ORTHOPAEDICS

FOR PRIMARY HEALTH CARE

Volume 2

Non-Emergency and Non-Trauma Pathology

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Nerve injuries

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Learning objectives

- Understand the anatomy of a nerve.
- Understand the types of nerve injuries.
- Management and when to refer.

Anatomy of a nerve

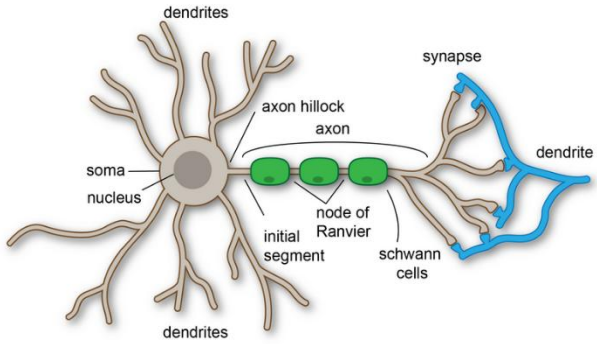

***Figure 1**: Anatomy of a nerve (Source: Curtis Neveu, CC BY-SA)*

While most other connective tissues are made of multiple cells, the functional unit of a nerve, the axon, is a single cell that, in the case of a motor nerve, might extend from the spinal cord to the foot.

The cell body sits in the anterior horn of the spinal cord and the end of this single cell sits on the motor end plate of the target muscle. This is why nerve injuries are devastating and associated with poor outcomes.

Depolarisation travels down the nerve by a relatively slow process. The myelin sheath allows the depolarisation to jump from the node of Ranvier to the next node of Ranvier, thereby accelerating the transmission in a process called saltatory conduction.

When other tissues are damaged, they can be replaced by fibroblasts, which can do a similar job to the host tissue. Nerves need to be replaced by nerves, otherwise the function is lost.

Types of nerve injury

Neuropraxia

Here the nerve is just "bruised", with a temporary inability to transmit the impulse from the cell body to the end organ. There is no intrinsic cell damage. Recovery should be 100% and can take anything from a few seconds – such as in the case of "funny bone" or a numb leg after sitting on a hard chair – to a few weeks.

Axonotmesis

Here the axon is damaged, but not the myelin sheath. The cell will make building blocks to send down to the damaged end to repair and regrow. The nerve can only grow down in an intact nerve tube. Recovery is incomplete, but fairly good. It is a slow process as nerves grow at 1mm a day.

Neurotmesis

Lumbar Here the whole nerve is divided by an extreme distraction force or a transection by a sharp object. Recovery is impossible unless it is surgically repaired.

After surgery, recovery is poor due to the inability to align the parts perfectly. In this sense, it is a macroscopic solution to a microscopic problem.

Management

General principles

There is a need to differentiate a neuropraxia (minor) from a neurotmesis (major).

Neuropraxia follows low-energy, non-penetrating trauma.

Consider that all nerves have a motor and a sensory component. Commit the peripheral nerve dermatomes to memory.

In neuropraxia, the sensation in that nerve's distribution might be intact.

If a high-energy or penetrating injury presents with nerve deficit, assume that it is neurotmesis and refer the patient to a hand or peripheral nerve surgeon.

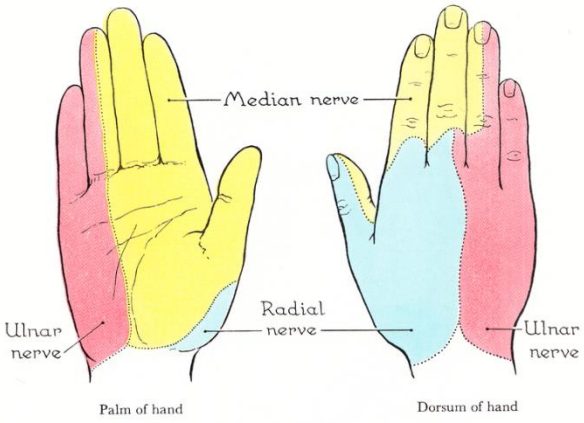

***Figure 2**: Dermatomes of the hand (Source: JCB Grant, CC0)*

Radial nerve

Supplies

Elbow extension

- Triceps

Wrist extension

- Extensor carpi radialis longus (ECRL)
- Extensor carpi radialis brevis (ECRB)
- Extensor carpi ulnaris (ECU)

Finger extension

- Extensor digitorum communis (EDC)
- Extensor indicis proprius (EIP)
- Extensor digiti minimi (EDM)

Thumb extension

- Extensor pollicis longus (EPL)
- Extensor pollicis brevis (EPB)
- Abductor pollicis longus (APL)

Presents with:

- Wrist drop
- Finger drop
- Thumb drop

Types:

- Saturday night palsy
- Associated with humerus fracture open or closed
- Penetrating

Management

If you suspect a neuropraxia, such as Saturday night palsy, then use a wrist extension splint to avoid contracture and refer to physiotherapy to maintain passive range of motion. There is expectant recovery.

