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Myositis ossificans causing ulnar neuropathy: a case report

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Abstract

Myositis ossificans (MO) can compress peripheral nerves and cause neuropathy. We herein describe a patient with ulnar neuropathy caused by MO at the medial elbow. A 28-year-old man with a drowsy mentality and multiple organ damage following a traffic accident was admitted to our hospital. After 3 weeks of postoperative care, the patient's mental status recovered. However, he complained of severe sharp pain in his left medial forearm and fourth and fifth fingers. He exhibited weak fifth finger abduction and wrist adduction. Severe elbow joint pain was elicited during range-of-motion testing of his left elbow. Ultrasound also showed an edematous, enlarged, hypoechoic ulnar nerve lying above the MO, and the MO outwardly displaced the ulnar nerve. Elbow radiographic examination, computed tomography, and magnetic resonance imaging revealed MO development and compression of the left ulnar nerve. The patient underwent surgery; the following day, his left medial forearm pain completely disappeared with slight improvement in the motor weakness of fifth finger abduction. Ultrasound is a useful tool to easily evaluate the presence of MO and compression of peripheral nerves caused by MO.

Keywords

Myositis ossificans, neuropathy, nerve compression, ultrasound, elbow, case report

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Introduction

Myositis ossificans (MO) is characterized by self-limiting and benign ossification that can affect any soft tissue, including the subcutaneous fat, tendons, and nerves; however, it most commonly involves solitary muscles.[1] MO is defined as bone formation due to an inflammatory cascade following skeletal muscle injury, such as trauma. Most patients with MO recall a history of specific or repetitive minor trauma.[1–4]

Although various symptoms and signs have been described, most patients with MO report muscular pain, tenderness, decreased range of motion (ROM) of adjacent joints, and swelling.[1,2] Although rare, neurologic symptoms such as paresthesia and weakness may also occur when the MO compresses the nerve.[1,3]

MO is diagnosed based on the patient's medical history, symptoms, and imaging findings. Plain radiography is an insufficient diagnostic imaging modality for MO; additional imaging modalities, such as ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI), are needed for accurate localization and differential diagnosis. US has advantages over CT and MRI in terms of accessibility, portability, cost-effectiveness, real-time evaluation, and dynamic examination for the diagnosis of musculoskeletal or nerve injury.[5,6]

We herein describe a patient with ulnar neuropathy caused by MO at the medial elbow. In this case, US was used as the imaging modality for the diagnosis of compression neuropathy.

Case presentation

A 28-year-old man presented to the emergency department for drowsy mentality (Glasgow Coma Scale score of 12) after a pedestrian traffic accident. A brain CT scan showed no specific abnormalities. However, a CT scan of the chest and abdomen showed multiple rib fractures, a diaphragmatic hernia, splenic rupture, and fractures of the spinous processes of T3 and T7 to T11. A spinal CT scan also revealed fractures of the transverse processes of right T1 and left T9. Surgical treatment of the damaged internal organs (splenectomy and primary repair of the diaphragmatic hernia) was promptly conducted. Intravenous sedatives were administered to help attenuate the patient's anxiety, pain, and agitation associated with invasive mechanical ventilation. After emergency surgery followed by 3 weeks of invasive mechanical ventilator care and postoperative care, the patient's mental status recovered (Glasgow Coma Scale score of 15).

After recovery, the patient reported numbness and weakness of his entire left arm; in particular, he experienced severe sharp pain (numeric rating scale score of 6) of the left medial forearm and fourth and fifth fingers. Severe elbow joint pain was also elicited during ROM testing of his left elbow. Physical examination revealed tenderness around the medial epicondyle and distal humerus. Weak fifth finger abduction and wrist adduction was noted (Medical Research Council scale for muscle strength score of 3). The patient could not fully extend his left arm. The ROM limitation of left elbow extension was approximately 5°. Hypoesthesia was observed on the medial forearm. In addition, his biceps and triceps jerks were decreased.

