NEUROLOGY NOTES

ANATOMY

The **axillary nerve** supplies the deltoid and teres minor as well as the skin over the deltoid.

The **ulnar nerve** innervates the third and fourth lumbricals, the interossei and adductor pollicis. Sensation is supplied to the fifth finger and the ulnar part of the fourth finger. It also innervates the *Interossei*- Dorsal: Abductors (DAB) and Palmar: Adductors (PAD).
Claw hand is typical of ulnar nerve injury which can be due to pressure palsy around the elbow. This is due to weakness of the small muscles of the hand leading to hyperextension at the MCP and flexion at the interphalangeal joints.

A good rule to follow is that the **radial nerve** supplies the extensors of the Flexion of the fingers and thumb abduction is supplied by the median nerve. Extension of the fingers are supplied by radial nerve. forearm and fingers, not the flexors –irregardless of whether it is ulnaris or radialis. Examples are: extensor carpi ulnaris, extensor pollicis longus, supinator.

Lesions of the **radial nerve** in the *spiral groove* spare the triceps.

The lateral two lumbricals, opponens pollicis, abductor pollicis brevis and flexor pollicis brevis are supplied by the **median nerve**. Flexion of the fingers and thumb abduction is supplied by the median nerve.

The fibers of the **musculocutaneous** nerve originate in the lower cervical spinal cord (usually C5 to C7), travel via the lateral cord of the brachial plexus, and supply sensory and motor innervation to the upper arm, elbow, and forearm. It supplies the biceps which controls elbow flexion. Sensation is to the lateral area (lateral cutaneous nerve) of the forearm.

A lesion in the **anterior interosseous nerve** results in weakness of the terminal phalanges of the thumb and index fingers.

Waiter's tip deformity is due to **C5** and **C6** brachial nerve injury (Duchenne-Erb paralysis).

A **C5** root lesion causes weakness in abduction of the shoulder and biceps, as well as sensory loss in the upper arm.
A **C7** root lesion causes weak wrist extensors and flexors, weak finger extensors and sensory loss to middle finger.
A **T1** lesion causes weak intrinsic hand muscles.

The **axillary nerve** supplies the deltoid and teres minor as well as the skin over the deltoid.

The **tibial nerve** supplies the gastrocnemius muscle. Tibial nerve palsy causes weakness in in knee extension, plantar flexion and foot inversion on the left. He also

is unable to tiptoe on the same foot. Ankle jerk is absent. The tibial nerve carries L4 & L5 roots.

The **sciatic nerve** supplies iliacus, pectineus, sartorius, quadriceps femoris. It supplies cutaneous branches to the front of the thigh. The sciatic nerve is commonly injured by fractures of the pelvis, gunshot wounds, or other trauma to the buttocks or thigh.

Injury to the **lateral cutaneous nerve** of the thigh as it travels under the inguinal ligament can cause numbness and sensory loss to the antero lateral part of the thigh.

Foot drop can be caused by damage to the tibial nerve and common peroneal nerve.

The **obturator nerve** supplies gracilis, the adductor (longus, brevis, magnus) and the skin over the lateral aspect of the thigh.
Femoral nerve supplies the quadriceps.

The **common peroneal nerve** controls foot eversion and dorsiflexion. Sensation is supplied to the antero-lateral part of the leg and the dorsum of the foot.

EPILEPSY

Brief episodes of jerking suggests simple partial seizures. *Carbamazepine* is first line therapy for this.

For a single seizure, driving is not permitted for 1 year.
An epileptic patient can drive after 1 year of they have been free from any attack, or after 3 years if they have had attacks only during sleep.

HGV licence – only if seizure free for 10 years.

Absence seizures consist of suspension of awareness lasting a few seconds. They occur without warning, are provoked by overbreathing, and are not usually associated with complex motor movements or post-ictal confusion. The characteristic ictal EEG is 3 Hz spike and wave.

Complex partial seizures may be preceded by an aura, can be associated with behavioural and cognitive signs.

