

Case

34F G8P5 at 23w6d presented to a freestanding emergency department (ED) after being involved in a motor vehicle collision.

Patient was the restrained passenger of a vehicle struck by another vehicle travelling approximately 35 mph. Patient presented to a free-standing ED for evaluation of abdominal pain and was found not to have any life-threatening injuries. She was subsequently transferred to a tertiary care hospital for trauma and obstetric consultation.

Focused assessment with sonography in trauma (FAST) exam was performed and demonstrated an anechoic stripe in the hepatorenal recess concerning for free fluid.

CT abdomen pelvis was subsequently performed and demonstrated no evidence of free fluid.

Pertinent Exam:

Free-standing ED: VSS, FHT 170. Exam: GCS 15, a gravid uterus with tenderness in left hemi-abdomen without rebound, guarding, or rigidity.

Tertiary Care Center: VSS. Exam: GCS 15, tenderness in left hemiabdomen without peritoneal signs.

Pertinent Lab Data:

Hgb 12.6 g/dL, Platelets 229 K/uL, INR 1.02, ABORh: B+, UA w/ <3 RBCs/hpf

Clinical Questions

1. What are the sensitivity and specificity of the FAST vs CT to identify intra-abdominal injury?

Following blunt abdominal trauma, FAST has a sensitivity of 68% (CI 59—75%); specificity of 95% (92—97%). CT imaging has a sensitivity and specificity of 97-99%.⁵

