

Prospective Evaluation of Contrast-Enhanced MRI for Non-traumatic, Non-appendicitis Acute Abdomen with Direct Comparison to MDCT

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Introduction: Magnetic resonance imaging (MRI) evaluation has received growing interest in the setting of patients with suspected appendicitis^{1,2}. However, acute appendicitis may only account for 25%^{3,4} of symptoms in patients presenting with non-traumatic acute abdominal pain. As MRI emerges as a viable imaging modality in the emergent setting, etiologies other than appendicitis must also be evaluated, particularly those commonly diagnosed using CT⁵. The purpose of this prospective study was to demonstrate the utility of contrast enhanced (CE) MRI in the evaluation of non-traumatic and non-appendicitis causes of acute abdominal pain using MDCT as the reference.

Methods: A total of 165 patients presenting to the emergency department with acute abdominal pain were included in the prospective study. The study was approved by the IRB, and written informed consent was obtained in all patients. Criteria for inclusion included age 12 years and older in patients for whom a CT had been ordered for possible appendicitis. Exclusion criteria included pregnancy and patients with contraindications to MRI or gadolinium-based IV contrast. CE-MDCT and CE-MRI were performed in close succession, less than 1 hour apart. The MRI protocol included a three plane localizer, coronal T2w SSFSE, axial T2w SSFSE with and without fat suppression, sagittal T2w SSFSE, axial DWI, axial T1w pre-contrast LAVA, axial T1w 40 seconds and 3 minutes post-contrast LAVA and coronal T1w 90 seconds post-contrast LAVA sequences. A standard CE-MDCT protocol with oral contrast was utilized. Two experienced radiologists reviewed all available clinical and imaging data in consensus to derive an image-based diagnosis.

Results: A total of 62/165 (38%) subjects were diagnosed with relevant imaging findings other than acute appendicitis according to the reference standard. Of these, 30/62 (48%) patients were diagnosed with a non-appendiceal gastrointestinal abnormality (Table 1), 31/62 (50%) with genitourinary abnormalities (Table 2), and 1/62 (2%) with extra-abdominal abnormality (acetabular fracture). The two expert readers determined that MR and CT were concordant in all but three cases. One of these cases was cholelithiasis, where the gallbladder was not included in the MRI field of view. The other two were cholelithiasis and an acetabular fracture seen only on MRI. An example of ascending colitis is shown in Figure 1 including T2w SSFSE, DWI, post-contrast T1w and the corresponding CT images. Additionally, an example of pyelonephritis is shown in Figure 2.

Discussion/Conclusion: Our study confirms that a large proportion of patients referred to diagnostic MDCT for clinical suspicion of appendicitis often have alternative diagnoses explaining their abdominal symptoms which can be identified on CE-MRI. One limitation included different field of views between the MR and CT images, however several additional diagnoses were made with MRI. This large prospective study compared MR with CT for evaluation of nontraumatic nonappendiceal abdominal pain.

References: 1. Birchard et al. AJR, 2005; 184:452-458. 2. Singh et al, Radiographics, 2007; 27:1419-1431. 3. Inci et al. Eur Jour of Radiology, 2011; 80:253-258. 4. Pickhardt et al., Ann Int Med 2011; 154:789-796. 5. Pooler et al., Radiology, 2012; 265: 733-742.

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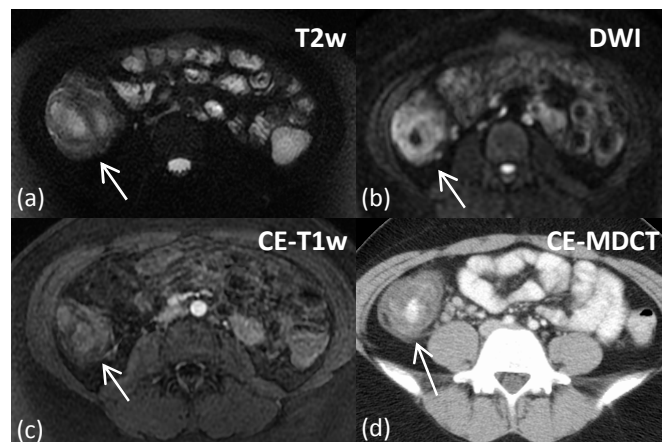


Figure 1: Axial T2w SSFSE (a), axial diffusion (b), axial T1w 40 second post-contrast (c) and axial CE-MDCT (d) images from a patient with ascending colitis characterized by thickened and enhancing colonic wall (arrows).

Table 1: Number (n) of nonappendiceal gastrointestinal abnormalities by imaging diagnosis.

Diagnosis	n
Colitis/enteritis/terminal ileitis	9
Diverticulitis	4
Cholecystitis/cholelithiasis	4
Constipation/ileus	4
Omental infarct/epiploic appendagitis	3
Pancreatitis	2
Meckel's diverticulum/diverticulitis	2
Surgical abscess, mesenteric lymphadenitis	1

Table 2: Number (n) of genitourinary abnormalities by imaging diagnosis.

Diagnosis	n
Ovarian cyst (hemorrhagic/simple/ruptured)	13
Ureteral stone/obstruction/UTI	7
Free fluid	5
Endometritis/Pelvic inflammatory disease	2
Degenerating fibroid, endometrioma, pyelonephritis, ovarian torsion	1

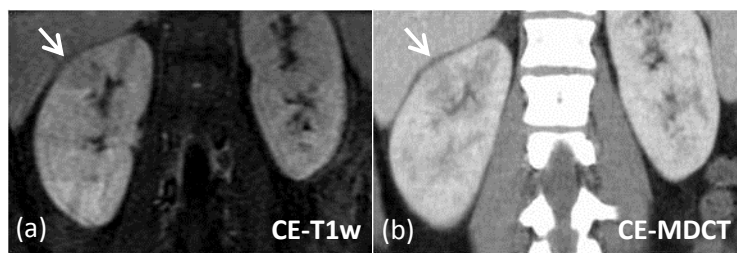


Figure 2: Coronal CE-T1w LAVA (a) and CE-MDCT (b) images from a patient with right-sided pyelonephritis (focal decreased enhancement, white arrows).