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Visual Case Discussion

# A low-cost, easy to make ultrasound phantom for training healthcare providers in pleural fluid identification and task simulation in ultrasound-guided thoracentesis

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Many training programs are utilizing simulation-based learning to provide increased opportunities to practice procedural skills in a low risk setting. These opportunities promote confidence, expertise, and long-term skill retention.[3] The use of point of care ultrasound (POCUS) for thoracentesis has been shown to decrease complications associated with this procedure.[1,2] The phantom described in this article can be used in the ultrasound identification of thoracic anatomy (lung parenchyma, diaphragm, pleural fluid, pleural lines and ribs shadowing). The phantom can also be used for needle tracking and eye-hand coordination for training of health care providers in POCUS guided thoracentesis. It can be difficult to learn and perform thoracentesis in real time on patients while a phantom or simulation-based learning provides a low-risk setting in which multiple attempts can be made (Figs. 1–3).

## Questions

1. Simulation education with point-of-care ultrasound for thoracentesis assists with the following
   a. Decreases incidence wrong side procedures
   b. Decreases incidence of pneumothorax
   c. Increases patient comfort
   d. Does not affect the performance of thoracentesis

2. Simulation education allows learners to identify pathology and needles with ultrasound. This allows learned to do the following:
   a. Track needles to perform procedures safely
   b. Estimate the size of the pneumonia
   c. Determine the cause of the pleural effusion
   d. Simulate an environment allowing learners to be completely competent

## Answers

1. Decreases incidence of pneumothorax. Explanation: Using simulation for training in point-of-care ultrasound and also pathology identification prior to attempting procedures has been shown to increase confidence and decrease complications associated with procedures. Using real-time guidance for thoracentesis has been shown to decrease the rate of complications such as pneumothorax and hemothorax and increase success. Reference: Cavanna L, Mordenti P, Bertè R, et al. Ultrasound guidance reduces pneumothorax rate and improves safety of thoracentesis in malignant pleural effusion: report on 445 consecutive patients with advanced cancer. World J Surg Oncol. 2014;12:139.doi:10.1186/1477–7819-12–139.
2. Track needles to perform procedures safely. Explanation: The use of simulation using phantoms and point-of-care ultrasound has been shown to increase competence, confidence and decrease complications associated with invasive procedures. Reference: Evans L V., Dodge KL, Shah TD, et al. Simulation Training in Central Venous Catheter Insertion: Improved Performance in Clinical Practice. Acad Med. 2010;85(9):1462–1469.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.visj.2017.03.010.

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**Fig. 1.** Plastic wrap is placed above the sponge and water layer. The gelatin thoracic cage is then placed on top of the plastic wrap.

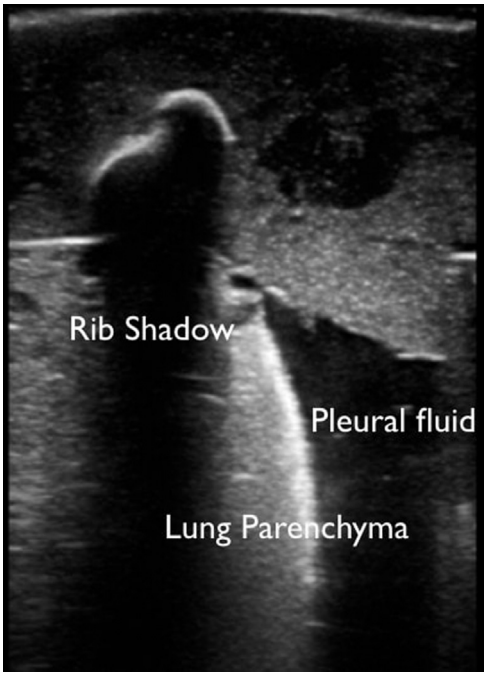


**Fig. 2.** Ultrasound image of the simulated lung parenchyma, pleural fluid and rib shadow using a linear transducer.

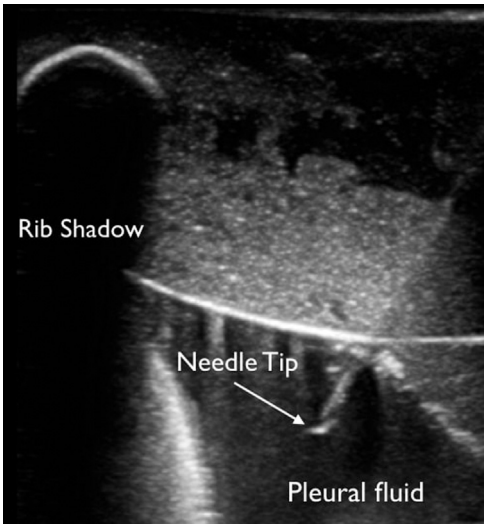


**Fig. 3.** Phantom ultrasound image with needle tracking during simulated thoracentesis.

## References

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