

## Renal Injury

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# What is a Clinical Pathway?

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

# Pathway Objectives

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- Standardize care to decrease variability in the management of patients with renal injuries
- Decrease length of stay to conform with current evidence-based guidelines
- Decrease unnecessary laboratory testing
- Avoid unnecessary PICU admissions
- Clearly delineate discharge criteria

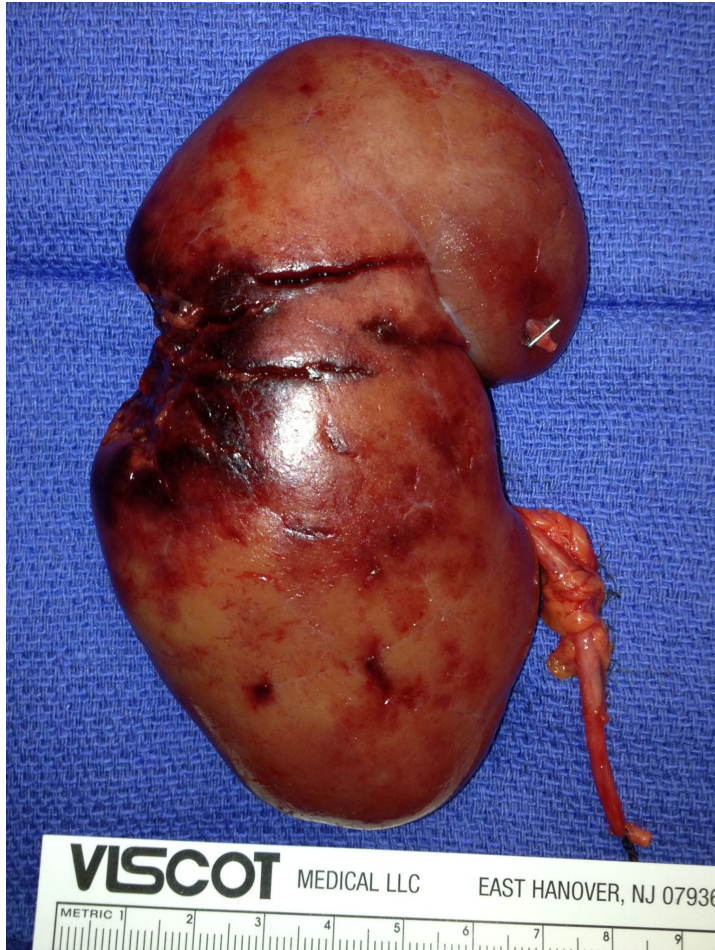
# Why is the pathway necessary?

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- The kidney is the most frequently injured urologic organ, with 70% to 80% being a consequence of blunt trauma.
- 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.

# Renal Injury Classification



## Classification

- **grade I:** contusion or non-enlarging subcapsular perirenal haematoma, and no laceration
- **grade II:** superficial laceration <1 cm depth and does not involve the collecting system (no evidence of urine extravasation), non-expanding perirenal haematoma confined to retroperitoneum
- **grade III:** laceration >1 cm without extension into the renal pelvis or collecting system (no evidence of urine extravasation)
- **grade IV**
  - laceration extends to renal pelvis or urinary extravasation
  - vascular: injury to main renal artery or vein with contained haemorrhage
  - segmental infarctions without associated lacerations
  - expanding subcapsular haematomas compressing the kidney
- **grade V**
  - shattered kidney
  - avulsion of renal hilum: devascularisation of a kidney due to hilar injury
  - ureteropelvic avulsions
  - complete laceration or thrombus of the main renal artery or vein

