INNOVATIONS

Low-Cost, Low Fidelity Meat Model to Teach Ultrasound Guided Nerve Blocks

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ABSTRACT:

Audience: The target audience of this workshop is emergency medicine residents; however, it is appropriate for all level of learners from medical students to faculty.

Introduction: Pain control is a major focus in the emergency department. Regional anesthesia is a rapidly growing alternative to opioid analgesia or procedural sedation. Nerve blocks are useful in many procedures and are relevant to some of our most common chief complaints. Ultrasound guided regional anesthesia has been shown to be highly successful with minimal complications, and has been shown to reduce the need for supplemental anesthesia such as sedation and narcotics.[1] Ultrasound guidance both decreases complications and increases success rate of nerve blocks.[2] We provide a simple format for learning relatively safe and technically easy ultrasound guided nerve block techniques. Meat models provide realistic and superior tactile sensation, sono-anatomy, and injection resistance compared to homemade or commercial gel models. Meat and tendons for models are inexpensive and universally available.

Objectives: Upon completion of this workshop, learners will be able to: 1) Describe the risks and benefits of ultrasound guided nerve blocks. 2) Choose the appropriate nerve to block based on the area that needs anesthesia. 3) Display proficiency in performing an ultrasound guided nerve block on meat models. 4) Verbalize confidence in successfully performing ultrasound guided regional anesthesia. By successfully meeting these objectives, we aim to improve learner confidence and clinical ability in performing ultrasound guided nerve blocks.

Methods: This module consists of a short introductory lecture followed by small group practicums. Learners will rotate through this workshop in groups of four. Each rotation will require about 30 minutes. The instructor will demonstrate appropriate technique for ultrasound guided nerve block using the prepared meat model. Learners will then practice the in-plane ultrasound guided nerve block technique.

Topics: Regional anesthesia, ultrasound, nerve block, ultrasound phantom, low fidelity, meat model, conference, workshop.

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USER GUIDE

List of Resources:

Learner Audience:
The target audience for our workshop is emergency medicine residents; however, it may be applied to all levels from medical students to faculty learners. In order to have highest benefit and smooth flow, learners should know the basics of ultrasound and have some experience with machine use.

Time Required for Implementation:
Innovation creation can take up to 1 hour depending on instructor comfort and experience. The session length is 30 minutes per group. Anticipate repeating this session every other year to maintain competence

Recommended Number of Learners per Instructor:
4 learners per group per instructor.

Topics:
Regional anesthesia, ultrasound, nerve block, ultrasound phantom, low fidelity, meat model, conference, workshop.

Objectives:
The goal of this workshop is to provide and enhance the knowledge and ability of the learners to perform ultrasound guided nerve blocks. By the end of this small group workshop, the learner should be able to:

1. Describe the risks and benefits of ultrasound guided nerve blocks.
2. Choose the appropriate nerve to block based on the anatomy of the area needing anesthesia.
3. Demonstrate proficiency in performing ultrasound guided nerve blocks on meat models.
4. Practice performing ultrasound guided regional anesthesia.

Linked objectives, methods and results:
The goal of this innovation is to provide learners with a hands-on, realistic, cost-effective simulation exercise to learn and practice ultrasound guided nerve blocks. By using a meat model, we are able to create a cheap, low fidelity model that is sonographically and tactically realistic. This gives us the opportunity to address subtle teaching points including fascial planes and other anatomic structures relevant to this procedure.

Cognitive objectives (objective #1 and #2) are achieved by the mini lecture.

Psychomotor objectives (objective #3) makes up the main portion of this workshop and is achieved by the kinesthetic format. This improves learner engagement and retention by reinforcing the skills learned during the didactic portion.

Affective objective (objective #4) is measured with a short survey before and after the workshop.

Measurement of other variables such as time to procedure completion and rate of successful anesthesia in addition to provider confidence can be performed in 6 months and 1 year to further measure learner retention and workshop effectiveness.

