# Pediatric Solid Organ Injury Updates

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Rio Grande trauma Conference

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# Disclosure

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- I have no financial disclosures

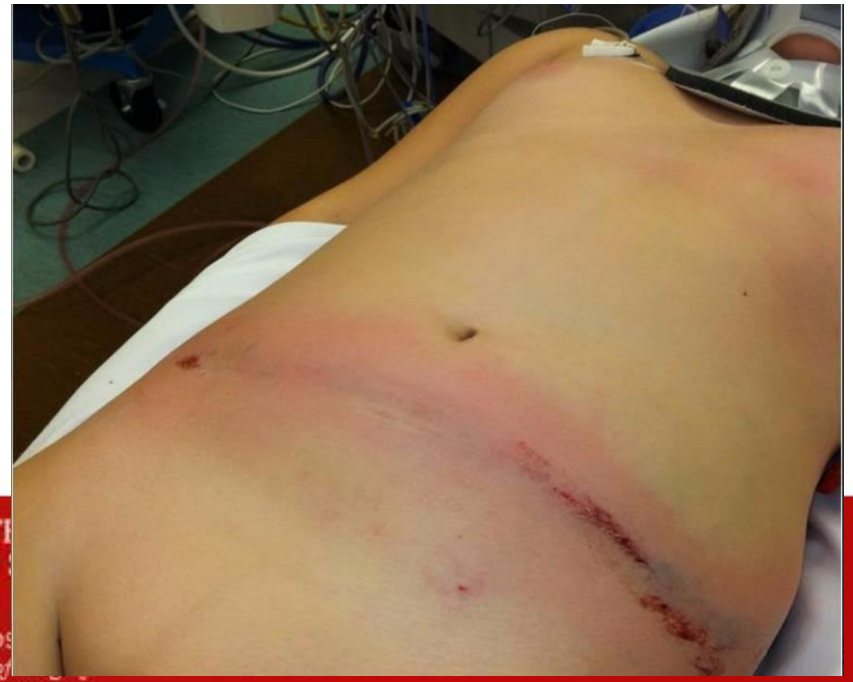
- I have spent the last 10 years of my life in training (general surgery, pediatric surgical critical care, and pediatric surgery) taking care of trauma and the last 4 years exclusively caring for children.

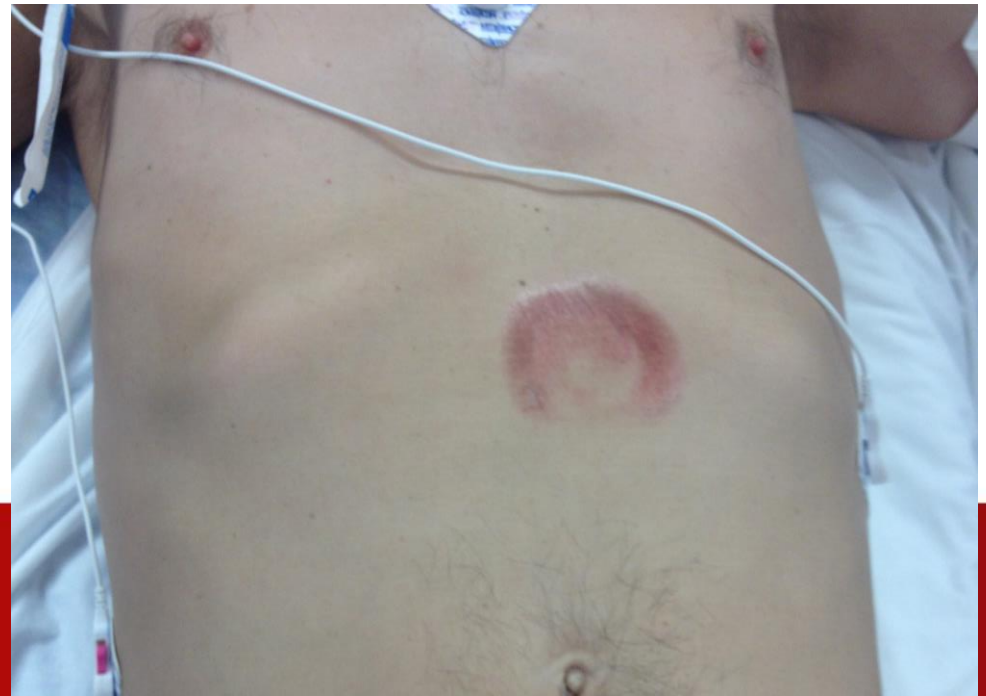
# Objectives

- Review injury patterns and incidence of solid organ injuries in pediatric patients
- Understand age appropriate vital signs as one of the key factors in decision making for pediatric solid organ injuries
- Recognize and treat complications following solid organ injury
- Identify specific follow-up issues after solid organ injury in pediatric patients

