomy tube for post trauma urine leak will be case by case and per Urology.

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Treatments Not Recommended

- Angioembolization and surgery are NOT indicated for CT contrast blush without instability[5]
- Bedrest is no longer indicated for hemodynamically stable patients, regardless of injury grade[6,7]
- Follow-up imaging is not indicated for asymptomatic liver or spleen injured patients.

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Deterioration & Escalation of Care

Identification of Deterioration

- ED patient: If patient is a non-alert or Level 2 alert with suspected ongoing bleeding or hemodynamic derangement, upgrade to a Level 1 Trauma Alert.
- Floor patient: Patients with Hgb <7.0 mg/dl, hypotension, hypoxia, worsening tachycardia despite adequate pain control, or PEWS >5 should be evaluated by the fellow or attending for need of intervention and/or PICU transfer

Escalation of Care Protocol

- Floor patient:
  - RN to contact Pediatric Surgery APP assigned to the patient
  - Refer to **Patient/Family Care Policy 15:15 Assessment and Consultation Team (ACT)**
  - APP to contact fellow or attending if Hgb <7.0 mg/dl, hypotension, hypoxia, worsening tachycardia despite adequate pain control, or PEWS >5
- PICU patient: Contact Pediatric Surgery fellow or attending for evaluation of need for intervention

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Discharge Criteria & Planning

Discharge Criteria

- Tolerating diet
- Minimal abdominal pain
- Age-appropriate vital signs

Follow Up

- Based on highest grade injury if multiple SOIs.
- Grade 1-2 Spleen/Liver: Phone follow-up in 2 weeks with Trauma Clinic
- Grade 3-5 Spleen/Liver: Follow-up in trauma clinic in 2 weeks
  - Consider follow-up Imaging for symptomatic patients with prior high grade (3+) injuries
- Kidney: Follow-up in Urology clinic in 2 months, if Grade ≥3 obtain RUS

Discharge Education

- **Helping Hands – Speen Injury**
- **Helping Hands – Kidney Injury**
- **Helping Hands – Liver Injury**

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Patient & Caregiver Education

- Discharge Instructions: Liver/Spleen injuries have a risk of significant bleeding. X patient was monitored closely in the hospital for bleeding. Most injuries heal on their own without surgery. X patient will have activity restrictions to protect against further injury during this time. Most liver/spleen injuries do not need follow-up imaging after discharge.
- Grade 1-2 may return to light weight lifting, jogging, non-contact/collision and non-fall risk activities as tolerated
- Grade 3-5 light activity only until trauma clinic appointment
- Restrict heavy lifting and risk of falling/collision for Grade + 2 weeks (eg. Grade 2 injury = 4 weeks)

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Risk Awareness & Zero Hero

Patients with high-risk injury mechanisms or signs/symptoms of solid organ injury, but normal imaging may have injuries such as bowel injury or other sources of bleeding and have risk for deterioration. These patients should be admitted to Pediatric Surgery for ongoing assessment and tertiary survey following a trauma alert.

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Tables

- **AAST Grading Scale Hyperlink** [Injury Scoring Scale - The American Association for the Surgery of Trauma (aast.org)]
- **APSA 2019 SOI Hyperlink** [Admission (apsapedsurg.org)]

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References

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6. American Pediatric Surgical Association. *Updated APSA Blunt Liver/Spleen Injury Guidelines*, April 2019. Available from: https://apsapedsurg.org/wp-content/uploads/2020/10/APSA_Solid-Organ-Injury-Guidelines-2019.pdf
7. Cunningham AJ, Lofberg KM, Krishnaswami S, et al. Minimizing variance in Care of Pediatric Blunt Solid Organ Injury through Utilization of a hemodynamic-driven protocol: a multi-institution study. *J Pediatr Surg*. 2017;52(12):2026-2030. doi:10.1016/j.jpedsurg.2017.08.035
8. Notrica DM, Eubanks JW 3rd, Tuggle DW, et al. Nonoperative management of blunt liver and spleen injury in children: Evaluation of the ATOMAC guideline using GRADE. *J Trauma Acute Care Surg*. 2015;79(4):683-693. doi:10.1097/TA.0000000000000808

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Quality Measures

Goals:

ED: Reduce the rate of abdomen/pelvis CTs for patients presenting to the ED with blunt abdominal trauma and reassuring physical exam and labs.

IP: Encourage earlier ambulation and reduce lab draws for stable patients admitted with SOI.

ED Metrics:

Process measures:
- ED Order Panel utilization

Outcome measures:
- Rate of abdomen/pelvis CTs among patients presenting with blunt abdominal trauma within 24hrs and concerning signs/symptoms or high risk mechanism with normal labs (AST/ALT/Lipase, Hgb/Hct, UA)
  - Consider excluding trauma activations since they follow a different workflow/acuity
- ED length of stay

Balancing measure:
- Abdomen/pelvis CT rate among patients returning to the ED within 24hrs

IP Metrics: - All of these to be tracked manually by the trauma program

Process measures:
- IP Order Set utilization – Trauma Admission Order Set

Outcome measures:
- Reduced LOS for patients admitted with SOI stratified by grade
- Rate of SOI patients not following recommended inpatient management (lab frequency, patient activity, LOS, urology consult)

Balancing measure:
- 30 day readmission rate

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Potential Areas of Research

- Reduction in length of stay and hospital costs after pathway implementation
- QOL study, return to play and sports following solid organ injury

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Pathway Team & Process

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Advisory Committee Date: *October, 2022*

Origination Date: *October, 2022*

Next Revision Date: *October, 2025*

Clinical Pathway Development

This clinical pathway was developed using the process described in the NCH Clinical Pathway Development Manual Version 6, 2022. Clinical Pathways at Nationwide Children's Hospital (NCH) are standards which provide general guidance to clinicians. Patient choice, clinician judgment, and other relevant factors in diagnosing and treating patients remain central to the selection of diagnostic tests and therapy. The ordering provider assumes all risks associates with care decisions. NCH assumes no responsibility for any adverse consequences, errors, or omissions that may arise from the use or reliance on these guidelines. NCH's clinical pathways are reviewed periodically for consistency with new evidence; however, new developments may not be represented, and NCH makes no guarantees, representations, or warranties with respect to the information provided in this clinical pathway.

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