A Cut Above: A Low-Cost Porcine Model for Ultrasound-Guided Stellate Ganglion Block Training

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Background

Ultrasound-guided Stellate Ganglion Block (SGB) is increasingly utilized by physicians for a variety of indications, such as complex regional pain syndrome (CRPS), acute herpes zoster (AHZ), refractory angina, post-traumatic sympathetic pain syndromes, postherpetic neuralgia (PHN), and peripheral vascular disease (4), creating a need for affordable procedural training models. Ultrasound (US) guidance has been shown to improve the accuracy and safety of SGB compared with traditional landmark-based techniques by enabling direct visualization of vascular structures, cervical anatomy, and local anesthetic spread (4). Prior studies have also demonstrated that ultrasound guidance reduces complications, such as hematoma formation, compared with landmark-based techniques (1, 2).

Methods

We constructed a low-cost ($25), high fidelity dual-tissue phantom using pork neck containing cervical vertebrae for deep osseous landmarks, lean pork thigh for the sternocleidomastoid muscle, a gel-filled drinking straw for the carotid artery vessel, and a pipe cleaner for the cervical sympathetic chain. Emergency medicine clinicians (n=17; 13 residents, 2 fellows, 2 attendings) participated in a hands-on workshop emphasizing sonographic landmark identification, vascular avoidance, and real-time in-plane needle hydrodissection. Participants completed a pre-workshop survey evaluating baseline experience, self-reported procedural familiarity (1–10 scale), and objective knowledge regarding arrhythmia laterality, Chassaignac's tubercle (C6 anterior tubercle), clinical role, and local anesthetic dosing. Following hands-on training, participants completed a post-workshop survey (n=9; 7 residents, 1 fellow, 1 attending) reassessing knowledge, procedural familiarity, curriculum needs, and perceived model effectiveness on a 1–10 scale.



Image 1: Drinking straws filled with ultrasound gel (red arrow) and pipe cleaner soaked in ultrasound gel (blue arrow) layered over pork neck. Lean beef chuck layered over the drinking straws, yarn, and vertebrae pork cut



Image 2: Pork thigh (yellow arrow) layered over the drinking straws, pipe cleaner, and pork neck (green arrow).

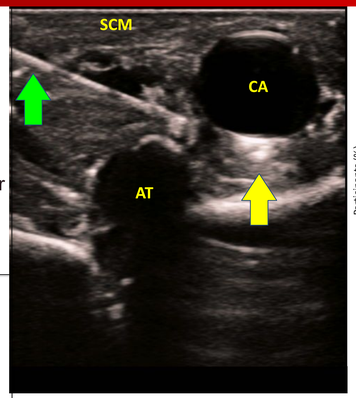


Image 3: Ultrasound of the SGB model with visualization of the needle (green arrow) directed towards the stellate ganglion (yellow arrow). SCM = sternocleidomastoid, CA = carotid artery, AT = anterior tubercle of the C6 transverse process

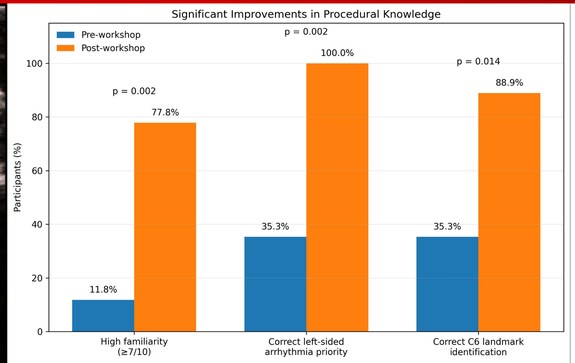


Image 4: Pre- and post-workshop survey responses demonstrate significant changes in procedural familiarity and knowledge of ultrasound-guided stellate ganglion block (SGB), including arrhythmia laterality and anatomic landmark identification

Domain / Metric	Pre-Workshop (n=17)	Post-Workshop (N=9)	Absolute Change
Procedural Familiarity (Scale 1–10, Mean)	3.12 (Median 2.00)	8.00 (Median 9.00)	+4.88
High Familiarity (Score ≥7/10)	11.8% (2/17)	77.8% (7/9)	+66.0%
Arrhythmia Laterality (Left-Sided Priority)	35.3% (6/17)	100.0% (9/9)	+64.7%
Anatomical Landmark (Chassaignac's Tubercle / C6)	35.3% (6/17)	88.9% (8/9)	+53.6%
Clinical Role (Temporizing Bridge in Refractory VF)	88.2% (15/17)	100.0% (9/9)	+11.8%
Local Anesthetic Dosing Accuracy (5 mL)	64.7% (11/17)	77.8% (7/9)	+13.1%
Refractory VF Definition Recognition	100.0% (17/17)	100.0% (9/9)	0.0%
Model Effectiveness Rating (Scale 1–10, Mean)	N/A	9.44 (Median 10.00)	N/A
Curriculum Expansion Endorsement	N/A	100.0% (9/9)	N/A

Table 1: Pre- and post-workshop survey responses assessing familiarity with SGB, including anatomical knowledge and clinical significance; perceived effectiveness of the simulation model; and support for increasing pain management training within residency curricula.

Results

Pre-workshop, participants reported low procedural familiarity (mean 3.12, median 2.00), with 64.7% (11/17) reporting zero prior SGB experience. Post-workshop, procedural familiarity increased by 156.6% to a mean of 8.00 (median 9.00), with 77.8% (7/9) rating familiarity ≥7/10. Correct arrhythmia laterality (prioritizing left-sided block for ventricular arrhythmias) rose from 35.3% (6/17) to 100.0% (9/9); identification of Chassaignac's tubercle increased from 35.3% (6/17) to 88.9% (8/9); recognition of SGB for electrical storm as a temporizing bridge rose from 88.2% to 100.0%; and recommended anesthetic dosing (5 mL) improved from 64.7% to 77.8%. The low-cost model received an outstanding mean effectiveness rating of 9.44/10 (median 10.00), with 66.7% assigning 10/10. All post-survey respondents (100.0%) endorsed expanding formal emergency medicine ultrasound-guided regional anesthesia curricula.

Conclusions

A novel $25 porcine simulation phantom is highly effective for ultrasound-guided stellate ganglion block training. Hands-on simulation produced marked gains in procedural familiarity and critical anatomical and clinical knowledge among emergency clinicians while receiving superior learner evaluations. This easily reproducible, low-cost model provides emergency medicine training programs with a scalable, practical tool to achieve procedural competency in critical, low-frequency emergency regional anesthesia techniques.

Citations

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