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This atlas is intended as a guide to the examination of patients with lesions of peripheral nerves or nerve roots.

Examination should, if possible, be conducted in a warm and quiet room where patient and examiner will be free from distraction. Most patients will be unfamiliar with the procedures in a neurological examination, so that the nature and object of the tests should be explained in some detail to secure their interest and co-operation.

**MOTOR TESTING**

**Inspection:** look for abnormal posture, wasting and fasciculation with the limb at rest.

**Tone:** in adults, the assessment of tone is only useful for upper motor neuron lesions.

**Power:** muscle power is assessed by testing the strength of movement at a single joint, which is usually achieved by more than one muscle acting in different ways, and these may have different spinal root and peripheral nerve supplies.

A muscle may act as a *prime mover*, as a *fixator*, as an *antagonist*, or as a *synergist*. Thus, flexor carpi ulnaris acts as a *prime mover* when it flexes and adducts the wrist; as a *fixator* when it immobilises the pisiform bone during contraction of the adductor digiti minimi; as an *antagonist* when it resists extension of the wrist; and as a *synergist* when the digits, but not the wrists, are extended.

**CHOICE OF MOVEMENT**

Ideally, movements should be chosen which help to differentiate upper from lower motor neuron lesions and be innervated by a single spinal root and peripheral nerve; and in peripheral nerve lesions, to identify the affected nerve and the site of the lesion. Therefore, preference should be given to muscles which have a single root innervation and preferably an easily elicitable reflex, a single peripheral nerve innervation, be the main or only muscle effecting the movement and one that can be seen and felt. This is not often possible, especially in the lower limb. The table on p 64 lists the commonly tested movements, indicates whether they are preferentially affected in upper motor neuron lesions, and gives their principal root supply, relevant reflex, if there is one, peripheral nerve and main effector muscle.

**TECHNIQUE**

When testing a movement, the limb should be firmly supported proximal to the relevant joint, so that the test is confined to the chosen muscle group and does not require the patient to fix the limb proximally by muscle contraction. In this book, this principle is illustrated in Figs 12, 18, 28B, 31 and many others. In some illustrations, the examiner’s supporting hand has been omitted for clarity (for example Figs 30, 34, 48 and 53). The amount of leverage applied should be such that a patient with normal strength is evenly matched with the examiner, so that minimal weakness is more easily appreciated (for example Figs 21, 70). However, the same technique should be used for all patients, so that the examiner can acquire experience of the variability in strength of different subjects. Optimal techniques are illustrated in the figures.
Muscle power may be recorded using the Medical Research Council scale, but this is not a linear scale and subdivisions of grade 4 are often necessary. Grades 4−, 4 and 4+ may be used to indicate movement against slight, moderate and strong resistance respectively.

**MRC SCALE FOR MUSCLE STRENGTH**

0  No contraction  
1  Flicker or trace of contraction  
2  Full range of active movement, with gravity eliminated  
3  Active movement against gravity  
4  Active movement against gravity and resistance  
5  Normal power

Muscles have been arranged in the order of the origin of their motor supply from nerve trunks, which is convenient in many examinations. The usual nerve supply to each muscle is stated in the captions, and the spinal segments from which it is derived, the more important of these are printed in heavy type. The peripheral nerve diagrams show the usual order of innervation as a guide to the location of a lesion. Tables showing limb muscles arranged according to their supply by individual nerve roots and peripheral nerves are to be found on pp 62–63.

**SENSORY TESTING**

Asking the patient to outline the area of sensory abnormality can be a useful guide to the detailed examination. If this clearly indicates the distribution of a peripheral nerve, for example the lateral cutaneous nerve of the thigh (meralgia paraesthetica, Fig. 59), the area can be mapped to light touch, tested with cotton wool or a light finger touch, and to pain using a clean pin (not a needle which is designed to cut the skin). In both cases, work from the insensitive towards an area of normal sensation. If the area of sensory abnormality is hypersensitive (hyperpathia), the direction is reversed.

