



APPENDIX ULTRASOUND PROTOCOL (UABDL)

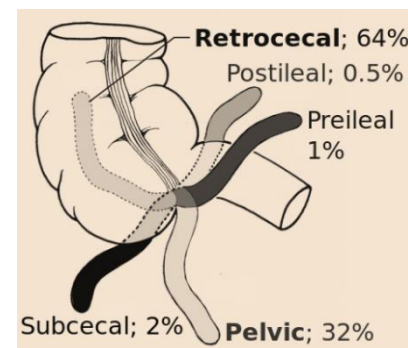
PATIENT PREP: Empty bladder

PATIENT POSITIONING: Supine and LLD

EQUIPMENT: Real-time and static images obtained using a L8-15 MHz or eL18MHz transducer, determined by the patient's body habitus.

ULTRASOUND FINDINGS IN APPENDICITIS:

- Positive Rebound Tenderness
- Non-compressible
- Overall diameter > 6 mm
- Fatty Stranding
- Circumferential color Doppler flow
- Appendicolith
- Free Fluid in RLQ
- Reactive Lymph Node
- Abscess



IMAGES TO OBTAIN

Begin scanning in supine position. If not visualized, always turn patient into LLD to shift the bowel and the location of the appendix. Steep Trendelenburg can be used also. If also performing a transvaginal exam for excluding pelvic pathology in a female patient, evaluate the superior right adnexa for the appendix if not seen transabdominally.

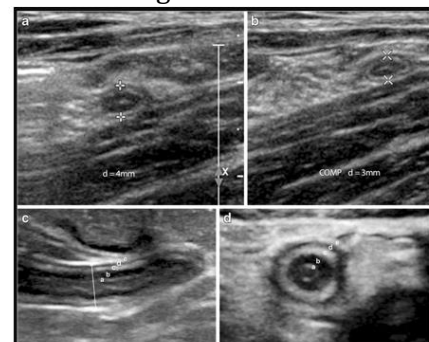
If no appendix is seen:

- Sagittal sweeps of RLQ showing the area of the psoas and ascending colon. Label the position of patient.
- Transverse cine sweeps of RLQ from superior to inferior. Label the position of patient.

If appendix is seen:

- 2D images of appendix in sagittal plane of the 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 a transverse plane. Use dual screen for with and without compression comparison.
- Cine clip demonstrating presence or absence of compression of appendix.
- 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.
- Color doppler and MFI imaging showing vascularity and looking for hyperemia or absence of flow.
- 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." It should be measured with compression.



LOCATING THE APPENDIX:

METHOD 1 – Always begin with having the patient use one finger to point to where they are having the most pain. In positive appendicitis cases, the patient can often pinpoint the exact area of the appendix.

METHOD 2 -

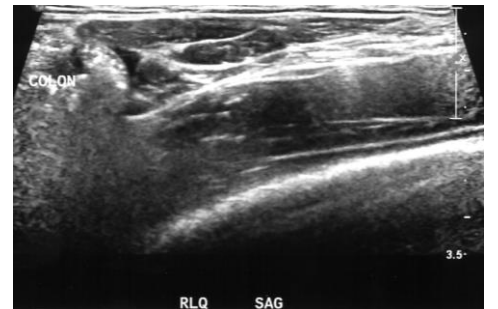
1. In transverse plane, at the inguinal canal, find the iliopsoas muscle just lateral to iliac vessels.

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.

Sagittal image of iliopsoas muscle with cecum and proximal ascending colon



3. Where the beginning of ascending colon is visualized:
 - a. In sagittal plane, go 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 are into the 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 almost 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. 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-The white arrow is pointing to a cross section of the appendix over the iliopsoas muscle.

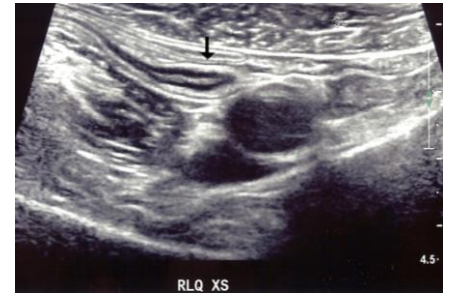
B. The black arrow is pointing to the terminal ileum before connecting to cecum.



