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The Editor's Desk

Shawn M. Neff, DC, MAS, FACO
Editor-in-Chief

I want to thank all of you for your patience as we transitioned from the Journal of the Academy of Chiropractic Orthopedists to the Journal of the International Academy of Neuromusculoskeletal Medicine (JIANM). As we move together with this new name you will find the same dedication to bringing you the finest science from researchers and thought leaders in the specialty.

As the world makes its way through the COVID-19 pandemic, we at the journal wish you and those you care about health safety and prosperity.

I hope you all enjoy this issue.

Sincerely,

-Shawn

The Academy of Chiropractic Orthopedists (ACO) is now the International Academy of Neuromusculoskeletal Medicine (IANM)!!

Why the name change?

One of the common problems faced by a Doctor of Chiropractic with a Diplomate in chiropractic orthopedics is being asked by other professional colleagues, health care administrators, businesses, and patients where the chiropractic orthopedist residency took place, surgical specialty and could they prescribe medication. Of course, the profession understood what this meant, but was confusing to the stakeholders and other interested parties.

Additionally, the term chiropractic orthopedist is not understood or recognized internationally. To solve this problem, the Academy felt the time was right for a name change that reflects more of what we do as neuromusculoskeletal specialists treating conditions of the neurological, muscular, and skeletal systems. The decision for change did not come on a whim, and it has been carefully considered by the Academy for nearly 2 years. The Academy contacted and synthesized comments from Diplomate Academy of Chiropractic Orthopedists (DACO) and Diplomate American Board of Chiropractic Orthopedists (DABCO) clinicians, about the name. All were upbeat and pleased with the new more specifically descriptive name. The doctors felt it was a better representation of our specialty. We provide specialized diagnostic and therapeutic acumen that includes the application of the chiropractic adjustment to our patient's frame and supporting structures along with many other approaches. The Academy has chosen the following name:

International Academy of Neuromusculoskeletal Medicine (IANM)

Over the last few years, many chiropractic institutions have focused on providing online education that provides the opportunity for doctors to learn at their own pace as well as significantly reducing the cost of travel, lodging, food, and time

away from the family and office. The Academy, noting this trend looked into the possibility of providing online testing in a secure, psychometrically approved venue. The 300 - hour training includes 50 hours of live classroom study and 250 hours of online learning. The expansion of testing opportunity has been accomplished with both Part I, multiple-choice, and problem-solving questions. In 2018 the board successfully provided its Part II examination online. In addition to the expense issues noted above, this allowed the Academy to provide testing worldwide. Overall costs were reduced significantly in time and money for the doctor.

General Information:

The Academy of Chiropractic Orthopedists (ACO), the Diplomate Examination Board and Forensic Sciences continue as a part of the IANM. The IANM Board has sub-specialties. Currently, this includes Chiropractic Orthopedists and Forensic Science. This change is immediate, and it is our goal to have all of our website material and correspondence reflect this by January 01, 2020.

Diplomates of the IANM can use the following: DIANM. The acronyms, DABCO and DACO are not going away. For existing DACO's or DABCO's, your curriculum vitae may reflect whether you are a DACO or DABCO. Current Fellows will have the FACO replaced by Fellow International Academy of Neuromusculoskeletal Medicine (FIANM). After the DIANM or FIANM, the country identifier is used. For example, the United States (us), Canada (can), Brazil (br), Australia (aus), United Arab Emirates (uae) and so forth.

However, there is a period of grandfathering where you may wish to change DABCO or DACO certificates to DIANM. Current certificants will be able to request a new certificate stating Diplomate International Academy of Neuromusculoskeletal Medicine. You cannot use any of these two groups of letters together. The announcement will be forthcoming when this option is available. With each certificate, it must be identified by global location. For the United States after DIANM (us), Canada (can), Brazil (br), Australia (au), United

Arab Emirates (uae) and New Zealand (nz) to reflect the international identification.

All state and national chiropractic organizations have been notified of this change including NCMIC and other chiropractic businesses.

Website changes will be reflected to include a new address (ianmmedicine.org)

Classes are ongoing in the Pacific basin, and contacts are in discussions in South America and Canada. It is the goal to continue to expand the footprint of the chiropractic neuromusculoskeletal manual clinician treating acute and chronic pain throughout the world. Classes are increasing in the United States. This included Alaska for the first time! The specialty is on an upward path. Arrangements are being made to repeat classes in prior venues due to demands. The residency program at the University of Bridgeport has been growing. These doctors are being placed in health care facilities upon completing the neuromusculoskeletal course work and successfully passing the credentialing examination hosted by the IANM. The areas and facilities of placement continue to grow.

Conclusion:

It is the Academy's opinion that generic use of neuromusculoskeletal medicine complements our chiropractic orthopedist principles and desired treatment protocols. Other professions are using chiropractic manipulation; it is our opinion that the use of neuromusculoskeletal medicine is appropriate for our specialists. The term "Neuromusculoskeletal" encompasses all that the chiropractic orthopedist has been and will be into the future, only now it will become more understandable what we do as specialists in chiropractic health care. The name change is more descriptive of we do and is easier for everyone to understand.

Original Article

Chronic Low Back Pain with Lower Extremity Weakness: A Case for Conversion Disorder

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Abstract

Introduction
The purpose of presenting this case is to describe the management of an adult male patient with chronic low back pain and right lower extremity weakness with differential diagnosis including lumbar radiculopathy vs conversion disorder. The authors will describe the patient's presentation as well as their treatment approach, review possible etiologies, and propose mechanisms to explain treatment response. They will also describe the research, however limited, regarding manual therapies for management of conversion disorder.

Case Presentation
A 46-year-old male Army veteran presented with low back pain and right lower extremity weakness of approximately 15 years' duration. The patient's primary care physician had made a diagnosis of chronic low back pain, lumbar radiculopathy and right foot drop. He had a limited response to conservative care. Advanced testing included lumbar MRI and EMG, neither of which supported a diagnosis of lumbar radiculopathy.

Management and Outcome
Treatment included manual spinal manipulative therapy, manual flexion/distraction, and home care recommendations of lumbar stretches and cutaneous stimulation. Outcome measures included the PROMIS Pain Interference Short Form 6b and VAS. Repeat examination at the 6th

follow-up appointment revealed improved right lower extremity strength and increased sensation to pinprick. Functional improvement included patient-reported improved ease of ambulation.

Conclusions
A male patient with chronic low back pain and right lower extremity weakness responded favorably to conservative treatment of lumbar flexion/distraction technique, spinal manipulation, and home recommendations of lumbar stretches and cutaneous stimulation. Given the chronicity of the complaint and the failure of advanced imaging and electrodiagnostic studies to produce correlative findings, it is unclear whether recovery was the result of lumbar radiculopathy responding to manual therapy or a functional neurologic disorder responding to non-specific therapeutic effects.

Indexing terms
chronic low back pain, chiropractic, flexion-distraction, spinal manipulation, lumbar radiculopathy, foot drop, conversion disorder, functional neurologic symptoms disorder

Background

Proximal neuropathies with clinical presentation of foot drop can include a lesion of the L5 nerve root, lumbar plexus, or the sciatic nerve. Foot drop is a term used to describe weakness of the dorsiflexor muscles of the foot, especially tibialis anterior. The innervation of the tibialis anterior begins in the anterior horn cells of the lower spinal cord. Axons travel in the L4 and L5 spinal roots, join to form the sciatic nerve, and travel within the common peroneal nerve before terminating as the deep peroneal nerve which supplies the tibialis anterior, extensors of the toes, and fibularis tertius for foot eversion. The deep peroneal nerve also supplies sensation to the skin over the anterolateral aspect of the lower leg to the dorsum of the toes. The medial terminal branch of the deep peroneal nerve provides cutaneous innervation to the web space between the first two toes. Foot drop is commonly associated with peripheral nerve entrapment at the neck of the fibula, however it can also be a result of anterior horn cell disease, L5 radiculopathy, and sciatic nerve disorders. Distal vs proximal nerve involvement is distinguished by testing of the flexors of the hip, knee, and plantar flexion, as foot drop will likely only affect foot eversion and dorsiflexion. Impingement of the common peroneal nerve may cause variable presentations in sensory or muscle activation of the distal leg. [1, 2]

Lumbar radiculopathy is often caused by protrusion of the disc material into the neuroforamen leading to nerve root irritation and impingement. [3] Lumbar radiculopathy may or may not present with symptoms of low back pain radiating into the lower extremity. The affected nerve root can cause pain, weakness, or loss of sensation in a myotomal or dermatomal pattern in the lower extremity. Any lesion to the lumbar roots or plexus may also present as weakness in the lower extremity with weakness in dorsiflexion typically being the most apparent associated weakness. A thorough clinical history is needed when generating a differential diagnosis and identifying potential confounders. [2, 3]

According to the North American Spine Society (NASS) the diagnosis of lumbar radiculopathy caused by disc herniation is most supported by positive findings from manual muscle testing, sensory testing, supine straight leg raise, Lasegue sign, and crossed Lasegue sign.[4] Other research found dermatomal radiation, positive Valsalva's maneuver, and positive straight leg raising to be predictors for signs of lumbar radiculopathy (not specific to disc herniation) on needle electromyographic testing (EMG). [5] Specific spinal level of involvement is difficult to determine from clinical presentation as research has demonstrated variability of dermatomal distributions and radicular patterns.[3,6]

Additional evaluation or testing is indicated when the etiology of muscle weakness and loss of sensation is unclear. The most recent NASS guidelines on advanced studies for suspected lumbar radiculopathy recommend magnetic resonance imaging (MRI) and computed tomography (CT) of lumbar spine first. Further imaging may include lumbar radiographs or extremity CT or MRI to rule out insidious pathology such as soft tissue masses and bone lesions. Electrodiagnostic testing may be appropriate if there is suspicion of nerve root compression.[4] Nerve conduction and EMG studies are useful in determining nerve level of involvement and degree of axonal atrophy if present. In differential diagnosis of foot drop, a pathology of the common fibular nerve will show conduction and EMG abnormalities specific to that nerve. Any involvement of the biceps femoris or tibialis posterior indicates more proximal lesions. This type of testing can also help predict recovery, as those who show little axonal damage typically recover within weeks, where those with demyelinating damage may take months to years to recover. [2]

When advanced imaging and testing does not correlate well with symptomatology, conversion disorder (CD), also known as functional neurologic symptoms disorder (FND), may warrant consideration. Conversion disorder is a psychiatric disorder in which symptoms and signs affecting voluntary motor or sensory function cannot be explained by pathoanatomical conditions. Conversion disorder symptoms include blindness, paralysis, dystonia, seizures, anesthesia, difficulty walking, hallucinations, dementia, swallowing deficits, motor tics, among other neurologic symptoms. The term conversion disorder was coined by Sigmund Freud, who hypothesized that the symptoms not well explained by medical etiology were due to somatic manifestation of unconscious or repressed psychologic conflict.[7] Guidelines for diagnosis listed in DSM 5 include "(1) one or more symptoms of altered voluntary motor or sensory function; (2) clinical findings showing incompatibility between the symptom/s and recognized neurological or medical conditions; (3) these symptoms or deficits are not better explained by another medical or mental health disorder; and (4) the symptom/s cause clinically significant distress or impairment in social, occupational, or other important areas of functioning that warrants medical attention." [8] Due to the rarity and variability in presentation of CD, an estimated 2 to 22/100,000 cases per year, evidence based guidelines on diagnosis and treatment are limited.