# Pediatric abdominal trauma

- Prehospital details
- Mechanism (MVA, fall, assault, ped v. car)
- External signs of injury (seatbelt sign, abrasions, contusions)





# Blunt Trauma Patterns

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- Waddell's triad (Ped vs. Car)
  - Lower extremity fx, thoracic/upper abdominal trauma/head trauma
- Bike accident
  - Head/ortho
  - Handlebar injuries-shearing of abdominal wall away from skin (handlebar hernia), pancreas and duodenal injuries
- MVA with lap belt worn too high→seat belt injury
  - Duodenal hematoma, small bowel injury
  - Pancreas or liver injury
  - Chance fx of lumbar vertebrae

# Liver and Splenic Injury

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- Spleen-Most commonly injured organ with blunt abdominal trauma
- Symptoms abdominal pain, elevated LFTs
- Vast majority managed non-operatively
- ICU admission
  - Hemodynamic lability after resuscitation
  - Concomitant injuries (ie brain)
- If they’re going to fail, kids fail non-op management early, within 24 hours by hemodynamic lability

# Liver Injury Grading

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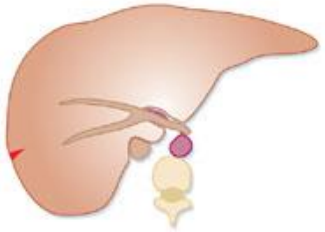
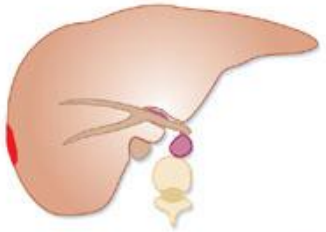
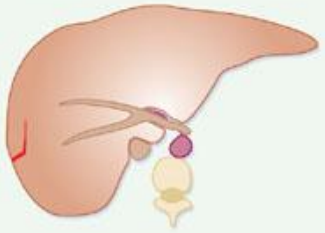
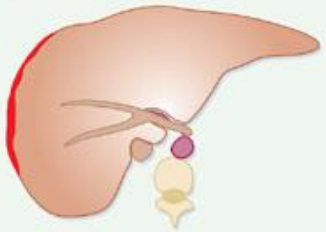
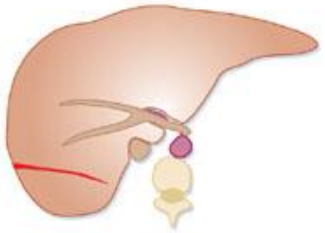
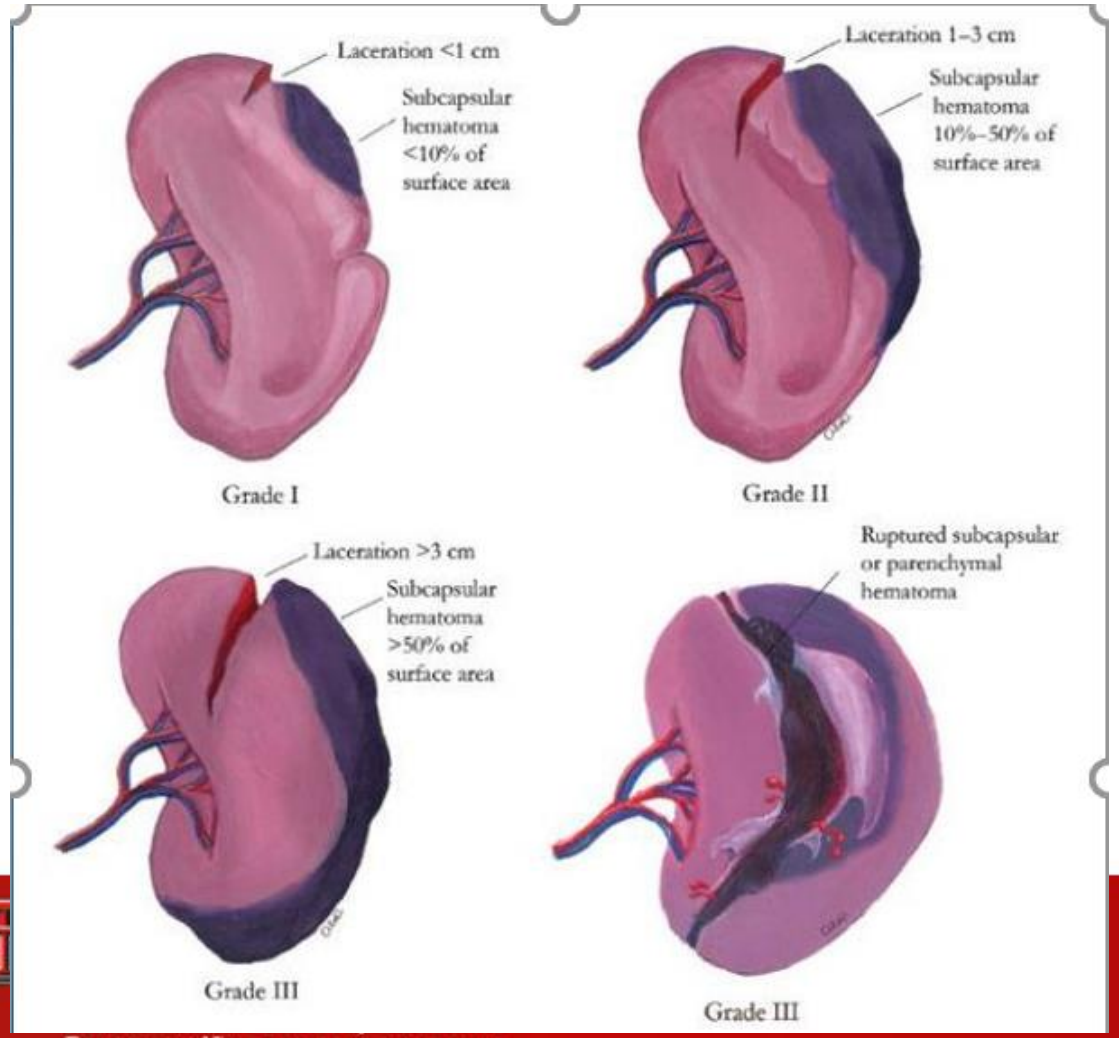
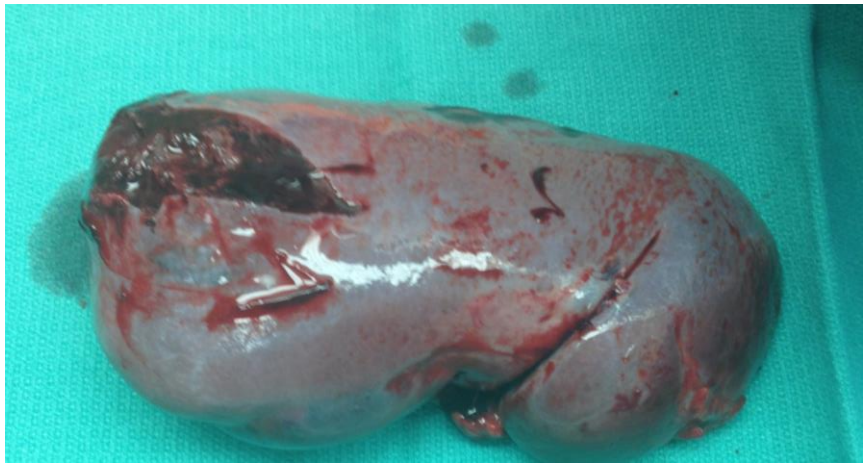
| Grade | Laceration | Hematoma | Vascular |
|---|---|---|---|
| I | Capsular tear < 1 cm deep  | Subcapsular hematoma < 10% surface area  | None |
| II | 1-3 cm deep<br><10 cm long  | Subcapsular hematoma: 10%-50% surface area<br>Intraparenchymal hematoma < 10 cm  | None |
| III | Parenchymal laceration more than 3 cm deep  | Subcapsular hematoma > 50% surface area, expanding or ruptured (regardless of size)<br>Parenchymal hematoma > 10 cm or expanding  | None |

