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Development of a fresh cadaver model for instruction of ultrasound-guided breast biopsy during the surgery clerkship: pre-test and post-test results among third-year medical students

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Abstract

BACKGROUND: The aim of our study was to determine if a fresh cadaver model is a viable method for teaching ultrasound (US)-guided breast biopsy of palpable breast lesions.

METHODS: Third-year medical students were assessed both preinstruction and postinstruction on their ability to perform US-guided needle aspiration or biopsy of artificially created masses using a 10-item checklist.

RESULTS: Forty-one third-year medical students completed the cadaver laboratory as part of the surgery clerkship. Eight items on the checklist were found to be significantly different between pre-testing and post-testing. The mean preinstruction score was 2.4, whereas the mean postinstruction score was 7.10 ($P < .001$).

CONCLUSIONS: Fresh cadaver models have been widely used in medical education. However, there are few fresh cadaver models that provide instruction on procedures done in the outpatient setting. Our model was found to be an effective method for the instruction of US-guided breast biopsy among medical students.

Ultrasound (US)-guided breast aspiration and biopsy has become an integral tool for the workup and treatment of clinically palpable breast lesions.[1] The procedure accurately distinguishes benign from malignant breast disease and has been found to be a cost effective way to prevent unnecessary surgical procedures.[2] Although today's surgical residents are well trained in intensive care unit and trauma US techniques, their exposure to breast ultrasonography may be quite limited, as this procedure is often performed during outpatient visits.[3] The historical Halsted adage, "see one, do one, teach one," has been put to rest in deference to patient safety. Thus, the resident of today is often expected

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to have a modicum of mastery of a procedural skill before its performance. With the advent of simulation, the latter concept has become a reality. Although numerous breast biopsy models have appeared in the literature, we could only discover one report that used a fresh cadaver model, and this study focused on sentinel lymph node dissection.[3–7] The aim of this study was to investigate the utility of a fresh cadaver model for the instruction of US-guided breast aspiration and biopsy of palpable breast lesions among third-year medical students who had no US experience in the evaluation of a palpable breast mass.

Methods

All fresh cadavers used for procedural instruction at our institution are obtained through our University Willed Body Program. During the surgery clerkship orientation, third-year students are instructed in multiple surgical procedures using a fresh cadaver. The procedures include airway management and insertion of chest tubes, pig tails, and central lines.[8] This newly added procedure of US-guided breast aspiration and biopsy was introduced before the start of the other technical skills previously noted. A list of required equipment for the model is noted in Table 1.

The lesions (cystic and solid) are made from the tips of latex-free gloves, injected with yogurt for the solid and red food colored water for the cystic lesions. Using a 10-cc syringe without a needle, the glove tips are filled with 3 to 5 cc of yogurt or colored water depending on the size of the lesion one wishes to create. The tip of the glove is twisted after insertion of the substance so that the newly formed mass is tense and will puncture easily with needle contact. A 2-0 silk tie is placed around the base of the filled glove tip and left long such that the suture will exit the inframammary incision once closed. This allows for simple pulling on the suture to remove the punctured mass.

After creation of the artificial breast lesions, the fresh cadaver dissection is begun. A marking is created along the inframammary fold from the sternum to the anterior axillary line. An incision is made, and a plane is developed between the breast tissue and the pectoralis major. The dissection is carried superior to just below the clavicle, 2 to 3-cm lateral from the edge of pectoralis major muscle and medially to the edge of the sternum. The filled glove tips are placed at various depths in the breast tissue so as to be palpable. US appearance is quite distinct between the yogurt and water-filled lesions (Figs. 1, 2).

At the beginning of the cadaver laboratory (preinstruction period), the student is instructed to palpate various implanted breast lesions. The US machine is present along with 3 different probes, multiple needles of different gauges, and syringes. After the selection, they are then asked to perform an US-guided aspiration or biopsy of the lesion (Fig. 3). The preinstruction assessment was completed by a senior author while observing this exercise. After the student's attempt, they were then carefully instructed by one of the authors and were required to complete the procedure independently before finishing the exercise. Successful completion required passing through all 10 steps independently with final US visualization of the needle within the lesion and aspiration in the case of a fluid filled (cystic) mass or biopsy in the scenario of the yogurt filled (solid) mass. The students then were asked to return to the cadaver laboratory at the end of their rotation to repeat the exercise (along with the other learned skills) and again were assessed (postinstruction period). Students did not have the opportunity to practice in-between sessions.

Table 1 List of required equipment

Equipment required for model
Fresh cadaver
Ultrasound with linear probe
10 cc syringe
22-gauge needle (for aspiration of cystic mass)
18-gauge needle (for biopsy of solid mass)
0 or 2-0 silk ties
Latex-free gloves
Yogurt
Water with yellow or red food coloring added
Marking pen
#10 scalpel

We used a modified checklist of 10 items to assess acquisition of technical skills (Table 2).[6,9] McNemar's test was used to assess differences among binomial paired data. A paired two sample *t*-test was used to compare group score means for the pre-test and post-test. Statistical significance was set at $P < .05$.

Results

Between December 2014 and June 2015, a total of 41 third-year medical students participated in this study during their third-year general surgery clerkship. None had

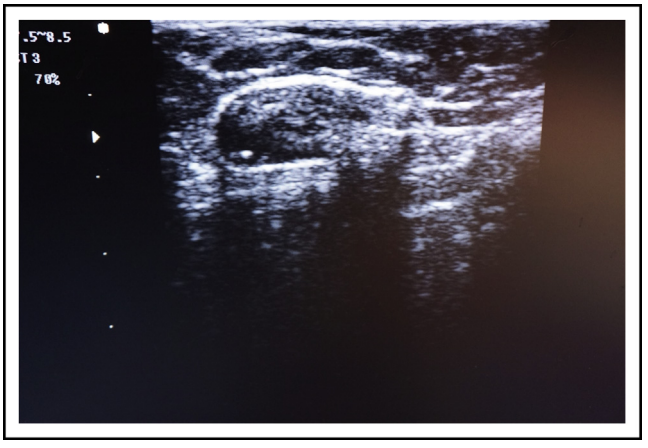

Figure 1 Yogurt filled lesion that is simulating a solid lesion.