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A Rare Cause of Forearm Pain: Two Cases with Pronator Teres Syndrome

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Background: The most common entrapment neuropathy of the median nerve (MN) is carpal tunnel syndrome (CTS), in which the MN is compressed at the wrist level; however, MN compression can also occur at the elbow level, as in pronator teres syndrome (PTS).

Case Report: In this article, we present 2 cases of PTS: one had developed as a result of repetitive and compelling forearm pronation movements due to the patient's profession, and the other had developed as an iatrogenic response to coronary angiography. The former case recovered with conservative treatment, whereas the latter case required surgical treatment.

Conclusion: PTS should be differentiated from CTS, anterior interosseous syndrome (AIS), brachial plexus lesion, and cervical radiculopathy because it has overlapping symptoms with all of these. Examination findings should be confirmed by electrophysiological tests in patients with suspected MN lesion. The first choice in treatment should be conservative, but surgical treatment should be considered in patients whose complaints do not regress.

Key words: Median nerve, pronator teres syndrome, forearm pain

BACKGROUND

Pronator teres syndrome (PTS) is a rare but clinically important condition that causes pain in the forearm. It results from compression of the median nerve (MN) in the proximal forearm by the pronator teres (PT) muscle or other adjacent anatomical structures in the upper forearm (1). The PT muscle is a round muscle that pronates the forearm and consists of 2 heads, the humeral and ulnar. The heads and forearm together form a common flexor tendon during their course. Before the 2 heads unite, the MN passes between them. Rapid and repetitive pronation movements of the forearm can cause hypertrophy of the PT muscle and compression of the MN, especially in individuals with additional fibrous bands. PTS has also been defined in patients who undergo local trauma, schwannoma, anticoagulation therapy, and kidney dialysis (2,3).

PTS should be differentiated from carpal tunnel syndrome (CTS), anterior interosseous syndrome (AIS), brachial plexus lesion, and cervical radiculopathy because it has overlapping symptoms with all of these. In this article, we present 2 cases of PTS: one had developed as a result of repetitive and compelling forearm pronation movements due to the patient's profession, and the other had developed as an iatrogenic response to coronary angiography. The former case recovered with conservative treatment, whereas the latter case required surgical treatment.

CASES

Two patients applied to our outpatient clinic due to pain in the forearm (Table 1).

Case 1: A 22-year-old man had complaints of pain in the right forearm volar face for one month. The patient was engaged in assembly work that forced the

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Table 1. Needle electromyography findings (Case 1).

Muscles	Fibrillation	PKD	MÜP amp	MÜP duration	MÜP polyphasia	Muscle contraction
FPL	+	+	N	N	+1	Decreased
PL	+	+	+1	+1	N	Decreased
FKR	+	+	+1	+1	+1	Decreased
APB	0	0	N	N	N	N

Abbreviations: Amp, amplitude; APB, abductor pollicis brevis; FKR, flexor carpi radialis; FPL, flexor pollicis longus; MÜP, motor unit potential; PKD, positive sharp wave; PL, palmaris longus

forearm into pronation. He had no history of additional systemic disease.

Case 2: A 71-year-old man complained of pain and weakness in the volar aspect of the right forearm and the first 3 fingers of the right hand following coronary angiography performed in the right cubital region 2 months previously. He had a history of hypertension and diabetes mellitus.

The examinations in both cases revealed weakness in the distal interphalangeal joint flexion of the first and second fingers of the right hand. Muscle strength scored 3 of 5 in the flexor pollicis longus (FPL), flexor digitorum profundus (FDP), and flexor digitorum superficialis (FDS) muscles in Case 1, and 2 of 5 in Case 2. (Case 2 failed to make an "O" sign properly by joining the thumb and forefinger). Case 1 had paresthesia in the right forearm, right hand thenar region, and the first 3 fingers, and Case 2 had dysesthesia. Case 1 showed tenderness of the PT muscle distal to the medial epicondyle and exacerbation of pain with resistant pronation of the forearm, while Case 2 showed edema and tenderness on palpation of the distal part of the medial epicondyle.

Nerve conduction studies performed in Case 1 revealed a lower median motor and sensory nerve response on the right side than on the left, and late-onset latency occurred. Needle electromyography (EMG) did not reveal any pathological findings in the abductor pollicis brevis (APB) muscle. Slight increases in spontaneous activity and mild polyphasic motor unit potentials (MUP) were observed in the FPL, palmaris longus (PL), and flexor carpi radialis (FCR) muscles. The EMG findings were consistent with partial axonal damage of the right MN at the level of the PT muscle (Table 1). Magnetic resonance imaging (MRI) of the elbow and forearm, performed to rule out lesions that may cause compression on the nerve along the MN trace, revealed no pathology. PTS was considered to have developed in the patient as a result of repetitive and compelling forearm pronation movements due to his occupation.

