Neurology Extra topics

- Most of these topics are not mentioned in the slides but there were questions about them in the mini OSCEs and past papers

  Best of luck ☁️

2 Parietal lobe

Dominant side

FUNCTION
Calculation
Language
Planned movement
Appreciation of size, shape, weight and texture

LESIONS
Dyscalculia
Dysphasia
Dyslexia
Apraxia
Agnosia
Homonymous hemianopia

Non-dominant side

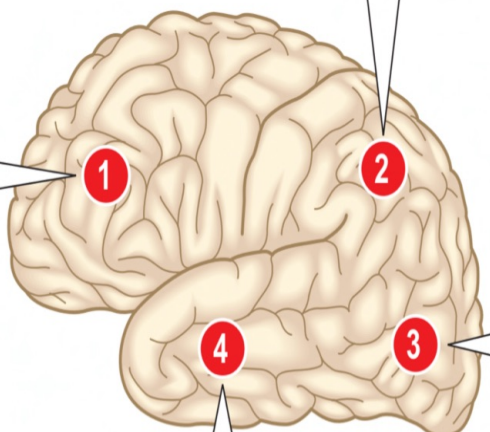
FUNCTION
Spatial orientation
Constructional skills

LESIONS
Neglect of non-dominant side
Spatial disorientation
Constructional apraxia
Dressing apraxia
Homonymous hemianopia

1 Frontal lobe

FUNCTION
Personality
Emotional response
Social behaviour

LESIONS
Disinhibition
Lack of initiative
Antisocial behaviour
Impaired memory
Incontinence
Grasp reflexes
Anosmia



3 Occipital lobe

FUNCTION
Analysis of vision

LESIONS
Homonymous hemianopia
Hemianopic scotomas
Visual agnosia
Impaired face recognition (prosopagnosia)
Visual hallucinations (lights, lines and zigzags)

4 Temporal lobe

Dominant side

FUNCTION
Auditory perception
Speech, language
Verbal memory
Smell

LESIONS
Dysphasia
Dyslexia
Poor memory
Complex hallucinations (smell, sound, vision)
Homonymous hemianopia

Non-dominant side

FUNCTION
Auditory perception
Music, tone sequences
Non-verbal memory (faces, shapes, music)
Smell

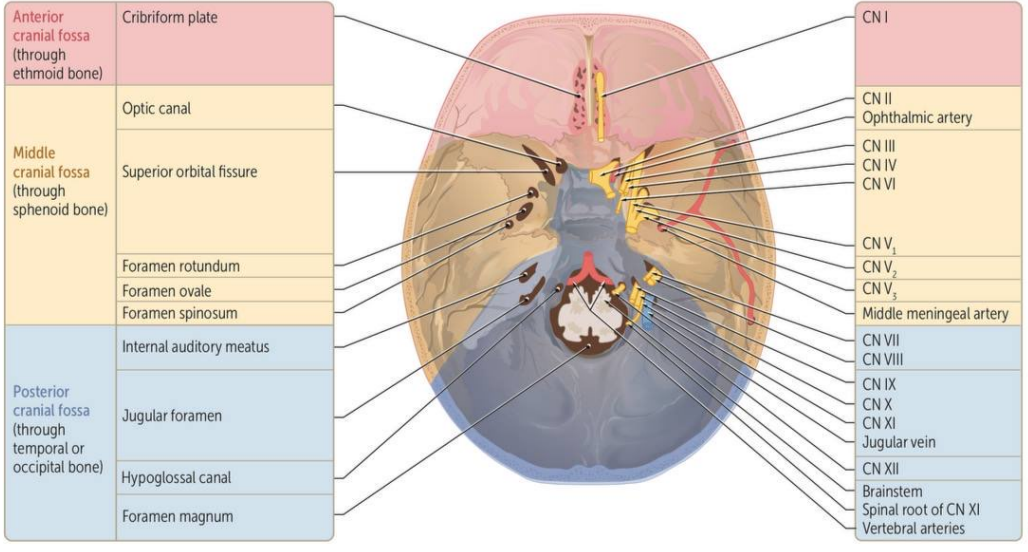
LESIONS
Poor non-verbal memory
Loss of musical skills
Complex hallucinations
Homonymous hemianopia

A

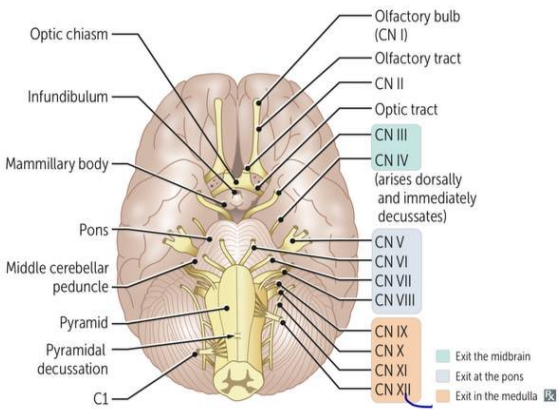
TABLE 11-1. Aphasias

Type	Fluency	Comprehension	Repetition	Commonly Associated Signs	Lesion Location
Broca	Impaired	Relatively preserved	Impaired	Right hemiparesis (especially face)	Broca's area (inferior frontal)
Wernicke	Preserved, but often nonsensical or "jargon aphasia"	Impaired	Impaired	Right upper quadrantanopia	Wernicke's area (superior temporal)
Conduction	Preserved	Preserved	Impaired	Many paraphasic errors	Arcuate fasciculus, insula, temporal isthmus
Transcortical motor	Impaired	Preserved	Preserved. In some cases repetition is the only verbal output	Right hemiparesis	Subcortical, adjacent to Broca area
Transcortical sensory	Preserved	Impaired	Preserved	–	Subcortical, adjacent to Wernicke area
Global	Impaired	Impaired	Impaired	Severe right hemiparesis, gaze deviation to left	Large left hemisphere lesion
Subcortical	Variable	Variable	Variable, often preserved	Hypophonia, often in patients with basal ganglia lesions	Left basal ganglia, thalamus

Cranial nerves and vessel pathways



Brainstem—ventral view



- CN are above pons (I, II, III, IV).
- CN exit the pons (V, VI, VII, VIII).
- CN are in medulla (IX, X, XI, XII).
- CN nuclei are medial (III, IV, VI, XII).

