Pediatric Blunt Abdominal Trauma

Seema Bhatt

4/08/2016

Unique anatomic features in children

- Organs are proportionally larger and closer
- Greater degree of force per body surface area
- Less fat, connective tissue and muscle
- Rib cage is higher
- Bladder is in the abdomen

Mechanisms

- **Motor vehicle accidents**
- Pedestrian struck by car
- Falls
- Bike accidents: handle bars
- Sports injuries
- Child abuse

Motor Vehicle Accidents

- Most common cause of blunt abdominal trauma
- Detailed history important
  - Speed
  - Direction
  - Location of impact
  - Ejection
  - Air bag
  - Restraints
  - Others injured
- Restrained children more predisposed to injury

Lap belt injuries

- Incorrect positioning
- Underdeveloped pelvis
- Seat belt sign
- Injuries in plane of lap belt

Evaluation

- History : mechanism, PMHx
- A,B,Cs
- Hemodynamic instability?: HR, BP, pulses, perfusion
- Neurologic status
- Consider early IV access, NG/OG decompression, foley catheter
- Secondary survey: head to toe exam

Concerning abdominal exam findings

- Ecchymosis
- Abrasions
- Tire tracks
- Seat belt marks
- Distention
- Tenderness
- Rigidity
- Masses
- Pain in shoulder

Low risk rule for IAI

- Multicenter, prospective observational study
- Not validated
- Criteria
  - No evidence of abd wall trauma, no seat belt sign
  - GCS>13
  - No abd tenderness
  - No evidence of thoracic wall trauma
  - No c/o abd pain
  - No decreased breath sounds
  - No vomiting

Lab Evaluation

- Low suspicion on initial exam
- **CBC**: serial Hgb/Hct levels
- Renal
- pH, lactate level, base deficit
- **AST** (>200)/**ALT** (>125)
- **Amylase**/ Lipase
- **Urinalysis**: gross or microscopic (>50 RBC/HPF) hematuria
- Type and Screen
- Coags

Diagnostic Studies: Abdominal Radiographs

- Not routinely performed
- Lack sensitivity and specificity
- Useful in penetrating trauma

Diagnostic Studies :US/ FAST

- Focused assessment with sonography for trauma
- Detects hemopericardium, intraperitoneal fluid
- RUQ, LUQ, subxiphoid region, pelvis
- Negative FAST cannot exclude IAI
- Unstable patient with positive FAST=OR
- Stable with positive FAST= CT

Diagnostic Studies :CT scan

- Preferred diagnostic modality in HDS patients
- IV contrast
- Sensitive and specific in diagnosis of liver, spleen and retroperitoneal injuries
- Less sensitive if only using IV contrast for injuries of pancreas, intestines, bladder
- Radiologic blush sign

CT Indications

- Tenderness not explained by minor/ superficial injury
- Seat belt sign
- Hx or mechanism suggestive of IAI in patient with distracting injuries or inability to perform adequate exam
- Elevated AST/ALT
- Hematuria
- Declining or unexplained low Hgb/Hct
- Positive FAST (US) exam
- Unaccountable fluid/ blood requirements

Peritoneal Lavage

- Rare in children
- Less injury/ organ specific
- Cannot detect retroperitoneal organ injury
- Risks: introduction of air/fluid, peritoneal irritation
- Positive if:
  - >5 ml gross blood
  - Enteric contents (bile, stool)
  - Fluids contain >100,000 RBCs or >500 WBCs
  - Amylase concentration of fluid is elevated

Management

- Non-operative management
  - Serial exams
  - Close vital sign monitoring
  - Serial Hgb/ Hct
  - PICU
  - Analgesia
- Laparotomy
  - Pneumoperitoneum
  - HD unstable
  - Increasing tenderness
  - Solid organ injury with continued bleeding
  - Bladder rupture
  - Major pancreatic duct injury

