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Pictorial Review

Clinical mimics of acute appendicitis: Is there any role of imaging?

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ABSTRACT

Acute appendicitis (AA) is a common surgical emergency. Accurate and timely diagnosis of AA is essential for successful outcome. Imaging plays an important role in the diagnosis, exclusion of AA as well as diagnosing alternative clinical conditions which can closely simulate AA. A correct alternative diagnosis may obviate the need of unnecessary appendectomy or may even change the treatment regime altogether. This pictorial essay illustrates various clinical conditions which mimicked AA clinically during our day to day practice.

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Introduction

Acute appendicitis (AA) is the most common cause for acute abdomen requiring surgical intervention for all ages and both sexes. Despite being a common entity with improved clinical understanding of the disease process, incredible advancement in the field of laboratory sciences and imaging, many a time, accurate and timely diagnosis of AA remains challenging. Even today, clinicians often face the dilemma of balancing between

negative appendectomy and perforation rates. Traditionally AA has always been considered as essentially a clinical diagnosis. A number of scoring systems have been developed over last three decades which take into account of various clinical and laboratory parameters. Role of imaging (ultrasound, CT scan, MRI) has also been well established amidst occasional debate. Usage of CT scan has seen a sharp increase for the diagnosis of AA. Computer aided artificial intelligence based techniques are being increasingly advocated for an accurate diagnosis of AA. Ironically, most of the researches/

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studies on AA focus only on the presence or absence of AA. It is often forgotten that a patient presents with pain at the right fossa (RIF) rather than AA. There are many conditions which can present as pain RIF and simulate AA. While timely and accurate diagnosis of AA remains crucial, it is equally important to diagnose alternative conditions which can mimic AA clinically or otherwise as the treatment options and prognosis may vary drastically. The role of imaging in establishing alternate diagnosis in clinically suspected AA has often been underestimated. The following pictorial review illustrates some of the common as well as uncommon clinical mimics of AA resolved on the basis of imaging. Ultrasonography was done using 5 MHz convex, 7.5 MHz linear and 6 MHz transvaginal probes (Wipro GE, LOGIQ P5) in appropriate cases.

Case 1

A 60 year old male patient presented with sudden onset central abdominal pain which radiated later on to the right iliac fossa. On examination, he had tachycardia (pulse rate: 96/minute), fever (temp: 101 °F), guarding and rebound tenderness at the RIF. Clinically, he was diagnosed to have AA and was advised an urgent ultrasonography (USG) study. USG study revealed presence of free fluid in the abdomen particularly in the RIF and pelvis. The appendix was visualized and was normal in size and morphology. Small bowel loops were distended, fluid filled and showed reduced peristaltic activity (Fig. 1). A non contrast CT scan abdomen revealed presence of pneumoperitoneum with possible perforation of

D1 segment of duodenum. The patient underwent laparotomy through a right paramedian incision which confirmed presence of perforation of D1 segment of duodenum with peritonitis. Localized peritonitis due to collection of bowel contents at the RIF through the right paracolic gutter may have been responsible for simulating AA clinically.

Case 2

A 30 year old patient, primigravida at 33 weeks 3 days of gestation reported to the emergency department of a tertiary care hospital with complaints of pain RIF and 3 episodes of vomiting for last 6-8 h. There was no history of bleeding per vaginum. On clinical examination, she had tachycardia and was afebrile. Local examination revealed acute tenderness at the RIF above the Mc Burney's point. Her laboratory parameters were within normal limit. Clinically she was diagnosed to have AA and was referred for an urgent USG. On USG, there was a viable fetus of 33 weeks duration in longitudinal lie and cephalic presentation. No evidence of any placental/retro-placental pathology was noted. The appendix as such could not be convincingly identified on USG. Instead, a cystic lesion was noted in the RIF in relation to the right ovary. The lesion did not reveal any vascularity except at its pedicle (Fig. 2a). There was significant probe tenderness over the cystic lesion. Based on the clinical presentation and sonographic findings, a diagnosis of twisted ovarian cyst (right) with viable singleton fetus of 33 weeks 3 days gestation was made. She underwent urgent surgery which confirmed the diagnosis of twisted right

Fig. 1 – USG reveals normal sized appendix (a) and dilated, hypoperistaltic ileal loops with free fluid in the RIF and pelvis (b) A non contrast CT scan demonstrated (not shown here) presence of pneumoperitoneum with possible perforation of D1 segment of duodenum which was confirmed at surgery. The appendix was found to be normal at per-operative inspection.

