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Christian R Falyar, *Virginia Commonwealth University*



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# Ultrasound-Guided Interscalene-Supraclavicular Block for an Intramedullary Nailing of a Pathologic Humeral Fracture: Practical Application of Ultrasound-Guided Regional Anesthesia

Christian R. Falyar, CRNA, DNAP  
Eric C. Grossman, MD

*Fractures of the proximal upper extremity present a challenge to the anesthesia provider when administering a regional anesthetic because the dermatomal distribution of the upper extremity requires more local anesthetic coverage than any single brachial plexus nerve block can provide. A 60-year-old woman underwent intramedullary nailing of a pathologic humeral fracture using a combination of regional and general anesthesia. This case study shows how*

*ultrasound guidance permitted the performance of both an interscalene and supraclavicular nerve block for a single procedure without the increased volume of local anesthetic that would normally be required, while still providing complete coverage of the entire upper extremity.*

**Keywords:** Interscalene block, local anesthetic, supraclavicular block, ultrasound.

**A**nesthesia for surgery of the upper extremity may involve general anesthesia, regional anesthesia, or a combination of both. Although general anesthesia offers definitive control of the airway and is a familiar technique among anesthesia providers, regional anesthesia has been shown to decrease both intraoperative and postoperative opioid requirements, reduce recovery time, and decrease the incidence of unplanned admissions related to pain control.<sup>1,2</sup> When regional anesthesia is an option, the advantages of ultrasound-guided regional anesthesia over traditional landmark and nerve stimulation methods are well documented. Improved onset times, block quality, and success rates, as well as decreased procedure times are all documented benefits of performing a regional anesthetic with ultrasound guidance.<sup>3-5</sup> Additionally, studies have demonstrated the ability to reduce local anesthetic volumes to achieve equipotent results as well as reduce side effects associated with certain blocks.<sup>6-8</sup> Fractures of the proximal upper extremity present a particular challenge when performing regional anesthesia because the dermatome distribution of the upper extremity requires extensive local anesthetic coverage. A single brachial plexus regional technique may not provide the comprehensive dermatome distribution necessary (Figure 1).

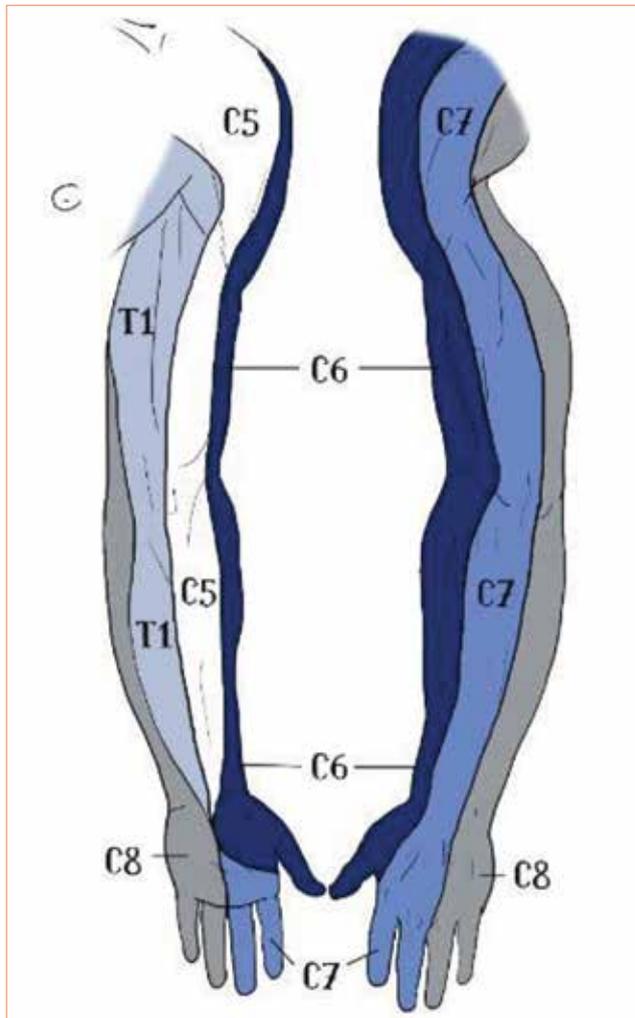
The interscalene block (ISB) is the preferred procedure for surgeries involving the shoulder and upper arm.<sup>9</sup> However, it is commonly accepted that this block may inadequately block C8 and T1 (the lower trunk),

seen clinically as ulnar sparing.<sup>10</sup> The supraclavicular block (SCB) is commonly used for procedures involving the upper extremity, excluding the shoulder because the suprascapular nerve branches off the upper trunk and is often missed.<sup>11</sup> This case study shows how ultrasound guidance allowed the performance of both blocks without increasing the dose of local anesthetic, while still providing complete coverage of the entire upper extremity in a case initially posted as a general anesthetic only.

