What Not to Miss: Five Years' of Resident Discrepancies on Pediatric ED Exams

Michael Baad MD, David Kromrey MD, Seng Ong MD, Mario Zaritzky MD, Kate A. Feinstein MD

Project Overview

Problem
Residents may miss important findings while taking call with a perceived increase in errors in July

Goal
To improve resident interpretation of pediatric ED exams

Solution
1. Analyze resident misses to identify patterns
2. Present findings to the residents with example cases and teaching points
3. Track subsequent resident performance
Logistics of Call at U Chicago Medicine

• Residents (R2-R4) take in–house call from 5pm to 8am with attendings available from home prn

• Preliminary interpretations are entered into the StatConsult system (UC proprietary software) with review of interpretations in the morning consisting of
  1. Agree
  2. Agree but see report
  3. Mild discordance
  4. Significant discordance – Discrepancy which may negatively affect patient care

• Current R2 preparation for call
  1. Buddy short call for the last 6 months of R1 year
  2. General pre-call exam and pediatric specific pre-call exam
  3. Required proficiency in pediatric UGI and VCUG studies

Step 1: Analysis of Prior Discordances

• All significant discordances over a 5 year period were reviewed
  ▪ Start January 1, 2010
  ▪ End December 31, 2014

• A total of 322 Significant Discourses were found in 33,423 studies interpreted
  ▪ Overall rate of 0.97% in a 5 year period

• Studies analyzed by:
  Exam Time
  Resident Level
  Exam Type
  Pathology Missed
Step 1: Analysis of Prior Discordances

Discordance Rate by Year

- Decreased rate in 2014 (official “buddy” call instituted)

Discordance Rate by Month

- Rate greatest in July and August as R2s start call
Step 1: Analysis of Prior Discordances

Discordance Rate by Time of Day (military time)

- Rate between 17-1 (1.15%) > 1-8 (0.84%). 17-1 is a busier period, with 3.3x more studies.

Step 1: Analysis of Prior Discordances

Discordance Rate by Resident Level

- Majority (57%) of discordances are made by R2s.
Step 1: Analysis of Prior Discordances

Discordance Rate by Exam Type

- XR Chest has a high number (77), but a low rate (0.6%)
- Highest Rates: XR Toe (3%), Wrist (2.6%), Hand (2.2%)

Discordance by Etiology

- Missed fractures account for the a large portion (46%)
- Of all discordances
  - Missed Fxs of the Hands/Wrist/Distal forearm = 28.2%
  - Missed Fxs of the Feet/Ankle/Distal leg = 17%

Top 5 Missed Fractures
- Phalanx, finger 35
- Distal radius 30
- Metatarsal 15
- Distal tibia 15
- Phalanx, toe 11
- Metacarpal 10
- Elbow 6

Top Missed Fractures
- Missed fracture 148
- Missed pneumonia 57
- Overcall fracture 12
- Missed elbow effusion 7
- Overcall pneumonia 6
Step 2: Presentation to Residents

- The 322 discordances were individually reviewed by two residents

- A presentation was created and discussed with all residents on 2/26/2015

- The prior analysis was included along with a set of representative missed cases organized as follows
  1. Common discordances
  2. "Bad" discordances
  3. Pediatric "gotchas"

- A sample of the presentation follows

Common: Missed Pneumonia

- StatConsult: No acute abnormalities
- Read: RUL PNA

Teaching Point: Many missed PNAs are much more evident on the lateral view. Look there!
Common: Missed Finger Phalanx Fx

- StatConsult
  - No Fx
- Read
  - SH II Fx proximal phalanx thumb

Teaching Point: Pediatric phalanx Fxs can be very subtle. Look for STS and try to obtain history if possible

Common: Missed Finger Phalanx Fx

- StatConsult
  - Ossification adjacent to 1st MC may be a Fx
- Read
  - SH II Fx proximal phalanx thumb
  - Ossicle mentioned in prelim is a sesamoid

Teaching Point: Satisfaction of search. Continue to look at entire study after detecting a finding
Common: Missed Distal Radius Fx

- StatConsult
  - No Fx
- Read
  - SH1, distal radius

Teaching Point: A SH1 Fx can be very subtle. Look for widening of the physis and effusion. Compare with priors.

