

VARIABLE PRESENTATIONS OF ACUTE APPENDICITIS

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ABSTRACT

BACKGROUND

Acute appendicitis is the commonest cause of pain in all age groups, which if not diagnosed and treated can lead to perforation and peritonitis. So early diagnosis and prompt treatment can reduce morbidity and mortality.

Objective- To evaluate the advantage of ultrasound in variable positions and presentation of acute appendicitis.

MATERIALS AND METHODS

We have done ultrasound scanning in 50 patients who presented with pain abdomen. CT evaluation is also done in cases with complications of appendicitis like perforation of appendix and peritonitis.

RESULTS

Ultrasound has a sensitivity of 96% and specificity of 93% in the diagnosis of acute appendicitis.

CONCLUSION

High resolution real time ultrasound with graded compression is a sensitive and specific imaging method for the diagnosis of acute appendicitis and its complications.

KEYWORDS

Acute Appendicitis, Ultrasound, Variable Presentations and Position of Appendix.

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BACKGROUND

Vermiform appendix is a vestigial organ present in humans and apes. It is a blind muscular tube which is morphologically the underdeveloped distal end of caecum.

At birth, appendix is short and broad situated at the junction of caecum. Later during childhood the growth of caecum rotates the appendix to its common retrocaecal position. The appendix sits at the junction of small intestine and large intestine.

Various Positions of Appendix

1. Retrocaecal 43.5%
2. Subcaecal 24.4%
3. Post-ileal 14.3%
4. Pelvic 9.3%
5. Paracaecal 5.8%
6. Pre-ileal 2.4%
7. Situs inversus totalis where you find appendix in left iliac fossa.
8. Rare places like subhepatic which posed a diagnostic dilemma in one case I encountered.

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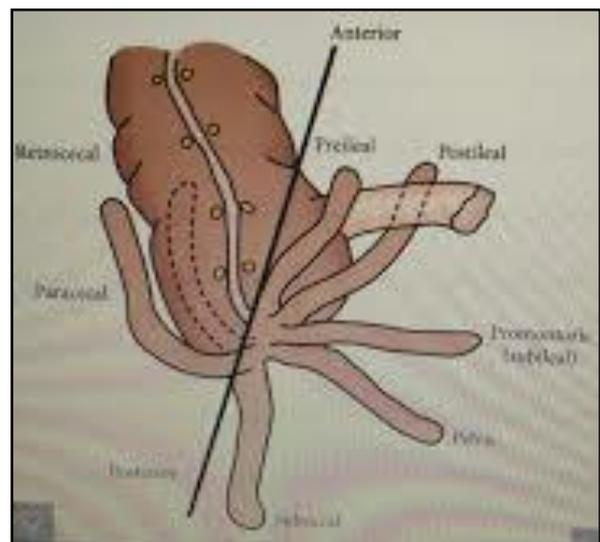


Image 1

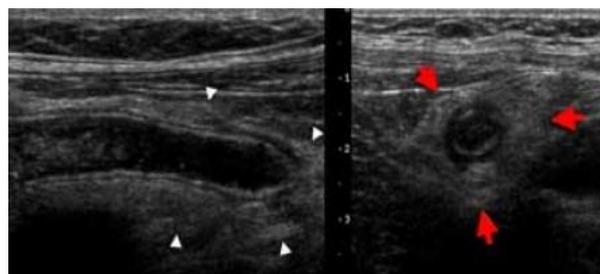


Image 2. LT-A

Image 2. TS-B



Inflamed Appendix

Inflamed appendix at sonography. Longitudinal (A) and transverse (B) cross-section show a distended non-compressible appendix, surrounded by hyperechoic inflamed fat (arrowheads).

Inflamed Appendix

An inflamed appendix has a diameter larger than 6 mm, and is usually surrounded by inflamed fat. The presence of a faecolith or hypervascularity on power Doppler strongly supports inflammation.

Appendicitis is the most common acute surgical condition of the abdomen.¹

Acute appendicitis is the common cause of acute abdomen in nearly all age groups. The clinical presentation of acute appendicitis is usually typical in 70% of cases. But different positions and presentations make preoperative diagnosis inconclusive leading to unnecessary laparotomies.

Appendicitis is usually caused by a bacterial infection, although the reason the appendix becomes infected is unknown.

The appendix may become obstructed by a lump of faeces, calcium salts, and faecal debris (called faecoliths) or tumours (rarely), leading to inflammation and infection.

Swelling and inflammation lead to infection, blood clot, or rupture of the appendix.

Lymphoid hyperplasia is associated with inflammatory and infectious disorders such as Crohn's disease, measles, amoebiasis, gastroenteritis, respiratory infections, and mononucleosis.

The study was conducted in 50 cases of patients with suspected appendicitis. Ultrasound was performed using a real time scanner with 6.5 and 10 MHz transducers. During examination gradual compression was applied to the area of interest via the transducer.