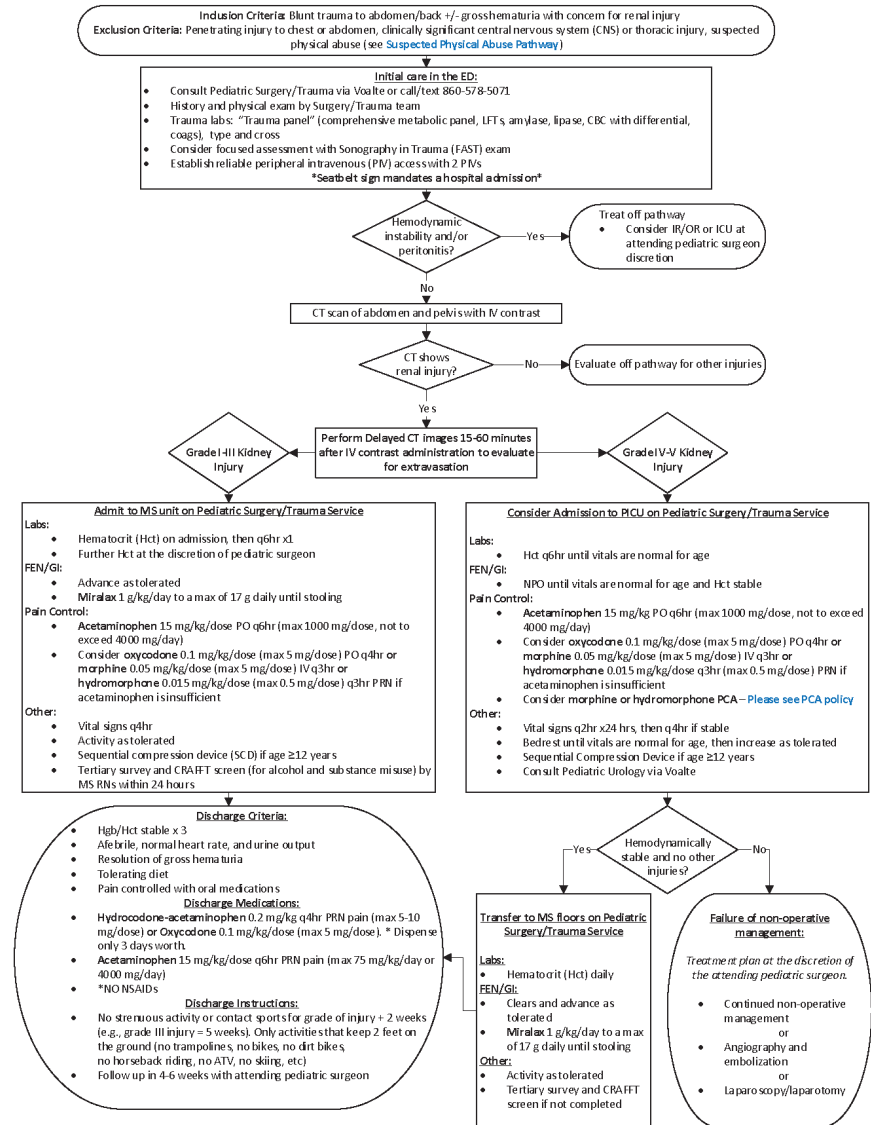
NB. advance one grade for bilateral injuries up to grade III.

A Radiologist will grade the injury using this scale.

**CLINICAL PATHWAY:**  
**Renal Injury**

THIS PATHWAY  
SERVES AS A GUIDE  
AND DOES NOT  
REPLACE CLINICAL  
JUDGMENT.

This is the Renal Injury Clinical Pathway.  
We will be reviewing each component in  
the following slides.



