Use of Oral Contrast in CT Evaluation of Pediatric Blunt Abdominal Trauma

Trauma Rounds

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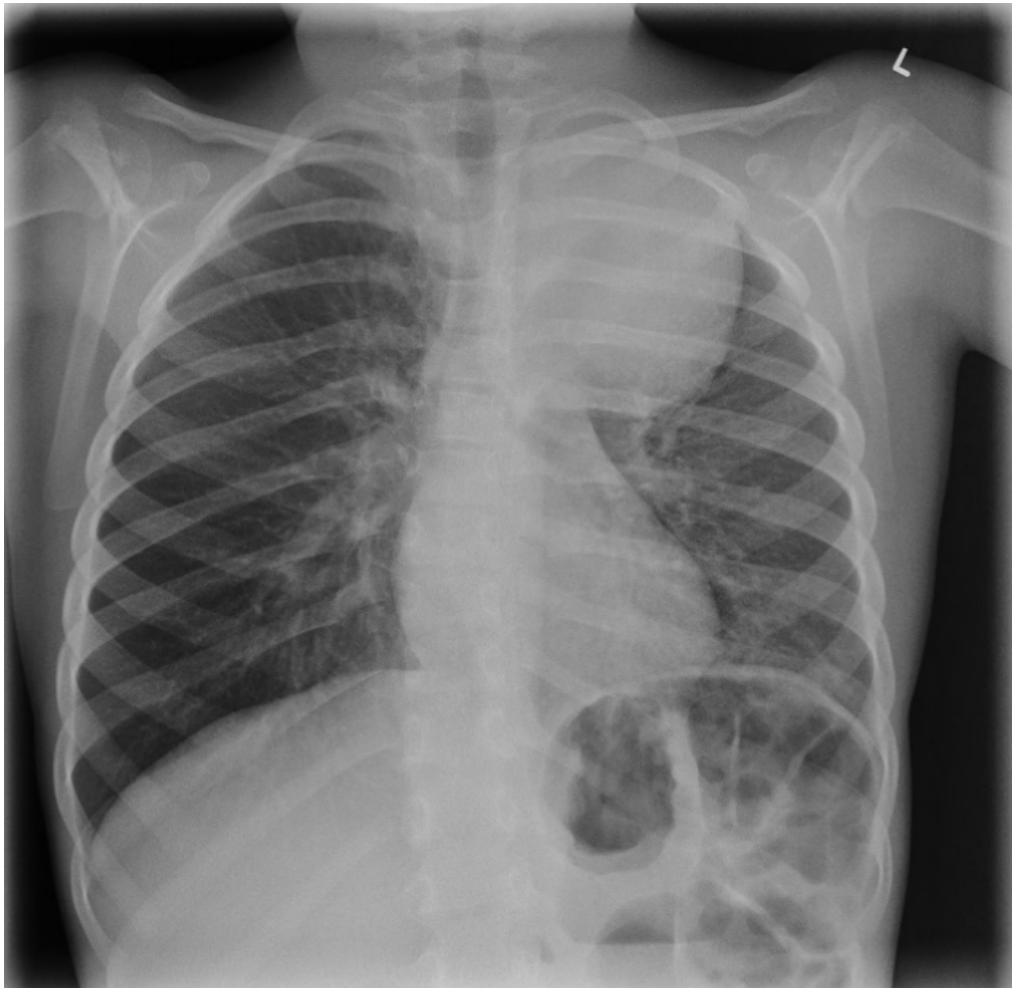
No Disclosures ....

Background

Why this debate exists...

- Clinical scenario # 1
  - 6 yo healthy male presents to ED with a cough...
  - ROS: nil sig
  - Exam: ↓ A/E in RUL
    - Investigative Test ordered...

Background



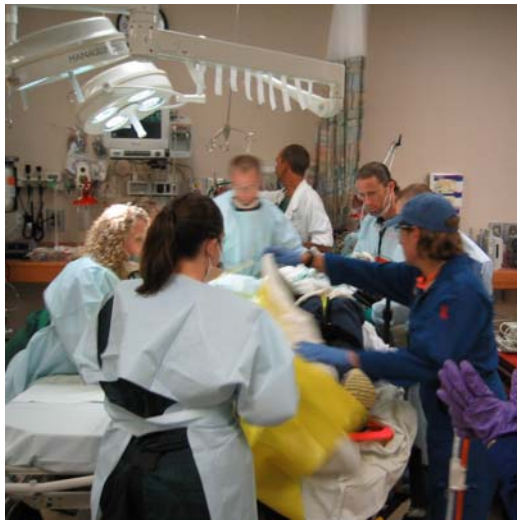
Background

- Clinical scenario # 1
  - CBC/Lytes obtained (2 hours later)
  - CT Chest performed same day (4 hours later)
  - Spot urine for tumor markers (6 hours later)
  - MIBG scan performed (6 days later)
  - Bone Scan performed (7-8 days later)
  - OR for Rx (15 days later)