Fig. 2 – Doppler study reveals a cystic lesion (55 × 58 mm) in the right adnexa with no vascularity except at the pedicle. Note uterine vascularity and visible fetal parts on the left side of the image (a) Post operative specimen (b) demonstrates ovarian cyst with gangrenous changes seen throughout. The appendix which was removed at the same time was normal (shown on the right side of the image).

ovarian cyst with evolving gangrenous changes within. The appendix was normal both on gross and on histopathological examination (Fig. 2b).

Case 3

A 13 year old male patient presented with fever, pain peri-umbilical, RIF region and nausea for one day duration. He had leucocytosis (total leucocyte count ~10,000/cumm) with a leftward shift. Clinically, he had tachycardia and was febrile (temperature ~100 °F). There was diffuse tenderness over the RIF. He was referred for urgent USG to rule out AA. On USG, there was free fluid in the pelvis, right paracolic gutter extending up to the sub-hepatic space. The appendix was identified and appeared normal. In addition, multiple enlarged discrete mesenteric lymph nodes were noted. Based on the imaging features, a diagnosis of mesenteric adenitis was made (Fig. 3a–b). The patient made an uneventful recovery on conservative treatment. He was followed up for

one year during which he did not have any recurrence of such pain.

Case 4

A 23 year old male patient presented with symptoms suggestive of right ureteric colic with associated fever. On clinical examination, he had tachycardia and marked tenderness in the RIF. Clinically, there was a diagnostic dilemma between ureteric colic and AA. He underwent an urgent USG which revealed mild pelvicaliectasis on the right side. A dilated (08 mm), non compressible, aperistaltic tubular structure was noted in the RIF with associated probe tenderness. The urinary bladder was not optimally distended; however, on a closer look a 03 mm sized calculus was noted at the right vesico-ureteric junction (VUJ). The appendix could not be convincingly demonstrated. The cause for probe tenderness was not clear at this point. The patient was taken up for a NCCT which confirmed presence

Fig. 3 – (a) USG reveals presence of free fluid in the RIF. Multiple discrete enlarged mesenteric lymph nodes were identified. (b) Based on the USG findings, a diagnosis of mesenteric adenitis was made. IA: Internal iliac artery, N: lymph node, Ao: Aorta, IVC: Inferior vena cava.

Fig. 4 – USG RIF reveals (a) dilated (>8 mm) tubular structure crossing iliac vessels. (b) Also noted was a 03 mm sized calculus at the right vesico-ureteric junction in an undistended bladder. The same was confirmed at limited NCCT. (c) NCCT also demonstrated periureteric fat stranding (curved arrow) (d) dilated ureter (arrows).

of a 03 mm sized calculus at the right VUJ with dilated right ureter and minimal hydronephrosis. In addition, there was significant periureteric fat stranding (Fig. 4a–d). The appendix was found to be normal. It was concluded that in addition to VUJ calculus with backpressure changes, possibly there was an element of ureteric/periureteric inflammation responsible for the clinical as well as probe tenderness in the RIF simulating features of AA. The patient was treated

conservatively and recovered fully after expulsion of the VUJ calculus within a week.

Case 5

A 42 year old healthy female patient without any known comorbidity, presented with the chief complaints of pain and

Fig. 5 – USG, RIF reveals (a) heterogeneously hypoechoic collection in the anterior abdominal wall (26 × 72 mm, AP × TR). (b) Limited NCCT pelvis reveals the collection to be rectus sheath hematoma.

Fig. 6 – NCCT lower abdomen reveals fat stranding (white arrow) anterior to cecum-ascending colon. No other abnormality was detected.

