

Radial/Posterior Interosseous Nerve Decompression

Surgical Indications and Considerations

Anatomical Considerations: The close proximity of the radial/posterior interosseous nerve to bony, muscular, tendinous, and arterial structures puts it at risk for entrapment. There are several regions where compression of the radial/posterior interosseous nerve occurs – in the axillary/proximal region, at the elbow, and very rarely at the wrist.

Pathogenesis: Nerve compression of the radial/posterior interosseous nerve is caused by both intrinsic and extrinsic factors. In addition to the factors listed below, compression can be caused from tumors, septic arthritis in the elbow, synovitis secondary to rheumatoid arthritis, lipomas, hemangiomas, ganglion cysts, and other masses. Also, a tardy palsy may occur secondary to compression by a callus in a healing fracture at any of the locations.

High radial nerve (upper arm to elbow) compression sites and syndromes:

- Close proximity of the radial nerve to the radial groove of the humerus puts the nerve at risk for compression against the bone, being severed secondary to a fracture, or compressed by either orthopedic plates to repair a fracture or by a callus during bone healing
- Close proximity of the radial nerve to the medial and lateral head of the triceps, or a fibrous origin of the lateral head of the triceps leading to injury during strenuous activity
- Compression secondary to axillary crutches
- Secondary to “windmill” pitching in competitive softball
- “Saturday Night Palsy” – arm draped over a chair or hard surface as patient is asleep or intoxicated, “Honeymooners Palsy”- caused by one honeymooner resting on the other’s arm
- External compression and trauma most common cause of problems in this region

At the elbow

- Entrapment by fibrous bands around the anterior margin of the radial head
- Entrapment by the “Leash of Henry”- vessels from the radial recurrent artery
- Entrapment by the tendinous edge of Extensor Carpi Radialis Brevis
- Entrapment at the Arcade of Frohse (proximal entrance of the posterior interosseous nerve into the supinator muscle)-this structure is soft in childhood and can become fibrous in adulthood with fibrous occurrence ranging from 30-50% in cadaver studies but present in 80% of patients who undergo radial nerve decompression at the elbow
- Entrapment at the distal entrance of the posterior interosseous nerve from the supinator muscle
- Compression secondary to elbow synovitis in patients with rheumatoid arthritis
- Compression secondary to Monteggia fracture (fracture of proximal ulna in combination with posterior dislocation of the radial head)
- Frisbee flinging

Lipoma, elbow ganglion (tumor should be considered when there is dense paralysis)

At the wrist

4th extensor compartment

Epidemiology: The radial nerve is involved less frequently than the ulnar or median nerve in entrapment syndromes, however the radial nerve is the most frequently traumatically injured nerve in the arm, usually secondary to fractures. The dominant arm is involved twice as much as the nondominant arm, and men are affected twice as often as women. Injuries involving the elbow are thought to be related to activities that involve repeated supination and pronation such as tennis, racquetball sports, swimming, violin playing, orchestra conducting, and manual labor. Radial nerve compression often coexists with compression syndromes of other nerves or with other conditions such as lateral epicondylitis.

Diagnosis: Radial nerve compression is difficult to diagnose due to its wide spectrum of presentation, which often coexist or are confused with nonneurologic syndromes. EMG studies generally not reliable for diagnosis, but can be used to rule out radiculopathies from C7. If compression is suspected to be secondary to fracture or due to pressure from a mass, the use of radiographs, MRI, CT scan, and sonography can be useful in diagnosis. More evidence for the use of sonography in diagnosing radial compression is becoming apparent.

High Radial Nerve

Proximal to the radial groove

Involves weakness in elbow extension, wrist, thumb and finger extension

Sensory loss over the posterior arm and forearm and of the posterior lateral hand and thumb

Rule out C7 radiculopathy

History of use of crutches with compression in the axillary region

Mechanisms of injury consistent with “Saturday Night Palsy” or “Honeymooner’s Palsy”

At the radial groove

Involves weakness in wrist extension, thumb and finger extension

Possible sensory loss over posterior lateral hand and thumb with sensation of posterior arm and forearm intact

At the elbow

Radial tunnel (distal to the lateral intermuscular septum and proximal to the supinator muscle) **Note there is a discrepancy in the literature of what the radial tunnel refers to with several authors including the supinator muscle in the tunnel with the tunnel ending distal to the supinator.

