

# **“Mommy – My Tummy Hurts...”**

## **Assessment and Care of Abdominal Injuries**

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## **Requirements for Successful Completion:**

The learning goal/purpose of this educational activity is:

To provide the registered nurse with evidence-based information on managing the pediatric patient with abdominal injuries. The latest scientific information on assessment and treatment guidelines will be discussed. This information will be utilized by the pediatric nurse to deliver safe care that will result in positive outcomes for the pediatric patient who presents with abdominal injury.

The objectives of this educational activity are:

1. Relate how the anatomical and physiological differences of the pediatric abdomen require specialized assessment skills.
2. Apply knowledge of advanced assessment to 4 case scenarios.
3. Discuss most recent evidence based literature relating to assessment and treatment of the pediatric patient with abdominal injury.

To receive contact hours for this continuing education activity the participant must:

- Attend the entire activity and complete/submit an evaluation.

Once successful completion has been verified, a "Certificate of Successful Completion" will be awarded for 1.0 contact hours.



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WOW – what am I going to learn today???

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# Most abdominal injuries will NOT be obvious





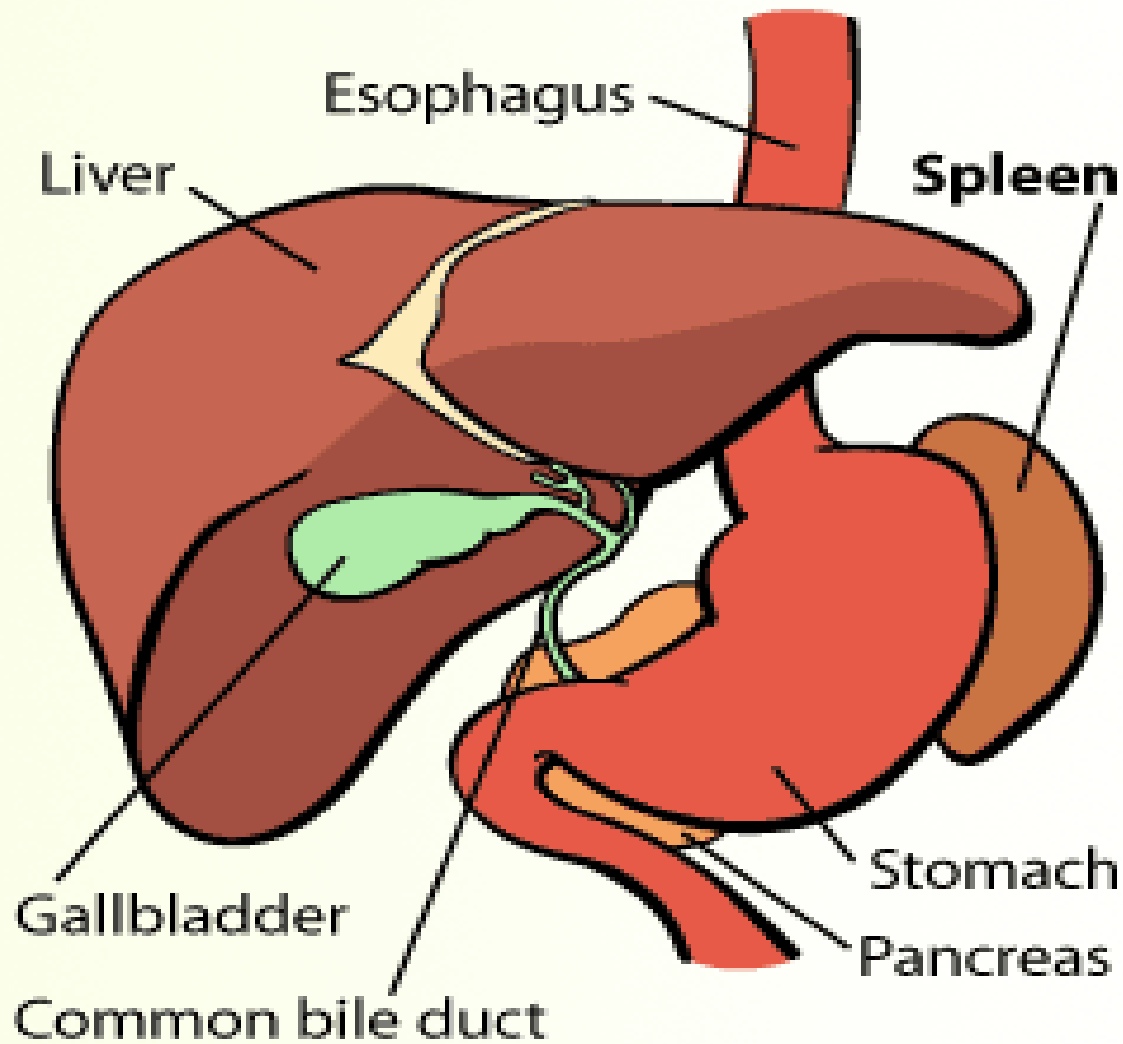


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# Case abd 1

- 2 year old climbing on the back of the couch which was under a window.
- A screened but open window
- He pushed on the screen and fell landing on wet dirt and grass from the THIRD story....



- ? LOC – when parents made it down two flights of stairs, he was awake and crying
- 911 called
- EMS - no identifiable injuries; GCS of 11
- Full spinal immobilization; 100% NRB;  
1 IV started
- Took him to a level 1 trauma hospital
- GCS went down to 5 enroute

# EC

- H/H – 10/29
- VSS ; GCS 11
- CT scans done
  - Head – normal
  - Chest – small left pneumothorax; NO rib fxs
  - Abd
    - Grade 4 splenic laceration
    - Grade 3 left kidney laceration
    - Hematomas noted around both\*\*\*\*\*