Background

Why this debate exists…

- Clinical scenario # 2
  - 16 yo healthy male presents to ED after MVA
  - 1º survey:
    - initial hypotension, responds to fluid
    - GCS 12 (?falling?) PERRLA
  - 2º survey
    - Seatbelt sign
    - Abdo tenderness
    - Displaced/open L femur #



Background

Why this debate exists…

- Clinical scenario # 2
  - Rx begun (2 min)
  - Labs drawn (10 min)
  - CXR/Pelvis/C-spine done (25 min)
  - ? What next

- Competing interests that require a rapid, triaged approach to **diagnosis** and Rx

Background

Diagnosis – Blunt Abdominal Trauma

- CT = gold standard
  - Often dictates management by confirming suspected Dx, or raising new concerns…
  - But A CT scan is not therapeutic, and may be harmful…
  - Not all CTs are equal…
    - Contrast (IV or PO)
    - Sequence (early, delayed etc…)
- So: How do we optimize yield and minimize risks?

Question:

- What is the role of Oral contrast for CT evaluation of the acute trauma patient with a blunt abdominal injury?

Advantages Disadvantages

Background

ADVANTAGES

- identification of bowel loops → injury
- delineation of mesentery → injury

- Not v useful for solid organ injury

Background

DISADVANTAGES

- vomiting → aspiration → morbidity/mortality
- interference with subsequent angiographic studies
- inadequate gut opacification; delays scanning → definitive treatment
- ? lack of substantial added benefit

CT Findings of Bowel Injury

- bowel wall thickening
- focal hematoma of bowel wall
- pneumatosis
- hemoperitoneum/FF without solid organ injury
- FA, extravasated oral contrast

CT Findings of Mesenteric Injury

- focal hematoma of mesentery
- hemoperitoneum/FF without solid organ injury
- mesenteric infiltration or streaking

Oral contrast solution and computed tomography for blunt abdominal trauma: a randomized study

Arch Surg 1999; 134:622-7

objective: evaluate necessity of oral contrast in CT evaluation of patients with blunt abd trauma; assess possible disadvantages to use of oral contrast

study design: RCT

setting: Level I trauma center, Minnesota

study period: June 1993-Oct 1996

patients: 394 adult patients sustaining blunt abd trauma requiring CT abd → 199 oral contrast + 195 no oral contrast

Oral contrast solution and computed tomography for blunt abdominal trauma: a randomized study

Arch Surg 1999; 134:622-7

results:

- oral contrast: sensitivity 86% SB injury, 84.2% solid organ injury
- no oral contrast: sensitivity 100% SB injury, 88.9% solid organ injury
- vomiting: 12.9%, no difference between groups
- time to CT: 39 mins no contrast vs. 46 mins with contrast, p=0.008

limitations:

- low incidence of SB injuries
- missing records → decreased sample size

Oral contrast solution and computed tomography for blunt abdominal trauma: a randomized study

Arch Surg 1999; 134:622-7

conclusion:

- addition of oral contrast to acute CT protocol for evaluation of blunt abd trauma patient is unnecessary and delays time to CT

Performance of helical computed tomography without oral contrast for the detection of gastrointestinal injuries

Ann Emerg Med 2004; 43:120-8

objective: describe performance of helical abdominal CT scan without oral contrast for the detection of blunt gastrointestinal injuries

study design: retrospective review

setting: Level I trauma center, Sacramento

study period: May 1996-Sept 2001

patients: 13 014 trauma admissions → 6 052 underwent CT abd

Performance of helical computed tomography without oral contrast for the detection of gastrointestinal injuries

Ann Emerg Med 2004; 43:120-8

results:

- 106 patients = 1.8% gastrointestinal injury confirmed by laparotomy, autopsy, or additional imaging
  - 69% bowel injuries
  - 64% mesenteric injuries
- 91/106 = 86% had abnormal CT
- 81/106 = 76% had findings on CT suggestive of GI injury specifically
- 14% with GI injury had normal CT
- 91% sensitivity for “major” GI injury (full thickness bowel laceration, active mesenteric hemorrhage, mesenteric devascularization)

