

## Outlines:

- Anatomy & Physiology.
- Common symptoms history.

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Introductory: Section 2, CH.7: Nervous System.

Note: This summary contains all Macleod's important notes.



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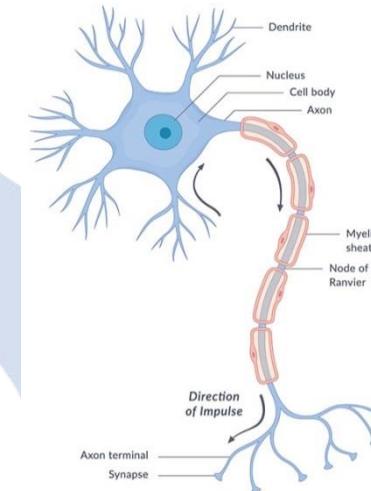




# Nervous System History

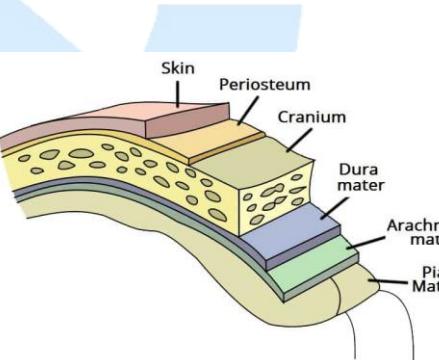
## Anatomy

- The nervous system consists from **CNS & PNS** .
- CNS consists from **brain** and **spinal cord**.
- PNS consists from **somatic** and **autonomic nerves**.
- The neuron is the **functional unit** of the nervous system.
- Each neuron has a **cell body** and **axon** terminating at a synapse, supported by **astrocytes** and **microglial cells**.
- Astrocytes** provide the structural framework for the neuron, **control their biochemical environment** and form the **blood– brain barrier**.
- Microglial cells** are **blood-derived mononuclear macrophages** with immune function.
- In the CNS, myelin is produced by **oligodendrocytes**.
- In the PNS, myelin is produced by **Schwann cells**.



## ✓ Meninges

- Brain and spinal cord are covered with **three membranous layers** called the meninges: **dura mater** next to the bone, **arachnoid** and **pia mater** next to the nervous tissue.

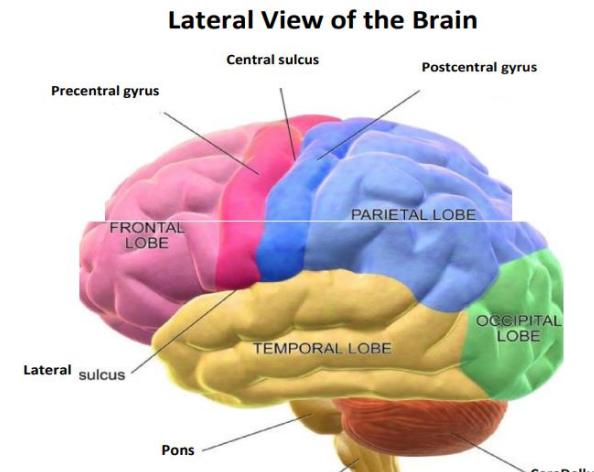


## ✓ CSF

- The subarachnoid space between the **arachnoid** and **pia** is filled with cerebrospinal fluid (CSF) produced by the **choroid plexuses**.
- The total volume of CSF is between **140 and 270 mL** and there is a turnover of the entire volume 3–4 times a day .
- Rate of production **700 mL per day** .

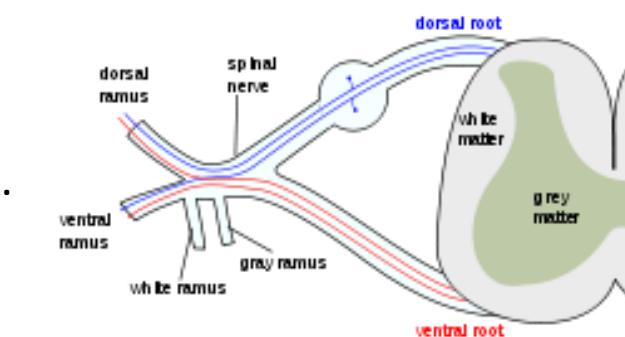
## ✓ Brain

- Two cerebral hemispheres, each with **four lobes (frontal, parietal, temporal and occipital)**, the brainstem and the cerebellum.
- The **brainstem** comprises **the midbrain, pons and medulla**.
- The **cerebellum** has two hemispheres and a central vermis attached to the brainstem by three pairs of cerebellar peduncles.