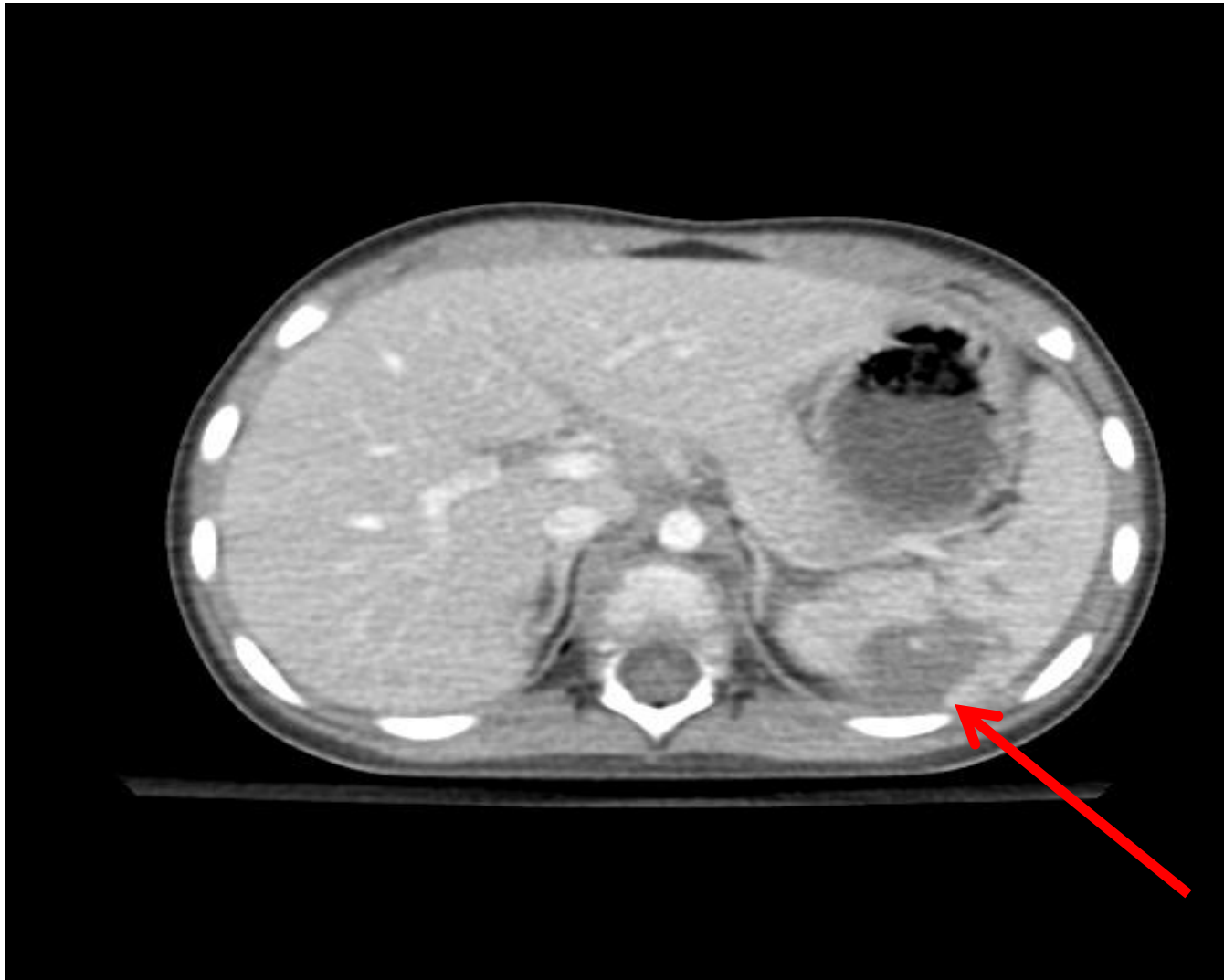


Day of injury

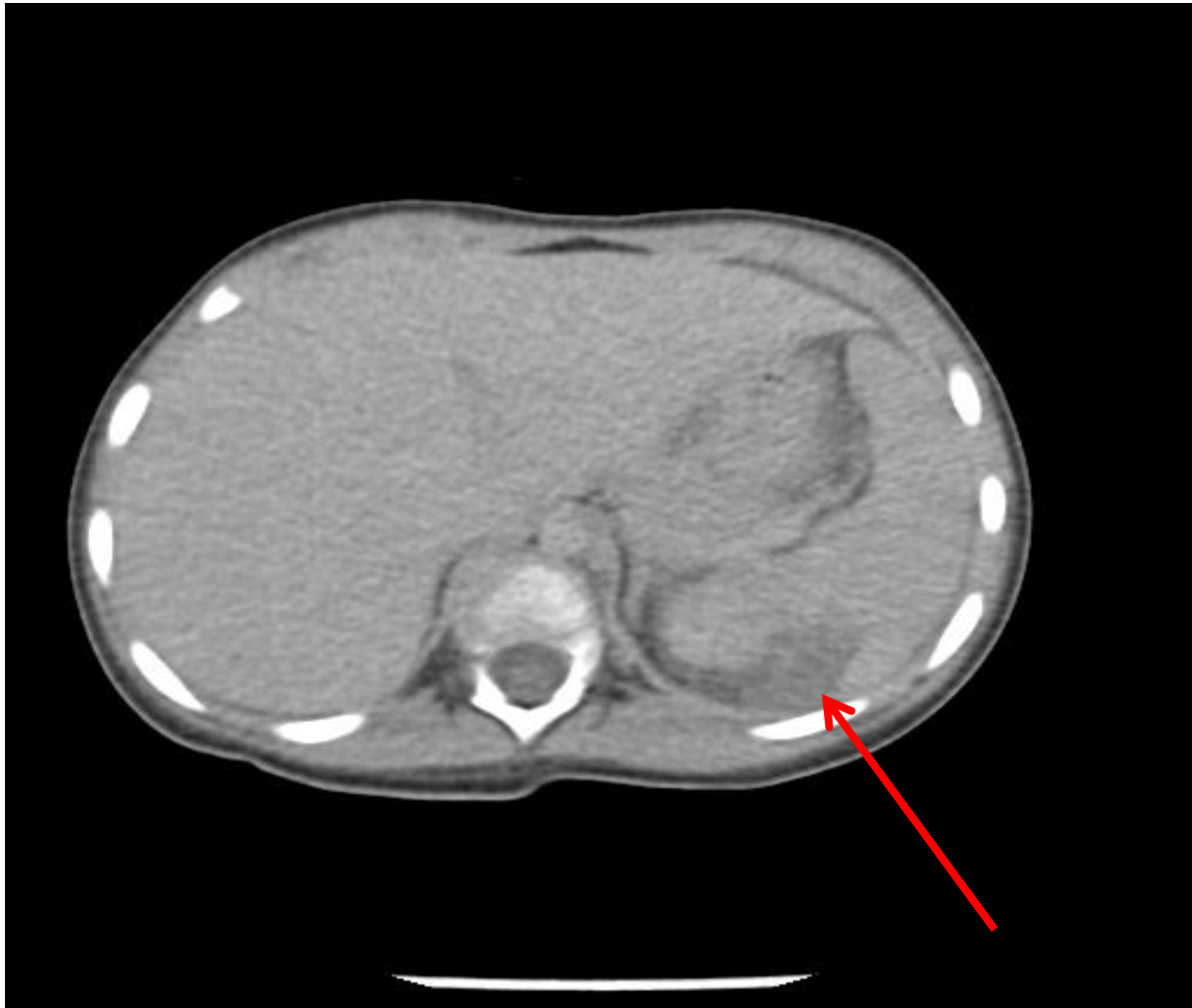
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- Admitted to ICU for obs.
- Q 4 hour H/H
- NO tenderness, guarding, or rebound
- Repeat CT done 2 days later
  - inc size of hematomas
  - H/H : 8/23 (from 10/29)
  - no pneumothorax
  - no tenderness to palpation
  - pt awake but listless



**HD # 3**

- Pt sent home HD #3
  - Stable H/H; abd labs stable
  - No findings on repeated physical exam
  - Pt awake and playful
  - Discharge instructions given



# So Let's discuss

- Why didn't he have a head injury?
- Why did he have a large spleen and kidney laceration?
- Why did they decide NOT to operate?



Where does the abdomen begin  
in a child?

