
BRIEF COMMUNICATION

Low-cost Self-made Phantom Model for Ultrasound-guided Breast Intervention Practice

VSH Chan, VKS Li, SY Hui, TPW Lam, WWM Lam

Department of Radiology, Queen Mary Hospital, Pokfulam, Hong Kong

INTRODUCTION

Ultrasound-guided intervention plays a major role in breast radiology. Phantom models for training are often expensive and suffer from artefacts secondary to repeated interventional practice and material degradation. The authors propose the construction of a low-cost, self-made phantom model that can be used for training residents and radiologists for ultrasound-guided breast intervention. Self-made phantom models have been discussed in the literature,¹⁻³ but not in the context of a realistic breast-related ultrasound phantom model for interventional procedures.

METHODS

Add 20 g agar, 17-22 g of oatmeal (for heterogeneity of density) and 30 to 35 g of gelatine into 1500 mL boiling water (100°C) and mix till gelatin is dissolved. Pour the mixture into a water-tight container approximately 18 × 11 × 7 cm, and allow to cool. Cut all five fingers from a latex glove (Figure 1) and fill each with water. Tie the open ends of the glove fingers and ensure there are no leaks. When the gelatine body reaches a semi-solid state — firm enough to allow targets to be suspended in the gel without sinking, but not completely set — add fruit targets (e.g. tangerine segments, grapes, or olives)

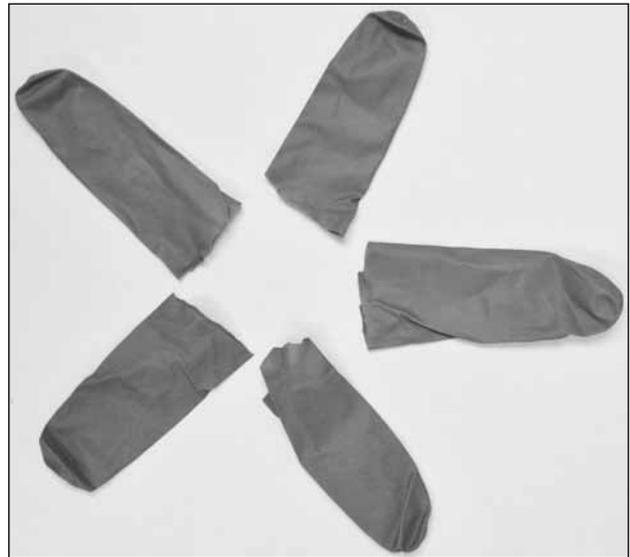


Figure 1. Latex glove fingers.

and the water-filled latex fingers. After the gelatine body has solidified, mix 50 mL corn starch, 18 g of gelatine into 100 mL of boiling water (100°C). Add this mixture to the top of the gelatine body to reinforce the surface and refrigerate at 4 to 8°C until needed. The total time

Correspondence: Dr VSH Chan, Department of Radiology, Queen Mary Hospital, Pokfulam, Hong Kong.
Email: chanshvictor@gmail.com

Submitted: 13 Jul 2018; Accepted: 14 Aug 2018.

Contributors: VSHC and VKSL contributed to the design of this study. VSHC, VKSL and SYH contributed to the image acquisition and construction of the phantom. VSHC, TPWL and WWML contributed to the interpretation of images and clinical applications. All authors contributed to the drafting of the article. VSHC, TPWL and WWML critically revised the article for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of Interest: All authors disclosed no conflicts of interest.

Funding/Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

required for the model to set is approximately 3 to 4 hours. When required for usage, the self-made gelatine phantom model should easily fall out of the container (Figure 2). The cost for the materials required for the construction of this self-made phantom model is less than HK\$20 (US\$2.56) at the time of writing.

RESULTS

Practice sessions of ultrasound-guided fine needle aspiration cytology technique can be performed on the water-filled glove fingers, which allow for realistic simulation of aspiration of cystic contents (Figure 3). Biopsies can be performed on the various fruit targets (Figure 4). This is useful for residents-in-training who would like to start interventional practice early in the

career prior to performing procedures on genuine cases. This self-made ultrasound phantom model also has further clinical potential for expansion to other techniques, including the addition of cystic targets in the form of tied latex glove fingers for ultrasound-guided drain placements (Figure 5), and the addition of fluid-filled long, thin balloons for practising ultrasound-guided vascular access (Figure 6).

