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Clinical commentary

## Apparent C8-T1 radiculopathy with hand weakness due to mid-cervical spondylosis <sup>☆</sup>

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## ABSTRACT

Hand weakness and wasting in the setting of mid-cervical spondylosis and disc herniation without radiological evidence for compression of the C8 or T1 roots has been rarely reported. We retrospectively studied the data of patients with hand weakness and mid-cervical spondylosis. The clinical and radiological findings were compared to a control group of patients with weakness of the arm or forearm muscles and similar mid-cervical spondylosis. We found 19 patients with weakness and atrophy of the intrinsic hand muscles, and 13 patients with weakness proximal to the hand muscles to serve as a control group. Eleven patients (58%) had lower limb hyperreflexia or Babinski sign. Nine patients (47%) had compression of the C7 root, 12 patients (63%) had compression of C6, 8 patients (42%) had compression of C5, and 2 patients (11%) had compression of the root C4. In all but three patients (84%), magnetic resonance imaging (MRI) showed cord compression. In the control group, five patients (38%) showed hyperreflexia of the lower limbs and Babinski sign. Five patients (38%) had compression of the C7 root, eight patients (62%) had compression of C6, and twelve patients (92%) had compression of C5. Cord compression was found in eight patients (62%). Hand muscle weakness and wasting due to mid-cervical spondylosis seems to be more common than usually believed. The lack of clinical-radiological correlation should not mislead the clinician from the correct diagnosis, and should not delay the surgical decompression of the cord and the roots.

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## 1. Introduction

The localization of the involved root in patients with cervical radiculopathy is imperative, especially when surgery is indicated. It is usually based on classical myotomal and dermatomal charts and tables that show the motor, reflexes, and sensory changes that characterize each root lesion. Yet, relying on textbooks and current reviews of cervical radiculopathy [1] may leave the clinician perplexed by lack of clinical-radiological correlation. Of special interest is the weakness of the intrinsic hand muscles without radiological evidence for C8 radiculopathy. Overlapping with the T1 root, the C8 root innervates the finger flexors and all the intrinsic hand muscles [2,3]. The sensory innervation zone of C8 is the ulnar two digits and the medial aspect of the forearm. C8 radicu-

lopathy is characterized by radicular neck pain, hand weakness, and sensory deficit of the ulnar fingers and medial forearm.

Hand weakness and wasting in the setting of mid-cervical spondylosis and disc herniation without radiological evidence for compression of the C8 or T1 root was reported in 2 patients 1981 [4], in 15 patients in 1988 [5], and in 12 patients in 2012 [6].

To further elucidate the etiology of this apparent C8 radiculopathy, we have investigated 19 patients with unilateral hand weakness that had cervical spondylosis and disc herniation above the level of the C8 root. We compared their radiological findings to 13 patients with C5–C7 radiculopathy who presented the classical clinical features that correspond to the involved roots and served as a control group.

## 2. Methods

We retrospectively reviewed the database of our patients from January 2010 to June 2016. All patients were observed by us, their history was taken, and they underwent complete neurological examination. All patients had cervical magnetic resonance imaging (MRI) scans. The inclusion criteria for the studied group were unilateral weakness of intrinsic hand muscles that were innervated by

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both the median and ulnar nerves, sensory deficit of digits 4 and 5 or the medial forearm or no sensory loss, and cervical spondylosis affecting the levels C4-5, C5-6, and C6-7. The inclusion criteria for the control group were unilateral weakness of the arm or forearm muscle without significant weakness of the hand muscles, sensory disturbance compatible with dermatomes C5, C6, or C7 or no sensory deficit, and cervical spondylosis of C4-5, C5-6, and C6-7 disc levels. Patients with mild pyramidal signs such as lower limb hyperreflexia, Babinski sign, or very mild lower limb weakness were not excluded; however, patients with spasticity, significant lower limb weakness, or sphincter involvement were excluded. Other exclusion criteria included polyneuropathy or ulnar or median mononeuropathies, brachial plexopathy, and bilateral hand weakness.

Nerve conduction studies and electromyograms (EMGs) were either performed by us or elsewhere; however, we reviewed all the electrophysiological studies.

All the MR images were reviewed by experienced neuroradiologists. Their reports focused on the presence and severity of disc herniation, foraminal narrowing, spinal canal diameters, and compression of each nerve root. The degree of cord compression and the presence of a hyperintense MRI T2-weighted signal was noted. Primary intramedullary lesions such as tumors or syrinx were excluded. The MR images were also viewed by us. The neuroradiological findings of the two groups of patients were compared.

### 3. Results

#### 3.1. Patients

Nineteen patients were found to have weakness of the intrinsic hand muscle. Sixteen were men and 3 were women. Their ages were between 43 and 79 years, with a mean age of 61 years. Ten patients had left hand weakness, and 9 patients had right hand weakness. The control group was comprised 13 patients with weakness proximal to the hand muscles (i.e., the arm and forearm muscles). The ages in the control group ranged from 37 to 69 years, with a mean age of 56.5 years. Eight patients had left-sided weakness, and 5 patients had right-sided weakness. Two representative patients are reported here.

