

Clinical anatomy of the radial nerve

In the immortal words of Homer Simpson, one of the great commentators on modern society, “Alcohol is the cause of, and solution to, all of life’s problems!”. It certainly causes its fair share of disease and injury in the peripheral nervous system and this includes the radial nerve. This nerve is the most frequent target of that peculiar alcohol related neuropathy, “Saturday night palsy”. So this issue I thought I might briefly review the clinical anatomy of the radial nerve.

Anatomy

The radial nerve is the main continuation of the posterior chord of the brachial plexus. Consequently it receives branches from each nerve root from C5/T1. After leaving the axilla the nerve gives three sensory branches (Table 1) and innervates the three heads of the triceps muscle and the small anconeus muscle (this latter muscle being used by many Neurophysiologists to assess for a decrement on repetitive stimulation in myasthenia gravis). The nerve then snakes its way down the humerus in the spiral groove, after which it gives muscular branches to brachioradialis, the long end of the extensor carpi radialis and supinator and then bifurcates into a sensory and motor branch. The sensory branch, the superficial radial nerve travels in the forearm over the radial bone and over the extensor tendons to the thumb where it can easily be palpated and supplies most of the dorsal surface of the hand. This superficial location makes the radial nerve a useful marker for assessing sensory axonal loss in polyneuropathy.

At the elbow the motor branch of the radial nerve becomes the posterior interosseous nerve and enters the extensor compartment through the supinator muscle under the arcade of Frohse (Figure 1). There it supplies the remaining extensors of the wrist, thumb and fingers (Table 2).

For the anoraks amongst you the Posterior interosseous nerve does have some sensory branches to the interosseous membrane and articulation between the radius and ulna.

Table 1: Sensory Branches of the Radial Nerve

Arm
Posterior Cutaneous Nerve of the Arm
Lower Lateral Cutaneous Nerve of the Arm
Posterior Cutaneous Nerve of the Forearm
Forearm
Superficial Radial Nerve

Clinical

Radial Neuropathy at the Spiral Groove

By far the most common radial neuropathy is due to external compression or trauma to the radial nerve in the spiral groove. The external compression can occur because of immobilisation of the arm. After intoxication, the classical description is that the patient falls asleep with the arm draped over a chair, “Saturday Night palsy”. It is my own experience that when getting history from these patients the story of intoxication is often clear, but patients have difficulty in remembering which chair may have been involved. The close association with the humerus in the spiral groove also renders the radial nerve vulnerable to injury when there is fracture of the shaft of

the humerus (figure 2). In some cases this injury is iatrogenic when the orthopedic surgeons repair the humerus with meccano. Clinically these patients present with wrist drop, weakness of finger extension, sensory disturbance and sensory loss in the distribution of the superficial radial nerve. There is some weakness of supination but elbow extension is spared as the branches to the triceps originate before the spiral groove.

Other Radial Neuropathies

The radial nerve may also be vulnerable to external compression from inappropriate use of crutches. In these patients, in addition to wrist drop and weakness of supination there is also weakness of elbow extension and sensory loss in the distribution of the more proximal cutaneous branches. The posterior interosseous branch of the radial nerve may also become entrapped in the supinator muscle under the arcade of Frohse. This is easily distinguished from injury or compression in the spiral groove by the following features:

1. There is no sensory involvement.
2. The sparing of the brachioradialis and the long end of the extensor carpi radialis results in radial deviation when the patient attempts to extend the wrist. Rarely, the superficial radial nerve may become entrapped by tight fitting watches, bands, bracelets, handcuffs. This results in sensory symptoms without wrist drop.