Nerve conduction studies performed on Case 2 revealed very low right median motor and sensory nerve responses, and late-onset latency was observed. Needle EMG showed a moderate increase in spontaneous activity and polyphasic MUP in the APB, FPL, PL, and FCR muscles. The EMG findings were consistent with complete axonal damage of the right MN at the level of the PT muscle (Table 2). MRI of the elbow and forearm revealed edema at the level of the PT and FCR muscles, and this had a compression effect on the MN (Fig. 1). The patient was thought to have developed PTS as an iatrogenic response to coronary angiography.

The treatment of both cases involved ultrasound-guided application (MyLab 30, Esaote SpA, Genoa, Italy) of 5 mL 0.5% bupivacaine and dexamethasone around the MN at the proximal level of the forearm. Then pulse radiofrequency of the median nerve proximal to the elbow is applied (Fig. 2). The patients also received ibuprofen (1600 mg/day) and a resting splint kept the right elbow in semiflexion and supination. The patients also underwent daily treatments consisting of a total of 30 sessions of intermittent galvanic current (3 mA, 70 Hz for 20 minutes, 10 minutes of application, 5 minutes of rest), joint range of motion exercises, stretching, and massage.

At the end of the 30-day treatment, the pain and sensory symptoms decreased by more than 50% in Case 1. The patient was able to make the "O" sign with the first 2 fingers, and the 3 of 5 muscle strength score in finger flexion had increased to 5 of 5 (Fig. 3). The patient's clinical signs continued to improve, and he was recommended to avoid using his forearm in work that forced pronation. By contrast, Case 2 did not see a decrease in his complaints at the end of the treatment. He was referred for a consult with the orthopedics department, where surgery was recommended.

Discussion

The most common entrapment neuropathy of MN is CTS, in which the MN is compressed at the wrist level; however, MN compression can also occur at the elbow

Table 2. Needle electromyography findings (Case 2).

Muscles	Fibrillation	PKD	MÜP amp	MÜP duration	MÜP polyphasia	Muscle contraction
FPL	+	+	+1	+1	+1	Decreased
PL	++	++	+2	+2	+2	Decreased
FKR	++	++	+2	+2	+2	Decreased
APB	+	+	+1	+1	+1	Decreased

Abbreviations: Amp, amplitude; APB, abductor pollicis brevis; FKR, flexor carpi radialis; FPL, flexor pollicis longus; MÜP, motor unit potential; PL, palmaris longus; PKD, positive sharp wave