The area of greatest abdominal tenderness is localised and gradually compressed to displace the bowel and obscuring bowel gas. Ultrasound is done to visualise the tip of caecum, the psoas muscle and iliac vessels which are the landmarks in the area of appendix.

Herbert Fitz was the first author to publish on the need for early diagnosis and surgery for acute appendicitis.² Percussion tenderness, guarding, and rebound tenderness are the most reliable clinical findings indicating a diagnosis of acute appendicitis.³

To visualise the subhepatic and retrocaecal appendix, scanning is done through the sagittal plane through the abdominal wall and in horizontal plane from the right lateral position. Total abdomen was scanned to look for additional/alternative diagnosis.⁴

U/S diagnosis of acute appendicitis is based on non-visualisation of appendix in 95% and visualisation of the normal appendix in 5%.

The normal small bowel loops are seen as tubular structures with mucosal folds, thin hypoechoic (walls measuring 2 mm) and peristalsis. The colon is seen as a large tubular structure with haustra, occasional peristalsis and wall thickness of 5 mm. The inflamed appendix is seen

as sausage shaped, blind ending structure on longitudinal imaging/target lesion on transverse imaging. The inflamed appendix is rigid, non-compressible measuring 3-10 mm in diameter. You can visualise periappendicular fluid collection in perforated appendix. Sometimes an appendicolith is seen as an echogenic structure.

Differential Diagnosis

Mesenteric lymphadenitis- Mesenteric lymphadenitis is a common mimicker of appendicitis.

It is the second most common cause of right lower quadrant pain after appendicitis.

It is defined as a benign self-limiting inflammation of right-sided mesenteric lymph nodes without an identifiable underlying inflammatory process, occurring more often in children than in adults.

This diagnosis can only be made confidently when a normal appendix is found, because adenopathy also frequently occurs with appendicitis.

Bacterial Ileocaecitis

Infectious enterocolitis may cause mild symptoms resembling a common viral gastroenteritis, but it may also clinically present with features indistinguishable from appendicitis especially in bacterial ileocaecitis, caused by Yersinia, Campylobacter, or Salmonella.

Right-sided Diverticulitis

Right-sided colonic diverticulitis may clinically mimic appendicitis or cholecystitis, though the patient's history is generally more protracted.

In contrast to sigmoid diverticula, right-sided colonic diverticula are usually true diverticula, i.e. outpouchings of the colonic wall containing all layers of the wall.

This may possibly explain the essentially benign self-limiting character of right-sided diverticulitis.

Salpingitis

Salpingitis is a common mimicker of both of appendicitis and diverticulitis.

Transvaginal sonography depicts an inhomogeneous enlarged inflamed ovary.

Epiplonic Appendagitis 1

CT characteristic of epiplonic appendagitis with a right-sided fatty mass surrounded by a hyperattenuating ring.

Epiplonic appendages are small adipose protrusions from the serosal surface of the colon.

An epiplonic appendage may undergo torsion and secondary inflammation causing focal abdominal pain that simulates appendicitis when located in the right lower quadrant or diverticulitis when located in the left lower quadrant.

The characteristic ring-sign corresponds to inflamed visceral peritoneal lining surrounding an infarcted fatty epiplonic appendage.

Epiplioic Appendagitis 2

Left-sided epiplioic appendagitis in a patient clinically suspected of having a diverticulitis. Characteristic hyperattenuating ring sign.

Epiplioic appendagitis has been reported in approximately 1% of patients clinically suspected of having appendicitis.

It is very important to make a positive diagnosis of this characteristic entity since epiplioic appendagitis is a self-limiting disease.

Both U/S and CT will depict an inflamed fatty mass adjacent to the colon.

Key Finding- Inflamed fatty mass adjacent to the colon with characteristic ring sign.

Urolithiasis- Small stone in right ureter (arrow) causing right flank pain.

Urolithiasis often causes flank pain, but a ureteral stone (arrowhead) may occasionally present with clinical signs simulating appendicitis, cholecystitis or diverticulitis.

Appendicitis on the other hand may cause haematuria, pyuria and albuminuria in up to 25% of patients because of ureteral inflammation from an adjacent inflamed appendix.

Ruptured Aneurysm

Left retroperitoneal fluid collection due to ruptured aneurysm.

Ruptured Aneurysm- Most abdominal aortic aneurysms rupture into the left retroperitoneum.¹

Clinically, this may simulate sigmoid diverticulitis or renal colic due to impingement of the haematoma on adjacent structures.

However, most patients will present with the classic triad of hypotension, a pulsating mass and back pain.

Continuous leakage will lead to rupture into the peritoneal cavity and eventually death.

Sonography is a quick and convenient modality, but it is much less sensitive and specific for the diagnosis of aneurysmal rupture than CT.