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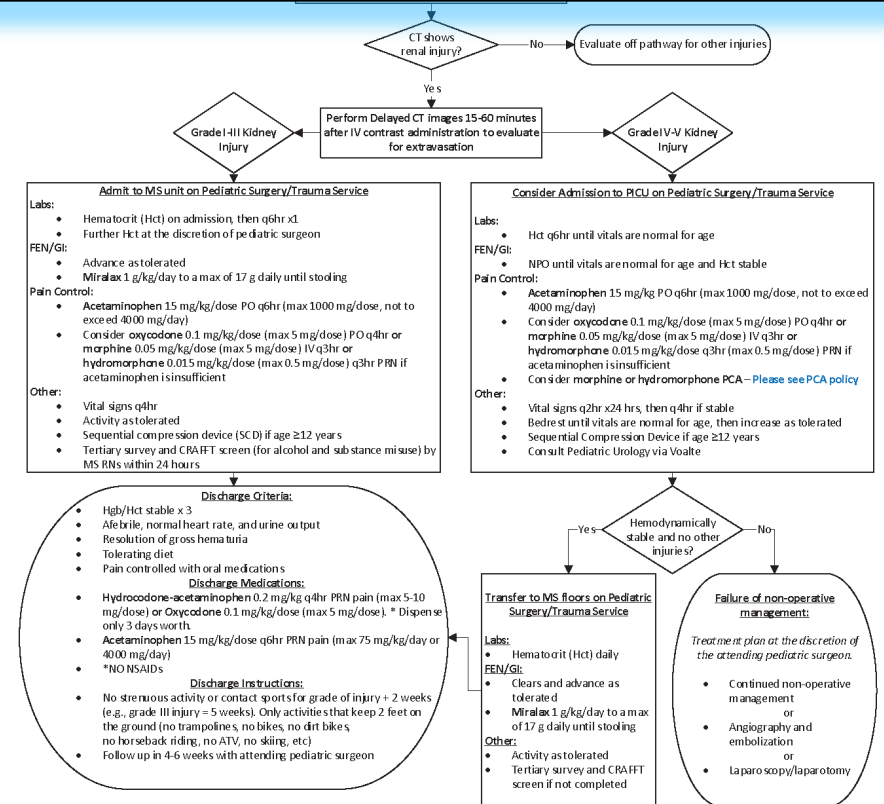
Initial care:

- 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
  - Other exams should be considered based on presentation
- Establish IV access early

**Initial care in the ED:**

- Consult Pediatric Surgery/Trauma via Voalte or call/text 860-578-5071
- History and physical exam by Surgery/Trauma team
- Trauma labs: "Trauma panel" (comprehensive metabolic panel, LFTs, amylase, lipase, CBC with differential, coags), type and cross
- Consider focused assessment with Sonography in Trauma (FAST) exam
- Establish reliable peripheral intravenous (PIV) access with 2 PIVs