Partial seizures from the **temporal lobe** typically causes motor movements like grimacing and sucking movements, rotation of the head and eyes. There are other features associated with **temporal lobe epilepsy**. Déjà vu and Jamais vu (unreal perceptions) may occur. Visual, auditory and olfactory hallucinations may occur. An aura may occur, associated with micropsia (distorted visual perception in which objects appear smaller than their actual size) or physicial sensations in the stomach.

Carbamazepine and phenytoin are used to treat the condition.

Juvenile myoclonic epilepsy (JME) is an idiopathic generalized epileptic syndrome characterized by myoclonic jerks, generalized tonic-clonic seizures (GTCSs), and

sometimes absence seizures. These can be precipitated when sleep deprived. Apart from *sodium valproate, lamotrigine and topirimate* can also be used.

MIGRAINES AND HEADACHES

In **migraines**, beta blockers, calcium channel blockers and antidepressants may be helpful in prophylaxis.

Cluster headaches: Verapamil, prednisolone, prochlorperazine, lithium carbonate, ergotamine and methysergide can help to prevent these.

Third nerve palsy leads to ptosis, dilated unreactive pupil and eye looking down and out. The afferent pathway is controlled by the optic nerve and the efferent pathway by the oculomotor nerve - hence a dilated poorly reacting pupil.

IIIrd nerve palsy causes:
- Neurosyphillis / meningovascular syphillis
- Diabetes Mellitus
- Myasthenia gravis
- Opthalmic migraine

Syphillis causes **Argyll Robertson pupil** - small and iregular pupils which do not react to light because they are already small.
[mnemonic: ARP: Accomodation Reflex Present, PRA: Pupillary Reflex Absent]

Dilated pupils occur in *IIIrd nerve palsy* and *Holmes Adie* pupil. Holmes Adie is also called a myotonic pupil due to the slow reaction and is ssociated with diminished tendon reflexes. A **Holmes Adie** pupil is a large pupil, unresponsive to light.

Marcus Gunn pupil is an afferent pupillary defect – thus pupils do not constrict.

The pathway of the **pupillary light reflex** consists of: retinal receptor cells, bipolar cells, ganglion cells, optic nerve and tract, lateral geniculate bodies, superior colliculus and pretectal nucleus of the high midbrain, Edinger-Westphal nucleus, efferent two neurone pathway via the oculomotor nerve (IIIrd nerve), ciliary ganglion, constrictor muscle of the iris.

Superior quandrantinopia is seen in damage to the temporal part of optic radiation lesions.

Inferior quandrantinopia is seen in damage to the parietal part of optic radiation lesions

Bitemporal hemianopia is seen in optic chiasmic lesions.

Central scotoma is usually caused by lesions between the optic nerve and chiasm

Causes of Central Scotoma
- Hereditary familial optic atrophy
- Syphillitic optic atrophy

- Papilloedema
- Retrobulbar neuritis

Internuclear opthalmoplegia: The **medial longitudinal fasciculus** (MLF) connects the sixth nerve and third nerve to the Paramedian Pontine Reticular Formation. There is nystagmus in the **abducting eye** (mnemonic **NAB**) and limited movement in the **adducting eye** on the same side. Upward gaze is not affected.

Internuclear opthalmoplegia can be caused by:
Multiple Sclerosis
stroke (basilar artery)
encephalitis
syphilis
lyme disease
phenothiazines
tricyclic antidepressants

Causes of optic neuritis:
Sarcoid
Multiple sclerosis
drugs (ethambutol)
infections (syphillis, CMV, brucella, toxoplasmosis)

Causes of **papilloedema**:
Intracerebral haemorrhage
central retinal vein thrombosis
venous sinus thrombosis
benign intracranial hypertension

The lateral gaze centre is situated in the **pons**. A lesion in the right pons will cause impaired conjugate gaze to the right side, with consequent deviation away from the right side.

