The Advantage of Trapezoid Imaging in Ultrasound-guided Regional Anesthesia.

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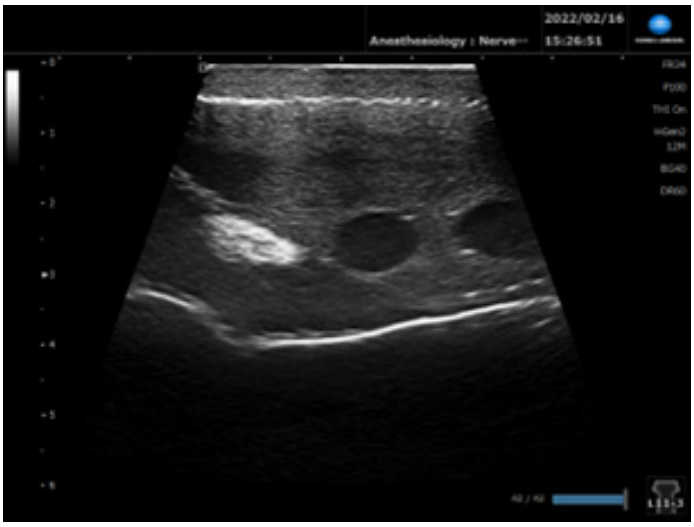
The use of point-of-care ultrasound for image guidance during regional anesthesia procedures continues to increase. Regional anesthesia is utilized for chronic pain management and to block sensations from pain during procedures without the use of general anesthesia. The quality of ultrasound imaging for needle guidance is dependent on the system and its features as well as the operator's knowledge and expertise. While there has been much focus on clinical education and training for ultrasound-guided procedures, image quality and the ability to visualize structures is reliant upon the ultrasound system, probe and image processing software being utilized for the procedure.

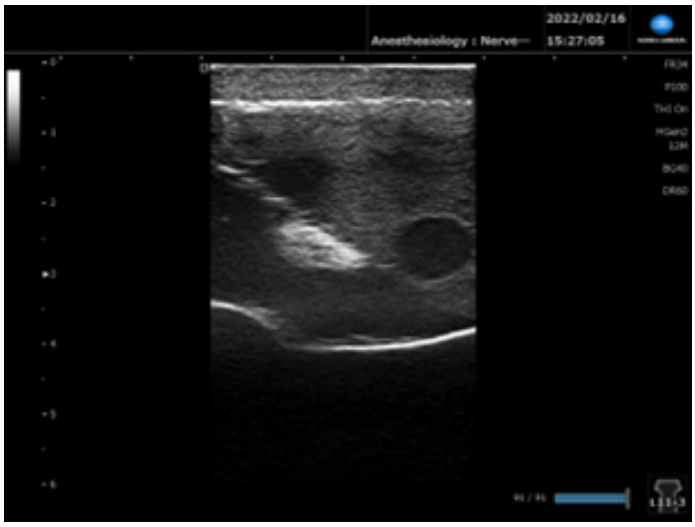
The laws of physics indicate that, with current ultrasound technology, deeper structures are better visualized with lower frequency probes. These probes often employ a curved array design which results in an image that appears cone-shaped to the operator. Once imaged, these deeper structures appear significantly smaller, albeit with much improved clarity of the imaged target and a wider viewing window. In contrast, more shallow structures are best imaged using a high frequency probe, generally with a linear array. In sacrificing depth, one achieves a much clearer target image in closer proximity to the probe in this instance. However, use of a linear probe with increasing depth reduces the width of the visual window.

According to Jaffe, "in regional anesthesia and analgesia clinical practice, it may be ideal to have a combination of these two general types of probes and their associated benefits in one probe. This is particularly advantageous when performing the hip or PENG block (PEricapsular Nerve Group) in obese patients, for example." The target for this block is relatively deep in patients with a larger body habitus wherein additional tissue may increase the distance from the skin-probe interface to the target structure.

Novel technology called trapezoidal imaging, available on new ultrasound equipment, allows for a 'best of two worlds' imaging capability whereby one can use a linear probe, allowing for the larger target image with a view of deeper structures and a wider field of view. This allows for visualization of the target and other structures that need to be avoided by the advancing needle. In as much as the approach to the target is to be successful, so too must avoidance of unintended structures being contacted by the injectate. "Excellent visualization of the intended target coupled with a large width of view allows for minimizing risk of needle misplacement while increasing the likelihood of a successful local anesthetic deposition", Jaffe added.



A) Trapezoidal Image of PENG Target



B) Traditional linear image of the PENG target

"As can be seen by the images above, additional anatomy evaluation is possible with the linear probe using the trapezoidal imaging feature to include visualization of other structures when performing a PENG block. This information is also helpful in other approaches to a nerve block procedure whereby the existence of other structures can indicate incorrect placement of the probe on the patient", says Jaffe. For example, it is regarded by many experts that during the performance of a femoral nerve block, if one visualizes multiple branches from the common femoral artery, there is an increased opportunity to spare some segments of the femoral nerve should the injection be performed where this branching of the artery occurs. A lateral lying femoral nerve may be visualized, but deeper branched arteries may not be visible without the additional width of view.

As ultrasound solidifies its place in routine point-of-care imaging, the focus on enhancing accuracy and risk reduction must be a priority in delivery of regional anesthesia and chronic pain management. Technology sometimes complicates more than it simplifies. Indeed, this can be true, however, there are myriad technological advances that have proven to do just exactly what is needed in the fast-paced world in which many physicians are practicing.

Byrne and colleagues describe point of care ultrasound as "...a fundamental skillset for all practicing anesthesiologists." Indeed, in the current practice environment, it could also be argued that any patient facing physician could benefit from the advantages of this now ultraportable technology. Its widespread acceptance will likely promote the utilization of real time dynamic image guidance to many standards of care.

In conclusion, the patient's body habitus, the location of the intended target and the ability to see and avoid other structures is critical to the success and safety of a regional anesthesia procedure. Utilizing an ultrasound system and probe that enables high-quality trapezoidal imaging provides the best of two worlds: the ability to visualize deep targets or penetrate thick tissues with the ultrasound beam and also obtain a wider field of view with one probe can increase the likelihood of a successful procedure and enhance patient satisfaction.

References

Berlioz BE, Bojaxhi E. PENG Regional Block. 2021 Mar 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan–. PMID: 33351429.

Girón-Arango L, Peng PWH, Chin KJ, Brull R, Perlas A. Pericapsular Nerve Group (PENG) Block for Hip Fracture. Reg Anesth Pain Med. 2018 Nov;43(8):859-863

Byrne M, Singleton M, Kalagara H, Haskins SC. Perioperative Point-of-Care Ultrasound. Adv Anesth.

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