**At the nipple line**

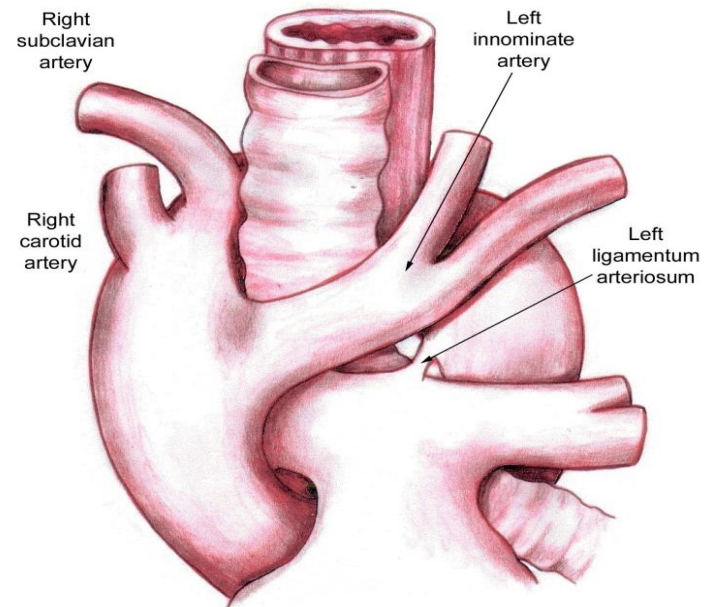
# Acceleration/Deceleration

- The smaller the size, the greater the force that gets transmitted to the body.
- $E = \frac{1}{2} \text{ mass} \times \text{velocity}^2$



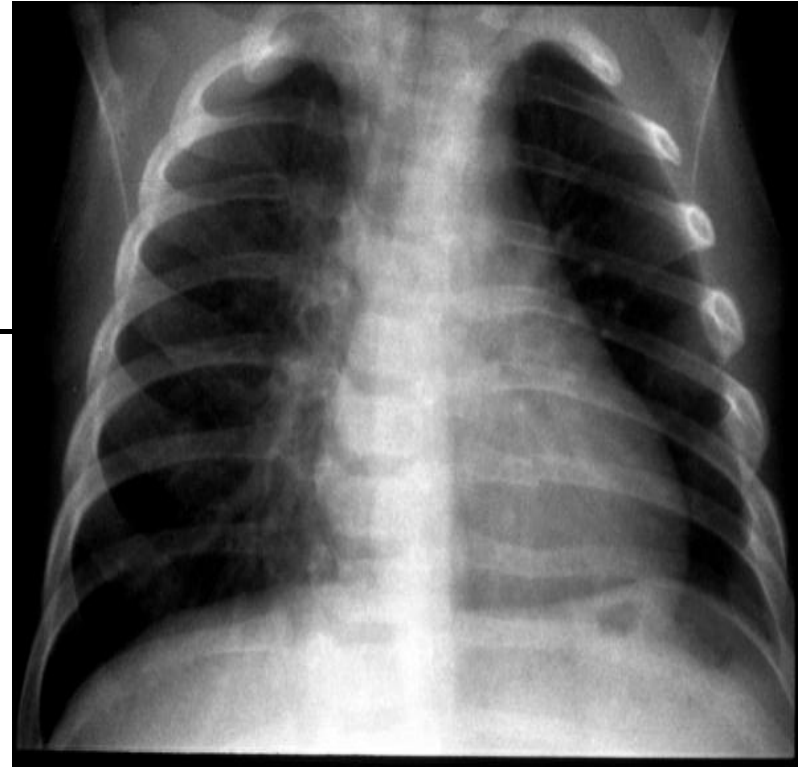
# Points of the body that do not move:

- Descending portion of aorta
- Part of retroperitoneal duodenum
- Ligament of Treitz
- Ileocecal valve [ 1 ]



# Why are kids more susceptible?

- No muscle
- Ribs horizontal
- Spleen/liver unprotected –  
higher costal margins
- Very pliable skeleton





# Spleen

- Adult – holds up to 200cc of blood and about 12 cm in size
- 2 year old – 9 cm in size
- Can be functional at 1/3 of spleen is left
- Kerr's sign
- Post – splenectomy sepsis
- #1 injured area of abd for kids

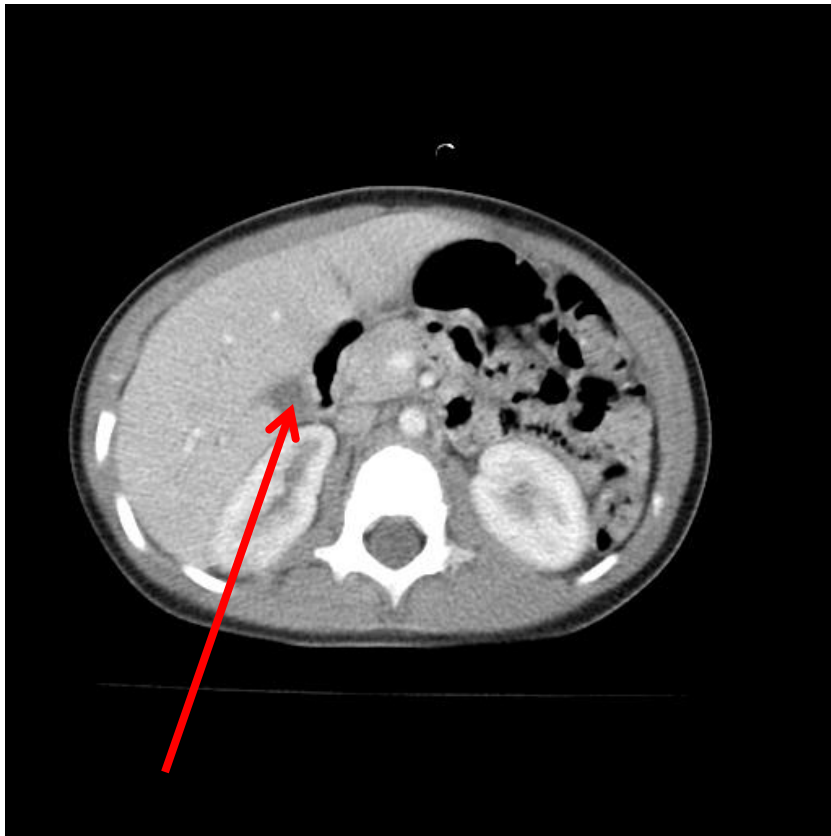
**The ONLY absolute indication for performing a splenectomy in children is massive disruption and hemodynamic instability. (6)**

# Case abd 2

## EC

- 3 year hit by a car at low speed
- NO loc
- ? Run over by car
- Did not c/o abd pain
  - on initial exam abd soft, nontender
- CT done due to history





# Case abd 2

- Pt admitted to ICU
  - Q 4 hour H/H – remained stable
- Pt sent to floor on HD #2 and observed
- Sent home on HD #4 😊

# Liver

- # 2 injured area of the abdomen (debatable)
- 90% of liver injuries managed non operatively with an 85 -90% success rate [ 3 ]
  - Initially very high LFTs ( even in the EC) then will go down
  - IF  $AST > 400$  or  $ALT > 250$ , abd CT is indicated [ 7]
- \*\*\* AST/ALT do not reflect liver function, detects inflammation

# Grade 5 +++ Liver Laceration





# OR or not to OR?

- Non operative management is gold standard for blunt solid organ IF they are **hemodynamically stable**
- Those who will “fail” non operative management will do so within first 12 -24 hours [5]
- The decision to operate is made by clinical exam – NOT CT findings. [4]

- \*\* Send home with very specific signs to watch for – delayed bleeding has been reported up to 6 weeks after injury



# Norms for kids

Weight in kg – twice the age in years plus 8

Maximum resp rate is 60

Lowest acceptable systolic BP for a child 2 years of age and older is:

$$70 + ( 2 \times \text{age in years} )$$

# APSA guidelines

- Grade 1: no ICU, 2 HD, rest 3 weeks
- Grade 2: no ICU, 3 HD, rest 4 weeks
- Grade 3: no ICU, 4 HD, rest 5 weeks
- Grade 4/5: 1 day ICU, 5 HD, rest 6 weeks

(American Pediatric Surgical Association)

# Hollow Organ

- Most common injured in restrained MVC
- MUST have high index of suspicion
- Signs of peritonitis will not show up right away..... May be very very subtle
- Colon – s/s in 6 hours
- Small Intestine – s/s in 12 -24 hours
- \*\*increasing tenderness, guarding

