APPENDIX ULTRASOUND PROTOCOL (UABDL)

PATIENT PREP: Empty bladder

PATIENT POSITIONING: Supine and LLD (LLD increases the chance finding retrocecal appendicitis).

EQUIPMENT: Real-time and static images obtained using a linear array 8.0-15 MHz transducer, determined by the patient's body habitus.

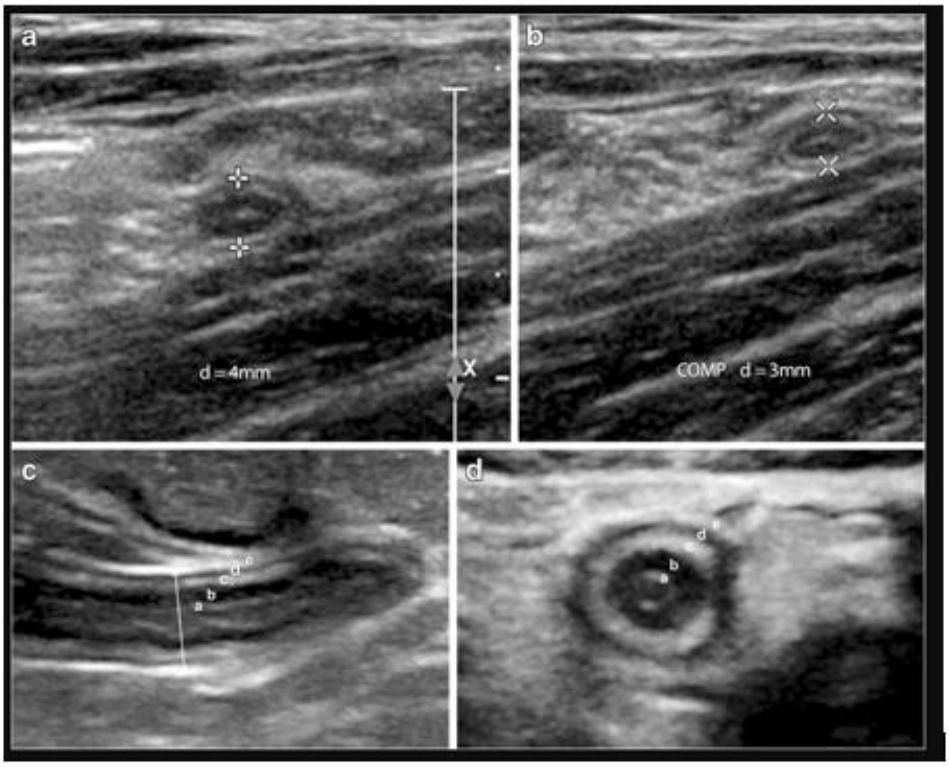
IMAGES TO OBTAIN

If no appendix is seen:

- Sagittal sweep through RLQ showing the area of the psoas and ascending colon
- Transverse cine sweep of RLQ from superior to inferior

If appendix is seen:

- 2D images of appendix in sagittal (of organ) showing its origin at cecum and that it is a blind ending structure.
- Cine clip of structure showing no peristalsis.
- 2D image of appendix in transverse (of organ)
- 2D image with compression of appendix in transverse - Use dual screen for with and without compression comparison.
- 2D image measuring thickness of the compressed appendix from hypoechoic outer to hypoechoic outer margins. (In the image below, it would include layers "a-d" on both sides, not including the outer serosa/echogenic layer "e"). Normal appendix thickness is <6mm AFTER compression.
- Color doppler image showing vascularity looking for hyperemia
- Document enlarged lymph nodes, free fluid or fat stranding in the area



To measure thickness of appendix - Include layers "a-d" on both sides, not including the outer serosa/echogenic layer "e."

PROCEDURE:

The right lower quadrant is imaged in sagittal and transverse planes. The cecum is scanned to visualize the appendix. It is crucial to compress the tissues since one of the criteria for appendicitis is the inability to compress a round structure in the right lower quadrant. Color Doppler or Power Doppler is used to document for circumferential flow.

Listed below are the various diagnostic criteria for appendicitis:

Positive Rebound Tenderness	**Non-compressible**	**Appendicolith(s)**
Free Fluid in RLQ	**Fatty Stranding**	**Circumferential color Doppler flow**
Reactive Lymph Nodes	**Overall diameter > 6 or 7mm in transverse after compression**	**Abscess**

LOCATING THE APPENDIX:

When looking for the appendix, it is helpful to have a constant landmark to refer back to. These techniques are not full proof, but they can help in finding a majority of appendices in an average patient.

1) In transverse plane, at the inguinal canal find the iliopsoas muscle just lateral to iliac vessels.

(White arrow is pointing to the iliopsoas muscle just lateral to iliac vessels)

2) Turn sagittal on the iliopsoas muscle and go straight up the pelvis, the ascending colon, dense with air, will be seen.