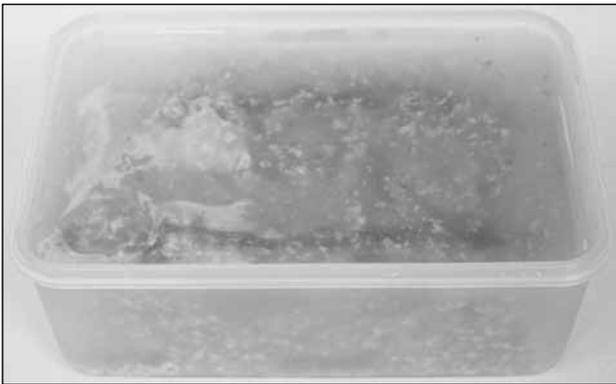


Figure 2. Finalised gelatine phantom model.

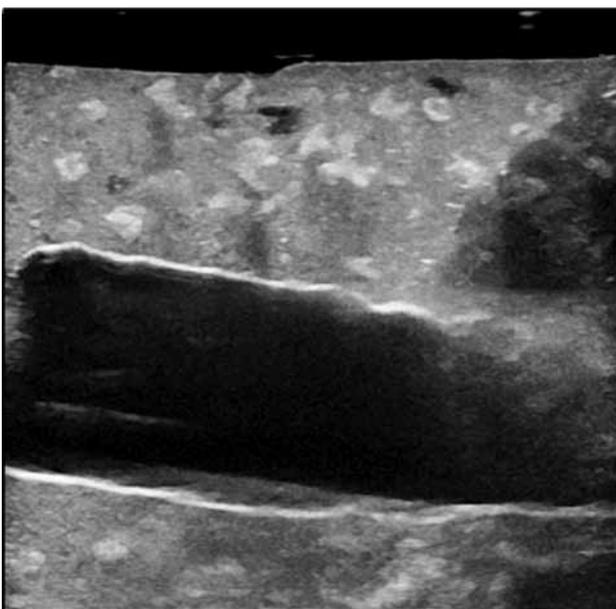


Figure 3. Ultrasound-guided aspiration of cystic contents using a water-filled latex glove finger model.



Figure 4. Ultrasound-guided biopsy using a fruit (grape) target.



Figure 5. Ultrasound-guided insertion of a pigtail catheter into a cystic lesion using a latex glove finger model of a cystic lesion.

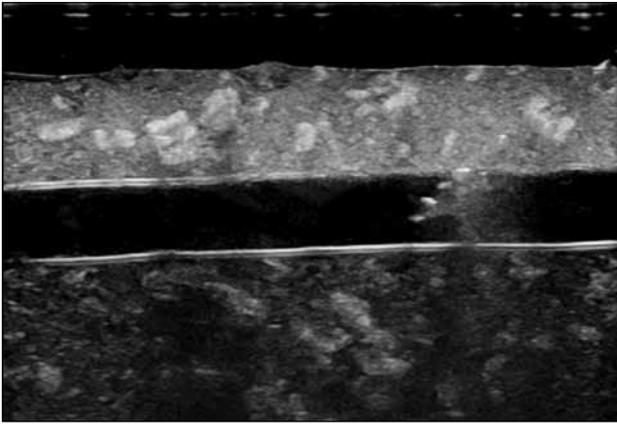


Figure 6. Ultrasound-guided needle insertion for practising vascular access using a long thin balloon model.

CONCLUSIONS

A low-cost self-made phantom model that mimics the sonographic appearance of breast tissue is invaluable in the training of ultrasound-guided interventional techniques for breast radiologists. The proposed self-made phantom model can also be used in general interventional practice, for example for the placement of drains and catheters under ultrasound guidance.

REFERENCES

1. Sekhar A, Sun MR, Siewert B. A tissue phantom model for training residents in ultrasound-guided liver biopsy. *Acad Radiol.* 2014;21:902-8. [Crossref](#)
2. Morrow DS, Cupp JA, Broder JS. Versatile, reusable and inexpensive ultrasound phantom procedural trainers. *J Ultrasound Med.* 2016;35:831-41. [Crossref](#)
3. Kim YH. Ultrasound phantoms to protect patients from novices. *Korean J Pain.* 2016;29:73-7. [Crossref](#)