Case reports

Chiropractic management of work-related upper limb disorder complicated by intraosseous ganglion cysts: a case report

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Abstract

Objective: Work-related upper limb disorder (WRULD) encompasses a broad array of occupational upper limb injuries, the most common being carpal tunnel syndrome (CTS). Carpal tunnel syndrome occasionally presents with concomitant ganglion cysts. The purpose of this case report is to describe the chiropractic management of a patient with bilateral WRULD complicated by ganglion cysts.

Clinical Features: The patient was diagnosed previously with bilateral CTS and presented with common CTS symptoms that were nonresponsive to several previous courses of care. Magnetic resonance imaging revealed bilateral ganglion cysts, and electrodiagnostic studies found left CTS and bilateral radial neuralgia. Right limb findings appeared more consistent with nonspecific arm pain.

Intervention and Outcome: Chiropractic manipulative therapy, soft-tissue approaches, and physiotherapy modalities were applied to the arms and wrists over a 3-month period. Home care included exercises using elastic tubing and a gyroscopic handheld device. Chiropractic manipulative therapy and other conservative approaches resulted in subjective improvements of decreased hand paresthesias and muscle weakness and objective improvements in range of motion and neurologic deficits. Although the patient's symptoms and function improved, she remained with a level of permanent impairment.

Conclusion: This case demonstrates successful chiropractic management of a patient with WRULD complicated by ganglion cysts. Further larger-scale studies are recommended to determine if chiropractic management demonstrates positive outcomes for this condition.

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Introduction

Work-related upper extremity disorder (WRULD) consists of both specific and nonspecific causes of work-related arm pain.¹ Specific conditions include hand-arm vibration syndrome and soft-tissue syndromes (fascial, tendon, or nerve [including carpal tunnel syndrome; CTS]) with definitive diagnostic findings. Nonspecific WRULD is essentially a diagnosis by exclusion² and has also been referred to as *nonspecific arm pain* (NSAP), *overuse syndrome*, *repetitive strain injury*, and *repetitive strain disorder*.¹ For the purpose of this article, nonspecific WRULD will be referred to as *NSAP* except when it was otherwise defined in a cited article.

According to Helliwell,¹ obligatory symptoms for WRULD are a relevant work history and pain in the arm; other symptoms may include weakness, burning, paresthesias, cramps, tremor, incoordination, vasomotor disturbances, and swelling. Signs may include muscle tenderness, incoordination, and loss of grip/pinch strength. A 2007 literature review of high-quality studies on conservative treatment of specific upper limb disorders found that short-term, effective treatments included local steroid injection, exercise, and stretching, with limited evidence for the use of ultrasound and no support for nonsteroidal anti-inflammatory drugs.³ This same study found no evidence to support or refute conservative treatment of diffuse nonspecific upper limb disorders.

Carpal tunnel syndrome is the most common, specific WRULD.³ It affects the median nerve and may have a significant impact on the injured individual's ability to compete in the open labor market and perform routine activities of daily living. Carpal tunnel syndrome is one of the most commonly seen repetitive stress injuries.⁴ The incidence of repetitive motion disorders increased from 18% in 1980 to 48% in 1990 with respect to all reported industrial injuries.⁴ The incidence of CTS in computer workers has been reported at 16.7%.⁵ Melhourn⁶ reported in 1998 that cumulative trauma disorders account for 56% of all occupational injuries and that the US government predicted that, by the year 2000, 50% of the American workforce will have occupational injuries annually and 50 cents of every health care dollar would be spent toward repetitive stress injuries.

The natural history of CTS appears to demonstrate progressive functional and anatomical deterioration with continued repetitive motions involving the wrists. Early treatment approaches for CTS include eliminating aggravating activities, rest, anti-inflam-

matory drugs, ice, wrist splints, and stretching. Diuretics, corticosteroid injections, and vitamin B6/pyridoxine supplements have also been used to ameliorate symptoms. A search of PubMed revealed several studies supporting various manual therapies for those with CTS.⁷⁻¹² Often combined with patient self-stretch, these techniques resulted in symptomatic and/or electrodiagnostic improvements. Therapeutic ultrasound¹³ and use of a pneumatic intermittent axial traction device¹⁴ have also been shown to be effective. Bland¹⁵ reports that neutral-angle wrist splinting has a success rate of 37%, whereas steroid injection has an initial response rate of 70%, but with frequent relapses.