Recommended pre-reading for instructor:

- Avila J. Posterior tibial nerve block – 5 min vid. 5 Min Sono. http://5minsono.com/ptnb/. Published January 14, 2016. Accessed August 22, 2018.
- Bunting LV. Ultrasound guided nerve block. ACEP Ultrasound guide for emergency physicians. https://www.acep.org/sonoguide/nerve_block.html. Accessed August 22, 2018.
- Dawson M and Mallin M. Episode 29 - Ultrasound guided nerve blocks part 1. Ultrasound Podcast.com. http://www.ultrasoundpodcast.com/2012/06/episode-29-ultrasound-guided-nerve-blocks-part-1/. Published June 1, 2012. Accessed August 18, 2018.
- Dawson M and Mallin M. Episode 30 - Ultrasound guided nerve blocks part 1. Ultrasound Podcast.com. http://www.ultrasoundpodcast.com/2012/06/episode-30-ultrasound-guided-nerve-blocks-part-2/. Published June 7, 2012. Accessed August 18, 2018.

Learner responsible content (LRC):
Learners should have basic knowledge of ultrasound physics and use. PowerPoint for the lecture portion is attached. Teaching points can be reinforced by learners reviewing videos of specific blocks that will be taught on nysora.org or utilizing the following references.

- Avila J. Posterior tibial nerve block – 5 min vid. 5 Min Sono. http://5minsono.com/ptnb/. Published January 14, 2016. Accessed August 22, 2018.
- Bunting LV. Ultrasound guided nerve block. ACEP Ultrasound guide for emergency physicians. https://www.acep.org/sonoguide/nerve_block.html. Accessed August 22, 2018.
- Dawson M and Mallin M. Episode 29 - Ultrasound guided nerve blocks part 1. Ultrasound Podcast.com.

http://www.ultrasoundpodcast.com/2012/06/episode-29-ultrasound-guided-nerve-blocks-part-1/. Published June 1, 2012. Accessed August 18, 2018.
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Associated content:

- Meat Model Setup PowerPoint
- Ultrasound Guided Nerve Blocks Lecture PowerPoint
- Ultrasound Guided Nerve Block Handout

Implementation Methods:

This workshop was implemented as part of the emergency medicine resident conference. It may also be used as part of an ultrasound workshop for students, faculty, or other learners. The attached PowerPoint and handout were used as supplements.

The session starts with a short lecture explaining risks and benefits of nerve blocks and highlighting commonly used nerve blocks in the emergency department to help supplement the learner responsible content. Teaching points focused on appropriate identification of fascial planes and nerves as well as proper technique for in-plane needle guidance. Further discussion reviewed hydrodissection and avoidance of blood vessels.

The learners were then split into groups of four, each group with an instructor, an ultrasound machine, and a meat model. They received a demonstration of the procedure by the instructor using the meat models. The learners then identified co-participant nerves using ultrasound with close guidance from the instructor. Then each learner had the opportunity to perform in-plane ultrasound guided nerve blocks individually with the hands-on training meat models and received immediate feedback from instructors.

List of items required to replicate this innovation:

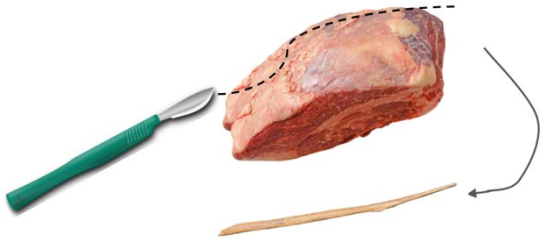
1. Ultrasound with linear probe
2. 10cc syringes/flushes
3. Spinal needles
4. Beef eye rounds
5. Beef tendons
6. Scalpel, long skewer
7. Optional: crochet needle or alligator forceps
8. Gloves, towels, bleach wipes