The onset of symptoms related to CD typically correlate with a certain stressor or trauma. The physical presentation will have no underlying pathoanatomical cause and the affected individual cannot control the symptoms. The patient may exhibit a general lack of concern over the physical symptoms. Differential diagnosis for CD includes myasthenia gravis, multiple sclerosis, polymyositis, stroke, lupus, and spinal cord injury. Anesthesia associated with CD typically occurs in the extremities and will have very precise and sharp boundaries. In cases of weakness,

paralysis, or paraplegia, deep tendon reflexes are normal, rather than decreased, and Babinski sign is absent. The symptoms may correlate with half of the body or a single limb and does not follow anatomical patterns. Dystonia presents as an inverted foot or clenched fist of adult onset with a fixed posture .[7]

Treatment for CD is individualized to symptoms, targeting both psychosocial and physical symptoms. Confronting patients about the psychological nature of their condition is a delicate process and trying to explain the etiology to the patient without first developing strong patient rapport may only exacerbate symptoms. It is advised against giving the diagnosis at initial encounter.[7] Laying the groundwork for discussion of psychosocial factors involves providing examples of stress-related physical symptoms such as high blood pressure in times of stress or tachycardia when nervous. Evidence for treatment strongly supports cognitive behavioral therapy (CBT). Other psychotherapies, physical therapy, occupational therapy, and speech therapies are utilized to address return to function and quality of life.[9, 10]

Case presentation

Patient History

A 46 year old veteran was referred to the chiropractic clinic with primary complaints of chronic low back pain with a long history of weakness in the right leg. The patient was a part time student during active treatment. Comorbidities included gastroesophageal reflux disease, chronic obstructive lung disease, depression, and tobacco use.

Complicating factors included bilateral knee pain related to history of parachuting while in the Army Airborne unit approximately 30 years ago. The veteran's career in the service ended when his primary parachute failed to open, and his spare parachute opened late. He recalls a hard landing on his feet and then losing consciousness from the fall. He reports no lingering injuries related to this incident, aside from knee pain.

The patient related his onset of low back pain to a fall over 20 years ago. Mechanism of injury was a slip and fall on wet bathroom tiles, where he landed with his low back contacting the edge of the bathtub. The onset of pain was sudden and severe. He could not ambulate due to pain at the time of injury and was transported by friends to emergent care. After serious pathology was ruled out the patient was treated with narcotic pain medication, which he continued for about 15 years. He described being on long term opioids for chronic pain as a "blurry time" and seemed to lose perception of time and memory eluding to struggles with opioid addiction. He expressed difficulty with his ability to recall specific details of the history of symptoms. The following history is the best representation gathered from subjective history and extensive chart review through VA and DoD databases. He denied referral of pain from the low back to the lower extremities during or shortly following initial injury.

The symptoms of weakness and numbness in the right lower extremity came on gradually, over 10 years ago, without inciting event or injury. He recalls the symptoms occurring periodically at

first, presenting as gradual right foot drop, then overall right lower extremity weakness. The symptoms of leg weakness had been present and constant for at least 5 years. At initial evaluation with this author the patient described weakness – especially with ankle, knee, and hip motion – as well as numbness over the entire right lateral thigh, leg, and dorsum and lateral aspect of the foot. The patient was unable to recall any specific positional changes, activity, or medications which improved or exacerbated right lower extremity numbness and weakness. He denied any painful referral into the right lower extremity. Low back symptoms were primarily located in a band-like distribution across the lumbosacral and sacroiliac region extending to the lateral iliac crests. Low back pain presented as constant pain of mild-moderate intensity, with periods of exacerbations. Quality of low back pain was dull, achy, and stiff. Symptoms were more pronounced in the morning and improved with light activity. Pain did not limit any activity. During severe episodes of pain patient experienced a burning sensation in the gluteal musculature and proximal posterior thighs bilaterally. Pain medications included Ibuprofen (3x800mg), Tramadol (2x50mg), and Cyclobenzaprine (2x5mg) daily as needed for pain management. Patient denied any symptoms of urinary incontinence or retention, constipation, bowel incontinence, or saddle anesthesia. Patient denied any history of cancer, unexpected weight loss, stroke, or progressive headaches. No personal history or family history of inflammatory arthropathies.

Previous treatments had included chiropractic care for a 6-month period with biweekly treatments as supportive care consisting of spinal manipulation; his last treatment was approximately one month before his consultation to the VA chiropractic clinic. Previous manual spinal manipulation had resulted in 2-3 week patient-reported improved symptoms. Occasionally following chiropractic treatments the patient had experienced short term (<1 day) painless paresthesia described as “static” affecting the lateral right thigh and leg. He had seen numerous providers over the years for progression of low back and right leg complaint and expressed difficulty recalling what specialties he had consulted. He did not recall any past treatments improving leg sensation or strength. He did not recall a surgical consultation, but eludes to completing a nerve conduction test, the results of which are noted within the chart review section.

Chart Review

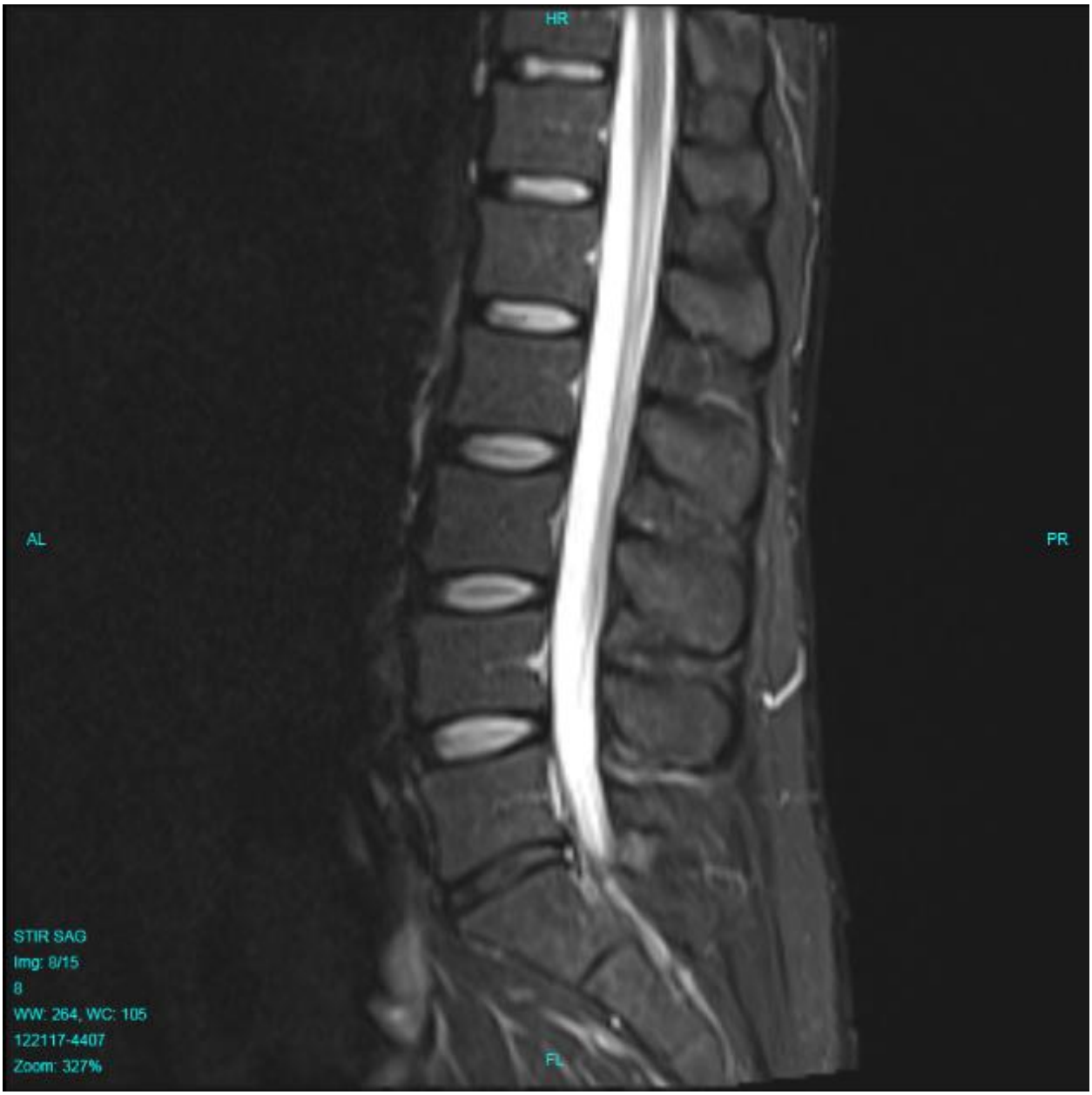
A neurology consultation from approximately 8 years ago indicated the patient presented with right knee pain and leg numbness which did not fit a neuroanatomical distribution. Reflexes were normal and symmetric at that time. A repeat nerve conduction study (NCS) and EMG also completed at that time indicated improvement of testing from a year earlier and was, in fact, completely normal despite patient presentation. No further workup was done at that time. There was no treatment or change in symptoms following that consultation.