Otherwise, it may be helpful to divide sensory testing into those modalities which travel in the ipsilateral posterior columns of the spinal cord (light touch, vibration and joint position sense) and those that travel in the crossed spinothalamic tracts (pain and temperature appreciation). Appreciation of vibration, a repetitive touch/pressure stimulus, is a sensitive test for demyelinating peripheral neuropathies. Two point discrimination is a sensitive and quantifiable test of light touch, but it is only reliable on the face and finger tips. Always start with a stimulus at or below the normal threshold and coarsen the stimulus as required.

There is considerable overlap in the area of skin (dermatome) supplied by consecutive nerve roots, so that section of a single root may result in a very small area of sensory impairment. Conversely, the rash of herpes zoster may be quite extensive, because it affects the whole area which has any supply from the affected root. The dermatome illustrations in Figs 88–94 are a compromise. The heavier axial lines, which separate non-consecutive dermatomes, are more reliable as boundaries. The area of impairment with a peripheral nerve lesion is more reliable and consistent than that from a nerve root lesion. The areas shown in the diagrams are the usual ones. Some nerves show considerable variation between patients (see Figs 25 and 59) and others are much more consistent: for example the ulnar nerve reliably splits at least part of the ring finger (see Fig. 46).
**Fig. 1** Trapezius (Spinal accessory nerve and C3, C4)
The patient is elevating the shoulder against resistance. *Arrow:* the thick upper part of the muscle can be seen and felt.

**Fig. 2** Trapezius (Spinal accessory nerve and C3, C4)
The patient is pushing the palms of the hands hard against a wall with the elbows fully extended. *Arrow:* the lower fibres of trapezius can be seen and felt.
Fig. 3 Diagram of the brachial plexus, its branches and the muscles which they supply.
**Fig. 4** The approximate area within which sensory changes may be found in complete lesions of the brachial plexus (C5, C6, C7, C8, T1).

**Fig. 5** The approximate area within which sensory changes may be found in lesions of the upper roots (C5, C6) of the brachial plexus.
Fig. 6 The approximate area within which sensory changes may be found in lesions of the lower roots (C8, T1) of the brachial plexus.
**Fig. 7** Rhomboids (Dorsal scapular nerve; C4, C5)
The patient is pressing the palm of his hand backwards against the examiner’s hand. *Arrow:* the muscle bellies can be felt and sometimes seen.

**Fig. 8** Serratus Anterior (Long thoracic nerve; C5, C6, C7)
The patient is pushing against a wall. The left serratus anterior is paralysed and there is winging of the scapula.
Fig. 9 Pectoralis Major: Clavicular Head (Lateral pectoral nerve; C5, C6)
The upper arm is above the horizontal and the patient is pushing forward against the examiner’s hand. Arrow: the clavicular head of pectoralis major can be seen and felt.

Fig. 10 Pectoralis Major: Sternocostal Head (Lateral and medial pectoral nerves; C6, C7, C8)
The patient is adducting the upper arm against resistance. Arrow: the sternocostal head can be seen and felt.
Fig. 11  Supraspinatus (Suprascapular nerve; C5, C6)
The patient is abducting the upper arm against resistance. *Arrow:* the muscle belly can be felt and sometimes seen.

Fig. 12  Infraspinatus (Suprascapular nerve; C5, C6)
The patient is externally rotating the upper arm at the shoulder against resistance. The examiner’s right hand is resisting the movement and supporting the forearm with the elbow at a right angle; his left hand is supporting the elbow and preventing abduction of the arm. *Arrow:* the muscle belly can be seen and felt.
Fig. 13  Latissimus Dorsi (Thoracodorsal nerve; C6, C7, C8)
The upper arm is horizontal and the patient is adducting it against resistance. Lower arrow: the muscle belly can be seen and felt. The upper arrow points to teres major.

Fig. 14  Latissimus Dorsi (Thoracodorsal nerve; C6, C7, C8)
The muscle bellies can be felt to contract when the patient coughs.
Fig. 15 Teres Major (Subscapular nerve; C5, C6, C7)
The patient is adducting the elevated upper arm against resistance. *Arrow:* the muscle belly can be seen and felt.