Fig. 8 – Transvaginal USG depicts typical features of hemorrhagic follicular cyst (right ovary).

tenderness in the right iliac fossa of one day duration. The pain was of gradual onset and had increased for last 12 h. She had tachycardia and localized tenderness at the Mc Burney's point. The attending surgical specialist made a clinical diagnosis of AA and referred for an USG study. On sonographic examination, the patient was found to have severe tenderness at the RIF. A heterogeneously hypoechoic collection was noted in the lower anterior abdominal wall measuring 26 × 72 mm. There was no sonographic feature of AA. A localized NCCT abdomen was done which revealed the anterior abdominal wall lesion to be a rectus sheath hematoma (Fig. 5a–b). The appendix was found to be normal at CT scan. On repeated questioning, she revealed lifting a bucketful of water preceding the onset of symptoms. She was treated conservatively with analgesics and recovered over a period of one week.

Case 6

A 34 years old male patient presented with pain RIF of two days duration. On clinical examination he had mild pyrexia,

leucocytosis and tenderness at the RIF. An USG study was requested with a clinical diagnosis of AA. On USG, there was probe tenderness at the RIF, however there was no definite signs of AA. A limited NCCT study was done which revealed the appendix to be retrocecal in position but normal otherwise. Significant fat stranding was noted anterior to the cecum (Fig. 6). Cecal wall was found to be normal. No evidence of any diverticulum was noted in the vicinity. On the basis of CT scan findings, a probable diagnosis of epiploic appendagitis was made. The patient made uneventful recovery on conservative treatment.

Case 7

26 years old female patient presented with acute onset RIF pain for 12 h duration. Clinically, she had tachycardia, and marked tenderness in the RIF. She also had leucocytosis (total leucocyte count ~11,300/cumm). Based on clinical and laboratory findings, she was diagnosed to be AA and was referred for USG. On USG, there were no features of AA.

Fig. 7 – (a) Transvaginal Doppler USG, reveals an ill defined right adnexal mass in relation to the right ovary (RO). The lesion has medium to high level echoes with. No definite vascularity is noted within or around the lesion. (b) Post operative specimen (cut open): reveals cheesy material admixed with hair within the central part of the lesion. Devitalised tissues are noted throughout the tumor.

Fig. 9 – USG RIF demonstrates 'target sign' (white arrow) suggestive of intussusception. Note multiple enlarged mesenteric lymph nodes (notched white arrow).

Instead, there was a right adnexal mass lesion related to the right ovary suggestive of twisted ovarian dermoid cyst. She underwent urgent surgery which confirmed diagnosis of twisted ovarian dermoid cyst (Fig. 7a–b).

Case 8

A 29 years old female patient presented with acute onset RIF pain for one day duration. She had 3 episodes of vomiting since

then. On examination, there was tachycardia (heart rate: 88/minute). She also had tenderness in the RIF. Her total leucocyte count was 9500/cumm. Clinically she was suspected to have AA and was referred for an urgent USG. Trans-abdominal followed by transvaginal USG revealed a hemorrhagic follicular cyst (Fig. 8) which was tender on probe palpation. The appendix was normal.

Case 9

A 4 year female patient was brought to the emergency department with the history of persistent crying possibly due to pain abdomen for 12 h. On examination, the child had tachycardia and fever (100 °F). She did not allow adequate examination of the right lower quadrant due to pain. There was no obvious palpable/visible lump in the abdomen. A clinical diagnosis of intestinal colic/acute appendicitis was made. USG right iliac fossa with graded compression revealed features of ileocolic intussusception with multiple enlarged mesenteric lymph nodes, which may have acted as lead point (Fig. 9). The child was operated which confirmed ileocolic intussusceptions due to mesenteric lymphadenopathy. The appendix was normal.

Case 10

A 21 year old male patient presented with pain RIF of two days duration. On examination, he was found to have tachycardia (heart rate: 90/min) and fever (99 °F). On local examination, there was deep tenderness at the RIF particularly Mc Burney's point. A clinical diagnosis of AA was made. USG revealed

Fig. 10 – USG RIF demonstrates edema of cecal wall. No other abnormality was detected.

