

Interosseous nerve compression

Synonym: Kiloh-Nevin syndrome I (anterior interosseous nerve compression)

Anterior interosseous nerve compression

As the anterior interosseous nerve is deeply located, it is protected by several structures, which make lesions to it rare. However, while these structures protect the nerve, they can be causes of its compression.^[1]

Anatomy^[2]

The anterior interosseous nerve is a branch of the median nerve. It arises from the median nerve just distal to the antecubital fossa, about 5.5 cm distal to the medial epicondyle of the humerus.^[3] It passes along the interosseous membrane between the ulna and radius. It terminates in the pronator quadratus muscle around the level of the wrist. It is largely a motor nerve. It supplies the flexor pollicis longus, the lateral half of the flexor digitorum profundus (ie to the radial two digits) and the pronator quadratus.

How common is anterior interosseous nerve compression? (Epidemiology)

Compression of either the anterior or posterior interosseous nerves is rare.^[1] Anterior interosseous nerve injuries account for only 1% of all nerve injuries affecting the upper limb.^[4]

Causes of anterior interosseous nerve compression^{[1] [2]}

- A deep head of pronator teres.
- An enlarged bicipital tendon bursa may impinge on the nerve.
- An aberrant or thrombosed radial artery branch in the mid-forearm.

- A thrombosed ulnar artery.
- Tendinous bands.
- Aberrant accessory muscles in the deep palmar compartment - eg, Gantzer's muscle, the accessory head of the flexor pollicis longus.
- Iatrogenic during fracture reduction, or drugs injected in the forearm.
- Trauma, such as supracondylar fracture of the humerus and the proximal third of the forearm.
- One study reported a case of spontaneous anterior interosseous compression secondary to Churg-Strauss syndrome (small and medium vessel vasculitis).^[5]

Symptoms of anterior interosseous nerve compression (presentation)^[1]

- Anterior interosseous nerve compression compressive syndrome is characterised by the inability to flex the distal interphalangeal joints of the thumb and index finger.
- There is an inability to hyperextend the distal interphalangeal joint, and flexion of the proximal interphalangeal joint.
- In the thumb, there is flexion of the metacarpophalangeal joint and hyperextension of the interphalangeal joint, which results in a contact area of the thumb pulp with the indicator much more proximal than normal.
- In incomplete AIN, less axonal damage is observed and only the flexion of the distal phalanx of the thumb or index finger is compromised.
- Pronator quadratus muscle impairment can be demonstrated by resisted active pronation of the forearm with a fully flexed elbow to neutralise pronator teres muscle action.
- No sensory deficits are observed in the clinical evaluation of the hand and forearm.

Differential diagnosis^[2]

- A lesion of the lateral cord of the brachial plexus.

- Avulsion of the flexor digitorum profundus or of the index profundus tendons.
- C8 radiculopathy (rare).

Investigations

- X-ray may be helpful to exclude fracture, dislocation, healing callus or tumour.
- MRI is the preferred option for imaging.^[6]
- The anterior interosseous nerve is deep, as are the muscles it supplies. Hence, neurophysiology and electromyogram (EMG) studies are difficult.^[2] EMG, however, can be very useful in determining the severity of the condition and whether treatment should be conservative or surgical.^[7]

Management of anterior interosseous nerve compression

- Rest and immobilisation using splinting may help.
- Non-steroidal anti-inflammatory drugs (NSAIDs) and steroid injections may have some value.
- Nerve release and/or repair may be needed for anterior interosseous nerve lesions.^[8]

Posterior interosseous nerve compression

Distal to its origin, the posterior interosseous nerve is susceptible to compression at several levels:^[9]

- As it passes the level of the radial head to travel beneath the fibrous bands that are confluent with brachialis, brachioradialis, extensor carpi radialis brevis, and the superficial head of supinator.
- At the level of the radial neck where the posterior interosseous nerve is crossed by radial recurrent vessels.

Anatomy

This is a deep motor branch of the radial nerve. After emerging above the elbow between the brachioradialis and brachialis muscles, the radial nerve divides into the superficial radial nerve and the posterior interosseous nerve (PIN) at the level of the lateral epicondyle.^[10] The PIN passes through the supinator muscle as it goes from the anterior to the posterior surface of the forearm.^[11] It supplies the extensor carpi radialis brevis and supinator before entering the arcade of Frohse (a fibrotendinous structure below the supinator muscle, present in 30% of adults, that may develop secondary to repeated rotational movements of the forearm). The PIN supplies all of the extrinsic wrist extensors except for the extensor carpi radialis longus.^[11]

The radial tunnel is commonly described as the area where the radial nerve exits between the brachioradialis and brachialis muscles to the area where it enters the arcade of Frohse.

