Mistakes We all Make

Emergency & Trauma Radiology

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Introduction

• Types of mistakes and Prevalence
• Emergency & Trauma Imaging
• Organ specific pitfalls
• The fingerprints of trauma.
Its like Nuclear power
How often do we make mistakes

Abdominal and pelvic computed tomography (CT) interpretation: discrepancy rates among experienced radiologists

Hani H. Abujudeh Email author Giles W. Boland Rathachai Kaewlai Pavel Rabiner Elkarn F. Halpern G. Scott Gazelle James H. Thrall
<table>
<thead>
<tr>
<th>Cause of Error</th>
<th>Explanation</th>
<th>Occurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complacency</td>
<td>A finding is appreciated but attributed to the wrong cause (false-positive finding)</td>
<td>0.9</td>
</tr>
<tr>
<td>Faulty reasoning</td>
<td>A finding is appreciated and interpreted as abnormal but is attributed to the wrong cause (true-positive finding misclassified)</td>
<td>9.0</td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>A finding is seen but is attributed to the wrong cause because of a lack of knowledge on the part of the interpreter</td>
<td>3.0</td>
</tr>
<tr>
<td>Underreading (missed finding)</td>
<td>A finding is present on the image but is missed</td>
<td>42.0</td>
</tr>
<tr>
<td>Poor communication</td>
<td>An abnormality is identified and interpreted correctly but the message does not reach the clinician</td>
<td>0.0</td>
</tr>
<tr>
<td>Technique</td>
<td>A finding is missed because of the limitations of the examination or technique</td>
<td>2.0</td>
</tr>
<tr>
<td>Prior examination</td>
<td>A finding is missed because of failure to consult prior radiologic studies or reports</td>
<td>5.0</td>
</tr>
<tr>
<td>History</td>
<td>A finding is missed because of inaccurate or incomplete clinical history</td>
<td>2.0</td>
</tr>
<tr>
<td>Location</td>
<td>A finding is missed because of the location of a lesion outside the area of interest on an image</td>
<td>7.0</td>
</tr>
<tr>
<td>Satisfaction of search</td>
<td>A finding is missed because of failure to continue to search for additional abnormalities after the first abnormality was found</td>
<td>22.0</td>
</tr>
<tr>
<td>Complication</td>
<td>A complication from a procedure</td>
<td>0.5</td>
</tr>
<tr>
<td>Satisfaction of report</td>
<td>A finding was missed because of overreliance on the radiology report from a previous examination</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Trauma

- Trauma remains the leading cause of death in people under 45 yrs and accounts for 10% of all deaths

- Huge financial burden: $406 Billion lifetime cost (US)

National Center for Health Statistics 2014, CDC
So What About the ETRD
ED is a Complex Environment

• Acute care (WB Trauma, Stroke, PE, Acute chest Pain)
• Outside imaging on patient transfers
• Volume generally unpredictable
• Code Orange – mass casualties
• Limited patient information
• Patient/Communication hand-offs abound
• Frequent interruptions
• 24/7 requirements for high intensity
CT – The *Catalyst* for Change

- Familiar
- Accurate
- Fast and Easy
- Non-invasive
- Readily available
- Surveys broadly for disease
Use of CT in Emergency Department changes Clinical Decision Making

- CT performed in patients with abdominal pain, chest pain, dyspnea, headache
- Physicians surveyed before and after CT to determine leading diagnosis, diagnostic confidence, management decisions

Randharipande PV et al. Radiology. 2015 Sept 24;150473 [Epub ahead of print]
Use of CT changes Clinical Decision Making

- Results
  - Favoured diagnosis changed in
    - 51% of patients with abdo pain
    - 42% of patients with chest pain/dyspnea
    - 25% of patients with headache
  - Decision to Admit changed in
    - 25% with abdo pain
    - 19% with chest pain/dyspnea
    - 19% with headache

Randharipande PV et al. Radiology. 2015 Sept 24;150473 [Epub ahead of print]
Clinical findings are equivocal / misleading in 20-50% of blunt polytrauma patients.

In setting of loss of consciousness/head injury, physical exam only 16% reliable in detecting abdominal injury.

