Evaluation of Ultrasound training workshop in improving detection of acute appendicitis and intussusception in children

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Diagnosis of acute appendicitis and intussusception in a timely fashion is very important, and has significant clinical implications.

Appendicitis and intussusception are common causes of abdominal pain in the pediatric patients, often presenting with vague and atypical symptomatology, and therefore demanding advanced technical skill of the sonographer.

Efficient and meticulous ultrasonography is used as a screening for suspected appendicitis and intussusception in children at our institution.
To identify if a dedicated instructive ultrasound workshop for sonographers could improve detection of acute abdominal processes on weekends, holidays, and from 5 PM to 8 AM on weekdays, when a pediatric radiologist may not be available for analysis of images and for providing guidance for additional scanning.
Prior to providing ultrasonography service for detection of appendicitis and intussusception in children on weekends/holidays and from 5 PM to 8 AM on weekdays, an instructive ultrasound workshop entailing key features to search for acute appendicitis or intussusception, was conducted for sonographers.

129 cases over a period of 12 months for which ultrasound was used as a screening imaging modality for acute appendicitis. Of these, 59 were additionally evaluated for clinical suspicion of intussusception.
Results

◆ The data collected over 12 months demonstrated that 6/129 (5%) with acute abdomen the appendix was not visualized on sonography, but were ultimately found to have appendicitis.

◆ 1/129 cases suggested early appendicitis, while effective treatment was delayed due to premature patient discharge. (Case 2)

◆ The diagnosis of intussusception was not missed on screening ultrasonography.

◆ Sensitivity of detecting appendicitis was 68%, and Specificity was 100%.

◆ Sensitivity of detecting intussusception was 100%, and Specificity was 100%.

◆ 51% followed-up with primary care provider after release from hospital, none of whom had any acute abdominal visits caused by appendicitis or intussusception.

◆ 47% did not have any recorded follow-up with the primary care provider after discharge.
Case 1

- A 6 y/o symptomatic male underwent a screening US, in whom an appendix was not visualized and was subsequently discharged.

- The patient returned to the emergency department with abdominal pain within 6 days of being discharged.

- Ultrasound at this time showed a hypoechoic mass in the right lower quadrant without visualization of an appendix (Figure 1)

Figure 1
Case 1

CT Abdomen/Pelvis demonstrated a loculated abscess in the right lower quadrant (solid arrow) with an adjacent fluid-filled appendix (dotted arrow) (Figure 2)
Case 2

- An 11 y/o symptomatic male underwent screening US, yielding a non-compressible appendix measuring 6.1 mm in diameter, reported as equivocal for appendicitis (Figure 3).

- Patient was discharged in the setting of stable clinical status.

- Repeat US 35 days later demonstrated a fluid-filled, non-compressible appendix with an appendicolith consistent with appendicitis (Figure 4).
There were 5 patients in whom the appendix was not visualized on ultrasound, but were followed up with CT that revealed appendicitis. (Figures 5 and 6 show retro-cecal location of appendix)
Discussion

- There are several challenges to identifying an acute abdominal process in a pediatric patient and appropriately treating them in a timely fashion. A critical element to early diagnosis of appendicitis—especially with greater than 33% atypical clinical presentation seen in children—is the technical skill and knowledge of the sonographer. Although the sensitivity of ultrasound in detecting appendicitis is variable, ultrasound serves as an important noninvasive diagnostic tool for early diagnosis.

- Literature reports sensitivity and specificity of ultrasound in the detection of appendicitis ranging between 44-100% and 47-99%, respectively. Our sensitivity and specificity in detecting appendicitis was 68% and 100%, respectively.

- Our sensitivity and specificity of detecting intussusception with sonography were both 100%, which supports the utility of ultrasound screening for intussusception.
Ultrasound training workshop for sonographers proved beneficial in enabling detection of acute appendicitis between 5 PM and 8 AM on weekdays, weekends, and holidays even with limited availability of a pediatric radiologist during these hours in a university hospital setting.

This workshop for sonographers also proved beneficial in enabling detection of intussusception, with 100% sensitivity and specificity.

Of the patients that followed up, 51% followed-up with primary care provider after release from hospital, none of whom had any acute abdominal visits caused by appendicitis or intussusception.