CEREBROVASCULAR DISEASES AND VARIOUS BRAIN STEM DISORDERS

Broca's Area (Inferior frontal lobe) damage causes impaired fluency, intact comprehension, impaired repetition [expressive dysphasia].

Wernicke's Area (posterior, superior temporal lobe) damage causes normal fluency, impaired comprehension, impaired repetition [receptive dysphasia].

The **cingulate gyrus** forms part of the limbic system, which is associated with mood and emotions.

Caudate nucleus, putamen and globus pallidus are areas within the basal ganglia which, when impaired, can lead to choreiform movements.

Medial medullary syndrome is caused by an ipsilateral 12th nerve lesion (tongue paralysis) and contralateral weakness and loss of postural sense due to lesions in the pyramidal tract and the medial leminiscus.

Lateral medullary syndrome:

Multiple areas are involved : 9th and 10th nerve - dysphagia and dysarthria
Nucleus ambiguus - vomiting and hiccup
Vestibular nuclei - vertigo
Inferior cerebellar peduncle - ipsilateral cerebellar ataxia
Descending autonomic fibres - Horner's syndrome
Fifth nerve nucleus - loss of pain and temperature sensation over the face (ipsilateral)
Lateral leminiscus - loss of pain and temperature sensation in the contralateral limbs

The **posterior cerebral artery** supplies the occipital lobe and occlusion causes damage to the visual cortex, resulting in homonymous hemianopia.

There are many **parietal lobe signs**. These include :

loss of two point discrimination
agraphia
agnosia
astereognosis
dyslexia
Gerstmann syndrome
receptive dysphasia
dressing and constructional dyspraxia

Dystonic posturing can be related to temporal lobe epilepsy. **Gerstmann syndrome** includes four features (acalculia, agraphia, finger agnosia, left right disorientation), and is due to a lesion in the dominant hemisphere.

In a right handed patient, the left hemisphere is dominant.

In a **lesion of the superior colliculus** (mid-brain) there may be damage to the IIIrd nerve nucleus and cerebral peduncles, leading to a third nerve palsy and contralateral hemiparesis.

MYASTHENIA

In **Lambert Eaton myasthenic syndrome**, 60% of cases are paraneoplastic (small cell lung ca is most associated). The clinical features are proximal weakness, loss of tendon reflexes and autonomic dysfunction.

Myasthenia gravis can be differentiated from **Eaton Lambert myasthenic syndrome** by electromyography. Repetitive stimulation in myasthenia gravis leads to a decrement of evoked muscle action potentials, whilst in myasthenic syndrome the condition improves by repetitive stimulation. Also, in myasthenia gravis the tendon reflexes are characteristically normal. If the reflexes are depressed, Eaton-Lambert syndrome should be considered.

Pyridostigmine is an anticholinesterase which reduces acetylcholine breakdown and hence improve symptoms of fatiguability in **myasthenia gravis**.

In **myasthenia gravis**, there are positive anti-Ach antibodies. Thymectomy improves the prognosis in patients below 40 years and in those with positive receptor antibodies. Following thymectomy, 60 % of patients will improve. Thymectomy is usually recommended because of the risk of malignancy.

The list of drugs which may make **myasthenia** worse are:
erythromycin
streptomycin
ampicillin
Verapamil
propranolol
Aminoglycosides
Quinidine
Procainamide
Magnesium
Lithium
Phenytoin
chlorpromazine
clozapine

PARKINSON'S

Causes of **parkinsonism** are:
Drugs - Reserpine, tetrabenazine, Phenothiazines
Toxins - methyl-phenyl-tetrahydropyridine, Manganese, Carbon monoxide,
Viral - Encephalitis, eg. Japanese B,
Neurone damage - Supra nuclear palsy, Shy Drager syndrome (Multi system atrophy), Cerebral tumour, Wilson's disease, Huntington's disease, Neurosyphillis