Case 1

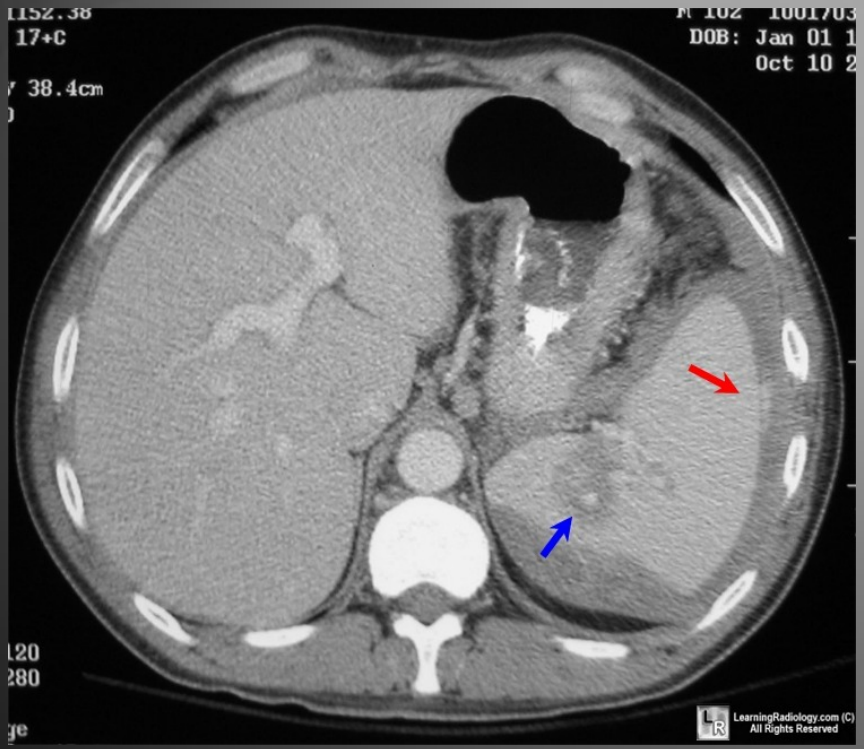
- 16 yo M football player took helmet to upper abdomen. Complaining of pain to upper abdomen, left shoulder pain
- VS: HR 115 BP 140/ 86
- What do you want to know?
- What do you want to do?

Splenic Injuries

- Most frequently injured intrabdominal organ in children
- Typically results from direct blow to left upper abdomen
- PE:
  - Kehr's sign: referred pain to left shoulder
  - LUQ abrasions
  - LUQ tenderness
  - Distention

Splenic Injuries

- Labs: CBC
- CXR: usually normal but may have rib fractures, elevation of left hemidiaphragm, displaced gastric bubble, pleural effusion
- CT abd, pelvis


17+C
38.4cm
DOB: Jan 01 1
Oct 10 2
LearningRadiology.com (C)
All Rights Reserved


hqmeded.com

CT grading of splenic injuries

Table 7. Grades Of Splenic Injuries

Grade	Extent of Splenic Injury
1	Hematoma: subscapular, non expanding, < 10% of surface area Laceration: capsular tear, non bleeding, < 1 cm of parenchymal depth
2	Hematoma: subscapular, non expanding, 10-50% of surface area; intraparenchymal, non expanding, < 2 cm in diameter Laceration: capsular tear, active bleeding, 1-3 cm of parenchymal depth that does not involve a trabecular vessel
3	Hematoma: subscapular, > 50% of surface area or expanding, ruptured subscapular hematoma with active bleeding, intraparenchymal hematoma, > 2 cm or expanding Laceration: > 3 cm of parenchymal depth or involving trabecular vessels
4	Hematoma: ruptured intraparenchymal hematoma with active bleeding Laceration: laceration involving segmental or hilar vessel producing major devascularization (> 25% of spleen)
5	Hematoma: completely shattered spleen Laceration: hilar vascular injury that devascularizes spleen

Splenic injuries

- Management: depends on HD status
  - Aggressive hydration
  - Blood
  - serial Hgb/Hct
  - Pain control
  - Partial or complete splenectomy
  - Vaccination against encapsulated bacteria
- Late complications
  - Pseudoaneurysm
  - Delayed rupture
  - Pseudocyst
  - Infection
  - Adhesions causing obstruction

Case 2

- 8 yo M restrained front seat passenger MVC, head on collision
- HR 130 BP 70/30
- What do you want to know?
- What do you want to do?