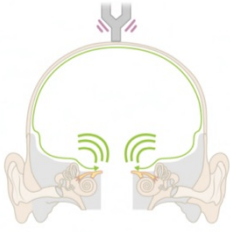
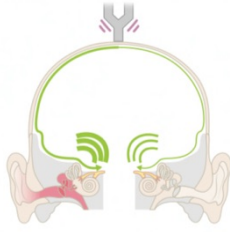
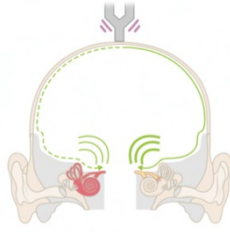
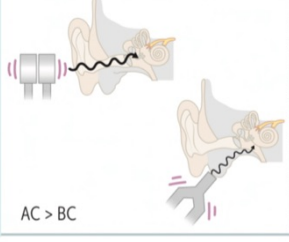
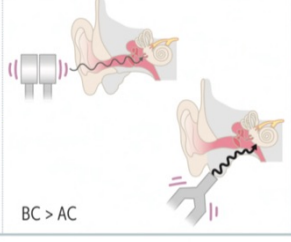
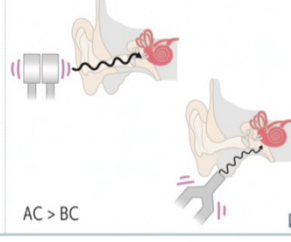
"Factors of 12, except 1 and 2."

Cranial nerve refl xes

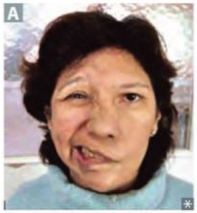
REFLEX	AFFERENT	EFFERENT
Accommodation	II	III
Corneal	V_1 ophthalmic (nasociliary branch)	Bilateral VII (temporal and zygomatic branches—orbicularis oculi)
Cough	X	X (also phrenic and spinal nerves)
Gag	IX	X
Jaw jerk	V_3 (sensory—muscle spindle from masseter)	V_3 (motor—masseter)
Lacrimation	V_1 (loss of reflex does not preclude emotional tears)	VII
Pupillary	II	III

Common cranial nerve lesions

CN V motor lesion	Jaw deviates **toward** side of lesion due to unopposed force from the opposite pterygoid muscle.
CN X lesion	Uvula deviates **away** from side of lesion. Weak side collapses and uvula points away.
CN XI lesion	Weakness turning head to contralateral side of lesion (SCM). Shoulder droop on side of lesion (trapezius).
CN XII lesion	LMN lesion. Tongue deviates **toward** side of lesion ("lick your wounds") due to weakened tongue muscles on affected side.

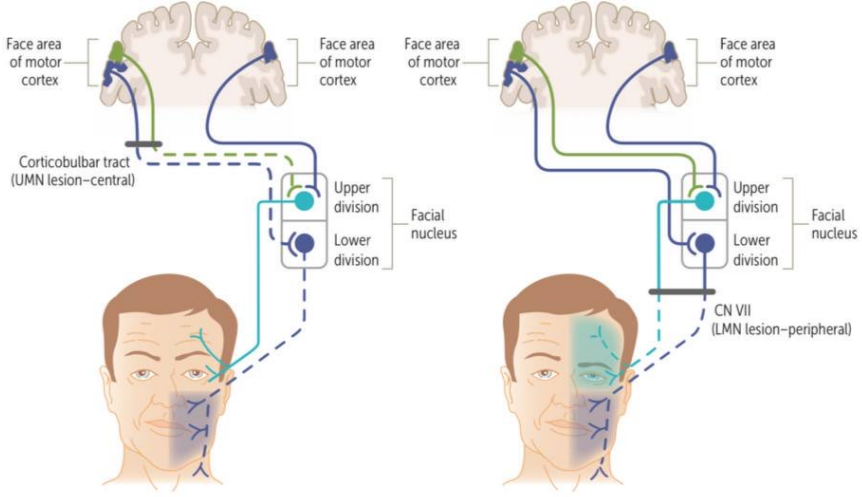
	Normal	Conductive	Sensorineural
Weber test Tuning fork on vertex of skull	 No localization	 Localizes to affected ear ↓ transmission of background noise	 Localizes to unaffected ear ↓ transmission of all sound
Rinne test Tuning fork in front of ear (air conduction, AC), Tuning fork on mastoid process (bone conduction, BC)	 AC > BC	 BC > AC	 AC > BC

Facial nerve lesions



Bell palsy is the most common cause of peripheral facial palsy A. Usually develops after HSV reactivation. Treatment: glucocorticoids +/– acyclovir. Most patients gradually recover function, but aberrant regeneration can occur. Other causes of peripheral facial palsy include Lyme disease, herpes zoster (Ramsay Hunt syndrome), sarcoidosis, tumors (eg, parotid gland), diabetes mellitus.

	Upper motor neuron lesion	Lower motor neuron lesion
LESION LOCATION	Motor cortex, connection from motor cortex to facial nucleus in pons	Facial nucleus, anywhere along CN VII
AFFECTED SIDE	Contralateral	Ipsilateral
MUSCLES INVOLVED	Lower muscles of facial expression	Upper and lower muscles of facial expression
FOREHEAD INVOLVEMENT	Spared, due to bilateral UMN innervation	Affected
OTHER SYMPTOMS	Variable; depends on size of lesion	Incomplete eye closure (dry eyes, corneal ulceration), hyperacusis, loss of taste sensation to anterior tongue

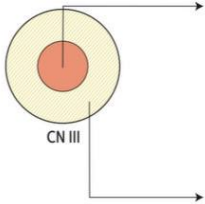


Cranial nerve III, IV, VI palsies

CN III damage

CN III has both motor (central) and parasympathetic (peripheral) components. Common causes include:

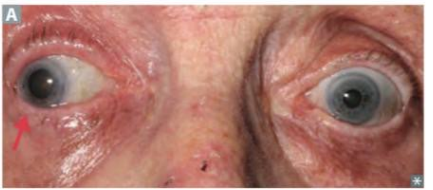
- Ischemia → pupil sparing (motor fibers affected more than parasympathetic fibers)
- Uncal herniation → coma
- PCom aneurysm → sudden-onset headache
- Cavernous sinus thrombosis → proptosis, involvement of CNs IV, V_1/V_2, VI
- Midbrain stroke → contralateral hemiplegia



Motor output to extraocular muscles—affected primarily by vascular disease (eg, diabetes mellitus: glucose → sorbitol) due to ↓ diffusion of oxygen and nutrients to the interior (**m**iddle) fibers from compromised vasculature that resides on outside of nerve. Signs: ptosis, "down-and-out" gaze.