Conservative approaches for mild to moderate CTS are recommended before referral for injection or potential surgical decompression¹⁶ because of less risk of complications. Carpal tunnel syndrome, when accompanied by demyelination, but without axonal degeneration, may be treated initially through conservative medical or manual procedures.¹⁷ The effectiveness of conservative measures including steroid injection has been acceptable in short-term, but not in long-term, follow-up.¹⁸ When suspected CTS does not respond to conservative treatment approaches, advanced imaging may be warranted to rule out complicating or confounding findings before referring the CTS patient for surgery.

Surgical approaches have been shown to be effective for the management of CTS; however, they carry risk of significant complications. Surgical intervention may be warranted when the patient reports progressive neurological deficit consisting of anesthesia and loss of muscle strength. For those receiving surgical decompression, Bland¹⁵ found that patients reported excellent results in 75% of cases and 8% of patients reported being worse. The effectiveness of endoscopic and open surgery for CTS was demonstrated in a randomized clinical trial.¹⁹ Another study found that most postsurgical complications may be attributed to technical errors during the initial procedure.²⁰

The presence of CTS with ganglion cysts has been shown to result in deafferentation and motor deficits. Twelve cases of ganglion cysts and CTS were reported, with 8 cases demonstrating abnormal motor conduction or distal sensory latencies.²¹ One half of the cysts were attributed to direct trauma with a common mechanism of hyperextension. The manifestation of median nerve entrapment at the wrist as a direct result of a space-occupying lesion, such as ganglion cysts, has been found to be more prevalent with unilateral CTS.²²

Nakamichi and Tachibana²² found that 35% of individuals with unilateral CTS also had a space-occupying lesion compared with 21% with bilateral CTS. Surgical exploration has also provided evidence that synovial cysts can cause compression of the median nerve.²³ Conservative management of CTS with concomitant ganglion cysts was not found in the literature.

Magnetic resonance imaging (MRI) may be a reliable method of identifying a space-occupying lesion within the wrist. A case report of CTS caused by a ganglion cyst was documented with follow-up study using MRI.²⁴ This study supports the benefit of using MRI to elucidate a diagnosis of CTS while being able to assess the carpal tunnel and associated structures involved in compression neuropathy at the wrist. Electrodiagnostic examination, such as nerve conduction velocity (NCV), is sensitive for diagnosis of peripheral nerve entrapment at the site of the carpal tunnel.²⁵

Correct diagnosis of CTS is critical for effective treatment of the condition. According to Lama,²⁶ a diagnosis of CTS requires 3 major criteria: characteristic pain history, clinical examinations, and neurophysiological studies. Classic signs and symptoms for CTS include numbness and tingling along the ventral hand into digits 1 through 3 and the lateral half of digit 4 and, in more severe cases, grip strength weakness and night pain. Carpal tunnel syndrome is commonly seen with occupations that require repetitive tasks involving the hand and wrist, including mouse use, keyboarding, painting, and jobs with similar duties. Although repetitive stress has been well documented as the mechanism of injury for CTS,^{27,28} other factors may predispose a patient to injury. These factors include a squarer anatomical configuration of the wrist and carpal tunnel,²⁹ and wrist angles maintained at greater than 20° of extension while typing.⁵

Conservative management of NSAP appears similar to that for CTS; however, positive outcomes are not supported by the literature.^{3,30,31} This may partly be due to the lack of certainty regarding the pathophysiology behind the various entities comprising non-specific WRULD.³ Patients with neurapraxia-related NSAP do not respond to steroid injection or wrist splinting.³⁰ Perle et al³¹ report that doctors of chiropractic commonly treat peripheral neuropathies and postulate that they are most likely to achieve results in neuropathy patients with neurapraxia pain. Robb and Sajko³² report on the case of variant radial neuropathy in an elite baseball player who had resolution of neurapraxia symptoms with the application of multi-

modal conservative therapies including the soft-tissue mobilization technique used in this case.

This case report appears to be the first to present conservative chiropractic management of a patient with specific (CTS with associated ganglion cysts) and nonspecific (NSAP) WRULD symptoms.