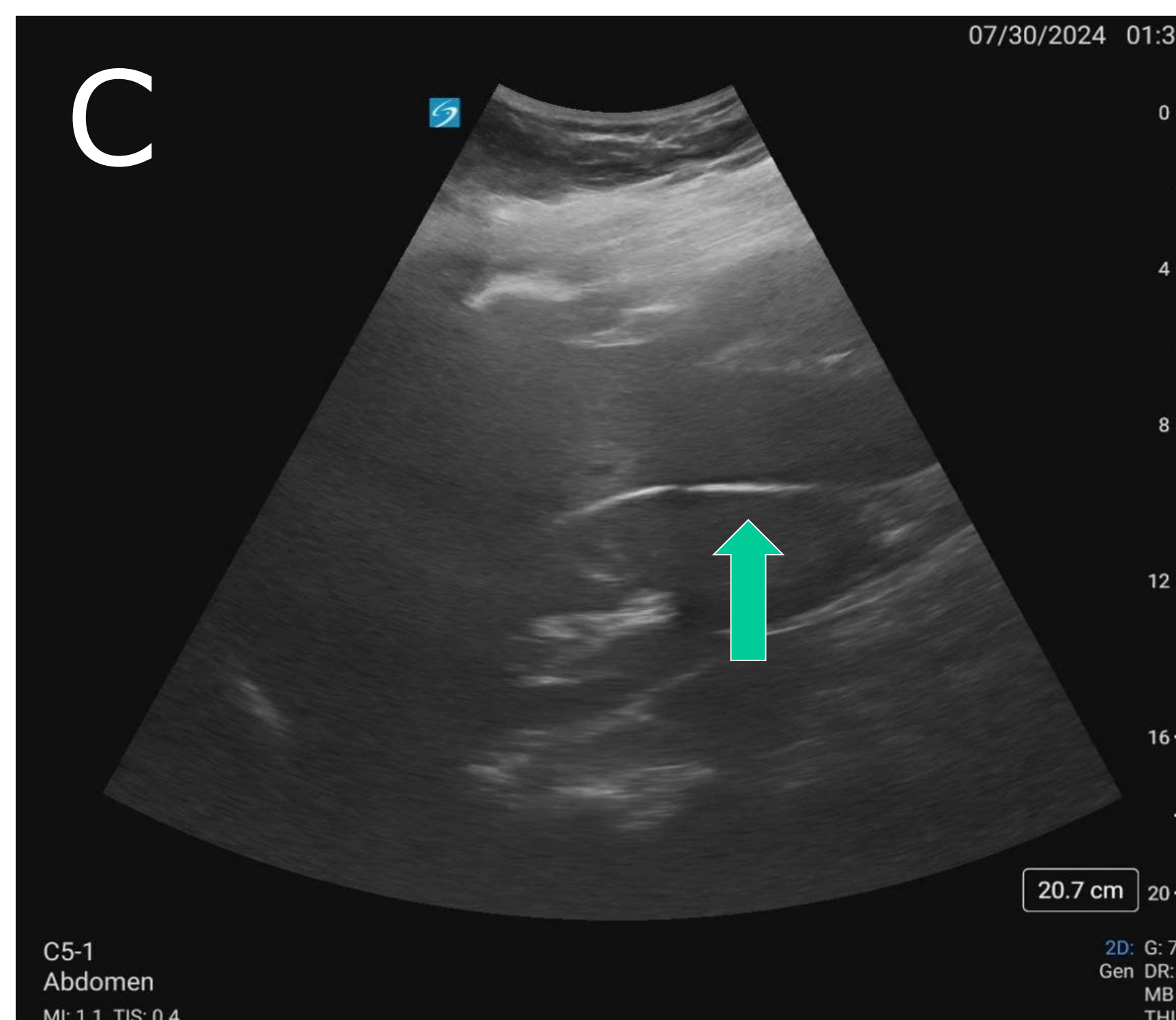
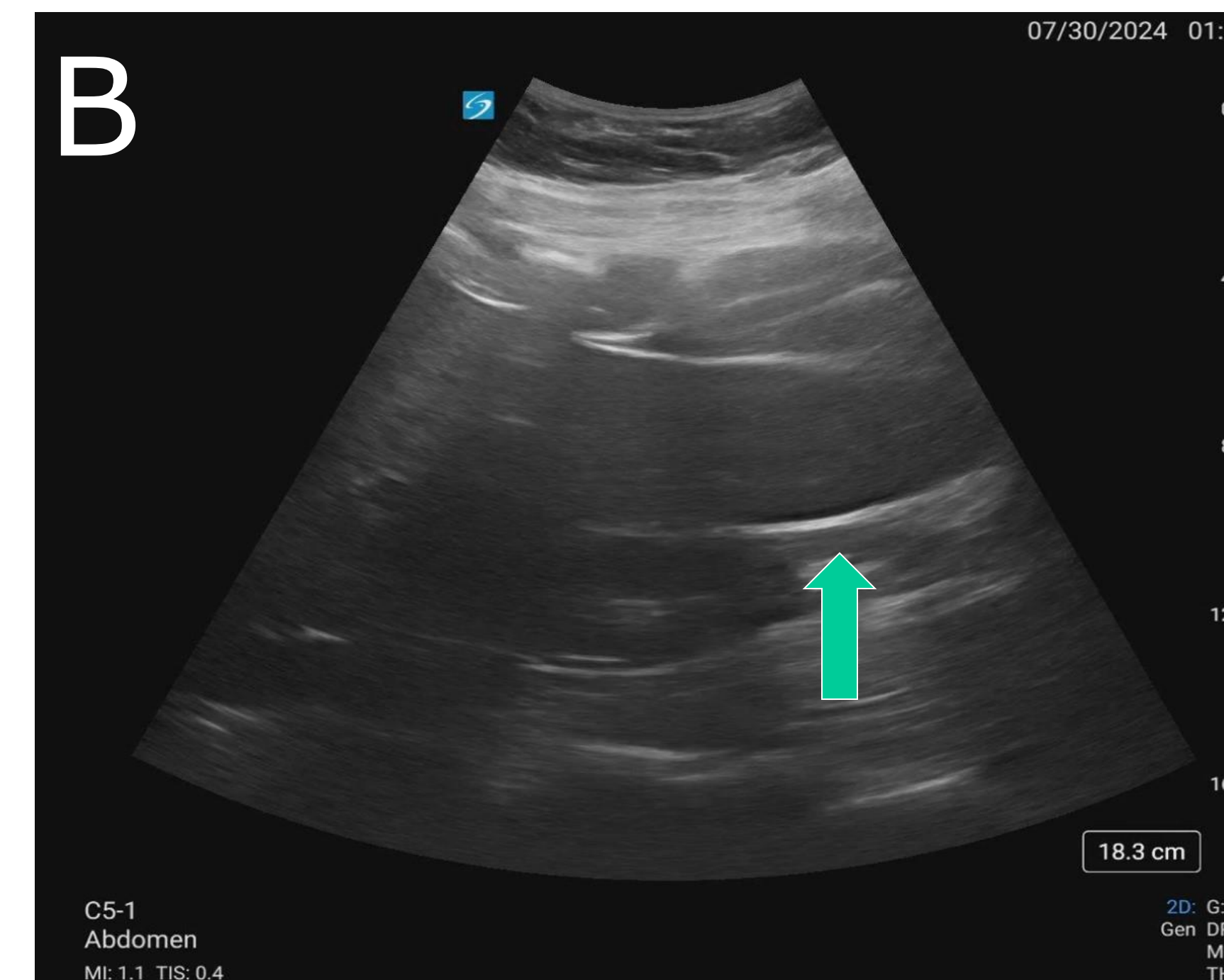
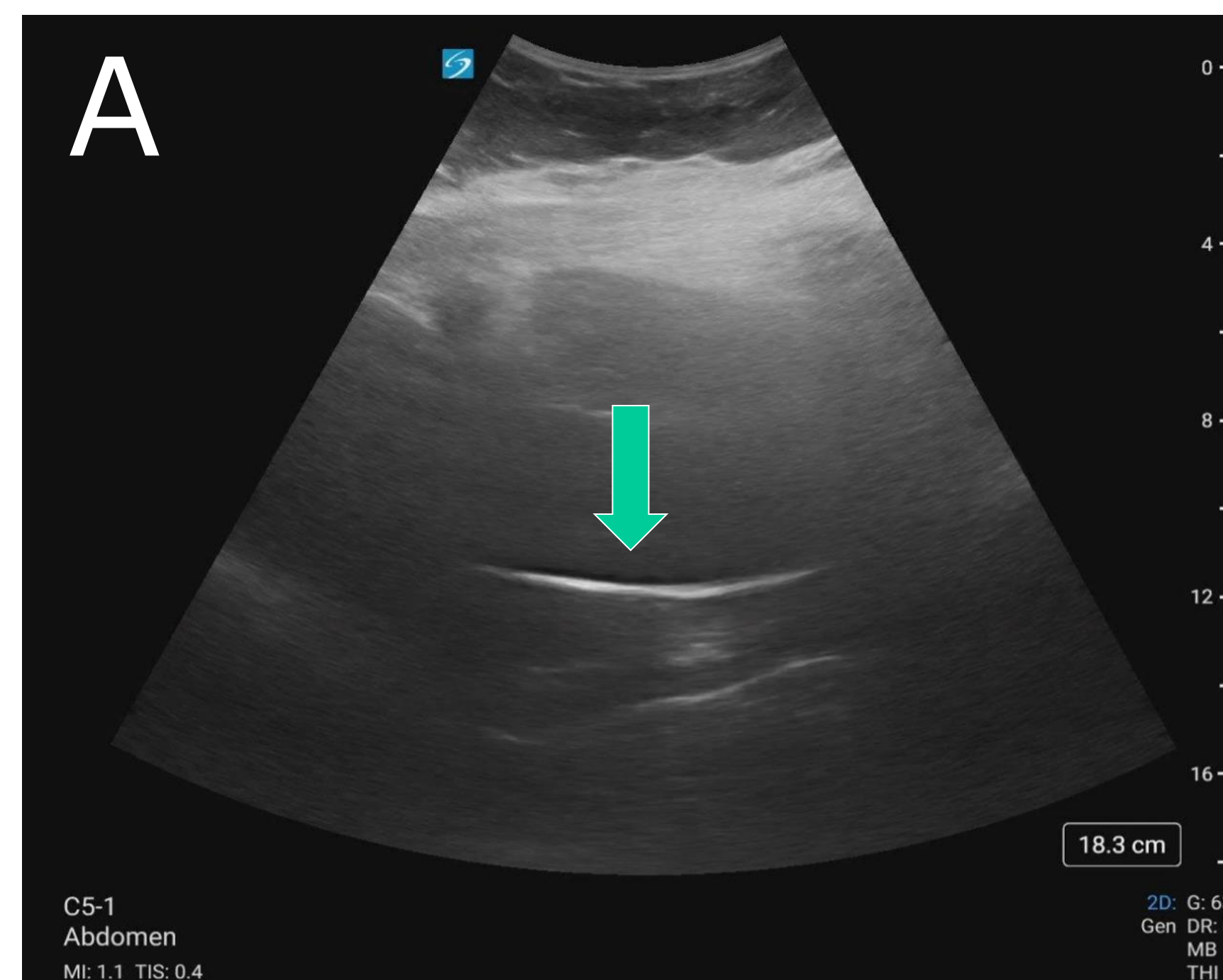
2. What is the lipliner artifact and how could the lipliner artifact have been evaluated further?