**\*Seatbelt sign mandates a hospital admission\***



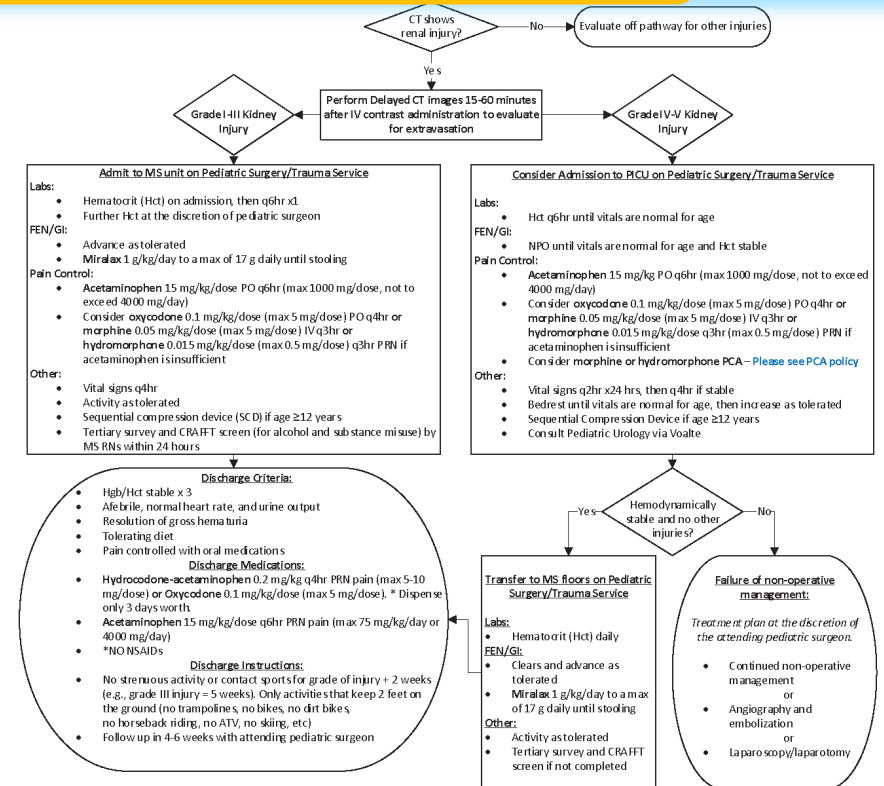
## Seatbelt sign

- 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

### Initial care in the ED:

- Consult Pediatric Surgery/Trauma via Voalte or call/text 860-578-5071
- History and physical exam by Surgery/Trauma team
- Trauma labs: "Trauma panel" (comprehensive metabolic panel, LFTs, amylase, lipase, CBC with differential, coags), type and cross
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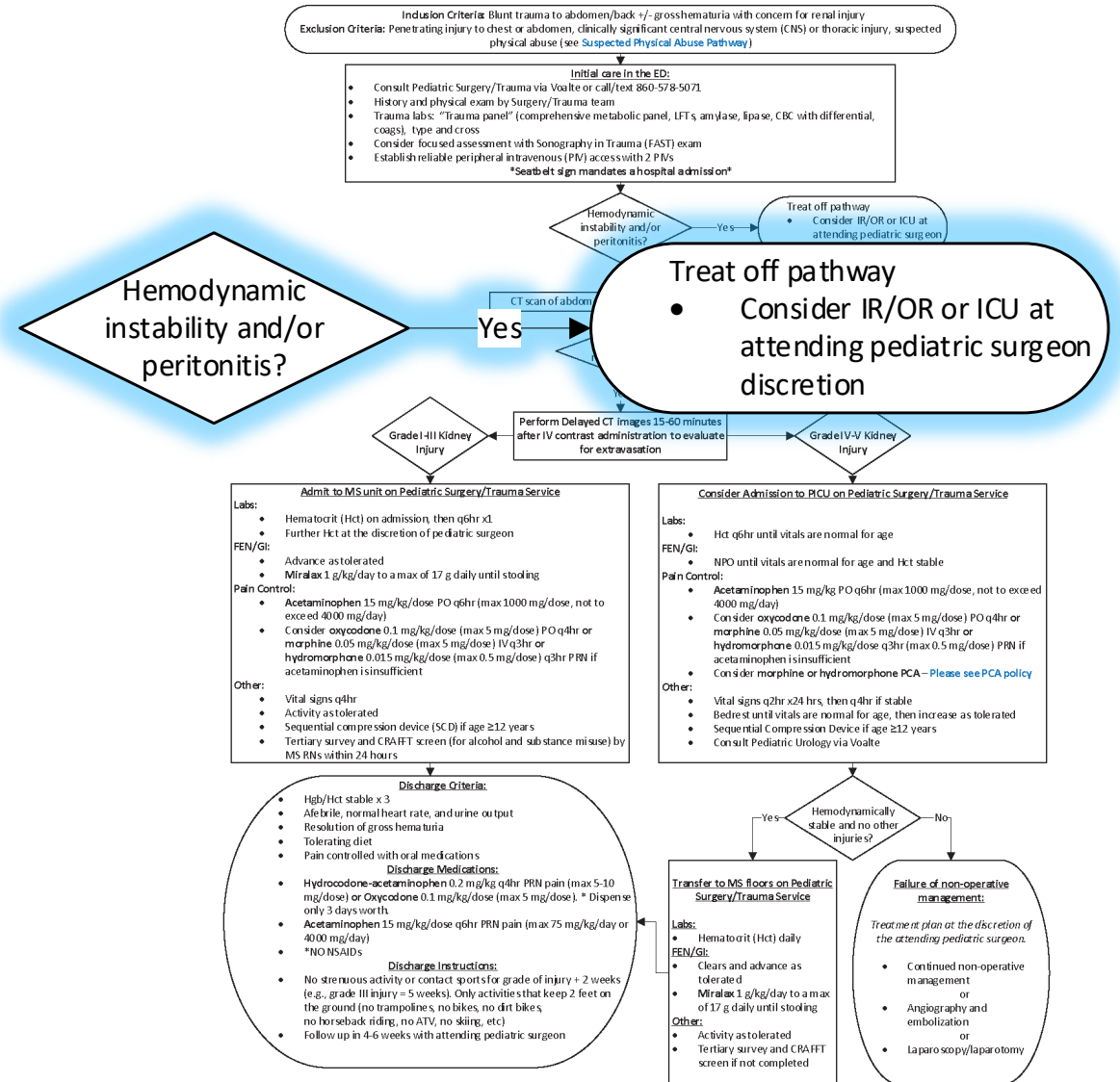
**\*Seatbelt sign mandates a hospital admission\***





