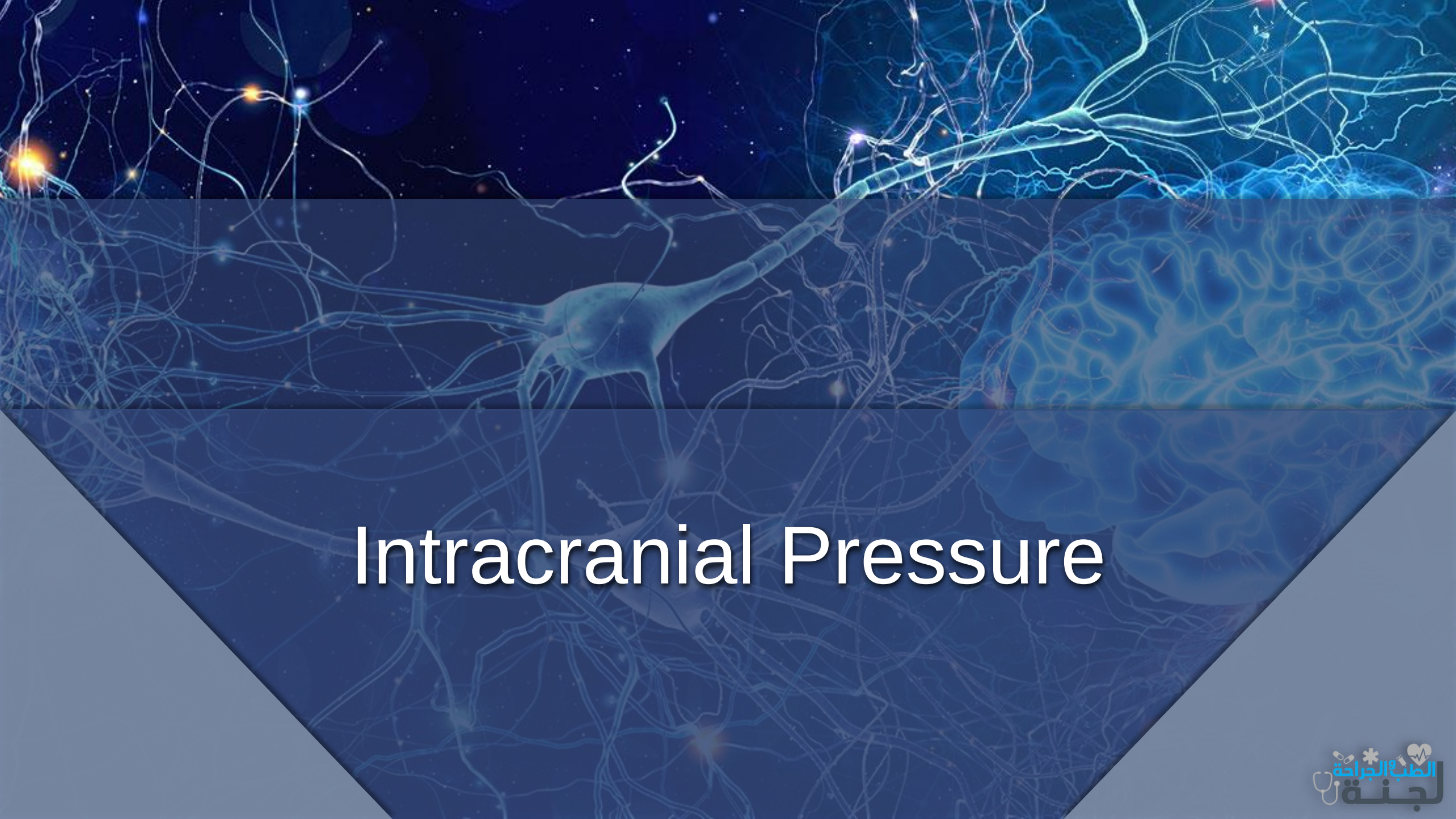
دراية الأسباب في جراحة الأعصاب

2023

إعداد محمود بركات

ملاحظات

- شامل لأسئلة سنوات حتى 09/March/2023
- الملف مرتب حسب المواضيع تحت كل موضوع فيه شرح وأسئلة السنوات
- أسئلة السنوات المكررة تم جمعها بسؤال واحد ووضع عدد مرات تكرار السؤال في هامش أعلى الصفحة من جهة اليمين أو على جانب السؤال
- أي كتابة بصندوق أزرق يعتبر هامش للملاحظات
- معاني الألوان: المهم، ملاحظات أو إضافات أو أسئلة من عندي، معلومات إضافية
- لا تنسوا تراجعوا أناتومي، بلا صياح
- في احتمالية كل فترة يجي فرع أو سؤال كامل جديد من برا المادة، بلا صياح 2
- زي ما تعودنا بس هبل



Intracranial Pressure

Intracranial pressure (ICP)

- **Adults physiological ICP**: ≤15 mmHg (7-15 mmHg)
- **Monro–Kellie hypothesis**
  1. The cranial compartment is inelastic & the volume inside the cranium is fixed
  2. Blood, CSF, and brain tissue create a state of volume equilibrium
  3. Any increase in volume of one of the cranial constituents must be compensated by a decrease in volume of another
  4. The principal buffers for increased volumes include CSF and, to a lesser extent, blood
  - The failure of these buffers result in elevated intracranial pressure
- **Cerebral autoregulation**
  - It is the process by which cerebral blood flow is maintained constant across a wide range of mean arterial pressures (MAPs): 50-150 mmHg
  - **Cerebral perfusion pressure (CPP)** = mean arterial pressure - intracranial pressure

سنوات (3)

  - **Normal cerebral blood flow (CBF)** = ~50ml/100g/min

سنوات (3)

Elevated intracranial pressure

- **Definition**: an intracranial pressure > 20 mmHg
- **Consequences of elevated ICP**
  - Decreased cerebral perfusion pressure (CPP) ⟶ Decreased CBF
  - Brain tissue herniation
  - **Cushing triad**: irregular breathing, widening pulse pressure, and bradycardia
- **Clinical features**
  - Cushing triad: irregular breathing, widening pulse pressure, and bradycardia
  - Reduced levels of consciousness & Psychiatric changes
  - Headache
  - Vomiting (Possibly on an empty stomach and/or projectile vomiting)
  - Papilledema
  - **In infants**: macrocephaly, bulging fontanel, sunset sign
  - Diplopia (if the sixth nerve is affected)

Intracranial pressure – Diagnostics

Neuroimaging (CT head/MRI head)

❖ **Indications**
- Clinical features of increased ICP
- Suspected intracerebral pathology: e.g., mass, seizures, head trauma

❖ **Findings of elevated ICP**
- Mass lesions
- Midline shift
- Changes in ventricular size
- Effacement of the basilar cisterns
- Effacement of cerebral sulci
- Evidence of brain herniation

Invasive ICP monitoring

❖ **Indications** سنوات (3)
1. Traumatic brain injury
2. Mass lesions (brain tumors, hemorrhages)
3. Diffuse brain injury due to infectious or vascular causes
4. Normal pressure hydrocephalus
5. Post intracranial surgery

❖ **Devices** سنوات (2)
1. Intraparenchymal catheter
2. Subdural catheter
3. Subdural bolt

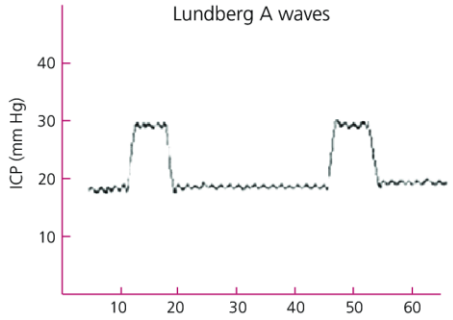
❖ **Complications** سنوات (2)

Infection, Hemorrhage, CSF leak

Lundberg waves

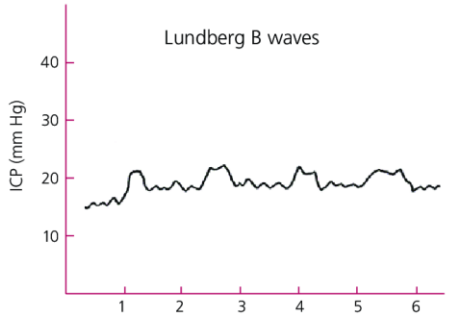
❖Lundberg A waves (Plateau waves)

- They are ICP increases for a period of 5 to 10 minutes.
- They reflect reduced cerebral compliance and impending herniation.



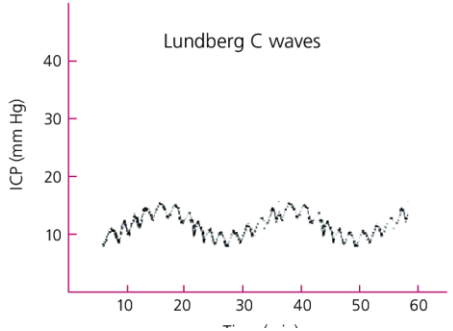
❖Lundberg B waves

- They are repeating elements in the ICP signal with frequencies of to 0.3 to 3 waves per minute that reflect elevated ICP.
- They have been observed in normal subjects, ventilated patients and during sleep. Thus, the value of these waves in clinical practice remains under investigation.



❖Lundberg C waves

- They are oscillating waves at the frequency of 4-8 cycles per minute
- They are thought to reflect normal interactions between the cardiac and pulmonary cycles.



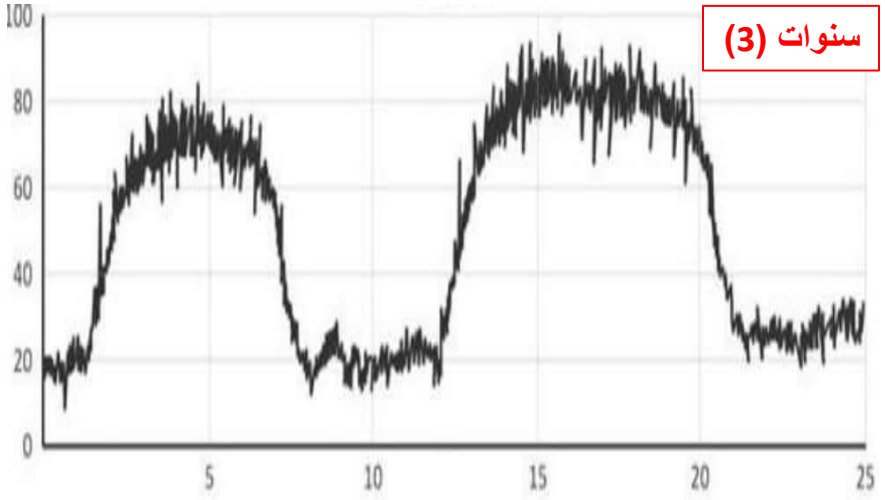
Lundberg waves

❖**What is the type of this wave ?**

- Lundberg Wave A (if you don't write Lundberg the answer is WRONG)

❖**What is the description of it?**

- Increase mean ICP > 50 mmHg
- Lasting for 5-20 minutes
- (these 2 points are enough)

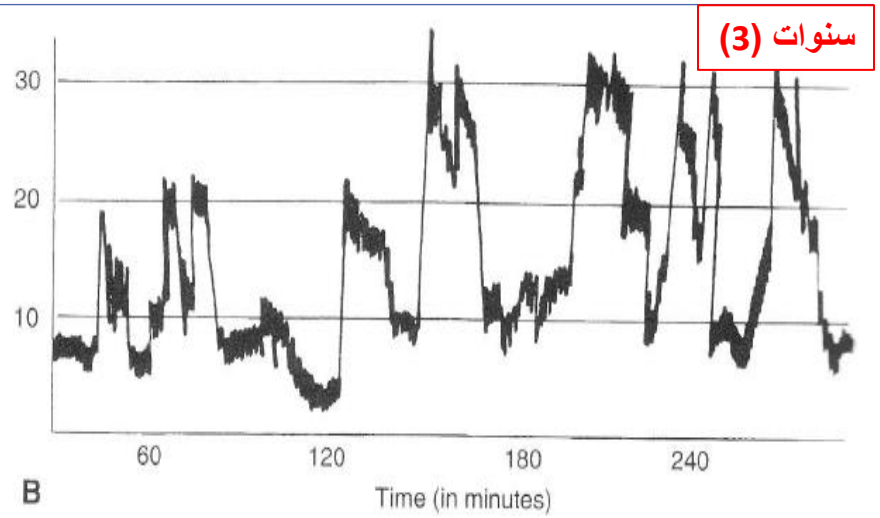


❖**What is the type of this wave ?**

- Lundberg Wave B (if you don't write Lundberg the answer is WRONG)

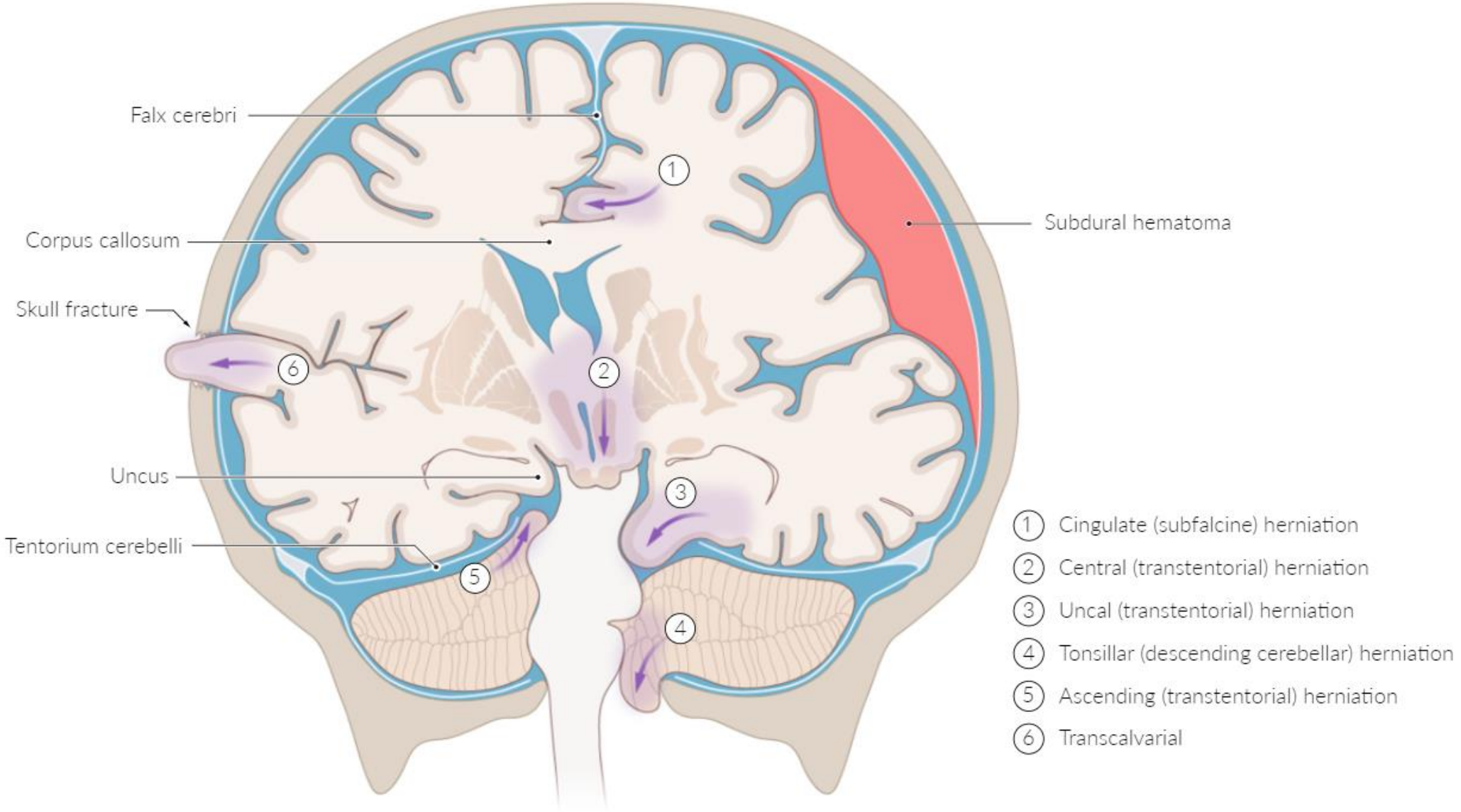
❖**What is the description of it?**

- Sharp, rhythmic increase ICP of (20-50) for 30s to 2 minutes



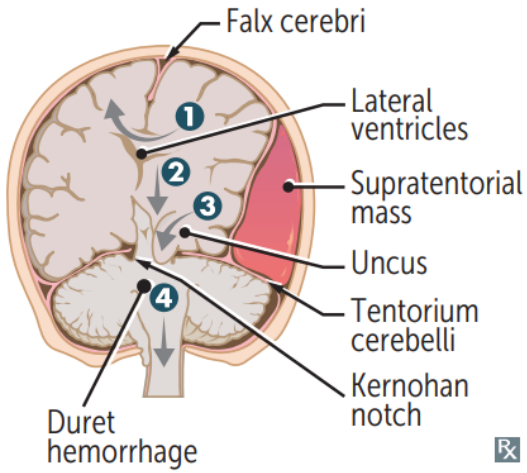
Cerebral edema				
	Vasogenic	**Cytotoxic**	**Interstitial**	**Osmotic**
Pathophysiology	Breakdown of tight endothelial junctions → impaired capillary permeability → extracellular accumulation of fluids	Damage to brain parenchyma cells (e.g., due to hypoxia) → impaired Na+/K+-ATPase function → intracellular accumulation of Na+ and fluids → expansion of neurons, glial, and endothelial cells	Blocked CSF drainage → ↑ ventricular pressure → CSF forced across the ependymal tissue and into the brain parenchyma → interstitial fluid accumulation	Lower plasma osmolarity than intracerebral osmolarity → osmotic gradient → water diffusion across BBB into interstitial fluid
Etiology	• Ischemic stroke (late stages) • Space-occupying lesions (e.g., brain tumors) • Traumatic brain injury (early stages) • Inflammatory (e.g., encephalitis) • Toxic (e.g., lead poisoning)	• Ischemic stroke (early stages) • Hyperammonemia (e.g., due to acute liver failure) • Traumatic brain injury (late stages)	• Hydrocephalus • Idiopathic intracranial hypertension	Hyponatremia
BBB integrity	Breakdown	Intact	Intact	Intact
Management	Treatment of underlying causes and elevated ICP, if present			

Brain herniation



Brain herniation

Herniation syndromes



❶ Cingulate (subfalcine) herniation under falx cerebri	Can compress anterior cerebral artery.
❷ Central/downward transtentorial herniation	Caudal displacement of brainstem ▲ rupture of paramedian basilar artery branches ▲ Duret hemorrhages. Usually fatal.
❸ Uncal transtentorial herniation	Uncus = medial temporal lobe. Early herniation ▲ ipsilateral blown pupil (unilateral CN III compression), contralateral hemiparesis. Late herniation ▲ coma, Kernohan phenomenon (misleading contralateral blown pupil and ipsilateral hemiparesis due to contralateral compression against Kernohan notch).
❹ Cerebellar tonsillar herniation into the foramen magnum	Coma and death result when these herniations compress the brainstem.