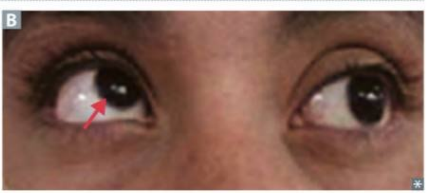
Parasympathetic output—fibers on the **p**eriphery are first affected by compression (eg, PCom aneurysm, uncal herniation). Signs: diminished or absent pupillary light reflex, "blown pupil" often with "down-and-out" gaze **A**.

Motor = **m**iddle (central)
Parasympathetic = **p**eripheral



CN IV damage

Pupil is higher in the affected eye **B**.
Characteristic head tilt to contralateral/unaffected side to compensate for lack of intorsion in affected eye.
Can't see the **floor** with CN **IV** damage (eg, difficulty going down stairs, reading).



CN VI damage

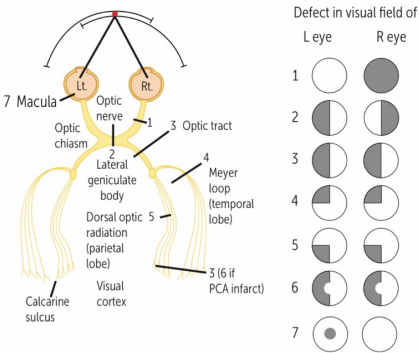
Affected eye unable to abduct **C** and is displaced medially in primary position of gaze.

Visual field defects

1. Right anopia (monocular vision loss)
2. Bitemporal hemianopia (pituitary lesion, chiasm)
3. Left homonymous hemianopia
4. Left upper quadrantanopia (right temporal lesion, MCA)
5. Left lower quadrantanopia (right parietal lesion, MCA)
6. Left hemianopia with macular sparing (right occipital lesion, PCA)
7. Central scotoma (eg, macular degeneration)

Ventral optic radiation (Meyer loop)—lower retina; loops around inferior horn of lateral ventricle.

Dorsal optic radiation—superior retina; takes shortest path via internal capsule.



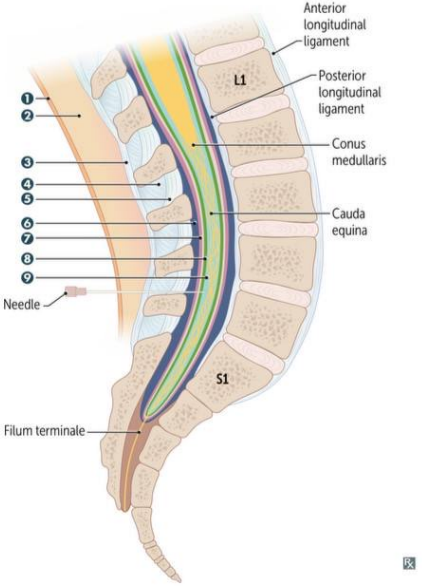
Note: When an image hits 1° visual cortex, it is upside down and left-right reversed.

Spinal cord—lower extent

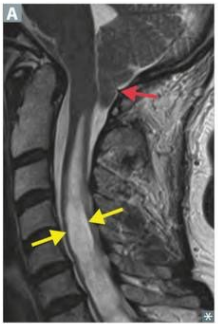
In adults, spinal cord ends at lower border of L1–L2 vertebrae. Subarachnoid space (which contains the CSF) extends to lower border of S2 vertebra. Lumbar puncture is usually performed between L3–L4 or L4–L5 (level of cauda equina) to obtain sample of CSF while avoiding spinal cord. To keep the cord alive, keep the spinal needle between L3 and L5.

Needle passes through:

1. Skin
2. Fascia and fat
3. Supraspinous ligament
4. Interspinous ligament
5. Ligamentum flavum
6. Epidural space (epidural anesthesia needle stops here)
7. Dura mater
8. Arachnoid mater
9. Subarachnoid space (CSF collection occurs here)

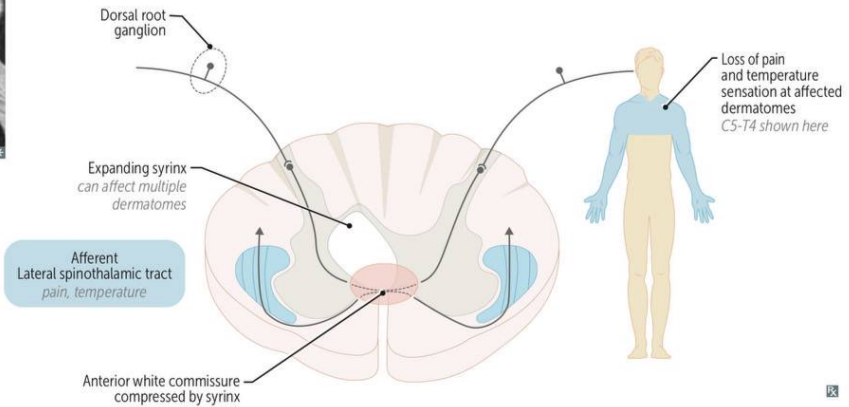


Syringomyelia

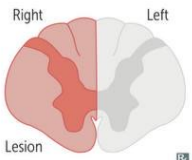


Fluid-filled, gliosis-lined cavity within spinal cord (yellow arrows in A). Fibers crossing in anterior white commissure (spinothalamic tract) are typically damaged first → "cape-like" loss of pain and temperature sensation in bilateral upper extremities. As lesion expands it may damage anterior horns → LMN deficits.

Syrinx (Greek) = tube, as in "syringe."
Most lesions occur between C2 and T9.
Usually associated with Chiari I malformation (red arrow in A). Less commonly associated with other malformations, infections, tumors, trauma.