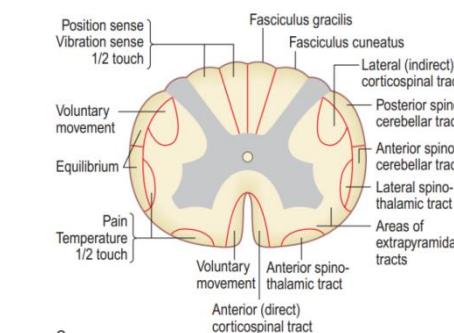
## ✓ Spinal cord

- The spinal cord is the **main pathway for information** connecting the brain and PNS.
- contains **ventral grey horn & dorsal grey horn**.
- Ventral roots** consist of efferent fibers that arise from motor neurons found in ventral grey horns.
- The **dorsal roots** are afferent fibers, receiving sensory information from organs to be transmitted to brain through sensory neurons found in dorsal grey horn.



### The spinal cord contains multiple tracts :

- Dorsal column (fasciculus gracilis and fasciculus cuneatus) :** Proprioception , vibration.
- Anterior & lateral corticospinal tracts:** voluntary movements
- Anterior & lateral spinothalamic tracts:** pain , tempertaure .
- Spinocerebellar tract:** equilibrium



## Peripheral nervous system

- Peripheral nerves may have myelinated or unmyelinated axons.
- Contains somatic and autonomic nerves .
- Somatic nerves: consist of sensory and motor nerves.



# History

- **The history is the key for diagnosis** as physical exam may be normal or unhelpful.
- In cases of **amnesia or loss of consciousness** we need additional **witness history**.
- We should **clarify exactly** what the patient means by any neurological symptom.
- Ask the patient **what they fear might be wrong**.
- For any neurological symptom ask about **onset, duration, pattern, exacerbating, relieving factors and associated symptoms**.

## Symptoms

### **1-Headache**

1. May be either **Primary** or **Secondary**.
2. Use **SOCRATES** to analyze it
3. **Isolated headache with a truly abrupt onset** may represent a potentially serious cause such as **Subarachnoid Haemorrhage** or **Cerebral Vein Thrombosis**, whereas **recurrent headache** is much more likely to be **benign** primary headache.

#### ✓ **Primary (idiopathic) causes**

1. Migraine
2. Tension Headache
3. Trigeminal Autonomic Cephalgias (Including Cluster Headache)
4. Primary Stabbing Headache
5. Cough, Exertional Or Sex Headache
6. Primary Thunderclap Headache

#### ✓ **Secondary (or symptomatic) headaches**

- **Meningitis**: associated with **neck stiffness, fever, rash, signs of raised intracranial pressure and false localizing signs, meningism**.
- **Subarachnoid hemorrhage**: **Abrupt onset**, may be **fatal** at onset, associated with **nausea/ vomiting, reduced consciousness, 3rd palsy**.

- **Temporal arteritis**: usually occur in patients **more than 55 yrs**, presents with **jaw pain on chewing, visual symptoms**, and **tender temporal arteries, elevated ESR and CRP**.

### Migraine

- Recurrent attacks of **moderate to severe** headaches.
- Mostly **unilateral**.
- Evolve over **30 minutes to 2 hours**, lasting **up to 72 hours**, with weeks to months of **symptoms free**.
- Classified into **Classic (With Aura)** and **Common (Without Aura)**.
- Associated with **Nausea/Vomiting, Photophobia/Phonophobia**
- During the attack the patient prefers to be in a **dark room**.