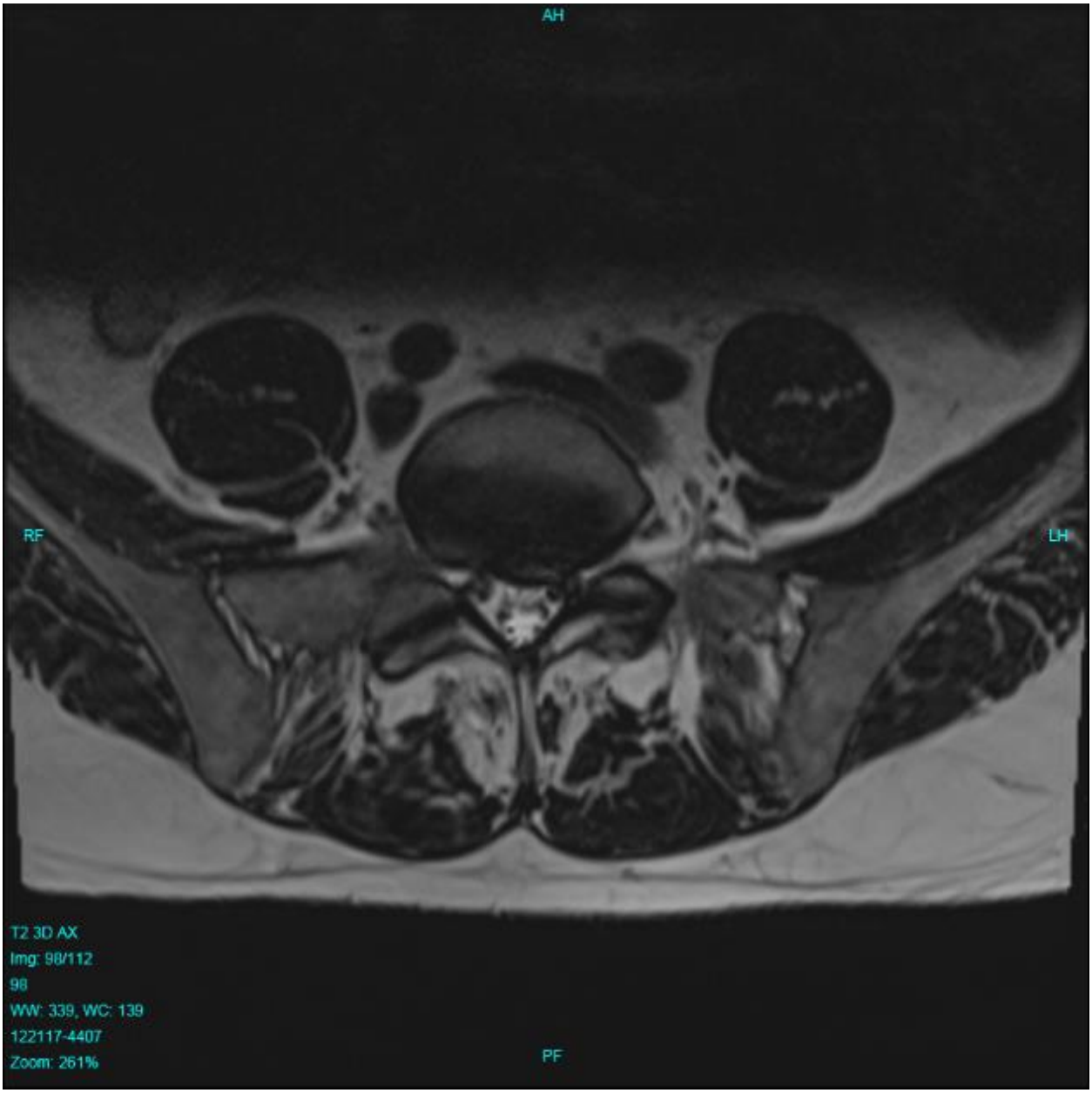
Based on chart review it had been at least 10 years since patient had met with a mental health provider regarding depression. It is unclear what type of psychotherapy patient had participated in.

Review of Testing

Lumbar and thoracic MRIs from one year prior to chiropractic consultation revealed mild degenerative disc changes, worst at L5-S1, with mild foraminal lumbar stenosis. Findings

included a small disc protrusion and annular fissure at L5-S1, where the disc margin abuts the descending S1 roots, left greater than right. There was no evidence of significant thoracic spine degenerative disc changes or stenosis. No modic changes seen. No significant facet arthropathy or stenosis.





A Cervical MRI from approximately 8 years ago was essentially normal.

Per neurology consultation chart review, NCS and EMG from 8 years prior did not demonstrate electrophysiologic evidence of a right lumbar radiculopathy. These findings were improved when compared to NCS 1 year prior which had indicated asymmetry between the left and right peroneal motor F-wave responses, though still within normal limits. The interpreting clinician noted that the results of the prior test may have been a result of incomplete effort, as opposed to neuroanatomical pathology.

Examination

Physical examination showed a well-nourished 68.5in, 169.5lb male. Gait was steady with the

use of cane, right rigid knee brace, and right AFO brace. Sagittal and coronal spinal curves were essentially normal. The patient transitioned with some difficulty due to right leg weakness, but no signs of apparent discomfort. The writer questioned that there may have been very subtle flexion/decorticate posturing of the extremities. Soft tissue palpation revealed flaccidity of the right hamstrings, right tensor fascia lata, right gluteal, right calf, and right quadriceps. Muscular hypertonicity was noted in the lumbar paraspinals bilaterally.

Orthopedic Testing

Lumbar range of motion was mildly-moderately limited in extension and mildly limited in right rotation with mild increase in focal low back pain. No change in leg sensation with lumbar range of motion. Seated and supine straight leg raise was negative for lower extremity symptoms at 80 degrees. Supine knee to chest, posterior shear, and FABER was essentially negative for change in lumbar or extremity symptoms. Sacral thrust and Yeoman's provoked local low back pain. No orthopedic testing produced any changes to right leg symptoms.

Neurological Testing

Motor strength of myotomes of the left lower extremity (L1-S1) was graded 5/5. Right hip flexion was graded 4/5, right hip adduction 4+/5, right hip abduction 3/5, right knee flexion 3/5, right knee extension 4/5, right ankle dorsiflexion 0/5, right ankle plantar flexion 4/5, and right great toe extension 4/5.

Reflexes at Patellar and Achilles tendons graded 2+ bilaterally. Sensation on the left lower extremity was intact to pinprick. Sensory testing of the right lower extremity revealed complete lack of sensation to pinprick over the lateral half of LE and dorsum of the foot, exam tested from the proximal-thigh extending distally. During palpation over clothing at the proximal thigh, patient reported decreased sensation to light touch over the right trochanter and lateral gluteal region when compared to the left. Babinski reflex was absent bilaterally. Rapid ankle dorsiflexion revealed one beat clonus on the right, no clonus on the left. Vibration sensation was intact bilaterally at the distal phalanx of the great toe. Upper extremity neurological evaluation revealed motor strength graded 5/5 C5-T1 bilaterally. Hoffman's sign absent bilaterally.

Case Management

The patient presentation lead to differential diagnosis of chronic mechanical low back pain, lumbar radiculopathy, right foot drop, and conversion disorder. The lack of clinical correlation between MRI, electrodiagnostic testing, and presentation was confounding. There seemed to be no clear anatomical explanation for anesthesia or weakness or the right lower extremity. The patient relocated multiple times over the past several years and indicated poor compliance with respect to attendance of medical appointments. This, in addition to a history of opioid abuse, complicated his history and the progression of his medical condition. From the patient history it appeared that initial diagnosis was right foot drop, which over a period of years evolved into lumbar radiculopathy. The patient was seeking treatment of low back pain only during this

consultation with no expectation that treatment would change chronic lower extremity symptoms, which was also discussed in the report of findings and consent.

According to NASS guidelines for the conservative treatment of low back pain and/or lumbar radiculopathy, spinal manipulation is an option for symptomatic relief, however there is insufficient evidence regarding treatment effect of spinal manipulation and traction/distraction. [4] Research is favorable for spinal manipulation on improving acute radicular symptoms, however there is very limited evidence on the effect of spinal manipulation for chronic radicular symptoms. [11] The patient had responded favorably to spinal manipulation in the past for low back symptoms and was seeking to continue this treatment modality. Chiropractic treatment in our clinic consisted of spinal manipulation, flexion/distraction therapy to the lumbar spine, and therapeutic exercises for stretching the lumbar musculature. Patient education included discussion of hurt vs harm, mind-body relaxation, and overall wellness at multiple appointments. Initial treatment frequency was weekly for 4 weeks, then every 2-3 weeks for supportive care. The patient was also given the option for physical therapy referral, which he declined.

The veteran had been treated a total of 14 times over a time period of 6 months. The patient responded favorably to care, with unexpected changes in lower extremity symptoms. Within 4 visits the patient noticed "pins and needles" intermittently following treatment in the area of the right lower extremity which was previously described as "numb" to all light touch. At the 6th treatment the patient explained that anytime the skin in this region was contacted he would feel a combination of tingling and burning in the area which he described as hypersensitive to touch. A re-examination was completed at the 6th appointment. At the re-examination motor strength of right ankle dorsiflexion improved to 2+/5, and right great toe extension improved to 4+/5. All other myotomes tested essentially the same. Deep tendon reflexes were still essentially normal. No clonus noted on rapid ankle dorsiflexion, as noted at initial exam. The patient was instructed to stimulate the hypersensitive area by massaging it with a hairbrush several times daily. At eight treatments the burning sensation had resolved, and while the entire right extremity was reported to feel less sensitive than the right, it was no longer completely "numb" to light stimulation as at consultation. Over this progression of treatments, the patient also began to report that he could initiate some dorsiflexion of the right foot, but foot would become "stuck" in that position. The patient was referred to physical therapy to attempt to capitalize on current progress. Following 14 visits it was also noted that the patient did not feel the need to refill his cyclobenzaprine or tramadol prescriptions.

Outcomes Measures of Visual Analog Scale and Patient Reported Outcomes Measurement Information System (PROMIS®) Pain Interference Score were recorded at consultation and at the 6th and 12th follow up appointments.[12] Results are recorded in Table 1.

Outcome Measures			
	Initial	6th	12th
VAS	50	41	34
PROMIS PI	63.6	62.7	61.8

Discussion

The initial diagnosis and presentation several years ago was right foot drop. The patient presentation with symptoms of lack of sensation and weakness in areas outside of the deep peroneal nerve supply indicate foot drop is not a complete diagnosis in this case. The chart review and previous advanced testing did not correlate well with patient presentation. Confounding factors that did not support a typical lumbar radiculopathy included the distal to proximal progression of symptoms, no history of pain in the affected extremity, and normal deep tendon reflexes. It should be reiterated that both previous EMG and NCV studies were essentially normal. [5] In the history and examination, there were no signs suggesting of a demyelinating disorder such as multiple sclerosis, Parkinson disease, stroke, Gullian-Barre, etc. There were no other abnormalities in the review of systems, no suspicion of autoimmune diseases, and the patient did not present with weakness or numbness in any other extremity. The distribution of anesthesia was also confounding as it seemed to include several dermatomes with a very clear border of symptoms. Though evidence has shown that radicular symptoms do not commonly follow a dermatomal pattern related to level of nerve root involvement, this can also describe findings of CD. [6]

Due to the chronicity of right lower extremity weakness and anesthesia, the improvement over the course of manual therapy alone was somewhat unexpected. The reported anesthesia had been present and constant for at least 5 years, and questionably episodic for about 10 years prior to that. The pathoanatomical theory for decrease in sensation and muscle strength is mechanical compression and associated chemical and inflammatory response. Nerve fiber deformation and demyelination can lead to numbness and paresthesia. There is limited research on axonal regeneration, but one retrospective study indicated patients continued to experience improving symptoms even at 1 year following decompression surgery. [13] The theoretical mechanism of action of lumbar flexion/distraction in combination with spinal manipulation may explain improvement of radicular type symptoms, if this were a case of radiculopathy. Previous studies have supported that distraction of the lumbar spine can temporarily decompress lower lumbar disk spaces and facet joints and theoretically reduce disc protrusion. [14]

Based on the presentation of this case, conversion disorder does warrant consideration. Some authors have suggested a correlation between chronic pain, PTSD, anxiety, and depression with CD. [9,7] There is also question of a higher incidence of CD in veterans, however research in this area is very limited. [10] The writer questions association between opioid use and the presentation of this veteran's complaints, however no related literature was found concerning incidence of CD and opioid use at the time of this report. During the course of care the veteran's primary care team was considering referral to spine surgery. Given the presence of medically unexplained symptoms an early diagnosis of conversion disorder may help to avoid unnecessary medical interventions. Treatment for conversion disorder typically involves complementary and alternative medicine and an integrative approach to treatment. [10] Based on this patient's presentation a psychology referral may have been a more appropriate option than surgical consultation. The treating provider was unfamiliar with conversion disorder at the start of this veteran's treatment plan, which delayed co-management with mental health providers.

