

# Neuropathy

## Biomedical Engineering - URJC

Rafa Carretero, MD, PhD

Internal Medicine Department

29 February 2024



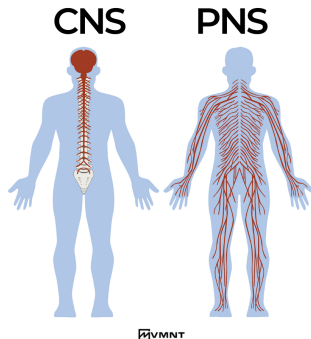
Universidad  
Rey Juan Carlos

# Introduction

## Peripheral Nervous System

Peripheral Neuropathy involve disorders of **peripheral nerves**:

- 1 cranial nerves
- 2 spinal nerve roots
- 3 nerve trunks
- 4 nerves of the autonomic nervous system



# Introduction

## Categories

They can be categorized as:

- mono-neuropathy
- multifocal neuropathy
- polyneuropathy

## Pathophysiology

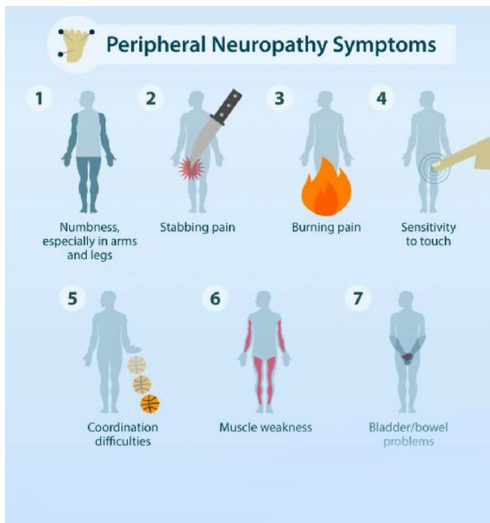
They can also be categorized as:

- Axonal
- Demyelinating
- Mixed

# Introduction

## Common symptoms

- Numbness, paresthesias
- Burning in the limbs, pain
- Weakness, and loss of deep tendon reflexes



- 1 Diabetic peripheral neuropathy is common, leading to complications such as foot ulcers and infections.
- 2 Carpal tunnel syndrome is the most prevalent mononeuropathy.

# Etiology

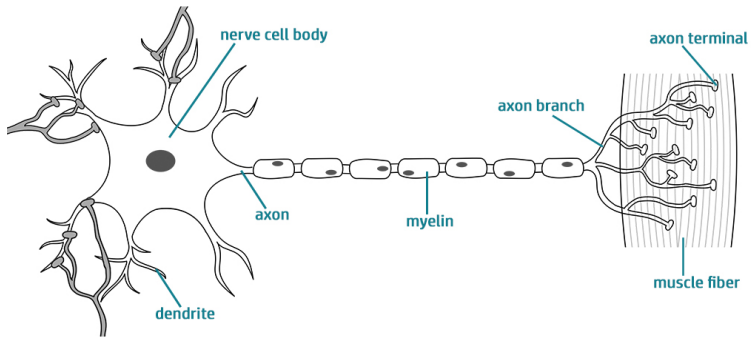
## Causes (I)

- Diabetes mellitus
- Chronic alcoholism
- Nutritional deficiencies (Vitamins B1, B6, B12)
- Inflammatory conditions (vasculitis)
- Hypothyroidism
- Autoimmune disease (Sjogren syndrome, lupus, rheumatoid arthritis)
- Infections

