# The Role Of Magnetic resonance imaging In Diagnosis of Peripheral Neuropathies Of The Median, Radial, and Ulnar Nerves

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## Summary

For the evaluation of peripheral neuropathies, physicians traditionally relied primarily on information gained from an accurate clinical history, a thorough physical examination, and electrodiagnostic testing with electromyography, nerve conduction studies, and recordings of somatosensory evoked potentials. The current diagnostic work-up of peripheral nerve injuries with electrophysiologic testing often leaves clinicians uncertain about the severity of the nerve injury for the first 2 weeks after injury. Later, the presence of a mixed pattern of nerve injury will make it problematic to determine the likelihood of recovery, thereby making treatment planning difficult. Magnetic resonance imaging (MRI) using the short inversion imaging recovery (STIR) technique displays high signal intensity in the affected nerve segment at the site of the compression, probably due to the presence of edema in the myelin sheath and perineurium. Magnetic resonance neurography is evolving as an important tool in sorting out various painful limb syndromes involving the forearm and shoulder. This technique has been incorporated by some groups into the management of patients with routine entrapment syndromes (eg, carpal and cubital tunnel syndrome). For many, MRI and other imaging modalities are used for patients with atypical presentations of common disorders, recurrent symptoms after previous operation, and in those suspected of having rare entrapments.

MR imaging is considered useful for the assessment of neuromuscular disorders. It provides high-resolution depiction of nerves and allows visualization of primary abnormalities, such as a mass lesion compressing a nerve, as well as secondary abnormalities, such as nerve enlargement and enhancement due to neuritis. However, the primary nerve abnormality may not be visible in some cases. In such cases, the observation of signal intensity changes in the muscle that is innervated by the abnormal nerve may be used to diagnose and localize the nerve lesion. Peripheral neuropathies may be categorized according to cause, as either entrapment or non-entrapment neuropathies. Entrapment neuropathies (also referred to as nerve compression syndromes) of the median, radial, and ulnar nerves are characterized by alterations of the nerve function that are caused by mechanical or dynamic compression. Nerve entrapment syndromes occur because of anatomic constraints at specific locations. Anatomic locations that are prone to nerve entrapment syndromes include sites where the nerve courses through fibro-osseous or fibromuscular tunnels or penetrates a muscle. If there is even a slight divergence from the normal anatomy or conditions at these locations—for example, an anatomic variant or a degenerative change—the passage may be narrowed, and nerve entrapment may result. Radiologists are often required to evaluate Compressive and entrapment neuropathies (CENs) primarily to rule out soft-tissue lesions as a potential cause of the syndrome. MR imaging has become the best technique for accurate delineation of soft-tissue lesions, and it is ideally suited for the assessment of CEN. MRI abnormalities with the greatest sensitivity for carpal tunnel syndrome (CTS) included an overall impression of abnormality at 96% followed by a hyperintense nerve signal at 91%. Based on these data, MRI appears to be a promising diagnostic test for CTS. The aim of this study

is to assess the accuracy of magnetic resonance imaging in the diagnosis of peripheral neuropathies of the Median, Radial, and Ulnar Nerves, using surgery & clinical data as a reference gold standard.

A number of 30 cases will be included in descriptive study. A study presented to assess the accuracy of magnetic resonance imaging in the diagnosis of peripheral neuropathies of the Median, Radial, and Ulnar Nerves, using surgery & clinical data as a reference gold standard. The study was done in the Radiology & Imaging department Suez Canal University Hospital in Ismailia.

Inclusion criteria:

- Age: 18-70 years.
- Patients referred from outpatient clinic with suspected peripheral neuropathies of median, radial & ulnar nerves.

Exclusion criteria:

- Cognitive disorder (e.g., mental retardation, dementia).
- Cardiac pacemakers, older aneurysm clips, new stents or aortic valves, ferromagnetic ocular fragments that could interfere with high-strength magnetic fields.