Neurophysiological Evaluation

In patients presenting with uncomplicated “Saturday night palsy” I normally start by doing sensory nerve conduction studies from the symptomatic and the contralateral side. It is important to remember to leave the studies for about two weeks after presentation as initially they are likely to be normal. Although it is possible to perform radial motor conduction studies I find it more convenient to localise radial nerve lesions with needle EMG. In the classical “Saturday Night Palsy” there will be denervation in the distribution of the posterior interosseous nerve (for example Extensor digiti communis) and muscles innervated by the main trunk of the radial nerve



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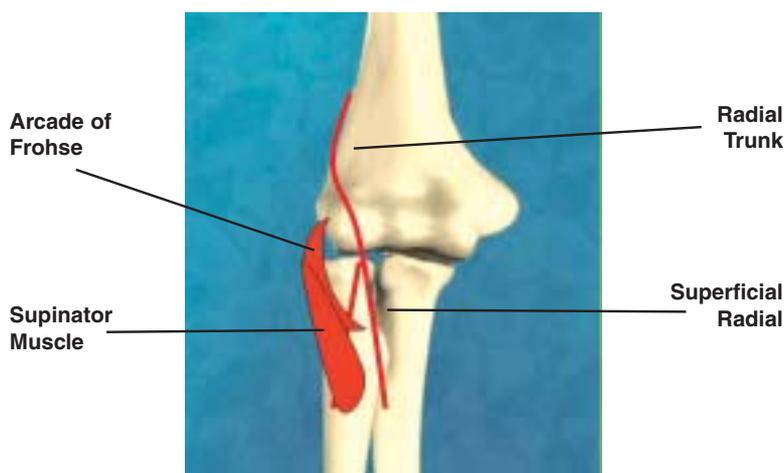


Figure 1: Course of the Radial Nerve at the elbow: after the spiral groove the nerve divides into the posterior interosseous and superficial radial branches, the posterior interosseous passes into the supinator under the fibrous arcade of frohse.

below the spiral groove will also be involved (Brachioradialis for example). However, triceps will be spared. In a Posterior interosseous Nerve Palsy, not surprisingly, the superficial radial nerve response is spared and there is denervation in the distribution of the posterior interosseous nerve only. In traumatic radial nerve injury, there may be additional injury to the Brachial plexus so it is worth examining muscles supplied by the posterior chord but not the radial nerve (the deltoid for instance). It is also worth examining the other main

nerves in that limb. It will sometimes be necessary to see patients very early after injury before clear signs of denervation (such as fibrillations) have developed. In those cases the aim is simply to demonstrate whether the nerve sheath is intact or not, and if there are voluntary motor units in muscles supplied below the site of injury then the nerve bundle is at least partially intact. Finally, in those patients presenting with "Saturday Night Palsy" it is worthwhile, if you have time, performing a full neuropathy screen for a sub-clinical alcohol polyneuropathy.

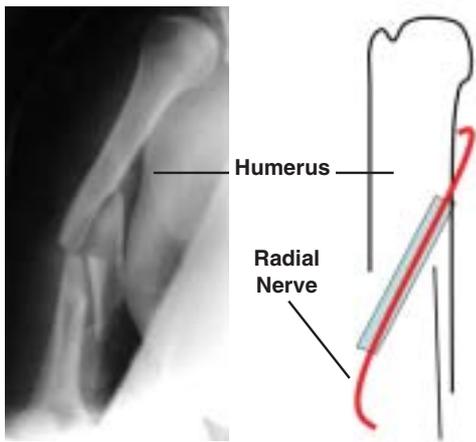


Figure 2: Radiograph from a patient who presented with wrist drop after a fracture of humerus the accompanying schematic shows how the nerve is vulnerable to trauma because of its close relationship to the bone

Table 2: Motor Branches of the Radial Nerve

Arm
Triceps (Three Heads)
Anconeus
Elbow
Brachioradialis
Long head of extensor carpi radialis
Supinator
Posterior Interosseous Nerve
Extensor Carpi Radialis (Short head)
Extensro Digitorum Cmmunis
Abductor Pollicis Longus
Extensor Indicis Proprius
Extensor Pollicis Longus
Extensor Pollicis Brevis

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