

# **SIMPLE GUIDE FOR SONOLOGICAL EVALUATION OF APPENDICITIS**

**A Case Study by Dr. Avni K P Skandhan, India**

*(Consultant Radio Diagnosis, Malabar Institute of Medical Science, Malappuram, Kerala)*

*Email: avniskandhan@gmail.com*

## **ABSTRACT**

Appendicitis is one of the commonest causes of emergency department visits. Though it is a common pathology and has classical clinical features, yet it often presents atypically. In such cases, the diagnosis is a dilemma especially as there are many close mimics and these are the cases where imaging helps and ultrasound often is the first to be undertaken. However ultrasound is largely operator dependent and frequently provides false negative result. These may be overcome to a large extent by following a systematic methodology of looking for the pathology. Based on a review of the articles a basic picture especially for beginners is presented here.

## **INTRODUCTION**

Appendicitis happens to be the commonest cause of acute abdominal pain <sup>1</sup>. The classical symptomatology is of RIF pain, low grade fever and vomiting and on examination Mc Burney's point tenderness and peritoneal signs may be elicited with leucocytosis <sup>1</sup>. Given this the diagnosis is straight forward, however a large number of cases do not present classically and also there are many mimics <sup>2</sup>. The delay in diagnosis may lead to a progression of the simple appendicitis into perforation, abscess formation, peritonitis, bowel obstruction which has a higher morbidity and mortality <sup>3</sup>.

Imaging helps in confirming appendicitis and to exclude other mimics, in cases where the diagnosis cannot be made clinically. Although these days role of CT in diagnosing appendicitis is being promoted, the primary imaging investigation remains ultrasound mainly as it is easily accessible, affordable and is radiation free <sup>4</sup>.

Ultrasound has the major drawback of being largely operator dependent, and thereby there are a large false negative cases. Also in retro cecal appendix, obese patients, muscular patients, gaseous bowel distension, and poor machine resolution the pickup rates are very low <sup>5</sup>. Considering all this ultrasound may be used as the primary screening modality especially in children and pregnant ladies which may be followed up by a CT scan in cases of persistent doubt.

## **SONOLOGICAL EVALUATION**

For appendix evaluation it is necessary to use a linear ( 7 – 10 MHz ) probe <sup>5</sup>. The diagnostic pitfalls in diagnosis of acute appendicitis are presence of tip / segmental appendicitis, retro cecal appendicitis, pelvic appendicitis, sub hepatic appendicitis, spontaneous resolution of appendicitis and mimics of appendicitis <sup>6</sup>. To overcome these a systematic approach could be employed. The best technique for evaluating an appendix sonologically is to examine the RIF and locate the cecum or ileocecal junction and then to locate the origin of the appendix from the cecum. Other ways of doing this are to ask the patient to point to the area of maximum tenderness and do a thorough search in this self localized area <sup>5</sup>. Regions to specifically look for are the pelvic brim where usually the appendix drapes over the illiac vessels, posterior to the terminal ileum and anterior to the illiacus muscle.

Various techniques to improve visualization <sup>6,7,8</sup>:

- Transverse and longitudinal scanning of RIF with patient in supine position
- Gentle graded compression by the probe to push the gas filled loops aside.
- Review areas to be seen are :
  1. Pelvis ( where the pelvic appendix could be found)
  2. Umbilical area (long appendix with tip in umbilical quadrant )
  3. Sub hepatic region (long sub hepatic appendix)
  4. Lateral aspect of the cecum (para cecal appendix )
- Posterior manual compression technique employs external compression at the back of right lower quadrant by placing patients hand behind the back, which brings the cecum closer to the anterior abdominal wall and transducer.
- Left oblique lateral decubitus position may be used. The bowel loops fall forwards in such a position, increasing chances of retro cecal appendix being picked up by looking specifically in the pre psoas region.
- Convex probe should be used to screen the pelvis for a pelvic inflammatory focus. Transvaginal scan may be employed to look actively for pelvic appendicitis.

## **CRITERION FOR TERMING APPENDICITIS <sup>8</sup>:**

1. Caliber of the appendix greater than 6 mm
2. Hypoechoic, non compressible and non peristaltic appendix.
3. Hyperemia in the wall of the appendix
4. Presence of appendicololith
5. Should be traced entirely to locate segmental appendicitis or a breach in the wall <sup>9</sup>.

Indirect evidences pointing to the presence of an underlying appendicitis.

- Cecum and distal ileum may show inflammatory changes
- Periappendiceal mesentric fat inflammation
- Free fluid with contents within in the RIF
- Clumping of bowel loops in illeocecal region.

