

ULTRASOUND GUIDED NERVE BLOCK IN LOWER LIMBS

ESSAY

Submitted In Fulfillment for the
Master Degree in Anesthesiology

By

Bassil hassan Ibrahim

M.B., B.B.Ch. (Cairo University)

Supervisors

Dr. Hoda Saad El-din Hafez

Professor of Anesthesiology

Faculty of Medicine

Cairo University

Dr. Maged Salah Mohamed

Assistant Professor of anesthesiology

Faculty of Medicine

Cairo University

Dr. Sameh Nabil Abu-Alam

Lecturer of Anesthesiology

Faculty of Medicine

Cairo University

Faculty of Medicine

Cairo University

2010

Acknowledgement

*Thanks to **Allah** for giving me the power and strength to carry out this work,*

Words stand short when they come to express my gratefulness to my supervisors.

*I wish to express my sincere gratitude and thanks to **Prof. Dr. Hoda Saad El-din Hafez** Professor of Anesthesiology, Faculty of Medicine, cairo University, for her remarkable effort, considerable help and continuous guidance which were the major factors behind the completion of this work. My deep gratitude goes to her faithful supervision, great cooperation and her meticulous revision of this work,*

*I am deeply indebted to **Dr. Maged Salah Mohamed** Assistant professor of Anesthesiology, Faculty of Medicine, cairo University, for his extreme patience, keen supervision. He generously offered me a great help through his experience, support, and encouragement.*

*My deep gratitude goes for **Dr. Sameh Nabil Abu-Alam** Lecturer of Anesthesiology, Faculty of Medicine, cairo University, for his constant support, valuable advice and remarks that have been of utmost help.*

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

(قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ)

صدق الله العظيم

(سورة البقرة: 32)

Abstract

The development of regional anesthesia, anesthetists all over the world tried to establish various mechanical aids like radiography to visualize the target nerve. The benefits of directly visualizing targeted nerve structures are significant as it allows the anesthetist to reposition the needle in the event of maldistribution and also it allows the anesthetist to monitor the distribution of local anesthetic.

Key words

GUIDED _ ULTRASOUND _ LOWER

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INTRODUCTION FOR ULTRASOUND

GUIDED NERVE BLOCK

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 thesis 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.

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).

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 Sivagnanaratnam (11) 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 report (12) 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). 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.

Application to clinical practice; (12, 14)

Although the evidence may not be complete for all the advantages claimed for ultrasound guidance in regional anesthesia, it is important to understand that the use of ultrasound can also change clinical decision-making. The ability to visualize the needle, the targeted nerve, and surrounding structures, such as blood vessels and other important structures, allows greater freedom in choosing which patients are appropriate candidates for blocks.

The absence of muscle twitches, or the elimination of reliance on these twitches, also allows us to perform blocks in patients in whom it would otherwise be difficult or impossible to proceed.

Lastly, the visualization of anatomy by ultrasound allows new techniques to be developed and plays an important role in education.

The visualization of the needle, the targeted nerve, and the surrounding structures is perhaps the factor that most changes how we think about peripheral nerve blocks. Nerve stimulation represents a “fixed-needle” technique. The twitch monitor technique requires that the needle tip be placed near the nerve being stimulated and, once there, to be held carefully in place.

During the injection of local anesthetic, the needle must not be moved. After injection has occurred, the ability to use twitches to locate the nerve is lost. Finally, there is no way to visualize where the local anesthetic is actually being injected; therefore, no refinement of needle tip position can be performed. In ultrasound guided blocks, by comparison, the needle can be moved under direct vision into a more advantageous position. The local anesthetic spread can be observed in real time with adjustment of the needle tip to affect better proximity to the nerve and thus better spread and coverage of the desired target (12).

For the cited reasons, with nerve stimulator techniques, it is impossible to repeat blocks once you have injected local anesthetic, because the twitch is lost as soon as injection occurs and the local anesthetic prevents subsequent nerve simulation. With ultrasound, many clinicians are willing to perform repeat nerve blocks (12), because the continuous direct visualization of the target provides an element of safety. The elimination of the twitch is also advantageous

in pediatric patients or severely injured patients where nerve stimulation can provide significant pain or discomfort (13).

Blocks can also be performed postoperatively without the pain of stimulation, perhaps adding to the flexibility of anesthetic planning as well as efficiency in busy centers. Not having to rely on twitches as the endpoint also allows blocks to be done in patients that have had amputations, where fingers and toes are not available to serve as endpoints for stimulation (14).

Direct visualization not only allows location of the target nerve when direct electrical stimulation is impossible or undesirable, but it also allows avoidance of nearby structures that could be injured with needle passage.

For example, case reports of blocks performed on anticoagulated Patients (15) and near vascular grafts (16) are representative of blocks that would likely not be done with any blind techniques. Ultrasound increases confidence when performing blocks on patients under general anesthesia (traditionally done in pediatric patients) as well (15).

The use of ultrasound also allows successful nerve blockade with lower volumes of local anesthetics. Many of the approaches described prior to the use of ultrasound were “volume-based” blocks, relying on fascial sheaths or planes to carry large volumes of local to the nerve structures and where volume was important to insure complete coverage of all the branches of interest.

With ultrasound, better needle placement, the ability to move the needle to inject all around the nerve target, and the ability to

visually confirm local anesthetic spread to all areas of interest means that lower volumes can result in successful blocks. Ultimately, ultrasound allows the consideration of multiple blocks on the same patient without as much concern for local anesthetic toxicity.

Lastly, it has been suggested that the fact that ultrasound shows us the relationship of underlying structures is useful for education in regional anesthesia (12, 17). Similarly, knowledge gained from the use of ultrasound and the precision by which it allows the needle to be placed has resulted in the development of new techniques and blocks that would not otherwise have been described, including blocks of sensory nerves that are not amenable to nerve stimulation techniques (18, 19).