

## When Is a Single-injection Nerve Block Not Really a Single Injection?

*To the Editor:*—I read, with interest, the case report describing a brachial plexopathy after an ultrasound-guided interscalene block in a patient with multiple sclerosis<sup>1</sup> and the accompanying editorial<sup>2</sup> and would like to make an observation not mentioned in either.

Interscalene blocks have been performed using either mechanical paresthesia or electrical nerve stimulation, for decades, with success rates reported to be 94–99%.<sup>3–5</sup> In both of these techniques, the entire dose of local anesthetic is injected upon eliciting the initial desired response. These true single-injection techniques occur at the first nerve root, and likely the most superficial one, encountered. Perlas *et al.* used real-time ultrasound to quantify the sensitivity of both paresthesia and motor nerve stimulation techniques. A 22-gauge insulated needle was in the axilla of 103 patients, and after visualizing direct needle-nerve contact, the patients were asked whether they felt any paresthesia. The nerve stimulator was then turned on, and a motor response was sought at 0.5 mA or less. The authors concluded that there are a significant number of false-negative responses (direct needle-nerve contact *not* resulting in paresthesia or motor response) with these traditional methods of localization.<sup>6</sup> This study showed that direct ultrasound visualization does not prevent intimate needle-nerve contact. Although Koff *et al.*<sup>1</sup> note that their needle “was not seen to penetrate the epineurium by [their] ultrasound image” after the first injection at C5, one must wonder how that initial volume of injection altered the ability to discern the needle-nerve relation of the three subsequent injections/maneuvers used to complete the block.

One of the many questions that needs to be addressed, as we continue to promote the benefits of ultrasound for peripheral nerve blocks, is whether there are any advantages to repositioning a needle

multiple times to be able to visualize local anesthetic spread around each of the nerve roots, because our historic success rates imply that this occurs adequately, with the initial injection. That is, does this practice of diving for individual and deeper nerve roots actually increase the risk to patients? The enemy of very good may prove to be better.

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## Ultrasound-guided Regional Anesthesia: Why Can't We All Just Stay Away from the Nerve?

*To the Editor:*—Hebl's response<sup>1</sup> to the case report by Koff *et al.*<sup>2</sup> highlights the quagmire that anesthesiologists have been stuck in since the invention of the nerve stimulator. This quagmire is “How close can I get to the nerve?” Because mechanical trauma and the risk of intraneural injection are two risk factors we have control over, shouldn't we be asking instead “How can I stay away from the nerve?”

Great regional anesthesiologists such as Winnie, Beck, and Dalens have published elegant block techniques using a detailed understanding of anatomy and fascial planes that do not require immediate proximity of the needle to the nerve.<sup>3–5</sup> Today, we can use high-resolution ultrasound to visualize nerves, blood vessels, and fascial planes. Why not use this new technology to position the needle accurately in a fascial plane containing the nerve rather than as the “visual equivalent of a nerve stimulator”? Small wonder that those still trying to “position the tip of the needle next to the nerve and get a donut sign” have not demonstrated any outcome differences using ultrasound techniques.

At the University of Utah (Salt Lake City, Utah), we have adopted the philosophy correctly stated by Marhofer *et al.*<sup>6</sup>: “Nerves are not blocked by the needle but by the local anesthetic.” The results have been encouraging. All of our techniques for single and continuous nerve block placements are performed by injection into fascial planes containing the nerve and *not* by attempting to place the needle in close proximity to the nerve. We have performed more than 6,000 blocks using only ultrasound guidance, including more than 3,800 continuous catheters. A recent prospective study of 200 single and continuous

interscalene blocks performed here using only ultrasound guidance showed a success rate of 99%, with only 1% of patients having mild, transient sensory deficits.<sup>7</sup> This is a considerable improvement over existing data for nerve stimulator techniques.<sup>8,9</sup> Our published data for 620 outpatients with ultrasound-guided femoral, sciatic, and interscalene catheters also show high success and low complications in comparison with nerve stimulator techniques.<sup>10</sup> As ultrasound gains more widespread application, additional outcome data will follow.