# Seat belt syndrome

- Abdominal Wall Bruising
- Intra-Abdominal Injury
- Vertebral Fracture

For every 9 children with bruising,  
only 1 will have injury [ 3 ]





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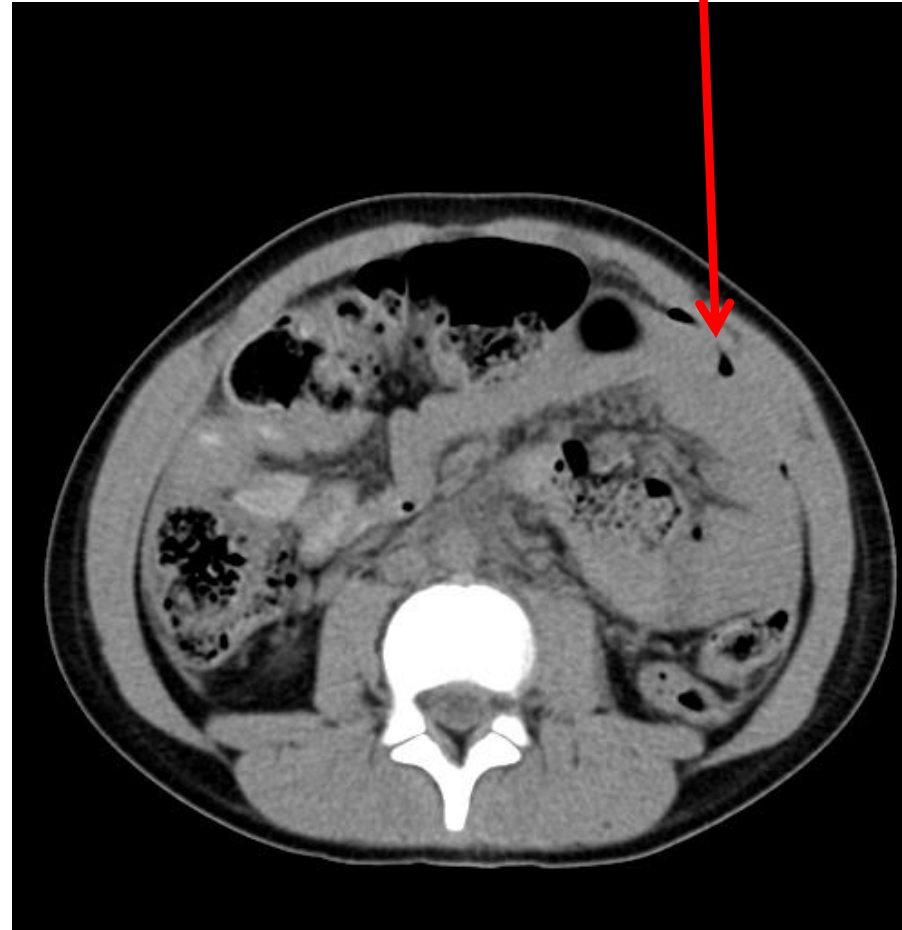
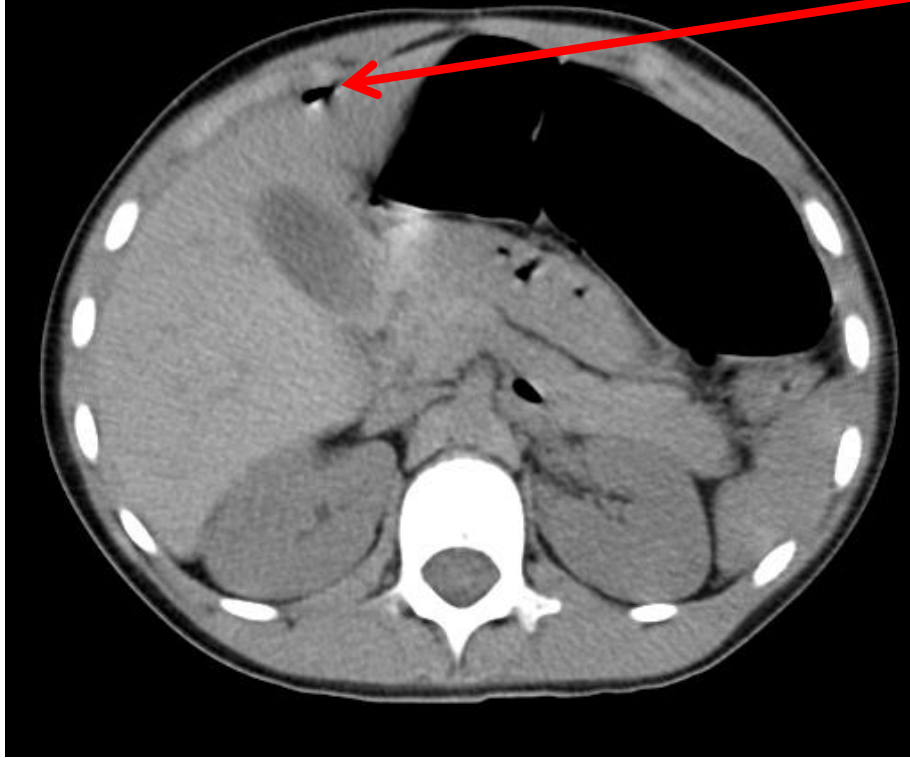
  
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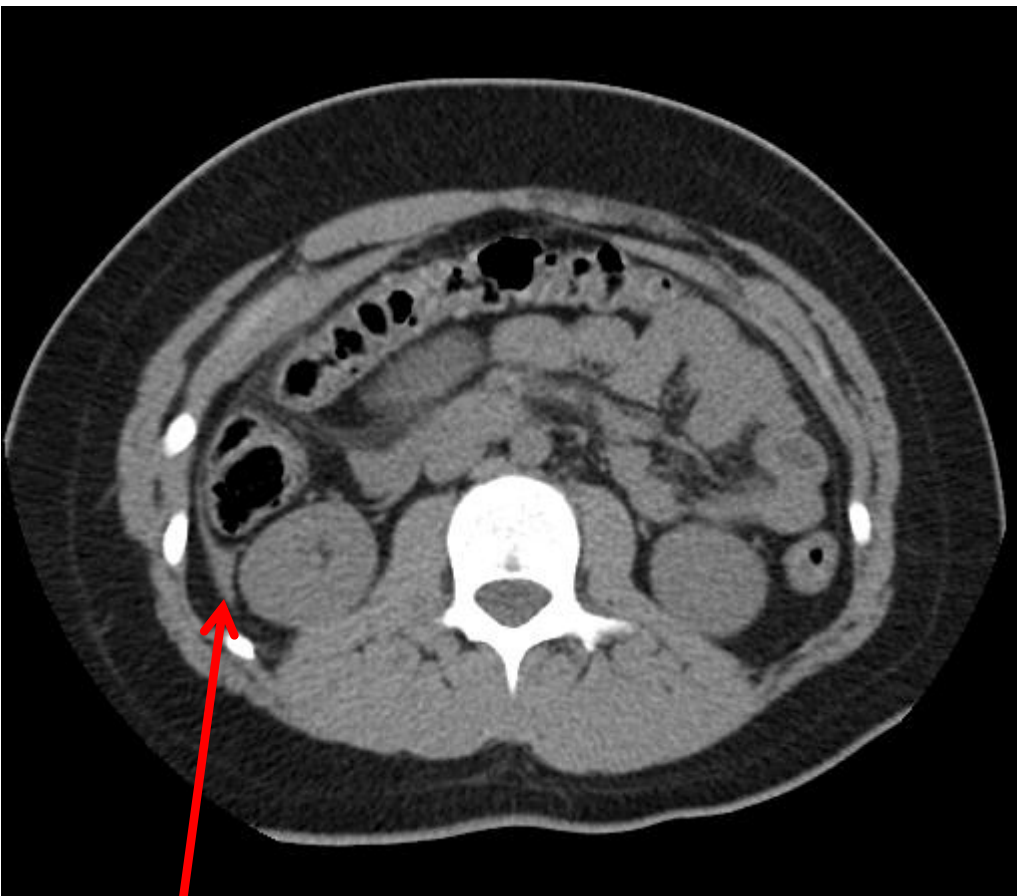