Parkinson's Therapy
Co-careldopa (contains L dopa) is the first medication used to increase dopaminergic activity in the basal ganglia. Side effects are dyskinesia, postural hypotension, nausea.
Benztropine is used for anticholinergic side effects.
Selegiline is an MAO inhibitor (potentiates dopamine)
Amantadine is an antiviral drug (also potentiates dopamine) used as a second line drug.
Apomorphine is used for on-off fluctuations.
Benzhexol is indicated when there is mild parkinsonism or when there is oculogyric crisis. Sterotactic surgery is indicated when there are unilateral symptoms.
Ropinirole is a dopamine 2 agonist,

In **progressive supranuclear palsy** (PSP), early onset of postural instability and vertical gaze palsy. However, a reduction in upgaze is non-specific as it may be present in a number of other conditions or even normal ageing. Other features of PSP include very reduced blinking, which may lead to dry eye and conjunctivitis.

Retrocollis and frontalis over activity, which leads to a startled expression. The akinesia is usually symmetrical from its onset.

MUSCLE DISEASES

Mutation in the *dystrophin* gene causes deficiency of dystrophin in **Duchenne's muscular dystrophy**. Patients develop progressive upper and lower limb weakness with pseudohypertrophy of calves and quadriceps.

Facioscapulohumeral dystrophy (FSHD) is one of the most common types of muscular dystrophy. It is of autosomal dominant inheritance. Onset is usually age 20 years. Initial weakness is seen in facial muscles, starting in the orbicularis oculi, orbicularis oris, and zygomaticus. Shoulder weakness is the presenting symptom in more than 82% of patients. Winging of the scapula is the most characteristic sign. Creatine kinase levels are raised. The drug *Albuterol* which relaxes bronchial smooth muscle has been shown to increase lean muscle mass when used over a period of months.

Myotonic dystrophy is autosomal dominant. It is a trinucleotide repeat disorder which exhibits anticipation (worse with successive generations). Associated features are cataracts, diabetes, testicular atrophy and cardiac conduction abnormalities, cardiomyopathy, dysphagia, cognitive impairment.

Spinal muscular atrophies are a group of disorders characterised by progressive degeneration of the motor neurons of the spinal cord and brainstem. Muscles weaken and atrophy due to degeneration of motor neurones which are nerve cells in the spinal cord.

In general we can distinguish three common types of SMA in childhood :
Type 1 Severe Infantile SMA, or *Werdnig-Hoffmann* disease,
Type 2 Intermediate type,
Type 3 Mild Juvenile SMA, or *Kugelberg-Welander* disease.
Most forms, especially the earlier onset, are inherited in an autosomal recessive manner.

Creatinine kinase is normal, although EMG may show fibrillations secondary to denervation. This also produces group atrophy on muscle biopsy. There are no treatments, and prognosis depends on the severity of the form.

CEREBELLAR SYNDROMES

The tremors in **cerebellar syndrome** are 3Hz, whilst the tremors in **essential tremor** are 5-8Hz.

Spinocerebellar Ataxia:
SCA 1 is purely cerebellar, whilst other forms may have eye involvement or areflexia.

Friedreich's Ataxia is an autosomal recessively inherited. It is multisystemic. Outside neurological abnormalities, patients may have cardiomyopathy and diabetes.

Neurological abnormalities include optic atrophy and retinitis pigmentosa, nystagmus, cerebellar disease and signs, loss of dorsal column sensation and weakness. *Pes cavus* (high arched feet) is usually present.

Anti Yo antibodies are associated with a *cerebellar syndrome* due to either lung, breast or ovarian carcinoma.

A mnemonic for **cerebellar signs** is VANISH'D – Vertigo, Ataxia, Nystagmus, Intention tremor, Scanning speech, Hypotonia and Dysdiadochokinesis.

MITOCHONDRIAL MYOPATHIES

Chronic progressive external ophthalmoplegia (CPEO) is a disorder characterized by slowly progressive paralysis of the extraocular muscles. Patients usually experience bilateral, symmetrical, progressive ptosis, followed by ophthalmoparesis months to years later.