Essay Questions

سنوات (1)

❖ **Mention 2 types of brain herniation other than Chiari malformation**

- Subfalcine herniation
- Descending transtentorial herniation
- Foramen magnum herniation

سنوات (1)

❖ **What are the types of brain edema and the cause of each one ?**

- **Vasogenic**: due to tumors, it responds well to steroid
- **Cytotoxic**: due to trauma (late stage)
- **Interstitial**: Hydrocephalus

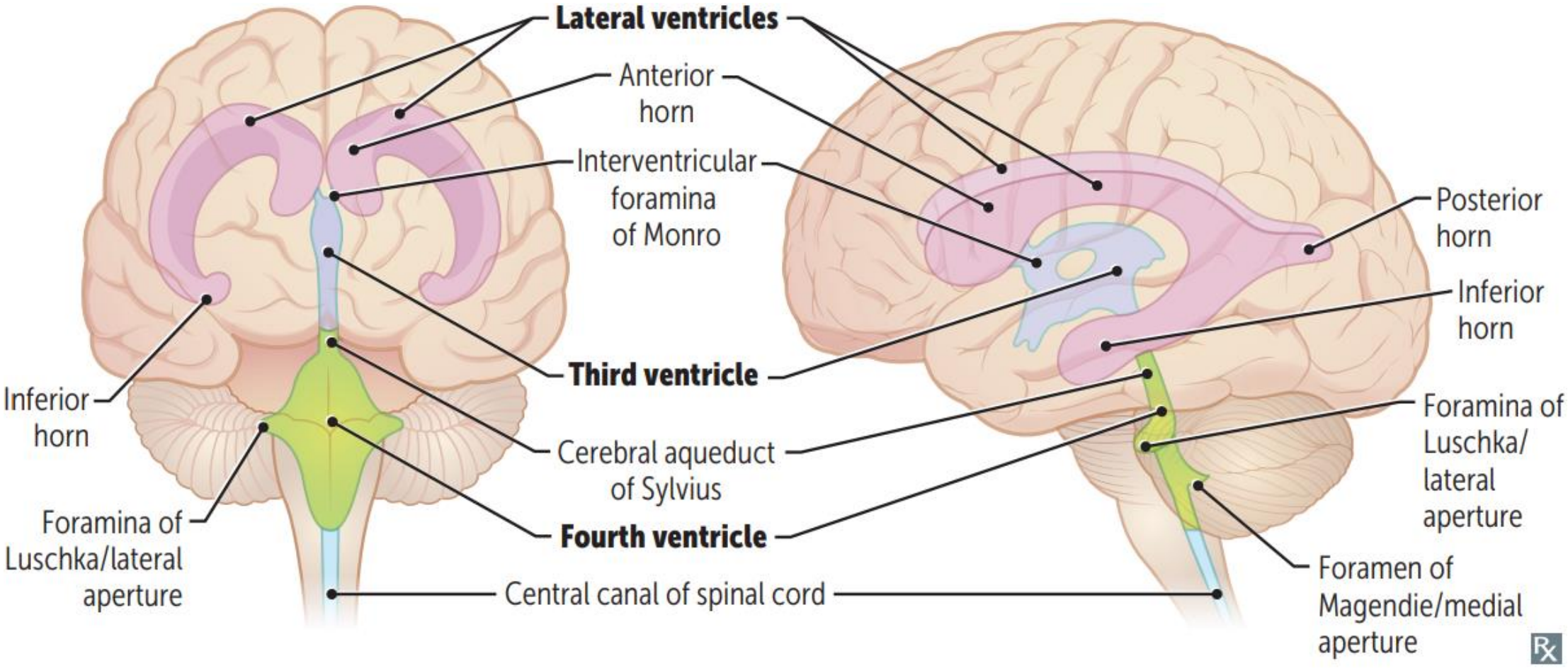
سنوات (1)

❖ **What the mechanism of early morning headache in intracranial hypertension ?**

- Co2 retention due to hypoventilation during sleep
- Recumbent position during sleep decreases venous return
- Cortisol level

Hydrocephalus

Ventricular system



سنوات (3)

CSF pathway from secretion to absorption

- CSF made by choroid plexuses located in the lateral, 3rd, and 4th ventricles
- Lateral ventricles → via right and left interventricular foramina of Monro → 3rd ventricle → via cerebral aqueduct of Sylvius → 4th ventricle → subarachnoid space via foramina of Luschka & foramen of Magendie → subarachnoid space → reabsorbed by arachnoid granulations → then drains into dural venous sinuses
- **Normal values of CSF dynamics**
  - **Volume**: 150 ml
  - **Formation**: 0.4 ml/min (0.3-0.6 ml/min)
  - **Turnover**: 3-4 times a day
  - **Normal amount of CSF produced daily**: 500-600 ml

سنوات (1)

Hydrocephalus

❖**Definition**: abnormal enlargement of the ventricles due to excessive accumulation of CSF usually due to disturbance of its flow, absorption

❖**Classification of hydrocephalus** سنوات (27)

Non-Communicating hydrocephalus	Communicating hydrocephalus
The obstruction is within the ventricular system ❖ Congenital • Aqueductal stenosis (most common congenital cause) • Chiari II malformation • Dandy-Walker malformation • Intrauterine infections: e.g., toxoplasmosis • Colloid cyst obstructing the interventricular foramen ❖ Acquired • Brain tumor (especially medulloblastomas, pinealoma, ependymomas, and astrocytomas)	1. Obstruction outside the ventricular system 2. Failure of absorption by the arachnoid villi • Inflammatory diseases of the central nervous system (e.g., meningitis) • Subarachnoidal or intraventricular hemorrhage • Congenital absence of arachnoid villi 3. Increased CSF production (uncommon) • Choroid plexus papilloma, Choroid plexus carcinoma, Inflammation of the choroid plexus

Clinical features

- What one single definite clinical manifestation for hydrocephalus in adults ?
- What is the mechanism of the sunset eyes ?

❖Features of increased ICP

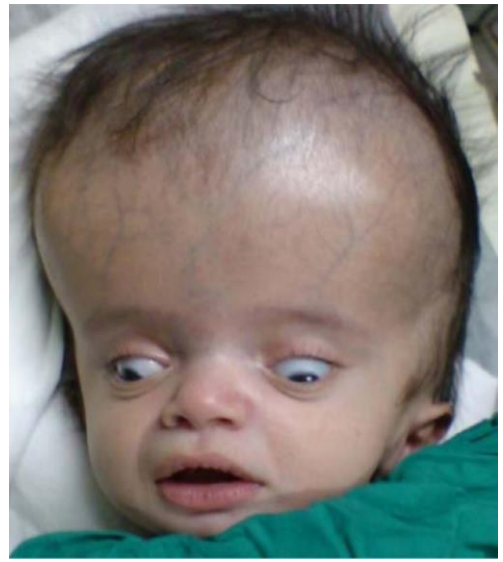
- Headache, nausea, and vomiting
- Papilledema
- Abnormal gait
- Impaired consciousness
- Cushing triad (irregular breathing, widening pulse pressure, bradycardia)
- Abducens nerve palsy (manifests as diplopia)
- Parinaud syndrome (in obstructive hydrocephalus)

❖Additional features in infants

- Macrocephaly, Tense fontanelle
- Setting sun sign: persistent downward deviation of the eyes
- Developmental delays (e.g., psychomotor delays)
- Behavioral changes (e.g., irritability)

❖Associated anomalies

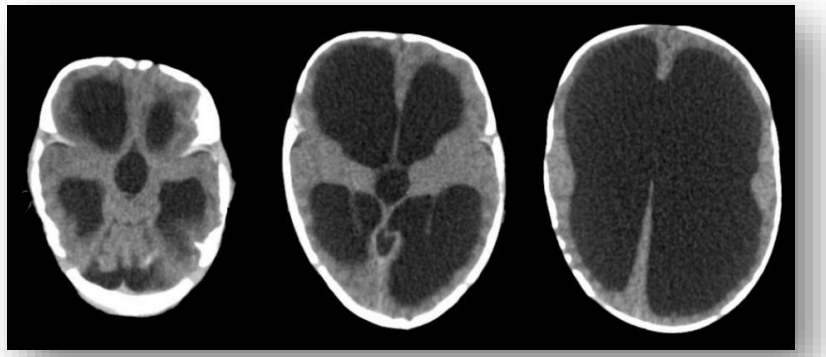
- Chiari malformation, Myelomeningocele, Thumb deformities



Diagnostics

❖ Ultrasonography

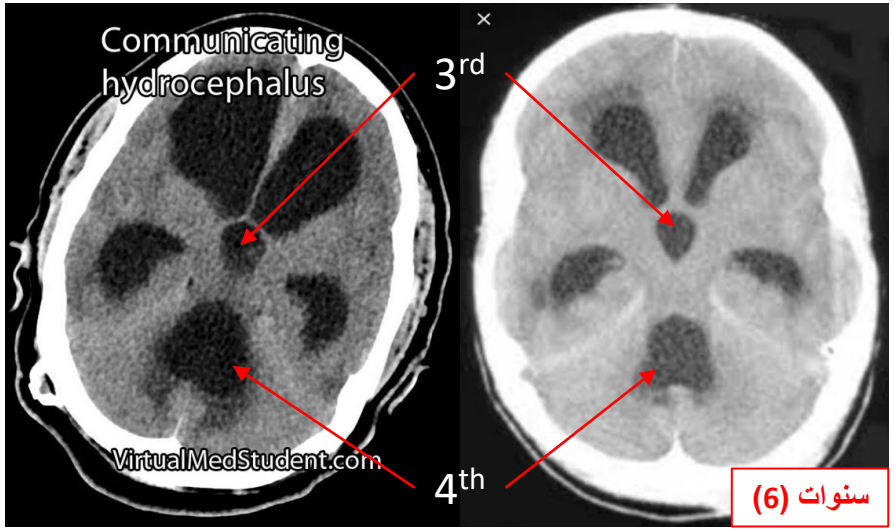
- **Indication**: clinical suspicion during antenatal period or in infants < 6 months of age (through the anterior fontanelle when it is still open)
- **Findings**: enlarged lateral ventricles



❖ MRI or CT

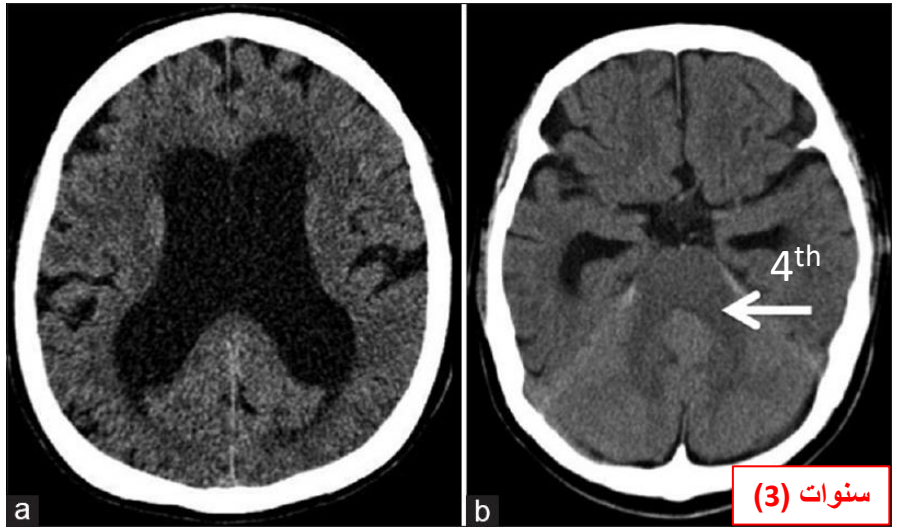
- **Indication**: Older infants and Adults
- **Features of hydrocephalus** سنوات (21)
  1. Enlarged ventricles
  2. Effacement of sulci (Dilated ventricles exert mass effect upon adjacent brain)
  3. Effacement of pericerebral spaces
  4. Periventricular edema
  5. Evans ratio > 30% (largest width of frontal horns vs largest biparietal diameter ratio)
  6. Upward bowing of the corpus callosum

What is the type of hydrocephalus seen in these images ?



Communicating Hydrocephalus

All 4 ventricles are dilated

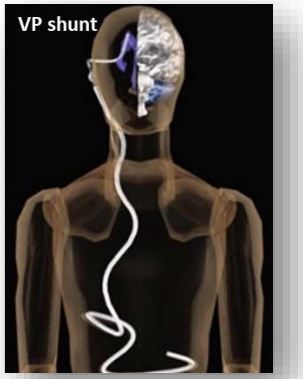


Non-Communicating Hydrocephalus

Lateral and 3rd ventricles are dilated while the 4th ventricle is normal

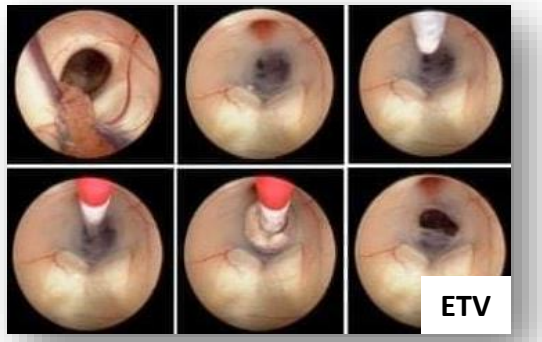
Management

- Management is always surgical
- **Available surgical procedures** سنوات (26)
  - Ventriculoperitoneal shunt
  - External ventricular drains
  - Endoscopic third ventriculostomy (contraindicated in communicating hydrocephalus)



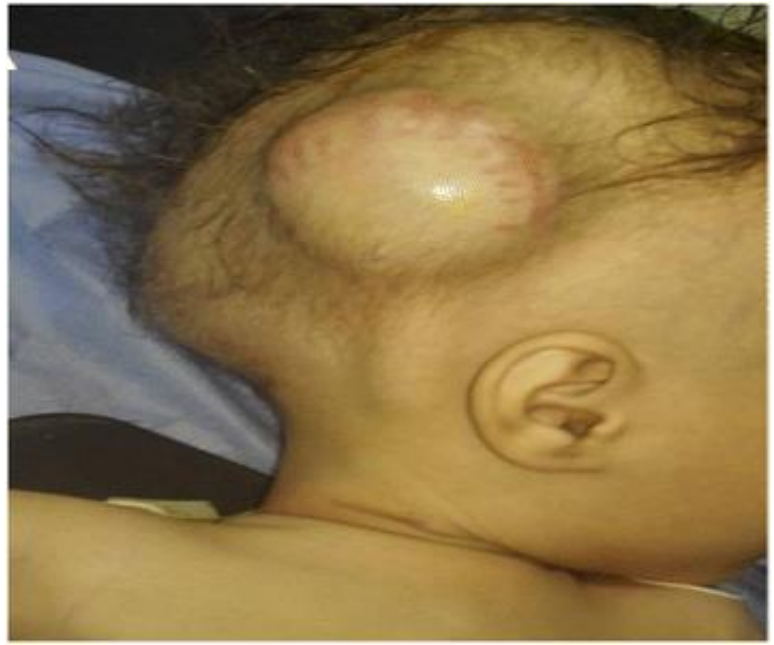
- **What are the complications of the VP shunt ?** سنوات (4)
  - Shunt infection, Shunt blockage, Underdrainage, Overdrainage, Slit ventricle syndrome, Subdural hemorrhage

- **Endoscopic third ventriculostomy (ETV)**
  - What is the site of fenestration ? The floor of 3rd ventricle سنوات (5)
  - Which artery might be injured ? Basilar artery سنوات (5)



Ventriculoperitoneal shunt

- A 3 months old child with VP, came with irritability, decreased oral intake. Vitals are stable, head circumference 45 cm



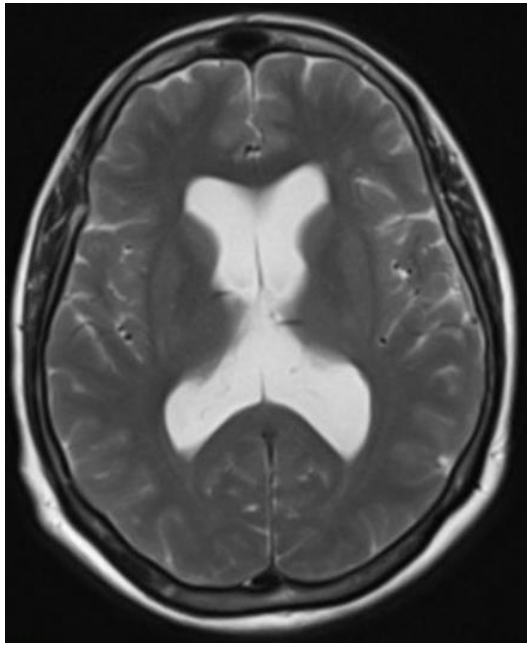
- **What is your diagnosis ?**
  - VP shunt blockage
- **What is the most common cause of hydrocephalus for this patient ?**
  - Aqueductal stenosis
- **Mention 4 signs of hydrocephalus can be present in this patient**
  - Macrocephaly, Tense fontanelle, Setting sun sign, Irritability, Developmental delays
- **What investigations to be done ?**
  - Ultrasound through the anterior fontanelle

Hydrocephalus 1

سنوات (5)

❖What is your diagnosis ?