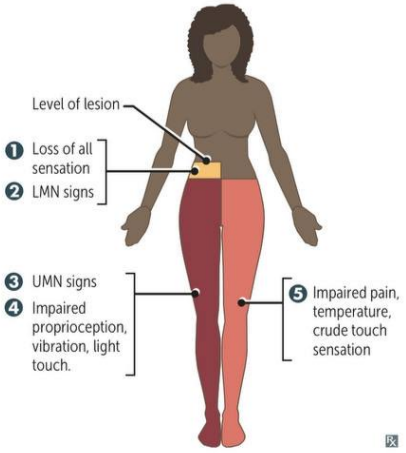
Brown-Séquard syndrome

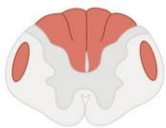


Hemisection of spinal cord. Findings:

1. Ipsilateral loss of all sensation **at** level of lesion
2. Ipsilateral LMN signs (eg, flaccid paralysis) **at** level of lesion
3. Ipsilateral UMN signs **below** level of lesion (due to corticospinal tract damage)
4. Ipsilateral loss of proprioception, vibration, and light (2-point discrimination) touch **below** level of lesion (due to dorsal column damage)
5. Contralateral loss of pain, temperature, and crude (non-discriminative) touch **below** level of lesion (due to spinothalamic tract damage)

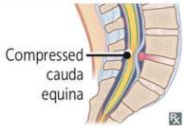
If lesion occurs above T1, patient may present with ipsilateral Horner syndrome due to damage of oculosympathetic pathway.





Vitamin B_{12} deficiency

Subacute combined degeneration (SCD)—demyelination of Spinocerebellar tracts, lateral Corticospinal tracts, and Dorsal columns. Ataxic gait, paresthesia, impaired position/vibration sense (⊕ Romberg sign), UMN symptoms.



Cauda equina syndrome

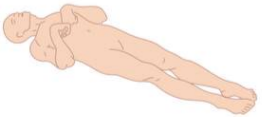
Compression of spinal roots L2 and below, often due to intervertebral disc herniation or tumor.
Radicular pain, absent knee and ankle reflexes, loss of bladder and anal sphincter control, saddle anesthesia.

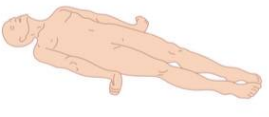
Motor neuron signs

SIGN	UMN LESION	LMN LESION	COMMENTS
Weakness	+	+	Lower motor neuron (LMN) = everything lowered (less muscle mass, ↓ muscle tone, ↓ reflexes, downgoing toes)
Atrophy	–	+	
Fasciculations	–	+	
Reflexes	↑	↓	Upper motor neuron (UMN) = everything up (tone, DTRs, toes)
Tone	↑	↓	
Babinski	+	–	Fasciculations = muscle twitching
Spastic paresis	+	–	Positive Babinski is normal in infants
Flaccid paralysis	–	+	
Clasp knife spasticity	+	–	

Abnormal motor posturing

	Decorticate (flexor) posturing	Decerebrate (extensor) posturing
SITE OF LESION	Above red nucleus (often cerebral cortex)	Between red and vestibular nuclei (brainstem)
OVERACTIVE TRACTS	Rubrospinal and vestibulospinal tracts	Vestibulospinal tract
PRESENTATION	Upper limb flexion, lower limb extension	Upper and lower limb extension
NOTES	"Your hands are near the cor (heart)"	Worse prognosis





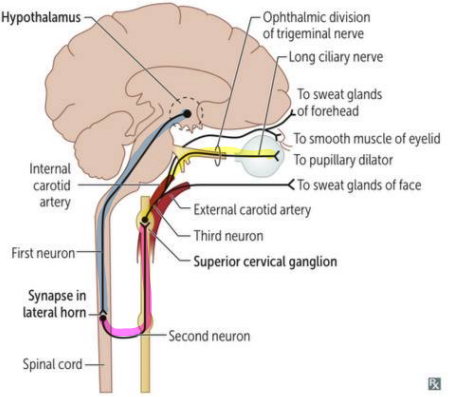
Horner syndrome

Sympathetic denervation of face:

- Ptosis (slight drooping of eyelid: superior tarsal muscle)
- Miosis (pupil constriction)
- Anhidrosis (absence of sweating) and absence of flushing of affected side of face

Associated with lesions along the sympathetic chain:

- 1st neuron: pontine hemorrhage, lateral medullary syndrome, spinal cord lesion above T1 (eg, Brown-Séquard syndrome, late-stage syringomyelia)
- 2nd neuron: stellate ganglion compression by Pancoast tumor
- 3rd neuron: carotid dissection (painful); anhidrosis is usually absent



Vertigo	Sensation of spinning while actually stationary. Subtype of "dizziness," but distinct from "lightheadedness." Peripheral vertigo is more common than central vertigo.
Peripheral vertigo	Due to inner ear pathologies such as semicircular canal debris (benign paroxysmal positional vertigo), vestibular neuritis, **Ménière disease**—endolymphatic hydrops (↑ endolymph in inner ear) → triad of ~~vertigo, sensorineural hearing loss, tinnitus~~ ("men wear vests"). Findings: mixed horizontal-torsional nystagmus (never purely torsional or vertical) that does not change direction and is suppressible with visual fixation.
Central vertigo	Due to brainstem or cerebellar lesions (eg, stroke affecting vestibular nuclei, demyelinating disease, or posterior fossa tumor). Findings: nystagmus of any direction that is not suppressible with visual fixation, neurologic findings (eg, diplopia, ataxia, dysmetria).

Meningioma	Common, typically benign. Females > males. Occurs along surface of brain or spinal cord. Extra-axial (external to brain parenchyma) and may have a dural attachment ("tail" E). Often asymptomatic; may present with seizures or focal neurologic signs. Resection and/or radiosurgery.	Arachnoid cell origin. Spindle cells concentrically arranged in a whorled pattern; psammoma bodies (laminated calcifications, arrow in F).

Idiopathic intracranial hypertension

Also called pseudotumor cerebri. ↑ ICP with no obvious findings on imaging. Risk factors include female sex, Tetracyclines, Obesity, vitamin A excess, Danazol (female TOAD). Associated with dural venous sinus stenosis. Findings: headache, tinnitus, diplopia (usually from CN VI palsy), no change in mental status. Impaired optic nerve axoplasmic flow → papilledema. Visual field testing shows enlarged blind spot and peripheral constriction. Lumbar puncture reveals ↑ opening pressure and provides temporary headache relief.

