



Evidence-based review of ultrasound imaging for regional anesthesia

Paul H. Ting, MD,^a and John G. Antonakakis, MD^b

From the ^aDepartment of Anesthesiology, University of Virginia Health System, Charlottesville, Virginia; and the ^bDepartment of Anesthesiology, Dartmouth Hitchcock Medical Center, Lebanon, New Hampshire.

KEYWORDS:

Ultrasound;
Imaging;
Guided;
Regional;
Anesthesia;
Peripheral nerve;
Block;
Blockade;
Evidence

Use of ultrasound guidance for regional anesthesia has grown in popularity recently. Advocates claim many benefits, including higher success rates, a decrease in block performance time, a decrease in onset time, a higher quality block, the ability to use less local anesthetic, and a longer duration of block. Many also believe that the ability to visualize critical structures decreases the rate of complications. This article reviews the current evidence for these claimed benefits. In addition, discussion of how clinical practice patterns are affected and how ultrasound can add to the knowledge base of regional anesthesia practice is presented.

© 2007 Elsevier Inc. All rights reserved.

The use of ultrasound for the placement of peripheral nerve blocks has received a great deal of attention lately in the anesthesiology literature and is beginning to solidify a place in clinical practice. As with any new technology, questions have been raised as to efficacy, cost versus benefit, safety, ease of use, and issues of proper training. Current techniques of nerve localization and blockade (specifically nerve stimulation) achieve a high rate of success when practiced by trained and experienced experts, and the rate of complications is quite low.¹ Do we really need a new technique that requires additional equipment, additional cost, and additional training while at the same time redefining the way we approach regional anesthesia?

What is indisputable, however, is that current techniques such as nerve stimulation do have a significant failure rate,^{2,3} the reasons for which are often unknown. In addition, although the complication rate is low, there is a small incidence of severe adverse events such as permanent nerve

injury.¹ Advocates of the use of ultrasound believe that the use of ultrasound technology provides a superior technique by allowing the visualization of the target structure (ie, the nerve), the visualization of other structures of interest (eg, blood vessels, lung, pleura), a real-time examination of the spread of local anesthetic as it is injected, and the ability to reposition the needle to both avoid injury and increase success rates.

Claimed benefits of ultrasound-guided regional anesthesia include that it is easier to learn and perform, quicker to perform, has a faster onset, results in higher success rates, results in more complete blocks, requires lower volumes of local anesthetic, and increases safety. Some advocates of the use of ultrasound have stated that it should be intuitive that direct visualization in real-time would have advantages,⁴ that common sense dictates its use,⁵ and that the safety implications of the technology are self-evident.^{6,7} Is there evidence in the literature to support these claims?

This article will review the current evidence citing advantages in using ultrasound regional anesthesia. A literature search was performed between January 1985 and June 2007 with the following terms: ultrasound, regional, anes-

Address reprint requests and correspondence: Paul H. Ting, MD, Department of Anesthesiology, University of Virginia Health System, P.O. Box 800710, Charlottesville, VA 22908-0710.

E-mail: PHT5D@hscmail.mcc.virginia.edu.

thetia, and peripheral nerve blocks. In addition, references found in relevant studies were selected and reviewed.

Many identified references are “proof-of-concept” or descriptive studies, case reports, or small case series. Others did not directly compare ultrasound with other methods. Many of these references are used and discussed for background and supporting information, but a smaller subset of studies is discussed regarding claimed benefits of ultrasound-guidance in regional anesthesia (see [Table 1](#)). In addition, other examples of new techniques and technology being introduced into clinical practice are discussed, and the suggestion is made that this historical perspective may lend insight into the future adoption of ultrasound guidance for regional anesthesia. In addition, the very use of ultrasound is self-instructional in that it alters the decision-making process regarding procedural performance.