Liver Injuries

- 2nd most common intra-abdominal injury
- Most common lethal injury secondary to significant hemorrhage
- Right lobe>Left
- MVCs, peds vs car, falls, assaults, bike injuries, abuse
- PE
  - Kehr's sign: right shoulder pain
  - Right upper abd pain
  - Right lower chest pain

Liver injuries

- Labs
  - Elevated AST/ALT
- CXR: usually normal but may have rib fracture, elevation of right hemidiaphragm, right pleural effusion

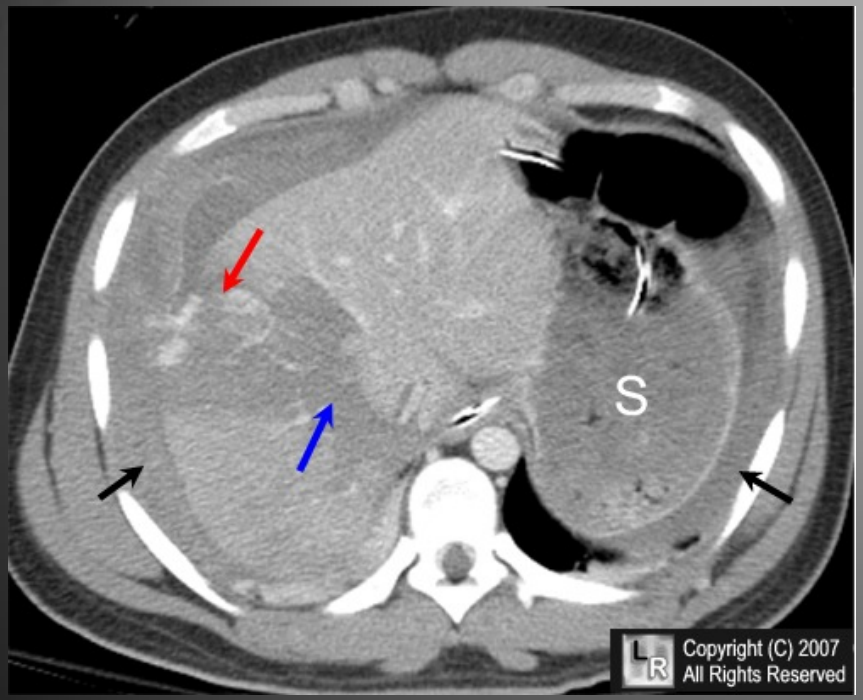
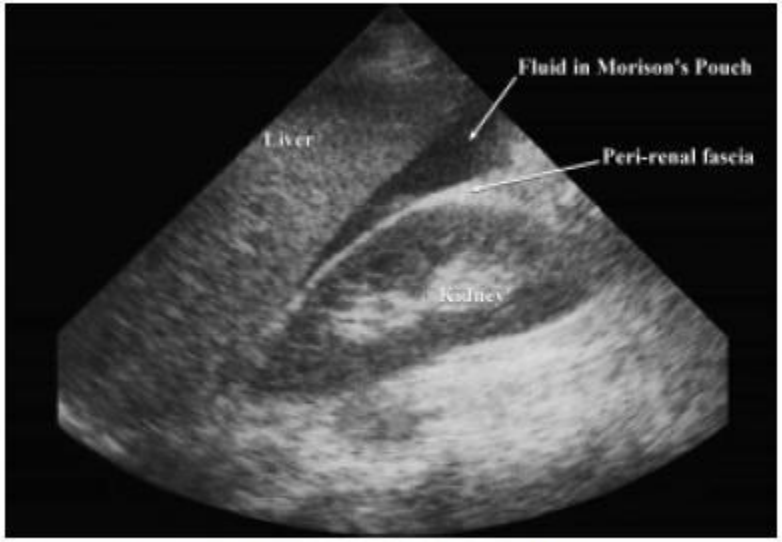