Treatment: weight loss, acetazolamide, invasive procedures for refractory cases (eg, CSF shunt placement, optic nerve sheath fenestration surgery for visual loss).

Carpal tunnel syndrome	Entrapment of median nerve in carpal tunnel (between transverse carpal ligament and carpal bones) → nerve compression → paresthesia, pain, and numbness in distribution of median nerve. Thenar eminence atrophies but sensation spared, because palmar cutaneous branch enters hand external to carpal tunnel.	Suggested by ⊕ Tinel sign (percussion of wrist causes tingling) and Phalen maneuver (90° flexion of wrist causes tingling). Associated with pregnancy (due to edema), rheumatoid arthritis, hypothyroidism, diabetes, acromegaly, dialysis-related amyloidosis; may be associated with repetitive use.

Normal CSF

Pressure 8-18 cm /80-180 cm

- Clear Salty taste
- 0-5 lymphocytes
- <45mg/dl protein 0.2-0.4g
- >45mg/dl glucose
  - About 2/3 of blood glucose (80-120)

›=50%

Acute inflammatory demyelinating polyneuropathy

Imp

Viruses	Cytomegalovirus, Epstein–Barr virus, HIV
Bacteria	*Mycoplasma pneumoniae*, *Campylobacter jejuni*
Vaccines	For example, against swine influenza
Surgery	

Most common subtype of **Guillain-Barré syndrome**.

Autoimmune condition that destroys Schwann cells via inflammation and demyelination of motor fibers, sensory fibers, peripheral nerves (including CN III-XII). Likely facilitated by molecular mimicry and triggered by inoculations or stress. Despite association with infections (eg, *Campylobacter jejuni*, viruses [eg, Zika]), no definitive causal link to any pathogen.

Results in symmetric ascending muscle weakness/paralysis and depressed/absent DTRs beginning in lower extremities. Facial paralysis (usually bilateral) and respiratory failure are common. May see autonomic dysregulation (eg, cardiac irregularities, hypertension, hypotension) or sensory abnormalities. Most patients survive with good functional recovery.

↑ CSF protein with normal cell count (albuminocytologic dissociation).

Respiratory support is critical until recovery. Disease-modifying treatment: plasma exchange or IV immunoglobulins. No role for steroids.

CIDP

Chronic Inflammatory Demyelinating Polyneuropathy

- Peripheral nerve disorder
- Similar to AIDP variant of Guillain-Barre
  - Motor weakness
  - Loss of reflexes
  - Albuminocytologic dissociation
- Distinguished by **time course** and **steroid responsiveness**

CIDP

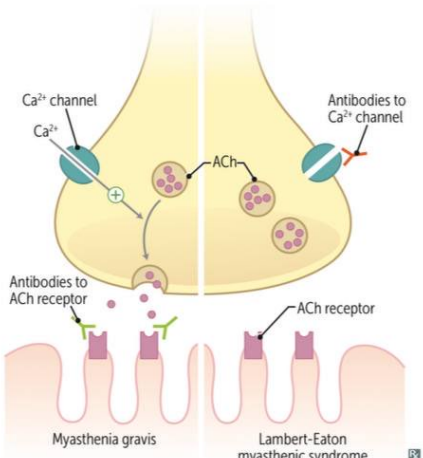
Chronic Inflammatory Demyelinating Polyneuropathy

- **Time course**
  - GBS: time to maximum weakness 4 weeks or less
  - CIDP: Longer than 8 weeks
- **Corticosteroids**
  - GBS: No benefit
  - CIDP: Effective

Rapidly Progressive

Neuromuscular junction diseases

	Myasthenia gravis	Lambert-Eaton myasthenic syndrome
FREQUENCY	Most common NMJ disorder	Uncommon
PATHOPHYSIOLOGY	Autoantibodies to postsynaptic ACh receptor	Autoantibodies to presynaptic Ca^{2+} channel → ↓ ACh release; L comes before M
CLINICAL	Fatigable muscle weakness—ptosis; diplopia; proximal weakness; respiratory muscle involvement → dyspnea; bulbar muscle involvement → dysphagia, difficulty chewing Spared reflexes Worsens with muscle use	Proximal muscle weakness, autonomic symptoms (dry mouth, constipation, impotence) Hyporeflexia Improves with muscle use
ASSOCIATED WITH	Thymoma, thymic hyperplasia	Small cell lung cancer
AChE INHIBITOR ADMINISTRATION	Reverses symptoms (pyridostigmine for treatment)	Minimal effect