Fig. 11 – USG RIF reveals a blind ending aperistaltic tubular structure with surrounding free fluid.

edema of caecal wall (Fig. 10). The appendix was not inflamed. Based on the USG findings, a diagnosis of acute typhlitis was made. He was treated conservatively with intravenous injection of metronidazole to which he responded. A follow up USG done at 3 weeks later did not reveal any abnormality.

Case 11

A 19 year old female patient presented with acute onset pain in the right iliac fossa for 48 h. On examination she had tachycardia (HR: 104/min). On local examination, there was tenderness and localized guarding at the right iliac fossa. Clinically, she was thought to have AA with localized peritonitis. An USG revealed a blind ending aperistaltic tubular structure in the RIF with surrounding fluid (Figs. 11 and 12a–b). Radiologically, she was diagnosed to have AA with peri-appendiceal leak. She underwent urgent surgery which revealed unruptured tubal ectopic gestation. Histopathology confirmed the diagnosis of tubal ectopic pregnancy.

Discussion

Timely and accurate diagnosis of AA has often been a subject of controversy.¹ Despite having decades of experience and understanding in the field of abdominal imaging, imaging has not yet found an unquestionably established position in the diagnostic algorithm of AA for reasons not known. There are well recognized proponents and opponents about the role of imaging in the diagnosis of AA. Sonography, once thought to be extremely useful in AA,^{2–4} has been losing its luster against CT scan, often at the cost of significant radiation burden. The reason often cited for favoring CT scan over sonography for diagnosing AA is the increased sensitivity and overall accuracy of CT scans. It is also argued often that sonography is an operator dependant technique while CT scan is not which is

Fig. 12 – Post op specimen of the same patient as in Fig. 11: Unruptured tubal ectopic pregnancy (a) The specimen cut open (b) to show inside view of the tubal pregnancy.

not entirely correct. Even today, significant research is in progress to decipher which scoring system and what cut off values are clinically useful for the diagnosis of AA without even mention of the potentially important role of imaging.⁵ If we analyze the components of two of the most commonly used scoring systems e.g. Alvarado score and pediatric appendicitis score, we find that most of the parameters in both these scoring systems are non specific. Even right lower quadrant tenderness and rebound pain need not be necessarily because of AA. The situation gets further complex in females of reproductive age group. The question that naturally comes to our mind is that what are the possible differential diagnoses if not AA in a patient of RIF pain. We firmly believe that imaging has a significant role in this regard. However, such an important aspect of imaging has found very little mention in the literature.^{6–10} Almost every time, imaging has been adjudged on the basis of its ability to diagnose AA accurately, completely undermining its equally important role in excluding a diagnosis of AA as well as suggesting alternative etiology for the patients signs/symptoms. Notably, alternative diagnosis is found in more than 30% of cases of clinically suspected AA which is quite significant. Finding of a non surgical alternative diagnosis may obviate the need for unnecessary surgical intervention and thereby reducing morbidity and health care costs.¹¹

The aforementioned cases illustrate the vital role of imaging in suggesting alternative diagnoses in clinically suspected cases of AA with an interpretive pitfall in the case of unruptured ectopic pregnancy. Surgery could be avoided in most of these patients by virtue of the imaging findings in the appropriate clinical contexts. It is time to reconsider about the important role of imaging in the diagnosis, exclusion of diagnosis of AA, suggesting alternative diagnoses as well as diagnosing combined and coexisting pathologies (although rare) which would help in choosing the most appropriate line of treatment. As suggested from time to time¹² ultrasonography should be used as the front line imaging modality followed by CT scan/MRI in select cases as problem solving tool in the greater interest of the mankind. We strongly feel that there is need to have a re-look into the existing scoring systems for diagnosing AA. It is suggested that, besides clinical judgment, imaging findings may also be incorporated in the scoring systems for AA as is being done for certain laboratory parameters.

Conflicts of interest

The authors have none to declare.

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