Clinical features

A 47-year-old female contract administrator presented at a private chiropractic practice with a chief complaint of progressively worsening bilateral wrist pain, weakness, and paresthesias. The symptoms began approximately 2 years prior, and she attributed the onset to performing repetitive duties and extensive computer data entry. She recalled no specific injury to her wrists and continued to work despite her progressively worsening symptoms. She denied injury or similar symptoms in the past.

A review of medical records revealed that the patient was seen by a medical doctor, orthopedic surgeon, 2 physical therapists, and an acupuncturist. She underwent a variety of conservative treatments, including modalities, nonsteroidal anti-inflammatory medication, and splints. Radiographs of the right elbow and bilateral wrists were unremarkable. Her condition failed to improve despite her compliance with all treatment plans. After being laid off and not working for over 2 months, her symptoms still failed to ameliorate. At this juncture, she presented to a chiropractic office for evaluation and management.

Subjective complaints included bilateral wrist pain, weakness, marked loss of wrist range of motion, and paresthesias described as numbness and tingling. Although she is right handed, she did rely heavily on her left hand for activities including grasping, pinching, and stapling. She reported an increase in symptoms with activities such as forceful gripping with repeated stapling, keyboarding for extended periods of time, and brushing her hair and teeth.

A comprehensive final permanent and stationary examination was performed for this work injury. Inspection was unremarkable. Palpation found tenderness along the forearm flexors. Goniometric assessment found the wrist range of motion to be diminished in all planes bilaterally, most notably upon extension and flexion. Phalen, Reverse Phalen, and Tinel tests reproduced paresthesias into the anterior first 3 digits on the left hand, indicating probable median nerve entrapment at the carpal tunnel. Pinch test was a grade 3

on the left, revealing weak flexor pollicis longus and flexor digitorum profundus muscles. Reflexes were bilaterally symmetrical and normal at 2+/4. Myotomal testing graded 3/5 at the bilateral wrist flexors, wrist extensors, and finger flexors. She was unable to perform grip strength of the right dominant hand and the left hand because of severe pain.

The patient was referred for electrodiagnostic studies of the bilateral upper extremities to rule out ablative pathology. Findings were consistent with mild left CTS and bilateral radial compression neuropathy, with the right elbow most affected. Needle electromyography showed mild evidence of irritation in the extensor forearm muscles. Magnetic resonance imaging studies were ordered to elucidate underlying pathology. The left wrist study revealed a ganglion with intraosseous component in the dorsum of the lunate bone and a small triquetrum intraosseous ganglion with cartilage degeneration. The right wrist study revealed distal and proximal triquetrum-pisiform joint recesses distended with fluid and 2 small ganglia in the subcutaneous tissue, as well as an apparent ganglion volar to the radial styloid. Slight bowing of the flexor retinaculum was also observed bilaterally.

The patient was diagnosed with chronic bilateral wrist sprain strain due to prolonged repetitive overuse while working, left-sided CTS, unspecified right wrist neuralgia, and bilateral wrist ganglia cysts.

Intervention and outcomes

A 3-month course of treatment was initiated at a frequency of 3 treatments per week, tapering to 1 treatment per week. Treatment consisted of diversified chiropractic manipulative therapy (CMT) to the lunate, scaphoid, and elbow joint characterized as high-velocity, low-amplitude adjustments.³³ Pulsed ultra-

Table 2 Active ranges of motion of the left wrist as measured through goniometry

Range of motion, wrist	Initial (°) left	Percentage (Pre %)	Final (°) left	Percentage (Post %)
Flexion	37/60	62%	40/60	67%
Extension	33/60	54%	51/60	85%
Ulnar deviation	19/30	63%	20/30	67%
Radial deviation	15/20	75%	18/20	90%

sound (50%, 3 MHz, 5 minutes) and electrical muscle stimulation (1-150 Hz for 15 minutes) were applied over the forearm flexors, extensors, and carpal tunnel to facilitate healing and was combined with ice or heat dependent upon the presence of inflammation. Myofascial release was applied via digital pressure in an orientation parallel to the affected muscle fibers at the forearm flexors and extensors to help restore range of motion by stripping the muscles of adhesions and scar tissue.³⁴ Proprioceptive neuromuscular facilitation techniques were used with the forearm flexors and extensors to help lengthen and stretch taut muscles, thereby indirectly alleviating some of the pressure at the wrist. Home stretching and strengthening exercises for the forearms were given, as well as a handheld gyroscopic device.