Electrodiagnostic studies were performed, including a nerve conduction study (NCS) and electromyography (EMG) of the left arm. In the NCS, the compound muscle action potential of the left ulnar nerve (recording on abductor digiti minimi muscle) showed pronounced conduction block, slowed conduction velocity (8 m/s) at the medial epicondyle, and

reduced amplitude (0.7 mV). An inching technique for the left ulnar nerve was performed to precisely locate the lesion; this procedure demonstrated that the lesion was located between the medial epicondyle and 2 cm proximal. No other abnormal findings were found on NCS of the left median, radial, axillary, and musculocutaneous nerves. Needle EMG studies showed positive sharp waves (1–3+) and increased insertion activity on the left deltoid, biceps brachii, triceps brachii, flexor carpi radialis, flexor carpi ulnaris, extensor carpi radialis, abductor pollicis brevis, abductor digiti minimi, and first dorsal interossei muscles. Based on the electrical diagnostic study results, we diagnosed the patient with left ulnar neuropathy around the elbow level with left brachial plexopathy at the whole trunk level. A lateral radiograph of the left elbow showed a 0.9- × 4.4-cm calcification proximal to the olecranon on the posterior aspect of the distal humerus (Figure 1(a)). We considered that MO had developed within the left triceps, compressing the ulnar nerve. To confirm that MO had

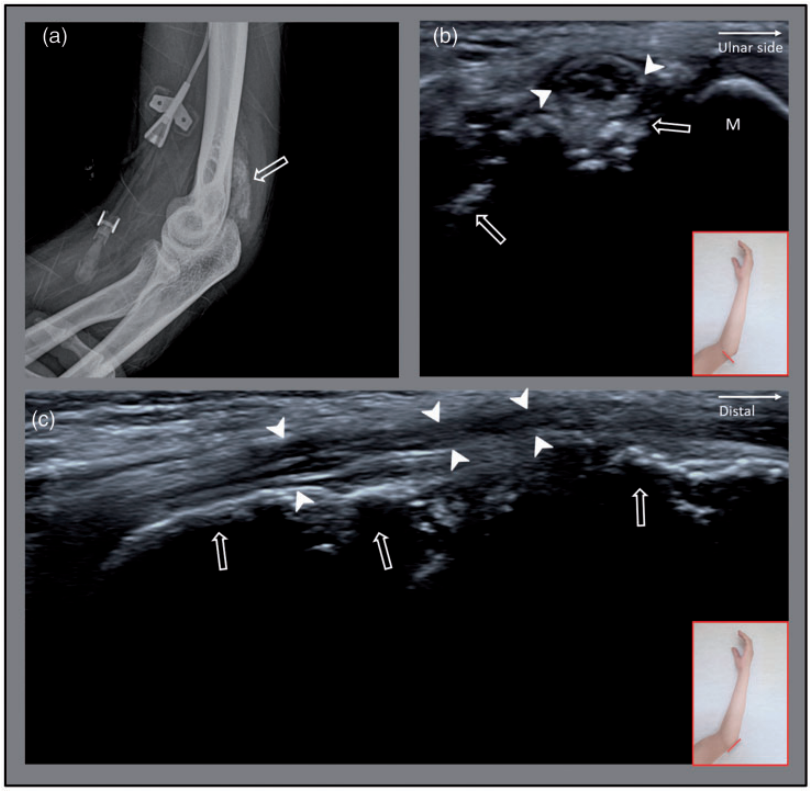

Figure 1. (a) Lateral radiograph of the left elbow showed a 0.9- × 4.4-cm calcification (open arrow) proximal to the olecranon on the posterior aspect of the distal humerus. (b) Transverse ultrasound revealed an edematous, enlarged, hypoechoic ulnar nerve (arrowheads) above the myositis ossificans (MO) (open arrows) and outward displacement of the ulnar nerve caused by the MO. (c) Longitudinal ultrasound revealed 0.9- × 1.8- × 4.5-cm MO (open arrows) around the left triceps, which had a hypoechoic center surrounded by a hyperechoic peripheral area. The edematous, enlarged, hypoechoic ulnar nerve (arrowheads) was also observed above the MO.
M, medial epicondyle.

caused the compression of the ulnar nerve, an US examination was conducted (Video S1 in supplementary materials). US revealed MO within the left triceps, which had a hypoechoic center surrounded by a hyperechoic peripheral area proximal to the medial epicondyle and olecranon, measuring $0.9 \times 1.8 \times 4.5$ cm. US also showed an edematous, enlarged, hypoechoic ulnar nerve lying above the MO, and the nerve was outwardly displaced by the MO (Figure 1(b), (c)). When the examiner scanned the area above the MO, the patient reported severe sharp pain in his left medial forearm that radiated to his fourth and fifth fingers.

