

## Technical Note

# A Simple Phantom for Learning Needle Placement for Sonographically Guided Biopsy

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In an effort to teach sonographically guided needle placement, we developed a simple phantom that contains objects that simulate normal and diseased structures. This phantom can be used to teach biopsy techniques and allows those learning the skills to practice before using them on patients. The phantom is applicable to both freehand and guided techniques.

### Materials and Methods

Previous attempts to create phantoms have included the use of water-based gelatins with acetate fibers, glass spheres, propanolol, and graphite [1, 2]. We developed a phantom that is made of commonly available materials. One hundred grams of Standard Methods Agar (BBL Becton-Dickinson, Cockeysville, MD) is suspended in 4 l of tap water. The broth is heated until the agar is dissolved. It is essential that the broth actually boil; otherwise, the agar will not solidify when it is left to cool. The broth is then transferred to a 2500-ml barium enema bag (E-Z-EM, Westbury, NY) (Fig. 1). To fill an entire enema bag, 4 l of broth is used, taking into account evaporation and expansion of the plastic. The tubing is cut near the bag and clamped with a hemostat. (The excess tubing can be used to siphon off the hot agar into the bag.) Ten milliliters of phenol per liter of broth is added as a bactericidal agent.

Diced carrots, pimento olives, and elbow macaroni are added to the agar-filled bag. We have found that these objects scan well and can be punctured easily. Recently, we introduced the fingertips of surgical gloves filled with 5 or 10 ml of normal saline (Fig. 2). The

fingertips are twisted and tied with 3-0 silk and cut just proximal to the sutures. After the various objects are added to the agar-filled enema bag, the bags are tilted to force out remaining air and carefully closed. While the bags are cooling, they are rotated every 20 min to obtain suspension of the cysts and vegetables in the agar. Once cooled, the phantoms can be scanned and objects punctured under direct sonographic guidance with needles as small as 22-gauge. The "cysts" can be aspirated (Figs. 2B and 2C).

The sonographic texture of the agar simulates liver parenchyma. Fracturing of the agar is inevitable; however, these fissures simulate vascular structures and further enhance the hepatic appearance of the gel. The bags generally last 1 week. Refrigeration helps maintain the bags and slows putrefaction, which occurs because of the nonsterile punctures and nonsterile vegetable matter. The cost per bag is approximately \$20.

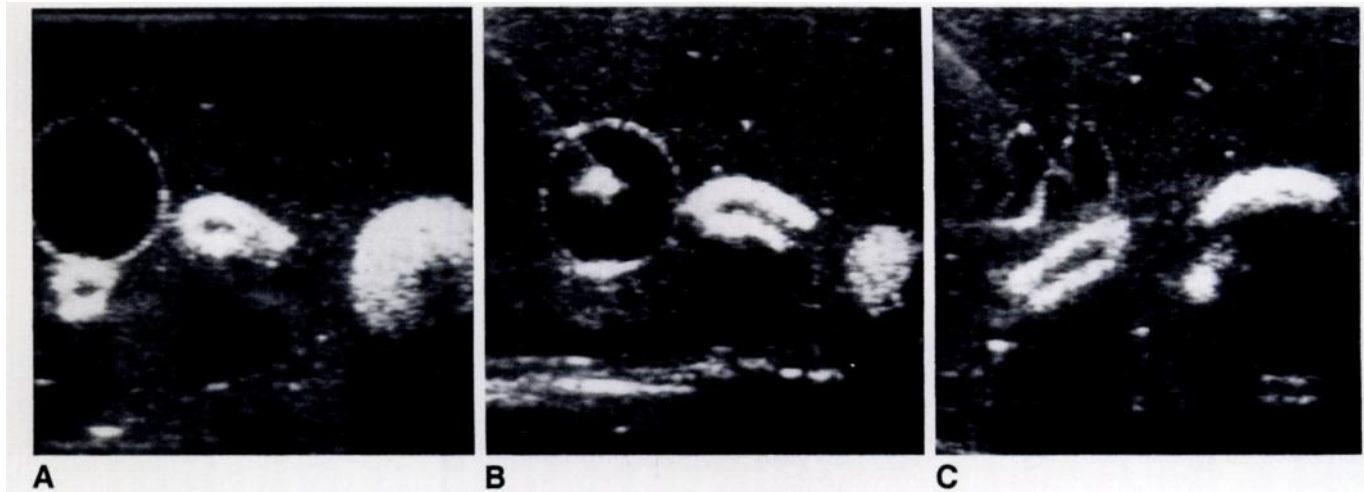


Fig. 1.—Barium enema bag has been filled with agar and allowed to cool.

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**Fig. 2.**—A, Sonogram shows elbow macaroni and a diced carrot. Fluid-filled tip of a surgical glove gives appearance of a cyst. B, Sonogram shows “cyst” punctured under guidance by using a 22-gauge needle with echogenic tip. C, “Cyst” has been partially evacuated. Needle is still in place.

### Conclusion

This model has proved to be valuable as a teaching aid. Those learning the skills can become proficient with the necessary dynamic interaction between their hands, needle, and projected sonographic image before actually performing these maneuvers on patients.

### REFERENCES

1. Edmunds P, Reye F, Parkinson D, Busey H. Human tissue phantoms. Presented at the 2nd International Symposium on Ultrasound Tissue Characterization, Gaithersburg, MD 1977
2. Madsen EL, Zagzebski JA, Banjavic RA, Jutila RE. Tissue mimicking materials for ultrasound phantoms. *Med Phys* 1978;5:391-394