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Yann-Rong Chen
Department of Physical Medicine and Rehabilitation, Shin Kong Wu Ho-Su Memorial Hospital,Taipei, Taiwan

Ying-Chen Kuo
Department of Physical Medicine and Rehabilitation, Shin Kong Wu Ho-Su Memorial Hospital,Taipei, Taiwan

Yu-Hsien Lin
Department of Plastic Surgery, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan;

Yu-Ting Lin
Department of Physical Medicine and Rehabilitation, Shin Kong Wu Ho-Su Memorial Hospital,Taipei, Taiwan, tim761208@hotmail.com

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CASE REPORT

Entrapment of the Deep Branch of the Radial Nerve by an Intramuscular Lipoma: A Case Report

Yann-Rong Chen [a], Ying-Chen Kuo [a,c], Yu-Hsien Lin [b], Yu-Ting Lin [a,*]

[a] Department of Physical Medicine and Rehabilitation, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan
[b] Department of Plastic Surgery, Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan
[c] School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan

Abstract

Lipomas are benign tumors that are common in subcutaneous tissue and are usually asymptomatic. However, intramuscular lipomas, which are less common, can cause nerve compression in rare cases. Herein, we report the case of a 61-year-old man with an intramuscular lipoma on his right forearm. The lipoma entrapped the deep branch of the radial nerve and caused wrist drop and finger drop. A nerve conduction examination and electromyography were conducted to quantify the degree of and localize the nerve injury. Sonography provided the initial diagnosis of a lipoma, which was verified with magnetic resonance imaging. The lipoma was resected, and the patient had a favorable recovery. Neuromusculoskeletal sonography is useful because of its accessibility. Clinicians should perform ultrasound initially when structural lesions are present to determine whether they are causing nerve entrapment. This can aid in the preliminary determination of the etiology, reveal anatomical relations with surrounding structures, and support surgical decisions to ensure that diagnosis and treatment are not delayed.

Keywords: Radial nerve entrapment, Posterior interosseous nerve, Intramuscular lipoma, Wrist drop, Ultrasound

1. Introduction

Lipomas are benign tumors that commonly occur in subcutaneous tissue and are usually asymptomatic. Intramuscular lipomas, which are less common, can cause nerve compression in rare cases. The radial nerve is the terminal branch of the posterior cord of the brachial plexus. The radial nerve enters the forearm just below the brachioradialis muscle and divides into the superficial and deep motor branch, piercing through the supinator muscle. The deep branch of the radial nerve becomes the posterior interosseous nerve (PIN) when it passes between the two heads of the supinator muscle. The PIN innervates the muscles in the posterior compartment of the forearm, which include the extensor carpi ulnaris, extensor digitorum, extensor indicis, extensor digiti minimi, abductor pollicis longus, extensor pollicis brevis, and extensor pollicis longus.[1,2] Herein, we report the case of a 61-year-old man with an intramuscular lipoma entrapping the deep branch of the radial nerve and causing wrist drop and finger drop.

2. Case report

A 61-year-old man presented with a palpable and asymptomatic mass on the radial side of his right forearm near the

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* Corresponding author at: Department of Physical Medicine and Rehabilitation, Shin Kong Wu Ho-Su Memorial Hospital, B1F., No. 95, Wen Chang Road, Shih Lin District, Taipei, Taiwan.
E-mail address: tim761208@hotmail.com (Y.-T. Lin).

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elbow joint. He had had the mass for 10 years. Over the preceding 3 months, he had gradually developed weakness in his right fingers during extension. He also reported mild soreness of the right forearm. However, the pain was not strong and he did not experience paresthesia. The patient reported no other disease or trauma. Physical examination revealed a swollen palpable mass measuring 6 × 5 cm^2 on the radial side of the patient's right proximal forearm (Fig. 1). The mass was smooth, firm, and immobile. No dyspigmentation, dilated veins, or scars were observed. No tenderness was reported by the patient when the site of the lesion was compressed. The patient's muscle strength during elbow flexion, elbow extension, wrist flexion, finger flexion, forearm protonation, and forearm supination was normal.