The absence of sonographic evidence of rupture does not rule out this entity if clinical suspicion is high.

Pancreatitis- Pancreas surrounded by fat stranding due to exudative pancreatitis.

Pancreatitis- CT depicts fat-stranding (arrowheads) surrounding the primary focus of the inflammation: the pancreas.

I want to share few cases of acute appendicitis that I encountered in my practice.

Case 1 Subhepatic Appendicitis

Complete non-descent of the caecum and appendix with its characteristic anatomical variance is significant as the source of appendicitis as cited below.⁴

One of the early cases of subhepatic appendicitis was reported by King in 1955.⁵

Liver abscess as a complication of appendicitis was first described in 1898 by Dieulafoy. Usually it is a solitary liver abscess, located in the right lobe with a frequency five times higher than the location in the left lobe.^{6,7}

A patient presented to the casualty with pain abdomen since four days, fever and vomiting. During ultrasound examination, appendix was not visualised in RIF. There was probe tenderness in right hypochondrium and epigastrium. The lateral wall of gall bladder was thickened mimicking a case of acute cholecystitis. CT scan was also done in this case which showed thickened gall bladder wall and free air in the subhepatic region. The patient was taken for an emergency laparotomy. It was a subhepatic appendix adherent to the gall bladder. It was a case of acute appendicitis with perforation.⁸

Abdominal CT is frequently required for diagnostic clarification of abdominal pain in the elderly or a non-typical case.⁹ The technique is excellent for diagnosing acute appendicitis, with sensitivity being 88–100%, specificity 92–98%, positive predictive value 86–98% and negative predictive value 95–100%.¹⁰ In situations where abdominal CT is inconclusive, clinical diagnosis of appendicitis remains doubtful and the patient remains clinically unwell, a diagnostic laparoscopy is recommended.¹¹

After cholecystitis, appendicitis is the second most frequent indication for abdominal surgery in late adulthood and the elderly.⁹ Multiple comorbidities, complex medication regimens and altered pathophysiological responses contribute to non-typical symptoms and signs as well as delayed diagnosis. Physical findings and investigations in early disease can be misleading.¹² Although appendicitis is a frequent cause of surgical abdominal disease in late adulthood, it is difficult to diagnose with only half of patients aged more than 50 years receiving the correct diagnosis at first presentation in one prospective study.⁹

The relatively high incidence of appendicitis in the general population and the increasing numbers of older adults in the developed world are expected to increase the burden of appendicitis in the elderly. Rarely reported primary subhepatic and other unusually located appendicitis may lead to diagnostic delays at any age, especially in the elderly. Early utilisation of abdominal CT scanning may help in establishing earlier diagnosis.*



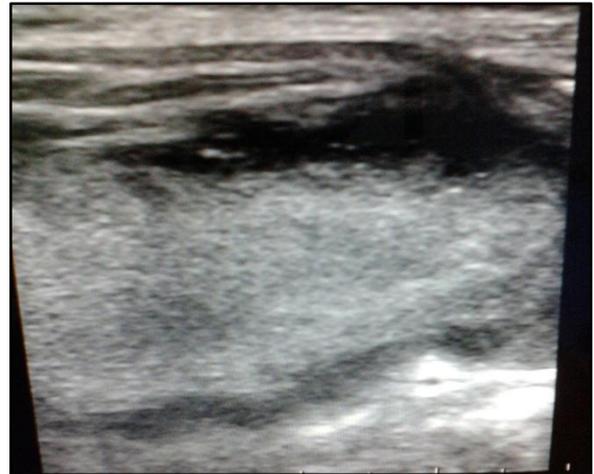
Image 3

**Image 4****Image 5**

transrectally or transvaginally. Retrocaecal appendicular abscess is drained retroperitoneally. Some patients may require open surgical drainage (laparotomy). The abscess drainage is supported with antibiotic therapy.

Patients with smaller abscesses who are in good condition may be managed initially with antibiotics alone. Patients showing no response may then require drainage of the abscess.

Poor management or rupture of an appendicular abscess can lead to more dangerous generalised peritoneal infection (peritonitis).

**Image 6**

Case 2 Appendicular Mass

Another case was an appendicular abscess. The patient presented with vague abdominal pain since 10 days and fever. There was probe tenderness in RIF. A hyperechoic mass was identified in RIF.

An appendicular abscess is a collection of pus resulting from perforation or rupture of acutely inflamed appendix. The pus remains localised close to the appendix, because it is walled off by adhesions formed by the surrounding abdominal structures.