- Hydrocephalus



❖Mention the entity classification of this picture, 2 examples on each one and the treatment

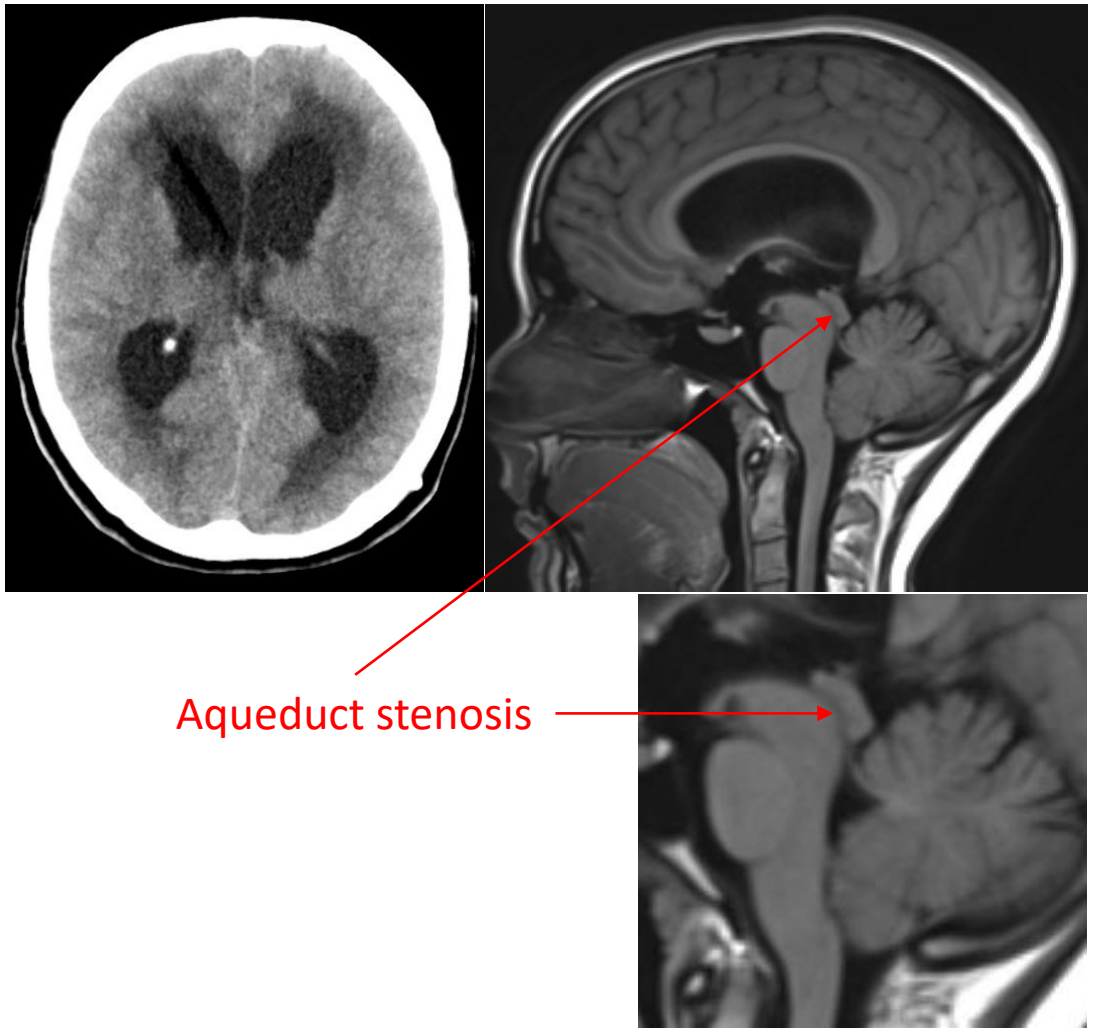
	Communicating	Non-communicating
سنوات (11)		
سنوات (7)	Infection and hemorrhage	Tumor and Aqueductal stenosis
سنوات (5)	VP shunt	VP shunt and ETV

❖Mention 2 signs of acute hydrocephalus on CT scan

- Dilated ventricles
- Periventricular edema
- Evans ratio > 30%
- Upward bowing of the corpus callosum

Hydrocephalus 2

- **What is the type of hydrocephalus seen in this image ?**
  - Obstructive (Aqueduct stenosis)
- **What is your management ?**
  - VP shunt or ETV
- **Mention 2 signs of acute hydrocephalus in adult on CT scan**
  - Dilated ventricles
  - Periventricular edema
  - Evans ratio > 30%
  - Upward bowing of the corpus callosum



Infant's Hydrocephalus

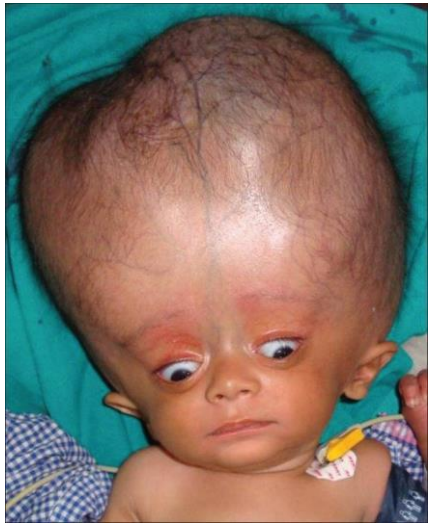
سنوات (10)
- **What is your diagnosis ?**
  - Hydrocephalus

سنوات (10)
- **Mention 4 radiological signs**
  - Dilated ventricles, Effacement of sulci, Periventricular edema, Evans ratio > 30%

سنوات (7)
- **Mention 2 solid clinical signs**
  - Sun setting eye sign, Dilated superficial veins & macrocephaly

سنوات (1)
- **Mention 2 symptoms**
  - Headache, nausea, and vomiting

سنوات (2)
- **Mention 2 signs seen in adults**
  - Papilledema, Abnormal gait



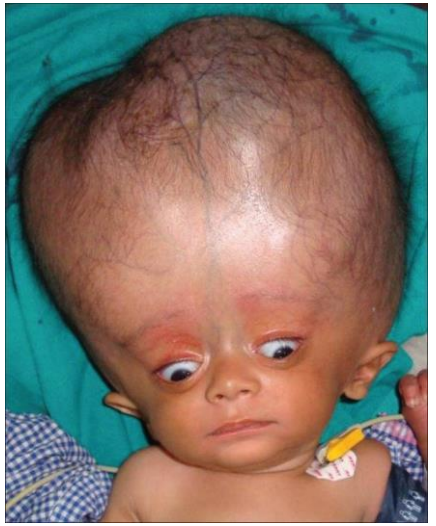
Infant's Hydrocephalus cont.

سنوات (6)
- **Mention 3 surgical procedures**
  - Ventriculoperitoneal shunt
  - Endoscopic third ventriculostomy

سنوات (2)
- **Mention one single definite clinical manifestation for hydrocephalus in adults**
  - Morning headache (not sure)

سنوات (2)
- **Mention a possible associated anomaly**
  - Chiari malformation
  - Myelomeningocele

سنوات (3)
- **Mention 2 possible causes**
  - Non-Communicating (Aqueductal stenosis)
  - Communicating (Infection)

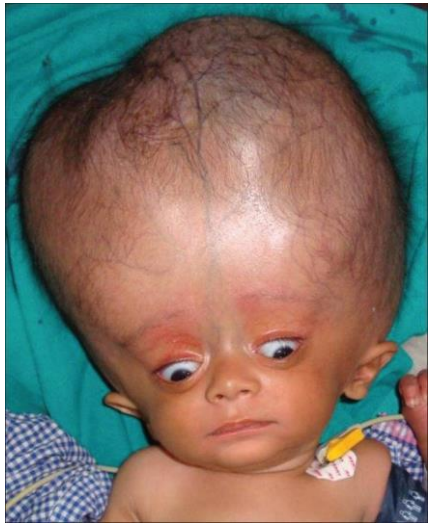


Infant's Hydrocephalus cont.

سنوات (2)

❖What is the mechanism of the sunset eyes

- Results from compression of the tectum, including the superior colliculus, adjacent oculomotor and Edinger-Westphal nuclei, causing dysfunction to the motor function of the eye

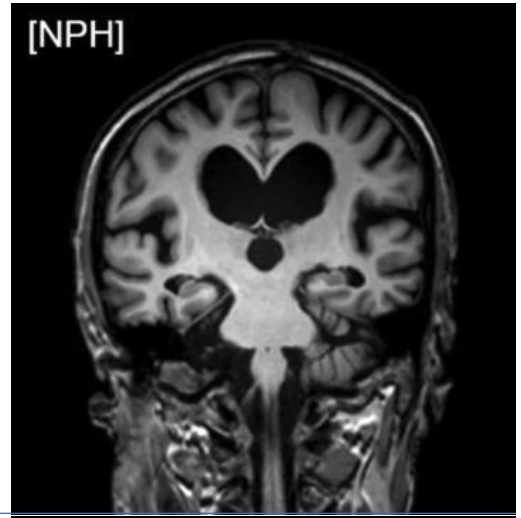


Normal pressure hydrocephalus

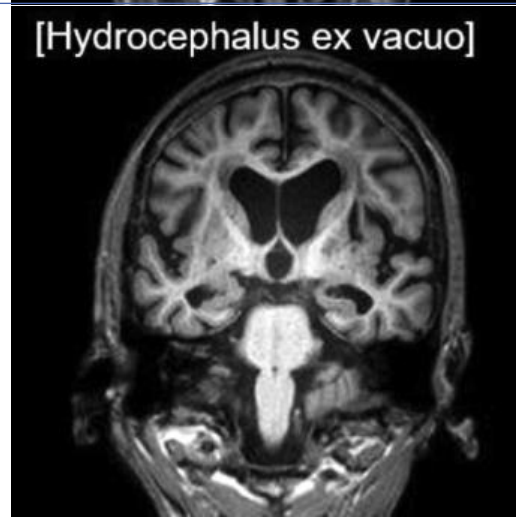
- **Definition**: a form of chronic communicating hydrocephalus that primarily affects elderly individuals and is characterized by a distinct clinical triad (urinary incontinence, dementia, apraxic gait) and normal or episodic increase in ICP
- **Etiology**
  - Idiopathic (most common in adults > 60 years)
  - Possible 2ry causes that result in obstruction and/or fibrosis of subarachnoid villi
- **Pathophysiology**: ↓ CSF absorption → CSF accumulation → enlargement of the ventricle
- **Clinical features**
  - Normal pressure hydrocephalus typically does not manifest with signs of increased ICP (e.g., headache, papilledema).
  - Patients present with the classic triad of the **3Ws**: **W**et (urinary incontinence), **W**acky (dementia), and **W**obbly (gait apraxia).

Imaging of NPH vs Hydrocephalus ex-vacuo

- The CT scan or MRI will show dilated ventricles without significant cortical atrophy.
- The difficulty arises that normal-pressure hydrocephalus may occur in patients with a scan appearance of cortical atrophy, but in these patients the degree of ventricular dilation should be more than would be expected just to compensate for the degree of atrophic change.



- The ventricles and subarachnoid space appear enlarged secondary to loss of brain tissue (an actual shrinkage of brain substance).
- Although there is more CSF than usual, intracranial pressure and flow of cerebrospinal fluid are normal.
- imaging: Enlarged CSF spaces, especially (lateral ventricles) and Cortical atrophy may be prominent.



Normal pressure hydrocephalus

- Case Scenario 1: 57-year-old male, complaining of incontinence, family says he has dementia, and physical exam shows ataxic gait.
- Case Scenario 2: 43-year-old male pt come to ER with ataxia, dementia, urine incontinence, tachycardia, B.P: 90/50 and he doesn't take medication

❖ **What is the diagnosis ?**

- normal pressure hydrocephalus

❖ **Write the triad of normal pressure hydrocephalus ?**

- Incontinence, Dementia, Ataxia

❖ **What is the definitive treatment ?**

- Ventriculoperitoneal shunt

❖ **Which the first symptom improves after treatment ?**

- Ataxia

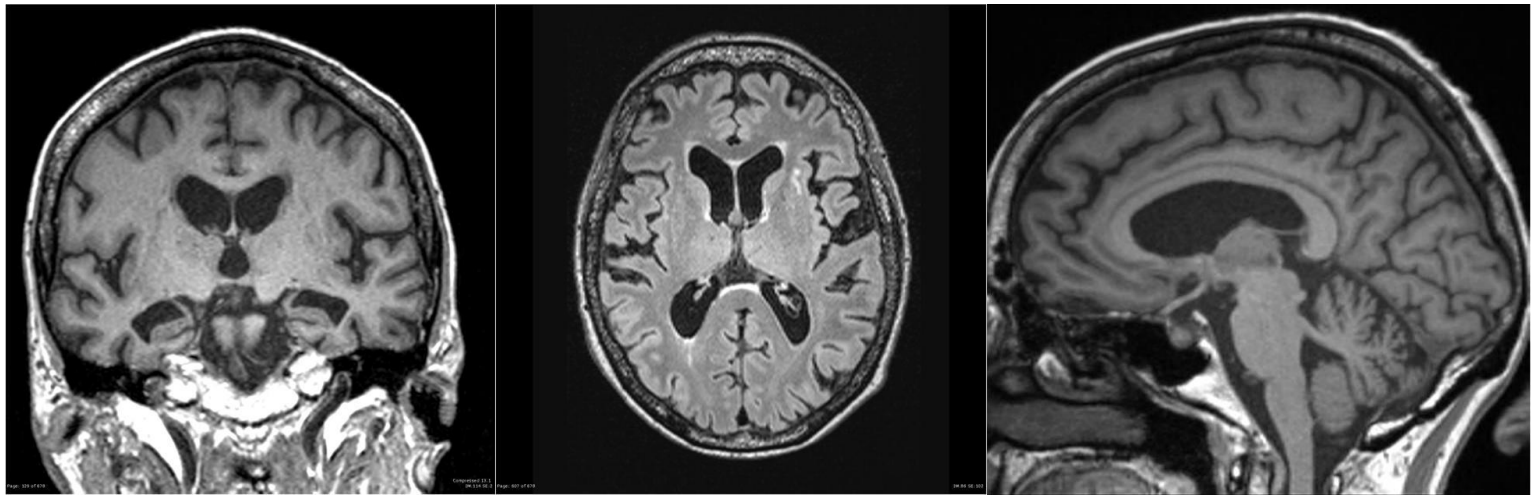
سؤال إضافي

Case Scenario

- 65-year-old female patient present with dementia, agitation, urinary incontinence and instable gait

- **What is the diagnosis ?**

- **What is your management ?**

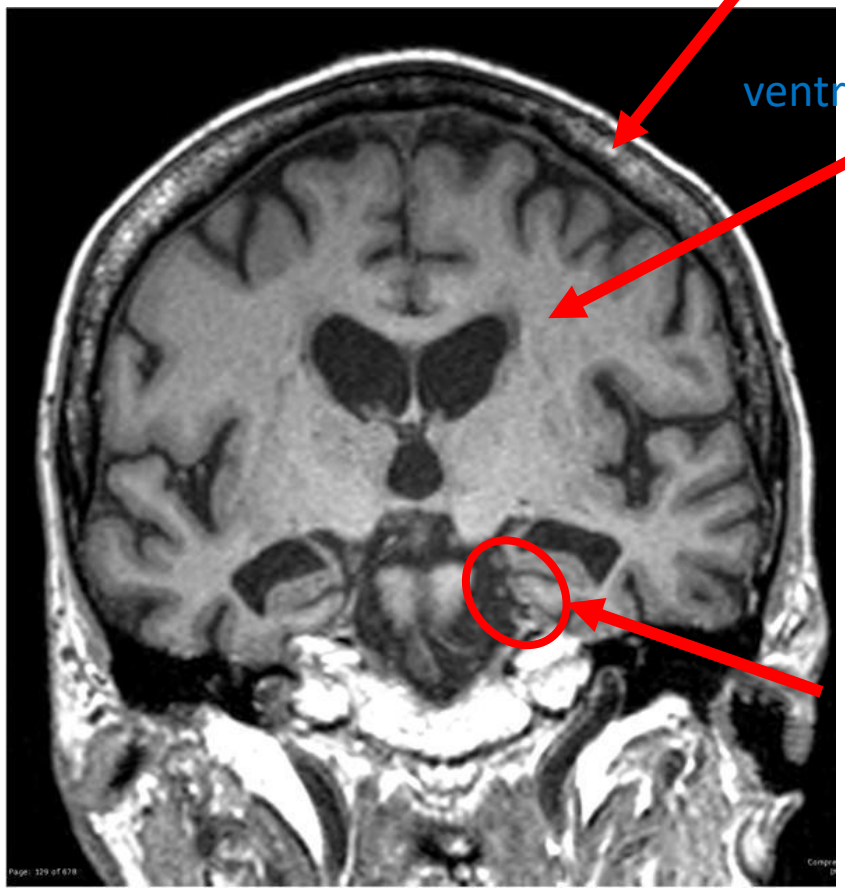


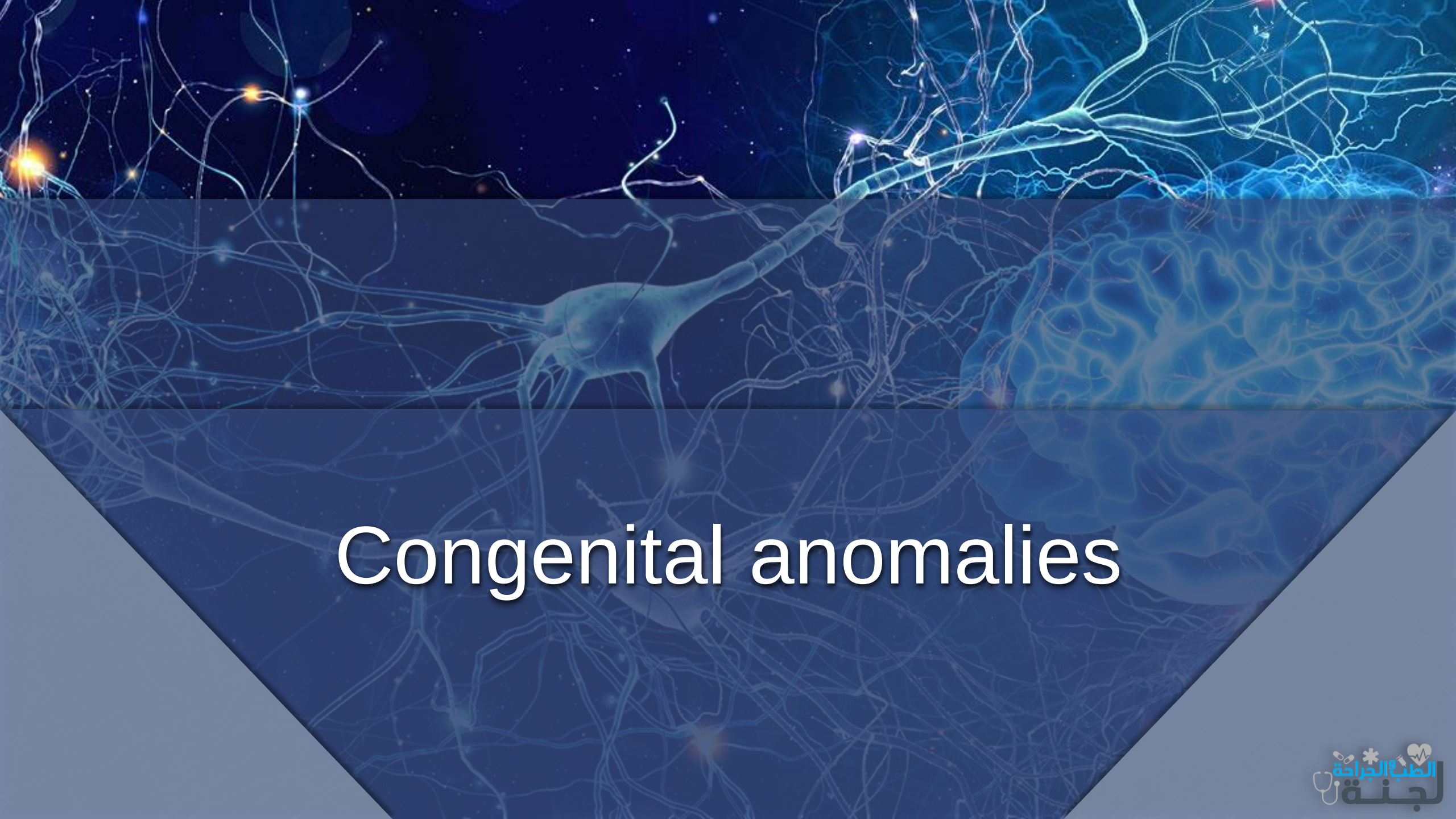
سؤال إضافي ما بيجي زيه

Case Scenario

- **Diagnosis**: Alzheimer disease
- **Management**:
  - Supportive care for dementia, including lifestyle modifications
  - Pharmacological treatment for AD as indicated
  - Management of conditions commonly associated with dementia