Weak thumb and finger extensors, varying degrees of wrist extension weakness (may or may not be present), may affect grip strength

Possible sensory loss over posterior lateral hand and thumb with sensation of posterior arm and forearm intact

Controversy over using a lidocaine injection to diagnose this syndrome

Aching in lateral humerus, lateral elbow, and extensor mass (most common point of pain is at radial neck where as for lateral epicondylitis it is most common at the radial head or on the lateral epicondyle)

Night pain common according to some literature

Elbow “popping” with passive pronation (may occur in some)

Resisted supination with elbow in extension reproducing pain a common test used for diagnosis (however also positive with lateral epicondylitis)

Middle finger test with resistance to elevation of middle finger with wrist in neutral and elbow extended reproducing pain is a test used for diagnosis but many authors have the opinion that it provides no diagnostic reliability

Rule out lateral epicondylitis (many times occurs along with radial nerve compression with decompression sometimes reliving symptoms of both and other times not)

Possible history of strenuous use of forearm

Posterior Interosseous Nerve

Weakness in wrist extension with ulnar deviation, thumb and finger extension (metacarpophalangeal joints), may cause grip weakness, may have thumb abduction weakness

Normal sensation

May be a history of strenuous or repetitive effort involving supination and pronation

Rule out tendon rupture (tenodesis is present with posterior interosseous nerve syndrome, not present in tendon rupture)

Pain in deep proximal forearm or elbow which may precede weakness

According to one recent study most consistent symptoms were deep aching pain in the forearm, pain radiation to the neck and shoulder, and a “heavy” sensation of the affected arm. The most common physical findings were tenderness over the radial nerve at the supinator muscle level, pain on resisted supination, and the presence of Tinel sign over the radial forearm.

Terminal Branch of Posterior Interosseous Nerve involvement

Dorsal wrist pain (may be following a resection of a dorsal wrist ganglion) described as a deep dull ache

Pain provoked by wrist flexion, extension, and pressure on the 4th compartment with wrist flexed

Pain relieved by a local anesthetic block

Nonoperative Versus Operative Management: High radial nerve injuries are generally neuropraxic in origin and resolve spontaneously. Treatment is conservative and guided by EMG, which should show evidence of recovery within 4 months, with surgical exploration recommended if no recovery by this time. When conservative measures for radial tunnel and posterior interosseous nerve syndrome fail to relieve symptoms within three months, surgical intervention is pursued. The same time frame is used for involvement with the terminal branch of the posterior interosseous nerve at the wrist. Favorable responses to nonoperative management have been reported to be infrequent, probably less than 10%. According to several authors it is not clear what candidates will have a successful decompression surgery and several complications are common such as keloid scar formation, recurrence of symptoms, and hematomas. Surgical outcome for radial tunnel syndrome is variable with success rates varying from 39% excellent or good outcome to 95%. Surgeries for posterior interosseous nerve syndrome have been reported to have a positive outcome with one study reporting a 97% good to excellent outcome and another reporting increase in strength, with most patients in the 4-5/5 range. The involvement of a patient in a worker's compensation suit as a determining factor in outcome, is controversial. The definition of excellent results does not seem to correlate well with subjective patient report or return to work rates. Therefore, the best method for evaluating patients, initially and on follow-up, the most appropriate surgical techniques or alternative therapies for treatment is open to debate, despite detailed anatomical studies. A call for randomized controlled studies has been made, but as of yet has not been conducted.