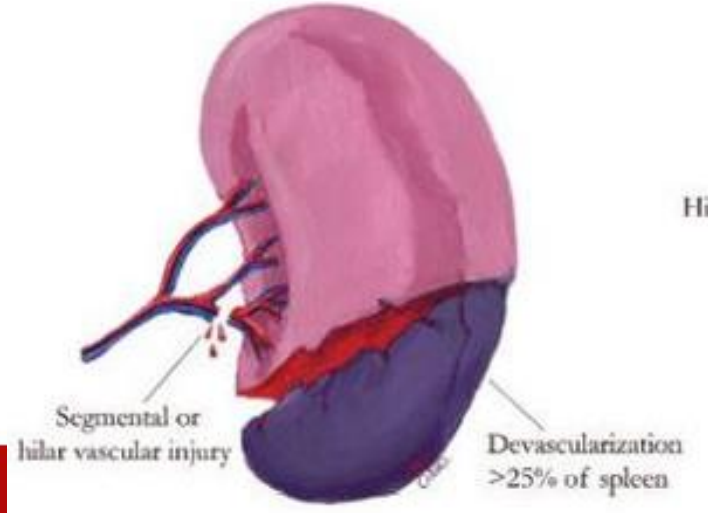
## Hepatic CT Injury Grading Scale

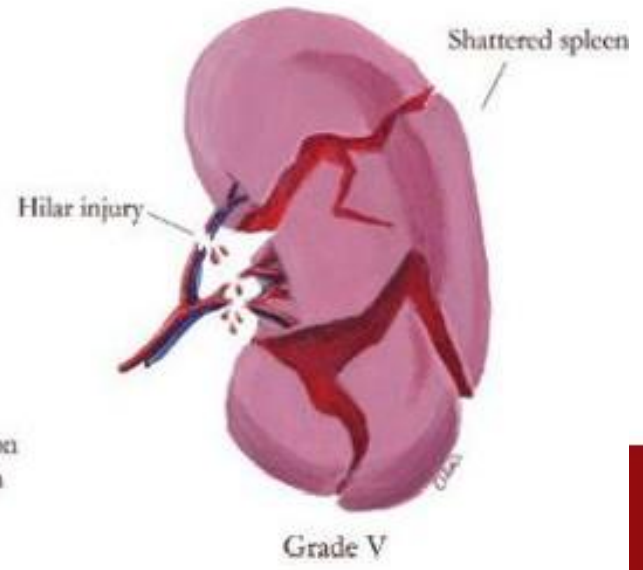
| | |
|---|---|
| Grade I | Laceration(s) < 1 cm deep<br>Subcapsular hematoma < 1cm diameter |
| Grade II | Laceration(s) 1-3 cm deep<br>Subcapsular or central hematoma 1-3cm diam |
| Grade III | Laceration(s) 3-10 cm deep<br>Subcapsular or central hematoma 3-10 cm diam |
| Grade IV | Laceration(s) > 10 cm deep<br>Subcapsular or central hematoma > 10cm diam<br>Lobar maceration or devascularization |
| Grade V | Bilobar tissue maceration or devascularization |

# Splenic Injury Grading





# Updated APSA Blunt Liver/Spleen Injury Guidelines 2019

## Admission

- **ICU Admission Indicators**
  - Abnormal vital signs after initial volume resuscitation
- **ICU**
  - Activity - Bedrest until vitals normal
  - Labs – q6hour CBC until vitals normal
  - Diet – NPO until vital signs normal and hemoglobin stable
- **Ward**
  - Activity - No restrictions
  - Labs - CBC on admission and/or 6 hours after injury
  - Diet – Regular diet

## Procedures

- **Transfusion**
  - Unstable vitals after 20 cc/kg bolus of isotonic IVF
  - Hemoglobin < 7
  - Signs of ongoing or recent bleeding
- **Angioembolization**
  - Signs of ongoing bleeding despite pRBC transfusion
  - Not indicated for contrast blush on admission CT without unstable vitals
- **Operative exploration with Control of Bleeding**
  - Unstable vitals despite pRBC transfusion
  - Consider massive transfusion protocol

## Set Free

- Based on clinical condition **NOT** injury severity (grade)
- Tolerating a diet
- Minimal abdominal pain
- Normal vital signs

## Aftercare

- **Activity Restriction**
  - Restricting activity to grade plus 2 weeks is safe
  - Shorter restrictions may be safe but there is inadequate data to support decreasing these recommendations
- **Follow up Imaging**
  - Risk of delayed complications following spleen and liver injuries is low
  - Consider imaging for ***symptomatic*** patients with prior high grade injuries



https://eapsa.org/apsa/media/Documents/APSA_Solid-Organ-Injury-Guidelines-2019.pdf

