First imaging modality in childhood appendicitis: Does the presence of a dedicated pediatric emergency physician affect modality choice?
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Background

- Appendectomy: most common surgery in children in the United States
  76,228 appendectomies/year in children in the United States\(^1\)

- 48% of children with a final diagnosis of appendicitis undergo
  computed tomography (CT) or sonography (US) during their admission\(^2\)

- American College of Radiology (ACR) recommendation (2011)\(^3\):
  > “In children, ultrasound is the preferred initial examination, as it is nearly as accurate as CT for the diagnosis of appendicitis without exposure to ionizing radiation.”
  > Reserve CT/MRI for patients where sonographic findings are equivocal
Purpose

• To compare adherence to the ACR “ultrasound-first” guideline in children with acute appendicitis presenting to emergency rooms with and without a dedicated pediatric emergency room physician (PEP).

• To compare temporal trends in the first imaging modality used in emergency rooms with and without a PEP.
Methods

- Retrospective study (Jan 1, 2004 - Dec 31, 2015)
- Institutional Review Board approved
- HIPPA compliant
- Multicenter institution

> 1 ER with PEP(PEPER)
> 3 ER’s without PEP(non-PEPER)
Methods

- Hospital’s integrated radiology information service search
- Patients ≤ 18 years old with primary discharge diagnosis of acute appendicitis during study period
- Identify first imaging modality *ordered* in each emergency room (CT or US)
- Correlate study modality with
  - Presence or absence of a PEP
  - Patient age
  - Patient gender
- Descriptive statistics (averages, medians, range, standard deviation, and odds ratio calculated)
### Results:
Distribution of patients and type of study ordered as a function of ER type

<table>
<thead>
<tr>
<th></th>
<th>Male:Female*</th>
<th>US Studies</th>
<th>CT Studies</th>
<th># of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEPEPER</td>
<td>167:126</td>
<td>133 (45.4%)</td>
<td>160 (54.6%)</td>
<td>293 (100%)</td>
</tr>
<tr>
<td>Non-PEPEPER</td>
<td>60:54</td>
<td>17 (14.9%)</td>
<td>97 (85.1%)</td>
<td>114 (100%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>227:180</td>
<td>150</td>
<td>257</td>
<td>407</td>
</tr>
</tbody>
</table>

*No significant difference in choice of first imaging modality was found based on gender*
Results: Patient age

- Mean age of all patients 12.7y (range 2-18y, median 13y)
- Mean age patients presenting to PEPER 10.9y (range 2-18y, median 12y)
- Mean age patients presenting to non-PEPER 14.6y (range 7-18y, median 16y)
Results: Imaging modality and patient age

- Mean age US as first diagnostic modality, all patients: 9.8 y (range 2-18 y, median 11 y)

- Mean age CT as first diagnostic modality, all patients: 13.2 y (range 3-18 y, median 15 y)

- Mean age US or CT as first diagnostic modality did not significantly differ between PEPER and nonPEPER

- Younger patients (≤11 y) are more likely to undergo US as the first imaging modality for suspected acute appendicitis regardless of ER type (PEPER (p<1.0*10^-5) ; non-PEPER (p<0.03))
Results: Imaging modality by ER type

Patients presenting to a PEPER were 4.7 times [95% CI 2.7-8.3] more likely to undergo US as the initial imaging modality (p<1.0*10^-8) than patients presenting to non-PEPERs.
PEPER
Decrease in CT as first imaging modality in pediatric acute appendicitis from 98% to 42%

non-PEPERs
Decrease in CT as first imaging modality in pediatric acute appendicitis from 100% to 76%

2011 ACR guidelines
• Differences between choice of imaging modality in PEPER and non-PEPER exist

• Children presenting to a PEPER are almost 5 times as likely to receive an US as the first imaging modality than those presenting to non-PEPERs.

• However, in both PEPER and non-PEPER young patients are more likely to receive an US as first imaging modality.

• Greater reduction in CT scans as the first imaging modality in children presenting to PEPER compared to the non-PEPERs between 2004-2015
Discussion

• PEPs may be more up to date on radiation safety guidelines in children.
• Non-PEPs may be more prone to managing children in the same manner as adults; ACR recommends CT as first imaging modality in adults for appendicitis
• PEPPERs often affiliated with Children’s Hospital; after hours US availability and US technologists’ experience/expertise with children may differ in PEP vs non-PEPER.
• On site pediatric surgeon at PEPPER may be more accepting of diagnosis of acute appendicitis based on US exam.
Conclusions

• Increased educational efforts on dose reduction in children should be directed to ERs without dedicated pediatric ER physicians.
• The trend towards the increased use of MRI in children with appendicitis will likely alter ordering patterns.
