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Case Report

Perineural Hydrodissection for Superficial Radial Nerve Compression Neuropathy: A Case Report

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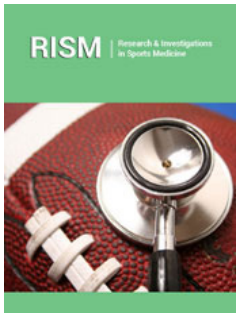

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Abstract

The Superficial Radial Nerve (SRN) is a sensory branch of the radial nerve that innervates the distal radial wrist and the radial dorsum of the hand. SRN neuropathy may occur at any point along the nerve, but entrapment is commonly noted distally between the brachioradialis and extensor carpi radialis tendons. Although SRN neuropathy is well documented in the literature, there are no reports of treatment involving perineural hydrodissection. Management is usually conservative with surgery reserved for recalcitrant cases. Presented is the first reported case of SRN compressive neuropathy treated with perineural hydrodissection in the literature. Perineural hydrodissection is a novel treatment for entrapment neuropathy that may be considered prior to surgical intervention.

Keywords: Superficial radial nerve; Perineural hydrodissection; Ultrasound; Case report

Abbreviations: SRN: Superficial Radial Nerve; ECR: Extensor Carpi Radialis; NSAIDs: Non-Steroidal Anti-Inflammatory Medications; EMG: Electromyography; MRI: Magnetic Resonance Imaging; D5W: 5% Dextrose in Water; TRPV1: Transient Receptor Potential Vanilloid Receptor-1

Introduction

The Superficial Radial Nerve (SRN) is a sensory branch of the radial nerve that innervates the radial side of the distal wrist and dorsum of the hand [1,2]. The SRN courses deep to the brachioradialis muscle, emerging superficially as it travels distally between the brachioradialis and the Extensor Carpi Radialis (ECR) tendons [3]. Injury or entrapment of the SRN is well documented in the literature dating back to 1932 when Wartenberg first described it as cheiralgia paresthetica in five cases [4,5]. SRN neuropathy may occur at any point along the nerve, but entrapment is commonly noted between the brachioradialis and ECR tendons from repetitive mechanical irritation [6]. Nerve injury is typically observed more distally due to distal radial fractures, handcuffs, wrist watches, wrist arthroscopy, acupuncture, or venipuncture [1,2,6-9]. Although SRN neuropathy is well known throughout the literature, there are no reports of treatment specifically with perineural hydrodissection to date. Historically, treatment options were limited to either conservative or surgical interventions. This is the first reported case of SRN compressive entrapment neuropathy treated with perineural hydrodissection in the current literature.

Case Presentation

A 35 year-old right hand dominant male military service member presented with right dorsal radial wrist pain for 8 years. The pain was described as a pins-and-needles sensation or electrical shock with light touch and thumb extension. The symptoms began after a

training exercise where he was handcuffed and tried to break free. He had failed prior splinting, Non-Steroidal Anti-Inflammatory Medications (NSAIDs), and physical therapy focusing on thumb extension and abduction. A first dorsal wrist extensor compartment corticosteroid injection performed by his primary care physician for presumed deQuervains tenosynovitis did not provide any immediate or delayed relief of symptoms. On examination, there were no skin changes or muscle atrophy of the forearm, wrist, or hand. He had full range of motion of the bilateral shoulders, elbows, wrists, and fingers with full strength throughout his bilateral upper extremities. There was diffuse discomfort with palpation of the distal radial wrist exacerbated by light touch, but sensation was otherwise intact in the radial, median, and ulnar nerve distributions. He exhibited positive Tinel's sign along the course of the SRN and positive Finkelstein's test. Watson's, Phalen's, Froment's signs were all negative (Figure 1).