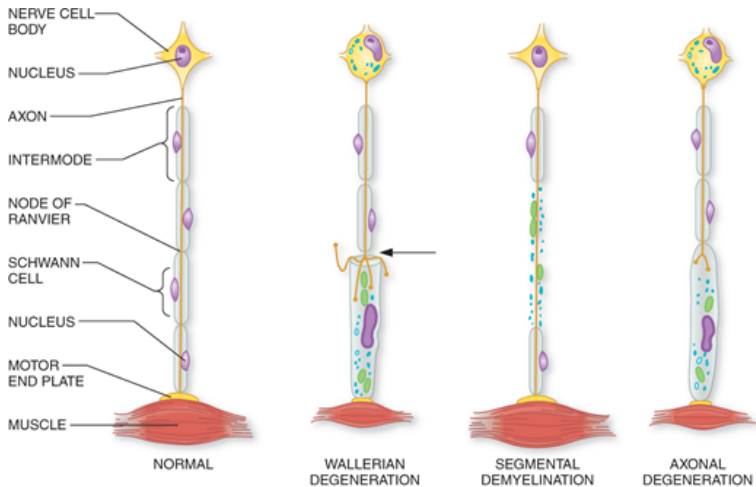
## Causes (II)

- Guillain-Barre syndrome
- Toxins (heavy metals, chemicals)
- Chemotherapy agents
- Medications (antibiotics, cardiovascular medications)
- Tumors (secondary to compression or associated paraneoplastic syndromes)
- Inherited conditions
- Trauma/injury

# Pathophysiology



# Pathophysiology



Source: Rooper AH, Samuels MA, Klein JP, Adams and Victor's Principles of Neurology, Tenth Edition: [www.accessmedicine.com](http://www.accessmedicine.com)  
Copyright © The McGraw-Hill Companies, Inc. All rights reserved.



## Segmental Demyelination

- Degeneration of the myelin sheath
- Sparing of the nerve axon
- MonoNeuropathy, sensorimotor, or, principally, motor Neuropathy
- Typical of inflammatory and sometimes immune-mediated disorders

## Wallerian Degeneration

- Nerve axon degenerates due to a lesion or physical compression
- the portion distal to the axon passively wastes away, due to a lack of nutrients from the cell body
- Focal mononeuropathy, secondary to trauma or infarction of the nerve

## Axonal Degeneration

- Symmetrical polyneuropathy (around 80 %)
- Weakness, most notably weakness in dorsiflexion of the ankles and foot, with accompanied trophic changes to muscle
- The axon degenerates in a pattern that starts distal and progresses proximally
- Diabetes, HIV, and Guillain-Barre syndrome

# Clinical Presentation

Varies depending on the underlying disease process:

- Some symptoms initially starting in digits and progressing to their proximal limbs.
- Symptoms range and include changes in sensation, weakness, atrophy, pain, numbness, and even autonomic disturbances.
- Advanced disease may progress to reduced or absent deep tendon reflexes, stocking-glove pattern sensory loss, muscle wasting, and weakness.

# Clinical Presentation

## Loss of sensation

- Hypoesthesia
- Difficulty discriminating textures
- Cottony feeling in hands
- Unsteady gait because of sensory ataxia
- Painless burns and traumas

## Positive and motor symptoms:

- Painful symptoms
- Burning sensation
- Hyperalgesia
- Flaccid distal weakness
- Hyporreflexia
- Muscle atrophy if axonal injury

# Evaluation

## Diagnostic tests

- No standard laboratory tests
- Narrowing down the underlying cause

### Test (I)

- Electrolyte imbalances
- Testing for diabetes
- Vitamin deficiencies (B1, B6, folate, B12)
- Heavy metal toxicities
- Infectious workup HIV, syphilis.

### Tests (II)

- Thyroid function testing.
- Autoimmune diseases
- Electromyography
- MRI or CT scans
- Nerve biopsy
- Genetic testing

# Treatment / Management

- Treatment focuses on addressing **underlying causes**, such as glucose control in diabetic neuropathy.
- Therapies include **corticosteroids**, immunoglobulin, and physical therapy.
- Neuropathic pain may require **membrane stabilizers** and **antidepressants**.
- Patient education is crucial for preventing injuries and infections.