# Blunt Abdominal Trauma- Complications

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- Complications from non-operative management
  - Splenic or hepatic cysts
- Complications following blunt liver injury
  - Hemobilia
    - IR embolizataion
  - Bile leak
    - IR drainage and ERCP

# Pancreatic injury

- 1-4% of children with intra-abdominal injuries
- Mechanism-fixed in retroperitoneum so vulnerable to injuries by crush or rapid change in energy
- Also direct trauma from bike handle etc
- Most commonly injured at the midbody
- 90% of pancreatic injuries are associated with OTHER INJURIES

- ***Level of amylase and lipase elevation does NOT correlate with severity of injury****

# Blunt Abdominal Trauma-Pancreatic Injury

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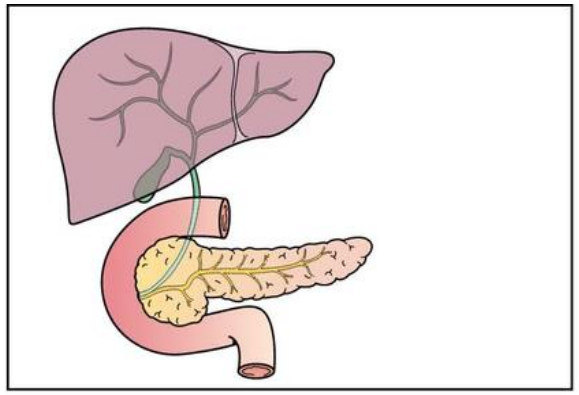
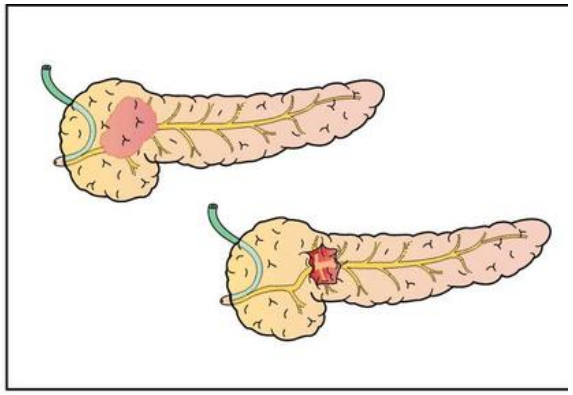
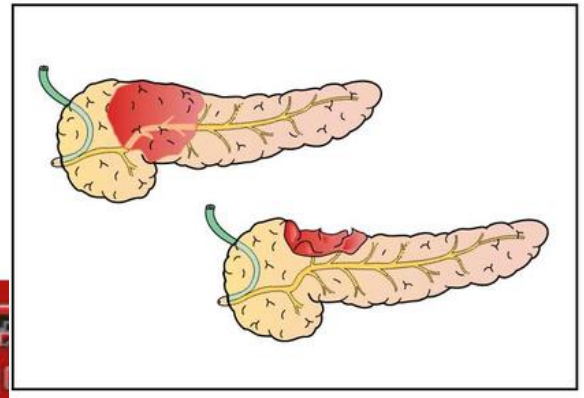


