Introduction

Ultrasound (U/S) guided peripheral IV catheter (PIV) placement is often needed when traditional IV attempts have failed. Use of U/S in PIV placement improves patient outcomes. Commercially available U/S IV training phantoms are expensive and degrade with use. Non-commercial phantoms made of various materials have been described in published literature and online tutorials; however, there has been no comparison of these models. The primary objectives of this study were to compare the echogenic resemblance and haptic similarity of various non-commercial phantoms to U/S guided PIV placement on human patients. Secondary objectives were to characterize the cost and ease of making the phantoms.

Methodology:

This prospective observational study trialed six unique phantom models: 1) Amini ballistics gel, 2) Morrow ballistics gel, 3) University of California San Diego (UCSD) gelatin, 4) Rippey chicken, 5) Nolting spam, 6) and Johnson tofu. Phantoms were assembled through instructions from the source references. Variables including total cost and time for creation were noted. Fellowship trained EM physicians performed U/S guided PIV placement on each model to evaluate their resemblance to human tissue haptic and echogenicity properties, utility for training, and comparability to commercial phantoms. Questions were answered via a 5-point Likert-scale, with higher numbers representing a better rating.

Results:

The six phantom models were successfully created and evaluated by six physicians. Ultrasound images of each phantom are seen in Figure 1. The Rippey model scored highest overall for the primary study objectives: haptic similarity 4.6/5, echogenic resemblance 4.9/5, teaching utility 5/5, and commercial comparability 4.8/5 with an aggregate score of 4.8/5. UCSD ranked second (aggregate score 3.7/5) and the Nolting spam ranked last (aggregate score 1.3/5). The primary objective scores are depicted in Figure 2. The costs of production ranged from $4.39 (Johnson) to $29.76 (UCSD). Creation times ranged from 10 minutes (Johnson) to 120 minutes (UCSD). Cost of production for the Rippey model was $16.87 with a creation time of 15 minutes.

Conclusion:

The Rippey model scored the highest in all categories, with a mid-level cost and minimal preparation time. Non-commercial U/S phantoms may represent cost-effective and useful PIV static simulation practice tools. Future studies could examine the utility of phantoms in teaching U/S guided PIV to novices and compare non-commercial to commercial phantoms.
**Figure 1:** Ultrasound images of homemade phantoms

A. UCSD gelatin  
B. Rippey chicken  
C. Amini ballistics  
D. Johnson tofu  
E. Morrow ballistics  
F. Nolting spam

**Figure 2:** Primary objective Scores for each phantom based on question responses are visually represented as:

A. Haptic similarity.  
B. Echogenic similarity.  
C. Utility for teaching.  
D. Commercial comparability.