Figure 1. Ultrasound image demonstrating the liver, kidney, and fluid in Morison's pouch.



(Used with permission by John L. Kendall, MD.)

CT grading of Liver injuries

Table 8. Grades Of Splenic Injuries

Grade	Extent of Liver Injury
1	Hematoma: subscapular, non expanding, < 10% of surface area Laceration: capsular tear, non bleeding, with < 1 cm deep parenchymal disruption
2	Hematoma: subscapular, non expanding, hematoma 10-50%, intraparenchymal non expanding, < 2 cm in diameter Laceration: < 3 cm of parenchymal depth, < 10 cm in length
3	Hematoma: subscapular, > 50% of surface area or expanding, ruptured subscapular hematoma with active bleeding, intraparenchymal hematoma > 2 cm Laceration: > 3 cm of parenchymal depth
4	Hematoma: ruptured central intraparenchymal hematoma Laceration: parenchymal disruption involving 25-75% of the hepatic lobe
5	Hematoma: parenchymal disruption > 75% of hepatic lobe Vascular: juxta-hepatic venous injury (retrohepatic cava/major hepatic veins)
6	Vascular: hepatic avulsion

Liver Injuries

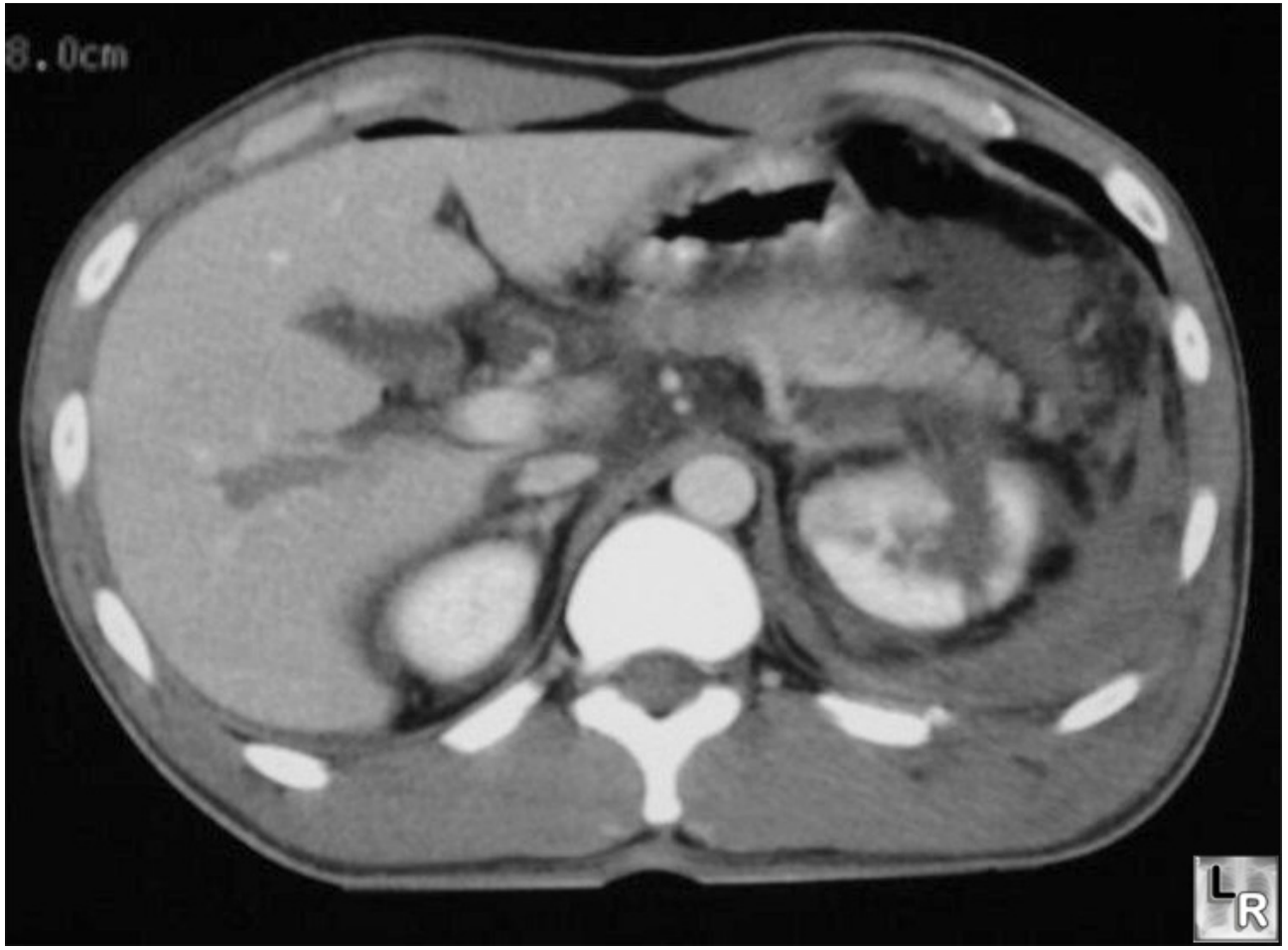
- Management
  - Predominantly nonoperative
  - Serial exams
  - Blood, fluids
  - Operative management for HD instability, peritoneal signs
- Complications
  - Biliomas
  - Delayed bleeding
  - Abscess formation