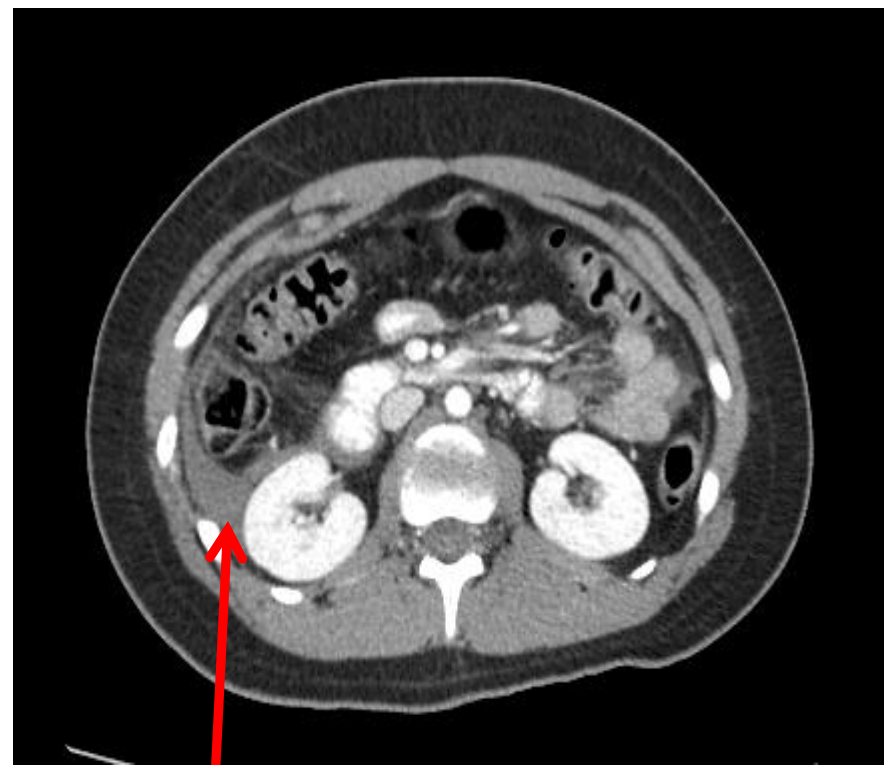
Figure 2: Telltale seatbelt sign of bruising across the abdomen



**Free air and free intraperitoneal and well as mesenteric blood.**



One hour post injury



8 hours post injury

# Seat Belt Syndrome

- Any child in whom a “seatbelt sign” of abdominal wall contusion is present should be evaluated carefully for a minimum of 24 hours for the development of evidence of peritonitis. (6)

# Don't forget to look at their back!



Happy Keeester!

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# Case abd 3

- 4 year old walking and tripped
- Used outstretched arm to catch himself
- Carpeted landing
- \*\* Pt nonverbal ( chromosomal disorder) and had heart history
- No LOC



- 911 called - obvious deformity to left elbow
- EMS arrived
  - only noticeable injury was **open** elbow fracture
- elbow splinted with + pulse noted before / after
- Pt very agitated when attempting spinal immobilization
- Due to PMH, pt transported to level 1 trauma facility



# EC

- Normal trauma lab panel sent
  - AST 90; ALT 80 on arrival
- Antibiotics started
- Xrays done of arm and chest
  - NO other obvious injuries seen or appreciated
- Xray of arm – widely displaced comminuted fracture of distal humerus



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# HD #2

- to OR for open arm fracture on HD #2
- Labs drawn
  - amylase: 1180; lipase: 3669
- Physical exam : - pt grimaced with pain and exhibited guarding when RUQ and LUQ palpated – NO bruising
- Abd CT done - **negative**
- VSS

# Now the rest of the story:

\*\*\*\*More in depth history obtained and father stated that child tripped and he did extend arm out while falling but that he hit his left side of abdomen with the handlebar of a toy when falling

# HD #3

- Labs drawn
  - amylase: 690; lipase: 3735
- Some guarding noted
  - decreased from previous day
- VSS
- Still on IV abx

# HD #4

- Labs drawn
  - Amylase: 700; Lipase: 1857
- No guarding or exhibiting pain upon palpation of abd
- Pt sent home with detailed instructions

# Pancreatic Injuries

- Body of Pancreas is retroperitoneal
- Very rare in pediatric patients
- Study of 3 pediatric patients who had complete pancreatic dissections from blunt force trauma
  - All had laparoscopic pancreatectomy with spleen preservation
  - All doing well [ 2 ]





# Blunt Pancreatic Injuries

- Look for sign of peritonitis due to release of pancreatic juice [4]
- Also has epigastric tenderness.
- Most common MOI is falls onto the handlebars of the bicycle.

# Amylase

Usually suggests a pancreatic injury

BUT has proven to be neither sensitive  
nor specific for pancreatic trauma

In **pancreatic ductal injury** – serum amylase  
is significantly elevated

- 10 yr retrospective review of pancreatic injuries (Dallas)
  - 51 pts, 26 met criteria
  - Amylase and lipase both increased 2 hrs s/p injury but amylase increase was statistically significant
  - **Suggests utility of delayed amylase level to predict pancreatic injury [ 8 ]**