Surgery revealed it to be appendicular abscess. Earlier treatment for appendicular mass was conservative followed by delayed appendicectomy. But early surgical exploration confirms the diagnosis, cures the problem, reduces the cost of management, shortens the convalescence and gives a good satisfactory outcome.¹³

The diagnosis of appendicular abscess is based on the clinical history, clinical features and investigations. Blood investigations show an increase in the white blood cell count. X-ray can sometimes show the presence of an abscess although ultrasound and CT scan are the more commonly used radiological investigations to confirm presence of abscess and to assess the size.

Treatment of an Abscess in the Appendix

Patients with abscess larger than 4 cm size and a high fever are usually managed with drainage of abscess. The abscess is drained after localising it radiologically. Drainage can be done through the rectum (transrectal), through vagina (transvaginal) or through the skin (percutaneous) depending on the location. An appendicular abscess in pelvis is drained

Case 3 Appendicitis with Appendicolith.

The appendicolith is formed by firm, dense stool and mineral deposits. It is also known as appendiceal calculi, appendiceal enterolith or appendicular lithiasis. Appendicoliths are usually seen in paediatric populations and young adults. They are detected more frequently in men.⁸ As a nidus for appendicolith, the prevalence of faecolith has been reported as 3% in the population by Jones et al. They also stated that the low-fibre diet has been associated with increased risk of faecolith formation.¹

A 21-year-old male patient presented in OPD with complaints of abdominal pain since 5 days associated with nausea and vomiting. Initially pain was periumbilical, later localised to RIF. O/E patient was conscious and coherent. There was McBurney point tenderness. Abdomen was rigid. Blood investigation showed leucocytosis (17,213; neutrophils 81%). Ultrasound and CT scan showed appendicitis with appendicolith. Laparoscopy was done. There was perforated appendix with peritonitis. Open laparotomy was done, perforated appendix removed and peritoneal lavage done.

Appendicolith is a conglomeration of firm faeces with some mineral deposits. It is usually found accidentally in abdominal computed tomography (CT) without any signs of appendicitis. Appendicolith may obstruct the appendix lumen, causing appendicitis and is found in approximately 10% of patients with appendix inflammation.¹⁴ Appendicitis which is caused by appendicolith is more commonly associated with perforation and abscess formation.

Appendicoliths are more commonly encountered after the development of imaging techniques in recent decades. They can present with different clinical symptoms. Most of the patients with appendicoliths are asymptomatic. However, appendicoliths may also cause serious appendicular inflammation and peritonitis. In this study, we reported three patients who had been operated on for appendicitis, caused by appendicolithiasis.



Image 7

Case 4. Acute Appendicitis with Appendicolith

Patient presented with abdominal pain since 2 days associated with vomiting. The vomitus was greenish in colour. Tenderness was present all over the abdomen more in RIF. On ultrasound evaluation, appendix was oedematous and there was evidence of appendicolith. CT scan of the same patient showed appendix which is enlarged with wall thickening, associated appendicolith and periappendicular collection.

Case 5. Acute Appendicitis

A 21-year-old male presented in OPD with pain abdomen since 2 days and vomiting. U/S shows thickening of appendicular wall of 8 mm with periappendicular collection. CT scan was not done as the diagnosis was clear. Laparoscopy was done and inflamed appendix removed.

RESULTS

A negative ultrasound diagnosis of acute appendicitis is based on non-visualisation of appendix/visualisation of normal appendix. Among 50 patients who presented with features of acute pain abdomen, fever and vomitings were subjected to ultrasound examination, 42 people had appendicitis who underwent surgery and histopathological examination proved it. One patient who was diagnosed to be a case of acute cholecystitis turned out to be a case of subhepatic appendicitis. One patient presented with appendicular abscess. False positive diagnosis was made in one patient, which proved negative on laparotomy. There

was no evidence of appendicitis in 5 patients. Thus, U/S is a useful imaging modality in the diagnosis of appendicitis.

DISCUSSION

We have evaluated 50 patients who presented with symptoms of acute abdominal pain, fever and vomiting, subjected to ultrasound examination. 45 patients were typical and had no diagnostic problem. High resolution, real time U/S is a noninvasive diagnostic modality which enables direct visualisation of inflamed appendix and periappendicular abscess. In healthy individuals, appendix usually cannot be visualised. U/S also allows alternative diagnosis to be made, thus increasing the overall usefulness in the management of these patients.

Subhepatic appendicitis was misdiagnosed as acute cholecystitis. Unexpectedly there was inflamed appendix adherent to gall bladder.

CONCLUSION

High resolution real time U/S with graded compression is a sensitive and specific imaging method for the diagnosis of acute appendicitis and its complications. Ultrasound examination of total abdomen helps to diagnose alternative pathologies. U/S examination of total abdomen and pelvis is done in all patients presenting with pain abdomen to diagnose different problems like torsion of ovarian cyst in a young woman. The triad of symptoms, signs and ultrasound examination significantly reduces the rate of unnecessary laparotomies in patients with an equivocal diagnosis of appendicitis.

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