Specific situations that one may encounter are:

1. **Stump Appendicitis** : A patient who has undergone appendectomy may present with similar complaints in the future. These cases are a diagnostic dilemma and the possibility of a rare entity like stump appendicitis must be borne in mind. A stub of residual appendix is seen showing signs of inflammation.

2. **Left sided appendicitis** : Left sided appendix may be seen in a patient who have malrotation of the gut, however this is extremely rare. A blind ending, non compressible, non peristaltic, tubular structure with features of inflammation if identified in the LIF should suggest the possibility of a left sided appendicitis, especially if the malrotation can be demonstrated by reversal of the SMA and SMV relation.

3. **Appendicitis in Pregnancy** : During pregnancy, due to underlying physiological and structural changes most often the patients do not present with the classical clinical picture. The diagnosis solely lies on ultrasound in such cases, as it is advisable to avoid CT in these patients. A complete screening of the right sided abdomen should be done as the gravid uterus displaces the bowel loops aside.

#### MIMICS OF APPENDICTIS <sup>1, 10, 11, 12</sup> :

1) **Mesentric Adenitis** : Mostly seen in pediatric age group. The patients have multiple enlarged mesentric lymph nodes in the RIF and periumbilical region, with the short axis of the significant lymph nodes measuring more than 6 mm.

2) **Right ovarian torsion**: An ovarian mass with loss of adnexal vascularity is demonstrated with minimal free fluid in the POD.

3) **Right sided ectopic** : A pregnant female with absence of an intrauterine gestation sac and presence of an adnexal mass /extra uterine gestation sac /tubal ring are suggestive.

4) **Intususception** : A bowel mass with a classical target appearance and demonstration of one bowel loop invaginating into another.

5) **Ileo cecitis** : The terminal ileum and / or cecum appear hypo dense with wall thickening suggestive of inflammation.

6) **Salpingitis** : On trans vaginal USG probe tenderness with POD fluid is noted. There may or may not be a dilated salpinx.

7) **Ruptured ovarian cyst** : Hemoperitoneum and an adnexal haematoma may be visualized. At times the collapsed cyst may be demonstrated.

8) **Epiploic appendagitis** : A focal area of mesentric fat inflammation is noted with probable demonstration of the epiploic appendage within the inflamed fat. CT is the preferred mode of imaging.

9) **Caecal diverticulitis** : Cecal wall thickening with adjacent fat inflammation may be noted. An abscess may also be demonstrated.

10) **Crohn's disease** : Terminal ileum appears thickened and can be differentiated from appendix by demonstrating a lack of a blind end. Peristalsis also can be seen in the ileal loop.

## SUMMARY

Appendicitis is one of the commonest causes of emergency surgeries. When evaluating a patient with RIF pain various pathologies should be borne in mind. In a case of clinical dilemma an ultrasound can be carried out as the first modality of screening. The rate of picking up an inflamed appendix increases when a targeted search is made in a systematic manner; however non visualization of the same does not indicate a normal scan. The inter observer variability could be overcome to a large extent by following a correct and methodical approach. Other mimics of appendicitis should be specifically looked for and on a negative scan with persistence of doubts a contrast enhanced CT scan should be carried out. Delay in diagnosis may lead to various complications of appendicitis like perforation, peritonitis and bowel obstruction.

## REFERENCES

1. Fox, J. C., Solley, M., Anderson, C. L., et al (2008). Prospective evaluation of emergency physician performed bedside ultrasound to detect acute appendicitis. *Eur. J. Emerg. Med.*;15(2),80-5.
2. Han, T. I (2002). Sonographic visualization of the appendix with a saline enema. *J. Ultrasound Med*, 21, 511-6.
3. Han, T.I (2002). Improved Sonographic Visualization of the Appendix With a Saline Enema in Children With Suspected Appendicitis. *J Ultrasound Med*, 21,511–516.
4. Jeffrey, R. B., Jain, K. A., Nghiem, H. V(1994). Sonographic diagnosis of acute appendicitis: interpretive pitfalls. *Am. J. Radiol.*;162:55-9.
5. Lee, J. H., Jeong, Y. K., Park, K. B., Park, J. K., Jeong, A. K., Hwang, J. C (2005). Operator-dependent techniques for Graded Compression Sonography to Detect the appendix and Diagnose Acute Appendicitis. *American Journal of Roentgenology*,184, 91-97.