### Cluster headaches

- **Abrupt onset**, Attacks **last up to 2 hours**.
- Recurrent attacks **1-4 times within 24 hours**, lasting weeks to months, with months to years of remission.
- **Awake the patient** from sleep.
- Orbital/retro-orbital; **Always Same Side During Cluster**, may switch sides between clusters
- Autonomic features, including **conjunctival injection, tearing, nasal stuffiness, ptosis, miosis, agitation**
- During the attack the patient keep pacing around the room in an agitated state, or even head banging.

### Stabbing headache

- **Abrupt onset**
- Last **very briefly**, seconds or less
- **Anywhere**
- Common in patients **with migraine**



## 2-Disturbances Of Consciousness

### \*\*Causes:

1. **Postural hypotension.**
2. Neurocardiogenic syncope (**Vasovagal**).
3. **Hypersensitive carotid sinus syndrome** (pressure over carotid sinus may lead to reflex bradycardia and syncope).
4. **Cardiac syncope** due to arrhythmias or mechanical obstruction of cardiac output.

### Syncope

- Most common cause of **transient loss of consciousness**.
- Due to **inadequate cerebral perfusion**.
- May be due to **vasovagal (reflex) or cardiac syncope**.

#### 1. **Vasovagal Syncope**

- It occurs due to **stimulation of parasympathetic system** due to **Pain , Emotion or illness** or in **people forced to stand in warm environment**. Leads to vasodilation and bradycardia.
- Often preceded by **light-headedness, vision dimming, tinnitus & nausea**.
- Lasts **1-2 minutes**.
- It causes **pale or grey skin**
- May be associated with myoclonic jerks
- If kept flat, recovery is rapid

#### 2. **Cardiac syncope**

- Syncope with **No Previous Alarm Or Trigger Or Exercise**.
- Causes: **hypertrophic cardiomyopathy, severe aortic stenosis or arrhythmia**.

### Postural hypotension

- Could be due to
  - 1- drugs (levodopa or anti hypertensive drugs) or
  - 2- autonomic diseases such as DM
  - 3- in people more than 65 years
  - 4- Hypovolemia

### How to ask about syncope??

- Ask about **witness**
- **any preceding symptoms** (palpitation, chest pain, lightheadedness, nausea, tinnitus, sweating and visual disturbance).
- **Duration** of loss of consciousness.
- **Appearance** of the patient while unconscious.
- Any **injuries sustained**.
- **Time to recovery** to full consciousness and normal cognition

### 3- Epileptic Seizures

- **Paroxysmal electrical discharges** from either the **whole brain (generalized)** or **part of the brain (focal)**.
- The **history** from the patient and witnesses can help distinguish epilepsy from syncope
- Usually triggered by **sleep deprivation or alcohol or drugs**.
- **Types:**
  1. **Generalized:** tonic-clonic seizure MC form
  2. **Focal (partial)**
- Tonic clonic seizure**
  - **Tonic phase:** typically follows a stereotyped pattern with early loss of consciousness associated with body stiffening
  - **Clonic phase:** rhythmical jerking subsiding over 0.5 – 2 minutes
- **Postictal phase:** period of **unresponsiveness** often with heavy breathing, the patient appears to be deeply sleep and finally confusion as the patient awakes.



## 7.2 Features that help discriminate vasovagal syncope from epileptic seizure

Feature	Vasovagal syncope	Seizure
Triggers	Typically pain, illness, emotion	Often none (sleep deprivation, alcohol, drugs)
Prodrome	Feeling faint/ lightheaded, nausea, tinnitus, vision dimming	Focal onset (not always present)
Duration of unconsciousness	<60 s	1–2 mins
Convulsion	May occur but usually brief myoclonic jerks	Usual, tonic-clonic 1–2 mins
Colour	Pale/grey	Flushed/cyanosed, may be pale
Injuries	Uncommon, sometimes biting of tip of tongue	Lateral tongue biting, headache, generalised myalgia, back pain (sometimes vertebral compression fractures), shoulder fracture/dislocation (rare)
Recovery	Rapid, no confusion	Gradual, over 30 mins; patient is often confused, sometimes agitated/aggressive, amnesia

### Focal seizure

- **Simple** (consciousness is preserved) or **complex** (impaired consciousness)
- Characterized by **whichever part of the brain is involved**
- **Frontal lobe seizures:** focal **motor** seizure.
- **Temporal lobe seizures** characterized by **autonomic and/or psychic symptoms**, often associated with **automatisms** such as lip smacking or swallowing.