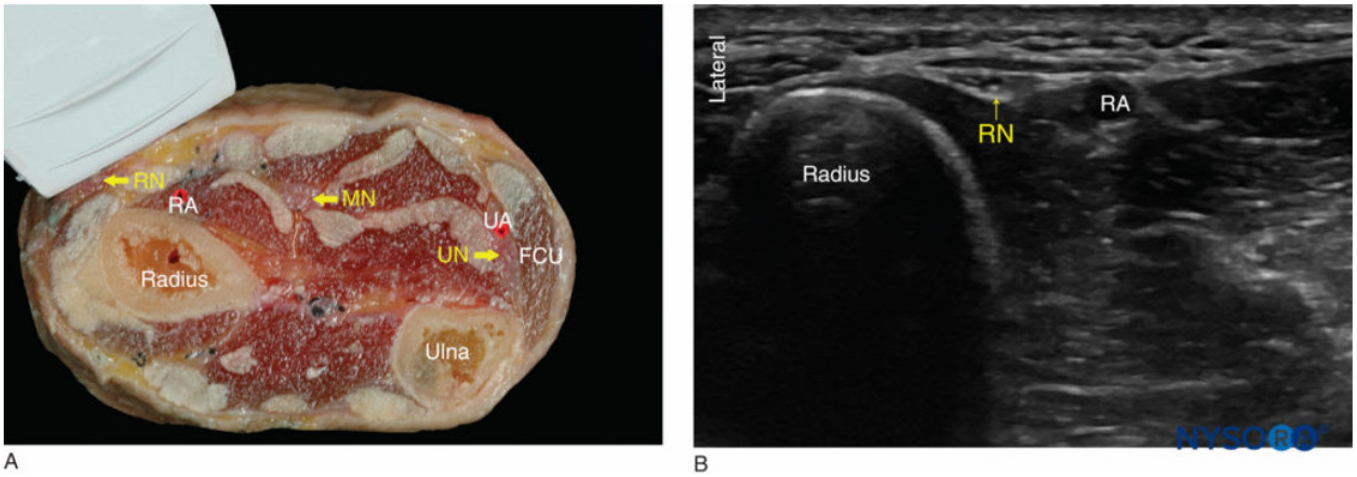

Figure 1: (A) Cross-sectional anatomy of the distal forearm. MN: median nerve; UN: Ulnar Nerve; UA: Ulnar Artery. (B) Sonoanatomy of the Radial Nerve (RN) at the forearm. RA: Radial Artery. SOURCE: NYSORA.COM

Plain radiographs of wrist were unremarkable. Point-of-care musculoskeletal ultrasound performed with the linear transducer transverse and long axis to first and second dorsal wrist extensor compartment tendons showed normal echogenic appearance without color uptake on power Doppler. Transverse views of the SRN exhibited normal hyperechoic and honeycomb appearance as it coursed between the brachioradialis and ECR tendons (Figure 1). However, as the nerve travelled distally there was flattening of the nerve, mild fascicular enlargement, and hypoechogenicity prior to branching. Further advanced imaging and diagnostic modalities such as Electromyography (EMG) and Magnetic Resonance Imaging (MRI) were not pursued in the interest of patient availability since there were limited clinical resources and he had an upcoming military move. After thorough discussion and shared decision making, he underwent diagnostic and therapeutic SRN perineural hydrodissection under ultrasound guidance (Figure 2). With the linear transducer positioned transverse to the SRN, a 25-gauge needle was used via a combination of in-plane and out-of-plane visualization to advance to the superficial then deep perineural space, where a total of 5 milliliters of 5% Dextrose in Water (D5W) was used to release the surrounding tissue from the nerve. The patient experienced immediate and continued resolution of his symptoms (Figure 2).

