

ULTRASOUND OF PERIPHERAL NERVES

Ultrasound is a surprisingly good and underused imaging modality for visualizing peripheral nerves. It is particularly good where the nerves are superficial, such as in the upper limb and the foot. It has applications for entrapments, mass lesions, peripheral nerve sheath tumours, transections, compression, fibrosis, scarring, inflammation and anatomical variants. It is particularly useful when there are atypical features, meaning it doesn't fit with a clinical syndrome or when there has been failure of adequate treatment. It also has a treatment role for guiding injections.

UPPER LIMB

ULNAR NERVE: Entrapment is common in the cubital tunnel where it may cause localized nerve swelling and it can be compressed by ganglia in Guyon's canal. (Fig. 1, Fig. 2)



Fig 1. **Ulnar nerve entrapment.** This shows a focally swollen ulnar nerve (calipers) due to distal entrapment in the cubital tunnel by a nonspecified process such as an osteophyte or fibrous band.

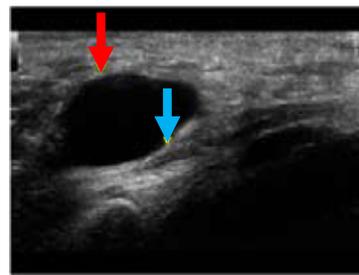


Fig 2. **Ulnar nerve compression.** This is a long axis image of the ulnar nerve (blue arrow) compressed by a large ganglion (red arrow) in Guyon's canal.

MEDIAN NERVE: A classic carpal tunnel syndrome rarely requires imaging but where the clinical picture is confusing or appropriate treatment fails, ultrasound can be diagnostic. A compressed median nerve demonstrates focal swelling. Compression can also be a result of tenosynovitis or a ganglion cyst. The median nerve is seen in the carpal tunnel and its cross sectional area is readily measured. (Figure 3) A tenosynovitis involving flexor tendon sheaths in the carpal tunnel is capable of producing compressive symptoms due to the mass effect within the constrained carpal tunnel. (Figure 4)

RADIAL NERVE: On occasions the radial nerve may be entrapped in a fracture between the bone ends and this can be visualized with ultrasound. This is a technique being increasingly utilized when there are neural symptoms or if internal fixation is contemplated in a fracture setting. (Figure 5)



Fig 3. **Normal median nerve.** This is a cross sectional image of the normal median nerve (arrow) in the carpal tunnel.

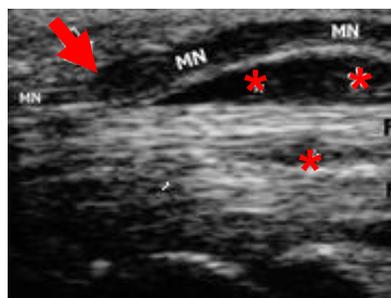


Fig 4. **Carpal tunnel synovitis.** This is a longitudinal image of a compressed median nerve (MN) due to a tenosynovitis with thickened synovium (asterisks) surrounding digital flexor tendons (F T) in the carpal tunnel. A normal noncompressed nerve is shown proximally (arrow).



Fig 5. **Radial nerve entrapment** by a fracture. This is a longitudinal ultrasound image of the radial nerve (arrow) which is trapped between the fragments of a distal humeral fracture.

DYNAMIC IMAGING: Ultrasound allows us to visualize a nerve dynamically in situations where the symptoms alter with motion. A prolapsing ulnar nerve can be seen to flip out from behind the epicondyle at the elbow between flexion and extension. (Figures 6 & 7)

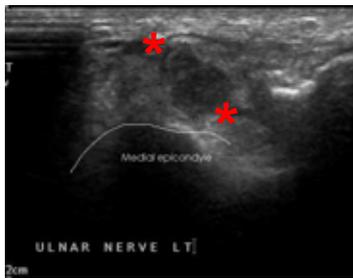


Fig 6

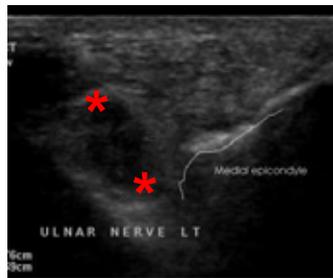


Fig 7

Fig 6 & 7. **Ulnar nerve prolapse.** Cross-sectional images showing the swollen ulnar nerve (calipers) prolapsing from behind the medial epicondyle (Fig. 6) to lie anteriorly (Fig. 7).

LOWER LIMB

LATERAL CUTANEOUS NERVE OF THE THIGH is subject to entrapment as it passes under the inguinal ligament in *meralgia paraesthetica*. Ultrasound image guidance is used to target the injection of cortisol and local anaesthetic.

PLANTAR NERVES: Tarsal tunnel syndrome is a condition where either the posterior tibial nerve or the medial or lateral plantar nerves are compressed in the tarsal tunnel below the medial malleolus by ganglia or vessels resulting in medial or lateral foot pain. Ultrasound below the medial malleolus is usually diagnostic. (Figure 8)

MORTONS NEUROMA: Metatarsalgia is a common clinical problem and ultrasound is used to look for either an intermetatarsal bursitis or a neuroma. It is also used to target the subsequent guided injection of local anaesthetic and steroid. The imaging findings can include an inflamed / distended intermetatarsal bursa, often with increased flow on Doppler interrogation. A Morton's neuroma is really fibrosis of the interdigital nerve due to chronic friction rather than a true neoplasm. The ultrasound reflects this with illdefined hypoechoic soft tissue often without discrete margins. The ultrasound can be surprisingly challenging because of the lack of a discrete mass and the vague nature of the hypoechoic soft tissue change.

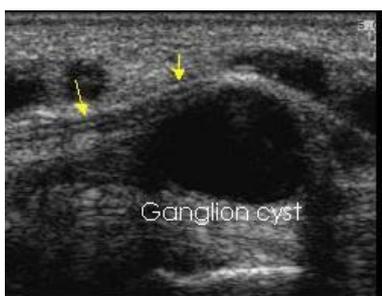


Figure 8. **Tibial nerve compression.** Longitudinal image of the tibial nerve (arrows) displaced and compressed by a large tarsal tunnel ganglion cyst.

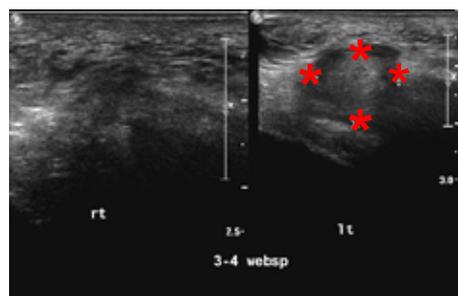


Figure 9. **Morton's neuroma.** Cross sectional ultrasound images comparing the appearances of a normal web space between the 3rd and 4th metatarsals on the right and the 3-4 web space with a large neuroma (calipers) on the left.

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