6. Old, J. L., Dusing, R. W., Yap, W., Dirks, J (2005). Imaging for Suspected Appendicitis. *Am Fam Physician*, 71(1):71-78.
7. Rioux, M (1992). Sonographic detection of the normal and abnormal appendix. *Am. J. Roentgenol*, 158, 773-8.
8. Sharma, M., Agrawal, A(2008). Pictorial essay: CT scan of appendicitis and its mimics causing right lower quadrant pain. *Indian J Radiol Imaging*, 18(1), 80–89.
9. Shin, L. K., Jeffrey, R. B (2010). Sonography and computed tomography of the mimics of appendicitis. *Ultrasound Q*,26(4),201-10.
10. Tauro, L. F., Premanand, T. S., Aithala, P. S., George C., Suresh, H. B., Acharya, D., John, P(2009). Ultrasonography Is Still A Useful Diagnostic Tool In Acute Appendicitis. *Journal of Clinical and Diagnostic Research*, 3, 1731-1736.
11. Trout, A. T., Sanchez, R., Ladino-Torres, M. F., Pai, D. R., Strouse, P. J(2012). A critical evaluation of US for the diagnosis of pediatric acute appendicitis in a real-life setting: how can we improve the diagnostic value of sonography? *Pediatr Radiol*, 42(7), 813-23.
12. Vriesman, A. V. B., Puylaert, J. B (2006). Mimics of Appendicitis: Alternative Non surgical Diagnoses with sonography and CT. *Am Jo of Roentgenol*, 186,1103-1111.

**Figures :**

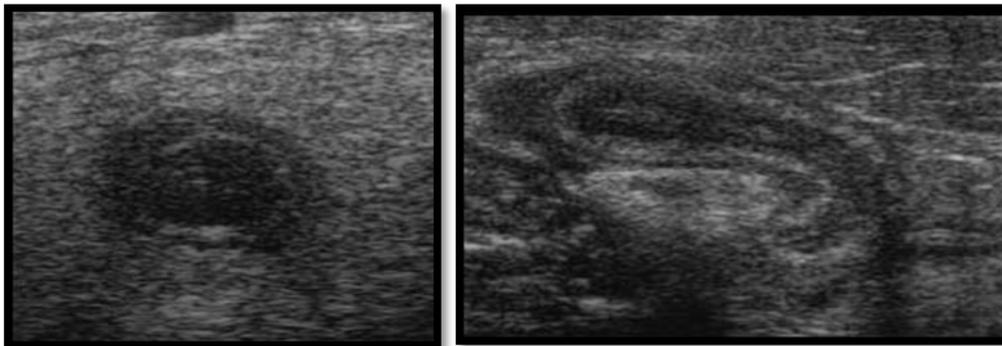


Figure 1a

Figure 1b

Figure 1a and 1b : Inflamed appendix on transverse and longitudinal sections : Hypoechoic and blind ending tubular structure

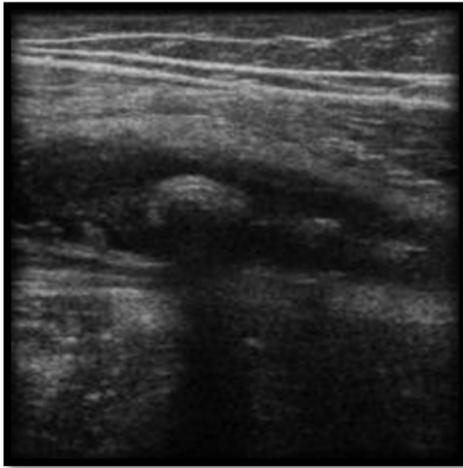


Figure 2: Hyperechoic, shadowing structures noted within appendiceal lumen suggestive of appendicolith.

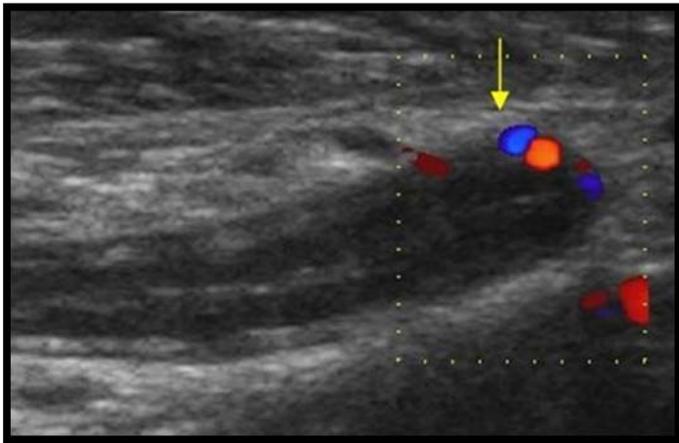


Figure 3 : Lonitudinal image of the appendix with increased vascularity