Case Report

Riche-Cannieu Anastomosis Presenting in a Patient with Suspected Carpal Tunnel Syndrome: A Case Report

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ABSTRACT

Objectives: To present an anatomical variant detected from the non-clinical correlation of electrophysiologic findings in a patient suspected of carpal tunnel syndrome (CTS).

Study design: A case report.

Setting: Rehabilitation Unit of Nakhon Pathom Hospital, Nakhon Pathom, Thailand.

Subjects: A 77-year-old man with a history of numbness in both hands for six months who underwent electrodiagnostic evaluation of CTS.

Methods: The patient's medical record was reviewed, and a nerve conduction study (NCS) was conducted.

Results: The nerve conduction study was conducted to rule out other forms of peripheral neuropathy. Despite the thenar muscles' bulk and strength being preserved, it was not possible to record the left median compound muscle action potential (CMAP). Further ulnar nerve stimulation at the wrist and elbow, recorded at the left abductor pollicis brevis (APB) muscle, revealed a normal CMAP response. Based on these results, Riche-Cannieu anastomosis in the left hand was suspected.

Conclusions: In the absence of other supportive evidence, Riche-Cannieu anastomosis should be excluded if the median CMAP response from the APB muscle cannot be obtained due to, e.g. motor weakness and muscle atrophy at the thenar eminence. Stimulation of the ulnar nerve while recording at the APB muscle can help avoid misdiagnosis

Keywords: carpal tunnel syndrome, electrodiagnosis, median-ulnar nerve communications, Riche-Cannieu anastomosis, ulnar-median anastomosis

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Introduction

Four major classifications of anomalous interconnections exist between the median and ulnar nerves. Interconnections manifesting in the forearm include Martin–Gruber and Marinacci, while those found in the hand are known as Riche–Cannieu and Berrettini.

Riche–Cannieu anastomosis (RCA) is an anatomic variant in which the deep branch of ulnar nerve fibers crossover to the recurrent branch of median nerve fibers in the hand, hence the ulnar nerve innervates muscles of the thenar eminence. RCA has been described in cadaveric dissections with a frequency range of 3.12-77%.[1] Roy et al.[2] conducted a meta-analysis of nerve communications in the upper limbs, analyzing 501 cases in 6 studies, and found the prevalence of RCA to be 55.5%.

Clinical presentation of RCA can take three forms. Whether these communications are sensory, motor, or mixed is still being investigated. All hand muscles can be innervated by the ulnar nerve (all ulnar hand), motor innervation can be dominantly provided by the ulnar nerve, or some of the median innervated muscles can be innervated by the ulnar nerve.[3-6] Of these three types of RCA, pure motor anastomosis between the deep branch of the ulnar and the recurrent branch of the median is the most common, while the all ulnar hand is rare.[1,3] The nerve conduction in studies of RCA varies depending on which types of anastomosis each individual has. In general, an absence of median motor response despite preserved bulk of the thenar muscles should raise the examiner's suspicion of possible RCA.

The presence of an anatomic variant may interfere with the interpretation of electrodiagnostic studies in diagnosing neuropathy. Normal subjects without median motor nerve response may be interpreted as severe median neuropathy at the wrist regardless of the average strength of the thenar muscles. The patient in the present case presented with RCA which was suspected of being carpal tunnel syndrome. If RCA is not recognized, nerve conduction study (NCS) results can be misdiagnosed as severe carpal tunnel syndrome (CTS) with no distal median motor nerve response preservation.

Case presentation

A 77-year-old man with a history of numbness in both hands for six months was sent for underwent an electrodiagnostic evaluation. The patient experienced paresthesia in both palms and all fingers. The symptoms were more prominent in the left hand than the right hand. His numbness symptoms were unrelated to weakness of the hands or upper limbs. He

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denied a history of neck, shoulder, or arm pain. During the diagnostic interview, the patient also reported intermittent numbness in both feet for one month. He had no significant back pain or radiated pain along either leg. His underlying condition was atrial fibrillation. The laboratory results were normal for fasting blood sugar.

Physical examination found the patient had no muscle atrophy with thenar eminences preserved in both hands. There was a slight decrease in abductor pollicis brevis (APB) muscle strength in the left hand (Medical Research Council grade 4/5), while the right hand was intact (5/5). Light touch sensation was decreased in the palmar surface of both hands, including all fingers and the plantar surface of both feet. The patient had a typical gait pattern. Spulring's test and the straight leg raise test (SLRT) were normal. Deep tendon reflex responses of the upper and lower limbs were 2+ with the plantar reflex causing a downward response to the Babinski test.

Nerve conduction studies (NCS) were performed using a Natus Synergy EDx machine (Natus Neurology Incorporated, Middleton, Wisconsin, USA) with controlled skin temperature of not below 32 °C. Motor nerve conduction studies were conducted by recording compound muscle action potential (CMAP) responses from the abductor pollicis brevis (APB) and adductor digiti minimi (ADM) muscles following stimulation of median and ulnar nerves at 8 cm. In addition, antidromic sensory nerve action potential (SNAP) of the median and ulnar nerves was obtained from the third and fifth fingers at 14 cm using ring electrodes. NCS of lower limb muscles was examined to rule out other possible peripheral neuropathy. The results were normal.

NCS of the right hand was consistent with a moderate degree of median neuropathy at the wrist. There were delayed response latencies with normal amplitudes in median SNAP and CMAP with normal ulnar SNAP and CMAP responses. However, when the median nerve was stimulated at the left wrist, no sensory response was obtained from the third finger, and no motor response was obtained from the APB muscle. Normal ulnar sensory and motor responses were obtained from left ulnar nerve stimulation. These findings would normally be interpreted as a severe degree of left median neuropathy at the wrist; however, the preserved motor strength in left thenar muscles suggested the possibility of an anomalous innervation.