Surgical Procedure: General surgical approaches include the anterior, posterior, transmuscular brachioradialis-splitting, and brachioradialis-extensor carpi radialis longus interval approach. For more details on the approaches see Hornbach and Culp. Most approaches involve proximal to distal dissection as this allows for less likelihood of injury to the radial nerve and its branches. Rinker et al. describe a different approach involving the use of intravenous corticosteroids before decompression with the idea that it reduces swelling and inflammation postoperatively. They also use a distal to proximal approach and a unique approach to bandaging, with no post-surgical immobilization cast or splint. A recent report of the use of arthroscopy to relieve radial tunnel syndrome by cyst decompression has also been reported. Intraoperative recordings of nerve action potentials were used in one study to make a decision for or against resection of the nerve.

Preoperative Rehabilitation

General preoperative care includes rest, non-steroidal anti-inflammatory medications, oral corticosteroids (in one study), refraining from repetitive supination/pronation activities (for compression or involvement at the elbow), various types of splinting with the use of buddy taping at times (taping a weaker finger to a stronger finger), and physical therapy using heat, ultrasound and massage. Steroid injections are controversial. Various time frames for conservative treatment are given from 1 month to 6 months unless there is motor weakness, clear trauma, or a suspected mass.

Extensor tenodesis splint has been recommended for posterior interosseous nerve syndrome (Eaton)

In radial tunnel syndrome, wrist extension splints are recommended with the elbow flexed and supinated to provide maximum relief (Levine)

General Conservative treatment according to Alba

Acute Phase (*Continues until patient reports decreased pain level at rest and during activities*)

Goal: Reduce patient's pain and inflammation

Interventions:

- Rest via splinting
- Avoidance of exacerbating postures
- Pain and edema control through non-steroidal anti-inflammatories and modalities (ultrasound, phonophoresis, electrical stimulation, and cryotherapy)
- Range of motion exercises-Active, active-assistive and gentle passive range of motion
- Modify ADL's

Rehabilitation Phase (May last in addition to acute phase for a total of 3-6 months)

Goal: Reintroduce dynamic forces across the forearm in a gentle, controlled manner to build endurance, strength, and postural awareness

Interventions:

- Progressive strengthening
- Modified work-simulated tasks
- Continued modalities

POSTOPERATIVE REHABILITATION

Note: Protocols vary and in many cases are not detailed in the literature with no research found on efficacy.

General Protocols:

Postoperatively active, but not strenuous motion is encouraged (Eaton)

Patient should be immobilized in a long arm posterior splint for 7-10 days with range of motion at the hand and shoulder encouraged immediately postoperatively. Gentle range of motion of the elbow is started when the dressings are removed at 7-10 days. (Levine, Spinner)

Following surgery for posterior interosseous nerve syndrome, patients should receive physical therapy that includes range of motion exercises. Many also benefited from a dynamic extension splint with outrigger, rubber bands and finger pads to maintain flexibility and mobility of all finger and thumb joints. (Cravens, Spinner)

Postsurgical protocol according to Rinker et al:

Phase I -Day 1 to 10

- Simple soft dressing is applied, without elbow immobilization
- Rest for 24 hours and maintain strict, continuous elevation of the limb for 48 hours
- Finger, thumb and shoulder exercises begun on day 2

Phase II – Day 10-12 to 2 months

Sutures removed post-op days 10-12 and scar taped longitudinally with 1-inch paper tape for a minimum of 2 months

General postoperative rehabilitation according to Alba

Phase I-Day 1 to 7

Goal: Rest

Treatment:

No formal therapy until after 1st week

Immobilization in a splint

Postsurgical dressings usually removed by end of this 1st week

Phase II-Day 8-21

Range of motion exercises

Wrist extension splint may be worn to promote healing and patient comfort

Modalities for pain and edema management (TENS, cryotherapy, pulsed ultrasound, high frequency electrical stimulation)

Scar management, including desensitization as tolerated, once wound completely closes

Radial nerve glides (only to point just before feeling of tension)

Phase III-5 to 6 weeks post-op to end of rehab.

Resistance exercises begun at 5-6 weeks post-op (begin with concentric and isometric, progress to eccentric as tolerated)

Work simulated tasks integrated as above progresses

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