➢ The reason I added this case is to emphasis that in real practice it's not that easy to say a patient have NPH just because he have the classic triad. This is because these symptoms are already common in the elderly patients



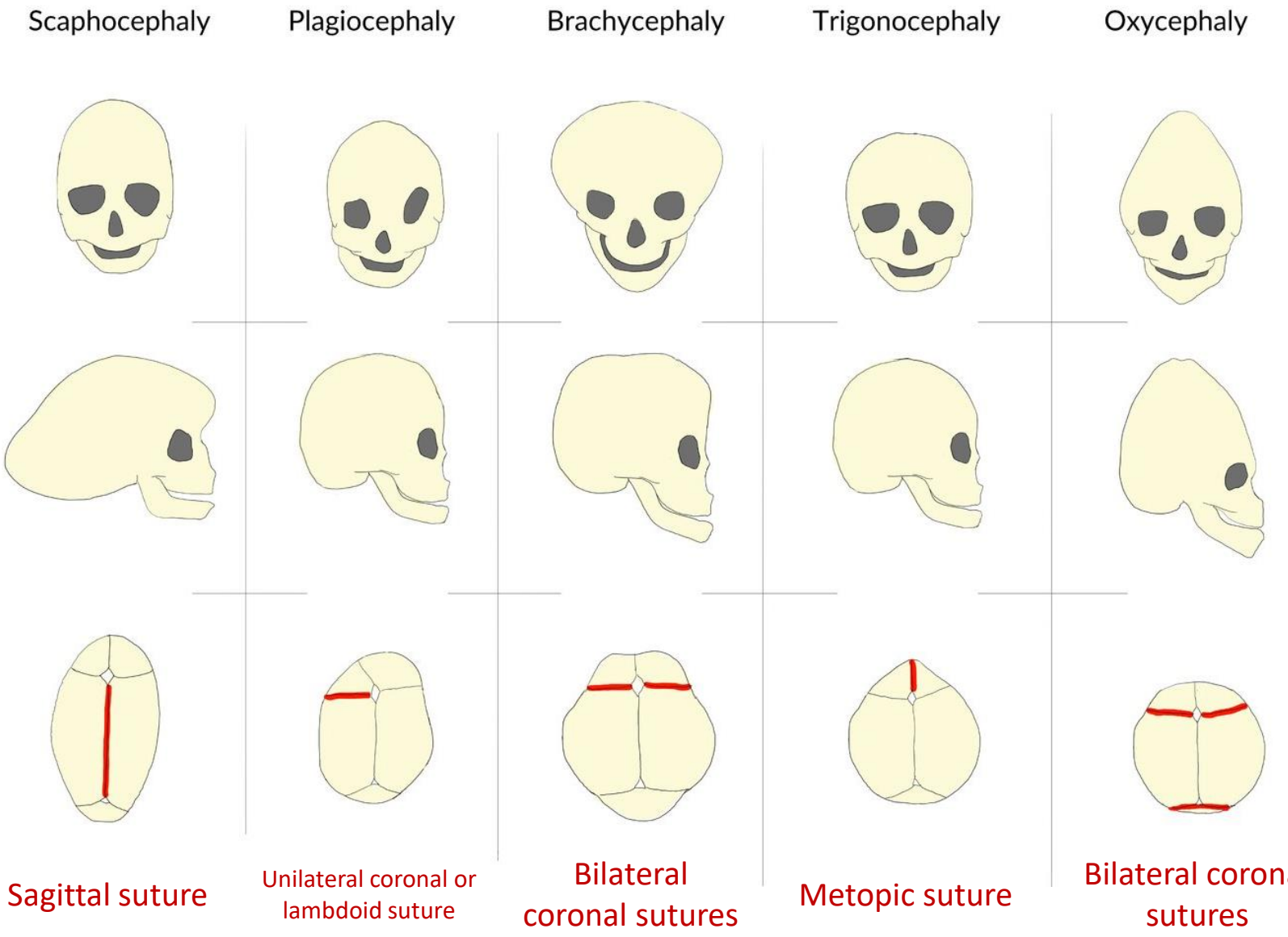


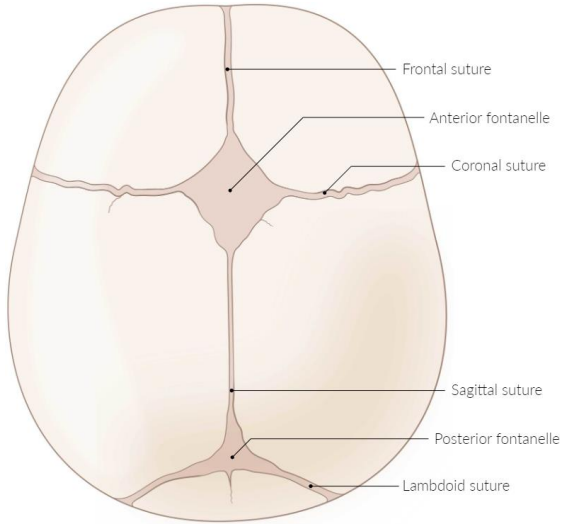
Congenital anomalies

Craniosynostosis

- **Potential risk factors**
  - Hereditary (positive family history)
  - Advanced maternal age
  - Nicotine use during pregnancy
  - Use of clomiphene citrate (used for infertility treatment)
- **Etiology**
  - Mutation in genes which encode for the fibroblast growth factor (FGF), FGF receptor, and/or transforming growth factor beta (TGF-β)
  - Altered FGF, FGF receptor, or TGF-β signaling between the dura mater and mesenchyma of the suture → premature fusion of the skull suture(s)
- **Pathophysiology**: Premature closure of one or more sutures → craniosynostosis
- **Clinical features**: Usually asymptomatic, bnormal head shape within the first year of life
- **Diagnostics**: Mainly a clinical diagnosis

Craniosynostosis

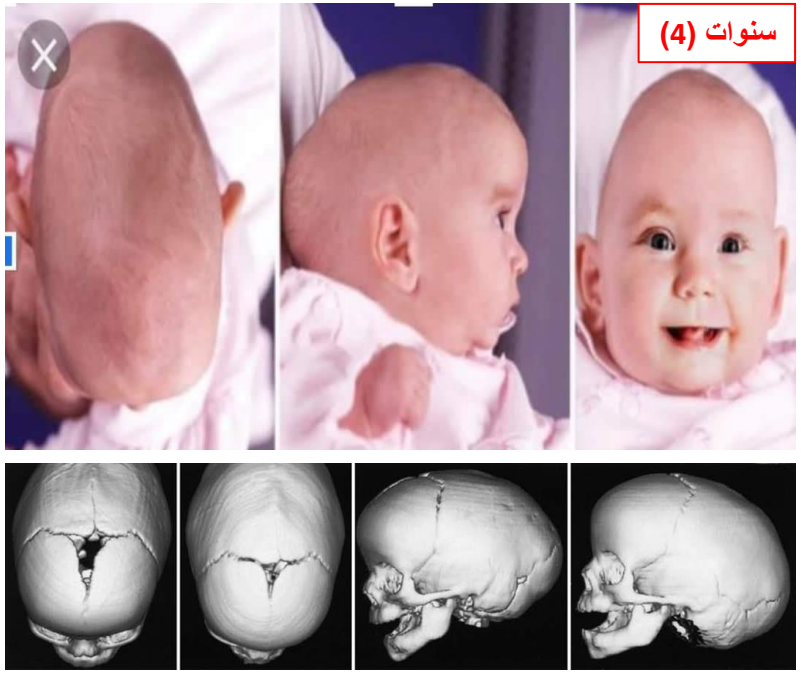




Craniosynostosis

Skull deformity	Suture/s involved	Features
Scaphocephaly/dolichocephaly (sagittal synostosis)	Sagittal suture	• Most common type of CS (~ 45%); 80% male • Long, narrow skull (boat-shaped)
Anterior plagiocephaly (unilateral coronal synostosis)	Unilateral coronal suture	• 2nd most common type of CS • More common in females • Laterally twisted/oblique skull and face
Posterior plagiocephaly (unilateral lambdoid synostosis)	Unilateral lambdoid suture	• Rare type of CS; (male:female = 4:1) • Twisted/oblique skull • Occipitoparietal flattening on the affected side • Low-set ears on the affected side
Trigonocephaly	Metopic suture	• Common type of CS (~ 25% of cases); 75% male • Triangular shaped head • Prominent occiput and parietal eminences • Close-set eyes (hypotelorism)
Brachycephaly	Bilateral coronal sutures	• Short, broad, flattened skull • More common in females
Oxycephaly (turricephaly)	Bilateral coronal sutures (if left untreated)	• Long skull (increased craniocaudal dimension)

What is your spot diagnosis and which suture is affected ?

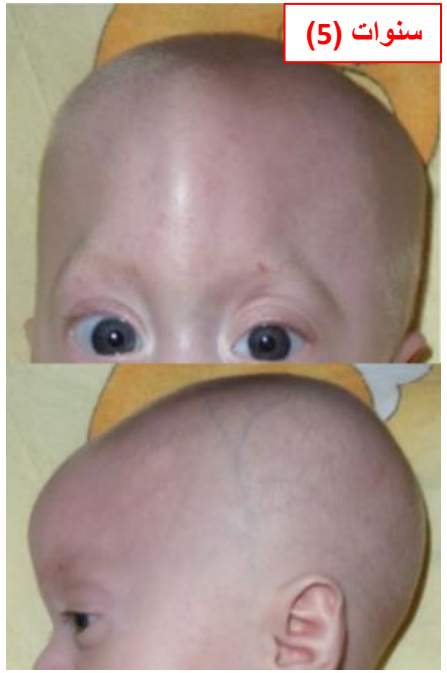


Scaphocephaly

Sagittal suture

Brachycephaly

Bilateral coronal sutures



Trigonocephaly

Metopic suture

Craniosynostosis (مهم)

❖**What is the name of this anomaly ?**

- Trigonocephaly

❖**What is the preferred imaging and why ?**

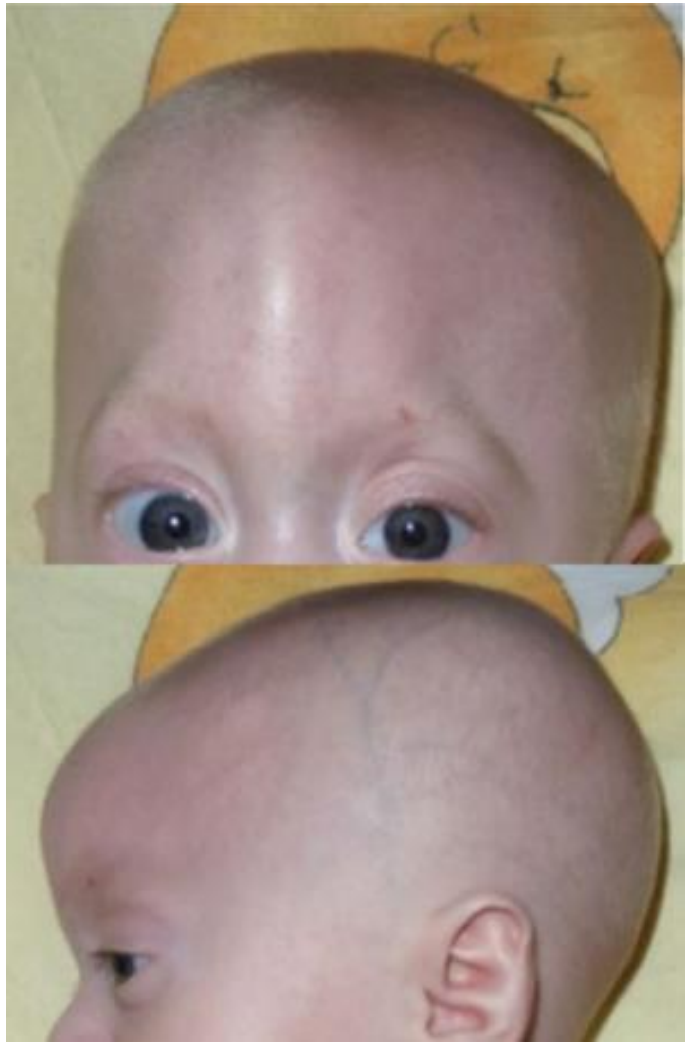
- Cranial CT (with 3D reconstruction)
  - To assess extent of CS
  - To identify hydrocephalus
  - Helps plan surgical reconstruction

❖**What is the treatment and at what age ?**

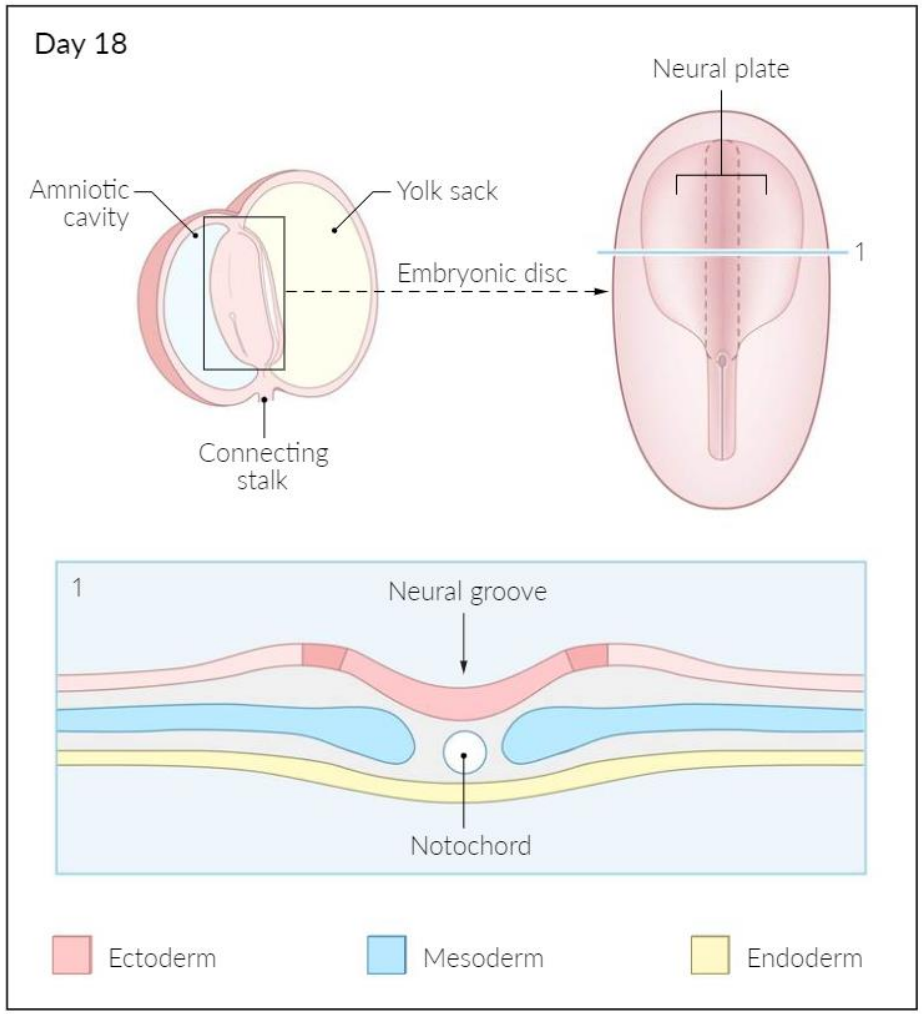
- Strip craniectomy or cranial vault remodeling
- Timing: controversial; mostly recommended at 3–9 months of age