Approximate cost of items to create this innovation:

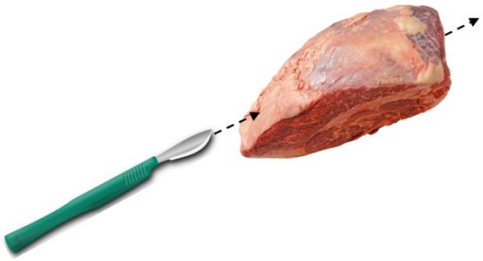
$35 for the meat including tendons. We were able to obtain chucks, spinal needles, saline flushes and syringes from our department's educational supply. We used ultrasound machines from our simulation department.

Detailed methods to construct this innovation:

1. Prepare a beef eye round model by using a scalpel to remove a long strip of tendon from the side.

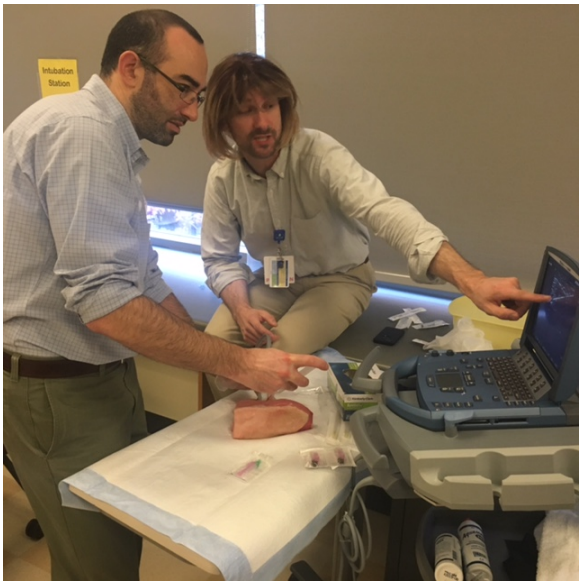


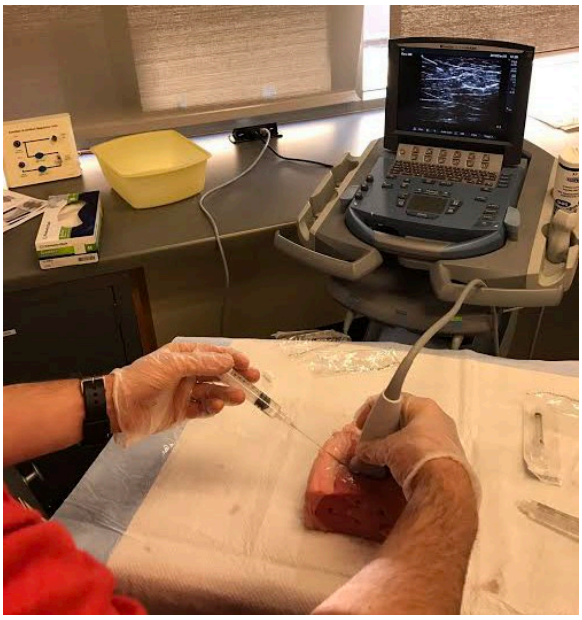
2. Cut the tendon into a long strand just under one centimeter in diameter and roughly the length of the eye round.
3. Use the scalpel with alligator forceps, crochet needle, or skewer to pierce horizontally through the longest part of the beef.



4. Thread the tendon through this passage. (A crochet needle or an alligator forceps will be particularly helpful here)

5. Ultrasound and practice injecting.





Results and tips for successful implementation:
Through post session feedback, the learners gave the workshop universally positive feedback, specifically highlighting their interest in the procedure; the novelty of the models and the fact that this was an "advanced topic" which helped keep their interest.

Originally, we had thought about using pork but changed to beef in lieu of certain resident preferences. To decrease down time, this workshop can also be performed in conjunction with other stations in case you do not have enough faculty or machines to have all residents go at once. When we performed this workshop, we combined it with two other stations that the residents could rotate through.