## Review of the Literature

The efficacy of the ISB for surgery of the shoulder and proximal upper arm has been well established. However, few studies have detailed the use of combination blocks to address expanded dermatomal coverage required for surgery involving the entire proximal upper aspect of the arm. Martínez et al<sup>12</sup> described a combination infraclavicular-suprascapular block for the repair of a humeral head fracture in an effort to avoid phrenic nerve paralysis in a patient with respiratory failure. Other authors described different variations of an axillary-interscalene (AXIS) block as a regional anesthetic for patients with multiple fractures in the humerus and fractures of the shoulder and elbow.<sup>13,14</sup> Guttman et al<sup>15</sup> described an ultrasound-guided supraclavicular-interscalene block for multiple pathologic fractures of the humerus in a severely ill, emaciated patient with metastatic hepatocellular carcinoma.

Here we describe a slight variation of the approach employed by Guttman et al, in which we used ultrasound



**Figure 1. Dermatomal Distribution of Upper Extremity**  
Surgeries involving proximal upper part of arm present challenges because no single brachial plexus block can adequately provide complete coverage.

guidance while performing an interscalene-supraclavicular approach in an obese patient undergoing an intramedullary nailing of a pathologic humerus fracture secondary to osteosarcoma. Our approach resulted in at least the same complete neural blockade; however, only 30 mL of local anesthetic was used compared with 50 mL used by our predecessors.

### Case Summary

The patient was a 60-year-old, 96-kg woman with a body mass index (BMI) of 33 kg/m<sup>2</sup>, a Mallampati score of 3 (with poor mouth opening), and a medical history of hypertension and high cholesterol. She presented to the surgery center for an intramedullary nailing of a pathologic fracture secondary to osteosarcoma. Preoperative laboratory values were within normal limits. Medications included aspirin, atorvastatin, cetirizine, losartan potassium and hydrochlorothiazide, metoprolol, hydrocodone-acetaminophen, a multivitamin, fish oil, and vitamin B12.

The case was scheduled as a general anesthetic per surgeon preference and the patient's wishes. However, the benefits of a regional anesthetic were discussed with the patient in the preoperative holding area, and the both the patient and surgeon agreed to a single injection to supplement the postoperative pain management plan. The surgical procedure involved the insertion of an intramedullary rod through the head of the proximal humerus with distal locking screws in the distal humerus. Because the procedure extended from the shoulder to the elbow, both an ISB and separate SCB block were planned. The use of ultrasonography for this procedure was deemed important given the potential complications of pneumothorax and vascular puncture. Additionally, because 2 separate blocks were being performed, ultrasound imaging afforded the use of decreased local anesthetic volumes, thereby decreasing the potential for local anesthetic toxicity.

Before the surgical procedure, the patient was admitted to a preoperative holding area for the performance of the block. The patient was placed in a supine position with slight elevation of the head, which was turned to the nonoperative side. Standard monitors were applied. Supplemental oxygen therapy was given via nasal cannula at 2 L/min. Midazolam, 2 mg, and fentanyl, 100 µg, were given for sedation as the left neck and shoulder were prepped in a sterile manner. An ultrasound-guided ISB block was performed first (M-Turbo ultrasound machine, SonoSite Inc) using a 13-6 MHz transducer with a sterile transducer cover. The roots of the brachial plexus were identified as described by Chan et al,<sup>16</sup> in which the brachial plexus was first viewed in the supraclavicular fossa in a short-axis view. The transducer was then moved cephalad until cervical roots C5-7 were identified between the anterior and middle scalene muscles. A 22-gauge block needle with a 30-degree bevel (Stimuplex, B Braun Medical Inc) was inserted using an in-plane approach, lateral to medial, until it bordered the hypoechoic roots of the brachial plexus. Following negative aspiration, 5-mL increments of 0.5% ropivacaine were injected until circumferential spread was accomplished with 15 mL (Figure 2).

The transducer was then moved caudally from this position to the supraclavicular fossa for the performance of the SCB. The needle was again placed lateral to medial using an in-plane approach, ensuring needle visualization above the first rib to avoid potential pneumothorax, as well as avoidance of the more medial subclavian artery. Following negative aspiration, 0.5% ropivacaine was injected in 5-mL increments between the inferior trunks/division of the brachial plexus and the first rib, lateral to the subclavian artery (Figure 3). After approximately 10 minutes, the patient reported no sensation and was not able to move the extremity. Although a continuous ISB a catheter would have been an excellent option to



**Figure 2.** Interscalene Block Showing Circumferential Spread Around Roots of Brachial Plexus

Abbreviations: BP, brachial plexus; LA, local anesthetic. White arrows indicate needle; yellow arrows, circumferential spread.



**Figure 3.** Supraclavicular Block, After Injection, With Needle Removed

Abbreviations: BP, brachial plexus; LA, local anesthetic. Yellow arrows indicate local anesthetic (LA) spread lateral to subclavian artery (SA) and superior to first rib.

maximize postoperative pain relief in this case, it was not placed at the surgeon's request.