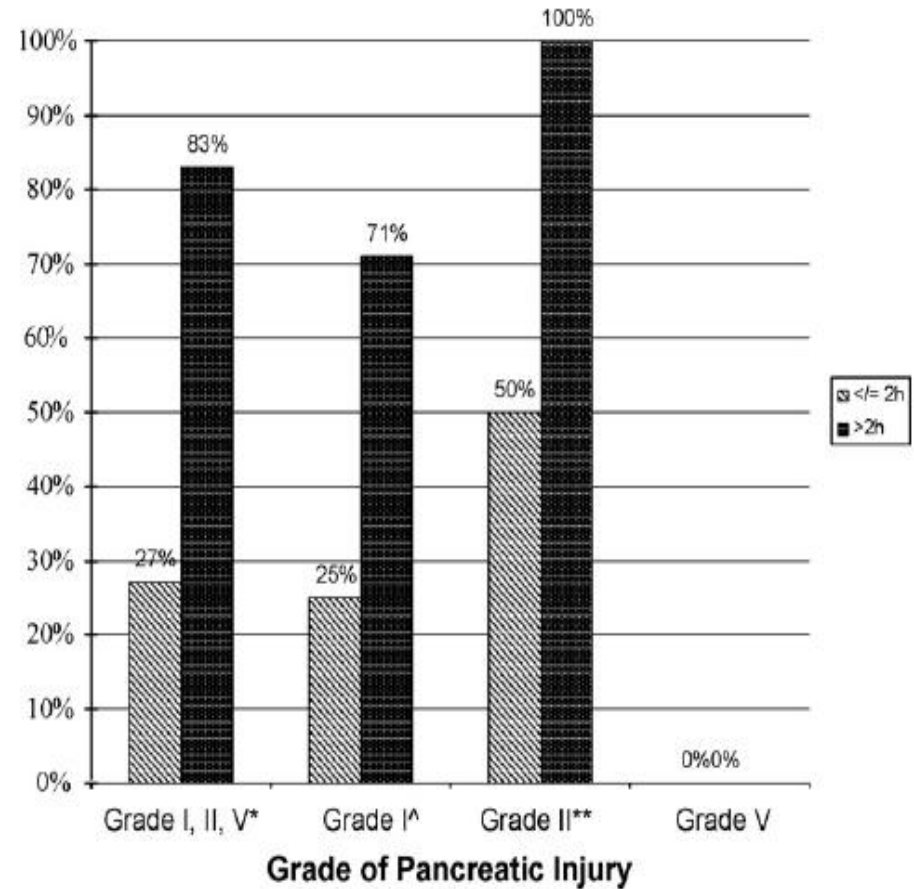
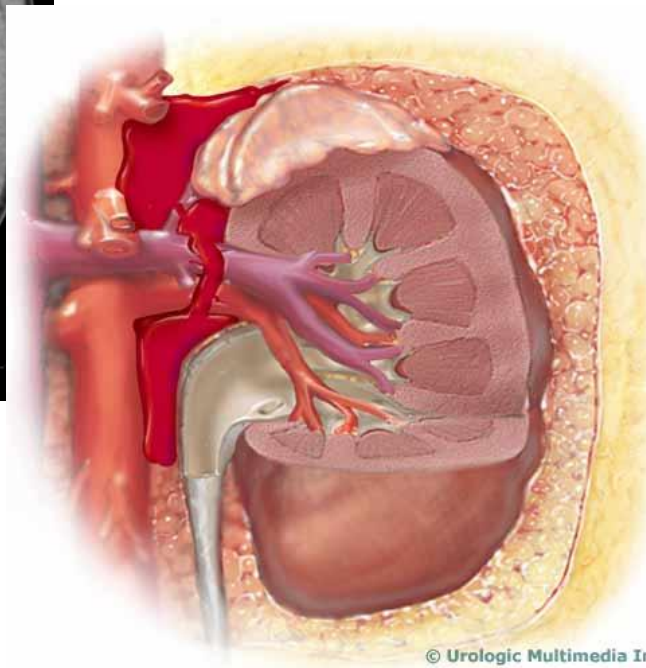
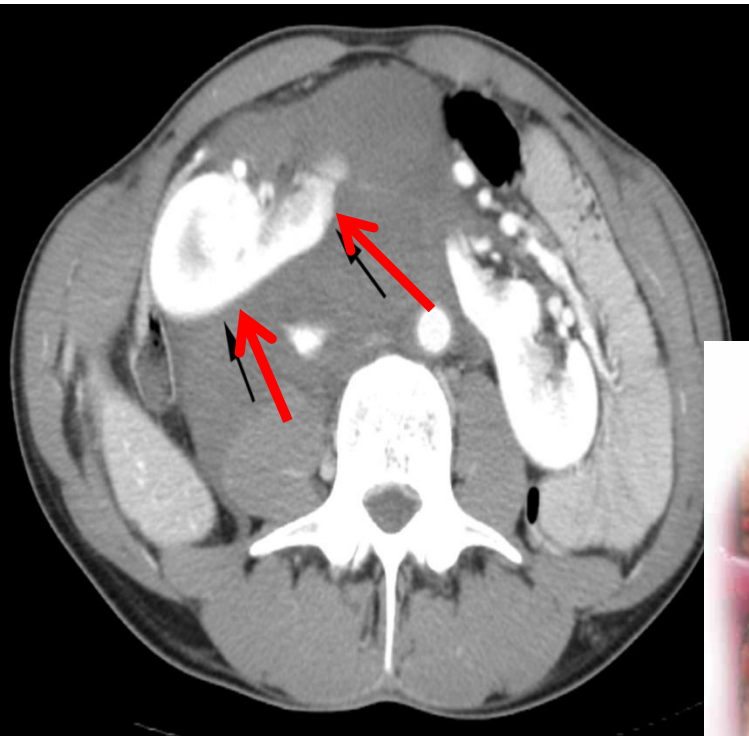


Fig. 2. Percentage of subjects with elevated amylase measurements by grade of injury and time of measurement.

# Case abd 4

- 12 year old girl playing soccer – kicked in back by other player.
- Comes in c/o flank pain
- No hematuria
- CT done.....

# What did CT show?



- NO blood flow to one kidney
- Transection of Kidney Artery

# Kidneys

- Injury to kidneys only occur about 10% of time
- Contusion is most common
- All grade V require OR management and of that only 30% have long term salvage  
[ 3 ]

# Retroperitoneal

- Retroperitoneal bleeding will not cause abdominal rigidity
- What structures are in the back?





# Studies/Tests

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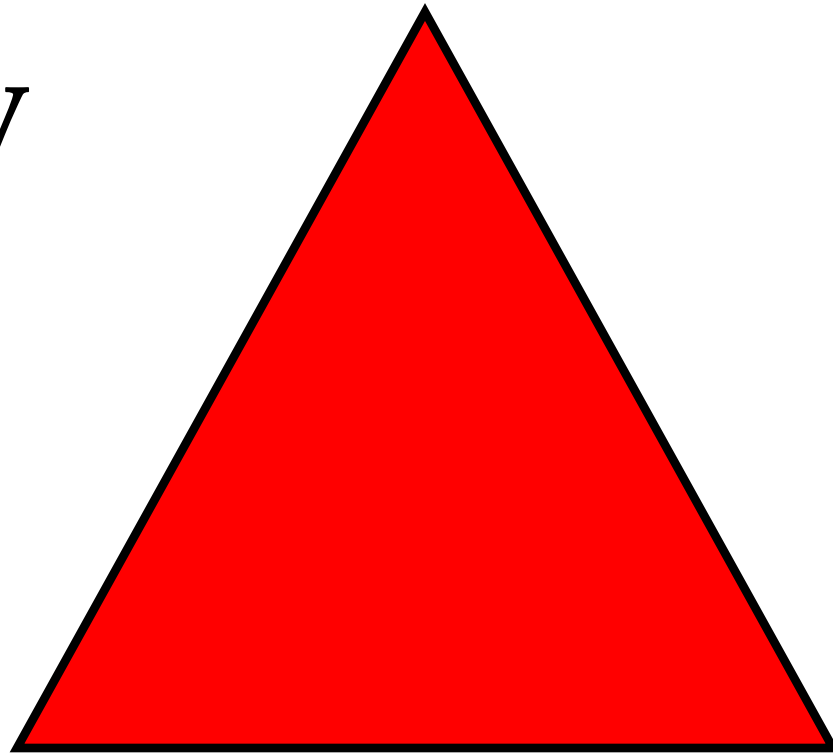


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# Deadly Triad

**Acidosis**



**Hypothermia**

**Coagulopathies**

- A, B, C.....
- TYPE AND CROSS
- Bedside glucose
- Plain films
- FAST and/or CT (with IV contrast)
- Labs – AST, ALT, Alk Phos, H/H, bili, amylase, lipase, PT/PTT, Chem 7, UA, UPT?, UDS?