Case 3

- 14 yo F kicked in the side by her horse
- HR 106 BP 110/70
- What do you want to know?
- What do you want to do?

Renal Injuries

- Most common urinary tract injury
- Mechanisms: MVC, falls, peds vs car, bike, crush injuries, sports injuries, animal kicks
- PE: flank tenderness, flank hematoma, abd tenderness, hematuria
- Labs: hematuria


8.0cm
L
R

CT grading of renal injury

Table 11. Renal Injury Grades

Grade	Extent of renal injury
1	Contusion: microscopic or gross hematuria, no depiction of injury with any imaging method Hematoma: subscapular hematoma with no parenchymal laceration
2	Nonexpanding perirenal hematoma or cortical laceration less than 1 cm deep with no urinary extravasation
3	Parenchymal laceration extending greater than 1 cm into the cortex with no urinary extravasation
4	Parenchymal laceration extending through the cortico-medullary junction and into the collecting system
5	Multiple major lacerations resulting in a shattered kidney or avulsion of renal hilum that devascularizes the kidney

Renal Injuries

- Management
  - Nonoperative
  - Percutaneous drainage
  - Nephrectomy

Case 4

- 10 yo M with upper abd pain, green emesis for 2 days
- Hx of bike accident 3 days ago
- What do you want to know?
- What do you want to do?


57
7
99.0
0
75
10
c
m

Duodenal Injuries

- Rare
- Perforation or hematoma
- Mechanisms: MVCs, bike accidents, contact sport injuries, fall onto blunt objects, abuse
- Symptoms: abdominal pain, nausea, emesis (bilious), distention
- Labs: elevation of AST/ALT, amylase, lipase
- CT scan, UGI, US
- Management:
  - Perforation: operative
  - Hematoma: bowel rest, decompression

Pancreatic Injuries

- Rare
- Frequently underestimated or missed initially
- Mechanism of injury involves compression of pancreas against the rigid spinal column
- Associated injuries common
- Upper abd tenderness, nausea, vomiting
- Labs: elevated amylase/lipase, not reliable
- CT: transection, thickening and edema, peri-pancreatic fluid collection, ductal dilatation

