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Radial Nerve Entrapment

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Introduction

Radial nerve entrapment is an uncommon diagnosis that is prone to under-recognition. Compression or entrapment can occur at any location within the course of the nerve distribution, but the most frequent location of entrapment occurs in the proximal forearm. This most common location is typically in proximity to the supinator and often will involve the posterior interosseous nerve branch.

The radial nerve arises from C5 to C8 and provides a motor function to the extensors of the forearm, wrist, fingers, and thumb. The superficial radial nerve provides a sensory function to the posterior forearm. Depending on the location of entrapment a patient may experience pain, numbness, weakness, and overall dysfunction or any combination of these.[1][2][3]

Etiology

Radial nerve entrapment is often thought to be a result of overuse but can certainly occur secondary to other causes such as direct trauma, fractures, lacerations, compressive devices, or post-surgical changes. The radial nerve divides into the superficial radial and posterior interosseous nerves at the level of the radiocapitellar joint. The posterior interosseous nerve runs along the radial neck before piercing the supinator muscle, a common site of entrapment. The nerve further divides into four terminal branches that can typically be compressed at one of four other sites as well. These four sites are the fibrous bands around the radial head, the recurrent radial vessels, the arcade of Frohse, and/or the tendinous margin of the extensor carpi radialis brevis. Overuse actions and exercises that can lead to this condition are often repetitive pronation and supination of the wrist and forearm and commonly occur in the locations discussed previously.[4][5]

Epidemiology

Radial nerve entrapment is uncommon and often under-recognized. The annual incidence rate of the posterior interosseous nerve compression is estimated to be 0.03% while the rate for superficial radial nerve compression is 0.003%.[6][7]

Pathophysiology

This condition is typically a result of nerve injury secondary to compression, traction, or direct trauma causing a process of local swelling, edema, or even partial or complete laceration. The compression and/or traction often occur secondary to repetitive motions causing inflammation or architectural changes to the surrounding tissue. There are varying degrees of nerve damage severity. In mild cases, the compression of the nerve causes no permanent damage to the nerve and nerve sheath fully recover. More severe cases can cause permanent damage to the nerve and/or nerve sheath causing persistent deficits.

Multiple classification system exist to categorize nerve injury grading. A popular one is the Sunderland Classification which is detailed as follows:

- 1st degree
  - mild neurapraxia (traction/compression)
  - At most in early/low grade nerve injuries, the myelin sheath is compromised
- 2nd degree
  - only the myelin sheath and axon are injured or disrupted
- 3rd degree
  - injury with endoneurial scarring; all components of the peripheral nerve are injured except the perineurium and epineurium
  - most variable degree of ultimate recovery
- 4th degree
  - nerve in continuity but at the level of injury there is complete scarring across the nerve, only the epineurium remains intact
- 5th degree
  - included within Seddon's neurotmesis

Correlating Sunderland and Seddon's classification systems with one another:

- Seddon first degree neurapraxia is the same as Sunderland 1st degree injury
- Seddon second degree axonotmesis is the same as Sunderland 2nd degree injury
- Seddon third degree neurotmesis injuries span Sunderland 3rd, 4th, and 5th degree injuries

History and Physical

The presentation can certainly vary given multiple areas of possible entrapment. Symptoms are usually very slow developing. The duration of symptoms often averages multiple years before a definitive diagnosis is made. As mentioned previously, symptoms of this type of nerve entrapment are pain, sensory and motor changes, paresthesias, and/or paralysis. Physical exam and/or history often reveal symptoms limited to the dorsoradial aspect of the distal forearm and hand. Findings of decreased sensation over the dorsoradial aspect of the forearm or hand are helpful in establishing the diagnosis. A positive Tinel sign along the radial aspect of the mid forearm is suggestive of this process. Wrist flexion, ulnar deviation, and pronation place strain on the nerve and will often reproduce or exacerbate symptoms. Resisted extension of the middle finger with the elbow extended is another sign of nerve entrapment. This sign is often used to aid in the diagnosis of lateral epicondylitis but it also often positive in cases of radial nerve entrapment.