Further studies were conducted, recording from the left third fingers and the left APB muscle while stimulating the ulnar nerve at the wrist and the elbow. Stimulation of the left ulnar nerve at the wrist resulted in a standard-looking shape of sensory nerve response being obtained from the third finger. There was normalization of the left ulnar-APB CMAP response. (Figs. 1 and 2).

Discussion

The prevalence of RCA in a normal population varies among studies. However, a recent meta-analysis reported RCA in 55.5% of individuals in the studied populations (95% CI, 30.6%-79.1%).[2] Caetano et al.[7] identified RCA in 100% of 80 dissected hands and suggested that RCA should be considered a normal anatomical neural connection, not an anatomical variation. Because of the high prevalence of RCA, recognizing its pattern in patients with normal NCS findings is crucial for an accurate diagnosis.

In this study, the RCA was confirmed by an absence of median motor response at the APB muscle when stimulated at the median nerve, but with normalization of the motor response when stimulating an ulnar nerve. In typical RCA, a

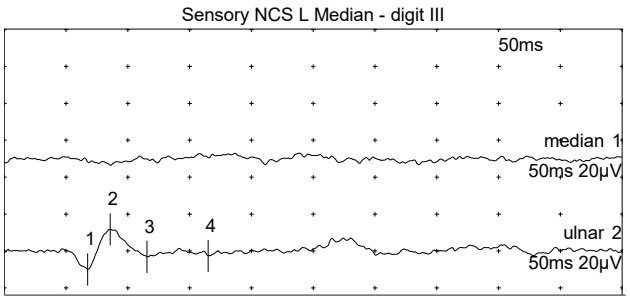

Figure 1. Sensory NCS stimulated from the left median and left ulnar nerves at the wrist, recorded from the left third finger

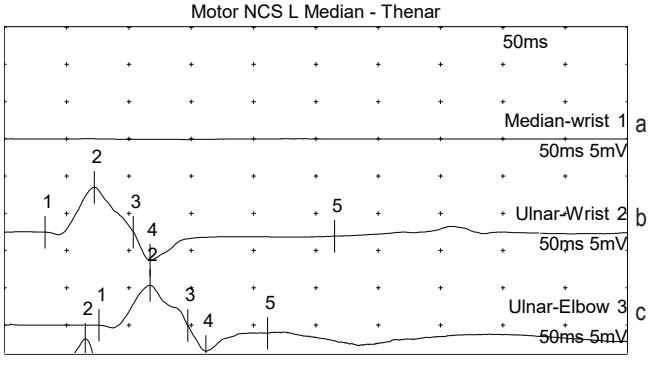

Figure 2. Motor NCS stimulated at median at left wrist recorded from APB muscle (a), stimulated at left ulnar at wrist (b) and elbow (c) recorded from APB muscle

Table 1. Nerve conduction study findings on the left hand

Nerve	Recording site	Stimulation site	Latency (msec)	Amplitude	Conduction velocity (m/s)
Sensory					
Median	3rd finger	Wrist	No response	No response	
Ulnar	3rd finger	Wrist	8.59	15.0 μV	
Motor					
Median	APB	Wrist	No response	No response	
Ulnar	APB	Wrist	3.28	6.0 mV	
Ulnar	APB	Elbow	7.6	5.4 mV	57.8

pathognomonic initial negative deflection waveform occurs when the APB muscle is stimulated by the ulnar nerve at the wrist.[1,8] In the present case, however, a positive rather than a negative deflection was observed. This finding could have resulted from volume conduction to other intrinsic hand muscles, apart from the APB muscle, that were innervated by the ulnar nerve which is the reason the all-ulnar hand type of RCA was suspected.

The absence of median sensory response recorded from the third finger when stimulating the median nerve at the wrist suggested the possibility of either co-existent CTS or the less common sensory-motor involvement in all ulnar-type RCA. To resolve this question, an antidromic sensory response stimulated by the ulnar nerve while recording at the third finger was performed which resulted in an ordinary-looking shape of the sensory nerve response with relatively prolonged distal latency. This finding further supported the probability of sensory fiber anastomosis between ulnar to median digital nerves, helping to confirm the presence of all ulnar-type RCA. The relatively prolonged sensory distal latency found in this case was similar to the results in a previous study by Kim et al.[3] in which the authors proposed that anomalous thin cutaneous nerves can lead to small amplitude and delayed latency sensory nerve action potential. In the present study, the slight positive deflection observed in the sensory response could have resulted from the aberrant ulnar to the median sensory anastomosis of RCA found in this patient. Additionally, the anastomosed ulnar to median fibers in this patient traveled longer distances to the third finger than the usual pathway of median innervation. For that reason, a lesion in the left ulnar nerve was not suspected because of the normal ulnar sensory and motor responses.

In addition to the NCS findings, needle EMG should be performed to confirm a patient's APB muscle denervation. In suspected CTS patients with RCA, typical results of needle EMG findings should be expected despite the absence of median motor response stimulated at the median nerve because the ulnar nerve, rather than the median nerve, innervates the thenar muscles.

In summary, the relatively high prevalence of RCA anastomosis is generally under-appreciated. Thorough knowledge of clinical correlation remains an essential tool for electrodiagnostic physicians. RCA should be excluded if no CMAP response is obtained from the APB with median stimulation in the absence of other supportive evidence, e.g., motor weakness and muscle atrophy. Stimulation of the ulnar nerve with recording at the APB muscle can help avoid misdiagnosis.

Disclosure

The author has nothing to disclose regarding this study.

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