There is very limited research on chiropractic treatment and conversion disorder; only one article mentioning both chiropractic and conversion disorder was found through a PubMed search at the time of this case study's submission. The case report reviewed chiropractic treatment of an 11-year-old girl referred by her psychologist for the treatment of extremity tremors attributed to conversion disorder. She experienced complete resolution of symptoms after 12 treatments of spinal manipulation over the course of 5 weeks. [15] While this study does not correlate well with our patient presentation, it is another example of conversion disorder managed with chiropractic treatment. One possible explanation may be the role of context and non-specific therapeutic effects of the chiropractic encounter which may include provider relationship, treatment features (including therapeutic touch) and environment.[16] A PubMed search for conversion disorder and/or radiculopathy/foot drop found one article presenting a case of a 24 year old male with sudden insidious unilateral foot drop and ascending numbness in the left leg not well explained by examination or history. Symptoms had been present for 3 weeks at the time of advanced testing including NCV, EMG, and brain CT. Curiously the patient had experienced a recent increase in stress not long before onset of symptoms due to the death of his brother from a motor accident in which his brother's limbs were severed. Presentation of symptoms prompted multidisciplinary treatment with a psychiatrist, physiatrist, and physiotherapist which included gait training, CBT, and venlafaxine (serotonin norepinephrine reuptake inhibitor). The patient experienced complete resolution of symptoms after 6 days of intensive therapy. [17] This case is rather thought-provoking as the presentation is very similar, including the reported distal to proximal onset of symptoms. An inventory of psychosocial stressors at the time of the veteran's onset of symptoms in this case study would have been interesting for comparison.

Limitations

This report is meant to raise awareness of a rare condition that may present with musculoskeletal complaints and mimic other common conditions. The authors do not claim to definitively diagnosis or treat conversion disorder.

Conclusions

It is still unknown as to whether it was the manual/mechanical approach to treatment or the non-specific therapeutic effects of treatment including informal patient education which resulted in changes in lower extremity symptoms. Since symptoms have been present for so long, it is difficult to determine how much effect of the current lower extremity weakness has been due to the reliance of AFO and lack of muscle activation. In the absence of clear pathoanatomic etiology of unilateral lower extremity weakness, conversion disorder may be an appropriate diagnosis. Early diagnosis and treatment may save the patient unnecessary testing and interventions.

Consent

Written informed consent was obtained from the patient for publication of this report. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions
JZ organized the information and drafted the bulk of the manuscript. LR contributed to manuscript preparation.

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References

1. Sourkes M, Stewart JD. Common peroneal neuropathy: a study of selective motor and sensory involvement. Neurology. 1991;41:1029–33.

2. Stewart JD. Foot drop: where, why and what to do? Practical Neurology. 2008;8:158-169.

3. Kortelainen P, Puranen J, Koivisto E, Lahde S. Symptoms and signs of sciatica and their relation to the localization of the lumbar disc herniation. Spine. 1985;10(1):88-92.

4. Kreiner DS, et al. An evidence-based clinical guideline for the diagnosis and treatment of lumbar disc herniation with radiculopathy. The Spine Journal. 2014;14(1):180-191.

5. Coster S, de Bruijn SFTM & Tavy DLJ. Diagnostic value of history, physical, examination and needle electromyography in diagnosing lumbosacral radiculopathy. J Neurol. 2010:257-332. https://doi.org/10.1007/s00415-009-5316-y.

6. Murphy DR, Hurwitz EL, Gerrard JK, Clary R. Pain patterns and descriptions in patients with radicular pain: Does the pain necessarily follow a specific dermatome? Chiropractic and Osteopathy. 2009: 7-9. doi:10.1186/1746-1340-17-9.

7. Ali S, Jabeen S, Pate RJ, Marwah S, Chinala S, Milankumar N, Rida S. Conversion disorder – mind versus body: a review. Innov Clin Neruosci. 2015;12(5-6):27-33.

8. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. Fifth ed. Arlington: American Psychiatric Association, 2013.

9. National Organization for Rare Disorders. Functional Neurologic Disorder [Internet]. Rare disease information; 2018. Available from: https://rarediseases.org/rare-diseases/fnd/

10. Tsui P, Deptula A, Yuan DY. Conversion disorder, functional neurological symptoms disorder, and chronic pain: comorbidity, assessment, and treatment. Curr Pain Headache Rep. 2017;21;6: 29. doi: 10.1007/s11916-017-0627-7.

11. Leininger B, Bronfort G, Evans R, Reiter T. Spinal manipulation or mobilization for radiculopathy: a systematic review. Phys Med Rehabil Clin N Am. 2011;22(1):105-125.

12. Amtmann DA, Cook K.F, Jensen MP, Chen WH, Choi SW, Revicki D, Cella D, Rothrock N, Keefe F, Callahan L, Lai JS. Development of a PROMIS item bank to measure pain interference. Pain. 2010;150(1):173-82.

13. Huang P, Sengupta DK. How fast pain, numbness, and paresthesia resolves after lumber nerve root decompression: a retrospective study of patient's self-reported computerized pain drawing. Spine. 2014;39(8):529-536. doi: 10.1097/BRS.0000000000000240.

14. Gay RE, Bronfort G, Evans RL. Distraction manipulation of the lumbar spine: a review of the literature. J Manipulative Physiol Ther. 2005;28(4):266-73.

15. Alcantara J, Adamek R. The chiropractic care of a child with extremity tremors concomitant with a medical diagnosis of conversion disorder. Complementary Therapies in Clinical Practice. 2012;18(2):89-93.

16. Newell D, Lothe LR, Raven TJL. Contextually Aided Recovery (CARe): a scientific theory for innate healing. Chiropr Man Therap, 2017; 13(26):6.

17. Ayaz SB, Matee S, Malik R, Ahmad K. Conversion disorder; an usual etiology of unilateral foot drop. Acta Neurol Taiwan. 2015;24(2):47-51.

Original Article

Chiropractic Clinical Reasoning in a Patient with Cervical Radiculopathy: A Case Report

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Abstract

Objective
This case presents the successful evidence-based diagnosis and treatment of a patient with cervical radiculopathy in a chiropractic setting.

Clinical Features
Cervical radiculopathy is a common and sometimes severe neuromusculoskeletal condition that is reported to affect about 2 out of every 1000 individuals and is most commonly diagnosed during the 4th and 5th decades of life. A 33-year-old male presented with persistent neck and left arm pain over the last 2 months. He had consulted with an orthopedic surgeon who recommended immediate surgical intervention.

Interventions
The patient elected to exhaust conservative measures prior to pursuing surgery. History and examination were consistent with cervical radiculopathy. Red flags were ruled out and there were no neurologic deficits other than those associated with cervical radiculopathy. A trial of chiropractic care was provided and included: manual traction of the cervical spine, pin and stretch, trigger point therapy, home strengthening and stretching activities, and low-level-laser therapy.
Outcome: The patient reported moderate relief immediately following the first visit; after a total of 5 visits over 3 weeks the patient rated his pain at 0/10 on an 11-point numeric rating scale and

reported feeling “normal”. A three year follow up revealed that the patient has been able to successfully adhere to his home exercise plan and has not needed further medical care for his condition.

Indexing Terms
Chiropractic; Manipulation, Chiropractic; Radiculopathy; Case Report; Neck; Neck Injuries; Spine; Conservative Treatment; Orthopedics; Intervertebral Disc

Introduction

The human neck is an intricate structure built for mobility and strength. It houses many delicate nervous system structures including spinal nerves, the irritation of which can cause cervical radiculopathy. Cervical radiculopathy is a complex and painful medical condition that affects about 1 out of 500 people in their lifetime. It occurs most commonly during the 4^{th} and 5^{th} decades of life [1]. Neck pain is a common cause of disability worldwide and 19% of people suffering from neck pain are found to suffer from cervical radiculopathy [2]. Risk factors that have been associated with cervical radiculopathy include cigarette smoking, being Caucasian and having a history of cervical/lumbar radiculopathy [1]. Cervical radiculopathy is most commonly attributed to mechanical compression or chemical irritation of the spinal nerve roots. Intervertebral disc degeneration can result in neuroforaminal stenosis, predisposing nerve roots to compression. Trauma, infection and tumors can also result in cervical radiculopathy [3]. The most common features associated with cervical radiculopathy are neck pain and arm pain that manifests with a gradual onset. The quality of pain reported with cervical radiculopathy may range from mild discomfort to sharp shooting pain. This pain presentation often begins in the midline of the neck and radiates into the shoulder and/or upper extremity. As the radiculopathy progresses, the pain often peripheralizes to the more distal aspects of the involved upper extremity. Individuals with cervical radiculopathy may also experience sensory changes along the dermatome associated with the compressed nerve root, or motor weakness within the corresponding myotome [4]. Cervical radiculopathy can be caused by acute trauma or insidious degeneration leading to the injury [4].

No single test or procedure can establish a diagnosis of cervical radiculopathy. Instead, elements of the history and a comprehensive exam lead a clinician to a diagnosis of cervical radiculopathy [2]. Electromyography (EMG) can help assess the function of a specific nerve root in suspected cases of cervical radiculopathy [3]. Advanced imaging such as a cervical magnetic resonance imaging (MRI) or computed tomography (CT) provide visualization of structures that may contribute to the cause of cervical radiculopathy [3]. This report presents a case of cervical radiculopathy that responded favorably to a short course of chiropractic care. Written informed consent was obtained from the patient for the publication of this case report. A copy of the written consent is available for review by the Editor-In-Chief of this journal.

Case Report

A 33-year-old male presented with a chief complaint of neck and arm pain and a recent diagnosis of cervical radiculopathy from an orthopedic surgeon. The pain originated in the left side of his

neck and “shoots” down his left arm into his thumb, pointer and index fingers. The patient also described an achy pain in his left shoulder region. The pain was rated 8/10 and described as sharp and shooting. Any amount of physical activity intensified the pain. Specific provocative actions included turning his head to the left, coughing and sneezing. The onset was two months prior to his presentation to our office. The patient stated that he had never experienced this type of pain before. He sought evaluation by an orthopedic surgeon prior to seeking chiropractic care and was offered surgery to minimize the likelihood of further injury and disability. The patient had undergone bilateral transverse carpal ligament release 4 years earlier to address carpal tunnel syndrome and appreciated only modest improvement. He was not eager to undergo another surgical procedure. Further, he was alarmed by the language used surrounding disability and elected to delay surgery, instead seeking an opinion from a provider of conservative care.