Performance of helical computed tomography without oral contrast for the detection of gastrointestinal injuries

Ann Emerg Med 2004; 43:120-8

limitations:

- retrospective
- patients selected for CT
- reading radiologists not blinded to clinical findings

conclusions:

- helical CT without oral contrast identifies ¾ patients with blunt GI injuries
- sensitivity improves in subset with major GI injury

Computed tomographic scanning without oral contrast solution for blunt bowel and mesenteric injuries in abdominal trauma

J Trauma 2004; 56:314-22

objective: determine sensitivity and specificity of CT scanning without oral contrast for blunt bowel and mesenteric injuries

study design: prospective review

setting: Level I trauma center, Salt Lake City

study period: July 2000 – Nov 2001

patients: 500 blunt abd trauma patients receiving CT abd with IV but no oral contrast

Computed tomographic scanning without oral contrast solution for blunt bowel and mesenteric injuries in abdominal trauma

J Trauma 2004; 56:314-22

results:

- 20 patients = 4% bowel/mesenteric injury confirmed by laparotomy, autopsy, or if CTRead2 + discharge summary described bowel/mesenteric injury
- 19/20 identified on CTRead1 → 95% sensitivity
- 2 false pos interpretations → 99.6% specificity

limitations:

- not designed as equivalence study
- overall incidence bowel/mesenteric injuries low
- no prospective control group

Computed tomographic scanning without oral contrast solution for blunt bowel and mesenteric injuries in abdominal trauma

J Trauma 2004; 56:314-22

conclusions:

- sensitivity for bowel/mesenteric injuries not compromised by withholding oral contrast
- rational clinical and image-based decisions regarding operative and non-operative management in patients with CT findings suspicious for bowel/mesenteric injury

Blunt abdominal trauma: performance of CT without oral contrast material

Radiology 2004; 233:689-94

objective: evaluate CT without oral contrast for depiction of bowel and mesenteric injuries that require surgical repair in blunt abd trauma

study design: retrospective review

setting: Level I trauma center, Boston

study period: Oct 2001 – Sept 2003

patients: 1082 adult blunt abd trauma patients underwent CT abd without oral contrast within 24 hours of injury

Blunt abdominal trauma: performance of CT without oral contrast material

Radiology 2004; 233:689-94

results:

- 4 groups based on CT
  - 932 negative CT
  - 102 solid organ injury only
  - 34 FF only
  - 14 suspected bowel or mesenteric injury
- 11 patients with bowel or mesenteric injury proven surgically
- 82% sensitivity
- 99% specificity
- 64% pos predictive value
- 99% neg predictive value

Blunt abdominal trauma: performance of CT without oral contrast material

Radiology 2004; 233:689-94

limitations:

- retrospective
- small number of bowel injuries

conclusions:

- CT without oral contrast is adequate for evaluation of patients with blunt abd trauma
- stable patients with single positive CT finding may warrant observation rather than surgical intervention
- questionable CT findings can be followed up by CT with oral contrast

informal email survey Canadian pediatric surgeons:

Vancouver	no oral contrast unless suspect duodenal injury
Calgary	no oral contrast, use if delayed scan r/o bowel injury
Edmonton	no oral contrast, at surgeon's discretion
Winnipeg	no oral contrast
London	oral contrast routine (despite Surgery objections)
Hamilton	no oral contrast
Toronto	no oral contrast, sometimes bolus on CT table to evaluate duodenum
Kingston	no oral contrast
Ottawa	no oral contrast unless suspect duodenal injury
Ste. Justine	no oral contrast
Halifax	no oral contrast unless suspect duodenal injury

Aspiration after administration of oral contrast material in children undergoing abdominal CT for trauma

AJR 1997; 169:1015-8

objective: determine how often aspiration occurs in children undergoing CT for blunt abd trauma

study design: retrospective review

setting: Level I pediatric trauma center, Chicago

study period: Jan – Sept 1995

patients: 50 children undergoing abd CT after blunt abd trauma

Aspiration after administration of oral contrast material in children undergoing abdominal CT for trauma

AJR 1997; 169:1015-8

results:

- 4 patients with fever >38.5°C within 48h post-CT, none suspected to have pneumonia
  - 2 had no opacities on CXR or chest slices of CT abd
  - 2 had opacities on chest slices of CT abd
    - 1 had fever prior to CT
    - 1 had infected ICP monitor
- 46 remaining patients had no witnessed aspiration, no clinical signs of aspiration (fever, cough, tachypnea, apnea)
  - 5 had opacities on CXR
    - 4 improved on subsequent CXR
    - 1 no F/U CXR
- 28 patients had opacities on chest slices of CT abd
  - 19 atelectasis, 2 contusion, 1 pulmonary laceration, 6 non-specific
    - 1 non-specific opacity same attenuation as contrast, normal CXR pre-CT → ? silent aspiration

Aspiration after administration of oral contrast material in children undergoing abdominal CT for trauma

AJR 1997; 169:1015-8

limitations:

- retrospective
- clinical F/U of only 48h, <24h in 7 patients
- opacities with lower attenuation than contrast could still represent aspiration if diluted with blood/secretions
- upper lung zones not imaged

conclusions:

- no clinically symptomatic episodes of aspiration
- 2% silent aspiration, clinically inconsequential
- no harm or injury resulting from use of oral contrast

Oral contrast agents for CT of abdominal trauma in pediatric patients: a comparison of dilute Hypaque and water

AJR 2004; 182:1555-9

objective: compare performance of water to dilute Hypaque as oral contrast agent in defining anatomic details of hollow GI tract

study design: retrospective review

setting: Level I pediatric trauma center, Cincinnati

study period: “date range of the scans reviewed overlapped with the period in which the oral contrast material used for scanning such patients was switched from dilute Hypaque to water”

patients: 74 pediatric patients sustaining blunt abd trauma requiring CT abd → 53 with dilute Hypaque + 21 with water

Oral contrast agents for CT of abdominal trauma in pediatric patients: a comparison of dilute Hypaque and water

AJR 2004; 182:1555-9

results:

- all anatomic regions (stomach, duodenal C- loop, D-pancreatic interface, prox SB, transverse D, distal SB, colon) seen equally well
- all non-bowel abnormalities (FA, FF, contrast extravasation, bowel wall thickening, bowel wall enhancement, mesenteric edema/hemorrhage, pancreatic trauma) seen equally well

Oral contrast agents for CT of abdominal trauma in pediatric patients: a comparison of dilute Hypaque and water

AJR 2004; 182:1555-9

limitations:

- retrospective
- single, unblinded radiologist
- subjective scoring scales for quality of visualization, and degree of confidence → qualitative data, observer bias
- no internal comparisons
- no clinical or surgical correlative F/U as reference standard

conclusion:

- water equally effective as dilute Hypaque as an oral contrast agent

Concerns Raised by Radiology

- any form of enteral contrast increases sensitivity of exam
- aspiration risk low
- Radiologist able to expand radiologic differential of injuries beyond those considered by Trauma Team

Concerns Raised by Surgery

- administration of enteral contrast delays disposition out of ER → to CT → to definitive management
- delays are particularly unacceptable in head trauma requiring operative management
- limited personnel available to administer contrast, manage aspiration if occurs
- head and spine traumas at particular risk of aspiration

Concerns Raised by Surgery

- objective of CT is to rule out major life-threatening injuries which require intervention or increased vigilance
- Surgery Fellow/TTL uniquely positioned to understand clinical context and exam findings, determine need for CT and specific injuries to be ruled in/out

We can work it out…

- Journal club held 10 days ago, jointly by many stakeholders
  - Surgery (including TTLs)
  - Rad (including chief technician)
  - PICU
  - ED

> “A consensus means that everyone agrees to say collectively what no one believes individually”
>
> Abba Eban

Consensus: Protocol in Evolution

- 1010: decision for CT imaging to be made by Surgery Fellow TTL
- 1010: no NG/po contrast administered in ER
- when need for CT determined, plan for enteral contrast in most cases
- develop list of exceptional cases where enteral contrast NOT to be used
  - continue adding to this list
  - include “other” at TTL’s discretion

Consensus: Protocol in Evolution

- head trauma
- GCS < 8
- spine trauma
- vomiting pre-contrast
- gross abdominal distention
- other, at TTL's discretion

Consensus: Protocol in Evolution

- sequence to begin with CT head if required, contrast administered for CT abd while CT head being interpreted
- water to be used as contrast agent
- water to be administered by CT tech or other available personnel “on table”

Thanks

“Honest disagreement is often a good sign of progress”

Mahatma Ghandi