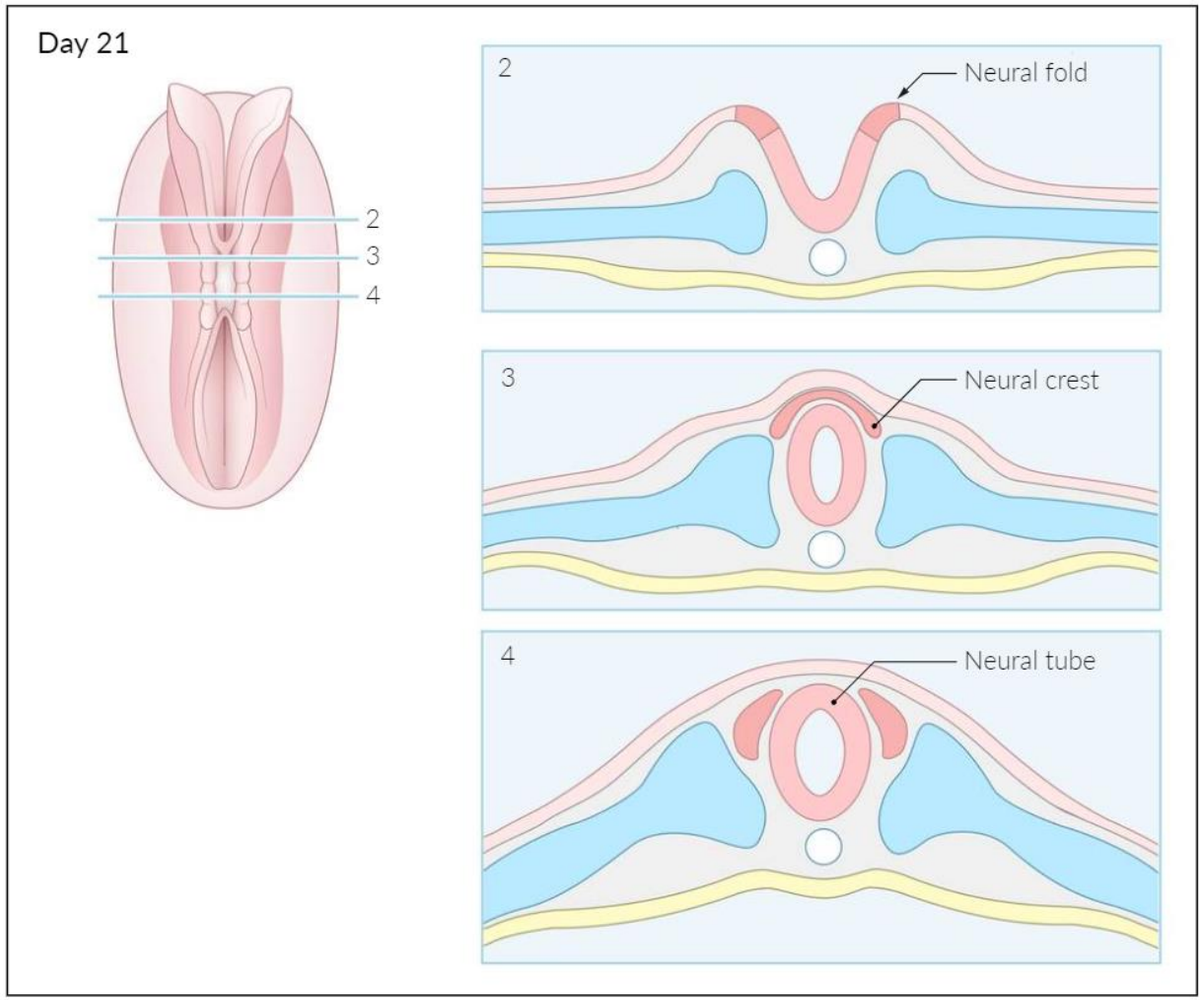
❖**Mention one goal for the treatment**

- To minimize cerebral constriction
- For cosmetic reasons



Neurulation





Neurulation

- The neural tube communicates with the amniotic cavity through cranial and caudal openings (neuropore)
  - **Anterior neuropore**: closes on ~ days 24–25
  - **Posterior neuropore**: closes on ~ days 26–27

سنوات (1)

- **Mention 4 congenital anomalies related to CNS abnormality** سنوات (1)

Brain	Spinal
○ Anencephaly ○ Cephalocele ○ Chiari malformation ○ Arachnoid cyst ○ Dandy-Walker malformation	❖ Occult ○ Intraspinal lipoma ○ Dermoid tumors ○ Diastematomyelia ○ Hypertrophic filum terminale ❖ Aperta ○ Meningocele ○ Myelomeningocele ❖ Lipomyelomeningocele

Anencephaly

- **Description**: Rostral neuropore remains open leading to the absence of the forebrain and open cranial vault
- **Etiology**: Inadequate Folic acid or Folic acid antagonists
  - Maternal type 1 diabetes mellitus, Maternal Hyperthermia, Family history, Amniotic band syndrome, Alcohol consumption
- **Clinical features**: Polyhydramnios, Incompatible with life (Survival period for such a patient is less than 5 months and usually only 24h)
- **Associated anomalies**: Cleft lip/palate, omphalocele
- **Diagnosis**: ↑AFP, identified by ultrasound as early as 13 weeks

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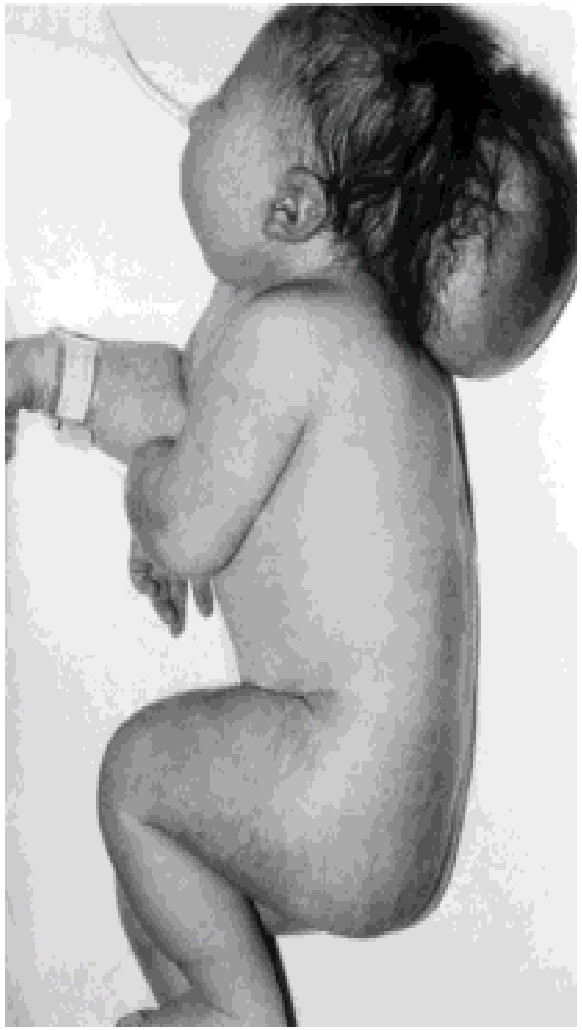
- **What is your spot diagnosis ?**
  - Anencephaly
- **How can you prevent it ?**
  - 4 mg of folic acid daily, started 3 months before conception

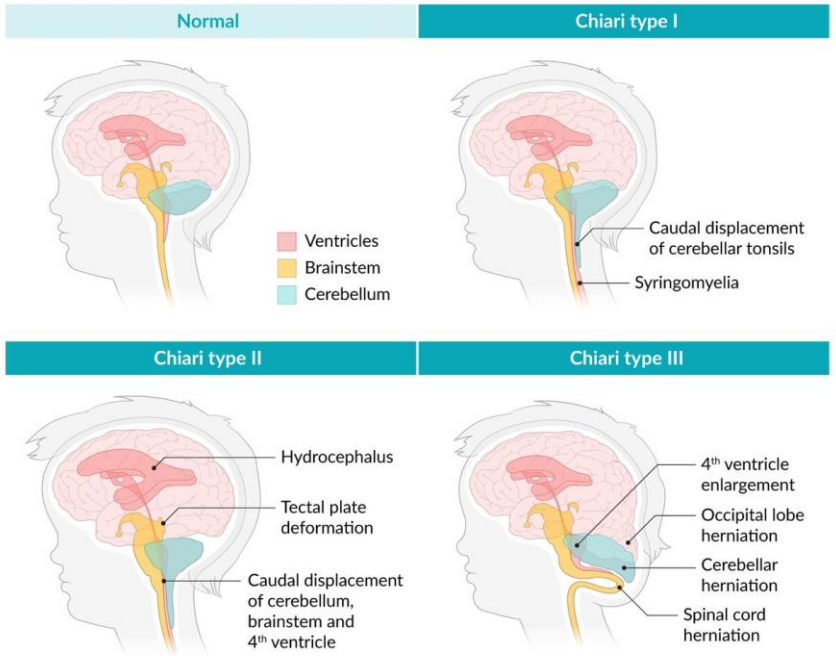
Encephalocele

- **Description**
  - Brain tissue herniates through bone defect
  - Usually covered by skin
  - **Location**: Occipital > Parietal > other
- **Clinical features**
  - Malformations and neurological deficits that vary in severity
  - Lethal in severe cases
- **Associated anomalies**: Trisomy 13 & 18, Meckle Gruber syndrome and Chiari 3 malformation
- **Diagnosis**: AFP usually not elevated, ultrasound
- **Management**: Excision of the herniated sac followed by craniorrhaphy



Chiari Malformation

- **Definition**: caudal displacement of the cerebellum with/without the medulla oblongata, through the foramen magnum, due to craniovertebral junction (CVJ) anomalies
- **Subtypes**: 4 subtypes →
- **Associations**
  - Neural tube defects (esp. meningomyelocele)
  - Syringomyelia
  - Hydrocephalus
  - Klippel-Feil syndrome
  - Basilar invagination



- **Treatment**
  - **Surgery**: indicated in all patients with type II and III CM and in symptomatic type I CM

Chiari Malformation

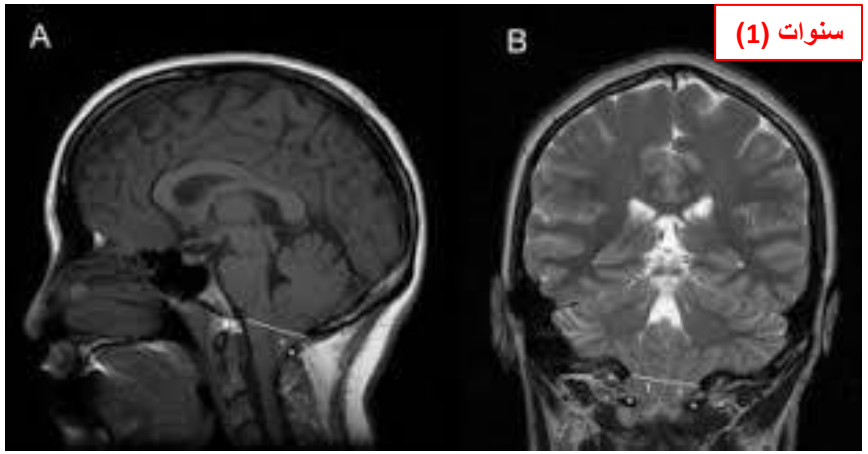
Type I CM (Chiari I malformation)	Type II CM (Arnold-Chiari malformation)	Type III CM (Chiari III malformation)	Type IV CM (Chiari IV malformation)
Definition: Ectopic extension of cerebellar tonsils through the foramen magnum thus disruption of CSF flow (Most common type)	**Definition**: Protrusion of cerebellar tonsils, vermis, and medulla oblongata into the foramen magnum	**Definition**: Herniation of parts of the cerebellum and brain stem through an abnormal opening in the back of the skull (encephalocele)	**Definition**: Cerebellar hypoplasia or agenesis
Usually symptomatic in adolescence/young adulthood	Usually symptomatic in infancy	Mostly fatal in early infancy	Not compatible with life
Clinical features • Occipital headache Neck pain • Radicular pain in the shoulders and arms • Lower cranial nerve disorders • Cerebellar symptoms • Downbeat nystagmus • Some patients develop syringomyelia and/or hydrocephalus	**Clinical features** • Obstructive hydrocephalus (98-99% of patients) • Breathing difficulties, including apneic episodes • Feeding difficulties • Muscle weakness or numbness • Always associated with myelomeningocele • Some patients develop syringomyelia		

Management: Posterior fossa decompression with or without tonsillectomy
For patient with hydrocephalus a shunt might be required

Chiari malformation

❖**What is your DX ?**

- Chiari type 1 malformation



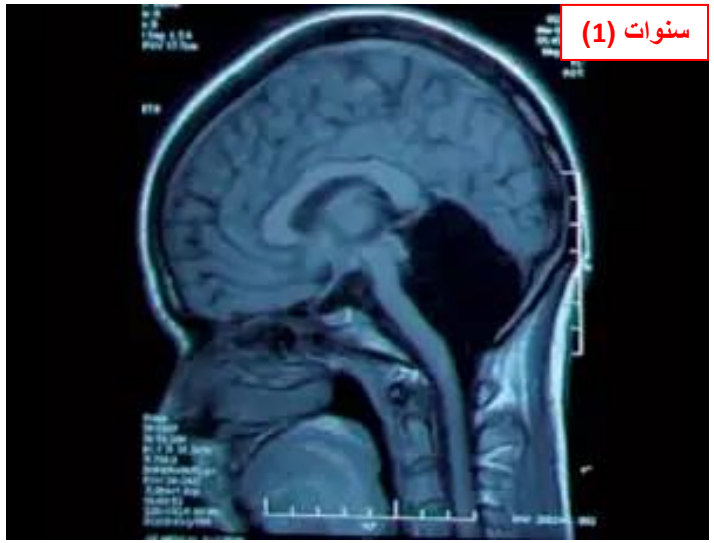
سنوات (1)

❖**What is malformation shown in this MRI ?**

- Chiari malformation type 4

❖**Give 2 differential diagnosis**

- Dandy walker malformation
- Arachnoid cyst
- Megacysterna magna


سنوات (1)

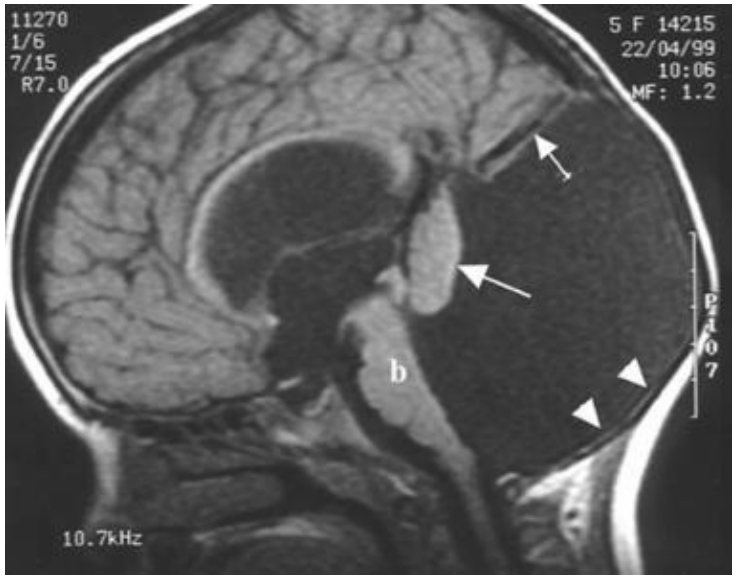
Dandy-Walker Malformation

❖Characterized by

1. Complete or partial agenesis of the cerebellar vermis (the part joining the two hemispheres of the cerebellum)
2. Cystic dilatation of the 4th ventricle (failure of foraminal outlets to open)
3. An enlarged posterior fossa with upward displacement of tentorium

❖Clinical features

- 90% of patient have obstructive hydrocephalus
- In childhood the major presenting features are ataxia, and delayed motor development
- Associated with a variety of extracranial abnormalities (e.g., craniofacial abnormalities, cardiac defects, spina bifida)

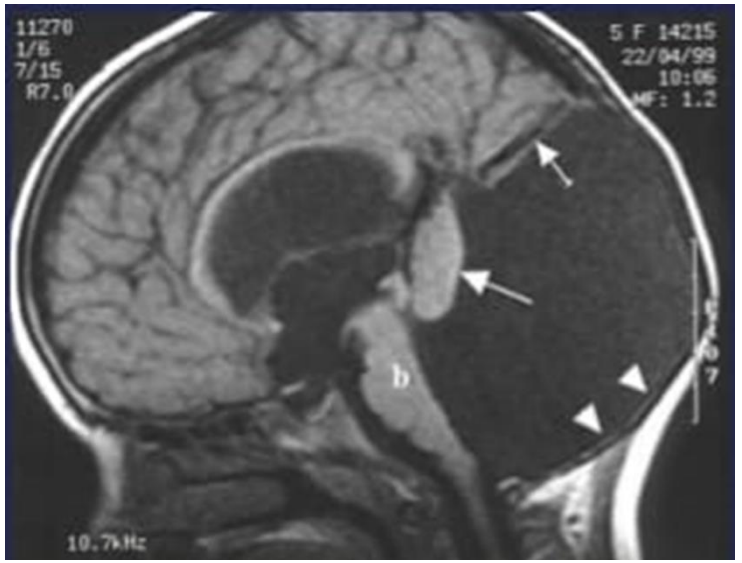


❖ Management

- Cyst-peritoneal shunt
- VP shunt

Dandy-Walker Malformation

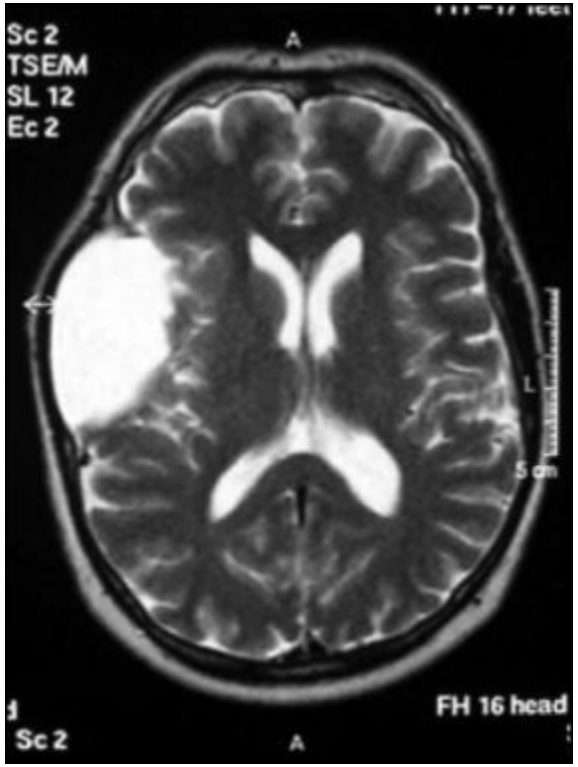
- **What is malformation shown in this MRI and what its type ?**
  - Dandy walker malformation
- **Give 2 differential diagnosis**
  - Arachnoid cyst
  - Chiari malformation type 4
- **Management**
  - Cyst-peritoneal shunt
  - VP shunt