Leber's Hereditary Optic Neuropathy is a rare condition which can cause loss of central vision. It usually affects men, most commonly in the late twenties or early thirties, but the symptoms can happen at any age, to men or women.

MELAS (myopathy, encephalopathy, lactic acidosis and stroke like episodes). Lactic acidosis is a very important feature of this disorder, as measured by a high lactate to pyruvate ratio. However, in general, lactic acidosis does not lead to systemic metabolic acidosis, and it may be absent in patients with impressive involvement of the central nervous system. Patients have a myopathy causing proximal muscle weakness and hypotonia, seizures and strokelike episodes. It is a mitochondrial inherited disorder.

MERRF (myoclonic epilepsy, ragged red fibres). The most characteristic symptom of MERRF syndrome is myoclonic seizures that are usually sudden, brief, jerking, spasms that can affect the limbs or the entire body. Ataxia as well as lactic acidosis may also be present in affected individuals. Dysarthria, optic atrophy, short stature, hearing loss, dementia and nystagmus may also occur.

MOVEMENT DISORDERS

The following features support a diagnosis of **Essential Tremor**:
(1) bilateral action tremor of the hands and forearms
(2) absence of other neurological signs, except the cogwheel phenomenon
(3) may have isolated head tremor with no signs of dystonia
Secondary criteria include a long disease duration (more than three years), a positive family history and beneficial response to alcohol.

Discomfort in the arms and legs, arm or leg restlessness, relief with movement and worsening symptoms in the evening are features that satisfy diagnostic criteria of **restless leg syndrome**. It is associated with Parkinsonism, iron deficiency anaemia, diabetes mellitus and hypothyroidism.

Hemiballismus is a rare disorder characterised by involuntary wild flinging movements of the limbs. It is usually unilateral (hence hemiballismus) and is caused by lesions in the contralateral subthalamic nucleus.

Catalepsy (a form of catatonia) is a disorder of muscle tone in which uncomfortable positions can be maintained for a long time. It is a feature of schizophrenia. Cataplexy is the sudden loss of motor tone associated with the sleep disorder narcolepsy.

Chorea
Huntington's disease, carbon monoxide poisoning, Behcet's disease and DRPLA are causes of **chorea**.

Huntington's disease is usually autosomal dominant. It is a *trinucleotide repeat disorder* involving CAG repeats. The gene is mapped to chromosome 4 (remember GABA 4 letters). There is an increase in the protein *Huntingtin* (polyglutamine), because glutamine is coded for by CAG. *Anticipation* refers to the increase in severity with subsequent generations. Patients with Huntington's disease have dementia, ataxia, abnormal choreiform movements and opthalmoplegia. A small percentage of children present with a parkinsonian like akinetic rigid syndrome or epilepsy. Treatment is with phenothiazines (haloperidol) for symptomatic control.

Sydenham's chorea is the least common presentation of acute rheumatic fever (3% of patients). It is mostly observed in young girls and presents as involuntary choreoathetoid movements of face, tongue and upper extremities.

MULTIPLE SCLEROSIS

80%	-	Relapsing / remitting – short attacks of relapses (4-6 weeks)
	-	1/3 of these patients become secondary progressives
20%	-	Primary progressive – gradual deterioration from onset

Diagnosis - Demyelination seen on MRI, gadolinium enhancing l4sions
Delayed Visual Evoked Potentials
CSF oligoclonal bands present (not in the serum)

Presentation - Optic neuritis – painsful visual loss, colour vision affected
Spastic paraparesis
Urinary retention or incontinence (may need self catheterisation)

Therapy – iv methylprednisolone for relapses (500mg for 3 or 5 days)
- B interferon – subcutaneous injection 1x a week only for relapsing remitting

MISCELLANEOUS

Absent tendon reflexes and extensor plantars point towards a combined UMN and LMN lesion.