At the conclusion of care, the initial verbal reporting scale pain rating of 6-7/10 reduced to 1-2/10 at rest and at times increased to 3-4/10 with provocative activities. Subjective complaints of hand paresthesias and muscle weakness also improved with respect to intensity and frequency. Goniometric measurement of wrist active range of motion showed improvement of the right (Table 1) and left wrist (Table 2).

Phalen and Tinel testing no longer produced paresthesias. Wrist extensor, wrist flexor, and finger flexor strength improved from 3/5 to +4/5 bilaterally. Grip strength testing, using a Jamar dynamometer, averaged 22 lb on her dominant right hand and 18 lb on the left. Grip strength remained weak when compared with normative values. The patient suffered permanent disability and impairment that resulted in a work preclusion of no repetitive and forceful gripping, no repetitive wrist motions, and no fine manipulation and grasping maneuvers of the right and left wrists. She declined a future medical award and was only seen in follow-up for a year after closing her case. Post MRI and electrodiagnostic

Table 1 Active ranges of motion of the right wrist as measured through goniometry

Range of motion, wrist	Initial (°) right	Percentage (Pre %)	Final (°) right	Percentage (Post %)
Flexion	33/60	54%	40/60	67%
Extension	23/60	38%	46/60	77%
Ulnar deviation	19/30	63%	25/30	83%
Radial deviation	10/20	50%	18/20	90%

studies were not performed because these tests were not clinically indicated.

Discussion

The patient presentation in this case was classic for CTS; and history, examination, and electrodiagnostic studies supported this diagnosis on the left. The right-sided symptoms were historically and largely clinically consistent with CTS²⁶ yet lacked the positive orthopedic test results and electrodiagnostic findings typically required for a CTS diagnosis. The patient had been previously diagnosed by multiple providers with CTS yet was unresponsive to several prior courses of conservative and pharmaceutical management.

Objective findings, especially positive Phalen and Tinel test results, and the electrodiagnostic finding of conduction deficits of the median nerve validated the diagnosis of left-sided CTS. The Phalen test was found to have greater sensitivity and specificity than the Tinel sign for CTS in a comparative study.³⁵ The value of the Tinel sign is questionable in identification of nerve compression syndromes, with one study finding it possibly pathognomic for CTS,²¹ whereas another found it of little value.³⁵

The patient's past failure to respond to multiple courses of conservative care provided indication for additional studies of NCV and MRI. Neurologic conduction velocity found mild CTS on the left, but not on the right. The MRI was very helpful in revealing an underlying anatomical factor, ganglion cysts, perhaps explaining, at least in part, the patient's ongoing symptoms and failure to fully respond.

In retrospect, a diagnosis of bilateral WRULD, with a specific WRULD (CTS) on the left and nonspecific WRULD (nonspecific arm pain) on the right, may have been more fitting for this patient than the diagnosis provided. The left-sided findings fit the criteria for diagnosis of CTS, but the right-sided findings were inconclusive for a specific origin. The NCV study found radial nerve entrapment at both elbows, yet the clinical manifestation of this finding is questionable. Signs and symptoms of radial nerve compression primarily involve motor findings and sometimes results in dull aching pain over the lateral forearm.³⁶ Neither of these were predominant complaints for this patient. In addition, results of peripheral nerve entrapment tests on physical examination at the elbow, such as Tinel, were unremarkable for reproduction of patient's symptoms.

Despite the lack of electrodiagnostic confirmation of CTS on the right, it remains possible that a diagnosis of CTS was clinically appropriate. Lama²⁶ notes that many authors consider a CTS diagnosis to be primarily based on clinical findings and question the usefulness of neurophysiological studies. He points out that between 16% and 34% of patients exhibiting classic symptoms of CTS have negative neurophysiological findings. If not CTS, then the patient's right-sided arm symptoms may better fit the diagnosis of NSAP.³⁰ Greening et al³⁰ demonstrated that patients diagnosed with NSAP showed a clear pattern of loss of function affecting all nerve fiber classes. Moloney et al³⁷ demonstrated that NSAP appears to have many features of neuropathic pain. The patient's neuralgia findings, as evidenced on nerve conduction velocity studies, may represent a more severe manifestation of NSAP. Greening et al also found evidence of minor entrapment in the carpal tunnel in NSAP patients with no NCV findings, demonstrating a link between the 2 conditions.