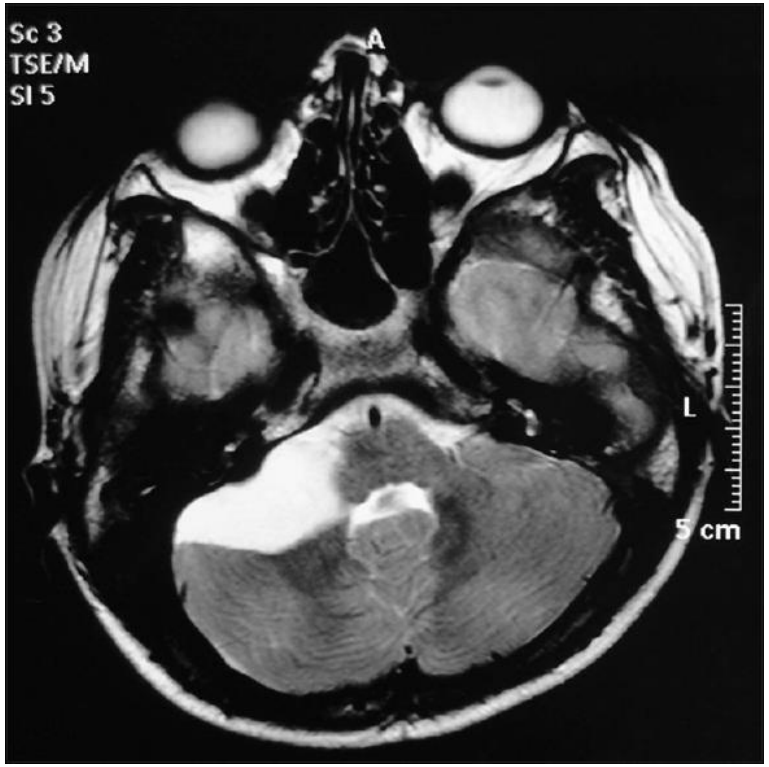
Arachnoid Cysts

- **Description**: Common, benign, and usually asymptomatic cystic lesion containing cerebrospinal fluid
- **Locations**
  - **Most common site** is the middle fossa particularly in the sylvian fissure
  - Cerebellopontine angle
  - Suprasellar
  - Other like Quadrigeminal, Vermin, Cerebral convexity
- **Clinical presentation**
  - Mostly presented as incidental findings
  - Rarely can present due to bone remodeling
  - Cerebellopontine angle cysts can mimic acoustic neuroma
  - Suprasellar cysts can present with hydrocephalus, visual impairment and endocrine dysfunction (especially precocious puberty)
- **Management**
  - Asymptomatic cysts: follow up at regular intervals
  - Symptomatic cysts: Craniotomy or cystoperitoneal shunt

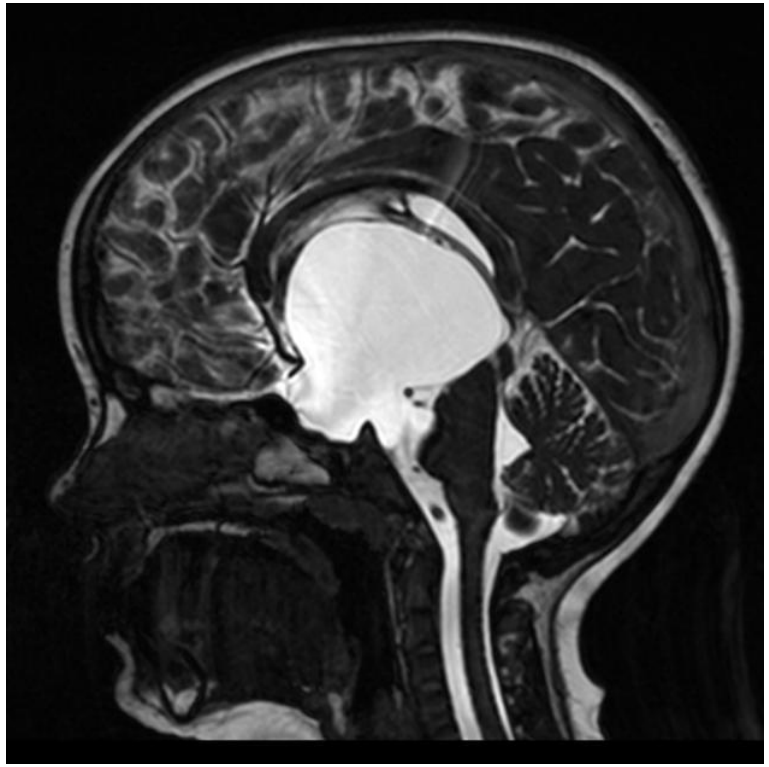
Arachnoid Cysts



Sylvian fissure cyst



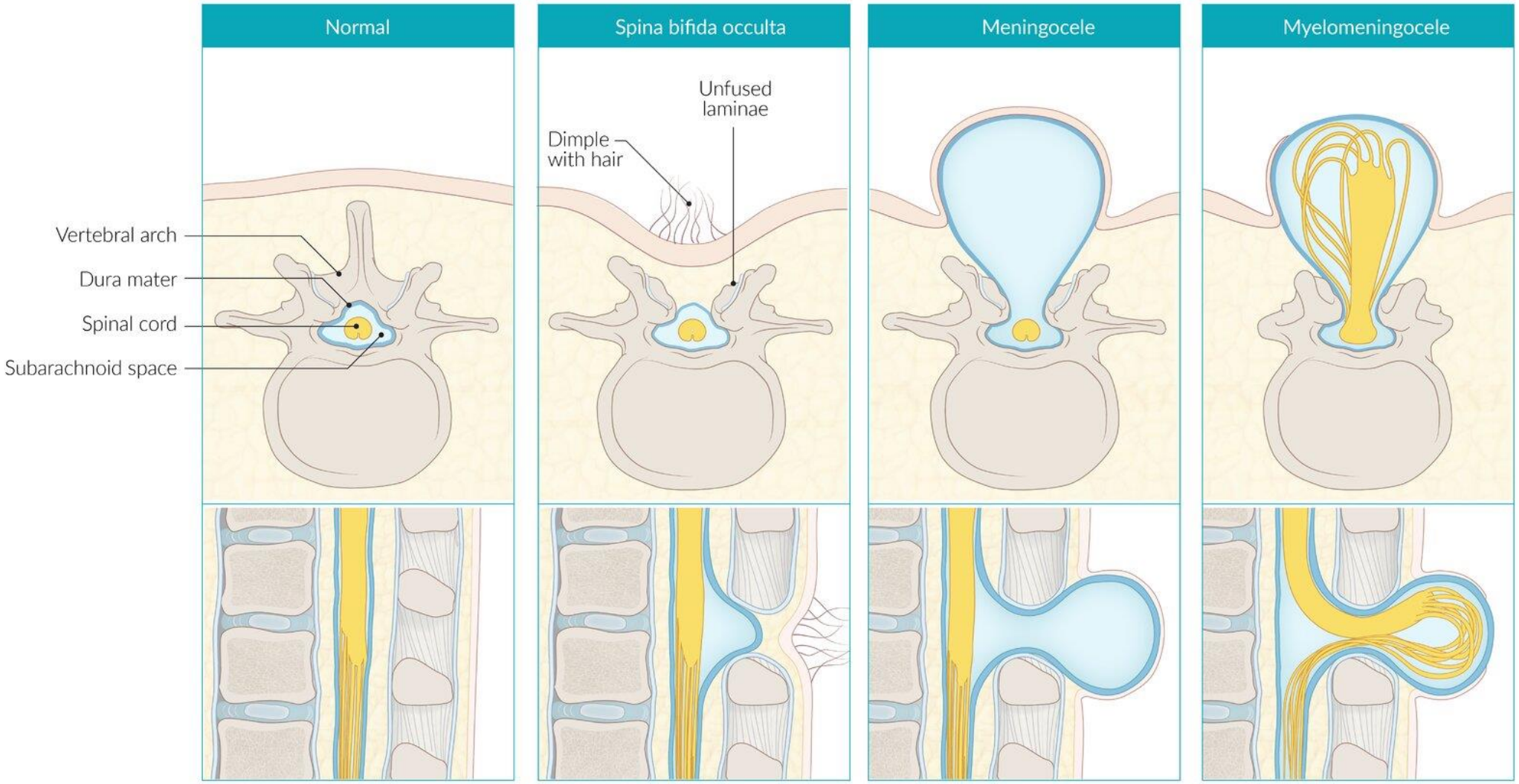
Cerebellopontine angle cyst



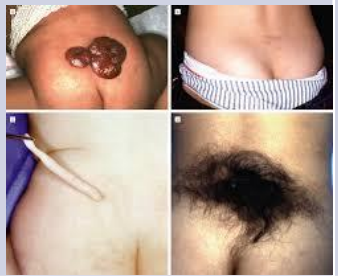
Suprasellar cyst

(The only extradural one)

Spinal defects (subtypes of spina bifida)

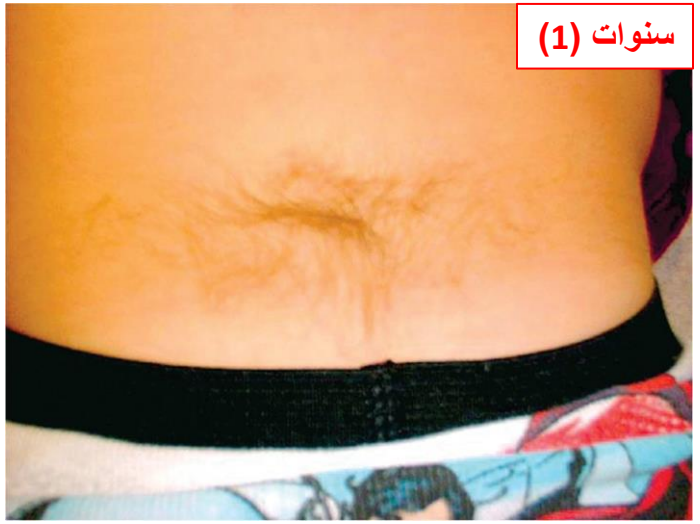


Closed spinal dysraphism

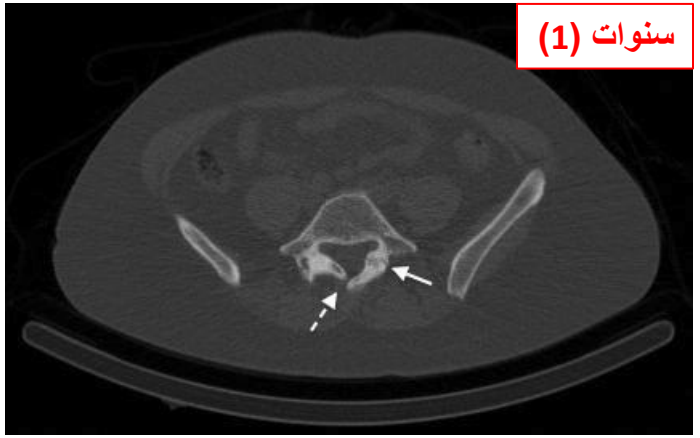
Condition	Description	Clinical features	Diagnosis
Spina bifida occulta	• Most common closed NTD • Vertebral bone defect without herniation • The spinal cord, meninges, and overlying skin remain intact.	❖ Most commonly affects the lower lumbar or sacral region ❖ Often asymptomatic (may be an incidental finding in imaging) ❖ Possible symptoms at the level of the vertebral defect: ○ Lumbar skin dimple ○ Collection of fat ○ Patch of hair ○ Sinus tract ○ Hemangioma 	Normal AFP
Lipomyelomeningocele	Myelomeningocele that also contains fat tissue and is covered by skin	❖ Often asymptomatic ❖ Subcutaneous mass in the lumbar or sacral region ❖ Possibly skin dimple and/or patch of hair	Normal AFP
Lipomeningocele	Meningocele that also contains fat tissue and is covered by skin		Normal AFP

Spina bifida occulta

- **What is this sign ?**
  - Hair tuft
- **What it's clinical importance ?**
  - It indicate spina bifida occulta



- **What is your spot diagnosis ?**
  - Spina bifida occulta

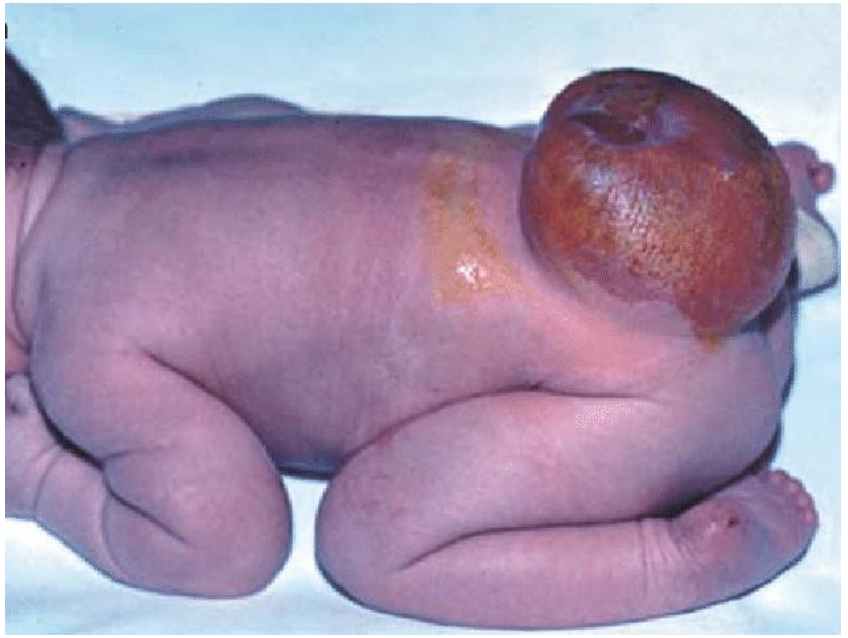


Open spinal dysraphism

Condition	Description	Clinical features	Diagnosis
Meningocele	Meninges (without neural tissue) herniate through vertebral bone defect	❖ Most commonly affects the lower lumbar and/or sacral region ❖ Neurological symptoms vary depending on the location and extent of neuronal damage. ○ Motor loss, flaccid paralysis (rare) ○ Sensory deficits ○ Bladder and bowel dysfunction ❖ Additional symptoms ○ Hydrocephalus (common) ○ Associated skeletal malformations, especially of the spine and lower extremities (e.g., club foot, sacral dimpling), joint contractures, back pain ○ Developmental delays, cognitive impairment, progressive neurological symptoms	↑ AFP
Myelomeningocele	• Meninges and parts of the spinal cord herniate through the vertebral bone defect. • Characteristic feature of Chiari II malformation • Associated with maternal diabetes and folate deficiency		↑ AFP ↑ AChE
Myeloschisis	• Portions of the neural tube completely fail to fuse, leading to bare, exposed neural tissue without coverage of meninges, bones, or skin. • Most severe subtype		↑ AFP
Myelocele	Parts of the spinal cord (without meningeal coverage) herniate through the vertebral bone defect.		↑ AFP

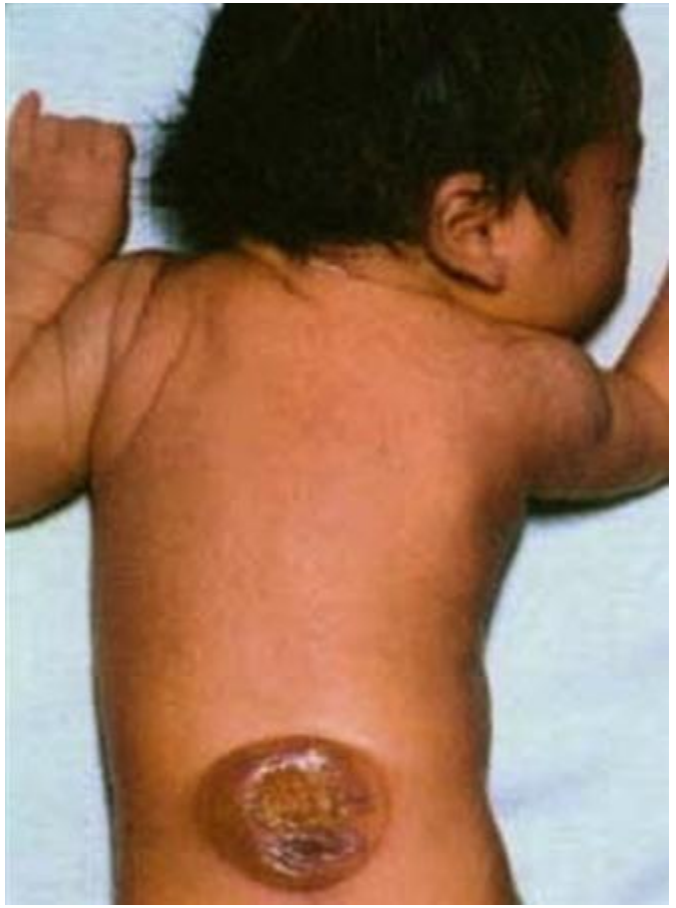
Open spina bifida 1

- **What is your spot diagnosis ?**
  - Open spina bifida (spina bifida aperta)
- **What is your next step ?**
  - Physical examination (transillumination test, neurological exam)
- **What is the site of the lesion?**
  - Limbo-sacral
- **When does the posterior neuropore closes ?**
  - closes on ~ days 26–27