**Patient 1.** A 52-year-old woman presented with progressive weakness of the right hand lasting 4 months, and difficulty with fine-motor movements of the fingers, such as fastening buttons. She also complained of mild weakness of the right leg and reduced temperature sensation in the left leg. The patient was otherwise healthy, except for chronic headache and mild hypertension. On examination, there was moderate weakness [grade 4- on the Medical Research Council (MRC) scale] and atrophy of all the intrinsic right hand muscles and finger extensors. There was mild weakness of the right iliopsoas muscle, and all other muscles were normal. Pinprick and temperature sensation was reduced in the left lower limb. Tendon reflexes were hyperactive with right Babinski sign. Cervical MRI showed posterior and anterior cord compression at C4-5 with T2 hyperintense signal (Fig. 1). The patient had surgery, and had posterior decompression at C4-C6. MRI after surgery showed mild T2 hyperintense signal in the cord, but no compression. On examination 10 months after surgery, there were very mild weakness and wasting of the right interossei, abductor digiti minimi, and finger extensors and normal strength in all other muscles. The patient also had mild reduction of sensation in the medial aspect of the hand and forearm and left lower limb. Tendon reflexes were hyperactive with indifferent plantar responses.

**Patient 2.** A 65-year-old man who had diabetes mellitus for 15 years without optimal treatment (HbA1C: 7.0–8.0) was being treated with statins for hypercholesterolemia. Five months before the

examination, he noticed wasting of the left thenar eminence and forearm muscles. He did not have neck pain nor limitation of neck movements. Nerve conduction studies showed reduced compound muscle action potential of the median and ulnar nerves with normal conduction velocities. EMG showed chronic denervation changes in the intrinsic hand muscles and the finger flexors. On examination, there was severe atrophy of the thenar muscles, interossei, and the palmar muscles of the forearm and mild wasting of the hypothenar muscles. There was grade 4 MRC scale weakness of the interossei, adductor pollicis, abductor pollicis brevis, and abductor digiti minimi, and mild weakness of the finger extensors and hand flexors. Sensation was normal, except for mild reduction of vibration sense in the toes. Tendon reflexes were normal with flexor plantar responses. Cervical MRI showed narrowing of the spinal canal at C5-6 with severe left foraminal stenosis and compression of the C6 root, and no pressure on the cord (Fig. 2). MRI of the brachial plexus was normal.

#### 3.2. Symptoms and signs

Seven of 19 (37%) patients with distal weakness had radicular pain. The pain was ipsilateral to the weakness and radiated from the neck toward the fingers. In 4 patients, the pain was aggravated by neck movements. The weakness was noticeable in the intrinsic hand muscles that are innervated by the ulnar and median nerves, and was somewhat more pronounced in the ulnar-innervated muscles. The weakness was accompanied by atrophy that corresponded to the degree of weakness. All but 4 patients also had weakness of the finger extensors. In two patients the intrinsic hand muscle weakness was severe (grade 1–2 on MRC scale), and the rest had mild weakness (grade 4). Two patients had weakness of the hand extensors, and six patients had mild (grade 4) weakness of the finger flexors (Fig. 3).

Seven patients (37%) had sensory symptoms that included sensory deficit and paresthesias in the medial aspect of the hand and forearm. The remaining patients did not have sensory complaints and their sensory examination was normal. Eleven patients (58%) had hyperactive tendon reflexes in the lower limbs, and 9 patients (47%) had unilateral or bilateral Babinski sign.

In the control group, 11 patients (85%) complained of radicular pain. Only one patient had mild (grade 4+) weakness of the intrinsic hand muscle in addition to the proximal limb weakness. In all, the weakness involved a combination of the following muscles: deltoid, biceps, triceps, pectoralis, infraspinatus, hand extensors, and hand flexors (Fig. 3). Only one patient (7.7%) had sensory dermatomal deficit, and in all other patients, sensation was intact. In 5 patients (38%) there was hyperreflexia of the lower limbs, and in 5 patients (38%) there was unilateral or bilateral Babinski sign.

#### 3.3. Electromyographic studies

Nerve conduction studies ruled out peripheral neuropathies. Motor amplitudes of the median and ulnar nerves were small, and sensory amplitudes were normal. EMG of the intrinsic hand muscles showed active denervation changes (fibrillations and positive sharp waves) in most patients. A few patients also showed fasciculations. All patients had large motor unit potentials with reduced recruitment. In most patients, there were mild non-active denervation changes in the forearm muscles.

In the control group, there were active and chronic denervation changes in the involved muscles. In some cases, there were fasciculations as well. The studies confirmed the clinical diagnosis of radiculopathy.

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