# CT vs. FAST

- CT is gold standard but only if patient is hemodynamically stable ( IV contrast )
  - Thickened bowels on CT is indicative of venous congestion, mesenteric injury
- FAST just detects fluid – cannot tell what kind

# Focused Abdominal Sonography for Trauma (FAST) in Children with Blunt Abdominal Trauma

Brian D. Coley, MD, Khaled H. Mutabagani, MD, Lisa C. Martin, MD, Nicholas Zumberge, BS, Donald R. Cooney, MD, Donna A. Caniano, MD, Gail E. Besner, MD, Jonathan I. Groner, MD, and William E. Shiels II, DO

The Journal of Trauma: Injury, Infection, and Critical Care

- 107 children; Sensitivity 55%, **Specificity 83%**, PPV 86%, NPV 50%

## Test Characteristics of Focused Assessment of Sonography for Trauma for Clinically Significant Abdominal Free Fluid in Pediatric Blunt Abdominal Trauma

J. Christian Fox, MD, RDMS, Megan Boysen, MD, Laleh Gharahbaghian, MD, Seric Cusick, MD, RDMS, Suleman S. Ahmed, Craig L. Anderson, MPH, PhD, Michael Lekawa, MD, and Mark I. Langdorf, MD, MHPE, RDMS

ACAD EMERG MED • May 2011

-357 children

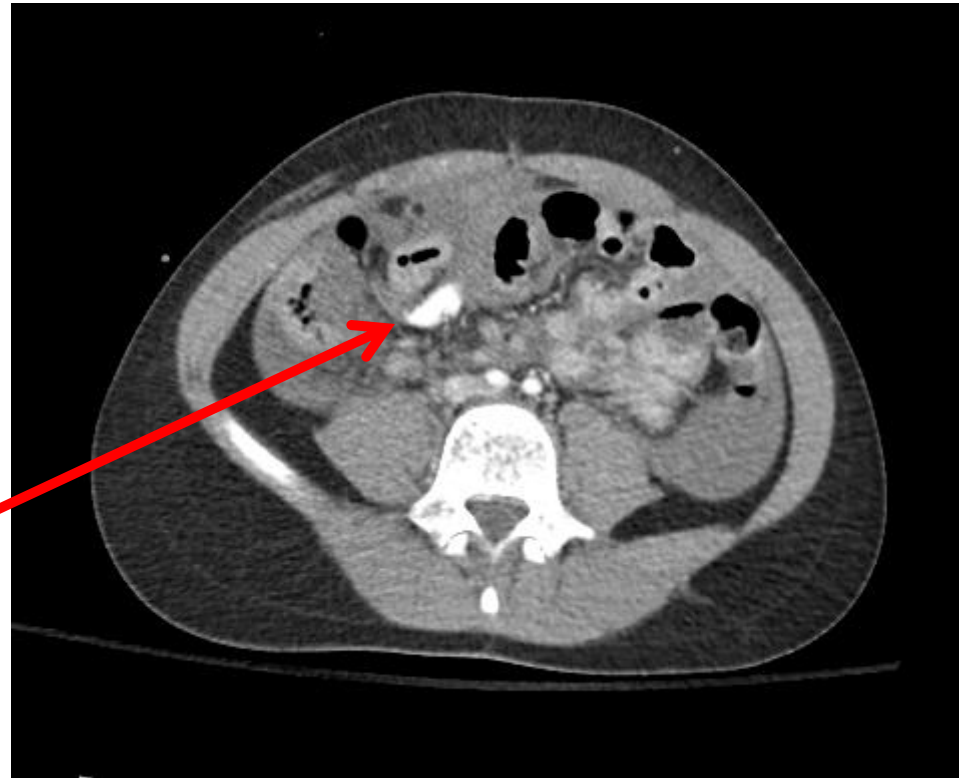
-FAST for hemoperitoneum: Sensitivity 52%, **Specificity 97%**, NPV 97%

-FAST for any free fluid: Sensitivity 20%, **Specificity 98%**, NPV 78%

# Focused Abdominal Ultrasound for Trauma (FAST)



If there is free fluid in the abd without solid organ injury – high suspicion for bowel injury [ 3 ]



# What about a DPL?

- Not performed in stable children if suspected injury
  - Managed nonoperatively
- MAY be performed to determine need for laparotomy in unstable head injured pt [4]



# BLUNT TRAUMA - CONSCIOUS, RELIABLE EXAM

Conscious child, GCS 14-15, significant mechanism  
(ex. High speed MVC, fall >10 ft, suspected NAT)  
**Reliable abdominal examination**

Abdominal tenderness or distention

**CONSULT SURGERY**

Hemodynamically **UNSTABLE**

Hemodynamically **STABLE**

FAST if available

CT abd/pel w/ IV contrast  
(per surgery discretion)

OR if clinical or FAST evidence of abdominal bleeding

Admit to Trauma for OR vs. Non-operative mgmt

Observe in ER, OK to discharge if pain-free, tolerating PO and no additional injuries needing admission

# BLUNT TRAUMA - UNCONSCIOUS

Unconscious child (GCS  $\leq 8$ ), significant mechanism  
(ex. High speed MVC, fall  $>10$  ft, suspected NAT)

Call Surgery STAT if not already present

Hemodynamically **UNSTABLE**

Hemodynamically **STABLE**

FAST if available

Look for other sources of hypotension, fluid resuscitation

CT abd/pel w/ IV contrast

OR if clinical or FAST evidence of abdominal bleeding

Admit to Trauma Service in PICU

Admit to Trauma for OR vs. Non-operative mgmt



# BLUNT TRAUMA - CONSCIOUS, UNRELIABLE EXAM



Conscious child, significant mechanism  
(ex. High speed MVC, fall >10 ft, suspected NAT)  
**Unreliable or equivocal abdominal examination**  
(ex. Distracting injury or GCS 9-13)

**CONSULT SURGERY**

Hemodynamically  
**UNSTABLE**

Hemodynamically **STABLE**

FAST if available

FAST if available

Labs: AST/ALT, H/H, Amylase,  
UA w/ micro, Cr, T+S  
UPT  $\geq 10$  yrs  
(Abdominal trauma panel)

OR if clinical or  
FAST evidence of  
intraabdominal  
bleeding

ALT/AST > 100, Hgb  
<10 or Hct <30%,  
AMY > 100, UA >50  
RBC/HPF

Repeat  
abdominal exam

CT abd/pel w/ IV contrast  
(per surgery discretion)