The patient was then taken to the operating room, and induced with 2% lidocaine, propofol, and succinylcholine. The patient was intubated without difficulty. A general anesthetic in the beach-chair position was maintained using 50% nitrous oxide and 50% oxygen with an end-tidal concentration of 1.5% sevoflurane. The patient was stable throughout the procedure, requiring no further analgesics.

Following the procedure, the patient was extubated and transported to the postanesthesia care unit (PACU) for observation. At the time of discharge (approximately 90 minutes later), the patient had received no additional analgesics and reported a pain score of zero on a scale from 0 (no pain) to 10 (worst possible pain).

## Discussion

Advocating the addition of regional anesthesia to surgical procedures of the upper extremity cannot be understated. In addition to the benefits of reduced opioid requirements, authors have shown decreased postoperative stays and greater patient satisfaction.<sup>1,2</sup> Although it would have been optimal to perform the procedure without a general anesthetic, there were concerns regarding the patient's airway because of the nature of the surgery and the position required to perform the procedure. We believed that securing the airway in a controlled manner before surgery was a safer option than having to possibly take control of the airway emergently during the case. Thus, the decision to use a combination of regional and general anesthesia was considered the best approach for this patient given her BMI, limited mouth opening, and Mallampati score.

Patients with humeral fractures present a unique chal-

lenge to anesthesia providers because no single brachial plexus block adequately covers the entire distribution of the upper extremity. Although the ISB is suitable for surgeries of the shoulder and upper extremity, this block commonly misses the C8-T1 roots (lower trunk), resulting in dermatomal sparing of parts of the arm.<sup>9,10</sup>

The ISB was performed first for 2 reasons. First, the greater contrast in the structures bordering the brachial plexus in the supraclavicular fossa (hypoechoic, pulsating subclavian artery and hyperechoic first rib) allowed for better visualization during the performance of the SCB, even after the ISB was accomplished. Second, considering the patient's increased BMI, there was concern that performing the SCB first might distort the anatomy of the ISB.

An axillary or infraclavicular block may have provided adequate anesthesia to the distal arm. However, given the increased BMI of the patient, visualization of the cords using an infraclavicular approach would have been challenging because of the increased depth secondary to body habitus. The steep angle of the needle in relation to the transducer would have reduced the reflection, making needle visualization very difficult. The axillary block was not considered an option in this case because of the decreased range of motion in the upper extremity secondary to pathologic fracture. However, had the decreased range of motion not been a limiting factor, the axillary block still would have been demanding because the nerve branches of the brachial plexus are situated around the axillary artery and veins. Although authors have shown good results with decreased volumes of local anesthetics when performing an axillary block,<sup>17</sup> the need to redirect the needle for multiple injections in such a highly vascular area would not be desirable. Also, given that the musculocutaneous nerve pierces the coracobrachialis

muscle high in the axilla, an additional dose of local anesthetic would most likely be needed, making it difficult to adequately perform an axillary block with just 15 mL. Because this volume was already used for the ISB, any local anesthetic in addition to this would put the patient at an increased risk of local anesthetic toxicity.

The supraclavicular approach was chosen as the second block because of the superficial nature at which the brachial plexus lies and the compact nature of the trunks/divisions at this level. The shallow level of the nerves allows for a more parallel needle approach to the transducer, which generates a greater reflection, enabling easier needle visualization. Because the nerves are compact at this level, a smaller amount of local anesthetic can be directed at the lower area of the plexus, increasing the possibility of a dense block of the lower trunk. Additionally, the SCB was chosen over the other 2 options because a lesser volume would adequately block the desired target, and it requires the needle to be redirected less, thus reducing the potential for complications.<sup>18,19</sup> Finally, given the proximity of the 2 blocks in relation to one another, a single preparation could be accomplished for both procedures, reducing both the procedure time and the possible need for patient repositioning to perform the second block.

In summary, we present further evidence that peripheral nerve blocks used for surgery of the upper extremity offer clear benefits over general anesthesia alone, including decreased opioid requirements during surgery, a reduced time in the PACU, and the decreased potential for an unplanned admission for pain control. Additionally, brachial plexus blocks performed under ultrasound guidance can be used in combination to safely reduce analgesic and anesthetic requirements during surgery to obtain complete postoperative pain coverage of the upper extremity without placing the patient at additional risk of local anesthetic toxicity.

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## AUTHORS

Christian R. Falyar, CRNA, DNAP, is a staff anesthetist for Commonwealth Anesthesia Associates in Midlothian, Virginia. He is also an assistant professor at the Virginia Commonwealth University School of Nurse Anesthesia in Richmond, Virginia, where he serves as the coordinator for the Regional Anesthesia Program. Email: cfalyar@verizon.net.

Eric C. Grossman, MD, is an attending anesthesiologist for Commonwealth Anesthesia Associates, Johnston-Willis Campus, in Midlothian, Virginia. Email: ecgman@hotmail.com.

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