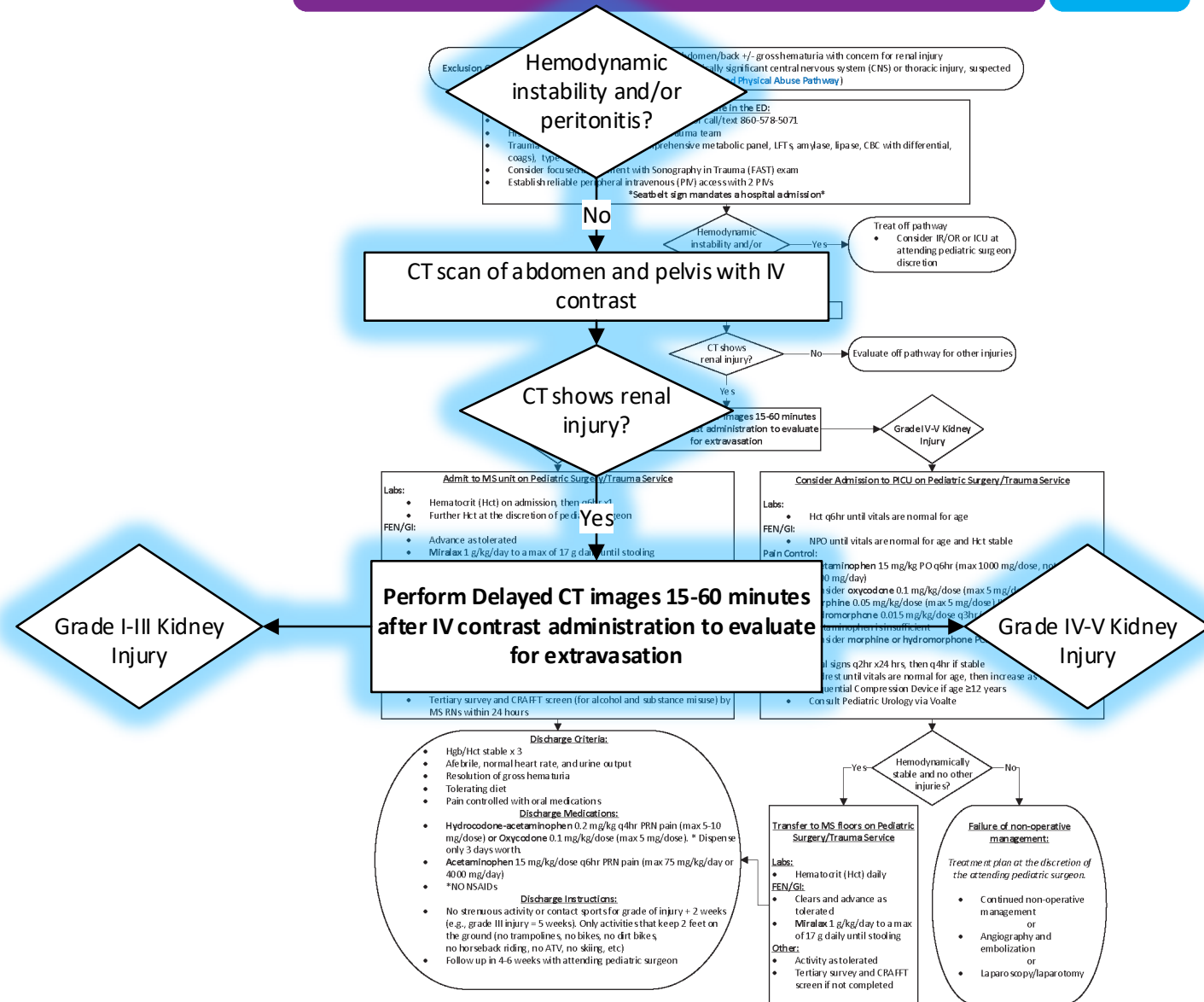
If the patient is hemodynamically unstable and/or has peritonitis:

- The patient may require IR/OR intervention, or transfer to the ICU, depending on their clinical status. This will be determined by the pediatric surgeon.



## Stable patients:

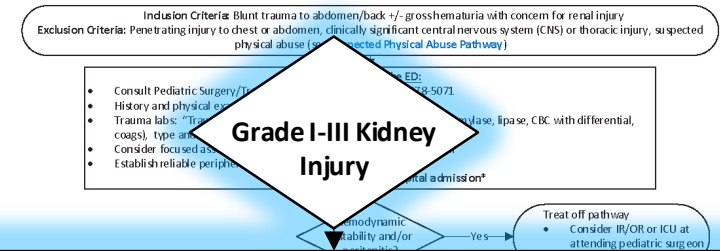
- Need CT scan of Abdomen and Pelvis with Contrast
- CT scan is read by a Radiologist who then Grades the injury
  - Grade I-V, higher the grade the more significant the injury
- Delayed images should be obtained (15 minutes after initial study and up to 60 minutes after initial study) to look for extravasation



## Grade I, II, or III injuries:

- Patients are admitted to the Med/Surg unit
- Need Hct on admission then x1 after 6 hrs
- 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



### Admit to MS unit on Pediatric Surgery/Trauma Service

**Labs:**

- Hematocrit (Hct) on admission, then q6hr x1
- Further Hct at the discretion of pediatric surgeon

**FEN/GI:**

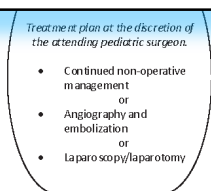
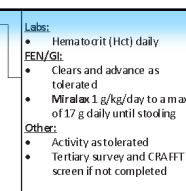
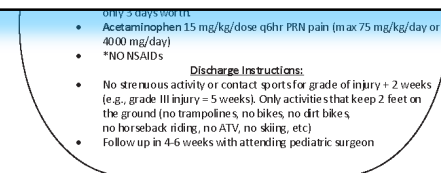
- Advance as tolerated
- **Miralax** 1 g/kg/day to a max of 17 g daily until stooling

**Pain Control:**

- **Acetaminophen** 15 mg/kg/dose 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

**Other:**

- Vital signs q4hr
- Activity as tolerated
- Sequential compression device (SCD) if age ≥12 years
- Tertiary survey and CRAFFT screen (for alcohol and substance misuse) by MS RNs within 24 hours



**Grade IV-V Kidney Injury**

Inclusion Criteria: Blunt trauma to abdomen/back +/- gross hematuria with concern for renal injury  
 Exclusion Criteria: Penetrating injury to chest or abdomen, clinically significant central nervous system (CNS) or thoracic injury, suspected physical abuse (see Suspected Physical Abuse Pathway)