The patient was a manual laborer and performed tasks specific to landscaping (operating heavy machinery, lifting large and/or heavy objects and using bulky motorized tools for various tasks). Upon presentation he had been unable to perform such work-related tasks for 2 months. The patient was not restricted with respect to activities of daily living (ADLs), but was in severe pain when performing them. Lying in supine with his left arm raised above his head was palliative. This pain-relieving position is known as “Bakody’s sign” and is suggestive of cervical radiculopathy. The patient reported previous treatment for this condition including acupuncture and over the counter NSAIDs, both of which provided modest temporary relief. The patient was adamantly opposed to using opioid medications as their use would preclude him from operating heavy machinery. He also communicated concern for the highly addictive nature of opioid medications.

Physical Examination

A detailed physical examination was performed. The first step in the physical examination was to rule out serious or emergent pathologies by assessing for “red flags”. [2] During the history the patient intimated elevations of stress and anxiety related to major work and life events which he felt impacted his ability to cope with his medical condition. After the history, a neurological exam was performed. Cerebral, cerebellar, cranial, and peripheral nerve examinations were all unremarkable. The head & neck, eyes, ears, nose, throat examination were unremarkable. Heart, lung, and circulatory examination were unremarkable. Orthopedic testing reproduced the patient’s chief complaint with neutral cervical compression, left lateral flexion cervical compression test, shoulder depression test, and upper limb median nerve tension test. A detailed chiropractic evaluation was performed on the patient to assess his neuromusculoskeletal system with an emphasis on biomechanics. Passive range of motion testing revealed that cervical extension, left lateral flexion, and left rotation were all decreased and reproduced the patient’s chief complaint. When performing flexion of the patient’s cervical spine, a “stretching” sensation was elicited within the musculature of the posterior cervical spine. Posterior to anterior springing of the C3-C7 spinal segments was tender to palpation, bilaterally over the articular pillars. Painful myofascial trigger points were detected, bilaterally, within the cervical paraspinal muscles, left levator scapulae, left upper trapezius, and left posterior scalene muscles. Anterior head carriage and scapular protraction were also noted and were consistent with the

postural features of upper crossed syndrome. This is significant as this type of postural abnormality leads to increased forces through the lower cervical spine and the affected cervical intervertebral disc.

The patient produced a copy of a cervical MRI from 2 months prior which revealed a large posterolateral broad-based disc protrusion that was causing moderate-to-severe left neuroforaminal canal stenosis at the C5-C6 level.

MRI Findings	C3-C4	C4-C5	C5-C6	C6-C7	C7-T1
Size of Disc Protrusion	None	Small	Large	Small	Small
Type of Disc Protrusion	None	Posterocentral	Posterolateral	Posterocentral	Posterocentral
Direction of Disc Protrusion	None	Central	Left	Central	Central
Intervertebral Canal Stenosis	Absent	Absent	Present	Absent	Absent
Severity of Protrusion	None	Mild	Moderate to Severe	Mild to Moderate	Mild

These radiographic findings correlated with the orthopedic testing further verifying our working diagnosis of cervical radiculopathy.

We implemented several outcome measures to quantify and track the patient's progress. We assessed pain severity using an 11-point numeric rating scale or NRS. The patient rated his level of discomfort as 8/10 on his initial visit and 0/10 by the end of care. We assess functional impact using the Neck Disability Index at initial evaluation, during his reevaluation roughly halfway through care and upon discharge.

Treatment/ Management

Current Evidence gives the following practice recommendations: [1] [4]

Treatment	Level of Supportive Evidence
Manual or Mechanical Intermittent Traction	Moderate Level of Evidence
Ancillary Treatments (Passive Modalities)	Moderate Level of Evidence
Surgical Intervention (Cervical Discectomy)	Moderate Level of Evidence
Epidural Steroid injection/ Nerve Block	Mild Level of Evidence
Multimodal Multidisciplinary Care	Mild Level of Evidence

Current literature suggests the natural course of cervical radiculopathy is usually favorable and self-limited, with 75%–90% of patients experiencing symptomatic improvement with conservative treatment [1]

A multimodal treatment plan was applied including manual therapies and a home exercise program (HEP). Manual Intermittent Traction was applied to the cervical spine. [5] [6] [7] Chiropractic manipulation was applied to the thoracic spine. [11] [12] Pin and stretch and manual trigger point pressure release (also known as ischemic compression) was applied to the upper trapezius, sternocleidomastoid, splenius capitus, splenius cervicis, anterior scalene, middle scalene, posterior scalene, semi spinalis capitis, suboccipitals, and levator scapulae bilaterally. [8] A HEP was provided and consisted of self-stretch for the parascapular and cervical paraspinal musculature as well as directional preference movements and nerve mobility exercises. [9] We also implemented FDA approved low level laser therapy for accelerated recovery of the same myofascial structures that were treated with manual therapy and at the level of the disc protrusion. [10]

Outcomes

The patient underwent treatment twice per week for the first 4 weeks, once per week for the next 2 weeks, and once every 2 weeks over the next 4 weeks, for a total of 12 treatments. He reported a reduction in pain from 8/10 to 4/10 on the NRS following initial treatment. After the 4th treatment he reported feeling "normal" with resolution of sharp shooting pains down his arm. By the end of the 5th treatment his pain level was rated 0/10.

From the 8th visit on the patient's primary complaint was neck stiffness, thought to be related to suboptimal posture and stress. NRS was again measured at 0/10. The patient's NDI score decreased significantly, consistent with his report of having returned to normal work duties. Peripheral nerve examination (e.g., dermatome, myotome, and myotatic reflex) and cervical orthopedic tests were repeated weekly to assess for progressive neurologic deficit. A three year follow up revealed that the patient has been able to successfully adhere to his home exercise plan and had not required further medical care regarding neck pain.

Discussion

This case report is an example of the conservative rehabilitation and management of a patient with cervical radiculopathy. The patient demonstrated consistent and steady improvement with the proposed plan of care. Improvement was seen in range of motion, pain intensity, muscular endurance, ability to perform ADL's and psychosocial aspects.

There is a growing body of research supporting conservative therapies for the treatment of patients with cervical radiculopathy. We based much of our clinical reasoning on the collective research on evaluation and treatment of cervical radiculopathy in this case. [5 – 12] The author carefully considered available options and chose a multimodal treatment plan that included various forms of manual therapy, passive modalities and a home exercise plan.

Manual intermittent traction of the cervical spine was performed for axial decompression of the involved structures. Depending on the clinical setting, tools available, provider preference, and patient preference either mechanical traction or manual traction could be performed. In our case

both the provider and the patient preferred manual traction over mechanical traction and thus it was selected as one modality of care. [5-7]

Chiropractic manipulation of the thoracic spine was performed to normalize regional and segmental range of motion and decrease regional muscle spasm thus increasing mobility in the affected area. Studies have demonstrated that impairments of the upper thoracic spine can cause problems in the cervical spine and many of the muscles of the cervical spine attach and act on the upper thoracic region making them closely interconnected. The patient was comfortable and able to tolerate lying in a prone position when the therapy was administered, and increased ROM was noted after the procedure was performed. [11-12]

Pin and stretch and ischemic compression were selected to address the myofascial components of his complaint. Either therapy type could be performed with the patient supine or seated depending on the patient's preference. This was important to consider initially when the patient was quite uncomfortable and unable to tolerate comfortably prior to therapy with our clinic. The muscles treated with manual therapy were the upper trapezius, sternocleidomastoid, splenius capitus, splenius cervicis, anterior scalene, middle scalene, posterior scalene, semi spinalis capitis, suboccipitals, and levator scapulae bilaterally. [8]

FDA approved low level laser therapy was applied throughout the course of care. The intention of using this modality was to increase the rate of recovery of the involved myofascial tissues. The laser was applied both centrally and laterally over the level of the disc protrusion in the cervical spine. The laser was also applied over the muscles that were treated with manual therapies via pin and stretch or ischemic compression. When one suffers from a painful spinal condition with aspects of their social life impacted, it is important to be effective and efficient in their recovery to help get them back to their normal life to avoid increased odds of long term disability. [10]

A home exercise plan was provided along with education regarding the importance of self-efficacy. Elements of the program were aimed at improving neurodynamic function, thereby decreasing pain related to the radiculopathy and increasing the patient's level of confidence and comfort. Other exercises were aimed at normalizing the patient's posture by stretching or strengthening involved musculature. [9]

Though the patient described in this case responded exceedingly well, the treatment approach and positive outcome may not be generalizable to others. Evidence-based care was provided by consulting the available research, bringing to bear the author's clinical expertise, and considering – at every step – patient preference. It is worth noting that the patient's condition may have improved with other combinations or in absence of treatment, as the natural history of cervical radiculopathy is such that many people improve without intervention. It is the author's judgment that, given the patient's anxiety about possible disability and surgery, professional guidance and reassurance, at the very least, were indicated. At 3-year-follow-up the patient had not experienced recurrence of neck or upper extremity pain. In addition, he endorsed greater confidence in his body's resilience and ability to recover from injury. It is important to consider the impact of radicular pain on quality of life and to mitigate distress not only through treatment but also through careful education.

Conclusion

This case describes the successful management of a patient with cervical radiculopathy using conservative, patient centered, evidence-based treatment in an outpatient setting.

Limiting Factors

The greatest limitation of this case is that this only pertains to one patient rather than multiple patients with the same diagnosis. Due to this the findings might not be reproducible in others with similar circumstances and the findings should be interpreted as such. Many individuals with cervical radiculopathy improve without intervention, so natural history must be considered.

Competing Interests

The authors declare that there were no conflicts of interest in the making of this study.

References

1. Woods BI, Hilibrand AS. Cervical Radiculopathy. *Journal of Spinal Disorders & Techniques* 2015;28(5).

2. Murphy D, Hurwitz EL. Application of a diagnosis-based clinical decision guide in patients with neck pain. *Chiropractic & Manual Therapies Chiropr Man Therap* 2011;19(1):19.

3. Murphy D. A Clinical Model for the Diagnosis and Management of Patients with Cervical Spine Syndromes. *Austrailasian Chiropractic & Osteopathy* 2004;12(2).

4. Bono CM, Ghiselli G, Gilbert TJ, et al. An evidence-based clinical guideline for the diagnosis and treatment of cervical radiculopathy from degenerative disorders.*The Spine Journal* 2011;11(1):64–72.

5. Young IA, Michener LA, Cleland JA, Aguilera AJ, Snyder AR. Manual Therapy, Exercise, and Traction for Patients with Cervical Radiculopathy: A Randomized Clinical Trial. *Physical Therapy* 2009;89(7):632–642.

6. Gudavalli MR, Potluri T, Carandang G, et al. Intradiscal Pressure Changes during Manual Cervical Distraction: A Cadaveric Study.*Evidence-Based Complementary and Alternative Medicine*2013;2013:1–10.