To say that ultrasound will not significantly improve patient safety is shortsighted. Many of the early techniques for ultrasound-guided blocks are still a variation on the nerve stimulator theme of “put the needle as close as possible to the nerve.” As we learn to use ultrasound to stay away from the nerve instead of getting close to it, we may be pleasantly surprised by the results. Dr. Hebl and others suggest that in ultrasound we have not found the “holy grail” of regional anesthesia.<sup>1,11</sup> In our opinion, it could be the “holy grail”; we simply must know how to use it.

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## Can Ultrasound Impact the Risk-Benefit Ratio for Nerve Blocks?

*To the Editor:*—Dr. Hebl's editorial<sup>1</sup> is thought provoking. The real potential of ultrasound lies in the opportunity to approach nerve blocks in entirely new ways. Regional anesthesia for hand surgery provides an example. Many anesthesiologists consider it axiomatic that one should avoid performing nerve blocks close to the tourniquet. This is partially defensive because "when the site of the block is close to the tourniquet, electromyographic and conduction nerve studies cannot allow such differentiation and by default, the anesthesiologist is usually blamed."<sup>2</sup> Despite this caveat, the most commonly used regional technique for hand surgery with an upper arm tourniquet is the axillary block. If one subscribes to the theory that serious nerve damage from axillary block is often the result of vascular trauma and a medial brachial fascial compartment syndrome,<sup>3</sup> rather than direct needle-nerve trauma, it is even more imperative to avoid axillary block with an upper arm tourniquet.

Ultrasound should permit the near total abandonment of the axillary block. With ultrasound, peripheral nerve blocks in the mid forearm become straightforward.<sup>4,5</sup> These blocks should replace the axillary block for minor hand surgery (*e.g.*, carpal tunnel, digit fractures).<sup>6</sup> Before ultrasound, many anesthesiologists avoided supraclavicular and infraclavicular blocks for fear of pneumothorax. With ultrasound, the lung and major vessels are directly visualized, so the proceduralist avoids them as a matter of course. For major hand, wrist, and elbow surgery, ultrasound-guided supraclavicular or infraclavicular blocks should be the first choice whenever an upper arm tourniquet is used.

The gist of Hebl's editorial and Koff *et al.*'s case report<sup>7</sup> seems to be that this patient had an unfavorable risk-benefit ratio due to preexisting neurologic disease. But, where was the benefit in the first place? For total shoulder replacement, the requirement for significant pain control will far outlast any single-shot nerve block. The "tip-of-the iceberg" reports of permanent diaphragmatic paralysis<sup>8</sup> after uneventful interscalene blocks offer another reason to demure the use of single-shot interscalene blocks for shoulder surgery. Ultrasound may allow more use of suprascapular blocks, either single shot or continuous.<sup>9</sup> The ultrasound-guided suprascapular block may not be quite as effective, but it avoids the interscalene's dreaded complications. For major shoulder surgery without evidence of preexisting brachial plexopathy, continuous brachial plexus blocks are still encouraged. The risk of a continuous block can be justified to the patient because it provides prolonged analgesia matched to the requirements of major surgery.

Ultrasound allows the abandonment of some, but not all, traditional practices associated with nerve blocks. Many ultrasonographers no longer aspirate before injection, because ultrasound is a far more sensitive detector of intravascular injection than any aspiration test. The same cannot be said for potential intrafascicular injection. As Dr. Hebl notes, the precise position of the tip and the nerve is not always apparent until one has injected 2-3 ml of local anesthetic. In the unlikely situation where one has actually placed the needle tip into a nerve fascicle, the damage may already be done before anything shows up on ultrasound. Therefore, ultrasound may not obviate the need for injection pressure monitoring during nerve blocks. Injection pressure can be monitored with an inexpensive proprietary device (BSmart; Concert Medical, Norwell, MA) or by assessing the compression of an air bubble above the local anesthetic in the syringe.<sup>10</sup>

Only when we thoroughly rethink our approach to surgical nerve blocks will ultrasound fulfill its potential for improved safety.

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