Difficult to distinguish from epileptic seizures, **clues to differentiate**

### psychogenic seizures:

1. occurring **multiple** times in a day.
2. may last considerably **longer**.
3. symptoms **waxing and waning**.

Functional dissociative attacks (non-epileptic or psychogenic attacks or pseudoseizures)

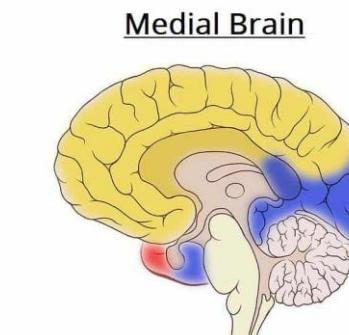
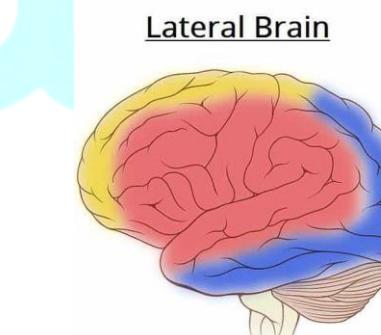
4. **asynchronous** movements.
5. pelvic thrusts, **side-to-side** rather than flexion/extension movements.
6. **absence** of postictal **confusion**.

- The widespread availability of videophones allows witnesses to **capture such events**.

### 4- Stroke symptoms

- **STROKE** is a focal **neurological deficit of rapid onset** that is due to a vascular cause, maybe **ischemic** or **hemorrhagic**.
- **Transient Ischaemic Attack (TIA)** is the same but symptoms **resolve within 24 hours**.

- TIAs are an important risk factor for impending stroke and demand urgent assessment and treatment.
- Symptoms are dictated by the vascular territory involved
- Much of the cerebral hemispheres are supplied by **the anterior circulation (Anterior and Middle cerebral arteries)** which are derived from the **internal carotid artery** .
- **the occipital lobes and brainstem are supplied by the posterior circulation (Posterior Cerebral Artery)** which is derived from vertebralbasilar circulation).



- Anterior Cerebral Artery
- Middle Cerebral Artery
- Posterior Cerebral Artery



## Ischemic And Hemorrhagic Stroke

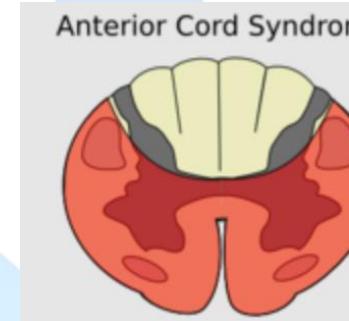
- 80% of strokes are **ischemic**
- **Hemorrhagic** stroke is much more frequent in **Asian populations**.
- Factors in the history or examination that increase the likelihood of **haemorrhage include:**

### Use Of Anticoagulation, Headache, Vomiting, Seizures And Early Reduced Consciousness.

- We have to do **brain CT without contrast** to differentiate between them.
- Isolated vertigo, amnesia or TLOC are rarely, if ever, due to stroke.

### Spinal strokes

- very rare; patients **present with abrupt onset , depending on the level of spinal cord affected.**
- **Anterior Spinal Artery Syndrome** is MC , causes loss of motor function , pain/temperature sensation, with sparing of joint position & vibration sensation **below the level of the lesion(sparing dorsal column).**



## 5-Dizziness and Vertigo

### Dizziness :

- Recurrent **dizzy spells** affect approximately 30% of those over 65 years.

#### • Causes :

- 1- Postural hypotension
- 2- Cerebrovascular disease
- 3- Cardiac arrhythmia
- 4- Hyperventilation induced by anxiety and panic.