The causes of extensor plantars (UMN) and absent ankle jerks (LMN) are:
Motor neuron disease
Subacute combined degeneration of the cord (B12 deficiency)
Tabes Dorsalis (syphilis)
Lesion of the cauda equine
Diabetes+CVA
Friedriech's ataxia

Arnold-Chiari Malformation is a condition in which the cerebellum portion of the brain protrudes into the spinal canal. It may or may not be apparent at birth.

Arnold-Chiari I type malformation usually causes symptoms in young adults and is often associated with *syringomyelia*, in which a tubular cavity develops within the spinal cord.

Arnold-Chiari II type malformation is associated with *myelomeningocele* (a defect of the spine) and hydrocephalus (increased cerebrospinal fluid and pressure within the brain).

Benign intracranial hypertension is most common in women between the ages of 20 and 50. BIH is likely due to high pressure caused by the buildup or poor absorption of cerebrospinal fluid in the subarachnoid space surrounding the brain. Symptoms include headache, nausea, vomiting, and pulsating intracranial noises, closely mimic symptoms of brain tumors. Vitamin A, prednisolone, minocycline and cyclosporin make benign intracranial hypertension worse. Acetazolamide is used to treat BIH.

Botulism is a paralytic disease caused by the neurotoxins of *Clostridium botulinum* and in rare cases, *Clostridium butyricum* and *Clostridium baratii*. Wound botulism, caused by systemic spread of toxin produced by organisms inhabiting wounds, is associated with trauma, surgery, subcutaneous heroin injection, and sinusitis from intranasal cocaine abuse.

The neurologic symptomatology often has been described as a progressive, symmetric, descending weakness or paralysis that first affects muscles innervated by the cranial nerves, then progresses to involve muscles of the neck, arms, and legs. Respiratory difficulty arises from airway obstruction and diaphragmatic weakness. Diplopia, dysarthria, dry mouth, and generalized weakness are among the most common presenting symptoms. The botulinum toxin assay can be done to confirm the diagnosis

Brown Sequard syndrome which describes hemisection of the spinal cord, causes ipsilateral UMN signs and proprioception loss, and contralateral sensory loss.

Causes of *Upper Motor Neuron* facial weakness
CVA
pontine haemorrhage
Multiple Sclerosis
motor neuron disease

Causes of *Lower Motor Neuron* facial weakness :
Sarcoidosis

infective polyneuritis
Lyme disease
poliomyelitis
Guillan-Barre Syndrome
vasculitis
HIV

Causes of lymphocytic meningitis :
TB, HSV, mumps, HIV, enteroviruses, Brucella and Listeria

EMG
Reduced amplitude and duration of motor units changes are consistent with a myositis.
In motor neuron disease, *fibrillation* is seen.
In myasthenia, there is diminished response to repetitive stimulation.
Reduced amplitude of action potential is seen in axonal neuropathy.
Reduced conduction velocity or conduction block is seen in demyelination.
In myotonia, an extended series of repetitive discharges lasting up to 30 seconds occurs.

New variant CJD commonly presents in young adults painful sensory symptoms in the lower limbs and also psychiatric symptoms. Cognitive impairment, pyramidal signs, myoclonus and primitive reflexes then develop.

MRI commonly shows high signal on T2-weighted images in the pulvinar (posterior aspect of thalamus). EEG is often normal, unlike sporadic CJD, in which triphasic waves are observed.

In **sporadic CJD**, the EEG changes usually show diffuse, non-specific slowing (1-2 Hz) and sharp wave complexes, in deep brain areas (thalamus).

A very rare condition associated with Hashimoto's Thyroiditis is **Hashimoto's Encephalopathy**. In Hashimoto's Encephalopathy, antibodies attack the neurons in the brain. Some of the common symptoms include: disorientation, psychosis, tremors, concentration and memory problems, jerks in the muscles and lack of coordination, headaches, partial paralysis on the right side, and speech defects. The main treatment is prednisolone.

In **HSV encephalitis**, there can be disorientation or dysphasia and seizures. There is also mild lymphocytosis on the CSF. MRI may show frontal or temporal lobe involvement. EEG may show periodic sharp wave activity temporally and background of focal or diffuse slowing.