7. Jellad A, Salah ZB, Boudokhane S, Migaou H, Bahri I, Rejeb N. The value of intermittent cervical traction in recent cervical radiculopathy.*Annals of Physical and Rehabilitation Medicine* 2009;52(9):638–652.

8. Salt E, Wright C, Kelly S, Dean A. A systematic literature review on the effectiveness of non-invasive therapy for cervicobrachial pain. *Manual Therapy* 2011;16(1):53–65.

9. Savva C, Giakas G. The effect of cervical traction combined with neural mobilization on pain and disability in cervical radiculopathy. A case report. *Manual Therapy* 2013;18(5):443–446.

10. Konstantinovic LM, Cutovic MR, Milovanovic AN, et al. Low-Level Laser Therapy for Acute Neck Pain with Radiculopathy: A Double-Blind Placebo-Controlled Randomized Study. *Pain Med Pain Medicine* 2010;11(8):1169–1178.

11. Norlander S, Aste-Norlander U, Nordgren B, Sahlstedt B. Mobility in the cervico-thoracic motion segment: An indicative factor of musculo-skeletal neck-shoulder pain. Scand J Rehabil Med. 1996;28:183–192.

12. 34. Cleland JA, Childs JD, McRae M, et al. Immediate effects of thoracic manipulation in patients with neck pain: A randomized clinical trial. Man Ther. 2005;10:127–135.

Original Article

The Most Effective Exercises for Low Back Pain: A Literature Review

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Abstract

Objective
To perform a literature review of the most effective exercises to be performed which increase core stability

Background
A need for this review was prompted when reviewing core stability exercises, although they are known to be effective, it is unclear which exercises or technique should be specifically utilized in a clinical setting to improve patient outcomes.

Methods
Peer reviewed articles were accessed from PubMed from years 2014-2019 using the search terms Core Stability AND Low back pain. A total of 51 articles with those search terms were returned. Following our initial results, inclusion criteria allowed for a review of 13 articles.

Discussion
For providers who wish to implement a core strengthening routine for their patients choosing the most effective exercise is of utmost importance. The ability for the average doctor to know which exercises most patients will benefit from with the least amount of adverse reaction is not a

well-known fact. The evidenced based chiropractic physician must know the most current exercises to effectively treat their patients.

Conclusion
The results of the literature review demonstrated that the prescription of generalized exercise positively benefits patient outcomes regardless of the particular type. Providers should prescribe exercise based on patient preference and clinician knowledge.

Indexing Terms
Core Stability, Core Strength, Performance, Specific Exercises, and Guidelines

Background

Estimates suggest as high as 70-80% of the general population will experience some generalized low back pain at some point in their life[1]. This is not only a burden on the individual but has a further impact on family, financial status, and the healthcare system as a whole[2]. It is well known that the addition of a core strengthening routine to the management of low back pain is an effective tool and can aid in the prevention of future injuries[3]. Unfortunately, initial treatment often depends on the type of provider that is seen first and not necessarily accepted best practices. Current evidence suggests that the most effective treatment for generalized back pain be, patient education, advice to remain as active as the pain allows, and exercise[4]. The European guidelines for Management of Chronic Non-specific Low Back Pain, recommend supervised exercise therapy as the initial treatment of generalized low back pain[2]. The advantage of continued supervised exercise is that the provider can not only ensure proper technique but also make any session modifications as needed.

There are several known techniques recommended for patients with low back pain, such as McKenzie method, pilates, yoga, back school, and general core exercises have demonstrated varying levels of improvement in overall pain levels of the patient[1]. Of the known techniques and exercises it is unclear which one is the most effective in the management of back pain. There are copious amounts of information stating that core strengthening exercises are effective but little information on which ones seem to be the most effective.

The main muscles that are active in lumbar stabilization are erector spinae, psoas, multifidus, internal and external obliques, rectus abdominis, and transversus abdominis. Many exercises activate these muscles that can be easily performed by most patients at the initiation of care with little to no additional cost to the patient [5]. The difficulty lies with the exercise selection itself.-

Current guidelines suggest the addition of a core strengthening program is effective in decreasing pain and improving function.[2] The literature however does not make clear recommendations as to which exercises would be most effective in this task of adding core strength. Due to

inconsistent use of the terms core strength and core stability, we must define the meaning and purpose of each first.

Historically core-specific exercise was considered more effective than general exercise for the management of low back pain. These exercises were thought to decrease pain while increasing back-specific functional status in patients[6] more effectively than other forms of exercise. However, many recent papers have suggested that generalized exercise is as effective as specific exercise for the management of back pain [2,3,6,7]. These findings suggest the goal of core strengthening exercises is to target the entire core musculature in place of focusing on specific muscles.

The purpose of this literature review is to determine the most effective core strengthening exercises that engage the core muscles.

Methods

Literature search

A literature search was performed using the terms "Core Strength AND Specific Exercises AND Guidelines AND Low back pain" using Pubmed returning a total of 5 articles. We then revised our original search criteria to include core stability AND low back pain AND guidelines. Our criteria returned a total of 4 articles. Of these articles only two met the inclusion criteria due to the date range. With such a limited scope our search was again revised, eliminating the search term guidelines. Our final review of terms only included Core Stability Exercises AND Low back pain, returning a total of 51 publications.

Inclusion/Exclusion Criteria

Of these abstracts reviewed for inclusion, 13 were included in the review. The inclusion criteria consisted of articles in the date range of 2014-2019 and be specific to core stability and low back pain with no other treatments, and discussed exercise performed.

Discussion

The question remains, what is the most effective exercise when dealing with low back pain? Many exercises have demonstrated the capacity to reduce pain, but which one does so consistently? Which exercises produce the highest outcomes while being the most cost-effective for clinical use? These are a few of the questions many practitioners have when selecting exercises to help treat low back pain. Historically many practitioners have believed it necessary

to isolate and target specific core muscles to generate spine stability. This practice has left many practitioners confused and even frustrated as attempts to isolate and control internal reflexive muscle is both difficult to coach and learn.

Furthermore, is the time required to teach and learn these techniques even necessary, is there a benefit in isolation over-generalized exercise? Another concern brought on by overly specific complex exercises is the patient's ability to perform them outside of the office. As requirements for home exercise prescriptions continue to grow, the practitioners should feel confident the assigned exercises can and will be done.

When comparing techniques, Halliday et al., (2019)[8] discovered that McKenzie exercises caused participants to report higher pain reduction values when compared to their counterparts who received motor control exercises. This is significant as McKenzie exercises are global spinal movement exercises while the motor control exercises were isolation exercises for the transverse abdominus, multifidi and pelvic floor.

Smith, Littlewood and May, (2014)[9] conducted a 29-study review which concluded there was no evidence that stabilization exercises were more effective than other forms of exercise for low back pain. Stuber et al., (2014)[10] in their 5 study 151 participant review concluded that specific exercise was not more effective than general exercise.

Adding to the evidence that generalized exercise provides quality outcomes for individuals with low back pain are the papers published by Joyce and Kotler (2017)[11] and Zou et al. (2019)[12] who concluded that Pilates and tai chi both serves as quality tools in the treatment of low back pain respectively. These papers continue to support the effectiveness of generalized spinal exercise over specific isolation exercises.

Anderson and Bliven's (2017)[13] contribution demonstrated that non-specific exercises such and breathing could influence back pain and quality of life in their respective cohort.

However, there is also contradicting research performed by Coulombe et al., (2017)[6] who concluded that core stabilization exercises were more effective than generalized exercise for the management of low back pain.

Conclusion

In conclusion, generalized exercise serves an important role in the management of low back pain. However, when compared to other forms of exercise the information is conflicting as to which is more effective. The lack of consistency should serve as empowering information for the general practitioner as the evidence seems to suggest that general exercise prescriptions are acceptable for the management of low back pain while overly specific isolation exercise programs seem unnecessary. Practitioners and patients are then free to choose the most cost-effective, time-efficient patient preferred exercise for the management of low back pain.

Limitations

Limitations of this study include a limited search. Searching additional databases and additional phrasing may have revealed more results. Author bias towards specific exercise was present and though attempts were made to remove bias, it cannot be eliminated.

References

1. T Paolucci, C Attanasi. W Cecchini, A Marazzi, S Capobianco, V Santilli. Chronic low back pain and postural rehabilitation exercise: a literature review. Journal of Pain Research 2019:12 95-107

2. M Gomes-Neto, J Lopes, C Conceicao, A Araujo, A Brasileiro, C Sousa, V Carvalho. Stabilization exercise compared to general exercise or manual therapy for the management of low back pain: A systematic review and meta-analysis. Physical Therapy in Sport 23 (2017) 136-142

3. Esser M. Effects of Core Stability Training on Masters Swimmers. Sportverletz Sportschaden. 2017 Jun;31(2):93-102. doi: 10.1055/s-0043-101973. Epub 2017 Apr 10. German.

4. P Kjaer, A Kongsted, I Ris, A Abbot, C Rasmussen, E Roos, S Skou, T Anderson, J Hartvigsen. GLA:D Back group-based patient education integrated with exercises to support self-management of back pain development, theories and scientific evidence. BMC Musculoskeletal Disorders (2018) 19:418

5. Calatayud J, Casaña J, Martín F, Jakobsen MD, Colado JC, Gargallo P, Juesas Á, Muñoz V, Andersen LL. Trunk muscle activity during different variations of the supine plank exercise. Musculoskelet Sci Pract. 2017 Apr;28:54-58. doi: 10.1016/j.msksp.2017.01.011. Epub 2017 Jan 31.

6. Coulombe, B. J., Games, K. E., Neil, E. R., & Eberman, L. E. Core Stability Exercise Versus General Exercise for Chronic Low Back Pain. J Athl Train, (2017), 52(1), 71-72. doi:10.4085/1062-6050-51.11.16

7. Giesche F, Streicher H, Maiwald M, Wagner P. Inpatient multimodal pain therapy : Additive value of neuromuscular core stability exercises for chronic back pain].Schmerz. 2017 Apr;31(2):115-122. doi: 10.1007/s00482-016-0178-6. German.

8. Halliday, M. H., Pappas, E., Hancock, M. J., Clare, H. A., Pinto, R. Z., Robertson, G., & Ferreira, P. H. A randomized clinical trial comparing the McKenzie method and motor control exercises in people with chronic low back pain and directional preference: 1-year follow-up. Physiotherapy, (2019). 105(4), 442-445. doi:10.1016/j.physio.2018.12.004

9. Smith, B. E., Littlewood, C., & May, S. An update of stabilization exercises for low back pain: a systematic review with meta-analysis. BMC Musculoskelet Disord, (2014) 15, 416. doi:10.1186/1471-2474-15-416

10. Stuber, K. J., Bruno, P., Sajko, S., & Hayden, J. A. Core stability exercises for low back pain in athletes: a systematic review of the literature. Clin J Sports Med, (2014), 24(6), 448-456. doi:10.1097/jsm.0000000000000081

11. Joyce, A. A., & Kotler, D. H. Core Training in Low Back Disorders: Role of the Pilates Method. Curr Sports Med Rep, (2017), 16(3), 156-161. doi:10.1249/jsr.0000000000000365

12. Zou L, Zhang Y, Liu Y, Tian X, Xiao T, Liu X, Yeung AS, Liu J, Wang X, Yang Q. The Effects of Tai Chi Chuan Versus Core Stability Training on Lower-Limb Neuromuscular Function in Aging Individuals with Non-Specific Chronic Lower Back Pain. Medicina (Kaunas). 2019 Mar 3;55(3). pii: E60. doi: 10.3390/medicina55030060.

