Evaluation and Treatment of Radial Tunnel Syndrome

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Relevance of Topic to Upper Extremity Care

Radial tunnel syndrome (RTS) develops from intermittent compression of the radial nerve in the structure known as the radial tunnel, leading to pain on the antebrachial dorsum without primary muscular weakness.[1] Clinicians have difficulty in diagnosing RTS due to its low prevalence rate; one study found that only 1% of 1,051 patients with forearm entrapment syndromes exhibited RTS.[2] Moreover, RTS presents with a location of symptoms similar to lateral epicondylitis, a more common upper extremity condition. Despite its relative unknown, RTS can be disabling due to the associated pain. Patients from athletes to musicians may suffer from RTS because of repeated supination and pronation movements in their occupations. Weightlifters who require positions that apply compressive forces into nearby musculature of the elbow may also experience RTS.[3] RTS is not well studied, as no randomized controlled trials exist regarding the efficacy of conservative treatment.[4] Hand therapists will find relevance in exploring best practices of diagnosis and interventions should they encounter RTS in clinical practice.

Methodology of Research

Relevant systematic reviews, case reports, and clinical perspectives were searched using ScienceDirect Journals, SAGE Journals, and EBSCO in December 2016. Articles were excluded if they did not come from peer-reviewed journals. Key terms included: "radial tunnel syndrome", "compression", "neuropathy", "elbow", "forearm", "entrapment", and "lateral epicondylitis." Thirteen articles associated with anatomy, diagnosis, and treatment of RTS were chosen. One article was selected as a reference for the prevalence rate of RTS while one article was selected as a reference regarding features of lateral epicondylitis. Two upper extremity texts were used for additional references for other clinical interventions.

Pathophysiology

The radial nerve is the terminal end of the posterior cord of the brachial plexus. It travels from the posterior compartment of the arm into the anterior compartment proximal to the elbow. The nerve divides into a motor component, the posterior interosseous nerve (PIN), and a sensory component, the superficial radial nerve (SRN).[5] The space surrounding the radial nerve and the PIN creates the radial tunnel, extending from the humeroradial joint past the proximal edge of the supinator.[6] The brachialis and biceps tendon form the medial border of the tunnel. The brachioradialis (BR), extensor carpi radialis longus (ECRL), and extensor carpi radialis brevis (ECRB) form the roof and lateral border. RTS results from compression from one of the following possible structures – the leash of Henry (crossing branches of the radial artery), the Arcade of Frohse (superficial arch of the supinator), ECRB, or the distal border of the supinator.[7,8] There is also compression of the motor nerve and PIN, as there are efferent and afferent fibers in motor nerves that can transmit nociceptive information to the brain.[9]

Diagnosis

Differential diagnosis requires careful subjective and objective examinations. From the client's history, key indicators suggestive of increased risk for RTS include occupations requiring grasping of weights above one kilogram and repetitive supination/pronation tasks with the elbow extended.[10] The client's main complaint is an aching pain local to the extensor mass and four to five cm distal to the lateral epicondyle.[9] In contrast, lateral epicondylitis typically presents more proximally, with tenderness just anterior and distal to the lateral epicondyle.[11] Other conditions to rule out include radial capitellar arthritis, a tear of the ECRB, and posterior plica impingement.[12] For RTS, rest and night pain are common complaints.[13]

Clinicians may use the 'rule-of-9' test to identify RTS, though its diagnostic performance has yet to be determined. They will draw a large square box over the anterior aspect of the client's proximal forearm, divided into nine equal and smaller squares. Pressure over the two most proximal lateral boxes is suggestive of RTS because of the location of the supinator and radial nerve.[14] A more provocative test involves resisting extension of the third digit with full elbow extension, forearm pronation, and a neutral wrist.[13] Pain reproduction in the ECRB or BR over the course of the radial nerve is the positive finding. Similarly, resisted supination of the forearm with the elbow in extension may cause pain and suggest RTS. In addition, the upper limb neurodynamic tension test with a radial bias may be positive.[13] Importantly, as opposed to the weakness and possible paralysis seen in PIN syndrome, RTS is a pain-only phenomenon. Muscle weakness may be present secondary to pain but not due to denervation of muscular dysfunction. Similarly, there are no sensory losses associated with RTS.[15] Nerve conduction studies have not been shown to be reliable for the radial nerve while radiographs serve only to exclude cervical spondylosis and degenerative elbow changes.[12] A formal diagnosis of RTS is made by corticosteroid injection; relief of symptoms would confirm the diagnosis.

