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# Nerve injury following ultrasound-guided nerve root block with 2% lidocaine for shoulder manipulation: a case report

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**Abstract**

Shoulder manipulation under ultrasound (US)-guided C5 and C6 nerve root block is effective for treating refractory adhesive capsulitis (AC). We herein report the development of cervical nerve root injury following manipulation under anesthesia (MUA) in a patient with AC. A 47-year-old woman underwent shoulder manipulation under US-guided C5 and C6 root block with 2% lidocaine for the management of AC-induced shoulder pain. For the procedure, 3 mL of 2% lidocaine (total of 6 mL) was injected around each C5 and C6 nerve root under US guidance. Seven days after the procedure, the patient visited a university hospital because of severe neuropathic pain (numeric rating scale score of 9) in the right anterior arm, lateral arm, and forearm areas. Sensory deficits in the corresponding C5 and C6 dermatomes and motor weakness of the right shoulder abductor, elbow flexor, and wrist extensor were observed. Electrophysiologic studies demonstrated C5 and C6 nerve root injury. The patient was diagnosed with right C5 and C6 nerve root injury following MUA, and lidocaine toxicity or ischemia was the suspected cause. Clinicians should be mindful of the possibility of this complication.

**Keywords**

Shoulder, manipulation, lidocaine, nerve injury, adhesive capsulitis, case report

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## Introduction

Shoulder manipulation under ultrasound (US)-guided C5 and C6 nerve root block is a therapy that can be applied to treat refractory adhesive capsulitis (AC).[1–4] Shoulder manipulation in patients with

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AC can increase the range of motion and reduce shoulder pain.[1–4] The C5 and C6 nerve roots are anesthetized to minimize or eliminate pain during the procedure. US-guided nerve root block prevents needle penetration of a nerve or vessel. The therapeutic effectiveness of manipulation under anesthesia (MUA) has been demonstrated in several studies.[1–4] When symptoms of AC are not sufficiently controlled by pain medications, therapeutic modalities, or intra-articular steroid injection, shoulder MUA (US-guided C5 and C6 nerve root block) is sometimes performed in clinical practice.

Although shoulder manipulation with US-guided cervical nerve root block is a relatively safe procedure, various adverse effects have been reported following MUA, including vasovagal reflex, panic attack, bony fracture, hemarthrosis, labral detachment, and tearing of the rotator cuff tendon and glenohumeral ligament.[5–7] Nerve root injury due to local anesthetic toxicity, ischemia, or needle injury may also occur, although these have not been reported in the literature.

We herein describe a patient whose C5 and C6 nerve roots were injured by shoulder MUA.

## Case report

A 47-year-old woman underwent shoulder manipulation under US guidance. C5 and C6 root block with 2% lidocaine was used to control her AC-induced right shoulder pain, which had persisted for 5 months. The patient had no specific medical history such as diabetes, thyroid disease, stroke, or psychological disorders. She also had no surgical history. Prior to MUA, the patient had received two intra-articular steroid injections, but these did not effectively control her pain. For MUA, 3 mL of 2% lidocaine (total of 6 mL) was injected around the right C5 and C6 nerve roots. During the lidocaine injection, the patient experienced no electrical shock sensation after placing the needle tip around the cervical nerve roots.

The patient visited the rehabilitation department of our hospital 7 days after MUA. She reported that she had experienced weakness in the right upper extremity immediately after MUA and pain in the right upper extremity the day after MUA. On physical examination, her right shoulder abductor strength was grade 3 on manual muscle testing, and her elbow flexor and wrist extensor strength was grade 4. The patient also had impaired light touch sensation and pain perception in the right arm and at the C5 and C6 dermatomes. The right biceps jerk was reduced but the triceps jerk was normal. Hoffman's sign was not observed. The patient reported severe neuropathic pain (sharp and lancinating; numeric rating scale (NRS) score of 9) in the right anterior and lateral arm and forearm areas. Cervical magnetic resonance imaging showed no abnormalities. An electrophysiological study performed 10 days after MUA showed normal nerve conduction (musculocutaneous, axillary, radial, median, and ulnar nerves). However, electromyography showed a positive sharp wave (1+), increased insertion activity, and mildly reduced recruitment during volitional activity in the right cervical paraspinalis, biceps brachii, triceps brachii, flexor carpi radialis, and extensor carpi radialis longus muscles. Based on the patient's history, clinical findings, and electrophysiological study results, she was diagnosed with right C5 and C6 nerve root injury after MUA.

By 14 days after MUA, the patient's motor weakness had recovered to nearly normal levels. However, her sensory deficit persisted, and the degree of pain had not changed. For pain management, the patient received pregabalin (300 mg), gabapentin (300 mg), and tramadol/acetaminophen

(75/650 mg). Twenty days after MUA, her neuropathic pain had improved from an NRS score of 9 to an NRS score of 5.

Forty days after MUA, her pain was limited to the first and second fingers (NRS score of 2). The patient's sensory deficit did not recover.

The patient provided written informed consent for treatment and participation in this study. The study was approved by the institutional review board of Yeungnam University Hospital. The reporting of this study conforms to the CARE guidelines.[8]

## Discussion

We have herein described the development of injury in the cervical nerve roots after injecting 3 mL of 2% lidocaine around each nerve root under US guidance for shoulder MUA in a patient with AC. The right C5 and C6 nerve root injury was diagnosed based on clinical symptoms and electrophysiological test results.

Our patient's nerve injury was likely caused by lidocaine toxicity or ischemia rather than needle trauma because the patient experienced no neuropathic pain radiating to her right upper extremity. All local anesthetics cause neurotoxicity in a dose-dependent manner.[9,10] Injected lidocaine can lead to neuronal cell death by inducing fragmentation of deoxyribonucleic acids and disruption of the mitochondrial membrane potential.[9] This causes uncoupling of the oxidative phosphorylation process, which subsequently results in the release of cytochrome c and initiation of the caspase pathway, leading to apoptosis of neuronal cells in the cervical nerve roots.[11,12] Furthermore, local anesthetics have local vasoconstrictive properties and may damage nerves via ischemia.[13]

During shoulder manipulation in patients with AC, severe pain at the shoulder is felt when the inflamed capsule is stretched.[5] Shoulder muscle contractions during passive range of motion of the shoulder joint prevent the shoulder capsule from being stretched excessively. Therefore, prior to shoulder manipulation, an anesthetic was injected around the C5 and C6 nerve roots. However, large doses of anesthetics are required for anesthesia of the cervical nerve roots.[1–4] The risk of nerve root injury caused by anesthesia for shoulder manipulation is higher than that associated with other nerve blocks for managing neuropathic pain.

By 14 days after the onset of the nerve root injury, most of our patient's motor functions had recovered. At 40 days after the nerve root injury, mild neuropathic pain remained. Our patient's prognosis was favorable. This concurs with published reports concluding that the prognosis of most cases of peripheral nerve injury after regional anesthesia is favorable.[14,15]

In the current study, we reported the occurrence of C5 and C6 nerve root injury due to 2% lidocaine injection for shoulder MUA in a patient with AC. This is the first report of cervical nerve root injury following MUA. Clinicians should be mindful of the possibility of this complication when performing MUA. Because anesthetic neurotoxicity is dose-dependent, clinicians are recommended to reduce the anesthetic dose to the lowest effective dose.

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The authors declare that there is no conflict of interest.

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