Admit to Trauma for OR  
vs. observation

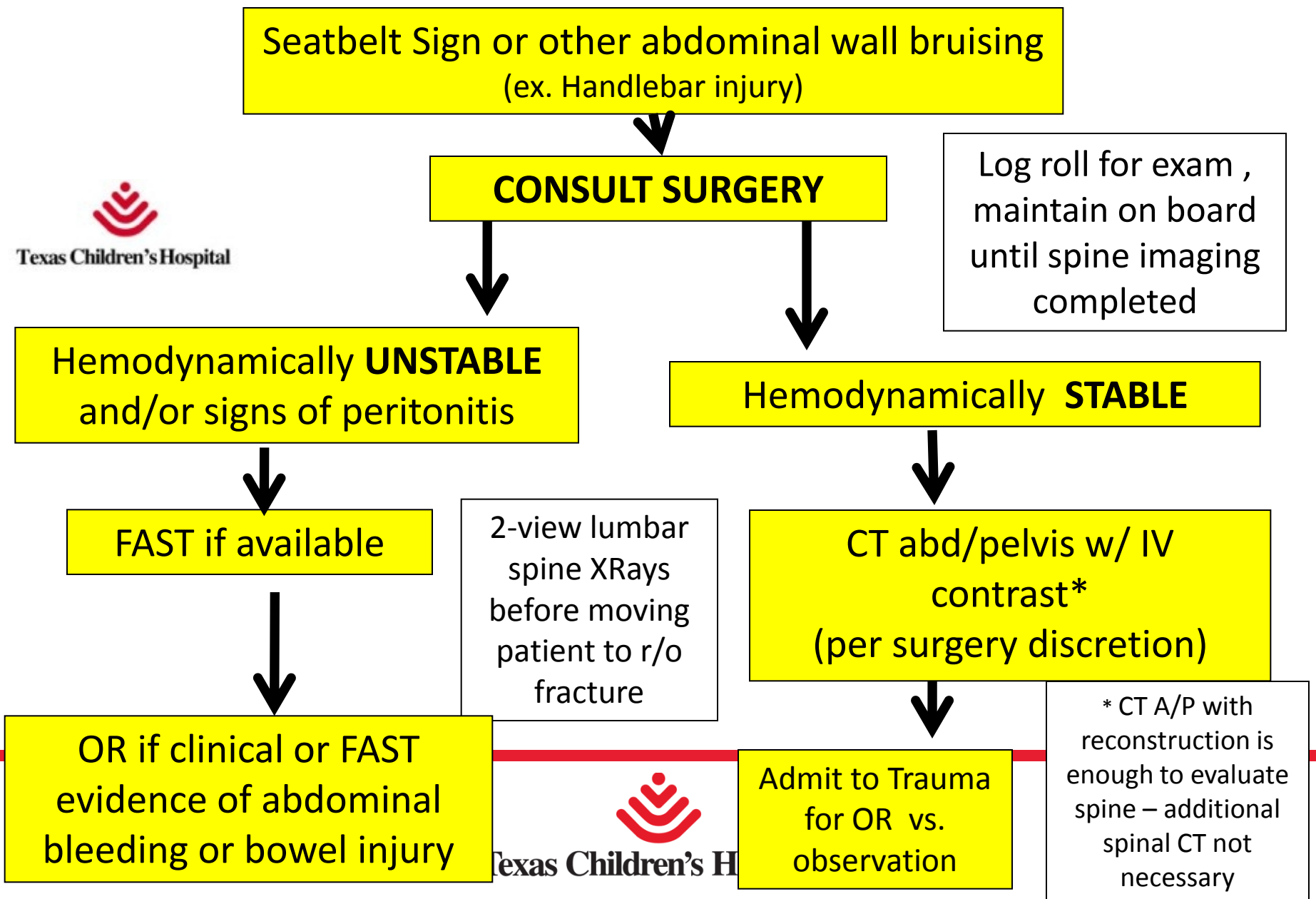
Discharge (only if GCS 15) vs.  
admit to trauma service for  
obs for pain or anxiety control

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# BLUNT TRAUMA - ABDOMINAL WALL BRUISING



# PENETRATING TRAUMA

CONSULT SURGERY TO  
EVALUATE WOUND



2-view Xrays if gun shot wound or to  
look for retained foreign object  
(don't need for stab wounds)

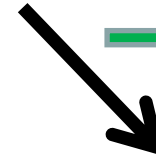


PERITONITIS



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Wound exploration vs.  
admit for observation;  
(additional imaging per  
surgery discretion)

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# Warning signs

- Tachycardia
- Fever 6-12 hours post injury
- Evidence of peritonitis – rebound, guarding – increasing WBC

# Take Home Points

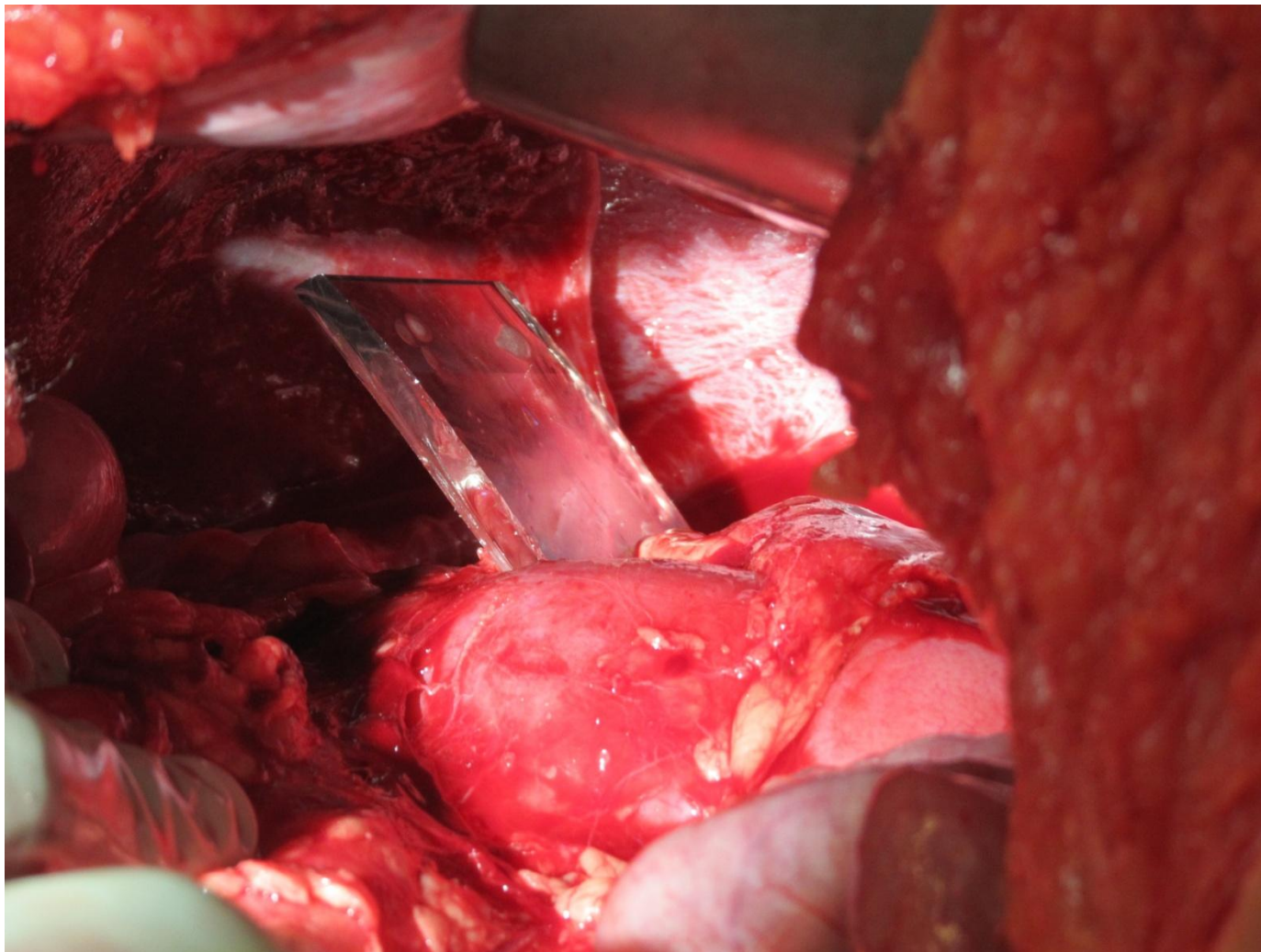
- Abdominal Injuries are most missed
- Watch for clinical signs which may appear first as very subtle
  - This guides treatment – not CT



Remember, trauma  
is a surgical  
disease.

And what you see  
is not what you  
get.





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# THANK YOU! ☺



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