13. Anderson BE, Bliven KCH. The Use of Breathing Exercises in the Treatment of Chronic, Nonspecific Low Back Pain. J Sport Rehabil. 2017 Sep;26(5):452-458. doi: 10.1123/jsr.2015-0199. Epub 2016 Aug 24.

Original Article

Sacral Neurostimulator Mimics Low Back Pain After a Fall: A Case Report

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Abstract

Objective
To discuss a case of female patient with musculoskeletal complications related to damage to her sacral neuromodulation device which occurred as a result of a slip and fall.

Clinical Features
46-year-old female patient with low back pain after slip and fall. The physical exam of this patient involved palpation and orthopedic exams, including Laslett's criteria for identifying sacroiliac joint pain. Segmental overpressure, with prone hip extension, demonstrated right sacroiliac joint restriction along with left sacroiliac joint pain.

Intervention and Outcomes
Treatment consisted of spinal manipulation, using Thompson drop technique, on the left sacroiliac joint. The patient reported only transient improvement. A careful review of the chief complaint was conducted. The patient reported that she had a sacral neural stimulator implanted in her left gluteal tissue, for the management of urinary incontinence. The patient was asked to

turn off her device, via remote control, and her pain was instantly relieved. Urology explanted the device to the opposite gluteal region, with no complications.

Conclusion
This case illustrates the importance of reviewing past medical history and ROS for visceral/surgical causes for MSK pain. This appears to be the first case in the literature of adverse event due to accidental damage to a sacral neurostimulator medical device.

Introduction

Sacral neuromodulation (SNM) has increased in frequency in the last two decades for the treatment of various conditions, including urinary voiding dysfunction, fecal incontinence, sexual dysfunction, and pelvic pain. [1] SNM is an intervention that stimulates the sacral nerves that control bowel and bladder function by delivering mild electrical pulses, below sensory threshold, using an implantable pulse generator (IPG). [3] Stimulation can be tested immediately using the Brindley- Stimulator, where patients are able to induce voiding by activating the IPG [4]. Patient can test the outcome of the intervention for 2-4 weeks using an external pulse generator, before a more permanent device is implanted through the third sacral foramen; the wire is placed adjacent to the pudendal nerves, using the Seldinger technique.. The IPG is implanted in the superior gluteal region.

The success rates for urinary and fecal incontinence are 68% and 89%, [7] but there have been multiple reports of adverse events resulting in surgical revisions or removal include loss of efficacy, pain at the IPG, painful stimulation, or painful stimulation down the leg [1, 2, 4, 6-9]. Adverse events occur highest within the first year of implantation [6, 8]. Medtronic lists “lead migration” as a possible adverse event causing pain in 2.5% of all recipients in its initial Summary of Effectivenes [2]. Lead migration occurs when the quadripolar lead do not adhere in the fascia of the gluteal region. Bielefeldt stated that “isolated lead replacement accounted for only 4.3% of reports”[8]. According to Medtronic, between 2010 and October 2018, 74.2% of the adverse events were related to the lead, but only 1.8% of subjects [11] A literature review identified over 500 references for “adverse effects of SNM”, but none described an accidental lead fracture as described in this case. This patient reported low back pain after a fall on her buttocks. She was evaluated for sacroiliac involvement and treated with only transient improvement. After a re-assessment of her surgical history, the diagnosis was amended to a failure of her SNM device.

Case Report

46-year-old female patient presented with a new complaint of ankle pain after a slip and fall. The patient had stepped off a boat and onto a floating dock where she slipped on a wet step. She

sought chiropractic care for her right ankle pain, which presented with marked discoloration and edema. She also had noticeably altered gait, due to her ankle pain. The patient was diagnosed with an ankle sprain and began a course of conservative care, which involved manual therapy, active care exercises, home icing instructions, and kinesiology tape.

With three weeks of treatment, her ankle pain had resolved, but the patient also began to complain of low back pain, which she attributed to her altered gait. Subsequently, a low back examination was performed, including Laslett's criteria for identifying low back pain that originates from one or more painful sacroiliac joints[11]. Visual inspection of the area was unremarkable. The test item cluster in Laslett's criteria (thight thrust, distraction, Gaenslen's, Iliac compression, sacral thrust) were negative in this case. Segmental overpressure with prone hip extension demonstrated right sacroiliac joint joint restriction, and pain in the right sacroiliac joint on hip extension. The patient rated her pain as a constant 7/10. Treatment consisted of prone high-velocity, low-amplitude spinal manipulation, using a Thompson table-assisted drop technique applied to the right sacroiliac joint. The patient only experienced transient improvement, stating only a few hours of relief between visits. Since this patient was not responding to treatment as expected, a review of the patient's history of present illness was performed, along with a review of the patient's past, family, and social history. The patient stated that she had a sacral neural stimulator implanted for urinary dysfunction approximately two years prior. A detailed review of the complaint revealed that when the patient had fallen, she landed on her buttocks on a flight of wooden stairs. She did not attribute her back pain to the fall, but to her altered gait from the ankle injury. Her implant was in the right gluteal region. The patient was advised to go home and turn off the device, using the external remote control. She cycled on and off several times; each time abolishing her pain and reproducing it. The patient was immediately referred to her urologist for follow up, where she was scheduled for exploratory surgery due to the suspected broken lead in her device. Surgery consisted of relocating her device to the opposite gluteal region with no further complications.

Discussion

This case is important because there were no published cases wherein a minor trauma was able to cause damage to an implanted neurostimulator. While this patient had received her neurostimulator as a treatment for urinary dysfunction, it is important to note that neurostimulators are used in healthcare for a wide array of conditions and/or symptoms. For both clinicians and academics, acknowledgement that minor trauma can alter surgically installed devices should be noted, and a more in-depth history should be examined in patients with implanted neurostimulators. Providers should assess pain generators throughout the care plan,

and revise the diagnosis if treatment is not successful. In this case, somatic pain was confounded by the broken lead, which reproduced musculoskeletal pain that mimicked sacroiliac joint pain.

Conclusion

In a case that presents like a simple musculoskeletal injury, it is important to thoroughly explore the patient's complete history, including previous surgeries. This is especially true if a short trial of conservative care is associated with a lack of improvement. This appears to be the first published case involving this traumatic etiology. It is the hope of the authors that introducing this case into the literature may help those patients who may experience a similar patient presentation.

List of Abbreviations

SNS: Sacral Nerve Stimulation, Sacral Neurostimulation
IPG: Implantable Pulse Generator
SNM: Sacral neuromodulation

Competing Interests

The author(s) declare that they have no competing interests.

References

1. Sutherland, S.E., et al., Sacral nerve stimulation for voiding dysfunction: One institution's 11-year experience. Neurourol Urodyn, 2007. 26(1): p. 19-28; discussion 36.

2. Medtronic, Summary of Safety and Effectiveness Data, FDA, Editor. 2014, FDA. p. 1-25.

3. Baxter, C. and J.H. Kim, Contrasting the percutaneous nerve evaluation versus staged implantation in sacral neuromodulation. Curr Urol Rep, 2010. 11(5): p. 310-4.

4. Engelberg, S., et al., Sacral Neuromodulation - Evolution of Techniques, Procedures and Outlook into the Future. Biomedical Engineering / Biomedizinische Technik, 2014. 59: p. s352-s355.

5. Spinelli, M., et al., New tined lead electrode in sacral neuromodulation: experience from a multicentre European study. World J Urol, 2005. 23(3): p. 225-9.

6. Gajewski, J.B. and A.A. Al-Zahrani, The long-term efficacy of sacral neuromodulation in the management of intractable cases of bladder pain syndrome: 14 years of experience in one centre. BJU Int, 2011. 107(8): p. 1258-64.

7. Medtronic. Therapies. [cited 2019 October 10, 2019]; A Medtronic page discussing various bladder control therapies and associated information.]. Available from: https://www.medtronic.com/us-en/patients/treatments-therapies/bladder-control/therapies.htm.

8. Bielefeldt, K., Adverse events of sacral neuromodulation for fecal incontinence reported to the federal drug administration. World J Gastrointest Pharmacol Ther, 2016. 7(2): p. 294-305.

9. Blandon, R.E., et al., Re-operation rates after permanent sacral nerve stimulation for refractory voiding dysfunction in women. BJU Int, 2008. 101(9): p. 1119-23.

10. Medtronic, Product Performance Report: Summary of Data from the Medtronic Post-Market Registry. 2018.

11. Laslett, M., et al., Diagnosing painful sacroiliac joints: A validity study of a McKenzie evaluation and sacroiliac provocation tests. Australian Journal of Physiotherapy, 2003. 49(2): p. 89-97.

Original Article

Fluoroquinolone Antibiotics: A Newly Identified Risk Factor for Cervical Artery Dissection

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Abstract

In 2018 Demetrious presented a rationale for the causal relationship of fluoroquinolone antibiotic induced connective tissue degradation and cervical artery dissection. In 2019, Del Zotto and Pezzini published an independent medical case-control study that has initially affirmed the Demetrious hypothesis**.** While past studies have associated recent infection and CAD, the presence of FQ antibiotics was neither assessed or considered as a risk factor or trigger**.** Fluoroquinolone antibiotics are causative in the pathogenesis of cervical artery dissection.

Background

In a seminal paper written by Demetrious in 2018, the author presented a rationale for the causal relationship of fluoroquinolone (FQ) antibiotic induced connective tissue degradation and cervical artery dissection (CAD). [1] This association was not previously recognized. In 2019, Del Zotto and Pezzini published an independent medical case-control study that has initially affirmed the Demetrious hypothesis. [2]

Reported CAD Risk Factors

Clinical risk factors have been associated with the pathogenesis of CAD including primary disease of the arterial wall (fibrodysplasia), Ehlers Danlos-syndrome IV, Marfan's syndrome, underlying arteriopathy, vessel tortuosity, recent respiratory tract infection, migraine, hyper-homocysteinemia, major head/neck trauma, and coughing. [3,4,5]

Infection or Fluoroquinolone?

While past studies have associated recent infection and CAD, the presence of FQ antibiotics was neither assessed or considered as a risk factor or trigger. [6,7] Grau et al. reported, "…short-lived trigger mechanisms may play an important role in the pathogenesis of CAD." Through multivariate analysis, the authors reported, "…mechanical stress does not significantly explain the association between infection and CAD." [6]

Campos et al. attributed a CAD to recent infection in their case report. [8] Interestingly, their patient suffered CAD, ischemic retinal, and cerebral strokes four days following the utilization of FQ antibiotics. In that paper, the use of the FQ medication was not identified as a CAD trigger.