### Vertigo: the **illusion of movement**.

- indicates a problem in **the vestibular apparatus (Peripheral)** (most common) or **the brain (Central)**.

### Peripheral Causes Of Vertigo:

- 1- **Benign paroxysmal positional vertigo (BPPV)**: recurrent episodes of vertigo lasting **a few seconds** , attacks increased **when sleeping on the affected side** or with **movement**.
- 2- **Meniere disease**: vertigo lasting **minutes or hours**, associated with **hearing loss, tinnitus, nausea and vomiting**.

### Central causes of vertigo:

- 1- Migrainous vertigo (with or without headache)
- 2- Stroke
- 3- Multiple sclerosis
- 4- TIAs **do not cause isolated** vertigo.

## 6-Functional/ Psychogenic / Hysterical / Somatization / Conversion Disorder

- **Not due to a true neurological disease**
- Presentations include **blindness, tremor, weakness and collapsing attacks**, and patients will often describe **numerous other symptoms**, with **fatigue, lethargy, pain, anxiety and other mood disorders commonly associated**.

### Clues include:

- 1- Symptoms **not compatible with disease** (such as retained awareness of convulsing during nonepileptic attacks, or being able to walk normally backwards but not forwards)
- 2- considerable **variability in symptoms** (such as intermittent recovery of a hemiparesis)
- 3- **multiple symptoms** with numerous visits to other specialties and multiple unremarkable investigations, leading to numerous different Diagnoses.

- Most functional neurological disorders follow recognizable patterns, so **be cautious when the pattern is atypical**.



## Past medical history

- History of **previous visual loss (optic neuritis)** in someone presenting with **numbness** suggests **multiple sclerosis**.
- **Birth history and development** may be significant, as in **epilepsy**.
- If considering **a vascular cause** of neurological symptoms, ask about important risk factors, such as other **vascular disease, hypertension, family history and smoking**.

## Drug history

- Always enquire about drugs, including prescribed, over-the counter, complementary and recreational/illegal ones.
- **Phenytoin** toxicity causes **ataxia**.
- Excessive intake of **simple analgesia** causing **Medication Overuse Headache**; use of **cocaine** provoke **convulsions**.

## Family history

- Parental **Consanguinity** is common, increasing the risk of autosomal recessive conditions.
- **Single-gene defects**: such as **myotonic dystrophy or Huntington's disease**.
- **Polygenic influences**, as in **multiple sclerosis** or migraine.
- Mitochondria uniquely have their own DNA, and abnormalities in this DNA can **cause a range of disorders** that manifest in many different systems (such as diabetes, short stature and deafness), and may cause common neurological syndromes such as migraine or epilepsy.
- Some diseases, such as **Parkinson's or motor neuron disease**, may be either due to **single-gene disorders or sporadic**.

## Social history

- How are patients **coping** with their symptoms? Are they **able to work and drive**?
- **Alcohol** it affects CNS (**ataxia, seizures, dementia**) & PNS (neuropathy)
- Ask about **diet**
  - **Vitamin deficiency** may occur in **alcoholism or dietary exclusion**.
  - **Vegetarians** may be susceptible to **vitamin B12 deficiency (Subacute Combined Degeneration Of The Spinal Cord)**.
- Ask about recreational drugs
- **Nitrous Oxide Inhalation** causes subacute combined degeneration of the cord due to dysfunction of the vitamin B12 pathway
- **Smoking** contributes to vascular and malignant disease.
- A **Travel History** may give clues to the underlying diagnosis such as:
  - **Lyme disease (facial palsy)**
  - **Malaria (coma)**
- Always consider **sexually transmitted or bloodborne infection**, such as human immunodeficiency virus (**HIV**) or **syphilis**, as both can cause a wide range of neurological symptoms and are treatable

## Occupational history

- **Lead exposure** : motor neuropathy.
- **Manganese** causes Parkinsonism.
- Some neurological diagnoses may adversely affect occupation, such as **epilepsy in anyone who needs to drive or operate dangerous machinery**.
- For patients with cognitive disorders, particularly dementias, it may be necessary to patients to stop working.