The use of ultrasound (and other imaging techniques) for the purpose of assisting with peripheral nerve blockade is not a new idea. It was first described in the anesthesiology literature in 1978 by La Grange and coworkers,⁸ who used a Doppler ultrasound blood flow detector to assist in the supraclavicular approach to brachial plexus blockade. Throughout the 1980s, there were reports of the use of ultrasound for different techniques of peripheral nerve blockade, mostly case reports or “proof-of-concept” communications showing that certain structures could indeed be imaged by ultrasound.^{9,10} In 1989, Ting and Sivagnanaratnam¹¹ confirmed cannulation of the axillary sheath with ultrasound and demonstrated the spread of local anesthetic when these cannulae were injected. They reported 100% success without any complications of paresthesia or puncture of blood vessels. The cannulae in this study, however, were placed without ultrasound guidance. Not until 1994 is there a report¹² in which ultrasound was actually used to guide placement.

Like all new technologies, the idea of routine use of ultrasound for peripheral nerve blockade required a confluence of changes and technical advances in order to gain a foothold in everyday practice. Only now that ultrasound technology has matured such that it is portable, affordable, and of sufficiently high image quality have clinical practitioners become excited about its regular use. Indeed, ultrasound guidance may result in a renewal of interest and popularity of regional techniques in the clinical practice of anesthesiology. Will regional anesthesia no longer be limited to experts and instead find its way into widespread general practice?

Clearly, the issue of risks and benefits of this new technique is one that requires additional study. It was not until the middle to late 1990s that studies appeared claiming benefits for regional anesthesia over other techniques began to appear. However, the specific question of whether ultrasound guidance results in a lower complication rate may be one that is not answerable by a traditional randomized study. Indeed, blinding for such a study may not be possible. Additionally, the complication rate for regional anesthesia

is low enough that a very large study would have to be performed to see significant differences. However, as some have suggested, the adoption of this technology into our everyday practice may occur without such evidence and before rigorous studies are completed.⁷ Some of the advantages and perceived benefits may indeed be as intuitive as some have claimed.⁴⁻⁷ Indeed, nerve stimulation has never definitively been shown by a double-blinded, randomized, controlled study to be easier, more effective, or safer than the use of paresthesiae to locate nerves, and yet it is in common and everyday use.

Historical perspective of laparoscopic surgery

It is perhaps useful to look at the historical example of laparoscopic surgery when considering the barriers a new technique faces when introduced into clinical practice. Laparoscopic surgery was first introduced in the early 1980s. The first appearance of information regarding this technique in the literature consisted of letters to the editor and short case series. This is very similar to the early reports of the use of ultrasound for peripheral nerve blockade. Also very similar is the fact that preliminary results with the new technique seemed to be extremely promising, and some authors began suggesting that the new technique was better and would lead to better outcomes.

These claims faced significant initial resistance, and this resistance delayed widespread adoption of laparoscopic surgery, with many considering it a novelty or a technique in search of an indication. Many complained about the fact that adoption of the technique required massive retraining for practicing surgeons. Most critics suggested that judgment be withheld until evidence of the benefits was presented in the form of controlled trials. Again, the parallels to the current status of ultrasound-guided regional anesthesia should be evident.

Now, of course, we know that the evidence for better patient outcome in those undergoing laparoscopic surgery versus open procedures does indeed exist in the literature. This technique has been widely adopted and is considered the first option for many procedures, only abandoned when technical difficulties prevent its use. As a result, a technique that started as one that you learned “on your own” or from a colleague has progressed to a standard part of surgical training in residency. Laparoscopic techniques are widely taught in every surgical training program. In fact, any program neglecting to train their residents in this technique would likely not be able to exist.

Of course, surgical training still involves learning to do operations without laparoscopy by using traditional open techniques. Quite simply, there are times when laparoscopic techniques are impossible or exceedingly difficult technically. There may be similar considerations requiring the teaching of multiple methods of peripheral nerve blockade versus teaching ultrasound-guided techniques alone, and there is

Download English Version:

<https://daneshyari.com/en/article/2771161>

Download Persian Version:

<https://daneshyari.com/article/2771161>

[Daneshyari.com](https://daneshyari.com)