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Bilateral Upper Extremity Neuropathy and Paraplegia: A Case Report

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Background: Patients who experience spinal injury and secondary paraplegia encounter a variety of risk factors that contribute to the development of subsequent upper extremity pathology. Trauma to surrounding structures, invasive surgical interventions, hardware placement, and overuse of the upper extremity among manual wheelchair users may further increase this risk.

Case Report: A 36-year-old woman suffered spinal and rib injuries, requiring surgical fixation, and recently developed paresthesias in her upper extremities. Prolonged manual wheelchair use presumably contributed to further associated injury. Thorough evaluation of the patient, including electrodiagnostic studies, supported a diagnosis of carpal tunnel syndrome. However, additional factors in the patient's history and physical examination findings supported concomitant thoracic outlet syndrome.

Conclusions: Our case emphasizes the importance of recognizing the nonclassical presentation of peripheral compression syndromes, performing a thorough evaluation, and providing the most appropriate management to promote optimal functioning and ultimately preserve one's quality of life.

Key words: Paraplegia, manual wheelchair use, carpal tunnel syndrome, thoracic outlet syndrome, case report

BACKGROUND

Upper extremity neuropathy in patients with paraplegia following high-impact trauma presents unique challenges due to a variety of contributing factors. Associated injuries, such as fractures to ribs, predispose to extrinsic compression of the brachial plexus and surrounding vasculature, which may result in varying degrees of thoracic outlet syndrome (TOS) (1). Proper diagnosis requires extensive workup, including history taking and a physical examination with a detailed neurological examination, consisting of sensory and motor testing of the upper extremities. Electrodiagnostic studies may further delineate underlying neuromuscular derangements. Management initially depends on proper diagnosis, which may range from cervical radiculopathy to more distal compression of peripheral nerves. There is a high prevalence of carpal tunnel syndrome and other nerve compression syndromes among manual wheelchair users (MWUs) (2). Therefore, practitioners must exercise caution to prevent premature carpal tunnel syndrome diagnosis by performing special testing for a relatively more proximal cause (e.g., Roos test for TOS or Spurling's test for cervical radiculopathy), and recognizing that multiple etiologies may also be present. Our case study focuses upon a patient with a complex medical history involving a traumatic event and surgical interventions, which have contributed to the development of upper extremity neuropathy, negatively impacting her quality of life. The patient's experience in this case provides an example of the careful considerations that health care providers must take into account with each patient encounter in order to provide the most appropriate care.

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CASE DESCRIPTION

A 36-year-old right-hand dominant woman with a past medical history of paraplegia presented with one year of bilateral pain, numbness, and tingling in the first, second, and third digits of her upper extremities. Eight years ago, the patient was involved in a motor vehicle accident that resulted in paraplegia secondary to complete spinal cord injury of T7-T12 level with severe retropulsion of bone. After the traumatic event, she underwent surgical interventions, including hardware placement in the upper ribs, thoracic spine, and lumbar spine regions, and utilizes a manual wheelchair for her daily life. The patient described the paresthesias in her upper extremities as comparably worse than the pain. She has completed a trial of a wrist brace, menthol-based topical gels, lidocaine patches, capsaicin, and occupational therapy.

On physical examination, no significant atrophy was noted. Light touch and pinprick sensation were intact. On manual muscle testing, bilateral upper extremities were 5/5. Tinel's test at the left wrist was equivocal, and Roos' sign was positive bilaterally. Upper extremity reflexes were ≥ 2. Upon examination of the cervical spine, no deformity was noted, and there was no tenderness to palpation at the cervical paraspinal muscles. Active range of motion was intact, with the exception of mild limitation in extension and cervical rotation. Spurling's test was negative bilaterally. Upon examining the shoulder, no deformity was noted, and the anterior shoulders were not tender to palpation bilaterally. The Lift-Off test and Hawkins test were negative. The Neer test elicited discomfort at the end range of motion.

