

The Brachial Plexus

I have always been a great believer in not doing today what can be safely put away until tomorrow. Hence I seem to have spent every Sunday night during my teenage years rushing to finish Friday's homework. Each issue before writing these primers I would say to myself, "I really must tackle the brachial plexus, as a working knowledge of it is essential for anyone engaged in peripheral neurophysiology". Of course I would take one look at the brachial plexus in the anatomy textbooks and rapidly chicken out. However, as this is the last of this little series there is no hiding place, so here it is, the sceptre that stalks every anatomy student's nightmares, the brachial plexus.

The brachial plexus lies between the neck and the axilla with the distal portion lying behind the clavicle and the pectoral muscles. It is formed from the C5, C6, C7, C8 and T1 nerve roots and is best understood by dividing it into three parts; trunks, divisions and cords. The upper trunk is formed from the C5 and C6 roots, the C7 root becomes the middle trunk and the lower trunk is formed by the C8 and T1 roots. Each trunk then divides into an anterior and a posterior division giving six divisions that unite to form cords at the level of the clavicle. The three posterior divisions unite to form the posterior cord, the anterior divisions of the upper and middle trunks form the lateral cord while the anterior division of the lower trunk carries on to form the medial cord. The major peripheral nerves of the upper limb are formed from the cords in the following way:

- the posterior cord gives rise to the radial and axillary nerves;
- the lateral cord gives rise to the musculocutaneous nerve; and
- the medial cord forms the ulnar nerve.

The median nerve is formed from branches of the medial and lateral cord. The other branches of the cords are shown in table 1 and figure 1. There are three branch-

es that arise proximal to the cords and these are the dorsal scapular, the suprascapular and the long thoracic nerve (figure 1).

The causes of brachial plexopathy are outlined in table 2. The top three causes in my experience are trauma, neuralgic amyotrophy and radiation plexopathy, and typically the brachial plexus is diffusely affected in these conditions so it is unusual to come across a pure middle trunk plexopathy for instance. Furthermore evaluation of a traumatic plexopathy is often complicated by nerve trauma elsewhere in the upper limb, for example axillary or radial nerves as a result of a fractured humerus.

Neuralgic amyotrophy has had more names than the artist formerly known as "Prince", being variously known as brachial plexitis, brachial amyotrophy and Parson-Turner syndrome. It often presents like a mononeuropathy, so it is not uncommon for the patient to develop a syndrome indistinguishable from either an anterior interosseus or long thoracic nerve palsy.

Post radiation induced brachial plexopathy often presents years after the initial treatment, typically after radiotherapy for breast, lung and neck cancers. It needs to be distinguished from a recurrence of the primary malignancy, and in this respect it is worth looking for myokimia on EMG as this is a common finding in radiation plexopathies.

The best known localised lesion of the brachial plexus are lower trunk plexopathies, as these arise as a result of local infiltration by tumours or as a result of a fibrous band that runs from a rudimentary first rib to the first thoracic rib.

The neurophysiological assessment of brachial plexus lesions is like a good book - it cannot be rushed. It is worth giving them two slots on an EMG list. Plexopathies can be distinguished from root lesions using sensory nerve conduction studies as in a pure radiculopathy there

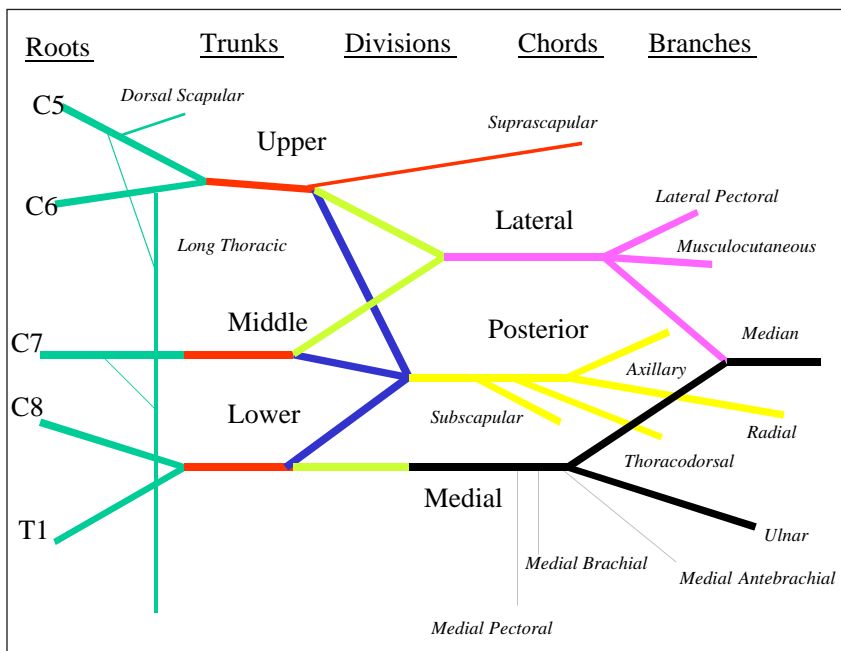


Brian McNamara is Consultant Neurophysiologist at Cork University Hospital. He was SHO and Registrar at Cork University Hospital, and SpR at Addenbrooke's Hospital in Cambridge. His interests include magnetic stimulation, cellular electrophysiology and all aspects of clinical neurophysiology.

