Median Nerve Entrapment Resulting in Unilateral Action Tremor of the Hand

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abstract: *This article discusses a case of median nerve entrapment with an associated action tremor of the right hand in a 39-yr-old woman. The complaint of unilateral hand tremor was dismissed by her allopathic physicians as "psychological." A thorough history and physical examination were used to rule out a pathological cause of the tremor and effectively find the cause. Management was directed toward multiple areas of entrapment along the kinetic chain of the upper extremity and cervicothoracic spine. Treatment included Active Release Technique, contract relax technique, electrical muscle stimulation, diversified chiropractic manipulative therapy, active stretching of the wrist flexors and extensors, and active strengthening of the wrist flexors and extensors. This patient recovered sufficiently to return to normal occupational and social activities. She experiences occasional exacerbations with increased keyboard work that resolve with supportive treatment as previously discussed.*

key words: Tremor, Median Nerve, Entrapment, Hand, Pronator Teres, Active Release Technique

INTRODUCTION

Physiological tremors are defined as purposeless, involuntary, oscillatory movements that may be rhythmic in nature. The movements result from reciprocally innervated muscle groups (agonists and antagonists) contracting in an alternating pattern (1–3). Tremors have been reported in several regions of the body, including the head, neck, tongue, shoulders, arms and hands (1–5). The anatomic site of the tremor, as well as its nature (slow, fast, flexion-extension, pronation-supination, etc.), will provide diagnostic clues for establishing the cause. For example, pathological tremors tend to be slower in frequency than physiological tremors (2). Although each classification of tremor has characteristics that assist in its diagnosis, the severity of certain disorders and the coexistence of tremor with some of these disorders may make distinguishing them more difficult.

An extensive search of Medline using the Grateful Med software failed to find published reference material documenting the onset of action tremors as a result of peripheral nerve entrapment. Previous publications reported tremor in association with hereditary or acquired polyneuropathies such as Guillain-Barré syndrome, but not with isolated peripheral nerve entrapment (1–3).

Several authors have established classification schemes for tremors based on their occurrence during rest or while attempting a voluntary movement (1–5). Categories within this classification scheme are described in Table 1. Using the previously described classification scheme (1–5), a careful history (including past medical history, family history and occupational history) and physical examination, the physician determines a reasonable cause for the presenting tremor. Balduc has stated that

> An appreciation of the nature and cause(s) of each of these tremors will enable the doctor to recognize the tremor's relationship to the function of the human motor system and the influence that manipulative therapy may exert (2).

CASE REPORT

A 39-yr-old female secretary visited the Department of Chiropractic at the HIP Health Plan of New Jersey's Somerset Health Center complaining of a tremor in her right upper extremity from the elbow to the hand, a condition of 1.5 yr duration. Onset of her tremor was insidious and gradual. The tremor was postural (occurring during voluntary activation of the musculature; i.e., lifting a cup to the mouth or sustaining a posture, such as holding the arms in an outstretched position) and was not present at rest. It was worse when she actively used her right hand, such as when she tried to write; this is indicative of an action tremor (3). Initially, the tremors had been more intense (higher amplitude and frequency) in the morning and had improved as the day went on. It had progressed to the

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Table 1
Tremor Types

Tremor Type	Patient position or action that stimulates tremor
Resting tremor	Patient sitting with hands in lap (2, 7).
Postural tremor	Patient with arms outstretched in front of the body (2, 7).
Action tremor	Patient moving arms or using hands to write or lifting a beverage to the mouth.
Intention tremor	Finger-to-nose maneuver (dynamic goal-oriented performance).
Contraction tremor	Patient makes a fist or squeezes the examiner's hand.

point where she spilled beverages and could not write legibly. She denied headaches, seizure activity, fatigue, malaise, or weight loss. The patient was a secretary at the local medical school. Her work included considerable time at a computer keyboard performing data entry. Her past medical history was negative for tremors, Parkinson's disease, multiple sclerosis, or other primary neurological disease. She was right-handed. She did not smoke and she drank decaffeinated coffee. On the weekends, she consumed approximately three beers. The alcohol intake reportedly had no effect on the tremors (alcohol will tend to reduce or eliminate essential tremors) (1–3).