Implements morbidity and mortality in polytrauma patients.

20.3% of patients with a normal abdominal exam had a change in treatment based on findings on the abdominal CT scan.
Rapid Imaging Protocol In Trauma

RIPIT

AR

PV
Utopian clarity vs information overload
The risk is there
How do we minimize it!!

Structured review can lead to structured reporting

Time is of the essence, but mistakes cost even more.

No division is an island.

Have I answered the question or just generated ten more?!

Take a minute: Am I about to say something really stupid!!
Make mistakes, don’t fake perfection.
NeuroRadiology

- The CT Brain: What it is and what it is not!
Functional imaging: Cardioembolic stroke
Functional imaging: Cardioembolic stroke
Dont forget the basics

- Is there blood: Yes or No?
- Is there a large area of established infarct: Yes or No?
- Is there mass effect.
- Take it from there
SAH can be subtle
A certain percentage of SAH will have a “Normal CT”

The Role of communication
Stroke
Posterior Fossa

- CT is suboptimal in many cases.

- Subtle, nonspecific findings: MRI
What do I miss

- Subtle strokes, posterior fossa.
- Aneurysms, small volume subdural
- PAROTIDS!
Thoracic Trauma
Mediastinal widening
AP window
Opacification
Obliteration of aortic knuckle
What are the abnormalities?

- Indistinct Aorta
- Widened mediastinum
- Increased Density Behind Heart
- Apical Cap
- Displaced NG Tube
- Indistinct Aorta
- Widened Mediastinum
CT IS THE IMAGING MODALITY OF Choice in Blunt Trauma

- 42% of patients with injuries had additional findings on CT not found on radiography
- 19% had a subsequent investigation or intervention as a direct result of the findings
- Most commonly, flail chest, vertebra fractures, pneumothorax, hemothorax, mediastinal hematoma

The use of chest computed tomography versus chest X-ray in patients with major blunt trauma

Matthias Traub, Mark Stevenson, Suzanne McEvoy, Greg Briggs, Sing Kai Lo, Steven Leibman, Tony Joseph

INJURY
INTERNATIONAL JOURNAL OF THE CARE OF THE INJURED
## Direct and indirect signs of aortic injury on CT

<table>
<thead>
<tr>
<th>Direct signs</th>
<th>Indirect signs</th>
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<tbody>
<tr>
<td>• Intimal tear/flap</td>
<td>• Mediastinal hematoma</td>
</tr>
<tr>
<td>• Traumatic pseudoaneurysm</td>
<td>• Indistinct mediastinal fat planes</td>
</tr>
<tr>
<td>• Intraluminal mural thrombus</td>
<td>• Peri-aortic hematoma</td>
</tr>
<tr>
<td>• Abrupt change in caliber of aorta</td>
<td>• Retrocrural hematoma</td>
</tr>
<tr>
<td>• Dissection</td>
<td>• Small caliber aorta</td>
</tr>
<tr>
<td>• Active contrast extravasation</td>
<td></td>
</tr>
</tbody>
</table>
Spectrum of CT findings in blunt aortic injury

Small intimal tear

Steenburg S et al. Radiology. 2008;248(3)
Most commonly injured areas in blunt thoracic aorta injury
- 90% isthmus
- 5-8% root/ascending
- 1-2% arch
- 1-2% descending

Ascending aortic injuries may be underreported based on CTA as they are cause of immediate death

Aorta is fixed at three locations
- Valve
- Ligamentum Arteriosum
- Diaphragm

We have discovered a new Abdominal Organ!!!!!
The Mesentery
Vascularity
What can we hold on to

- FREE STUFF
- Walk the small bowel
The leaflets of the mesentery

MVA patients
Solid organ injury
Bowel Wall Hyperenhancement

- 37-year-old male involved in an MVA.
- Shock bowel
- Hypoperfusion complex
Putting it all together
SMA Pseudoaneurysm.
Fingerprints of Trauma
Take Home points

- We All make mistakes.
- Structured image review and structured reporting
- Certain patterns seem to trip us up.
- Look for the fingerprints of trauma
Thank you