**Consider Admission to PICU on Pediatric Surgery/Trauma Service**

- Labs:**
- Hct q6hr until vitals are normal for age
- FEN/GI:**
- NPO until vitals are normal for age and Hct stable
- Pain Control:**
- 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 q3hr (max 0.5 mg/dose) PRN if acetaminophen is insufficient
  - Consider **morphine or hydromorphone PCA** – Please see PCA policy
- Other:**
- Vital signs q2hr x24 hrs, then q4hr if stable
  - Bedrest until vitals are normal for age, then increase as tolerated
  - Sequential Compression Device if age ≥12 years
  - Consult Pediatric Urology via Voalte

**Decision: Hemodynamically stable and no other injuries?**

**Yes:**

- Advance as tolerated
- Miralax** 1 g/kg/day to a max of 17 g daily until stooling
- Pain Control:**
  - Acetaminophen** 15 mg/kg/dose 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 q3hr (max 0.5 mg/dose) PRN if acetaminophen is insufficient
- Other:**
  - Vital signs q4hr
  - Activity as tolerated

**No:**

- NPO until vitals are normal for age and Hct stable
- Pain Control:**
  - 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 q3hr (max 0.5 mg/dose) PRN if acetaminophen is insufficient
- Other:**
  - Consider **morphine or hydromorphone PCA** – Please see PCA policy
  - Vital signs q2hr x24 hrs, then q4hr if stable
  - Bedrest until vitals are normal for age, then increase as tolerated
  - Sequential Compression Device if age ≥12 years
  - Consult Pediatric Urology via Voalte

**Transfer to MS floors on Pediatric Surgery/Trauma Service**

**Labs:**

- Hematocrit (Hct) daily

**FEN/GI:**

- Clears and advance as tolerated
- Miralax** 1 g/kg/day to a max of 17 g daily until stooling

**Other:**

- Activity as tolerated
- Tertiary survey and CRAFT screen if not completed

**Decision: Hemodynamically stable and no other injuries?**

**Yes:**

**Transfer to MS floors on Pediatric Surgery/Trauma Service**

**Labs:**

- Hematocrit (Hct) daily

**FEN/GI:**

- Clears and advance as tolerated
- Miralax** 1 g/kg/day to a max of 17 g daily until stooling

**Other:**

- Activity as tolerated
- Tertiary survey and CRAFT screen if not completed

**No:**

**Failure of non-operative management:**

*Treatment plan at the discretion of the attending pediatric surgeon.*

- Continued non-operative management or
- Angiography and embolization or
- Laparoscopy/laparotomy

**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
- Once a patient is hemodynamically stable, they may be ready to transfer to the Med/Surg floors.

Grade IV-V Kidney Injury

Inclusion Criteria: Blunt trauma to abdomen with gross hematuria +/- gross hematuria with concern for renal injury  
 Exclusion Criteria: Penetrating injury to chest or abdomen, clinically significant central nervous system (CNS) or thoracic injury, suspected

Consider Admission to PICU on Pediatric Surgery/Trauma Service

- Labs:**
- Hct q6hr until vitals are normal for age
- FEN/GI:**
- NPO until vitals are normal for age and Hct stable
- Pain Control:**
- 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 q3hr (max 0.5 mg/dose) PRN if acetaminophen is insufficient
  - Consider **morphine or hydromorphone PCA – Please see PCA policy**
- Other:**
- Vital signs q2hr x24 hrs, then q4hr if stable
  - Bedrest until vitals are normal for age, then increase as tolerated
  - Sequential Compression Device if age ≥12 years
  - Consult Pediatric Urology via Voalte

**Discharge Criteria:**

- Hgb/Hct stable x3
- Afebrile, normal heart rate, and urine output
- Resolution of gross hematuria
- Tolerating diet
- Pain controlled with oral medications

**Discharge Medications:**

- Hydrocodone-acetaminophen 0.2 mg/kg q4hr PRN pain (max 5 mg/dose) or Oxycodone 0.1 mg/kg/dose (max 5 mg/dose). \* Diff only 3 days worth
- Acetaminophen 15 mg/kg/dose q6hr PRN pain (max 75 mg/kg/4000 mg/day)
- \*NO NSAIDs

**Discharge Instructions:**

- No strenuous activity or contact sports for grade of injury + 2 weeks (e.g., grade III injury = 5 weeks). Only activities that keep 2 feet off the ground (no trampolines, no bikes, no dirt bikes, no horseback riding, no ATV, no skiing, etc)
- Follow up in 4-6 weeks with attending pediatric surgeon

Hemodynamically stable and no other injuries?