All patients in this study will be subjected to the following:

A) Clinical assessment including:

*Relevant history:

Detailed complaint & present history:

- Experience of chronic forearm & hand pain.
- Experience paresthesia and numbness of the affected hand, weakness and atrophy due to prolonged nerve compression.
- **Nerve Injuries**, **Infections (viral or bacterial), and** mass lesions.

Relevant past history:

Presence of previous nerve injury, mass lesion and, previous operations.

MRI examination will be done in Suez Canal University Hospital for all patients using Philips machine 1.5 Tesla.

MRI technique:

1. Standard MR pulse sequences are used to visualize the anatomic features of normal and abnormal peripheral nerves and the tissues that surround them. In our experience.
2. The axial plane: is useful for assessment of peripheral nerves of the upper extremity, since all these nerves are longitudinally oriented within the limb.
3. The use of T1-weighted spin-echo (SE) sequences: allows depiction of fine anatomic detail, including the fascicular structure of the nerve.
4. The T1-weighted sequence, when applied after the administration of an extracellular gadolinium-based contrast agent: can be useful for demonstrating the anatomic relationship of nerve fascicles to closely associated mass lesions
5. On T2-weighted images acquired with fast SE or short inversion time inversion recovery (STIR) sequences: the MR signal in normal peripheral nerves is isointense to mildly hyperintense,

compared with the signal intensity in normal muscle. Nerve fascicles may have a signal intensity slightly higher than that in the perineurium and internal perineural tissue.

Normal findings:

1. A normal nerve on T1-weighted images appears as a smooth round or ovoid structure with an MR signal that is isointense to that in adjacent muscle.

2. A rim of hyperintense signal often surrounds peripheral nerves.

3. Normal nerves do not appear enhanced after the intravenous administration of a gadolinium-based contrast agent.

4. The MR signal in normal peripheral nerves on T2-weighted images acquired with fast SE or short inversion time inversion recovery (STIR) sequences is isointense to mildly hyperintense, compared with the signal intensity in normal muscle. Nerve fascicles may have a signal intensity slightly higher than that in the perineurium and internal perineural tissue.

5. MR imaging can readily demonstrate abnormalities such as neurogenic muscle edema or fatty muscle atrophy.

Variables to be assessed by Magnetic Resonance Imaging:

1. Anatomic site:

-Site of lesion.

-Site of nerve affected: normal site or anatomical variant.

2. Nerve:

-Signal intensity: low or high.

-Nerve shape: round, oval or flat.

-Size: small or large. It is assessed by comparison the changes occur at the whole course of the nerve.

-Degree of nerve compression: normal, mild, moderate, severe.

3. Cause of neuropathy:

-Entrapment neuropathies.

-Non- entrapment neuropathies.

4. Cause of entrapment:

-Neoplasm.

-Arthritis.

-Congenital anomaly.

5. Type of entrapment or compression:

-Focal.

-Diffuse.

6. Muscle:

-Volume: normal or decrease volume.

-Edema.

- Muscle signal: normal, mild, moderate, severe.

-Fatty atrophy.

7. Associated features:

-Fracture. -Osteoarthritis.

-Synovitis. -Bone & muscle anomalies.

-Masses.

Indications of operative treatment of non-entrapment neuropathies:

- Closed nerve injury: With no evidence of recovery either clinically or with electrodiagnostic studies at 3 months following injury, surgery is recommended.

- Open nerve injury (ie, laceration): Surgical exploration is recommended as soon as possible. All lacerations with a reported loss of sensation or motor weakness should be surgically explored.

- Crush nerve injury: Surgical exploration of the nerve may be delayed for as long as several weeks. However, after 3 months with no evidence of reinnervation electrically (motor unit potentials [MUPs] present) or clinically, surgical reconstruction with repair or graft is indicated.

Indications of operative treatment of Entrapment neuropathies:

- Acute rapidly progressive involvement of the nerve.

- Severe chronic syndromes.

- Syndrome recurrence.

- Motor involvement.