The application of multiple therapeutic approaches makes it impossible to know which intervention, if any, was most responsible for the patient's improvement. It is also difficult to know whether the CTS, NSAP, or aspects of both were impacted by the treatment. The underlying goal of treatment was to reduce median nerve compression by improving motion of the carpal bones, reducing adhesions, and improving soft-tissue pliability. Although many approaches were incorporated to achieve this goal and cumulatively may have contributed to the healing process, it is arguable that the inclusion of CMT played an important role given the patient's failure to respond to multiple previous courses of the same or similar conservative approaches exclusive of CMT.

The presence of ganglion cysts likely resulted in increased signs and symptoms and poorer prognosis due to the reduction in anatomical space potentially creating a compression neuropathy. The anatomy of the hand, wrist, and carpal tunnel has been shown to predispose a patient toward CTS.²⁹ Structural components involving the wrist, such as the depth and width of the carpal tunnel, can be considered to effectively assess potential complications that may arise when the median nerve is entrapped and, simultaneously, ganglion cysts are present.²⁹ The anatomical configuration of the injured worker in this case was not assessed, so it is impossible to know if it played a role in her case.

Chiropractic treatment may ameliorate or alleviate CTS symptoms.³⁸ In one case study, CMT was found to be effective in the treatment of suspected ulnar tunnel syndrome.³⁹ Hypothetically, manipulation may result

in correction of small osseous misalignments and/or improvement of carpal bone glide, resulting in increased functional space within the carpal tunnel and wrist structures, thereby decreasing compression on the median nerve or other affected structures. Supporting this hypothesis is an osteopathic study that used pre- and postmanipulation MRI to demonstrate a significant increase with the anteroposterior and transverse dimensions of the carpal canal.⁸ Manipulative maneuvers may release or stretch the transverse carpal ligament, resulting in a larger carpal canal.⁸ It appears that the carpal canal is a distensible structure that may respond favorably to manipulation, myofascial release techniques, and other conservative interventions. By the same mechanism, it may also serve as an effective conservative treatment of CTS with the presence of ganglion cysts.

Although the patient did suffer permanent disability from residual symptoms, the treatment was deemed successful by the fact that this injured worker demonstrated positive outcomes consisting of improved range of motion, decreased intensity and frequency of pain, and improved physical examination findings. Grip strength testing at the conclusion of the case revealed continued significant weakness and contributed to the permanent impairment rating. There was no baseline comparison from the initial examination because the patient was unable to perform grip strength testing due to pain. Swanson et al⁴⁰ found the normative grip strengths for women between the ages of 40 and 47 years for the major and minor hand as 51.6 and 47.4 lb, respectively. Grip strength improvements were limited by the lack of baseline measurements that would have been helpful in assessing objective improvement. Although a post MRI and follow-up electrodiagnostic studies would have been helpful in the confirmation of clinical improvement, they were not performed because of patient improvement.

Limitations

Limitations of this study are significant because it consists of only one case and thus cannot be applied to the general public. Multiple therapeutic interventions were applied, leaving to question the benefit of any one alone. Follow-up MRI and post electrodiagnostic studies were not performed, leaving some question as to the resolution of the nerve entrapment and possible persistence of the ganglion cysts. Additional research is recommended to determine the efficacy of conservative chiropractic management of WRULD.

Conclusion

The case of a 47-year-old woman with bilateral WRULD complicated by bilateral ganglion cysts is presented. The patient experienced subjective and objective improvement after undergoing conservative treatment approaches including CMT but remained permanently impaired. Ganglion cysts are not uncommon in the wrist and may negatively impact patient response and prognosis. Clinicians should be aware of the prevalence and impact of ganglion cysts on CTS patients and understand the usefulness of MRI in diagnosing them in nonresponsive CTS patients. Further studies of broader scope may be warranted to determine the efficacy of chiropractic management for those individuals with WRULD with concomitant ganglion cysts.

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