

Effective range of ultrasound-guided interscalene brachial plexus block

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INTRODUCTION Shoulder surgery under ultrasound-guided interscalene block anesthesia (ISB) is recently becoming popular because ISB has a high success rate, low complication rate, and cost-effectiveness compared to general anesthesia [1, 2]. ISB indication covers most of the arthroscopic and open shoulder surgeries, such as rotator cuff repair, labrum repair, transfer of coracoid, humeral fracture, clavicle fracture, and arthroplasty [1, 2]. However, the proximal direction of an effective range of ISB frequently varies from one patient to another despite the standardizing of the technique. We consider that visualizing the range may help determine the limitation of ISB indication for shoulder surgeries. To our knowledge, research about the effective range of ultrasound-guided ISB is limited. Therefore, the present study aims to investigate the difference among individuals in the specific area affected by ultrasound-guided ISB.

METHODS: This study included 74 patients (40 males and 34 females, with average age of 68.2 ± 12.6 years, height of 160.7 ± 10.3 cm, and weight of 61.5 ± 12.0 kg) who underwent arthroscopic shoulder surgery under ISB without any additional local anesthesia between 2021 and 2023. A single orthopedic surgeon performed all the ISBs using the same technique. Patients were placed in the supine position immediately after describing the ISB procedure, and the C5–C7 nerve roots were visualized using an ultrasonic scanning system. Using a posterior “in plane” technique, 0.2 ml/kg (minimum 10 ml) of 0.75% ropivacaine was injected around the roots. The seven bars are defined as line A (drawn proximal from the anterolateral corner of the acromion to the proximal edge of the clavicular), line B (drawn proximal and parallel to line A from the coracoid), line C (drawn inferior and vertical to line B from the coracoid), line D (the bisector of lines B and C), line E (drawn proximal along the spine of the scapula from the posterolateral corner of the acromion), line F (drawn inferior and vertical to line E from the posterolateral corner of the acromion), and line G (the bisector of lines E and F) (Fig. 1). The effective range of ISB along the seven lines was measured by gently stimulating the skin using the needle-like pain stimulator in the recovery room postoperatively. The ratio of the actual measurement of the range of ISB to the distance from the anterolateral corner of the acromion to the proximal edge of the scapula was used to standardize the physical difference among the patients.

Participants signed written informed consent after explaining the purpose of the study as well as potential risks. The ethical committee of Owase General Hospital approved this study (ID: 839). Data were expressed as mean \pm standard deviation.

RESULTS SECTION: The average length and ratio were 106.9 ± 39.2 mm and 0.56 ± 0.19 in line A; 84.1 ± 41.8 mm and 0.44 ± 0.21 in line B; 58.2 ± 26.0 mm and 0.31 ± 0.14 in line C; 67.9 ± 29.7 mm and 0.36 ± 0.15 in line D; 57.4 ± 24.3 mm and 0.30 ± 0.13 in line E; 56.8 ± 20.0 mm and 0.30 ± 0.11 in line F; and G 54.7 ± 20.5 mm and 0.29 ± 0.12 in line G, respectively (Fig. 2). The maximum length and ratio were 170 mm and 0.85 in line A; 140 mm and 0.76 in line B; 100 mm and 0.59 in line C; 120 mm and 0.71 in line D; 110 mm and 0.58 in line E; 100 mm and 0.53 in line f; and G 100 mm and 0.59 in line G, respectively. The minimum length and ratio were 20 mm and 0.125 in line A; were -20 mm and -0.10 in line B; 0 mm and 0.0 in line C; 0 mm and 0.0 in line D; 10 mm and 0.05 in line E; 10 mm and 0.06 in line F; and 10 mm and 0.06 in line F, respectively.

The skin stimulation by the pain stimulator did not cause any complications.

DISCUSSION: The present study revealed the specific area affected by ultrasound-guided ISB. The results indicated a relatively wide difference in the area among the patients. ISB is considered to mainly affect the areas innervated by the suprascapular nerve, axillary nerve, musculocutaneous nerve, radial nerve, and median nerve [3]. Additionally, the analgesia innervated by the supraclavicular nerve was confirmed in most patients, whereas the area relatively varied. We speculate that the discrepancies in the range innervated by the peripheral nerves and in the infiltrating rate of the drug in the soft tissue caused the difference.

SIGNIFICANCE: The effective range of ISB was widely different among the patients. Considering the variation is necessary when the surgeon performs shoulder surgeries under ISB alone.

REFERENCES: [1] Singh A, et al. J Bone Joint Surg Am 2012;94-A:2040-6. [2] Takayama K, et al. J Shoulder Elbow Surg 2022;6:149-54. [3] Nadeau M-J, et al. J Can Anesth 2013; 60:304–20.

CONFLICT of INTEREST: The authors have no conflict of interest to disclose.

Acknowledgment: The authors would like to thank Yuki Sano for a photo model of the figures and Enago (www.enago.jp) for the English language review.

Figure 1. A: Anterior part. B: Posterior part.
The effective range of ISB was measured along the lines A–G described below.

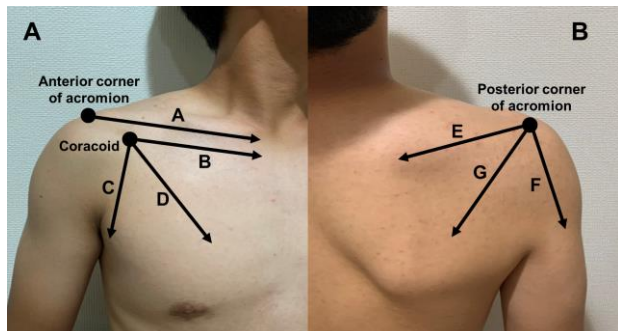


Figure 2. A: Anterior part. B: Posterior part.
The average length (ratio vs. the distance from the anterolateral corner of the acromion to the proximal edge of the scapula) of analgesia along lines A–G described in Figure 1.