Symptoms of posterior interosseous nerve compression (presentation)^[9]

There are two syndromes that can occur when the PIN is entrapped/compressed: radial tunnel syndrome and posterior interosseous syndrome.

Radial tunnel syndrome

- Pain over the anterolateral proximal forearm, maximal four fingers' breadth distal to the lateral epicondyle.
- Extension of the elbow and pronation of the forearm intensifies symptoms.
- Resisted active supination and extension of the middle finger also causes pain.
- There is not usually any motor weakness or sensory loss.

Posterior interosseous syndrome^[12]

- Proximal forearm pain (not a primary symptom). Pain can be reproduced on resisted supination and sometimes on resisted pronation of the forearm. It can also be reproduced on wrist flexion and with resisted extension of the middle finger.

- There may be tenderness over the lateral epicondyle and the arcade of Frohse.
- There is no sensory deficit.
- There is partial-to-complete motor paralysis of the wrist extensors BUT brachioradialis, extensor carpi radialis longus and extensor carpi radialis brevis and supinator muscles may be spared because they are innervated by more proximal branches. Any wrist extension that remains will have radial deviation.
- The patient will be unable to extend the thumb or other digits at the metacarpophalangeal joints. Interphalangeal joint extension will be possible.

Causes of posterior interosseous nerve compression

PIN palsy can occur secondary to both mechanical (including local tumour compression, trauma and iatrogenic injuries) as well as non-mechanical events.^[13]

Radial tunnel syndrome

- May be a result of overuse.
- May represent an early posterior interosseous syndrome.
- Sites of compression may be:^[14] ^[15] ^[16]
 - Fibrous bands attached to the radiocapitellar joint.
 - Radial recurrent vessels.
 - Tendinous origin of the extensor carpi radialis brevis.
 - Tendinous origin of supinator.
 - Fibrous thickenings within and at the distal margin of supinator.

Posterior interosseous syndrome^[12]

- Radiocapitellar joint synovitis.
- Tumours (eg, lipomas, ganglions).

- Congenital tightness of ligamentous arcade of Frohse.
- Poorly placed screws for fracture fixation.
- Monteggia fractures.
- Idiopathic compression syndrome.
- Radial recurrent vessels.
- Iatrogenic injury - one study reported a case of posterior interosseous syndrome resulting from friction massage.^[17]

Differential diagnosis

- C7 radiculopathy (will produce weakness of the triceps and wrist flexors, unlike a PIN lesion).
- [Lateral epicondylitis](#) (will not show tenderness about 4 cm distal to the lateral humeral epicondyle).
- Extensor [tendon rupture](#).

Investigations

The diagnosis is mainly established on clinical findings.^[18]

- X-ray may be helpful to exclude fracture, dislocation, healing callus or tumour.
- MRI is sometimes used.
- Electrodiagnostic tests are normal in radial tunnel syndrome.
- Nerve conduction studies and EMG studies are abnormal in posterior interosseous syndrome and can be helpful to identify the site of compression.
- Injection of local anaesthetic four fingers' breadth distal to the lateral epicondyle will result in temporary PIN palsy and will result in temporary relief of pain if there is PIN compression syndrome.^[12]

Management of posterior interosseous nerve compression

- Conservative treatment is usually enough in radial tunnel syndrome but surgery may be needed if there is still pain at 12 weeks.^[14] ^[15]
^[16]
- Conservative treatment includes:
 - Rest and immobilisation using splinting.
 - NSAIDs and steroid injections.
 - Soft-tissue-based management, neural gliding and rehabilitation may be helpful, especially in cases not involving paralysis or denervation.^[19]
- The surgical treatment of radial tunnel syndrome is controversial. The success rate of decompression surgery in radial tunnel syndrome is between 10–95%. The combined treatment, releasing both the PIN and the superficial branch of the radial nerve, shows more consistent success rates compared with releasing the PIN alone. However, one study reported satisfactory results after decompression of the superficial branch of the radial nerve only.^[20]
- Surgery should be used in posterior interosseous syndrome after 12 weeks if there is no improvement with conservative treatment or if there is deterioration in symptoms/signs.

Prognosis

- If nerve entrapment has only caused mild damage to the nerve, recovery will be quicker.
- The outcome after surgery depends on the degree of damage to the nerve pre-operatively.
- If affected muscles have atrophied/fibrosed before the patient seeks medical help, tendon transfers may be needed at the same time as nerve decompression for a satisfactory outcome.
- Early operation tends to produce good recovery.

Further reading

- [Wheeler R, DeCastro A](#); Posterior Interosseous Nerve Syndrome. StatPearls, Jan 2023.
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