We noted that he had a reduced ability to extend his right fingers, particularly his ring finger. He demonstrated grade 4 muscle strength. Mild radial deviation with a reduced dorsal wrist crease on the ulnar side during wrist extension was also observed, with a muscle strength of grade 4. Neither sensory deficit nor tenderness was noted. Nerve conduction examination revealed reduced right radial nerve compound muscle action potential in the extensor indicis muscle, with a conduction block at the forearm. The patient's superficial radial sensory nerve action potential was normal. Electromyography revealed polyphasic waves, with reduced recruitment in the right extensor indicis, extensor digitorum, and extensor carpi ulnaris muscles, indicating denervation with reinnervation in the affected muscles. Musculoskeletal sonography revealed a well-defined ovoid homogeneous isoechoic mass measuring approximately 5.95 × 2.87 cm^2 underlying the brachioradialis muscle. The mass was connected to another ovoid homogeneous isoechoic mass measuring approximately 2.11 × 1.09 cm^2 that was invading the supinator muscle (Fig. 2). An intramuscular lipoma was suspected. The deep branch of the radial nerve was elevated and

Fig. 1. Gross appearance of the patient's right forearm. A palpable mass was detected near the elbow joint on the radial side of the right forearm.

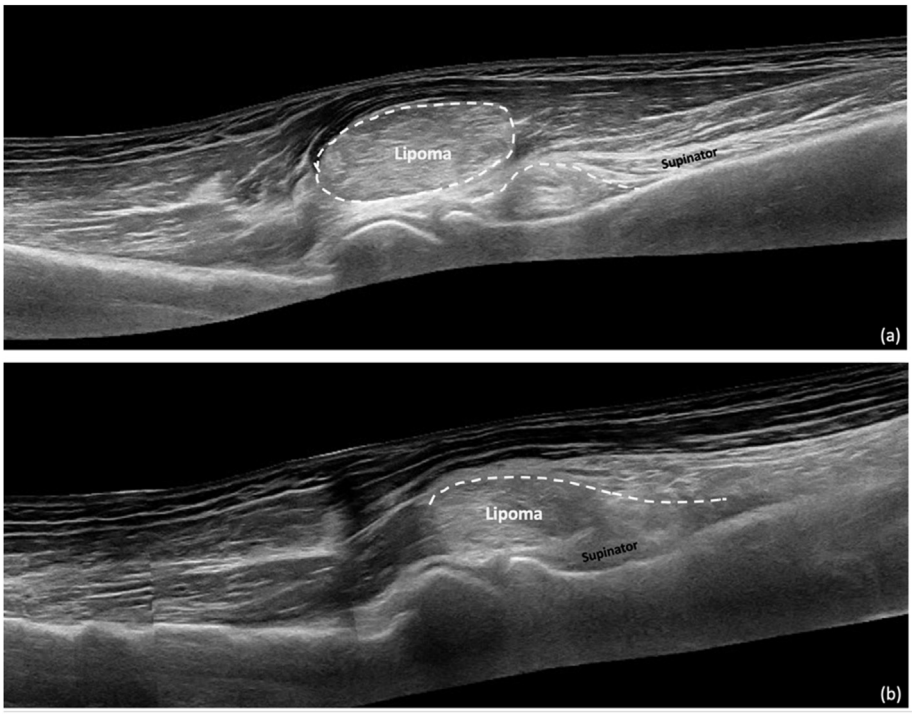

Fig. 2. Panoramic view of the musculoskeletal ultrasound. A well-defined ovoid homogeneous isoechoic mass measuring approximately 5.95 × 2.87 cm^2 underlying the brachioradialis muscle (a) and connected to another ovoid homogeneous isoechoic mass measuring approximately 2.11 × 1.09 cm^2 invading the supinator muscle; the extension part of the main mass exhibited an infiltrative nature into the supinator muscle (a, b). (White dashed line: lipoma).

compressed by the mass lesion (Fig. 3); the extension of the 2.11 × 1.09 cm^2 ovoid mass infiltrated the supinator muscle (Fig. 2).

To localize and identify the lesion more accurately, we performed magnetic resonance imaging (MRI). The MRI revealed an intramuscular lipoma compressing the deep branch of the radial nerve (Fig. 4a and b) with abnormal T2 hyperintensity in the extensor muscle groups and supinator (Fig. 4c), indicating nerve entrapment–related denervation.

Surgical excision of the mass pinching the nerve was recommended. The deep and superficial radial nerves were carefully identified, and the mass was resected (Fig. 5).

Gross examination revealed that the resected specimen was a 4.5 × 4 × 2-cm^3 fat tissue nodule. It was noncapsulated, yellowish, and elastic, with a homogeneous cut surface. The pathology report revealed a lipoma composed of lobules of mature adipose cells. Several collagen fibers and skeletal muscle fibers within the fatty lobules were also observed. No evidence of malignant change was detected.

Following discharge, the patient underwent regular physical therapy, which included therapeutic exercise, muscle strengthening, and electrical stimulation. Two months after the operation, the patient remained unable to fully extend his right fingers and exhibited reduced muscle power (grade 4–5). A follow-up nerve conduction examination and electromyography at 2 months postoperation revealed axonotmesis of the right radial nerve, with signs of denervation and reinnervation in the extensor indicis, extensor digitorum, and extensor carpi ulnaris muscles. We observed no local recurrence after surgery.

