

Sonographer preference for Knox versus ballistic gelatin for the creation of deep venous thrombosis ultrasound phantoms

Patrick Olivieri, Michael Doctor, Sebastian Siadecki, Gabriel Rose, Aaran Drake, Turandot Saul

Department of Emergency Medicine, Emergency Ultrasound Division, Mount Sinai St. Luke's / Mount Sinai Roosevelt Hospital Center, New York, New York

To the Editor,

Simulation-based teaching can enhance learner confidence and the ability to perform various ultrasound scans for diagnosis and procedural guidance. Phantoms can be particularly useful in the demonstration of pathology, which may not always be readily available in a human model. Commercially available phantoms exist; however, their expense limits widespread use.

Recipes for homemade gelatin phantoms have been shown to be suitable for practice and for teaching a variety of sonographic applications [1-2]. A sonographic evaluation for deep venous thrombosis (DVT) involves the compression of the vessel as an indicator of vein patency. Many of the phantoms that follow traditional recipes using store-bought gelatin are too delicate for use in DVT education and puncture when pressure is applied. Ballistic gelatin closely simulates the density and viscosity of human tissue and is used as a standardized medium for testing the performance of firearms ammunition. It is used instead of muscle tissue, as its properties can be carefully controlled, allowing for consistent and reliable comparisons.

The specific aims of this study were to describe our process of creating DVT ultrasound phantoms using store-bought gelatin and commercial ballistic gelatin and



Fig 1. Ultrasound phantom containing compressible and non-compressible vessels

to compare their various sonographic features, durability and shelf life.

DVT phantoms were created by suspending water-filled 5/8" Penrose drains (Convidien, Minneapolis, MN) half way up the side of a plastic container. Pieces of a 0.28" diameter hot glue gun stick (3M, St. Paul, MN) were inserted into several areas of the Penrose drains to create areas of non-compressibility. The gelatin preparations described below were poured over the suspended Penrose drains.

Knox gelatin (Kraft Foods, Northfield, IL) is inexpensive (\$1.00/ounce) and is available at most supermarkets. A 10% concentration (three 0.25oz packets of gelatin/1 cup of water) was used to create the phantom. Ballistic gelatin is available from a number of manufacturers and can be ordered online. 10lbs of ballistic gelatin powder (Vyse Gelatin Co, Schiller Park, IL) cost \$125 (\$0.78/ounce) plus \$18 for a de-foamer solution recommended for clarity by the manufacture. A 10% concentra-

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Corresponding author: Turandot Saul

Mount Sinai St. Luke's Mount Sinai West
Department of Emergency Medicine
1000 Tenth Avenue, Room G-01
New York, New York 10019
(c) 917-209-5110/(f) 212-523-8000
E-mail: tsaul@chpnet.org

tion solution was used for the ballistics gelatin as well. Several drops of blue food coloring were added to make the models translucent. Models were gently agitated for 60 seconds to remove air bubbles prior to solidification.

Twenty emergency medicine residents attended a 15-minute lecture on the basics of DVT ultrasound. Two Sonosite Edge systems (Bothell, WA) with L25 high frequency (13-6MHz) linear transducers were used to scan the phantoms (fig 1); then, residents completed a survey. The phantoms were covered with a plastic wrap, refrigerated and checked weekly. The Knox and ballistic gelatin powder cost \$6.00 and \$5.08 respectively to create one phantom. After the educational session, the Knox phantoms were cracked in multiple places and the ballistic phantom was intact. Mold growth was present on the Knox gelatin after 3 weeks of storage with no growth on the ballistic gelatin after 12 weeks. 18/20 (90%) of residents stated that the ballistic gelatin allowed for clearer visualization of the vessel. 15/20 (75%) said the Knox gelatin was more similar to human tissue in consistency and firmness, and 16/20 (80%) concluded that the Knox gelatin had less distracting particles. The group was divided (10/20 [50%]) each, for which product best returned to baseline after com-

pression. Ballistic gelatin was favored over Knox gelatin in overall preference (13/20 [65%]).

Ballistics gelatin was preferred by the educators for the following reasons: 1) creation of the models is time consuming and the more durable the gel, the less this process would have to be repeated; 2) ballistics gelatin is recyclable. It can be removed from its container and melted; 3) the cost per phantom of Knox gelatin is more than ballistic gelatin; 4) the ballistic gelatin was more durable after repeated compression.

Overall, the ballistic gelatin phantom was preferred by the emergency medicine residents for its sonographic features and it was preferred by the investigators because of its durability and longer shelf-life.

References

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