If there is a penetrating injury, refer early to a nerve surgeon.

Ulnar nerve

Supplies

Extrinsics (muscles in forearm)

- Flexor carpi ulnaris (FCU)
- Flexor digitorum profundus (FDP) to little and ring fingers

Intrinsics (small muscles in hand)

- All interossei
- Hypothenar muscles
- Adductor pollicis
- Lumbricals to little and ring fingers

Presents with:

- Ulnar nerve claw - Hyperextended metacarpophalangeal joints (MPJs) of the little and ring fingers and a flexed position of the proximal interphalangeal joints (PIPJs) in the little and ring fingers.

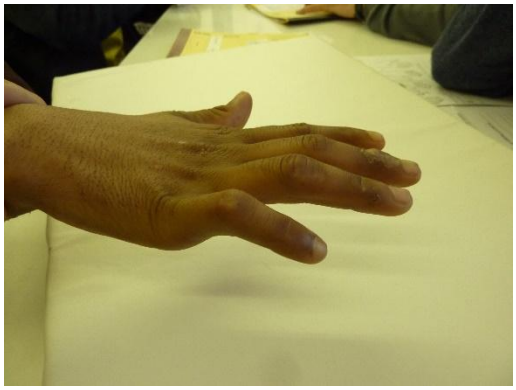

***Figure 3**: Ulnar nerve claw*

- Weak pinch - Tends to hyperflex the thumb interphalangeal (IP) joint (Froments sign).

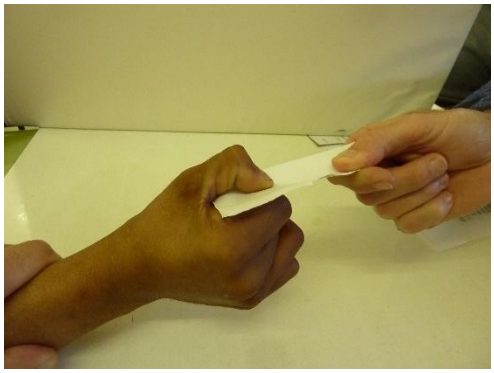

***Figure 4**: Weak pinch leading to a Froments sign when asked to pull a piece of paper*

Median nerve palsy

Supplies

Extrinsics (muscles in forearm)

- Flexor carpi radialis (FCR)
- Flexor digitorum profundus (FDP) to the index and middle fingers

Intrinsics (small muscles in hand)

- Thenar muscles – opposition, abduction, flexion
- Lumbricals of the index and middle fingers

Presents with:

- Inability to flex the thumb and index finger when trying to make a fist.
- High median nerve palsy only.
- Benediction sign/pointing sign/gun sign/trigger sign.

***Figure 5**: Benediction sign in a patient with median nerve palsy*

Other nerves

Brachial plexus

Obstetric:

- Usually occurs due to an obstructed labour with shoulder dystocia. Most patients recover but 10% need surgery.
- Refer at a maximum of 2 months for assessment if the patient has not recovered fully.

Traction:

- Low-energy: Associated with a dislocated shoulder. It is important that it is documented before reducing the shoulder. Most patients recover.
- High-energy: Associated with a fall from a height or a motorbike accident onto the shoulder. It needs early referral.

Peroneal nerve

- Injury occurs due to a direct blow to the peroneal nerve as it winds around the fibula neck or following major knee injury.
- It presents with foot drop.
- Orthosis and referral are required.

Sciatic nerve

- It can present with a substantial loss of function and sensation in the lower leg after a fracture of the pelvis or dislocation of the hip.
- Refer early.

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ABOUT THE BOOK

This is the second volume of the *Orthopaedics for Primary Health Care* textbook edited by Michael Held, first published in 2021.

Most patients with orthopaedic pathology in low- and middle-income countries are tested by non-specialists. This book was based on a Delphi consensus study* with experts from Africa, Europe and North America to identify topics, skills and cases concerning orthopaedic trauma and infection that need to be prioritised in order to provide guidance to these health care workers.

The aim of this book is to be student-centred.

*Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):elO.

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This textbook is not intended as a substitute for the medical advice of physicians.

The information in this book is meant to supplement, not replace, orthopaedic primary care training.

The authors, editor and publisher advise readers to take full responsibility for their safety and know their limits. Before practicing the skills described in this book, be sure that your equipment is well maintained, and do not take risks beyond your experience, aptitude, training or comfort level.

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