3. Discussion

Several underlying pathologies can lead to compression of the deep branch of the radial nerve and the PIN. These pathologies include tumors (lipomas, fibromas, arteriovenous malformations, and ganglion cysts), supinator compression, thickening or tightness of the arcade of Frohse, muscle anatomy abnormalities, amyloidoses, and trauma.[3] A subcutaneous lipoma is common but usually asymptomatic.[4] Deep-seated soft tissue lipomas are less common and

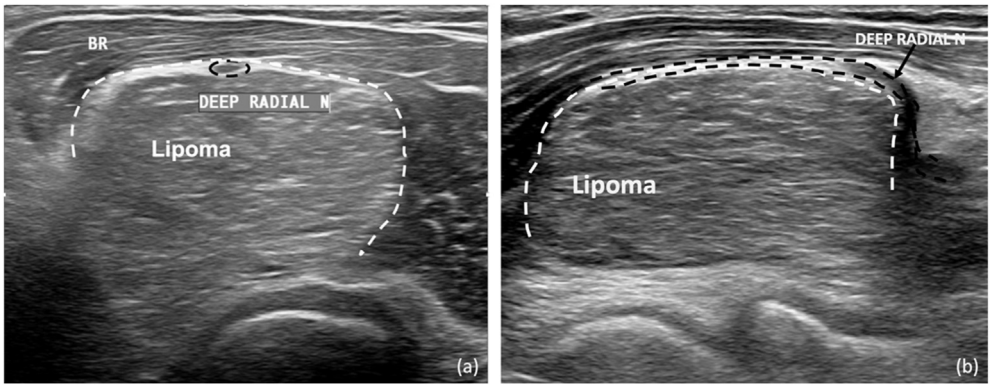

Fig. 3. Musculoskeletal ultrasound of the radial side of the right forearm from a (a) transverse and (b) sagittal view. The deep branch of the radial nerve was elevated and compressed by the lipoma. (BR: brachioradialis muscle; white dashed line: lipoma; black dashed line: deep branch of the radial nerve).

may be supramuscular (above the muscle), intermuscular (between muscles), intramuscular (within the muscle), or submuscular (below the muscle).[5] Intramuscular lipomas are rare, accounting for approximately 1.8% of all primary adipose tissue tumors and less than 1% of all lipomas. In rare cases, intramuscular lipomas can lead to nerve compression or entrapment.[6] Deep lipomas are mainly lipomas that infiltrating into muscles and are usually incompletely capsulated or noncapsulated. An intramuscular lipoma may cause nerve compression syndrome when it is located in the supinator muscle or the muscle surrounding the deep radial nerve. The duration of the symptoms before diagnosis vary from several months to years.[4,6,7] A neurological examination should be conducted in patients exhibiting wrist drop and finger drop. Performing wrist extension exercises to verify the presence of radial deviation is crucial to localize the injury level of the radial nerve.

Nerve conduction examinations are performed to verify both the presence of radial mononeuropathy and the severity of nerve injury. In the present case, we verified axonotmesis of the radial nerve. According to Sunderland's classification of nerve injury, in Class II, III, or IV injury, despite Wallerian degeneration, the nerve maintains continuity. Therefore, timely surgical exploration can increase the likelihood of functional recovery and a favorable prognosis.[8,9] Electromyography can be used to detect denervation and reinnervation in the muscles. In the present case, electromyography revealed polyphasic waves, with reduced recruitment in the right extensor indicis, extensor digitorum, and extensor carpi ulnaris muscles, indicating denervation with reinnervation in the muscles. This electromyography result was consistent with the 3 months of weakness the patient had experienced and the presence of the asymmetric swollen mass for over 10 years.

In determining the etiology of wrist drop, particularly that associated with structural lesions, neuromusculoskeletal sonography can be used for the initial diagnosis; it is noninvasive, accessible, convenient, and inexpensive.[10,11] Ultrasound can localize lesions and enable early identification of structural lesions that may cause entrapment. Ultrasound can also assist in determining the continuity of the nerve. Sonography is beneficial for preliminarily distinguishing a benign tumor from a malignant tumor.[2,6] Unlike subcutaneous lipomas, intramuscular lipomas cannot generally be identified on the basis of clinical findings alone. Ultrasound is typically the first choice of examination. Multiple features can be visualized through ultrasound.[5] Paunipager et al. investigated the ultrasound characteristics of deep-seated lipomas and discovered that the majority (56%) were intramuscular and had ovoid, roundish, or oblong shapes.[5] Moreover, the majority had well-defined margins and was more hyperechoic compared with muscle echogenicity. However, a small percentage was isoechoic or hypoechoic. In Doppler ultrasounds, most deep-seated lipomas exhibit minimal vascularity or no increased