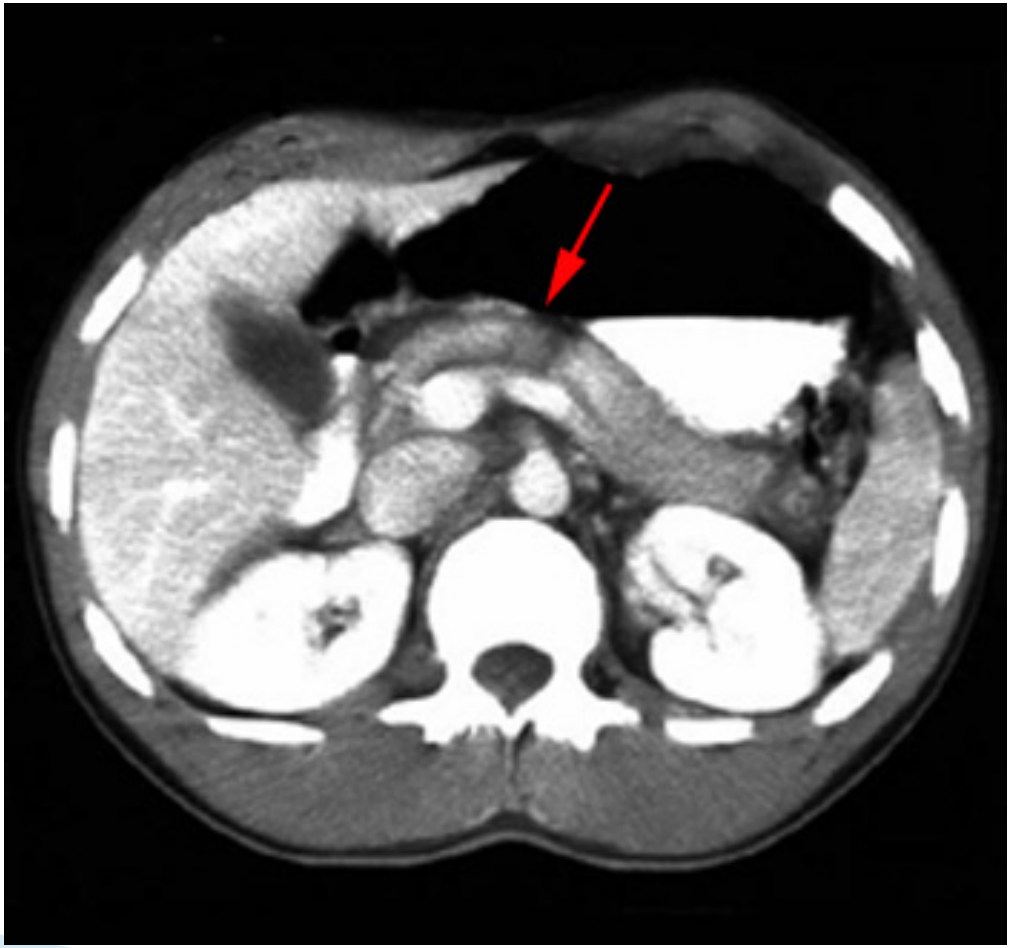


Table 9. Classification Of Pancreatic Injuries

Classes	Description
Class I	Contusion or laceration without duct injury
Class II	Distal transaction or parenchymal injury with probable duct injury
Class III	Proximal transaction or parenchymal injury with probable duct injury
Class IV	Combined pancreatic and duodenal injury

Pancreatic Injuries

- Increased need for operative management compared to other IAI
- If no ductal injury, nonoperative management with bowel rest, parenteral nutrition
- Complications
  - Pseudocyst
  - Pancreatitis
  - Fistula
  - abscess