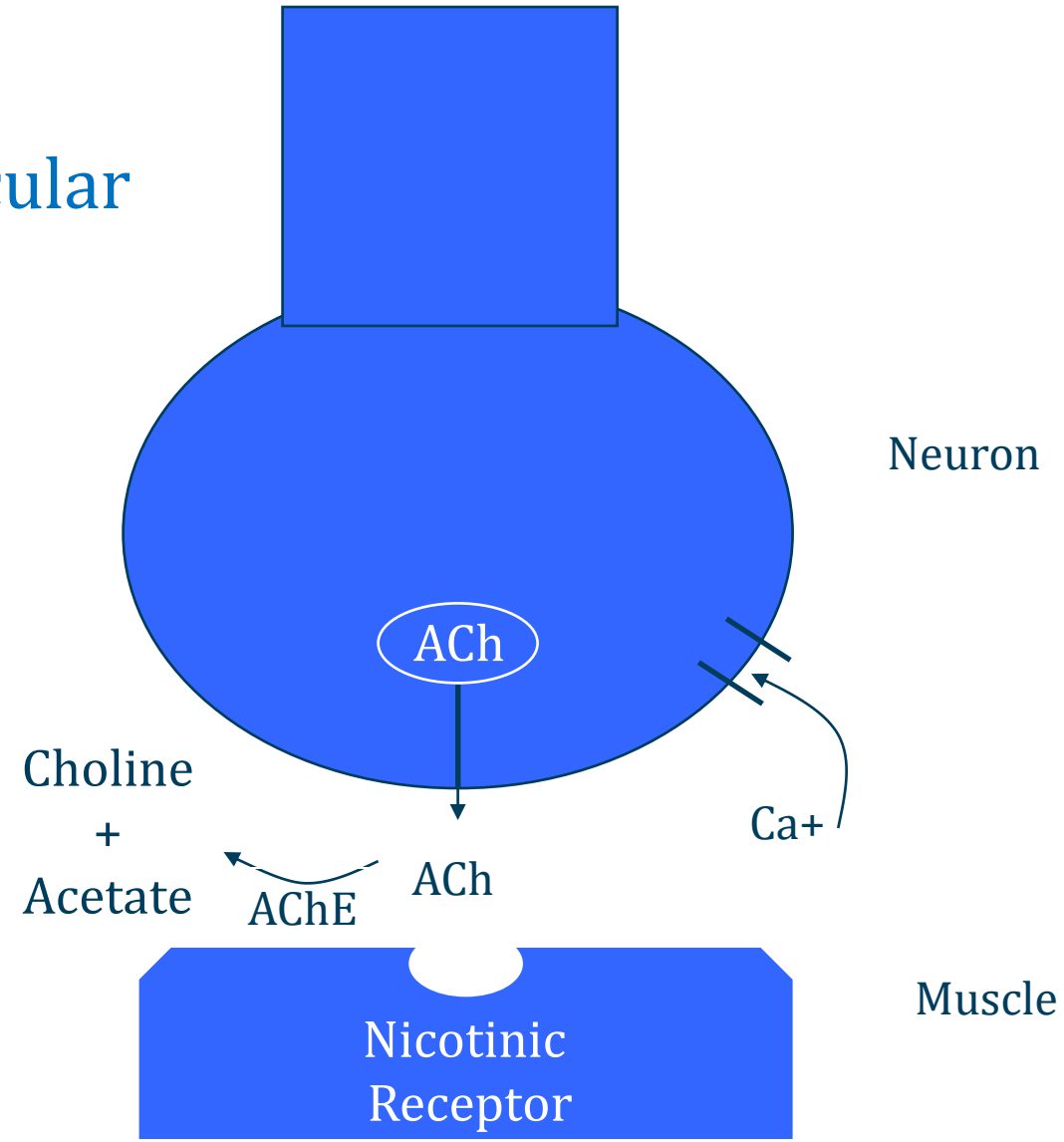


Myasthenia Gravis

- **Neuromuscular junction disorder**
- Autoimmune disease
- Antibodies block nicotinic ACh receptors
- Compete with ACh for receptor biding
- Muscle weakness
- More common in women
- Diagnosis: **acetylcholine receptor antibodies**

Martin Brändli /Wikipedia

The Neuromuscular Junction



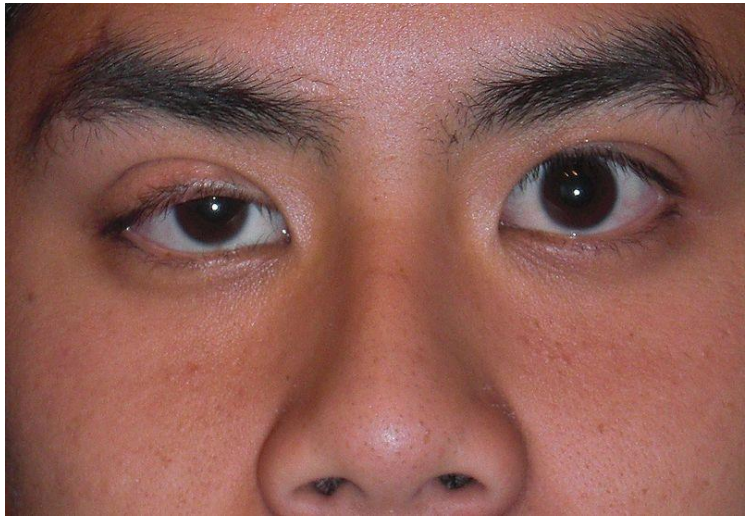
Myasthenia Gravis

- **Bimodal age distribution**
- Women: peak 20s to 30s
- Men: peak 60s to 80s

Myasthenia Gravis

Clinical Features

- **Muscle fatigability**
  - Repeated nerve stimulation → ↓ ACh release
  - **Muscles weaken with use**
- **Diplopia and ptosis**
  - Extraocular muscle weakness
  - 50% patients present with eye complaints
- Speech, chewing and swallowing problems
  - 15% patients present with "bulbar symptoms"

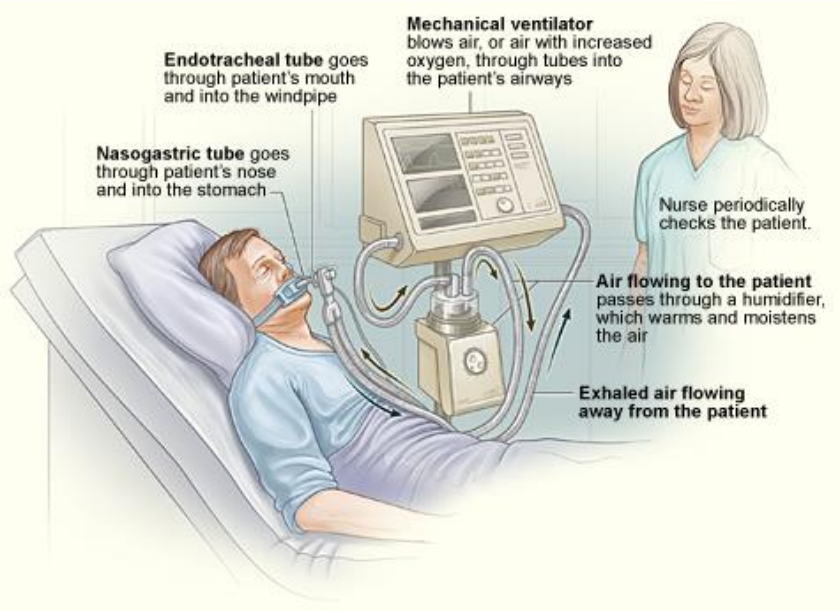


Andrewya/Wikipedia

Myasthenia Crisis

- Rapid, life-threatening worsening of weakness
- Most common precipitant: infection
  - Also surgery
- Can be caused by many drugs:
  - Hydroxychloroquine
  - Antibiotics: aminoglycosides, fluoroquinolones
  - Beta-blockers
- Requires **intubation or noninvasive ventilation**
  - Weakness of respiratory muscles
  - Severe bulbar muscle weakness → airway obstruction
- Treatment: **plasma exchange or IVIG**