Acute disseminated encephalomyelitis (ADEM) is a demyelinating disorder of the CNS that seems to be immune mediated. It may be precipitated by measles, rubella, Varicella-zoster, smallpox, mumps, influenza, parainfluenza, infectious mononucleosis, typhoid, mycoplasma infections. PML, CNS lymphoma, encephalitis (HSV, CMV), cerebral toxoplasmosis and cerebral TB are AIDS related.

HMSN 1 is the most common form of hereditary neuropathy. Severely and uniformly slowed nerve conduction velocities (NCVs) and primary hypertrophic myelin pathology with prominent onion bulbs and secondary axonal changes are the hallmarks of the disease. Motor symptoms predominate over sensory symptoms. Often, patients report loss of balance, muscle weakness, and foot deformities. Onset in the first decade of life is typical, but disease develops in some patients in young or mid adulthood.

HMSN 2, on the other hand, represents the nondemyelinating neuronal type with relatively normal NCVs and primary axonal pathology. Although nerves are not enlarged in the neuronal form, weakness often is less marked and onset of this neuropathy is delayed. Peripheral nerves are not enlarged clinically, and weakness of feet and leg muscles predominates; hands are less severely affected than the legs. Patients experience sensory loss in the distal extremities, and foot deformities (ie, pes cavus) tend to be less marked than those of HMSN 1.

Hereditary spastic paraparesis often classified based upon whether progressive spasticity occurs as an isolated finding (i.e., uncomplicated or "pure" HSP) or with other neurologic abnormalities (i.e., complicated HSP).

In families affected by complicated HSP, associated neurologic features have included mental retardation; deafness; degenerative changes of the retinas or the nerve-rich, innermost membranes of the eyes (retinopathy); impaired coordination of voluntary movements (ataxia); or progressive deterioration of thought processing and acquired intellectual abilities (dementia).

HSP may be inherited as an autosomal dominant, autosomal recessive, or x-linked recessive trait but the commonest form of inheritance is autosomal dominant.

Glioblastoma multiforme is by far the most common and most malignant of the glial tumors. Composed of poorly differentiated neoplastic astrocytes, glioblastomas primarily affect adults, and they are located preferentially in the cerebral hemispheres. Glioblastoma is commoner in adults than medulloblastoma. Although current therapies remain palliative, they have been shown to prolong quality survival. Without therapy, patients with GBMs uniformly die within 3 months. Patients treated with optimal therapy, including surgical resection, radiation therapy, and chemotherapy, have a median survival of approximately 1 year.

Guillain Barre syndrome is preceded by diarrhoea (e.g. campylobacter) and chest infections (e.g. mycoplasma) in two thirds of cases. Autonomic dysfunction and hyporeflexia re associated. Studies have shown that plasma exchange and IVIg are equally effective in treating people within two to four weeks of onset of GBS.

Inclusion body myositis: In this condition, dysphagia and respiratory involvement can also occur. Muscle biopsy shows intracellular inclusions (amyloid precursor protein, ubiquitins) and inflammatory infiltrates.
Clinical suspicion for s-IBM should be very high when the pattern of weakness affects

(1) the finger/wrist flexors out of proportion to the finger/wrist extensors and shoulder abductors or
(2) knee extensors disproportionate to the hip flexors. Dysphagia may occur in up to 40% of patients and is secondary to direct involvement of the cricopharyngeal musculature.

Kennedy's syndrome is an X linked recessive (spino-bulbar muscular atrophy), trinucleotide repeat disorder. There is peri-oral and tongue fasciculation, facial weakness, proximal limb weakness, limb fasciculation and dysarthria. CK is often elevated, and there may be gynaecomastia and testicular atrophy.

Multifocal motor neuropathy: There is lower motor neuron muscle weakness, typically in the legs. Anti-GM1 antibody and NP-9 antigen are present in multifocal motor neuropathy. Motor conduction block is also seen in multifocal motor neuropathy.

