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Is ultrasound-guided procedure entirely reliable?

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Regional anesthesia is a useful adjunct to general anesthesia, and can be used as the sole anesthesia for upper or lower extremity surgery. Especially peripheral nerve blocks have been used for upper extremity surgery as an important anesthetic technique from the past. The upper extremity blocks include supraclavicular, infraclavicular, interscalene, and axillary plexus block. The interscalene block and brachial plexus block (BPB) were first described in the early 1900s [1]. Nerve blocks including upper extremity blockade have been usually performed by reference to anatomical landmarks. For improved accuracy and effectiveness, the nerve stimulator technique was introduced in the late 1980s, while the ultrasound (US)-guided technique started in the early 1990s [2].

The use of US for nerve blockade has increased with the development of high resolution equipment, increased portability, and decreased costs. The US-guided technique has several advantages, including ease of performance, visualization of soft tissues and real-time needle advancement, no exposure to radiation, and observation of the spread of the injected local anesthetic [3]. A systematic review summarized the evidences for the superior onset, quality, and duration of block for US guidance versus other techniques for nerve localization [4]. According to this review, US guidance confers a modest improvement in block onset and the quality of peripheral nerve blocks, especially for the lower extremity. Sonographic visualization of the peripheral nerve and surrounding anatomy can provide valuable information for diagnostic purposes and procedure enhancement [5]. US-guided techniques for visualizing the needle tip and observing the spread of injected local anesthetic can reduce the risk of side effects, such as accidental intravascular injection and trauma to the surrounding tissues. US-guided technique also reduces the anesthetic volume required to produce an effective block [6]. However, there are some limits to US imaging, such as the inability to visualize deep structures, a narrow imaging window, artifacts, operator-dependent imaging performance, and difficulty of mastery.

In this issue of the *Korean Journal of Anesthesiology*, two cases of complications associated with US procedures are introduced. Kang et al. [7] reported a neurologic complication after US-guided supraclavicular BPB and Beh et al. [8] described a pulmonary complication induced by phrenic nerve block after interscalene BPB.

Upper extremity blocks are known to cause side effects, such as nerve damage, local anesthesia toxicity due to intravascular injection, pneumothorax, and diaphragm dysfunction. A recent update report by the American Society of Regional Anesthesia and Pain Medicine concluded that US-guided technique reduces the incidence and intensity of hemidiaphragmatic paresis, but has no significant effect on the incidence of postoperative neurological symptoms. US guidance reduces the risk of local anesthesia toxicity and may also reduce the frequency of pneumothorax, but training in visualization of the needle is required [6,9].

The development of US-guided techniques and advance in equipment open a new horizon in regional anesthesia and pain management. US is a rapidly developing area of technology and some of the newer modalities are discussed. US has been applied to peripheral musculoskeletal and axial structures, including by caudal and interlaminar epidural injections, cervical and lumbar facet injections, medial branch blocks, and sacroiliac joint injections [10,11]. New procedures and equipment have also been attempted, such as a perineural catheter [12] and US-guided percutaneous cryoneurolysis [13]. Further technological developments should allow for more accurate, higher resolution, and smaller sized US machine. Nevertheless, we should not place our complete trust in US-guided nerve block, because the accu-

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racy and safety of US-guided nerve block depend entirely on the skill and technique of the practitioner. As there is a significant learning curve associated with US-guided procedures, proper training is crucial for safe and successful practice. Therefore, a useful and well-organized training program in US-guided technique needs to be provided for trainees at all training hospitals.

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