Mechanical Ventilation



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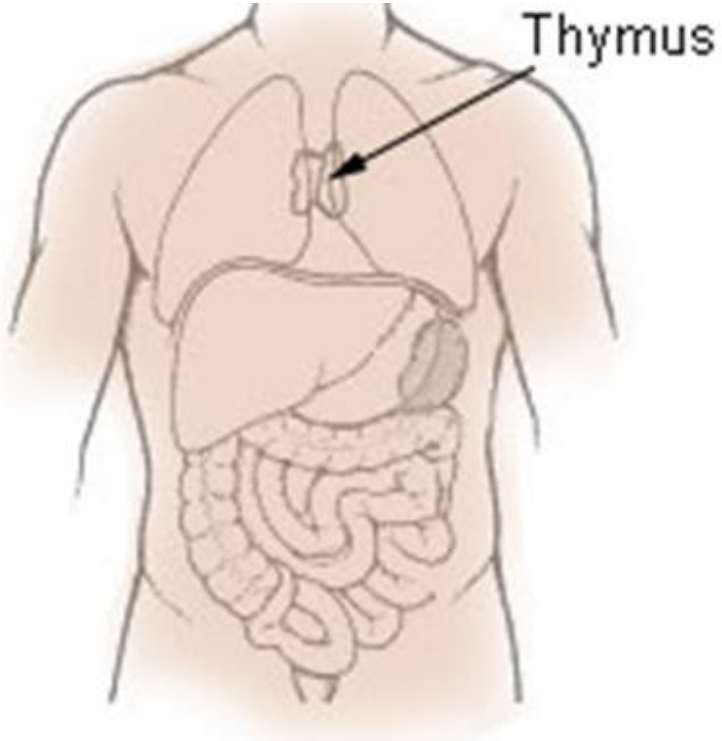
Myasthenia Crisis

- **Oral or nasogastric glucocorticoids**
- Moderate to high dose
- Given concurrently with plasma exchange or IVIG
- Alternatives: azathioprine, mycophenolate, or cyclosporine

Myasthenia Gravis

Disease Associations

- Most MG patients have **abnormal thymus**
  - Hyperplasia ~85%
  - Thymoma ~15%
- MG often resolves with thymectomy
- Thymectomy done for all thymomas
  - Nonthymomatous MG can also be cured with thymectomy
  - Nonthymomatous thymectomy often done patients < 60
- Key test: **imaging of mediastinum (CT or MRI)**
  - Anterior mediastinal mass (terrible Ts)



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Myasthenia Gravis

Drugs

- Some drugs worsen neuromuscular transmission
- Should be avoided by patients with MG
- **Antibiotics**
  - Aminoglycosides
  - Fluoroquinolones
- **Na channel blocking drugs**
  - IV local anesthetics (e.g., lidocaine)
  - Procainamide
  - Quinidine
- **Beta-blockers**

Myasthenia Gravis

Pregnancy

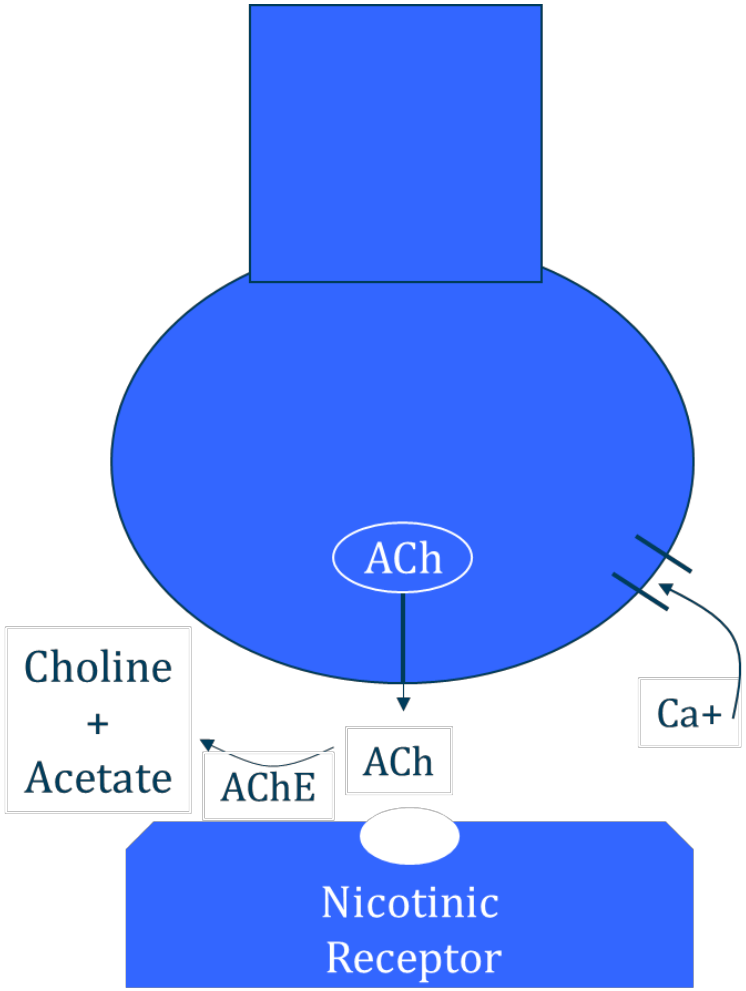
- Most women with MG tolerate pregnancy well
- MG can worsen in pregnancy and postpartum
- Flares most likely in **first trimester** and **first month postpartum**

Øyvind Holmstad/Wikipedia

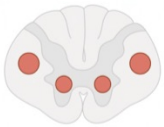
Myasthenia Gravis

Chronic Treatment

- **Acetylcholinesterase inhibitors**
  - First line: pyridostigmine
  - ↓ ACh metabolism
  - ↑ ACh levels in NMJ
- Immunosuppressants
- Thymectomy in appropriate patients



Amyotrophic lateral sclerosis



Combined UMN (corticospinal/corticobulbar) and LMN (brainstem/spinal cord) degeneration. Usually idiopathic. Familial form (less common) may be linked to *SOD1* mutations (encodes superoxide dismutase 1). ALS is also called Lou Gehrig disease.
LMN signs: flaccid limb weakness, fasciculations, atrophy, bulbar palsy (dysarthria, dysphagia, tongue atrophy). UMN signs: spastic limb weakness, hyperreflexia, clonus, pseudobulbar palsy (dysarthria, dysphagia, emotional lability). No sensory or bowel/bladder deficits.
Fatal (most often from respiratory failure). Treatment: riluzole ("riLouzole").