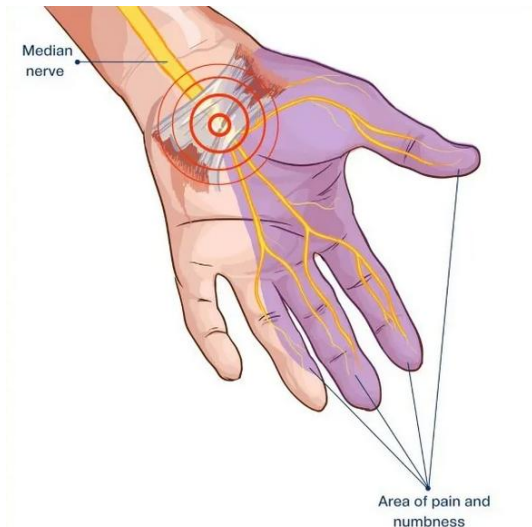
# Special Types of Neuropathy

## Compression neuropathies

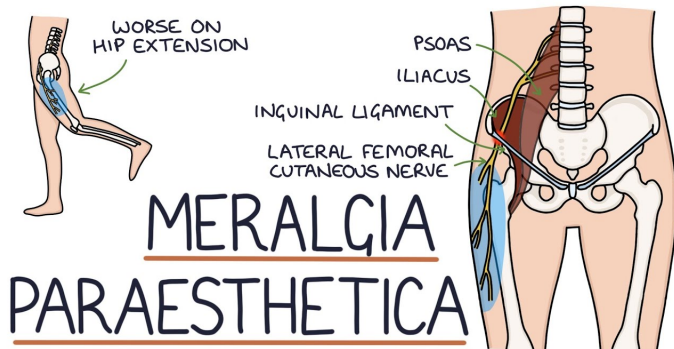
- The typical example is the **carpal tunnel syndrome**, affecting the **median nerve**.
- It is a **mono-neuropathy**.



# Special Types of Neuropathy



# Special Types of Neuropathy



# Special Types of Neuropathy

## Hereditary motor and sensory neuropathy (HMSN)

- The typical example is the Charcot-Marie-Tooth disease.
- Usually they are **polyneuropathy**.

# Special Types of Neuropathy

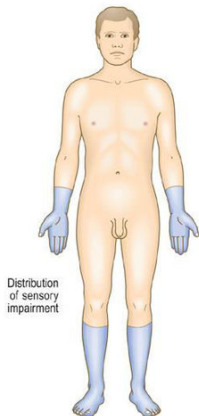
## Metabolic Neuropathy: Diabetes

- Sensory, motor, and autonomic neuropathy
- Peripheral nerve damage include oxidative stress damage, accumulation of sorbitol, and advanced glycosylation end products
- Usually they are **polyneuropathy** and distal sensory peripheral neuropathy.
- *Stocking-glove distribution.*
- Any kind of neuropathy: mononeuropathy, multiplex mononeuropathy (multiple mononeuritis), polyneuropathy, radiculopathy, and even cranial nerves.

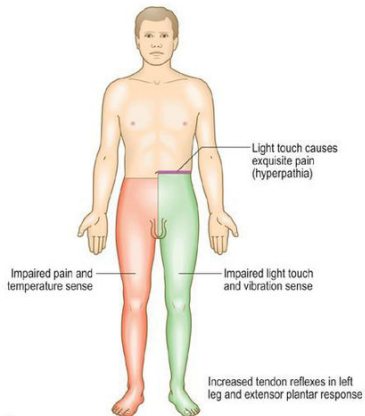
# Special Types of Neuropathy



# Special Types of Neuropathy



A



B

# Special Types of Neuropathy

## Toxic and nutritional deficit-related Neuropathy

- **Polyneuropathy** presenting with distal sensory deficits, paraesthesia, burning pain, distal muscle weakness, and impaired motion.

# Special Types of Neuropathy



## Symptoms of Neuropathy **FROM ALCOHOL ABUSE**

*These symptoms tend to worsen the longer and more severe the alcohol abuse is:*

- "Pins & Needles" sensation
- Pain in legs & arms
- Impotence
- Heat intolerance
- Constipation
- Incontinence