Electrodiagnostic testing was performed and revealed right median sensory neuropathy consistent with a right mild-to-moderate carpal tunnel syndrome. Additionally, a point-of-care ultrasound examination was completed and supported the findings of mild carpal syndrome. The circumference of the right median nerve was 1.28 cm, and the circumference of the left median nerve was 1.16 cm, as displayed in Figs. 1A and 1B, respectively.

The diagnosis of mild-to-moderate bilateral carpal tunnel syndrome was made, given the patient's reported symptoms and diagnostic studies. There is likely some degree of concomitant bilateral TOS given the patient's trauma and surgical history, as well as positive Roos test on physical examination. The management recommendations for carpal tunnel syndrome consisted of brace utilization and activity modification. Home exercise program participation and use of kinesiology tape were recommended for TOS. The patient was advised to follow-up with her referring provider regarding the recommendation to consider occupational therapy. She stated her agreement with the treatment plan and was motivated to implement the recommendations. At her follow-up visit with her primary care provider approximately 2 months later, the patient reports using braces and is working toward incorporating occupational therapy.

DISCUSSION

A spinal injury resulting in paraplegia, and the treatment interventions that follow, introduces a unique set of factors that may contribute to the development of TOS. In patients who have experienced trauma to the ribs and thoracic spine, TOS is an important differential diagnosis to consider. Furthermore, patients with paraplegia are at higher risk of experiencing upper limb neuropathy due to upper extremity overuse for mobility and transfers (2). This repetitive motion of the shoulder is an inevitable risk factor for MWUs and is a notable contributor toward the development of TOS (1). MWUs experience continuous trauma to the shoulder through muscle imbalances from the activities they complete in their daily lives (3). Peripheral nerve dysfunction unrelated to the primary injury can further lead to muscle wasting, which can contribute to functional loss and poor recovery in spinal cord injury patients (4). Additionally, for some populations of MWUs, structural and architectural barriers, such as uneven surfaces and limited transport options, may also perpetuate upper limb neuropathy (2). Over time, MWUs may develop shoulder pathology and concomitant upper extremity peripheral neuropathy, which emphasizes the need for prompt recognition and swift management to prevent further decline.

Neurogenic TOS is the most common of the 3 classifications, and it has the potential to present in a variable manner that requires a thorough history and physical examination (5). Due to its variable presentation, TOS may be misdiagnosed as double crush syndrome or carpal tunnel syndrome (1).

TOS is a complex condition, and diagnostic testing can aid in differentiating between neurogenic vs arterial vs venous subtypes. Treatment options for TOS include physical therapy, osteopathic manipulative medicine, injections, acupuncture, pharmacological interventions, and surgical procedures (5). The need to prevent and pursue early treatment is significant because shoulder pathology in this unique patient population can

severely affect quality of life. Although an inclination may be present to pursue relatively aggressive treatment options to preserve function, early recognition and intervention with conservative measures may profoundly reduce morbidity (3). Efforts to investigate the reversibility of neuronal changes, strategies to prevent further deterioration of nerves and muscle, and emerging therapies should be further explored (4).

Although our case report highlights many important patient care considerations, this specific case comes with limitations. The nature of the specialist referral required a follow-up with her primary care provider with given recommendations. Therefore, the patient's improvement, following therapy, bracing, and other lifestyle modifications, was only available through medical records rather than in-person follow-up with the specialist. Additionally, given the particular complex history of this patient, the generalizability of the findings pertaining to this case may be limited. However, this further highlights the importance of individualized attention and care for each patient and a dynamic workup based on the overall clinical picture.

CONCLUSIONS

In this case report, we emphasize the importance of considering multiple differential diagnoses when evaluating a patient with a unique history that involves trauma, surgical hardware placement, and prolonged MWU. Initially, the patient presented for bilateral hand numbness, and the diagnosis of carpal tunnel syndrome was supported by her history, physical examination, and electrodiagnostic testing. However, the patient's trauma history included rib fractures and a thoracic spine compression fracture resulting in MWU, and her surgical history included hardware placement within the upper ribs, thoracic spine, and lumbar spine. In addition, the physical examination resulted in a positive Roos test bilaterally. While the patient is at risk for multiple etiologies of bilateral upper extremity neuropathy, the combination of the history and physical examination supports a possible diagnosis of TOS. The recommendation was made to pursue management of carpal tunnel syndrome immediately, and a discussion to pursue a home exercise program for possible TOS was held.