- gait disturbance,
- early urinary incontinence.

Gross ventricular enlargement without cortical atrophy is seen on CT cranial scanning and lumbar puncture reveals normal CSF pressure. The pathogenesis of the condition is obscure. Though a single reading of CSF pressure at lumbar puncture is likely to be normal, continuous intracranial pressure monitoring over 1–2 days may reveal waves of raised pressure. Results of surgical treatment by ventriculoperitoneal shunting are variable.

Motor neurone disease

Motor neurone disease (alternatively known as **amyotrophic lateral sclerosis**) is a progressive degenerative disorder of cortical, brainstem and spinal motor neurones (i.e., both UMNs and LMNs).

Epidemiology

The incidence of motor neurone disease is 2 per 100,000 per year. There is a slight male preponderance (1.5:1) and the condition is more common in the middle-aged and elderly, with peak onset at around 60 years. Approximately 5–10% of patients have a family history, suggestive of autosomal dominant inheritance, with a younger age of onset in these individuals. Among the familial patients, a proportion have identified mutations in the gene for the enzyme superoxide dismutase.

Aetiology and pathogenesis

Two mechanisms of motor neurone degeneration are currently considered likely to contribute to the pathogenesis of this disease:

- **excitotoxicity** – toxins interacting with glutamate receptors, resulting in cellular calcium overload;
- **free radicals** – motor neurone damage by a cascade of reactions initiated by electron capture by oxygen free radicals, e.g. superoxide and peroxide.

These two mechanisms may act together. Thus, oxygen free radicals are generated in response to a rise in intracellular calcium, which may in turn be induced by unidentified excitotoxins.

Clinical features and prognosis

Patients typically present with wasting and weakness of upper limb, more commonly than lower limb, muscles. Cramps and fasciculation may precede other motor symptoms. Examination shows a combination of LMN and UMN signs. The diagnosis is straightforward when such signs coexist in the same region (e.g., wasted arms with brisk upper limb reflexes) and several regions (cranial nerves, arms, legs) are affected, with evidence of disease progression. However, difficulties may arise early in the evolution of the illness, when only LMN or UMN signs are present in one limb. Furthermore, 10% of patients show only LMN signs throughout (formerly termed the 'progressive muscular atrophy' variant).

Motor signs are usually asymmetrical, at least initially. Sensory signs are absent, and there is no sphincter involvement beyond constipation caused by pelvic and abdominal muscle weakness and reduced fluid intake. A few patients develop dementia of frontal type.

A minority of patients present with dysarthria and dysphagia (the 'progressive bulbar palsy' variant). Signs of a mixed bulbar and pseudobulbar palsy are present, e.g. a wasted, fasciculating tongue but brisk jaw reflex. These patients are at risk of chest infection as a result of aspiration, compounded by ventilatory muscle weakness. These complications also develop in patients presenting with limb involvement, as the majority progress to bulbar symptoms. Other features of advanced disease include:

- depression, with increasing social isolation,
- weight loss, malnutrition and dehydration because of dysphagia,
- venous thromboembolism, because of immobility,
- ventilatory failure, the usual cause of death.

The median survival in motor neurone disease is 4 years, with a worse prognosis in patients with

bulbar onset. Only 10% of patients survive 5 years or more, those with only LMN signs having a better outlook.

Investigations and diagnosis

Blood tests are usually normal apart from possible modest elevation of creatine kinase.

EMG typically reveals widespread evidence of denervation as a result of anterior horn cell damage. Nerve conduction studies exclude a motor neuropathy masquerading as motor neurone disease with purely LMN features.

Spinal imaging by MR may be needed to exclude cord or root compression.

Bulbar disease with solely LMN features may mimic myasthenia gravis, which may require formal exclusion by appropriate investigation (Chapter 17), as it is eminently treatable. Unlike myasthenia, motor neurone disease only very rarely involves eye movements.

Because of the grave prognostic implications, motor neurone disease should be diagnosed with certainty only on the basis of strict clinical criteria, ideally coexistent LMN and UMN signs in several regions, with evidence of progression. All other cases are only possible, or at worst probable, motor neurone disease, and care should be taken to exclude other potentially treatable conditions.

Management

Drug treatment

Most drug treatment is symptomatic:

- anticholinergic drugs for reducing saliva secretion when swallowing is difficult (other approaches to this problem include injection of botulinum toxin into the salivary glands),
- baclofen, dantrolene, tizanidine, diazepam for spasticity,
- quinine for cramp,
- antidepressants,
- laxatives (with increased fluids) for constipation,
- opiates, diazepam – terminally for symptomatic relief of dyspnoea.

The excitotoxicity theory of motor neurone disease pathogenesis has yielded a drug, **riluzole**, with antiglutamate activity. This has been shown to prolong life in motor neurone disease, but only for a few months in selected patients.

Other measures

- Physiotherapy.
- Communication aids for dysarthria.
- Adaptations at home – assessed by an experienced occupational therapist.
- Advice from speech therapists and dietitians for dysphagia.
- More severe dysphagia may require gastrostomy to bypass the defective swallowing mechanism and permit adequate fluid and nutritional intake.
- Assisted ventilation for respiratory failure may be justified, e.g. for nocturnal support, when other aspects of motor function are relatively preserved, but raises ethical issues in patients with advanced disease where life may be prolonged but so may suffering.
- Hospice care may be required terminally.
- Information and patient support is provided by the Motor Neurone Disease Association in the UK.

Key points

- Congenital neurological disorders, e.g. cerebral palsy, generally have static rather than progressive underlying pathology, though they may present in adult life
- Neurogenetic diseases may selectively 'target' specific neuronal populations
- Neurodegenerative disorders, which may or may not be inherited, also typically result in selective neuronal damage
- Treatable causes of dementia should be excluded before arriving at a diagnosis of a neurodegenerative condition