Evaluation

- If entrapment is suspected, radiography should be performed to detect or rule out a fracture, healing callus, or tumor as the cause of entrapment.
- Ultrasonography can often provide reliable visualization of injured nerves. Axonal swelling, hypoechogenicity of the nerve, loss of continuity of a nerve bundle, formation of a neuroma, and/or partial laceration of a nerve can all be visualized which may aid in diagnosis.

- Magnetic resonance imaging (MRI) can be useful in detecting more subtle causes not found on radiographs or ultrasound such as small tumors, masses, aneurysms, or a compressive synovitis. MRI can also at times detect nerve changes during acute entrapments.
- A diagnostic nerve block to help define the distribution of pathology and presentation is considered in some situations.
- EMG/Nerve conduction studies can also be considered but are inconsistent and should only be considered if surgery is a possibility.
- No standard laboratory work is necessary for establishing the diagnosis.[8][9]

Treatment / Management

First and Second Degree Nerve Injuries

- Most patients respond and recover after several months -- recommended management consists of serial exams and serial EMG/NCS testing
- Most patients respond well to conservative therapy. Consider removing any restrictive or compressive devices that are routinely worn. Consider relative rest from offending activity such as limiting repetitive pronation, supination, wrist flexion, and ulnar deviation. Often nerve glide exercises as part of occupation/physical therapy are performed in conjunction with rest and activity modification. If symptoms do not resolve with cessation of activity and rest, then consider splinting.
- If an area of pathology indicates possible compression and can be visualized on ultrasound, providers can consider ultrasound guided hydrodissection to free the compressed portion of the nerve.
- Oral or topical NSAIDs can be used for pain. Steroid and an anesthetic combination can be injected into the point of maximal tenderness for symptomatic relief. The steroid may help decrease any inflammation contributing to the process.
- In the setting of suspected mild degrees of nerve injury, but either prolonged, absent, or delayed evidence of recovery of nerve function both clinically and by serial EMG/NCS testing, surgery should be the last option if this process has become chronic and conservative treatment has failed after six to 12 months[10][11].

Third Degree *Nerve Injuries (*Neurotmesis*)*

- Acutely, direct surgical repair of the partial versus complete nerve laceration
- Nerve grafting techniques are employed in the setting of lacerations with retractions; often this can present in the subacute setting after injury
- Residual defects or "injury gap" measuring >2.5cm are recommended for nerve grafting techniques
    - Autograft options include the sural or saphenous nerves
        - There is no documented improved functional recovery or outcome when comparing autograft versus allograft or nerve conduits

Complications

Most complications are related to surgery and include:

- Stretching of the nerve
- Severing of the nerve

- Incomplete release
- Muscle atrophy

Pearls and Other Issues

Consider a differential diagnosis of De Quervain's tenosynovitis, intersection syndrome, lateral antebrachial cutaneous neuropathy, thumb carpometacarpal arthritis, C6 radiculopathy, lateral epicondylitis, or elbow bursitis.

Motor deficits indicate an entrapment or injury to the posterior interosseous nerve branch of the radial nerve. It does not carry any cutaneous sensory information though. These clinical findings can help distinguish an entrapment of this branch versus a compression more proximal or even a cervical radiculopathy.

The clinical presentation of posterior interosseous nerve entrapment is characterized by the loss of motor function due to variable degrees of weakness involving ulnar deviation.

If splinting is warranted, the splint will usually need to be worn for at least two to four weeks, or until symptoms have dissipated. Consider the addition of protective padding if the patient is an athlete and involved with sports that cause repetitive forearm trauma.

Enhancing Healthcare Team Outcomes

The acute management of radial nerve entrapment is surgical. However, once the surgery is completed, the patient needs to be followed by a neurologist, hand surgeon, physical and occupational therapist. After the healing is complete, most patients require extensive rehabilitation to recover motor and sensory function. In addition, the patient must wear protective splints to protect the hand. Recovery often takes months, and compliance with the exercise program is key. [12][5](Level V)

Outcomes

The outcomes after radial nerve entrapment depend on the severity of the injury. For those with neuropraxic injury, the outcome is good in most cases. For those with axonotmesis, recovery depends on the completeness of release. Unfortunately, many patients have residual deficits. Following neurotmesis, recovery is usually limited even with surgical repair. All patients need extended physical and occupational therapy, and recovery can take months or even years.[13][6] (Level V)

Questions

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