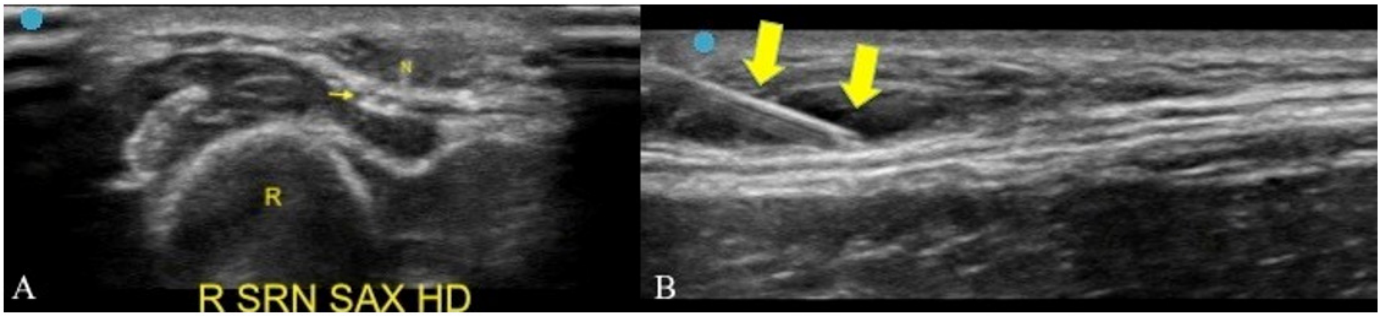

Figure 2: (A) Out-of-plane approach for ultrasound-guided perineural hydrodissection of the superficial radial nerve in transverse axis. R: Radius; N: needle tip. Thin arrow, superficial radial nerve. (B) In-plane approach for ultrasound-guided perineural hydrodissection of the superficial radial nerve in long axis. Thick arrows, needle.

Discussion

SRN neuropathy can be caused by compression or traumatic injury such as placement of handcuffs or venipuncture [1,2,6]. Patients often report dorsal radial wrist and hand paresthesia with allodynia [6]. Pain can be exacerbated by thumb and wrist movement, specifically wrist or thumb extension and ulnar deviation of the wrist. Patients often exhibit a positive Finkelstein's test, leading to the misdiagnosis of deQuervain's tenosynovitis and delayed treatment [10]. However, Tinel's sign along SRN distribution is usually positive, distinguishing SRN neuropathy from deQuervains tenosynovitis [1,6]. Hand and wrist range-of-motion and strength testing are often normal, although they may be decreased due to guarding. Radiographs and advanced imaging such as MRI may be helpful but are usually unremarkable and unnecessary to diagnose SRN neuropathy. EMG and nerve conduction studies also may or may not demonstrate delay [10]. Nerve ultrasonography can be beneficial and may reveal signs of entrapment, such as enlargement, flattening, or hypoechoic appearances with fascicular changes [11]. Management is initially conservative, consisting of activity modification, splinting, and physical therapy focused on improvement of elbow, wrist, and hand biomechanics [1,6]. Adjunct medication management with oral or topical NSAIDs and neuropathic medications such as gabapentin or pregabalin can be considered [1,2,6]. Conservative measures may be beneficial for symptom reduction but definitive treatment via surgical decompression or neurectomy may be needed especially in recalcitrant cases [1,2,6]. This case illustrates the failure of conservative treatment and avoidance of surgical intervention with perineural hydrodissection.

Awareness for perineural hydrodissection is increasing in the literature with use of high-definition ultrasound, leading to promise as novel treatment for peripheral mononeuropathy. Perineural hydrodissection is a procedure involving injection of fluid to separate the nerve from surrounding tissue over distance [12,13]. The injectate can be an anesthetic, saline, or D5W [12]. The benefit of nerve hydrodissection is not well understood, but a leading theory posits that dissecting the surrounding perineural tissue, whether it be fascia, tendons, muscle, or scar tissue, reduces compression of the nerve, allowing the nerves and vasculature supplying the nerve to function properly and the nerve to be healthier [12]. The choice of injectate also seems to be of importance, as D5W seems to provide greater benefit compared to other solutions [12,14]. It is postulated that D5W causes a downregulation of the Transient Receptor Potential Vanilloid Receptor-1 (TRPV1) ion channel and corrects glycopenia of the nerve [12]. In this case, there was no obvious post-procedural entrapment of the nerve exhibited on point-of-care musculoskeletal ultrasound, postulating that the D5W had a significant therapeutic effect.

Perineural hydrodissection is a novel and increasingly popular treatment for peripheral mononeuropathies using high-definition ultrasound. This case illustrates the benefit of perineural hydrodissection for SRN compressive entrapment neuropathy using D5W. There are multiple theories regarding the mechanism of action that provides benefit, whether it is mechanical decompression, chemical effect of the injectate, or a combination of both. More research is needed to show statistical benefit, but perineural hydrodissection may be considered as a treatment option for SRN neuropathy and other peripheral mononeuropathies prior to surgical consideration, especially in recalcitrant cases.

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Conflict of Interest Statement

Yao-Wen Eliot Hu: AMSSM - Received honorarium as scanning faculty at the Fundamentals of Ultrasound Pre-conference at the AMSSM Annual Meeting. Craig J. Van Tassel: none

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