A hypoechoic stripe found at the edge of two solid organs that originates from post-processing image adaptive filtering used by modern US machines.³

3. Could this pregnant patient have avoided an unnecessary CT scan?

QA review favored a positive FAST exam necessitating CT imaging. If lipliner artifact was considered and additional views obtained supporting that findings were artifactual, patient may have avoided CT.

Images



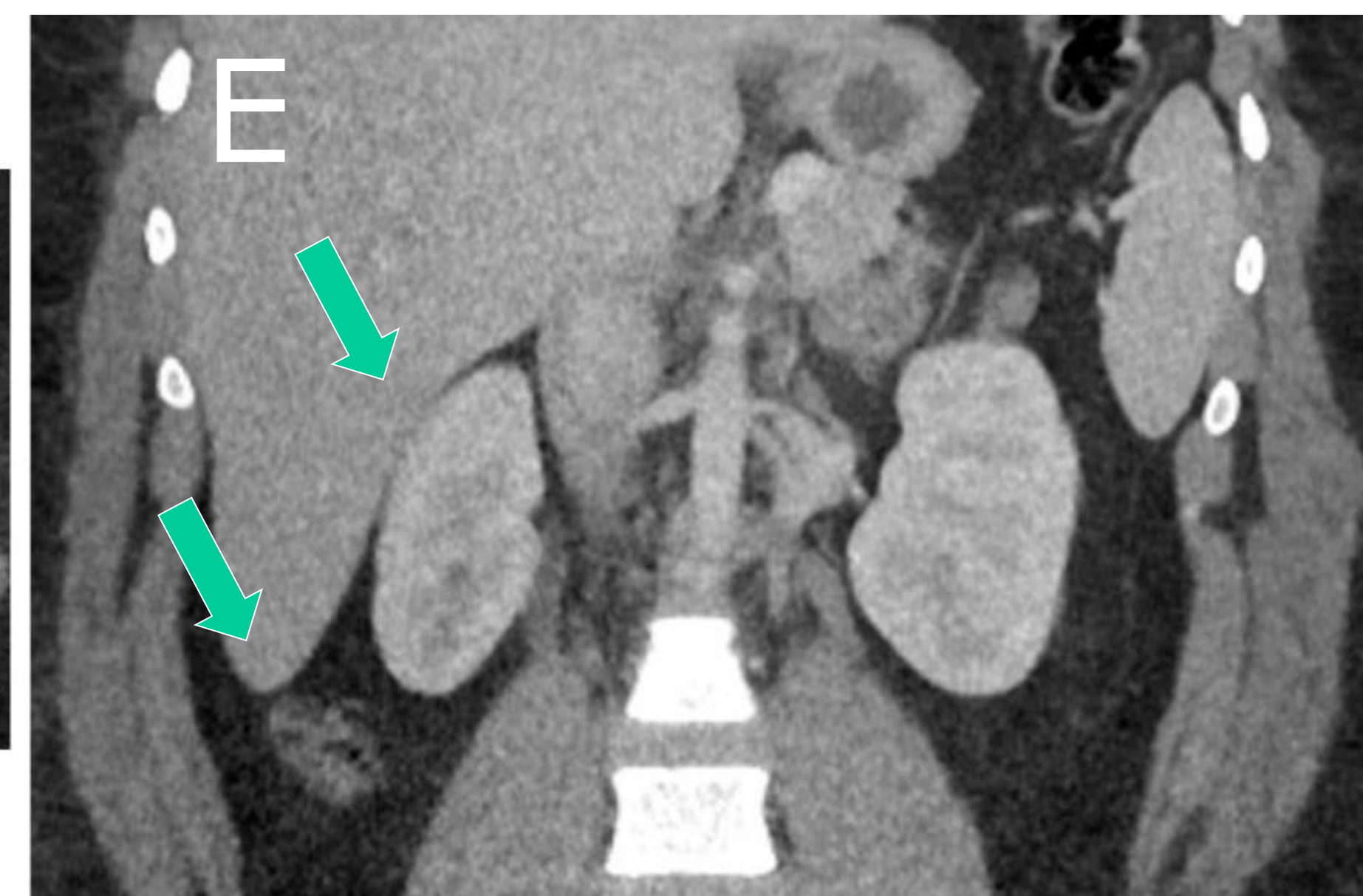
A: An anechoic appearing stripe overlying a hyperechoic fascial plane in the hepatorenal fossa. Unlike the double line sign, the anechoic area abuts a hyperechoic line on only one side.