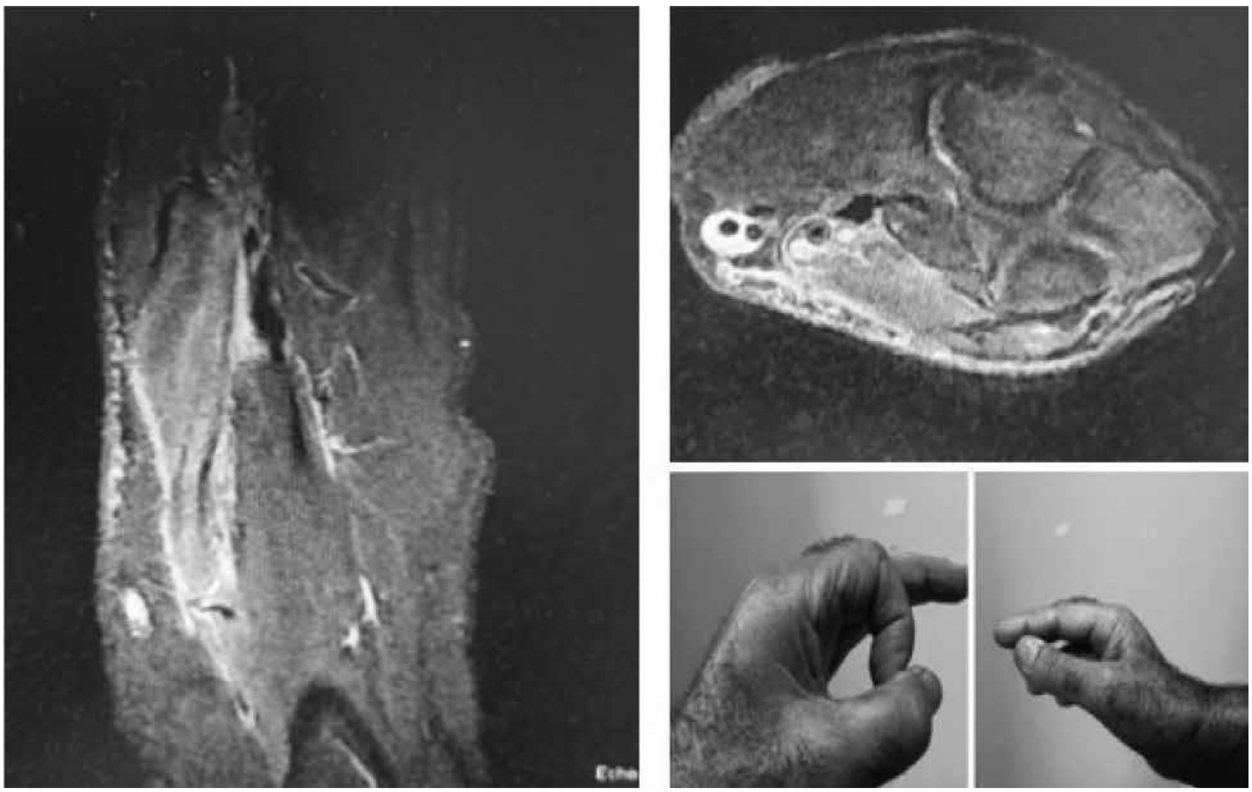

Fig. 1. Edema at the level of the pronator teres and flexor carpi radialis muscles and flexion weakness in the fingers in the axial and coronal sections of the right elbow (MRI of Case 2)

level, as in PTS (4). As seen in Case 1, and especially in people with additional fibrous bands, PT muscle hypertrophy and PTS can occur after rapid and repetitive grasping or pronation movements (prolonged hammering, dishwashing, tennis, etc.) (5). Compression of the MN at the elbow level, given the proximity of the nerve to the brachial artery, often results in a vascular injury and a poorly perfused extremity. Some case reports in the literature have also reported MN damage in the upper extremity after brachial angiography, such as occurred in Case 2 (6).

PTS is associated with intensified pain in the volar forearm, resulting in the observation of resistant pronation of the forearm and flexion of the elbow. A positive Tinel sign can be detected on the proximal edge of the PT muscle, while weakness may be detected in the FPL, APB, FDP, and opponens pollicis muscles. Sensory symptoms may occur in the thenar region, the thumb, and the index, middle, and ring fingers. Because of its overlapping symptoms, PTS can be confused with CTS, which is the most common MN entrapment neuropathy (7).

Some clinical clues can help the clinician differentiate between CTS and PTS. CTS has symptoms of paresthesia that are exacerbated at night, but pronation is preserved. By contrast, PTS does not have nighttime symptoms. In addition, the palmar cutaneous branch leaves the MN proximal to the carpal tunnel and distal to the PT muscle; therefore, sensation over the thenar area is preserved in CTS, whereas a loss of sensation occurs in the entire MN distribution in PTS (8). One study that aimed to determine the prevalence of PTS in patients with CTS reported that PTS should be considered a possibility in severe CTS and that men are more prone to develop PTS (9). More proximal PTS may be missed when both PTS and CTS syndromes are present in the same limb; therefore, PTS should be excluded in patients with CTS, especially when the patient is a candidate for surgery.

Fig. 2. The ultrasound transducer was positioned transversely on the antecubital fossa, and the median nerve (arrow) was identified on the medial side of the brachial artery (star).

Other differential diagnoses are AIS, brachial plexus injury, or cervical radiculopathy. However, AIS causes no sensory loss; rather, it results in pure motor weakness. As seen in our cases, the patient may present with difficulty in flexion of the distal phalanx of the thumb, index, and middle fingers, as seen in AIS in PTS. The pronator quadratus (PQ), FPL, and FDP may be affected; however,