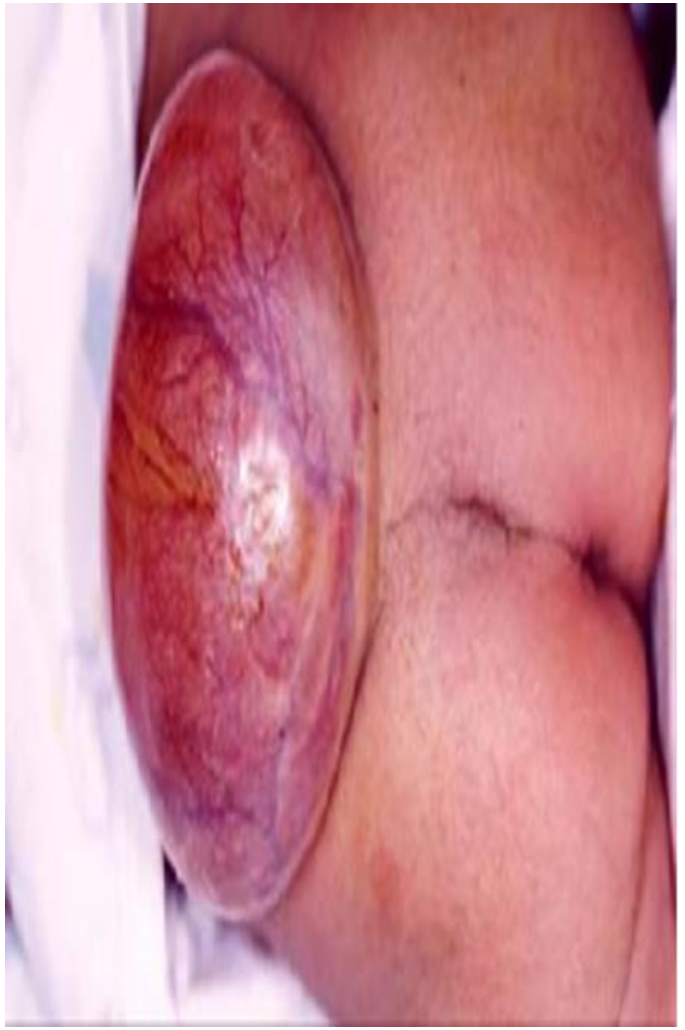
Open spina bifida 2

- **What is your spot diagnosis ?**
  - Open spina bifida (spina bifida aperta)
- **How do you classify this pathology ?**
  - According to the contents of the cyst
- **What is your next step of management ?**
  - Physical examination (transillumination test, neurological exam)
- **Mention 2 pathologies this disease is usually associated with**
  - Skeletal malformations
  - Hydrocephalus



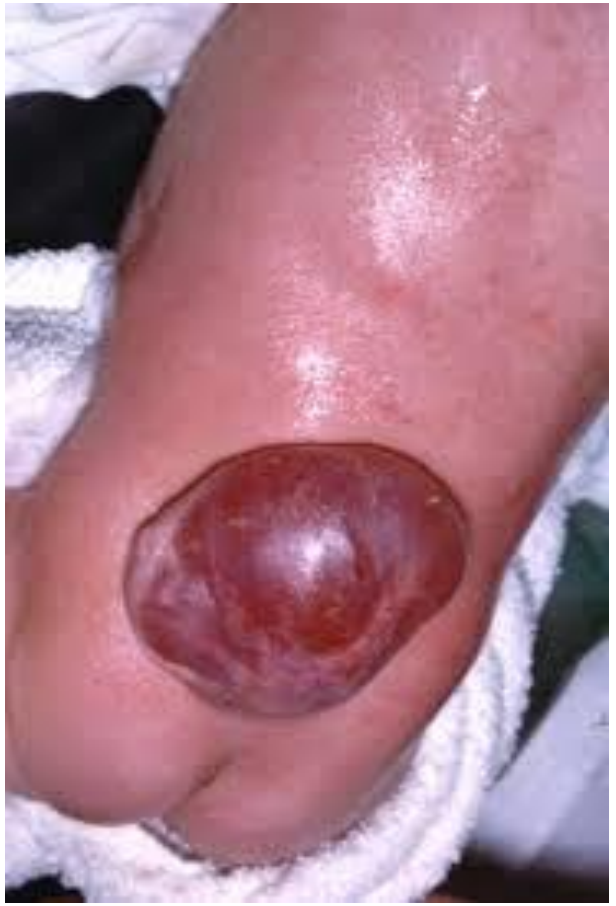
Myelomeningocele 1

- **What is your spot diagnosis ?**
  - Myelomeningocele
- **What is your next step of management ?**
  - Surgical excision (Excision of the cyst wall, isolation of neural placode and restoration of the shape of the cord with endoplastic repair e.g., flap)
- **Mention 3 advantages of treatment**
  - Prevent infection
  - For cosmetic causes
  - Prevent neurological deterioration (But do not improve or correct it)
- **Which type of Chiari malformation is it associated with ?**
  - Chiara 2 malformation



Myelomeningocele 2

- Pregnant women deliver the child in the picture, he suffer from urinary incontinence and lower limb weakness, transillumination was positive on Examination



- **What is your spot diagnosis ?**
  - Myelomeningocele

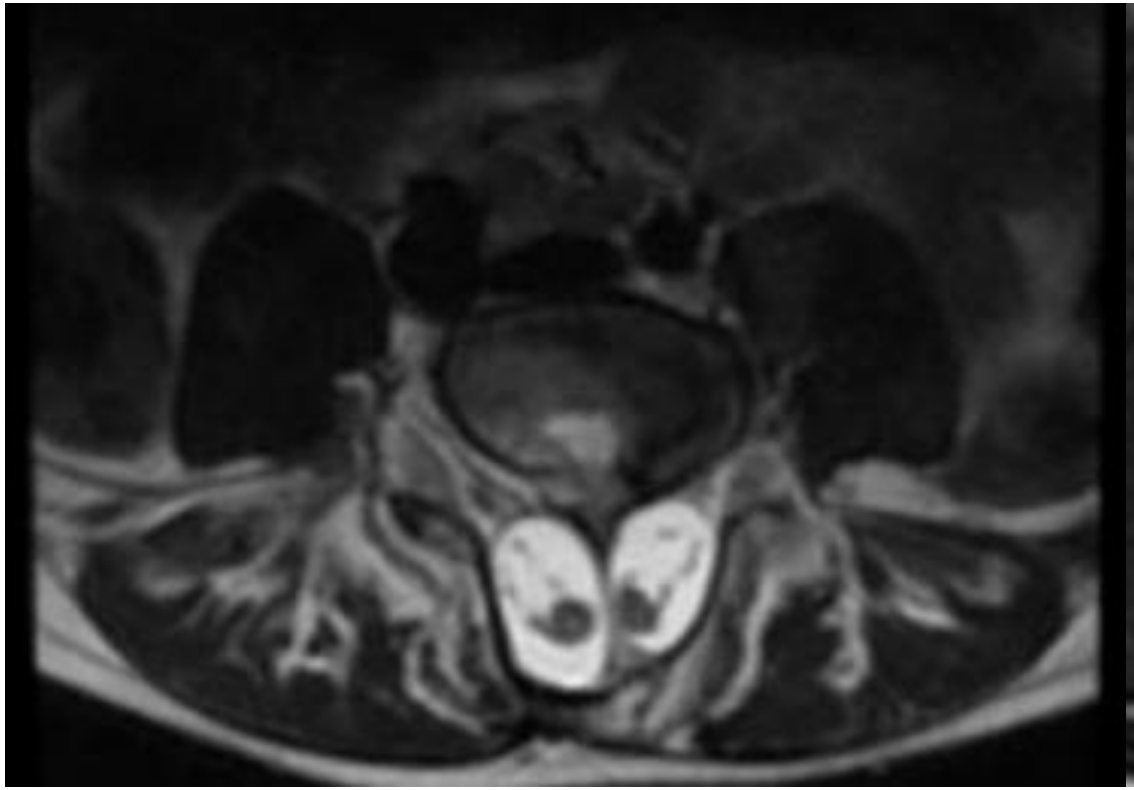
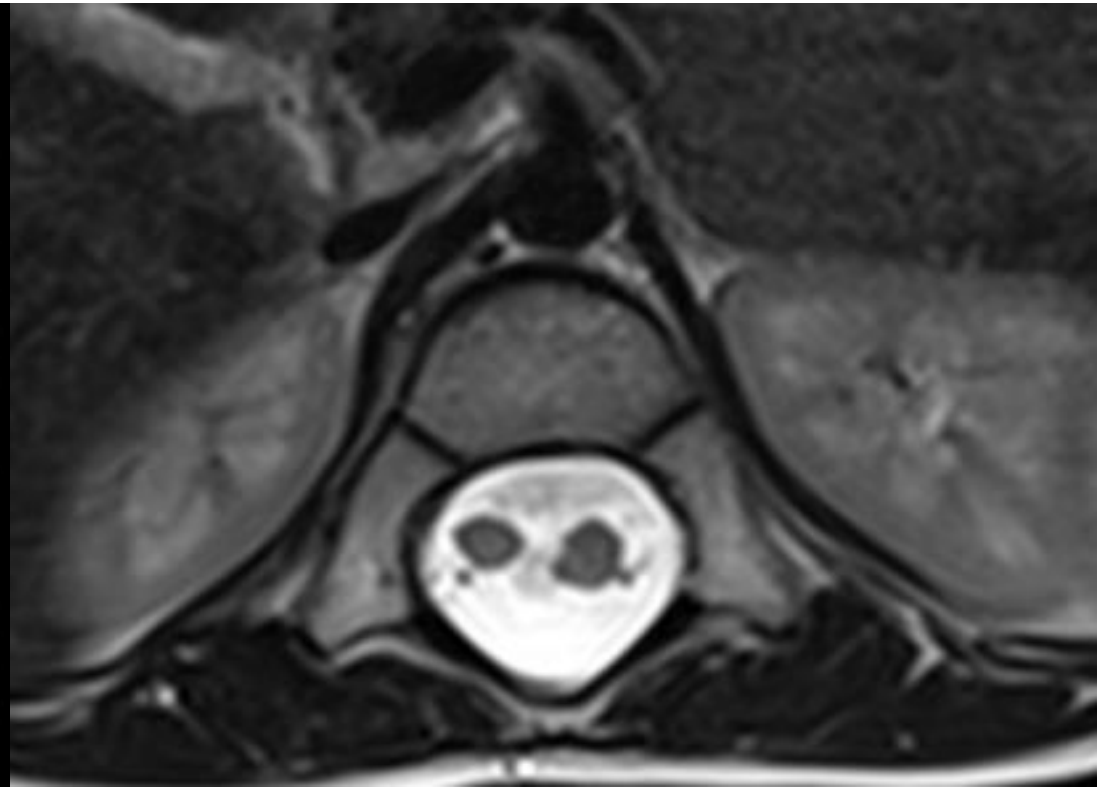
Transillumination test is positive in myelomeningocele because the sac contains CSF

- **What is the dose of folic acid in the next pregnancy and when she should start it ?**
  - 4 mg daily, started 3 months before conception
- **What is the aim of treatment ?**
  - Prevent infection
  - For cosmetic causes
  - Prevent neurological deterioration (But do not improve or correct it)

Split cord malformation

Type 1 (Diastematomyelia)	Type 2 (Diplomyelia)
Two hemicords are separated by bony spur and each one of them covered by its dura matter forming extradural bony spur	Two separated hemicords, but they are sharing the same dura matter and forming intradural septum
Most patients with diastematomyelia are symptomatic, presenting with signs and symptoms of tethered cord	Patients with mild type II may be minimally affected or entirely asymptomatic
Presenting symptoms include leg weakness, low back pain, scoliosis, incontinence	
Frequently have other **associated anomalies** including meningocele, neurenteric cyst, dermoid cyst, clubfoot, spinal cord lipoma, hemangioma overlying spine	–
Split cord malformations are more common in the lower cord but can sometimes occur at multiple levels • 50% occur between L1 and L3 • 25% occur between T7 and T12	
Treatment: surgery • The bony spur should be excised first to prevent spinal cord injury. • The dura matter should be cut open to excise the intradural septum and release the tethered cord then the dura matter is closed and repaired	

Split cord malformation

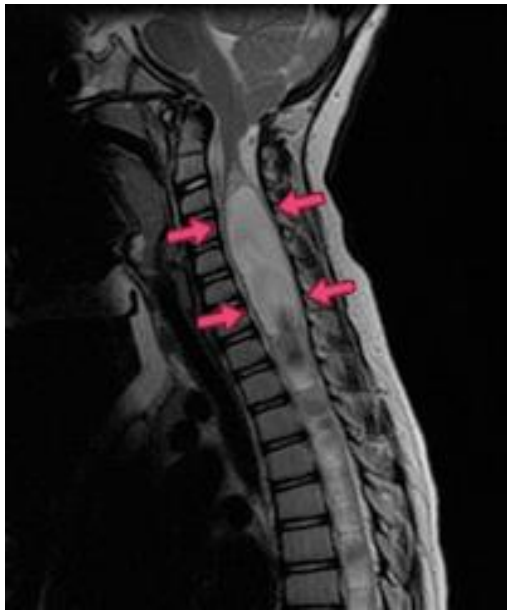
Type 1 (Diastematomyelia)	Type 2 (Diplomyelia)
	

Tethered cord syndrome

- **Definition**: a functional neurologic disorder caused by abnormal stretching of the spinal cord as a result of adhesions or obstructions attaching the caudal spinal cord to the spinal canal
- **Etiology**
  - Myelomeningocele/lipomyelomeningocele (most common cause)
  - Lipoma, dermoid cysts
  - Meningeal adhesions (e.g., after surgery for myelomeningocele or spinal trauma)
  - Adhesion or thickening of the filum terminale
  - Tumors
- **Clinical features**
  - Lower back pain (aggravated by flexion of lower spine)
  - Sensory and motor deficits of the lower limbs (e.g., muscle weakness, spasticity, abnormal reflexes)
  - Bladder/bowel dysfunction
  - Skeletal malformations (e.g., foot deformities, scoliosis)
  - Visible tumors or skin lesions on lower back (e.g., discoloration, hairy patch, dimple, lipoma)
- **Diagnostics**: MRI may show abnormally low position of the conus medullaris, thickening of the filum terminale, meningeal adhesions, lipomas, dermoid, cysts, or tumors.
- **Treatment**: removal of structure tethering the spinal cord (e.g., adhesiolysis, resection of lipoma)

Syringomyelia

- **Definition**: a condition in which an abnormal fluid-filled cavity, or syrinx, develops within the central canal of the spinal cord.
- **Etiology**
  - Chiari malformation, especially type I (most common cause)
  - Posttraumatic SCI
  - Postinflammatory: transverse myelitis, arachnoiditis
  - Postinfectious (meningitis)
  - Intramedullary tumors (must be ruled out)
  - Scoliosis
  - Other congenital malformations: tethered spinal cord syndrome
  - Idiopathic



- **Clinical features**
  - Often asymptomatic and/or slowly progressing (similar to central cord syndrome)
  - Cape-like distribution (neck, shoulders, arms) dissociated sensory loss, dysthetic pain, muscle atrophy, fasciculations, and areflexia

Syringomyelia

❖ Differential diagnoses

- **Hydromyelia**: Central canal cystic dilatation, lined with ependymal cells
- **Syringomyelia**: Central canal cystic dilatation, lined with glial cells, more acute presentation, associated with more severe conditions (e.g., tumors)

❖ Treatment

- **Conservative therapy** is usually sufficient, but definitive surgical treatment is recommended for patients with progressive neurological symptoms.
- **Surgical treatment**: Treat underlying pathology
  - **If due to Chiari**: then a posterior cranial fossa decompression is indicated to restore cerebral spinal fluid outflow through formen of Magendie
  - **If due to intramedullary tumor**: excision of tumor should restore the communication with central canal
  - **If post traumatic**: the obstruction should be revealed by decompression

Head injury

Traumatic head injury summery

Injury	Treatment	Injury	Treatment
Superficial injuries		**Extra axial intracranial hemorrhage**	
Abrasion	Dressing	Epidural hematoma	Craniotomy & evacuation
Laceration	Dressing or suturing	Acute subdural hematoma	Craniotomy & dura slitting
Scalp Hematomas		Chronic subdural hematoma	Burr holes
Caput succedaneum	Expectant	Subarachnoid hematoma	Expectant
Subgaleal hematoma	Strict observation	Intraventricular hematoma	Drainage
Cephalohematoma	Expectant	**Intra axial intracranial injuries**	
Skull fractures		Intracerebral hematoma	Expectant
Liner fracture	Expectant	Cerebral contusion	Expectant
Depressed fracture	Surgical elevation	Diffuse axonal injury	

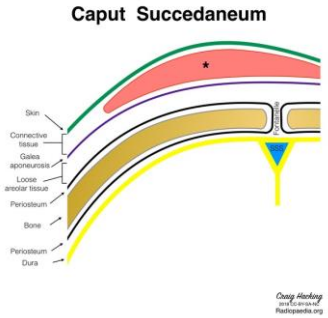
Traumatic head injury summery

Primary injury	Secondary injury
Definition: brain injury that occurs at the time of the trauma as an immediate consequence of head injury	**Definition**: indirect brain injury resulting from physiological changes following acute CNS insults and/or their treatment
Intracranial hemorrhage, Cerebral contusion, Coup-contrecoup injury, concussion	**Examples**: disrupted blood-brain barrier, hypoxic-ischemic encephalopathy, Generalized cerebral edema

Scalp Hematomas

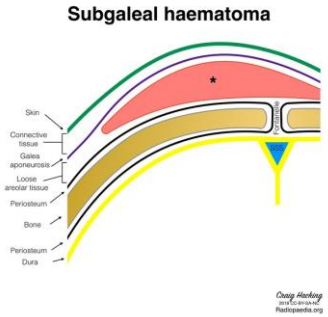
❖Caput succedaneum

- Benign edema of the scalp that extends across the cranial suture lines
- Firm swelling; pits if gentle pressure is applied
- No treatment required; resolves within hours or days



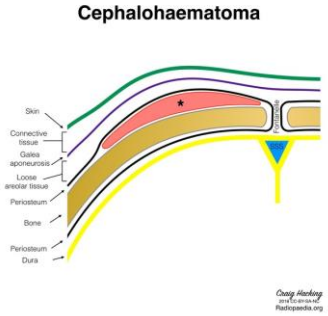
❖Subgaleal hemorrhage

- Rupture of the emissary veins and bleeding between the periosteum of the skull and the aponeurosis that may extend across the suture lines
- Associated with a high risk of significant hemorrhage and hemorrhagic shock



❖Cephalohematoma

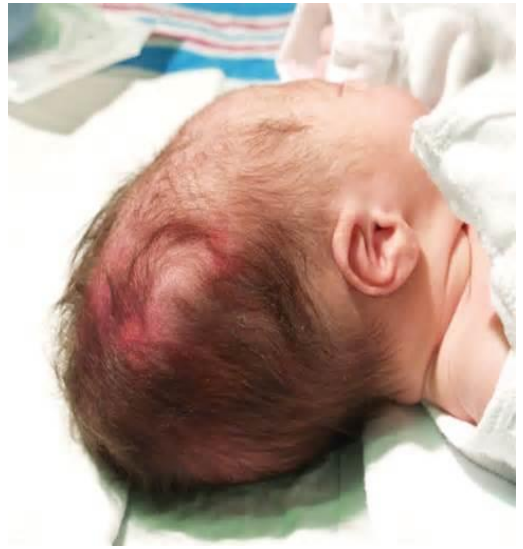
- Subperiosteal hematoma that is limited to cranial suture lines
- Complications: calcification of the hematoma, secondary infection
- No treatment required; resolves within several weeks or months

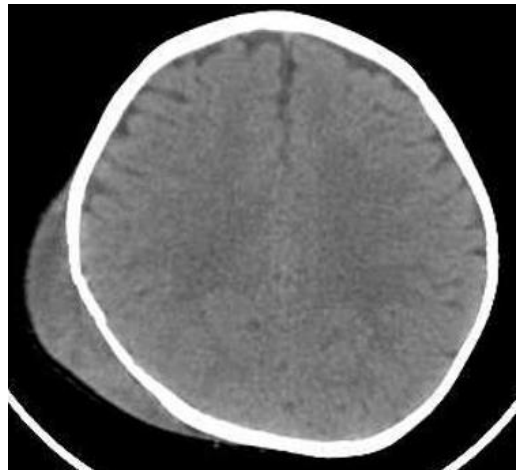


Case scenario

- A case of scalp swelling after delivery (hint: by palpation the lumb was soft not firm)

- **What is your diagnosis ?**
  - Subgaleal hematoma





CAPUT SUCCEDANEUM	CEPHAL HAEMATOMA
1. Present at birth on normal vaginal delivery.	1. Appears within a few days after birth on normal or forceps delivery.
2. May lie on sutures, not well defined.	2. Well defined by suture, gradually developing, hard edge.
3. Soft, pits on pressure.	3. soft, elastic but does not pits on pressure.
4. Skin ecchymotic.	4. No skin change.
5. Size largest at birth , gradually subsides within a day.	5. Become largest after birth and then disappears within 6-8 weeks to few months.
6. No underlying skull bone fracture.	6. May underlying skull bone fracture.
7. No treatment required.	7. No treatment required.