LOCATING THE APPENDIX *continued...*

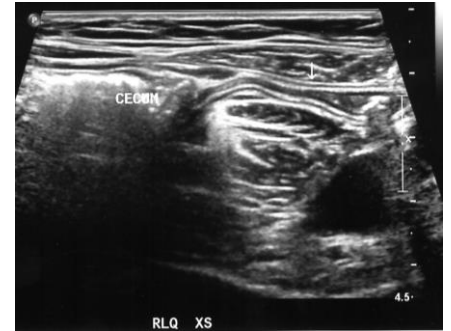
5. Follow the round, bullseye structure, keeping it in a cross-sectional plane. This makes it easier to follow and find the blunt end. You can then turn in sagittal to see the blind end.

Black arrow is pointing to the blind end/tip of the appendix



6. From the tip, you can follow appendix back to find connection to the cecum end. It is normal to see air in the appendix, also fecaliths have been noted in a normal appendix. This should be documented if present.

White arrow is pointing to the appendix as it joins to the cecum

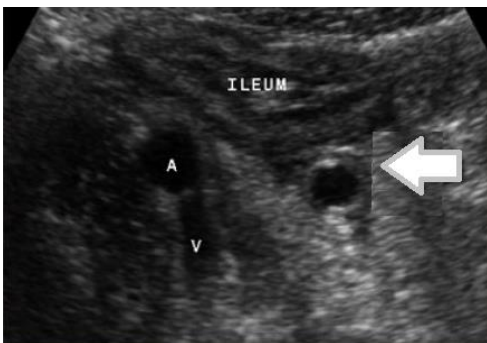


REPEAT WITH CHANGE IN POSITION IF NOT SEEN:

1. **LLD** position should always be used to attempt to shift the overlying bowel and move the appendix into a more visible location.
2. A very steep **TRENDELENBURG** position can be used as an additional step to help identify a appendix in a deep location.
3. **TRANSVAGINAL ULTRASOUND** Often referrals also include a pelvic ultrasound to rule out torsion or ovarian pathology in female patients. In these cases, a transvaginal sevaluation for the appendix should be included if it is not seen abdominally.

Scanning for the appendix transvaginally:

1. Find the right ovary in transverse plane.
2. Move superior and lateral to the ovary. Gradually move down inferiorly.
3. Look for a bullseye, non peristalsing structure with a blunt end.
4. Include a cine clip of this area.



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



White arrow pointing to blind ending tubular structure in the right adnexa

APPENDIX ULTRASOUND IMAGE LIST

IMAGE	MODE
Sagittal of appendix showing origin at cecum	2D
Sagittal of appendix showing blind end	2D
Cine clip of appendix showing no peristalsis	Cine
Transverse of appendix with and without compression	2D/DUAL
Cine clip of compression or lack of	Cine
Measurement of appendix thickness with compression. Normal <6mm <i>Hypoechoic wall to hypoechoic wall, do not include echogenic serosa</i>	2D+
Color and MFI of appendix	Color/MFI
Document abnormal lymph nodes, free fluid or fat stranding	2D
REPEAT IN LLD if not seen Steep Trendelenburg is an additional option	Repeat
<i>If doing a transvaginal on a female patient, look in superior right adnexa</i>	<i>TV Cine</i>
IF APPENDIX IS NOT SEEN	
Sagittal cine sweeps of RLQ w labels of patient position	Cine
Transverse cine sweeps of RLQ w labels of patient position	Cine

APPENDIX PROTOCOL HISTORY

	Date	Changes made	By whom
Updated	02/2022		Becky Marion
Reviewed	08/2022	No changes	Renee Betit Fitzgerald
Reviewed	03/28/2024	Added: -LLD and Trendelenburg needed if not seen -Method 1 – Have patient point to the pain -MFI to be used also -Cine clip demonstrating presence or absence of compression of appendix.	Protocol Meeting Attendees Dighe, Dhyani, Bornemeier, Marion, Edden, Fitzgerald