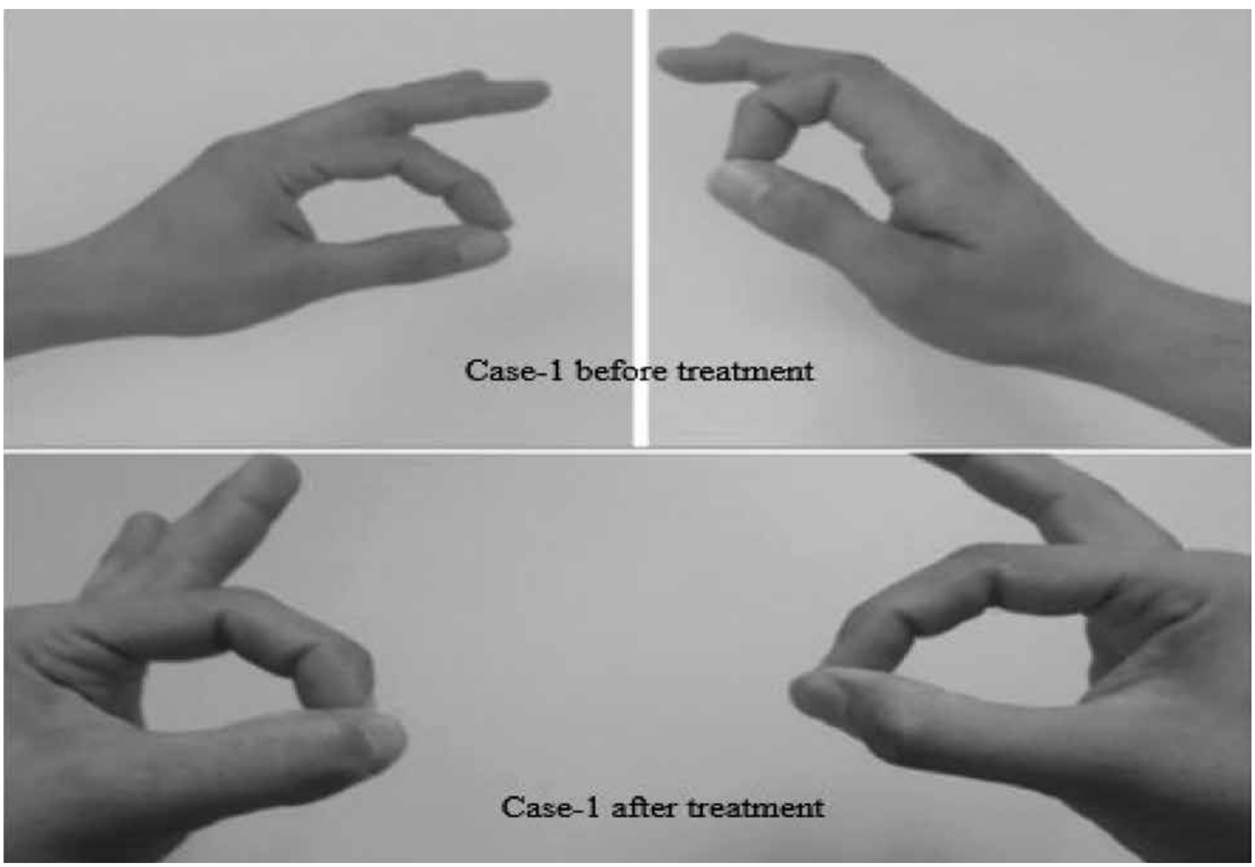

Fig. 3. Pre- and post-treatment finger flexors of Case 1 who did not make an "O sign" due to inability to use flexor pollicis longus and flexor digitorum profundus/flexor digitorum superficialis on the right index finger

AIS does not weaken the PT as it leaves the MN distal to the PT muscle. Both cases in this article had prominent sensory symptoms that were not compatible with AIS, which causes pure motor clinical findings. Brachial plexus injury or cervical radiculopathy may reveal weakness in muscles other than in the MN region, with pain often radiating to the neck, arm, and chest.

Electrodiagnostic studies are necessary to determine the location and severity of the lesion and to confirm the diagnosis. In entrapment neuropathies, mild compression inhibits venous flow, while severe compression results in arterial ischemia, causing congestion and edema. Prolonged or repetitive compression results in inflammation, fibrosis, and demyelination. Over time, compression leads to axonal degeneration with a poor prognosis (10). As seen in the cases in this article, patients with axonal PTS symptoms have sensory and motor amplitudes that are usually more affected by conduction velocities. EMG abnormalities occur in the FPL and FDP, less frequently in the FDS and APB, and rarely in the PT because compression in the area most often occurs distal to the innervation. Other muscles innervated by the same myotomes as the proximal median muscles, but innervated by a different nerve, should be tested to exclude brachial plexus or cervical radiculopathy.

Treatment of PTS includes rest, minimizing activities involving forearm pronation, physical therapy, and injection of nonsteroidal anti-inflammatory drugs, corticosteroids, and local anesthetics. If conservative treatment lasting at least 6 weeks fails to alleviate PTS, then surgery is performed to release all other compressive structures, as well as the PT muscle (11). The prognosis in PTS may vary depending on the severity of motor and sensory deficits, electrophysiological findings, and etiology. One of our cases responded to conservative treatment, while the other did not and was referred for surgery.

CONCLUSIONS

Proximal entrapment neuropathies of the MN are rare; however, PTS should be kept in mind when a patient presents with forearm pain. Despite similar physical examination and electrophysiological findings, differences in the severity and etiology of these findings may affect the patient's response to conservative treatment.

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