Three-dimensional reconstruction of the left elbow CT image showed a large, ill-defined, fluffy calcified mass and a central slightly hypointense lesion with peripheral ossification located around the distal humerus, medial aspect of the olecranon process, and medial epicondyle (Figure 2 (a), (b)). These CT findings were typical

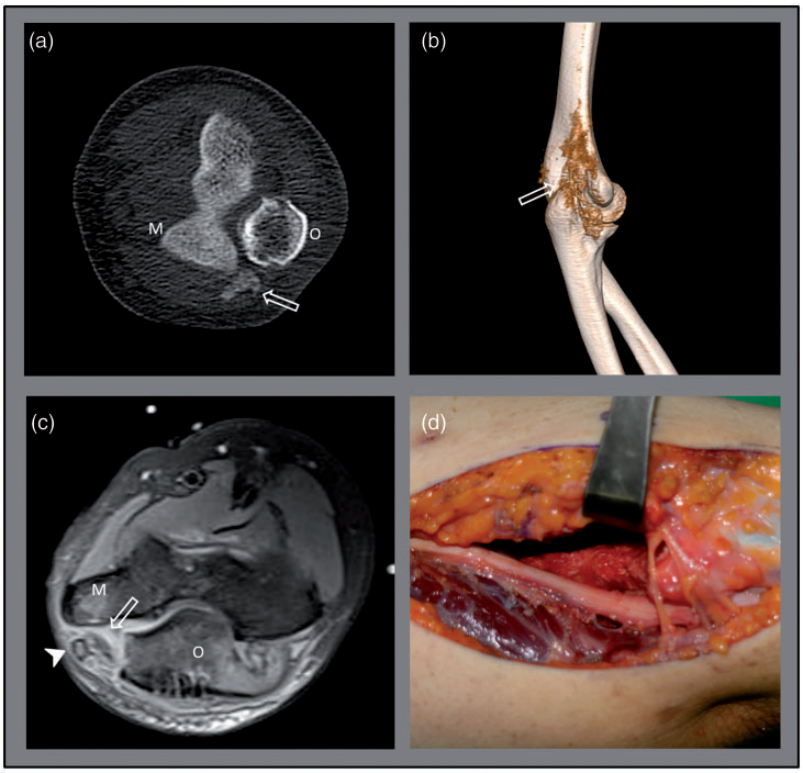

Figure 2. (a) Computed tomography showed ossification of a central slightly hypointense lesion (open arrow) with peripheral calcification between the medial epicondyle and olecranon. (b) Three-dimensional reconstruction of the left elbow computed tomography image revealed myositis ossificans (MO) (open arrow) located around the distal humerus, medial aspect of the olecranon process, and medial epicondyle. (c) Fat-suppression T2-weighted magnetic resonance imaging revealed a slightly heterogeneous, hyperintense lesion inducing superficial displacement and high signal change of the ulnar nerve (arrowhead). These findings demonstrated that the compression of the ulnar nerve was caused by MO (open arrow). (d) Intraoperative findings confirmed compression and outward displacement of the left ulnar nerve caused by MO.
O, olecranon; M, medial epicondyle.

for MO.[7] MRI of the elbow was also performed. Axial gadolinium-enhanced T1-weighted MRI showed a homogenous, hyperintense soft tissue lesion with infiltration. Fat-suppression T2-weighted MRI revealed a slightly heterogeneous, hyperintense lesion, inducing superficial displacement of the ulnar nerve and segmental high signal alteration of the adjacent ulnar nerve; these findings demonstrated compression of the ulnar nerve caused by MO following trauma (Figure 2(c)).