A reported 32.5 million FQ antibiotics are prescribed annually in the United States. [9] Fluoroquinolone medications include: Cipro, Levaquin, Avelox, Factive and Floxin. The global consumption of FQ antibiotics is approximately 1.5-2.5 Defined Daily Doses per 1000 inhabitants per day in lower and high-income countries. [10] The FDA has reported connective tissue degradation latency from hours to years following FQ use. [11]

Chiropractic Spinal Manipulation Does Not Cause CAD

In their population-based, case-control, and case-crossover study, Cassidy et al. reported that patients seek chiropractic or primary medical care for early vertebrobasilar (VBA) dissection related symptoms before developing strokes. The authors found no evidence of excess risk of VBA stroke associated with chiropractic care compared to primary care. [12]

In 2016, Church et al. reported, "There is no convincing evidence to support a causal link between chiropractic manipulation and CAD." The authors reported an unfounded belief in causation might have dire consequences. [13]

In 2017, Cassidy et al. published the results of a large population-based, case-crossover study in the *Journal of Stroke and Cerebrovascular Diseases*. The authors found no excess of carotid artery stroke following chiropractic care and confirmed that patients sought care with early dissection related symptoms before developing strokes. [14]

In a comprehensive review of the literature published in the *Annals of Medicine,* Chaibi and Russell concluded, "Manual therapy does not result in an increased risk of CAD." Additionally, the authors state, "…there is no firm scientific basis for direct causality between cervical spinal manipulative therapy and CAD." [15]

These exhaustive studies did not identify or causally relate FQ pathogenetic dissections and SMT. Additionally, the data indicate that mechanical stress is not a trigger for CAD. [6] The comprehensive studies conducted by Cassidy, Church, and Chaibi did not identify FQs as a contraindication or risk factor to chiropractic manipulative care with or without FQ utilization. [11,12,13,14]

Incorrect, Harmful and Improperly Reported Causality

In their systematic review and meta-analysis of chiropractic care, Church et al. concluded, "We found no evidence for a causal link between chiropractic care and CAD. This is a significant finding because belief in a causal link is not uncommon, and such a belief may have significant adverse effects such as numerous episodes of litigation." [12] Further, Church et al. reported, "The quality of the published literature on the relationship between chiropractic manipulation and CAD is very low." [12] The repeated publication of conclusions drawn from studies with methodological limitations and bias represents poor science. Chiropractic spinal manipulation is not a risk factor for CAD or stroke.

Improving the Identification of a Developing CAD and Stroke

Patients seek chiropractic care with CAD and stroke symptoms. Developing symptoms need to be scrutinized for the utilization of FQ antibiotics in patients' past histories. Chaibi et al. report that history taking is the single most important factor for detecting subtle symptoms of CAD. [13] Caregivers and the public need to be aware of the degradative effect of FQ medications and their role in the genesis of CAD.

Conclusion

Fluoroquinolone antibiotics are causative in the pathogenesis of cervical artery dissection. Symptoms associated with developing cervical artery dissections cause patients to seek chiropractic care. Cases of suspected and confirmed cervical artery dissection need to be carefully vetted for a history of fluoroquinolone usage. The current evidence indicates that spinal manipulation is not a causative risk factor for CAD with or without FQ utilization.

References

1. Demetrious J. Spontaneous cervical artery dissection: a fluoroquinolone induced connective tissue disorder? Chiropractic & Manual Therapies. 2018;26:22.

2. Del Zotto E, Pezzini A. Use of fluoroquinolones and the risk of spontaneous cervical artery dissection. European Journal of Neurology. 2019;26:1028–1031.

3. Micheli S, Paciaroni M, Corea F, Agnelli G, Zampolini M, Caso V. Cervical artery dissection: emerging risk factors. Open Neurol J. 2010;4:50–55.

4. Debette S, Leys D. Cervical-artery dissections: predisposing factors, diagnosis, and outcome. Lancet Neurol. 2009;8(7):668-78.

5. Rubinstein SM, Peerdeman SM, van Tulder MW, Riphagen I, Haldeman S. A systematic review of the risk factors for cervical artery dissection. Stroke. 2005;36(7):1575-80.

6. Grau AJ, Brandt T, Buggle F, Orbeck E, Mytilineos J, Werle E, Conradt C, Krause M, Winter R, Hacke W. Association of cervical artery dissection with recent infection. Arch Neurol. 1999;56:851-856.

7. Guillon B, Berthet K, Benslamia L, Betrand M, Bousser MG, Tzourio C. Infection and the risk of spontaneous cervical artery dissection: a case-control study. Stroke. 2003;34:e79-e81.

8. Campos CR, Bassi TG, Pinto F, Abrahão DKP. Internal carotid artery dissection in a patient with recent respiratory infection. Arq Neuropsiquiatr. 2005;63(2-B):523-526.

9. Centers for Disease Control and Prevention. Outpatient antibiotic prescriptions—United States, 2015. https://www.cdc.gov/antibiotic-use/community/pdfs/Annual-Report-2015.pdf. Accessed: 2 Sept. 2019.

10. Klein EY, Van Boeckel TP, Martinez EM, Pant S, Gandra S, Levin SA, Goossens H, Laxminarayan R. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. PNAS. 2018;115(15):E3463-E3470.

11. FDA Drug Safety Communication: FDA updates warnings for oral and injectable fluoroquinolone antibiotics due to disabling side effects. 2016. https://www.fda.gov/Drugs/DrugSafety/ucm511530.htm. Accessed 2 Feb 2018.

12. Cassidy JD, Boyle E, Côté P, He Y, Hogg-Johnson S, Silver FL, Bondy SJ. Risk of vertebrobasilar stroke and chiropractic care: results of a population-based case-control and case-crossover study. Spine. 2008;33(4 Suppl):S176-83.

13. Church EW, Sieg EP, Zalatimo O, Hussain NS, Glantz M, Harbaugh RE. Systematic review and meta-analysis of chiropractic care and cervical artery dissection: no evidence for causation. Cureus. 2016;8(2):e498.

14. Cassidy JD, Boyle E, Côté P, Hogg-Johnson S, Bondy SJ, Haldeman S. Risk of carotid stroke after chiropractic care: a population-based case-crossover study. J Stroke Cerebrovasc Dis. 2017;26(4):842-850.

15. Chaibi A, Russell BR. A risk-benefit assessment strategy to exclude cervical artery dissection in spinal-therapy: a comprehensive review. Annals of Medicine. 2019; 51 (2)118-127.

Ortho Quiz

by Steven L. Kleinfield DC, FIANM(us)

1. Lister's Tubercle is located on which bone of the body?
    a. Ulna
    b. Radius
    c. Tibia
    d. Fibula

2. Gerdy's Tubercle is located on which bone of the body?
    a. Ulna
    b. Radius
    c. Tibia
    d. Fibula

3. Another name for a buckle fracture in which the bone deforms but does not crack and is seen most commonly in children is called:
    a. Torus Fracture
    b. Transverse Fracture
    c. Oblique Fracture
    d. Compound Fracture

4. Which orthopedic test does not belong with the others?
    a. Bancroft's Test
    b. Homan's Test
    c. Pratt's Test
    d. Waldron's Test

5. The orthopedic test, Ortolon's, is a test that is used to help diagnosis which condition?
    a. Shoulder dislocation
    b. Osteoarthrosis of the facets in the lumbar spine
    c. Infant hip dislocation
    d. Chondromalacia Patella

Current Events

- **Diplomate testing**
  - **Part I Examination Dates:**

    Three hours are allotted to take the Part I online examination during one of the following test window dates:

    - **2021**:

      Thursday, January 14, 2021 – 4:00 PM to 7:00 PM EST
      Friday, February 19, 2021 – 11:00 AM to 2:00 PM EST
      Saturday, March 20, 2021 – 11:00 AM to 2:00 PM EDT
      Wednesday, April 21, 2021 – 4:00 PM to 7:00 PM EDT
      Thursday, May 13, 2021 – 4:00 PM to 7:00 PM EDT
      Friday, June 18, 2021 – 11:00 AM to 2:00 PM EDT
      Saturday, July 17, 2021 – 11:00 AM to 2:00 PM EDT
      Wednesday, August 18, 2021 – 4:00 PM to 7:00 PM EDT
      Thursday, September 9, 2021 – 4:00 PM to 7:00 PM EDT
      Friday, October 8, 2021 – 11:00 AM to 2:00 PM EDT

    - To begin the IANM Diplomate application process, **register and pay your non-refundable $95 application fee**.
    - Practice Tests available for all candidates and potential candidates.
    - The initial Part I Payment of $475 is due 90 days prior to examination. The final Part I Payment of $475 is automatically billed to the same card 45 days prior to the Part I IANM Diplomate examination date. **Pay your Part I Exam Fee**.

  - **Part II Examination Dates:**

    The Part II test will be a timed examination consisting of three OSCE modules in a four hour period. The Part II test window dates are:

    - **2020**:

      Thursday, Nov 5, 2020 – 9:00 AM to 5:00 PM EDT
      Friday, Nov 6, 2020 – 9:00 AM to 5:00 PM EDT
      Saturday, Nov 7, 2020 – 9:00 AM to 2:00 PM EDT

- **2021**:

  Thursday, Nov 11, 2021 – 9:00 AM to 5:00 PM EDT

  Friday, Nov 12, 2021 – 9:00 AM to 5:00 PM EDT

  Saturday, Nov 13, 2021 – 9:00 AM to 2:00 PM EDT
- The initial Part II Payment of $475 is due 90 days prior to examination. The final Part II Payment of $475 is automatically billed to the same card 45 days prior to the Part II IANM Diplomate examination date. **Pay your Part II Exam Fee**.
- Successful completion of the IANM Part I examination is required. The Part II fee is $950.00, plus any testing center/proctor fees. Qualified candidates may contact us for more information.

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Answers to Ortho Quiz

Questions for JACO by Steven L. Kleinfield D.C.,F.A.C.O.)

1. Lister's Tubercle is located on which bone of the body?

b. Radius

https://radiopaedia.org/articles/listers-tubercle?lang=us

2. Gerdy's Tubercle is located on which bone of the body?

c. Tibia

https://radiopaedia.org/articles/listers-tubercle?lang=us

3. Another name for a buckle fracture in which the bone deforms but ***does not crack*** and is seen most commonly in children is called:

a. Torus Fracture

https://www.medicalnewstoday.com/articles/173312.php

4. Which orthopedic test does not belong with the others?

d. Waldron's Test

https://medisavvy.com/waldron-test/

5. The orthopedic test, Ortolon's, is a test that is used to help diagnosis which condition?

c. Infant hip dislocation

https://medical-dictionary.thefreedictionary.com/Ortolani%27s+test