Fig. 4. Magnetic resonance imaging of the right forearm. T1 MRI revealed the intramuscular lipoma compressing the deep branch of the radial nerve and invading the supinator muscle (a,b). Abnormal T2 hyperintensity in the extensor muscle groups and supinator indicated denervation-related nerve entrapment (c). (BR: brachioradialis muscle; ECRL: extensor carpi radialis longus muscle; EDC: extensor digitorum muscle; EI: extensor indicis muscle; ECU: extensor carpi ulnaris muscle; white dashed line: lipoma; black dashed line: deep branch of the radial nerve).

vascularity.[6] In our case, a well-defined ovoid homogeneous isoechoic mass below the right brachioradialis and invading the supinator muscle was identified on the initial ultrasound; no increased vascularity was identified on the Doppler ultrasound. Early excision was performed to prevent further nerve injury, functional impairment, or malignant change.[1,12] Preoperative MRI was conducted, and the result was compatible with the ultrasonography findings.

Recovery of neurological deficits is influenced by the duration of symptoms.[12] In the present case, the patient had experienced

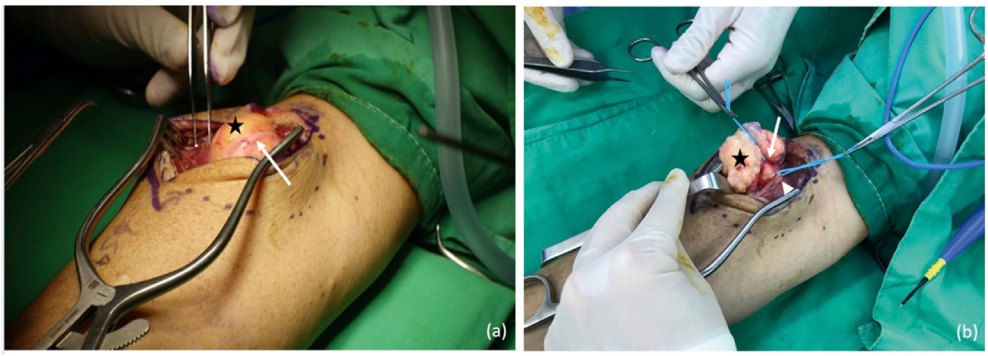

Fig. 5. Photographs of the operation. The deep branch of the radial nerve was elevated and compressed by the lipoma, which was compatible with the sonography finding (a). When the deep and superficial radial nerves were identified, the mass was resected (b). (Black star: lipoma; white arrow: deep branch of the radial nerve; white arrowhead: superficial radial nerve).

weakness in the finger extensor muscles for 3 months and had had an asymmetric swollen mass for over 10 years; nerve compression may have occurred long before the onset of obvious weakness. Furthermore, the patient compensated for the weakness through the recruitment of other extensor muscles.[5]

The prolonged compressive neuropathy was attributed to the insufficient strength and functional recovery of finger extension after surgical resection of the lipoma. Nerve reinnervation is a slow process; 2–5 months are required for collateral sprouting to become evident, and the rate of nerve regeneration is approximately 1.5–2 mm/day. Moreover, MRI revealed denervation and muscle atrophy of the extensor muscle groups, indicating that muscle strength recovery could be limited, even if neurological regeneration occurred.[9]

Researchers recommended early excision of lipomas compressing the deep radial nerve and PIN to promote neurological recovery.[3] To prevent lipoma recurrence, a complete and wide-margin excision should be considered.[7,13] Full recovery can occur when the period between symptom onset and surgery is $\leq$ 2 years.[1] After tumor excision and nerve decompression, the longest duration of recovery from all symptoms is 18 months.[3] Excision of lipomas was reported to have low recurrence rates.[3,14]

4. Conclusion

We present the case of a patient who presented with a palpable lipoma in his right proximal forearm below the brachioradialis that impinged the deep radial nerve and caused wrist drop and finger drop. The electrodiagnostic testing, sonography, MRI, and pathological findings supported a primary diagnosis of deep radial nerve constriction by the intramuscular lipoma. The prognosis of deep radial nerve and PIN entrapment is influenced by the duration of symptoms and the timeliness of surgical resection. In such cases, a rehabilitation program is required to minimize residual weakness and improve functional recovery. For structural lesions causing nerve entrapment, ultrasound can aid in the preliminary determination of the etiology, reveal anatomical relations with surrounding structures, and support surgical decisions.

Disclosure of interest

The authors declare that there is no conflict of interest.

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