Approximately 2 weeks after symptom onset, the patient underwent surgical neurolysis, removal of the MO, and tenolysis for release of the left elbow joint (medial collateral ligament, joint capsule, triceps, and flexor carpi ulnaris). Intraoperative examination revealed compression and outward displacement of the left ulnar nerve caused by MO, as revealed by imaging studies (Figure 2(d)). Tenolysis was also conducted to remove adhesion of the MO to the tendon. The patient's left medial forearm pain completely disappeared after surgery, with slight improvement in fifth finger abduction. The day after the surgery, the patient received a total dose of 7 Gy of radiotherapy in a single fraction to prevent recurrence of MO.

Discussion

We have herein described a case of ulnar neuropathy caused by MO at the medial elbow following a traumatic accident. Although the pathophysiology of MO formation is not completely understood, it has been known to occur by differentiation of fibroblasts into abnormal osteogenic cells after tissue injury.[1–3] Several recent studies have demonstrated that the inflammatory cascade following skeletal muscle injury leads to MO formation. Medici and Olsen[4] stated that cytokines (bone morphogenetic proteins 2 and 4 and transforming growth factor) are released when the inflammatory cascade is induced by trauma, resulting in the transition of skeletal muscle endothelial cells to mesenchymal stem cells and bone formation of extraskeletal tissue.[1,4]

The clinical manifestations of MO are characterized by muscular pain, tenderness, decreased ROM of adjacent joints, and swelling. Most patients with MO have a known history of blunt and repetitive muscle trauma. Therefore, if a patient with a history of trauma complains of muscular pain, tenderness, and limited ROM of joints, clinicians should consider the development of MO. If patients with MO complain of neurological symptoms, compression of the peripheral nerve caused by MO should also be considered.

To the best of our knowledge, five previous reports have described nerve compression caused by MO. In 1980, Jones and Ward[8] reported a sciatic nerve compressed by MO in the biceps femoris muscle. The diagnosis was achieved by radiography, needle EMG, and surgical exploration. In 1993, Fitzsimmons et al.[9] reported a case of radial nerve injury induced by MO located in the posterior mid-humerus, which was confirmed using radiography, a bone scan, and needle EMG. In 2001, Reavey-Cantwell et al.[10] reported a case in which MO below the scalenus and omohyoid muscle induced brachial plexopathy. In 2009, Poptodorov et al.[11] reported that MO located between the semitendinosus and biceps femoris muscles induced sciatic neuropathy. In these two cases, MRI and CT scans were used to diagnose MO and nerve compression, which were confirmed by invasive surgical exploration. Most recently, in 2016, Guan et al.[12] reported a case of sciatic nerve injury resulting from compression caused by MO in the gluteus muscle, which was found on MRI and CT.

Although plain radiography is a useful and adequate imaging modality for the

diagnosis of MO, other imaging modalities (e.g., US, CT, MRI) are needed for accurate localization, differential diagnosis, identification of associated neuropathy, and confirmation of the diagnosis. US can accurately diagnose a variety of soft tissue injuries, such as musculoskeletal and nerve injuries.[5,6] In particular, US is an excellent imaging modality for the localization and identification of the causative lesions in patients with entrapment neuropathy.[13] US also has advantages over CT and MRI in terms of accessibility, portability, cost-effectiveness, zero radiation, real-time evaluation, and dynamic examination in the diagnosis of musculoskeletal or nerve injury.[5,6] Therefore, if patients with MO are suspected to have nerve compression, clinicians can conduct US examinations as the first diagnostic modality.

In summary, we have herein described a case of ulnar neuropathy caused by MO-induced compression at the medial elbow. Moreover, we used US to confirm that the compression and displacement of the ulnar nerve were caused by MO. Our study is the first to show that US can be a useful tool to easily evaluate the presence of MO and compression of peripheral nerves caused by MO.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Ethics statement

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Written informed consent was obtained from the patient for publication of this study and any accompanying images. The study was approved by Yeungnam University review board (approval no. 2020-11-019).

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Supplemental Material

Supplemental material for this article is available online.

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