References/suggestions for further reading:

1. Sites BD, Chan VW, Neal JM, Weller R, Grau T, Koscielniak-Nielsen ZJ, et al. The American Society of Regional Anesthesia and Pain Medicine and the European Society of Regional Anaesthesia and Pain Therapy Joint Committee recommendations for education and training in ultrasound-guided regional anesthesia. *Reg Anesth Pain Med*. 2009;34:40-46. doi: 10.1097/AAP.0b013e3181926779
2. Wadhwa A, Kandadai SK, Tongpresert S, Obal D, Gebhard RE. Ultrasound guidance for deep peripheral nerve blocks: A brief review. *Anesthesiol Res Pract.* 2011:262070. doi: 10.1155/2011/262070
3. Willschke H. Ultrasonography for ilioinguinal/iliohypogastric nerve blocks in children. *Br J Anaesth.* 2005;95(2):226-230. doi: 10.1093/bja/aei157.

LEARNER MATERIALS

Ultrasound Guided Nerve Blocks

BENEFITS

-Better outcomes
-Faster, fewer complications

ANATOMY

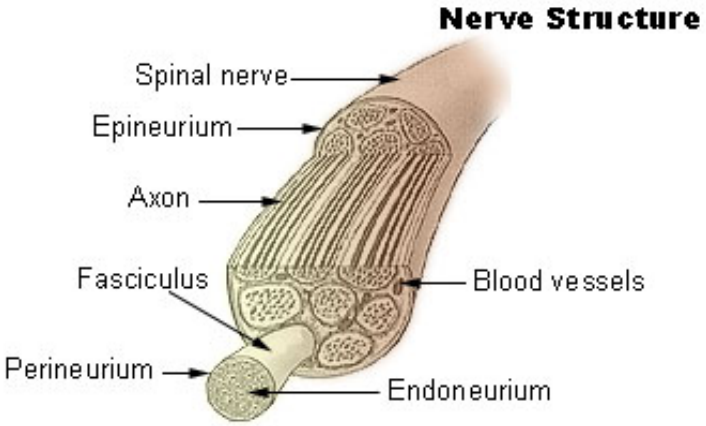
-Note Vessels
-Honeycomb appearance
-Fascial planes
-Anisotropy

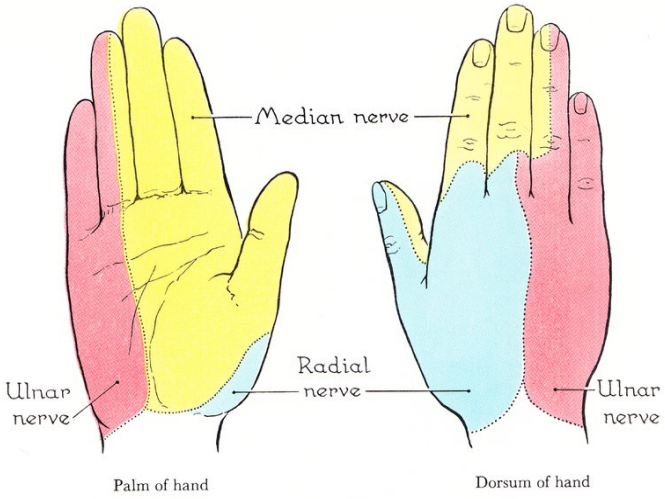
CONTRAINDICATIONS

-Neurologic Compromise
-Altered Mental Status
-Compartment Syndrome
-Consultants Uncomfortable

COMPLICATIONS

-Lidocaine anesthetic systemic toxicity (LAST)
-Nerve Injury
-Allergic Reaction





LEARNER MATERIALS

FOREARM BLOCKS

-Hand lacerations
-Boxer fracture

POSTERIOR TIBIAL NERVE

-Foot laceration
-Foreign body