Table 1: Branches of the brachial plexus

Roots	Branches
C5	Dorsal scapular nerve
C5, C6, C7	Long Thoracic Nerve
Trunks	
Upper	Suprascapular nerve
Divisions	
Cords	
Lateral	Lateral Pectoral
	Musculotaneous
	Median
Medial	Median
	Ulnar
Posterior	Subscapular
	Thoracodorsal
	Axillary
	Radial

Figure 1: Schematic Diagram of the Brachial plexus. Roots are shown in green, the anterior divisions in green and the posterior divisions in blue. Branches are labelled in italics.



will be denervation on EMG but sparing of the sensory nerve action potentials. Sensory assessment should aim to cover all three trunks (table 3), it is particularly important to perform sensory nerve conduction studies on the medial lateral cutaneous nerves of the forearm as these nerves are not prone to entrapment neuropathies which can confound the study of median and ulnar nerves in older patients. Motor nerve conduction studies across the brachial plexus are possible but not particularly useful in this instance. F wave studies can be helpful as they give some idea of proximal motor conduction, the principal limitation of routine motor nerve conduction studies is that they only cover one trunk of the brachial plexus (lower trunk). With needle EMG, the aim is to study muscles from each trunk and each cord. If a muscle is denervated then the finding can be confirmed by studying a muscle supplied from the same part of the brachial plexus but by a different peripheral nerve. For example if triceps is denervated then you should study the deltoid, if the deltoid is denervated then the lesion involves the posterior cord.

Correspondence Address:

Dr Brian McNamara, Dept of Clinical Neurophysiology, Cork University Hospital, Wilton Road, Cork, Republic of Ireland.
E-Mail: mcnamarab@shb.ie

Table 2: Some of the causes of Brachial Plexopathy.

Trauma
Birth Trauma (Klumpke's Palsy and Erb's Palsy)
Traction Injury
Penetrating Injuries
Neoplasm
Apical Lung Tumours
Compression by Axillary lymph nodes (Metastatic Tumours, Lymphomas)
Direct Infiltration
Inflammatory Causes
Neuralgic Amyotrophy
Radiation Plexopathy

Table 3: Sensory nerve action potentials that should be measured in assessment of brachial plexus lesions.

SNAP	Cord	Trunk
Lateral Cutaneous Nerve of the forearm	Lateral	Upper
Radial to thumb	Posterior	Upper
Median to thumb	Lateral	Upper
Median to middle finger	Lateral	Middle
Ulnar to little finger	Medial	Lower
Medial Cutaneous Nerve of the forearm	Medial	Lower

Corrective Statement regarding advertisement for Provigil®

At the MHRA's request, Cephalon would like to issue the following statement regarding our recent advertising campaign for Provigil (modafinil), which features images of driving.

Cephalon would like to point out that, while Provigil reduces excessive daytime sleepiness (EDS) in patients with narcolepsy and obstructive sleep apnoea/hypopnoea syndrome, this does not mean that such patients can assume that they will never doze off while driving and should seek advice from their healthcare professional. A reassessment of the patient's tendency to EDS after a trial of the product is required before any advice can be given as to whether or not a sufficient level of wakefulness has been resumed for the patient to be safe to drive. This process of assessment may also include the Driving and Vehicle Licensing Authority (DVLA).

Section 4.7 of the SPC draws attention to possible undesirable effects of Provigil that are relevant to driving "There is no information available concerning the effects of Provigil on vehicle driving and/or the ability to operate machinery. Undesirable effects such as blurred vision or dizziness might affect ability to drive (see 4.8 Undesirable Effects)".

Cephalon have now ceased using this campaign. We regret that our message was not perceived as intended and apologise for any confusion that may have been caused by this advertisement. Further information regarding the use of Provigil may be obtained from the Medical Information Department, Cephalon UK Limited, 20 Alan Turing Road, Surrey Research Park, Guildford, Surrey, GU2 7EH, or by calling Freephone 0800 783 4869.

National Stroke Nursing Forum

Nurses and other health and social care professionals with an interest in stroke nursing can now join the newly launched National Stroke Nursing Forum to access a central point of information and support, and network with others.

The Forum, developed by stroke nurses to meet the needs of those involved in stroke nursing, was launched at the third National Stroke Nurses Conference in Birmingham.

NSNF Chair, Tim Ayers, Consultant Nurse in Stroke (Exeter, East and Mid Devon Primary Care Trusts) said the organisation's main objectives are to provide a forum for discussion between all health professionals with an interest in stroke nursing and enable sharing of best practice. He said the forum would also provide nurses with a collective voice to influence policy development; and facilitate the development of a career pathway for nurses in the field of stroke.

The main feature of the Forum, which has been supported by an educational grant from Boehringer Ingelheim Ltd, will be an interactive website that can be accessed by members. As well as providing latest information and news, the website will allow networking with colleagues across the UK via a chat room and contact service. A regular newsletter is also under development.

Specific steering groups will focus on networking/communication; research development and education; and policy and service development.

Margaret Goose, Chief Executive of The Stroke Association welcomed the initiative adding, "We congratulate the stroke nurses who have developed the Forum for taking this lead, which will help drive forward the changes necessary to improve stroke care for patients and carers."

Mary Hopper, Team Leader, NSF for Older People, Department of Health said that the Forum would facilitate communication between all those involved in stroke nursing. She added, "The Forum will be an invaluable information resource for me to effectively consult with the whole of the UK. This is a unique initiative and I applaud the professionalism, energy and dedication of all those involved in it."

For more information about the Forum and/or to register, log on to www.nationalstrokenursingforum.com. Annual membership costs £10.