Common: Missed Distal Radius Fx

- StatConsult
  - No Fx
- Read
  - Distal radial buckle Fx

Teaching Point: Distal radial fractures are common and commonly missed. Look at the lateral closely!
Common: Missed Effusion

- StatConsult
  - No Fx
- Read
  - Joint effusion. FU to exclude occult Fx

Teaching Point: Begin evaluation of an elbow by looking for an effusion

Common: Missed Tibial Fx

- StatConsult
  - No Fx
- Read
  - Posterior tibia Fx

Teaching Point: Even if the AP view looks completely normal, still look closely at all views
Common: Missed Base of 5th Fx

- StatConsult
  - Lucency at base of 5th may represent asymmetric closure of apophysis
- Read
  - Base of 5th Fx

Teaching Point: These are common. An apophysis is oriented longitudinally. A Fx will be horizontal.

Common: Missed Toe Phalanx Fx

- StatConsult
  - No Fx
- Read
  - Buckle Fx of proximal phalanx little toe

Teaching Point: Foot phalanx Fx can be very subtle with only slight buckling. Look at all views.
Bad: Missed Appendicitis

- StatConsult
  - Appendix not visualized, no acute findings
- Read
  - Acute appendicitis

Bad: Missed NAT

- StatConsult: No Fx
- Read: Left posterior 9th rib Fx (CT also showed 10th)
Bad: Missed NAT

- StatConsult: No Fx
- Findings: Occipital bone Fx (confirmed on CT)

Teaching Point: Don’t assume all lucencies in the skull are sutures (or vice versa). Symmetry usually helps.

Bad: Missed Pneumatosis / PVG

- StatConsult:
  - Hazy lung opacities, bowel obstruction/ileus
- Read
  - RLQ pneumatosis
  - Portal venous gas
Bad: Missed SCFE

- StatConsult:
  - No Fx/dislocation
  - No SCFE
- Read
  - Bilateral SCFE

Teaching Point: Don’t get fooled by symmetry in SCFE cases. Around 20% are bilateral at presentation

Bad: Missed ACL Tear

- StatConsult
  - No Fx
- Read
  - Lateral Notch sign suspicious for ACL injury. MRI Recommended

Teaching Point: Don’t forget to look for secondary signs of ACL injury
Bad: Missed RA Thrombus

- StatConsult:
  - Effusions, AdenoCa
  - Carcinomatosis
  - SBO
- Read
  - RA thrombus at the catheter tip

Teaching Point: Findings are often missed on the first and last slices. Look at the heart and pulmonary arteries.

Gotcha: Normal Thymus

- Hx: 3 m/o trauma pt
- StatConsult
  - Hemopericardium
- Read
  - Normal thymus

Teaching Point: Don’t let this fool you or let the service convince you it’s lymphoma. This is normal.
Gotcha: Normal Pisiform

- StatConsult
  - Acute Fx along volar carpus
- Read
  - Normal exam

Gotcha: Cervical Pseudosubluxation

- StatConsult
  - Apparent anterolisthesis of C2 on C3
- Read
  - Pseudosubluxation
- Key
  - Spinolaminar line within 1 mm
Gotcha: Properitoneal fat stripe

- StatConsult
  - Thin lucency along the lateral aspect of the liver raises the suspicion for a small amount of free air
- Read
  - Normal properitoneal fat stripe. No free air

Step 3: Performance Following Intervention

Discordance Rate by Year

- Rate in 2015 after presentation decreased to 0.5% from 0.97% (2010-2014) and 0.93% in 2014
Step 3: Performance Following Intervention

- Discordance rate dropped following presentation
- No spike was seen in July-Sept (0.61% vs 1.35%)

Limitations

- Potential observation bias / Hawthorne effect as there has been increased focus on lowering resident discordances
- Gradual increases in volume resulted in having two residents on call during busy periods, lowering the overall volume per resident during that time
- Program director starting in 2012 is a pediatric radiologist, with a potential increased focus on pediatrics
- Future work will compare reductions observed in pediatric ED studies to other sections to see if these reductions are part of a general trend or pediatric specific
Conclusions

• Review and discussion of pediatric on call discordances may lead to improved resident performance

• Mistakes are more often made by R2s, during July-August, and during the busiest time periods

• The largest portion of resident discordances were missed fractures, particularly in the hands and feet

• Missed fractures and pneumonia often occur when the finding is more evident on the lateral view