Appendicitis: a pictorial essay

Stewart Seow

Department of Nuclear Medicine and Ultrasound, Westmead Hospital, Westmead, New South Wales 2145, Australia.
Correspondence to author via ASUM. Email authors@asum.com.au.

Abstract: Appendicitis is a common disorder which requires careful diagnosis to avoid complications. Ultrasound is being increasingly used for diagnosis because of its ease and simplicity. In this series, a range of abnormal findings are presented, as well as useful teaching points on technique and pitfalls.

Fig. 1: Normal appendix.

Fig. 2: Normal appendix.

Fig. 3: Bowel.

Normal appendix

Fig. 1: A normal appendix is seen in this patient with right iliac fossa pain; a pelvic ultrasound later demonstrated an ovarian cause for the patient's symptoms.

The appendix can usually be located at the base of the ascending colon and requires gentle graded transducer pressure to displace bowel from the region of interest. In this example, the appendix is found anterior to the external iliac vessels. Note the blind-ending nature of the appendix and its normal thickness.

Fig. 2: A normal appendix is easily compressible, non tender and with a mucosal thickness of < 6 mm as in this case.

Bowel

Fig. 3: An image of the small bowel, which could be mistaken for the appendix. Careful surveillance of this structure over several minutes should reveal normal peristalsis and confirm that it is not truly blind-ending.

Fig. 4: Acute appendicitis.

Acute appendicitis – position

Fig. 4: This image demonstrates one of the typical positions that the appendix can be found, namely draping over the right iliac vessels; it extends medially from the ileocecal region towards the umbilicus or pelvis. It is best identified by finding the ascending colon and then moving the transducer inferiorly toward the right iliac fossa. In my experience it is possible to distinguish between small and large bowel by virtue of their different gas patterns (small bowel is associated with more crisp posterior acoustic shadowing and large bowel tends to have more “dirty” shadowing). In the above example the appendix is abnormally thickened.

Acute appendicitis – positions

Fig. 5: This image shows that the position of the appendix can vary; the appendix has a retro-cecal position and is directed anteriorly. Rather than draping over the external iliac vessels,

Fig. 5: Acute appendicitis positions.

Fig. 6: Acute appendicitis positions.

Fig. 7: Acute appendicitis positions.

Fig. 8: Graded compression.

Fig. 9: Acute appendicitis fat oedema.

Fig. 10: Acute appendicitis – free fluid (right iliac fossa).

the appendix is deeper and more medial in this case. Note the abnormal thickness (8 mm). Retrocecal appendices occur in about 15–20% of cases; in my experience, these require more constant transducer pressure to detect.

Acute appendicitis – positions

Fig. 6: This is another example of a retrocecal appendix; note its origin deep to the cecum (C) and its location posterior to the iliac vessels. Again, the appendix is abnormally thickened.

Acute appendicitis – positions

Fig. 7: This image shows a retrocecal appendix, but in this case its orientation is more cranially directed; the aperistaltic

and blind ending nature of the structure confirms that it is the appendix. There is an abnormal thickness and no compressibility with gentle transducer pressure.

Graded compression

Fig. 8: This image demonstrates an inflamed appendix that is non compressible. Non compressibility is an important ultrasonographic finding. It is important to include either a split-screen or series of images which confirms the response of the appendix to compression.

Acute appendicitis – fat oedema

Fig. 9: This image shows peri-appendiceal fat oedema.

Fig. 11: Acute appendicitis – free fluid pelvis.

Fig. 12: Acute appendicitis – fecolith.

Fig. 13: Acute appendicitis – colour Doppler.

Fig. 14: Lymph nodes.

Often, it is possible to detect inflamed fat adjacent to the inflamed appendix and this is a useful ancillary finding.

Acute appendicitis – free fluid (right iliac fossa)

Fig. 10: Free fluid is another important ancillary finding and should be specifically sought in the right iliac fossa or pelvis. In this example, there is a moderate amount of free fluid in the right iliac fossa.

Free fluid-pelvis

Fig. 11: Echogenic fluid is seen in the pelvis on a transvaginal scan, in a patient who had a ruptured appendix.

Acute appendicitis – fecolith

Fig. 12: This image demonstrates a fecolith within the lumen of the appendix; in my experience this is seen in at least 50% of cases of appendicitis. However, it requires careful inspection of the entire appendix and is usually located proximally to the inflamed portion of the appendix. Accordingly, it may be difficult to demonstrate in a retrocecal appendix.

Acute appendicitis – colour Doppler

Fig. 13: Increased vascularity is seen in association with appendicitis. Colour Doppler can be useful, it may disclose increased vascularity in the mucosa, as in this case. I use low filter settings and/or amplitude imaging. However, it is rare to see abnormal vascularity in proven cases of appendicitis; this could reflect the fact that the depth of the appendix can reduce the sensitivity of colour Doppler or that many cases of appendicitis are mild in nature.

Lymph nodes

Fig. 14: In some cases of confirmed appendicitis, it is possible to identify mesenteric lymph nodes in the right iliac fossa. Although mesenteric adenopathy can be an alternative cause of acute right iliac fossa pain, the identification of an abnormal appendix in this case suggests that the lymph nodes are reactive in nature.

Take home messages

Appendicitis is an important cause of acute abdominal pain. Ultrasound is increasingly being employed as a first line imaging modality.

The appendix can be identified in about two-thirds of cases using a patient graded compression approach and high frequency linear transducer (usually ~8-9MHz). It usually takes 5–10 minutes to conduct an appropriate assessment.

The appendix is aperistaltic and blind-ending and usually located anterior to the external iliac vessels. However, retrocecal appendices have a deeper lie and variable orientation and these require slightly more transducer pressure to identify.

Appendicitis is associated with an abnormal thickness, tenderness and non-compressibility with gentle pressure. In some cases, one can also see a fecolith, increased mucosal vascularity, inflamed peri-appendiceal fat, free fluid and regional lymphadenopathy.