B: Anechoic appearing stripe deep to liver tip near inferior pole of kidney. The anechoic stripe is not bound on both sides making this distinct from the double line sign.

C: Redemonstrated anechoic appearing stripe between liver and kidney.

D: Axial view of CT Abdomen Pelvis without free fluid in hepatorenal fossa.

E: Coronal view of CT without free fluid around inferior tip of liver.



Discussion

This case report presents a hemodynamically stable pregnant patient with blunt abdominal trauma who was found to have a false positive FAST exam finding termed the **Lipliner Sign**.

The images from a Sonosite X-Porte [FUJIFILM Sonosite Inc.] machine demonstrate an anechoic appearing stripe in the RUQ. During Quality Assurance review, three Ultrasound-trained Emergency Medicine faculty deliberated between a positive or equivocal designation of the FAST exam. The anechoic areas did not classically track in the hepatorenal space and there was some variability in location based on angle of insonation between clips more consistent with artifact. The QA team favored calling exam positive to prioritize sensitivity.

There is increasing awareness of the lipliner artifact, which has been attributed to post-processing techniques to improve the resolution of the final image.

Unlike other ultrasound artifacts which amplify or attenuate their appearance with machine, probe, or patient position changes, the lipliner sign should reliably persist at the edge of solid organs despite these adjustments.

Unlike another similarly-appearing false positive FAST finding — the double line sign — the lipliner sign is visualized as an anechoic stripe adjacent to solid organs with a hyperechoic stripe on only one side.

Parker et al. first reported the lipliner artifact in a case series with three non-pregnant trauma patients and one healthy volunteer.³ To date, this report is the first to document this finding in a pregnant patient.

Pearls

- Positive FAST can rule in intra-abdominal free fluid, but negative FAST cannot rule out intra-abdominal free fluid.^{1,5,6}
- The lipliner artifact appears as an anechoic stripe occurring at the edge of solid organs and is attributed to ultrasound image post-processing.³
- The lipliner artifact can result in false positive FAST.
- Positive FAST findings obtained in one view should be confirmed in an orthogonal axis to reduce artifact.
- Serial FAST exams is an alternative strategy to mitigate unnecessary radiation exposure.

References

1. Khosravian K, Boniface K, Dearing E, Drake A, Ogle K, Pyle M, Frasure SE. eFAST exam errors at a level 1 trauma center: A retrospective cohort study. *Am J Emerg Med*. 2021 Nov;49:393-398. doi: 10.1016/j.ajem.2021.07.036. Epub 2021 Jul 21. PMID: 34325179
2. Lobo V, Hunter-Behrend M, Cullnan E, Higbee R, Phillips C, Williams S, Perera P, Gharahbaghian L. Caudal Edge of the Liver in the Right Upper Quadrant (RUQ) View Is the Most Sensitive Area for Free Fluid on the FAST Exam. *West J Emerg Med*. 2017 Feb;18(2):270-280. doi: 10.5811/westjem.2016.11.30435. Epub 2017 Jan 19. PMID: 28210364; PMCID: PMC5305137
3. M.A. Parker et al., *The Lipliner Sign: Potential Cause of a False Positive FAST Examination*, *Journal of Emergency Medicine*, <https://doi.org/10.1016/j.jemermed.2024.0>
5. Stengel D, Leisterer J, Ferrada P, Ekkernkamp A, Mutze S, Hoenning A. Point-of-care ultrasonography for diagnosing thoracoabdominal injuries in patients with blunt trauma. *Cochrane Database Syst Rev*. 2018 Dec 12;12(12):CD012669. doi: 10.1002/14651858.CD012669.pub2. PMID: 30548249; PMCID: PMC6517180.
6. Holmes JF, McGahan JP, Wisner DH. Rate of intra-abdominal injury after a normal abdominal computed tomographic scan in adults with blunt trauma. *Am J Emerg Med*. 2012 May;30(4):574-9. doi: 10.1016/j.ajem.2011.02.016. PMID: 21641163.