Low Field-Of-View CT in the Evaluation of Acute Appendicitis in the Pediatric Population

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Abstract

CT abdomen and pelvis is a widely-used imaging modality used in the evaluation of appendicitis but it carries risks of radiation. A recent retrospective review localizes all appendices (both normal and abnormal) below the level of the L1 vertebral body, obviating the need to scan superior to that level.

This study is a retrospective review of prospectively-collected data from 171 consecutive pediatric patients presenting with clinical suspicion of acute appendicitis and undergoing "low FOV CT." The low FOV CT uses the L1 vertebral body as the superior aspect of the exam instead of the dome of the diaphragm as in standard CT.

Results showed the FOV was reduced by an average of 26% without any reduction of sensitivity or specificity when compared to the current standard FOV. All visualized appendices (both normal and abnormal) were at or below the level of L2, allowing us to lower the superior aspect of the field of view (and thus decrease the ionizing radiation dose) without affecting the appendix visualization rate.

Introduction

- Acute appendicitis is the most common indication for emergent abdominal surgery in pediatrics. [1]
- Primary imaging modalities for acute appendicitis include ultrasound, CT, and MRI[2,3]
- Standard CT abdomen/pelvis uses the dome of the diaphragm as the superior border of the exam.
- A recent retrospective review concluded that CT field-of-view (FOV) can be reduced by using L1 as the superior aspect without reducing sensitivity or specificity. This is defined as the "low FOV" approach (*Figure 1)*.[4]
- Reducing the FOV will decrease exposure to ionizing radiation.

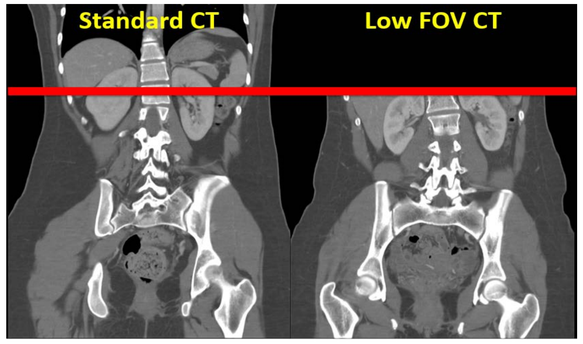
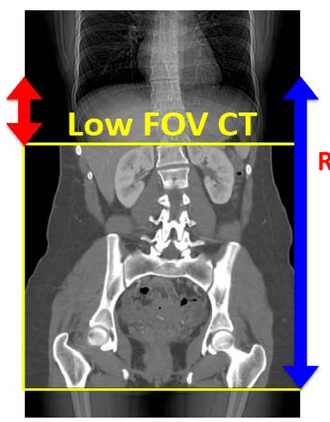


Figure 1: Coronal CT of the abdomen/pelvis with the red line depicting the area of field-of-view (FOV) that is reduced with the low FOV protocol.

Methods

- Retrospective review of pediatric emergency department patients from November 1, 2016 to October 31, 2017:
  - With suspected acute appendicitis
  - Underwent IV contrast-enhanced CT scan of the abdomen and pelvis with the FOV defined:
    - Superiorly by the L1 vertebral body
    - Inferiorly by the ischial tuberosities
- Location of visualized appendix recorded relative to vertebral body in the sagittal plane.
- Sensitivity, specificity, and appendix visualization rate were calculated.
- The FOV reduction was calculated by dividing the craniocaudal (CC) dimensions of low FOV CT by standard FOV CT (*Figure 2).*
- Radiologic diagnosis, including alternative diagnosis, were recorded. Clinical diagnosis confirmed by operative reports and 30-day chart review.



FOV reduction =
Reduced FOV / Standard FOV

Figure 2: Formula used to determine FOV reduction with accompanying CT abdomen/pelvis illustration.

Results

- Mean age was 11 years; 53% were male.
- The appendix was visualized in 163 in 171 subjects (95.3%).
  - 51 subjects (29.8%) diagnosed with acute appendicitis
    - 47 with confirmed clinical diagnosis
    - 4 with equivocal (false positive) CT
- All visualized appendices were at or below the level of L2 (*Table 1)*.
- Mean FOV reduction was 26% (95.0 mm).
- 6 alternative diagnoses were made on CT: hydronephrosis (n=2), pyelonephritis (n=2), cystitis, and ovarian torsion.
- Low FOV CT sensitivity and specificity in diagnosing acute appendicitis was 100% and 97%, respectively *(Table 2*).

Vertebral Body Level	Number of Subjects
L1	0 (0.0%)
L2	2 (1.2%)
L3	6 (3.7%)
L4	32 (19.6%)
L5	68 (41.7%)
Below L5	55 (33.7%)
Total	163

Table 1: Appendix Visualization at Corresponding Vertebral Levels

	Low FOV CT	Standard CT[4]
Sensitivity	100%	99%
Specificity	97%	97%
Appendix visualization rate	95.3%	90%

Table 2: Sensitivity, specificity, and appendix visualization rate of low FOV and standard CT

Discussion and Conclusions

- Low FOV CT can be used in the evaluation of acute appendicitis without any reduction in sensitivity or specificity compared to standard CT.
- All appendices were visualized at or below the level of L2, further confirming that FOV could be reduced without leading to non-visualization of appendix.
  - In the 8 cases where the appendix was not visualized, the appendix was most likely obscured by bowel as the cecum was visualized in the pelvis.
- This is the first prospective study in this topic. Future larger studies are warranted to validate the reliability of low FOV CT in evaluating acute appendicitis and to quantify radiation dose reduction.

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