Ultrasound-guided Popliteal Intraneural Approach: Comment

To the Editor:

We read the recent publication by Cappelleri *et al.*[1] with concern and disappointment. Our concern was for the patients who were intentionally subjected to a procedure known to cause nerve injury,[2] and our disappointment was in the rationalization used by the authors to justify this practice.

In this study, Cappelleri *et al.* claim that intraneural sciatic nerve injection poses no greater risk than extraneural injection. This claim is based on the authors' previous work published from 2016.[2] In that study, the investigators compared nerve conduction for patients who had received what they classified as intraneural and extraneural injection of the sciatic nerve. They report that "both techniques resulted in similar, significant reduction of action potential 5 weeks after surgery compared to baseline."[2] However, in this 2016 study, the needle tip position for so-called extraneural (also referred to as subparaneural) technique was so similar to the intraneural position that the investigators inadvertently performed intraneural injection on 22% of the extraneural study patients. This is a markedly different concept than what is generally considered to be extraneural.[1] The outcomes reported from their 2016 study have yet to be reproduced by other investigators. Most anesthesiologists proficient at ultrasound-guided regional anesthesia have adopted techniques for sciatic nerve block that do not require immediate proximity to the nerve.

It seems logical that any study justifying intraneural injection would provide irrefutable evidence that this practice does not increase the long-term risk of nerve injury. In the present study, 51% of the study participants were lost to follow-up before the study was completed. Paradoxically, the authors document electrophysiologic evidence of nerve injury in 49% of participants and go on to state that "no patients reported clinical neurologic symptoms."[1] Although it may be true that no patients in this study reported neurologic symptoms, it is also true that none of the patients were actually clinically examined for sensory deficit during follow-up in this study; the 6-month neurologic exam was a telephone call. A phone call cannot replace careful physical examination for detecting neurologic deficits. Anyone who has examined a patient carefully after foot and ankle surgery will agree that persistent sensory changes near incisions are common with or without a nerve block. The fact that no patient in this study reported hallucal sensory changes with bunion surgery is very unusual.[1]

Perhaps to assuage our concern of injury from intraneural injection, the authors state that "lasting neurologic dysfunction significant enough to arouse patient complaints is rare."[1] The reference cited to support this claim is a retrospective survey that predates ultrasound and provides no reference to intraneural injection.[3]

So, to what end do we embrace intraneural injection? The authors suggest that this technique determines a "significant decreased risk of systemic local anesthetic toxicity."[1] This would have been a persuasive argument 15 yr ago. Unfortunately for the authors, it is difficult to improve on the safety already afforded by ultrasound. Consider the fact that a recent report of more than 12,000 ultrasound guided peripheral nerve blocks showed one episode of systemic toxicity (seizure, without cardiac effects).[4] More importantly, for the nearly 1,000 popliteal fossa injections reported in the same study, there were no episodes of systemic toxicity.

Regional anesthesia has experienced a windfall of safety and efficacy as a result of ultrasound. The report by Sites *et al.*[4] reflects widespread success already being achieved without intraneural injection. In the face of such favorable outcomes, there must be compelling reasons to adopt a practice that has heretofore been associated with such angst. Unfortunately, the study by Cappelleri *et al.* falls short of this mark.

Competing Interests

The authors declare no competing interests.

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(Accepted for publication March 6, 2019.)

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To the Editor:

Although the study by Cappelleri *et al.*[1] provides us with insights about the reduction of nerve action potentials in human sciatic nerves that persist to at least 6 months after ultrasound-guided intraneural injections, we are concerned by the ethical implications and interpretation of safety of this study in widespread regional anesthesia practice. An unanticipated finding from a previous study, showing that unintentional intraneural injection in a small subgroup (4 of 48 patients) resulted in a faster block onset, allowed Cappelleri *et al.* to justify providing intentional intraneural injections to subjects receiving sciatic nerve blocks. Unfortunately, the original study was neither powered nor designed to measure long-term consequences on human nerves.[2] Similarly, a 2016 trial of 88 patients from the same author shaped the ethical foundation of this current study. However, the 2016 study lacked a sample size calculation on an important secondary outcome (electrophysiologic impairment) and was not powered to detect differences in neurologic recovery at 5 weeks.[3] Also, only two thirds of those patients completed assessment at 5 weeks.[3] This further weakened the probability of finding a difference in electrophysiologic impairments between the intraneural and extraneural groups. What if there had been significant recovery of amplitude and latency of action potentials in the extraneural group but not the intraneural group by 6 months in the 2016 study? Then, it would be ethically challenging to substantiate the current all-intraneural design. Alarmingly, during follow-up at 5 weeks in that 2016 article, "there was a nonsignificant trend toward patients in the intraneural group to present with more postoperative neurologic symptoms (in 5 of 7 patients)."[3]

Furthermore, the authors hypothesized that a decrease in volume of a highly concentrated ropivacaine solution might decrease the incidence of local anesthetic systemic toxicity. However, there is no reported case of local anesthetic systemic toxicity, to date, among patients undergoing hallux valgus surgery with extraneural techniques using higher volumes of local anesthetic. Proposing a controversial technique to minimize an extremely rare complication appears ill-advised.

Using ultrasound to safely prevent intraneural injections and hopefully to avoid fasicular injury is advocated, and frankly, without convincing safety data in animal nerve models or long-term electrophysiologic testing in humans or a clear clinical benefit, other than a 15-min shorter block onset time, we must use common sense when drawing conclusions.

Competing Interests

The authors declare no competing interests.

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