Failure of non-operative management:

Treatment plan at the discretion of the attending pediatric surgeon.

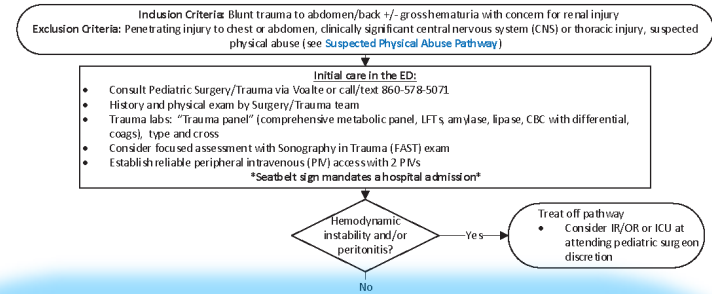
- Continued non-operative management or
- Angiography and embolization or
- La paroscopy/laparotomy

Grade IV or V injuries:

- However, if the patient is not hemodynamically stable with no other injuries, 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:
  - 3 day supply of oral Hydrocodone/Acetaminophen or Oxycodone
  - Miralax
  - Avoid NSAIDs
- Activity:
  - Duration of activity restriction is based on grade of injury + 2 weeks
- Follow up should be done in 4-6 weeks with the attending pediatric surgeon



### Discharge Criteria:

- Hgb/Hct stable x 3
- Afebrile, normal heart rate, and urine output
- Resolution of gross hematuria
- Tolerating diet
- Pain controlled with oral medications

### Discharge Medications:

- **Hydrocodone-acetaminophen** 0.2 mg/kg q4hr PRN pain (max 5-10 mg/dose) or **Oxycodone** 0.1 mg/kg/dose (max 5 mg/dose). \* Dispense only 3 days worth.
- **Acetaminophen** 15 mg/kg/dose q6hr PRN pain (max 75 mg/kg/day or 4000 mg/day)
- \*NO NSAIDs

### Discharge Instructions:

- No strenuous activity or contact sports for grade of injury + 2 weeks (e.g., grade III injury = 5 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 in 4-6 weeks with attending pediatric surgeon

no horseback riding, no ATV, no skiing, etc)  
 • Follow up in 4-6 weeks with attending pediatric surgeon

Discharge:  
 • Activity as tolerated  
 • Tertiary survey and CRAFT screen if not completed

operative  
 IR or  
 angiography and  
 embolization  
 or  
 laparoscopy/laparotomy

# Review of Key Points



- Renal injuries are graded (I-V) based on CT scan findings (ideally) with delayed images to evaluate for contrast extravasation (urine leak).
- Serial hematocrits are performed based on grade of injury and vital signs
- There are no longer activity restrictions on patients with grade I-III kidney injuries.
  - Patients with higher grade injuries (Grade IV-V) will remain NPO, with q6hr Hct, and bedrest until vital signs are normal for age.
- Discharge is based on physiology (e.g. heart rate, hematocrit) **NOT** grade of injury
- Duration of activity restriction at discharge is based on grade of injury + 2 weeks



# Quality Metrics

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- % Patients with Renal Injury Pathway order set
- Grade of injury
- % Patients with delayed CT imaging
- ALOS (days) 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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- **Brendan Campbell, MD, MPH**
  - Director of Trauma Services, Department of Pediatric Surgery and Trauma
- **Evan Fusaro, PA-C**
  - Department of Pediatric Surgery and Trauma
- **Jen Tabak, RN, MSN**
  - Trauma Program Manager

# References



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# Thank You!



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## **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.