Before consultation she was seen by her primary care physician, who diagnosed her with tremors of uncertain origin, possibly related to anxiety. Extensive lab studies were performed to rule out systemic or pathological causes of the tremor, including diabetes, thyroid disease, liver disease, anemia, pharmaceutical toxins, etc. (1, 3). The primary care physician referred the patient to the Department of Neurology for consultation. The neurological consult resulted in the ordering of a brain magnetic resonance image with gadolinium contrast, which was negative for brain pathology. The neurologist's diagnosis was "postural hand tremor." He recommended pharmaceutical treatment such as Mysoline or Inderal and diet modification to reduce caffeine.

The patient was in no acute distress. Examination of her upper extremity kinetic chain was conducted starting with the cervical spine and proceeding distally to the hand (6, 7). Range of motion of the cervical spine was within normal limits, with extension of the cervical spine producing generalized posterior cervical spine pain. Deep tendon reflexes of the upper and lower extremities were reactive and symmetrical bilaterally. Clonus was absent at the ankle and wrist. Opposition strength of the first-to-fifth and second-to-fifth digits of the hands were normal bilaterally. Motor examination of the upper and lower extremities was normal, as was the cerebellar examination. Tremor on the finger-to-nose maneuver was absent, reducing the possibility of an intention tremor. When the patient extended both arms in front, there was a noticeable tremor of the right hand, suggestive of a postural action tremor (1–3). Pupils were reactive to light. Cardinal fields of gaze were normal and full. George's test was negative bilaterally. Jackson's compression test elicited posterior cervical spine pain on the right. The shoulder depression test elicited trapezial ridge pain on the right. The scapular attachment sign (8) was present on the right. The cervical zygapophyseal joints were painful to palpation from C3 through C7 on the right and T3 through T6 bilaterally.

Active and passive range of motion of the shoulder, elbow, and hand were pain-free, within normal limits, and without cogwheel rigidity (2). Orthopedic testing of the shoulder and elbow was negative. Tinel's sign was positive for median nerve involvement over the right carpal tunnel. Phalen's test was negative. When the patient grasped the doctor's fingers and squeezed, a tremor was elicited in the right hand only, which is indicative of a contraction action tremor (3).

Palpation of the right subscapular region elicited localized pain, burning pain along the medial aspect of the brachium, lateral forearm, and first three digits of the right hand and revealed adhesion of the brachial plexus between the subscapularis muscle and the serratus anterior muscle (6, 7, 9). Palpation of the pronator teres muscle while patient contracted her right hand reduced the frequency of the tremor. Palpation of the right brachioradialis muscle and wrist extensors severely increased the tremor without the patient's performing an active hand movement or gripping action, which suggested a myofascial component to the patient's tremor.

DISCUSSION

The history, clinical presentation, physical examination findings (including clinical observation), negative intracranial magnetic resonance image and negative laboratory tests reveal a very unique case of an action tremor brought on by a whole-nerve syndrome of the right median nerve (6, 7). This was evident by physical examination.

These are the aspects of the physical examination that led to our conclusion. Manual examination of the upper extremity kinetic chain revealed altered soft-tissue motion and altered soft-tissue texture at the pronator teres, brachioradialis, wrist extensor muscle group, and between the subscapularis and serratus anterior muscles. The median nerve was targeted as the culprit because of several findings. First was the positive Tinel's sign, commonly used to diagnose median nerve entrapment at the carpal tunnel. Second was production of pain and burning along a peripheral nerve pattern consistent with

the median nerve during manual examination of the subscapular region. Third, we were able to intensify and reduce the frequency and amplitude of the tremor by manual pressure over the brachioradialis and pronator teres, respectively. The involvement of the anatomical regions in question can best be explained by the patient's occupation, which involves extensive keyboard work, promoting contracture and altered soft-tissue function along the upper extremity kinetic chain. Although she displayed a few of the physical findings characteristic of essential tremor, many of the diagnostic criteria were absent (Table 2). This patient's dilemma was more likely brought on by her occupation and the repetitive strain that intense daily keyboard work produces.

