Imaging for suspected pediatric appendicitis. Can ultrasound alone be trusted?

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Introduction

- Appendicitis is the fifth most common reason for hospitalization among children[1]
- Diagnosis of the condition relies on a combination of laboratory results, diagnostic imaging, and clinician judgement.
- CT imaging has traditionally been the "gold standard," yet may expose children to unnecessary radiation
- Ultrasound imaging is now considered first line, however, sensitivity for appendicitis is often lower than CT[2]

Aims and Objectives

- Determine sensitivity of ultrasound for pediatric appendicitis
- Determine if any significant difference exists in the diagnosis of appendicitis utilizing ultrasound alone or both ultrasound and CT together

Methods

- Retrospective review of patients ages 4-17 years of age who presented to Beaumont Royal Oak and Beaumont Troy emergency department for suspected appendicitis
- Cohort identified through review of ordered abdominal ultrasound and CT reports during time period of 1/1/2016-1/1/2019
- Radiology reports categorized as 1.) appendix visualized: positive appendicitis, 2.) appendix visualized: negative appendicitis, 3.) appendix not visualized
- For this cohort of imaged patients, ICD and CPT codes for an appendectomy were reviewed if applicable
- Pathology reports for patient who received an appendectomy were reviewed to determine if appendicitis was present post-operativley
- Comparisons between sites were done using Fisher's Exact, chi-square, and two-sample tests. The sensitivity of predicting appendicitis for those between imaging cohorts were computed using pathology reports as the gold standard for appendicitis.

Results

Demographics - by site

	Hospital location		
	RO (N=1113)	Troy (N=559)	P-value
BMI			0.5707[1]
N	444	233	
Mean (SD)	19.390 (5.262)	19.177 (4.274)	
Median	17.890	18.390	
Range	11.170, 47.260	12.510, 34.880	
Age			0.5432[2]
N	1113	559	
Mean (SD)	9.966 (3.773)	10.082 (3.531)	
Median	10.000	10.000	
Range	4.000, 17.000	4.000, 17.000	
Sex, n (%)			<.0001[3]
Female	453 (40.7%)	148 (26.5%)	
Male	660 (59.3%)	411 (73.5%)	

[1]Unequal variance two sample t-test; [2]Equal variance two sample t-test; [3]Chi-Square p-value;

Comparison between RO and Troy

	Hospital location		
	RO (N=1113)	Troy (N=559)	P-value
Received CT, n (%)			0.0008[1]
No	892 (80.1%)	407 (72.8%)	
Yes	221 (19.9%)	152 (27.2%)	
Received Appendectomy, n (%)			0.0563[1]
No	873 (78.4%)	415 (74.2%)	
Yes	240 (21.6%)	144 (25.8%)	
Appendix visualized on US, n (%)			<.0001[1]
appendix visualized, appendicitis	194 (17.4%)	94 (16.8%)	
appendix visualized, no appendicitis	216 (19.4%)	47 (8.4%)	
appendix not visualized	703 (63.2%)	418 (74.8%)	

[1]Fisher Exact p-value

Comapring rates of Appendicitis in those with CT+US vs those with just US

	Imaging Group		
	US+CT (N=118)	US Only (N=266)	P-value
Appendicitis, n (%)			1.0000[1]
Yes	104 (97.2%)	254 (97.3%)	
No	3 (2.8%)	7 (2.7%)	

[1]Fisher Exact p-value;

Results

- There was no statistically significant difference in BMI or age. Significant difference in gender (M>F)
- 373 patients (23%) received CT imaging in addition to ultrasound
- 118 (31%) patients received a CT when their ultrasound was positive
- A greater percentage of patients received a CT in addition to their US at Troy vs Royal Oak (p<.05)
- Appendix not visualized in a greater percentage of patients at Troy vs Royal Oak (p<.001)
- Of the 1,672 patients imaged, 384 received an appendectomy (23%)
- No statistically significant difference of rates of appendicitis when comparing those who received CT +US vs US alone when US positive (p=1)
- Sensitivity of US for detecting appendicitis 0.95 for Royal Oak vs 0.93 for Troy

Conclusions

- While the diagnosis of appendicitis in the pediatric population is multifaceted and should be individualized to each patient, our data demonstrates that a positive ultrasound finding alone may be sufficient for diagnosis without further CT imaging
- Differences in visualization of the appendix between Royal Oak and Troy may be due to pediatric patient volume

References

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