(Sagital image of iliopsoas muscle with cecum/proximal ascending colon)

3) Stop when beginning of ascending colon is visualized.

a) In sagittal plane, go far lateral with the probe until you are all the way out of the colon, and start scanning medially with gradual increase in pressure until you are out of the colon, and get into small bowel.

b) Keep depth to where the iliopsoas muscle is always showing.

4) A small, round, non peristalsing, bulls eye structure will appear lying over the iliopsoas muscle.

a) A part of the appendix will always be seen over the muscle.

b) If not visualized, keep moving further up the colon scanning from lateral to medial with gradual increase in pressure.

(a) Keep an eye on the space between iliopsoas muscle and colon the further up you go.

(When sagittal to the body, most commonly, the appendix will be seen in cross section, whereas in transverse to the body the appendix's length is seen - A.White arrow is pointing to a cross section of the appendix over the iliopsoas muscle. B. black arrow is pointing to the terminal ileum before connecting to cecum.)

5) Follow the round, bulls eye structure, keeping it in cross sectional plane for makes it easier to follow it, to find and confirm presence of a blunt end.

(Black arrow is pointing to the tip of the appendix)

6) From tip you can follow appendix back to find connection to cecum end.

a) It is normal to see air in the appendix, also fecaliths have been noted in a normal appendix.

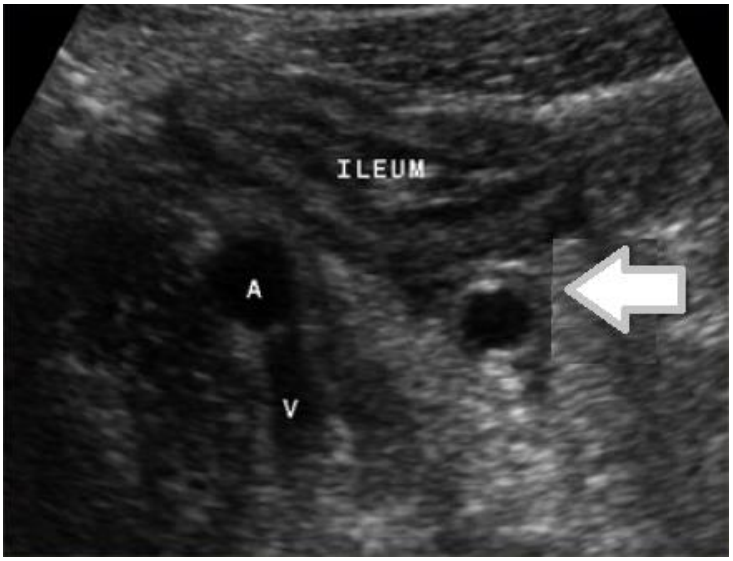
(White arrow is pointing to appendix as is joins to the cecum)

7) If you see colon just as you turn on the iliopsoas muscle, there is a high probability the appendix is in the deep pelvis.

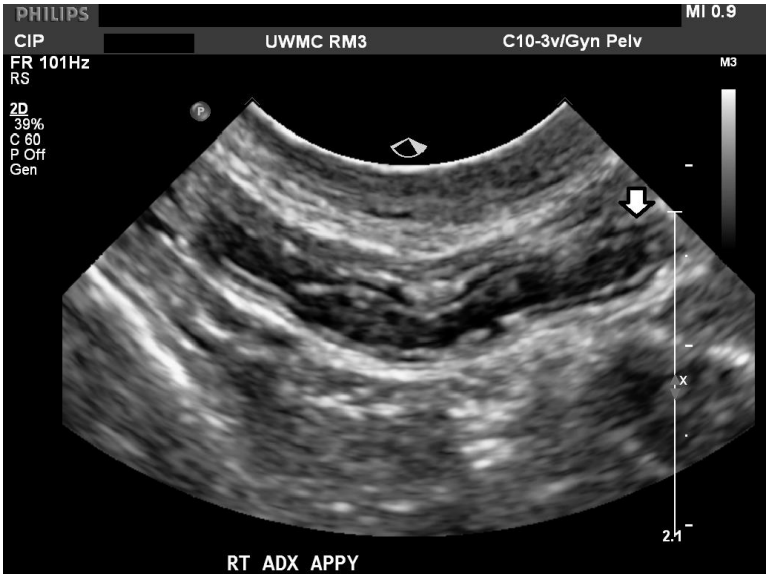
a) Trendelenberg the patient very steeply to see if that may move the appendix up towards the probe.

8) Transvaginal ultrasound can be a good 2nd option for a deep appendix in a female patient.

b) Scanning transvaginally
   i) Find right ovary in transverse plane.
   ii) Start scanning superior and lateral to the right ovary and gradually move down inferior.
   iii) Look for a bulls eye, non peristalsing, structure and try to follow it to towards a blunt end.



(White arrow *points to cross sectional image, non peristalsing, fluid filled, bowel loop far lateral and superior to right ovary*)



(White arrow pointing to blunt ended tubular structure in the right adnexa)

APPENDIX PROTOCOL HISTORY

	Date	Changes made	By whom
Updated	02/2022		Becky Marion
Reviewed	08/2022	No changes	Renee Betit Fitzgerald