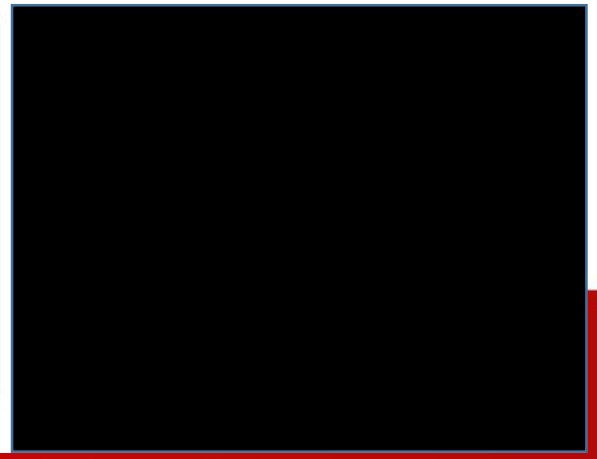
**a** Normal anatomy

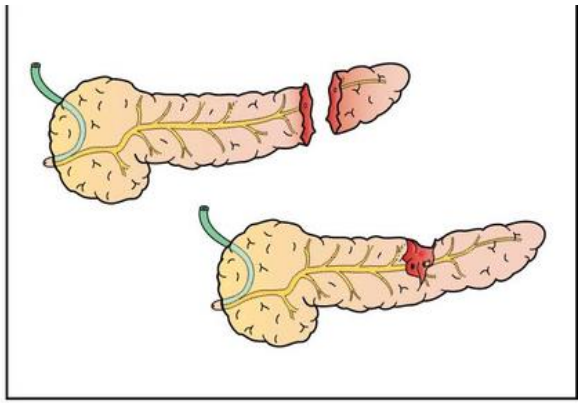


**b** Grade I

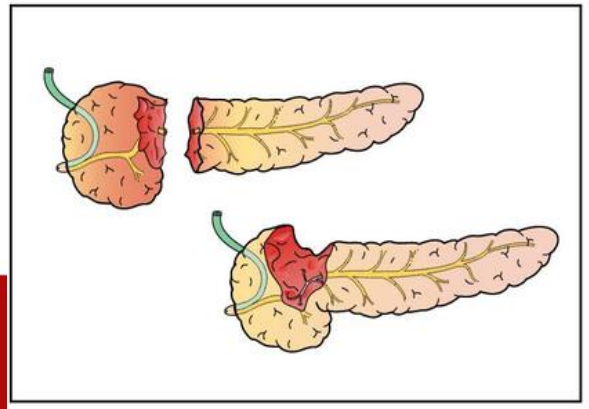


**c** Grade II

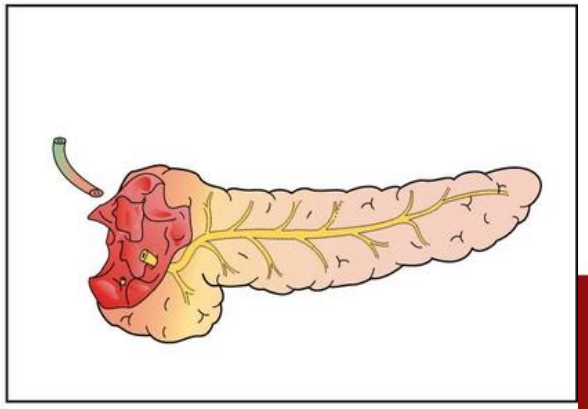




**d** Grade III



**e** Grade IV



**f** Grade V

# Complications from Blunt Pancreatic Injury

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- Persistent peripancreatic fluid collection
- Traumatic Pancreatitis
- Pancreatic fistula
- Intraabdominal abscess
- Delayed bleed
- Delayed ductal strictures
- **Up to 60% of pancreas injuries will have a complication**