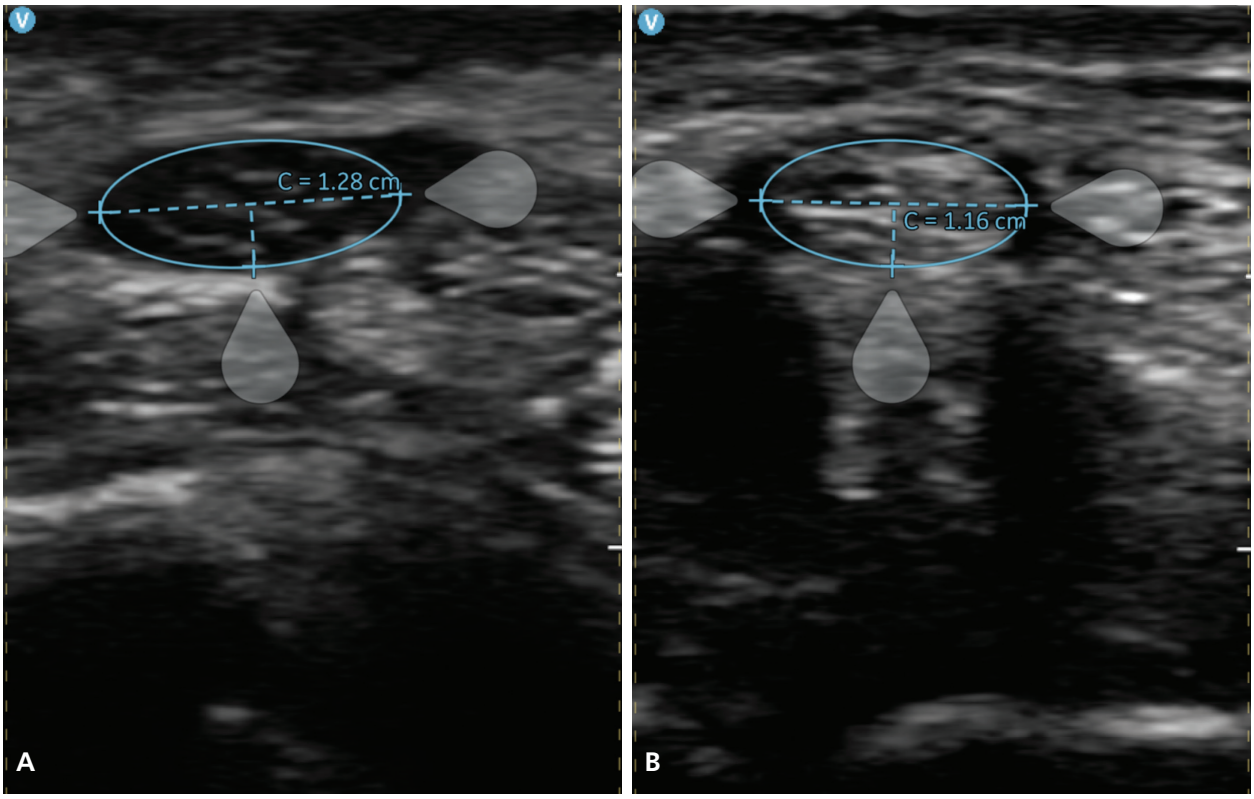

Fig. 1. Ultrasound imaging at the carpal tunnel of the right median nerve (A) and the left median nerve (B). Circumference of the right median nerve: 1.28 cm. Circumference of the left median nerve: 1.16 cm.

Many risk factors should be considered while evaluating a patient. Patients may present with classical symptoms of a medical condition; however, a comprehensive evaluation of a patient should not be overlooked in order to prevent the omission of key findings of related pathology or the development of new pathology. This is a particularly important caution when evaluating patients with complex medical histories.

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