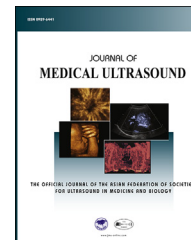


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CASE REPORT

Dynamic Ultrasound—A Useful Tool to Demonstrate Adhesions Postcarpal Tunnel Surgery

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Abstract Carpal tunnel syndrome is common, and open carpal tunnel release remains the treatment of choice for cases refractive to conservative treatment. However, up to 25% of postrelease patients remain symptomatic. Our case illustrates how ultrasound examination can visualize the movements of the contents of the carpal tunnel and reveal additional pathologies. A 42-year-old patient with previous bilateral open carpal tunnel release surgeries presented with recurrent symptoms of bilateral hand tingling sensation starting months after the first operation. Under real-time sonographic exam, the median nerve (MN) changed shape and migrated inferiorly when the patient extended her third finger, suggesting that the perineurium of the MN was adherent to the tendon sheath of the third *flexor digitorum superficialis* tendon. The patient opted to continue conservative treatment but unfortunately did not improve. Recurrent inflammation and fibrosis may have led to the adhesion of the flexor tendons to the MN which was only apparent on real-time evaluation of the displacement of the MN on ultrasound examination. We suggest that the observation of the displacement of the MN during active finger movement can be integrated into the examination of carpal tunnel syndrome patients both before and after surgical intervention and herein include an easy to follow protocol for such examinations.

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Conflicts of interest: None of the authors have any conflicts of interest.

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Introduction

Carpel tunnel syndrome (CTS) is defined by the American Academy of Orthopedic Surgeons as: "A symptomatic compression neuropathy of the median nerve (MN) at the level of the wrist" [1]. It is a common condition affecting an estimated 3.8% of the general population and is associated with significant disability and healthcare-related expenditure [2]. Twenty-five percent of patients typically present with symptoms of recurrent activity-related or nocturnal sensation of burning, itching, tingling, or numbness of the palm of the hand, especially over the thumb, index, and middle fingers.

Diagnosis is based on clinical examination and electrodiagnostic studies, although ultrasound guided examination is increasingly being used as a means of visualizing abnormal MN size [3]. The norms of displacement of the MN during movement as observed by ultrasound examination are not yet established though [4].

For cases in which symptoms are not significantly improved by conservative means, open carpal tunnel release surgery (division of the transverse carpal tunnel ligament) is the current treatment of choice with an estimated 75% rate of symptom reduction [5]. However, considering that as many as 25% of patients postcarpal tunnel release will still experience some form of symptom or disability, there remains a need to continue to improve patient selection, surgical technique, postoperative care, and follow-up. The case discussed below illustrates the utility of sonographic real-time evaluation of the movements of the contents inside the carpal tunnel, even in the chronic postcarpal tunnel release period.

Case Report

The patient is a 42-year-old woman of ethnic Chinese descent who had past medical history of bilateral CTS with open carpal tunnel release surgeries performed on the left wrist in May 2013 and right wrist in July 2013. Additionally, she suffered a right fourth trigger finger for which she underwent a release procedure in May 2015. She had no medical history of diabetes mellitus or infiltrative conditions that may have predisposed her to CTS. Her body mass index was 22.0. She had no history of trauma to the upper limbs. She worked as a manager in a pizza restaurant prior to being disabled by her symptoms of bilateral hand paresthesia and subjective weakness.

Despite bilateral CTS release surgeries, the patient presented with recurrent symptoms of bilateral hand tingling sensation starting within months after the transverse ligament division surgery, and the recurrent symptoms was severe enough to affect her activities of daily living such as using the computer and dressing. Strikingly, she reported worsening of the tingling sensation of the left hand on flexion of the left third finger specifically.

Clinical examination of the patient revealed bilateral provoked palmar tingling on percussion of the volar wrist (positive Tinel sign). The thenar muscle size of both hands were preserved. No objectively detectable weakness of the hand muscles was documented.

A nerve conduction study performed in September 2014 was reported as "Prolonged distal motor latency and

slowing of sensory nerve conduction velocity of bilateral median nerves during ring finger studies (46 m/s) compared to the ulnar side (58 m/s)."

Ultrasound examination of the left hand in that same month (September 2014) showed a left MN cross sectional area of 12 mm² at the carpal tunnel inlet (identified by the scaphoid and pisiform bones) without proximal swelling. The patient received hand physiotherapies, oral anti-inflammatory drugs, and neuropathic pain medications, but with little symptom improvement.

Repeated ultrasound examination of the patient's left carpal tunnel was performed on May 26, 2015. A Toshiba Xario XG (Toshiba Medical Systems Corporation, Tokyo, Japan) ultrasound machine equipped with a 12–14-MHz linear array probe was operated by a sonographer with 8 years of experience. Image acquisition was set at 33 frames/s with minimal image compression.

The patient was seated with the left forearm in full supination and the wrist at a neutral angle. In addition to static evaluation of the carpal tunnel structures, dynamic

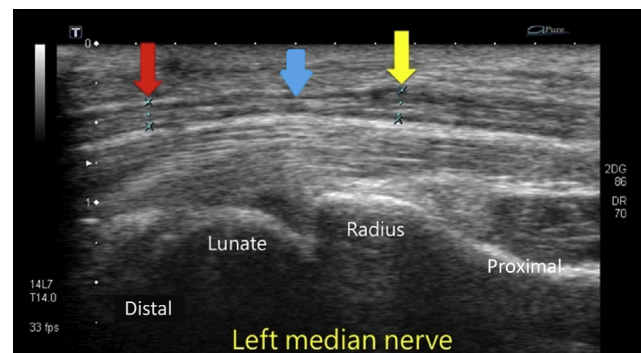


Figure 1 The longitudinal view of the left median nerve. The yellow arrow indicates the swollen portion of median nerve at the distal radius, proximal to the level of compression (diameter 1.9 mm). The area of focal compression is indicated by the blue arrow. The red arrow indicates thinning of the median nerve at the level of the distal lunate bone (diameter 1.5 mm).

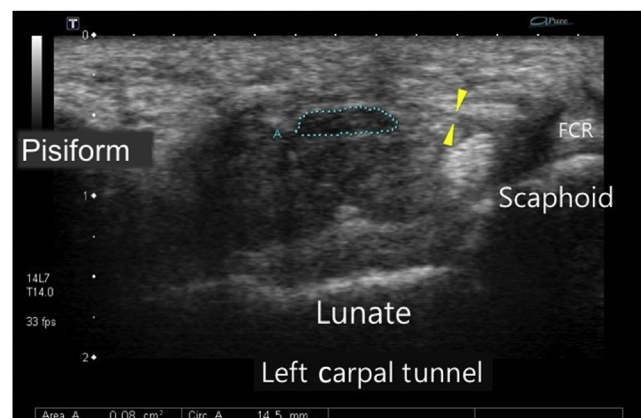


Figure 2 The cross sectional view of the left median nerve of the patient. The median nerve is outlined by blue dots. The yellow arrows indicate the remnants of the transverse carpal ligament. FCR = flexor carpi radialis tendon.

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