# Blunt Pancreatic Injury Pathway

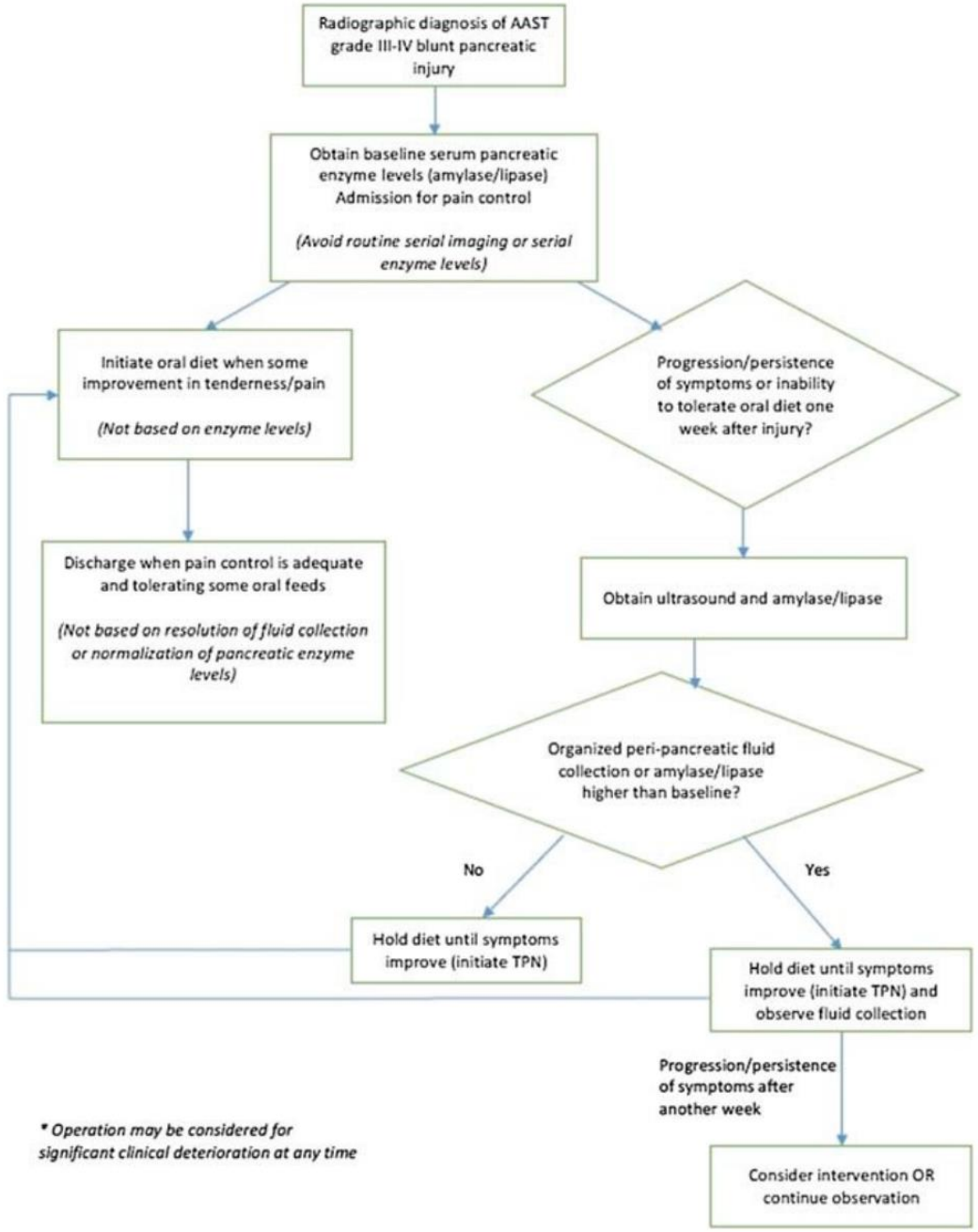


Figure 5. Proposed clinical pathway for NOM of blunt pancreatic injury in pediatric patients.

# Blunt Abdominal Trauma-Kidney injury

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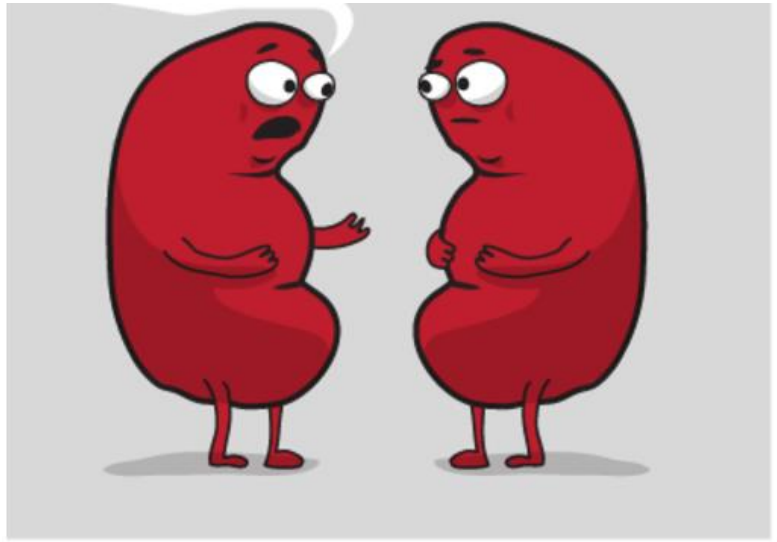
- **Initial management:**
  - All renal blunt traumas to be managed by observation initially unless **UPJ disruption or hemodynamic instability secondary to renal injury**
  - Do not need to place a catheter because of renal trauma unless hemodynamically unstable
  - Renal Injuries of Grade ≥2 or with perinephric fluid collection (hematoma vs urinoma) should all get delayed initial images
  - Time of delayed images to be decided by radiology (delayed images need to be adequate enough to visualize renal pelvis and ureters down to bladder), do not need fine cuts