Normal pressure hydrocephalus (NPH) is a clinical symptom complex characterized by abnormal gait, urinary incontinence, and dementia. Ventricular enlargement out of proportion to sulcal atrophy on the CT scan. Surgical CSF shunting remains the main treatment modality.

Narcolepsy
Hypnogogic and hypnopompic hallucinations are seen in narcolepsy.
Episodes of cataplexy occur.
The HLA association is DQB1, Clomipramine is a tricyclic antidepressant which may help, there is early REM sleep and hypnagogic hallucinations occur.

Neuroacanthocytosis is diagnosed by the demonstration of acanthocytes on the peripheral blood film. It is a progressive neurologic disease characterized by movement disorders, personality changes, cognitive deterioration, axonal neuropathy, and seizures.

Horner's syndrome. The sympathetic nerve fibres from the hypothalamus travel through brainstem and cervical cord to T1/T2. These synapse on preganglionic sympathetic fibres, travel up sympathetic chain to superior cervical ganglion, and then synapse onto postganglionic fibres which travel with common and internal carotid arteries.

Neurofibromatosis
NF1 (NF gene 1 defect) is found on chromosome 17 (mnemonic: there are 17 letters in the word).
NF2 gene defect is on chromosome 22.

Lisch nodules (pigmented spots) of the iris are present in more than 90% of patients with **neurofibromatosis type 1**. The diagnosis is suggested by six or more *café au lait* spots. Although the condition is autosomal dominant, almost half of all cases are new mutations.
Bilateral acoustic neuromas are a hallmark feature of neurofibromatosis type 2

In **motor neuron disease**, UMN signs include muscle spasticity, slowed recruitment of voluntary muscle strength, weakness especially in the extensors of the upper limb and flexors of the lower limb muscles, pseudobulbar palsy. LMN features include muscle wasting and fasciculation, depressed reflexes and bulbar palsy. Onset of the disease is usually in mid to late adult life with the incidence increasing with advancing age.

Paraneoplastic syndrome. Anti Yo antibodies are found in around half of all patients with paraneoplastic cerebellar degeneration. Associated with small cell carcinoma, ovarian tumours and Hodgkin's lymphoma. Anti Hu antibodies are associated with small cell carcinoma of the lung. It is usually associated with sensory neuropathy or with encephalomyelitis.

Pellagra: A triad of dementia, diarrhoea and dermatitis. Niacin (nicotinamide or nicotinic acid) deficiency causes pellagra only if tryptophan, an amino acid, is also deficient. Encephalopathy usually follows. It is characterized by confusion, disorientation, hallucinations, and memory loss.

Subacute Combined Degeneration of the cord: Vitamin B12 deficiency causes ataxia, posterior column cord damage (Loss of vibration sense and proprioception), spasticity, extensor plantars and neuropsychiatric symptoms. Pain is controlled by the spinothalamic tracts which are not affected in B12 deficiency.

Syringomyelia is chronic disorder characterised by the presence of glial-lined cavities situated in the central part of the spinal cord. Recognised causes include Chiari type I malformation, central cord tumours, basal arachnoiditis and trauma.

There may be sensory loss, wasting of the small hand muscles, uni- or bilateral Horner's syndrome, abnormalities of sweating, thickening of subcutaneous tissues, atrophy and decalcification of bones, development of Charcot's joints and Chiari I malformation (due to arachnoiditis).

Tuberous sclerosis. This is an inherited (autosomal dominant) hamartomatous condition in which there are facial angiomas (adenoma sebaceum), subungual fibromas, angiomyolipomas, cardiac rhabdomyomas, pulmonary lymphatic involvement, skin changes such as shagreen patches and ashleaf macules. Acoustic neuromas are associated with neurofibromatosis type 2 and not tuberous sclerosis.

von Hippel Lindau disease is associated with cerebellar haemiangioblastomas and retinal angiomas and polycystic liver or kidneys. Ectopic erythropoietin secretion by the haemangioblastomas cause polycythaemia.