Treatment

Treatment is usually conservative for the first three to four months before considering surgical interventions. Therapists will provide ergonomic education in the initial session and throughout the plan of care. They will assess their clients' posture and positioning at work and home. A client who requires computer use at work may adjust the environment to reduce triggering movements. A split keyboard permits a neutral wrist position or allows for several degrees of pronation, while an alternative is a forward-tilted keyboard to encourage less wrist extension. The client could place a writing instrument under the index finger during typing to hyperextend the MCP joint and place the radial nerve on slack.[13] Further, the client can use whole arm movements to manipulate the mouse instead of radial/ulnar deviations and wrist extension;[16] an alternative mouse is pencil shaped and vertically oriented. Moreover, the client could adjust heights and proximity of office objects to limit elbow extension. Usage of mechanical devices to perform housework reduces required pronation and supination. Clients may refrain from pinching by using tools to grasp onto objects for extended periods of time. Activity modification is helpful as the client rests, avoiding positions and activities that aggravate the pain (e.g. repetitive loading that includes repeated forceful gripping and pinching, pronation/supination motions, wrist extension, and elbow extension). Anti-inflammatory medications may be helpful for pain relief.

Clinicians may employ manual treatment to mobilize myofascial tissue and the muscles in the radial tunnel with myofascial release and slow prolonged stretching. One effective stretch is targeted lengthening of the supinator and ECRB muscles via active scapular elevation with ipsilateral cervical sidebending.[13] While clients are in a highly irritable state, they may self-employ neural mobilization with slider techniques to help with nerve excursion while minimizing strain. The client fixes the elbow and forearm in a position of 90 degrees of elbow flexion and forearm pronation. Next, the client performs similar ipsilateral scapular elevation and cervical sidebending with midrange wrist flexion. The wrist returns to extension once the scapula and cervical spine return to neutral.[13] At a mildly irritable stage, the client combines forearm pronation, wrist flexion, and ulnar deviation with midrange elbow extension before a return to the starting position; one repetition every 1-2 seconds maximizes excursion but minimizes neural strain.[13] The pace of the gliding is slow and rhythmic. Stretching as a home exercise program may consist of a series of 13 decompression exercises twice daily and six initial positions throughout the day.[16]

In terms of strengthening, improving core stability helps position the scapula to aid in unloading the radial nerve more distally. The client may advance performance by increasing instability during these exercises (e.g. sitting on a Swiss ball). Appropriately, strengthening of scapular stabilizers and rotator cuff muscles as symptoms reduce will reduce compensatory patterns. They may first be performed prone on a treatment table before graduating to an upright position with pulleys or resistance bands.[16]

Splints may be helpful in alleviating neural tension and preventing inadvertent movements that may elicit symptoms in a highly irritable stage. An orthosis that places the wrist in slight extension could decrease tension at the site. If a splint were to involve the elbow and forearm/wrist, the recommended orthosis maintains wrist extension, elbow flexion, and neutral forearm rotation.[17] Kinesiotaping may aid in facilitating supination and unloading the wrist extensors;[13] it could also improve myofascial mobility. Other possible modalities include moist heat and continuous ultrasound (US) to facilitate blood flow to the area of interest either before or after stretching. Specifically, therapists have used the setting of one megahertz of pulsed US at 1.0 watts/cm^2 for 15 minutes over the proximal dorsum of the antebrachium.[16]

Surgical interventions may help with RTS by releasing contributory structures to symptoms; specifically, the PIN can be dorsally or anteriorly exposed. Postoperatively, the dressing may be removed after three to five days and AROM exercises may be started at the elbow, forearm, and wrist. However, combined movements of elbow extension, pronation, and wrist flexion should be avoided to reduce excessive tension on the radial nerve. Once precautions are lifted, strengthening may begin in the subsequent three to four weeks.

Clinical Applications

In diagnosing RTS, the key clinical sign is a deep pain roughly five cm distal to the lateral epicondyle, with no motor dysfunction. The clinician must take care to differentiate RTS from the more common condition of lateral epicondylitis. Though the literature of conservative treatment in RTS is lacking, principles from treating other compression neuropathies have been clinically successful, ranging from activity modification, ergonomic adjustments, stretching, and upper extremity strengthening.[16]

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