# Blunt Abdominal Trauma-Kidney Injury Grading



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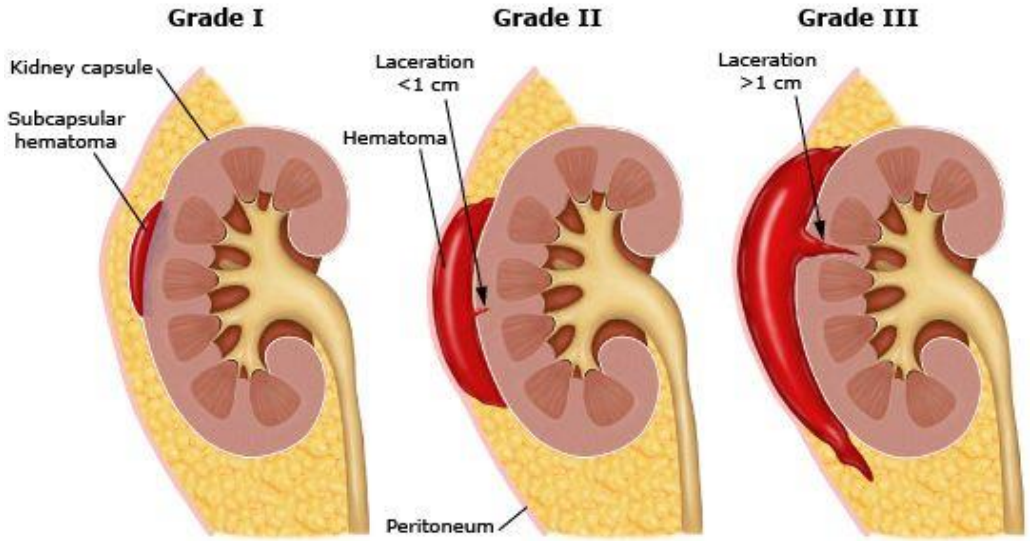


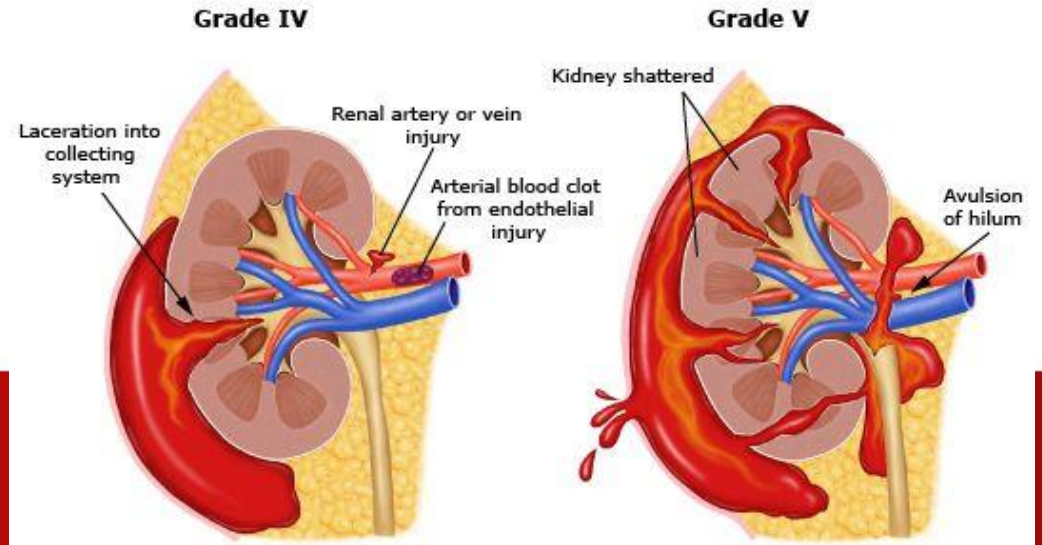

# Blunt Renal Trauma Guidelines 2019

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- Non-operative management
  - Greater renal salvage
  - Less transfusion
- Ongoing or delayed bleeding in a HD stable patient, recommend angioembolization
- BP checks should be performed as outpatient
  - 4.7% chance of developing renovascular hypertension

# Blunt Abdominal Trauma-Kidney injury

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- **Inpatient management:**
  - Discharge criteria:
    - pain controlled
    - hemodynamically stable
    - return of bowel function
    - good oral intake and afebrile
- **Outpatient f/u**:
  - Need BP checks for reno-vascular hypertension

# Pediatric Blunt Solid Organ Injury Take-Aways

- Management based on hemodynamics
  - Pay attention to examination and vital signs
- Non-operative management unless clinical decline or other indications for intervention
- Follow-up
  - Spleen/Liver-reimage if symptomatic
  - Pancreas-management based on tolerance of PO
  - Renal-follow-up BP checks as up to 5% will develop reno-vascular hypertension

# References


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