All dysfunctional aspects of the patients upper extremity kinetic chain were addressed during treatment. The muscular and joint dysfunction of the cervical and thoracic spine was initially addressed with electrical muscle stimulation, hot moist packs, Active Release Techniques (ART) and Diversified chiropractic manipulative therapy (10). ART was applied to the subscapular region to reduce adhesion formation between the subscapularis and serratus anterior, thus freeing the brachial plexus and re-establishing normal glide. ART was also applied to the pronator teres, brachioradialis, and wrist extensor muscles to reduce adhesion entrapment (6, 7, 9). After the treatment with ART, contract-relax technique was applied to restore flexibility to the muscle groups in question (11). Diversified chiropractic manipulative therapy was applied to the carpals to restore normal joint motion at this link of the kinetic chain (10). The patient was instructed on flexibility exercises for the brachioradialis, wrist extensors, and wrist flexors. She was also instructed on postural exercises for scapular stabilization and strengthening of the serratus anterior. The flexibility and strengthening exercises the patient was instructed to perform were aimed at restoring normal function and stability to the entire kinetic chain (7, 9).

Table 2
Diagnostic criteria for essential tremor vs. case study

Diagnostic criteria for essential tremor	Present (+) or absent (–) in case study
Positive family history of essential tremor.	–
Positive patient history of action tremor beginning in teens or any age for no apparent reason.	–
Evidence of flexion/extension action tremor beginning in the fingers/hand, especially the dominant hand.	+
Positive finger-to-nose test revealing tremor while holding arms outstretched or while moving the finger or hand toward an object.	+ outstretched arms – finger-to-nose – movement to object
Action tremor worsens as person ages.	–
Possible evidence of head nodding, rest tremor and cogwheel rigidity developing later.	–
No evidence of Parkinson's disease.	+
No evidence of cerebellar disease.	+
No evidence of neurological or other disease.	+
Temporarily relieved by alcohol consumption.	–

CONCLUSION

This patient recovered sufficiently (resolution of her tremors with recurrence at less intensity) to return to normal occupational and social activities. She experiences an occasional recurrence of a fine (slow frequency and low amplitude) tremor with increased keyboard work. This resolves with supportive treatment as previously discussed. Resolution of her exacerbation is usually seen in one or two treatment visits.

Her initial treatment plan was set at a frequency of two treatments per wk for the first 2 wk. She was then observed at 2-wk intervals for 6 wk, 3-wk intervals for 12 wk and, finally, monthly for 6 months, for a total of 17 office visits. This was not the immediate treatment plan of choice. There were several considerations that had to be accounted for. First, the patient was treated at a self-contained health maintenance organization (HMO). Chiropractic services are provided on a part-time basis at the center in question. Hours of treatment are not conducive to patient scheduling as they are based on space availability and not patient need. Ideally, it would have been more expedient to treat this patient more frequently for a shorter duration. Secondly, the Department of Chiropractic services a large number of 'lives' for this HMO. Therefore, appointment availability is also limited. Scheduling became a major factor in the treatment of this patient, as she was employed full time and her employer was less than cooperative regarding taking time off to receive treatment.

This patient had three consultations with her primary care physician and one consultation with a neurologist over a 12-month span before referring herself to the Department of Chiropractic. The chronicity caused by delayed treatment resulted in her treatment being less cost effective and more drawn out than it could have been had she been managed more expediently (12).

Although the case of tremor associated with nerve entrapment is, according to the published literature, an uncommon scenario, this case illustrates that it does occur. A thorough history, physical examination, family history and past medical history, including prior medical consultations, are critical to the accurate diagnosis and origin of tremors.

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