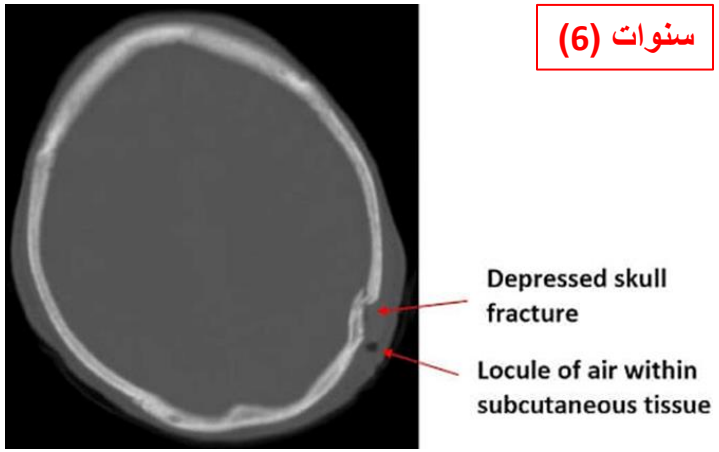
ملهش دخل بالسؤال بس ملهش وسع بالسلايد القبل

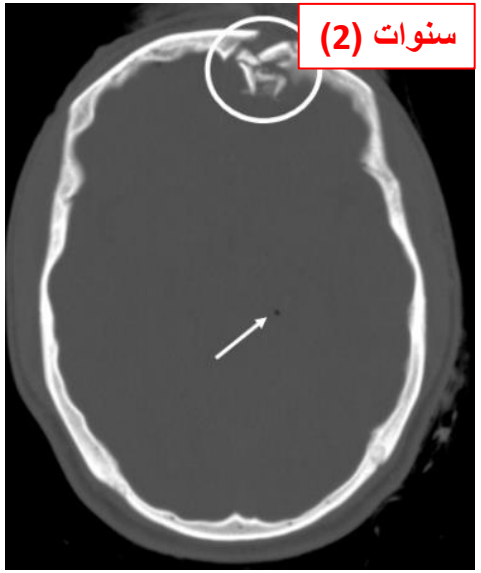
Skull fractures

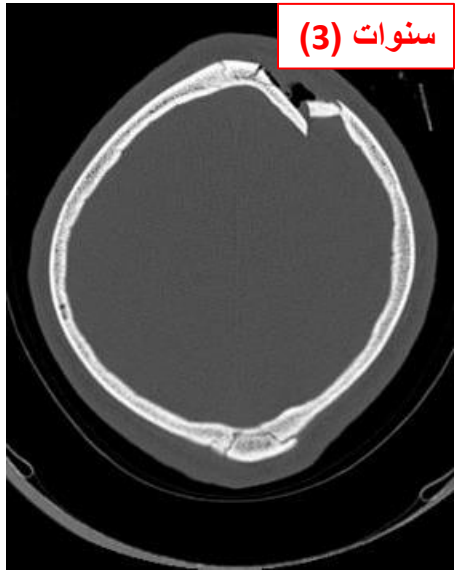
Liner fracture	Depressed fracture	Basal skull fracture
A single fracture that extends through the entire width of one or more bones of the skull; most common type of skull fracture	A skull fracture in which the skull depresses inward toward the brain parenchyma	A skull fracture involving ≥ 1 bone of the skull base (the ethmoid, sphenoid, occipital, paired frontal, and/or paired temporal bones)
Clinical features • Number of fracture lines: simple or comminuted fracture • Soft tissue involvement: closed fracture or open fracture • Fractures crossing the middle meningeal groove or dural venous sinuses may result in epidural hemorrhage. **Management**: Expectant except in • Children <3 years old • Neurological abnormalities • CSF leakage	**Clinical features** • Number of fracture lines: typically, a comminuted fracture • Often an open skull fracture • Often penetrates the dura (i.e., causing open head injury) • Location: most commonly involves the parietal and frontoparietal regions **Management** • Expectant unless surgery is indicated (surgical elevation)	**Clinical features** • **Liquorrhea**: CSF rhinorrhea and/or CSF otorrhea • **Raccoon eyes**: subcutaneous hematoma around the eyes • **Battle sign**: subcutaneous hematoma overlying the mastoid process • **Hemotympanum**: a collection of blood in the tympanic cavity behind the tympanic membrane • Signs and symptoms of traumatic brain injury **Management** • Conservative management • Emergency surgery may be indicated for comminuted or displaced fractures, large CSF leaks, or significant neurovascular complications

Depressed skull fracture

- **What is your spot diagnosis ?**
  - Depressed skull fracture
- **What is the management ?**
  - Surgical elevation
- **Mention 2 indications for surgery**
  - Cosmetic disfigurement
  - Depressed more than 1 cm
  - Presence of neurological deficits
  - CSF leakage
  - Seizures

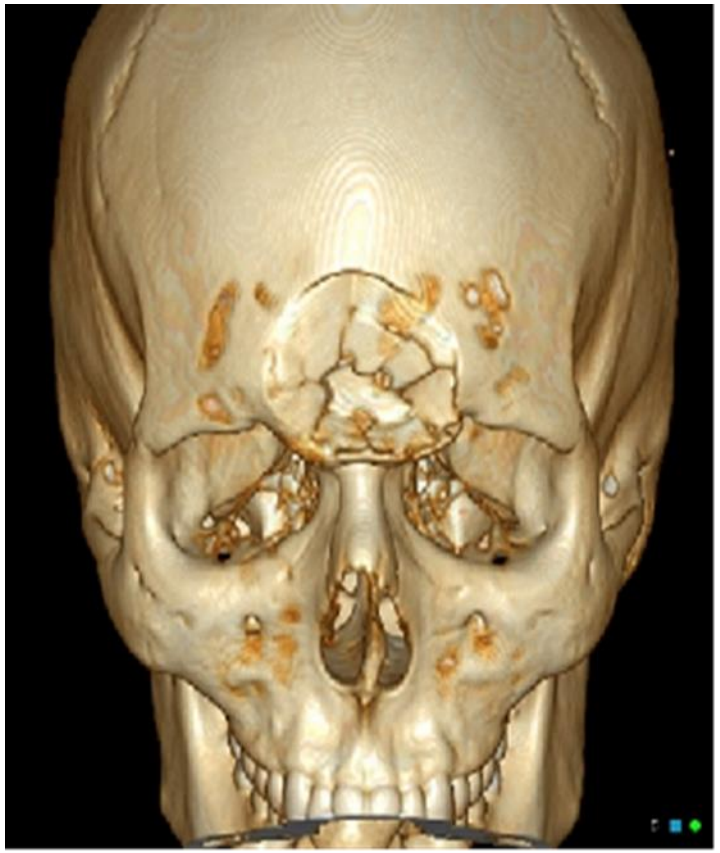






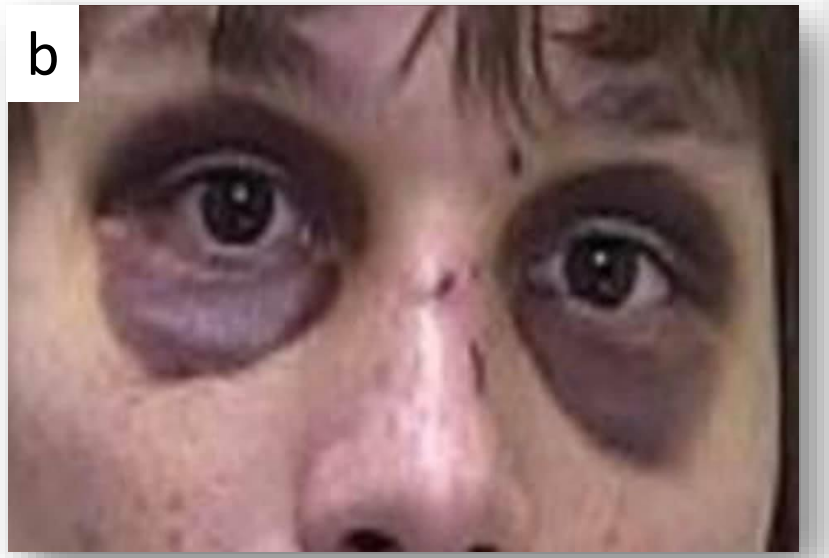
Depressed skull fracture

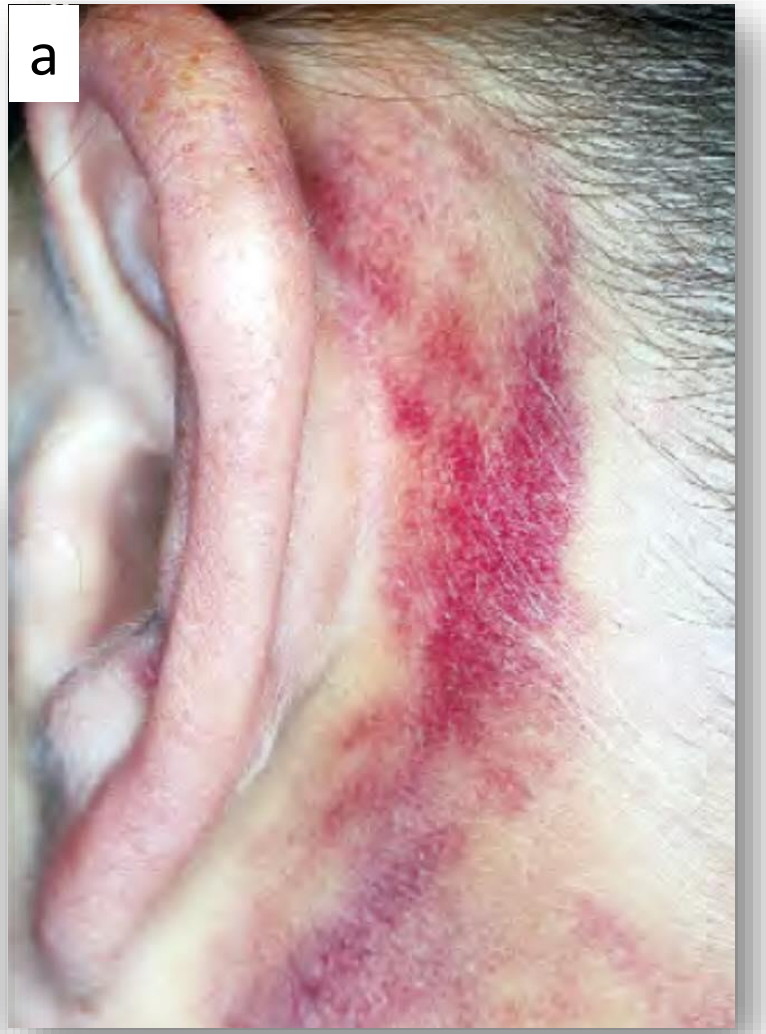
- **What is your spot diagnosis ?**
  - Depressed skull fracture
- **What is the management ?**
  - Surgical elevation
- **Mention 3 absolute indications for surgery**
  - **C**osmetic disfigurement
  - **C**SF leak
  - **C**ompressing
  - **3Cs**



Basal skull fracture

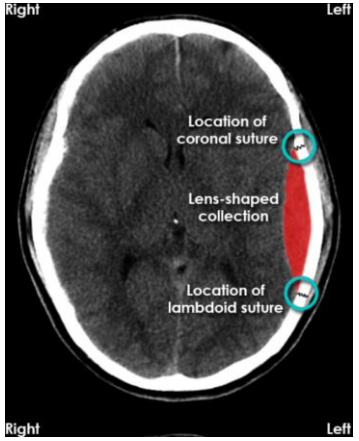
- **What is the name of this sign ?**
  a. Battle's sign
  b. Raccoon eyes
- **What does this sign indicate ?**
  - Basal skull fracture

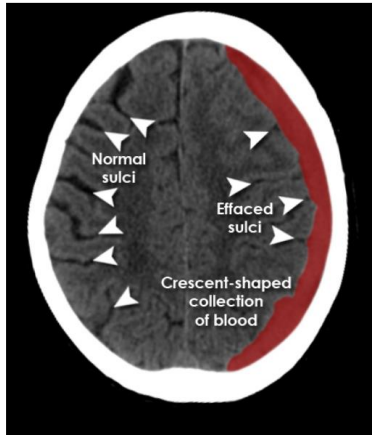


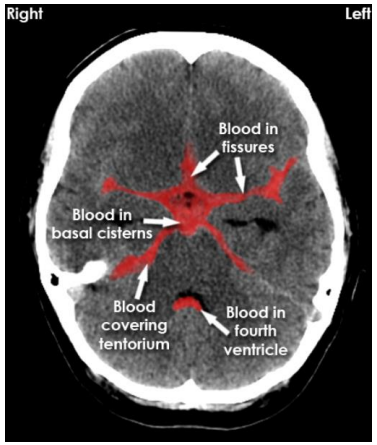


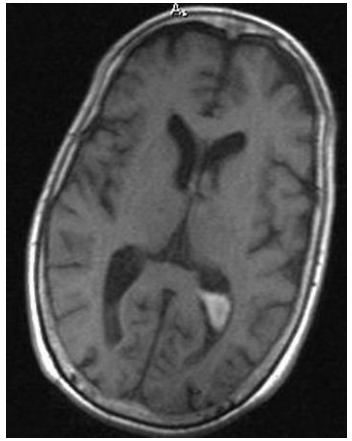
Extra Axial Hematomas

Epidural hematoma	Subdural hematoma	Subarachnoid hematoma	Intraventricular hematoma
• **Shape**: Lens (biconvex) • Respect the sutures • Can cause mass effect • **Most common from** the middle meningeal artery • **Venous EDH** (rare) from the middle meningeal vein or dural venous sinus injury • **Treatment**: Craniotomy & evacuation	• **Shape**: Lacunar • Doesn't respect suture • Less likely to cause mass effect • **Most common from** the bridging veins • **Treatment**: Craniotomy & dura slitting	• Bleeding in sulci & citterns • Usually found centrally (around the circle of Willis) but can occur in other parts of the brain • **Most commonly due to** rupture of an intracranial aneurysm (berry aneurysm) • Commonly present with "The worst headache in my life" complain • **Treatment**: Expectant	• Inside cerebral ventricles • Can be primary or secondary to a large extraventricular component with secondary extension into the ventricles • **Treatment**: Drainage



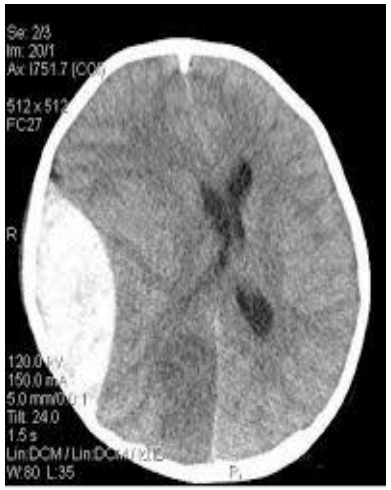


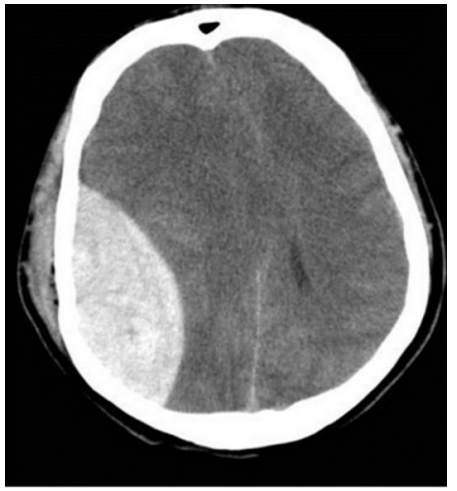


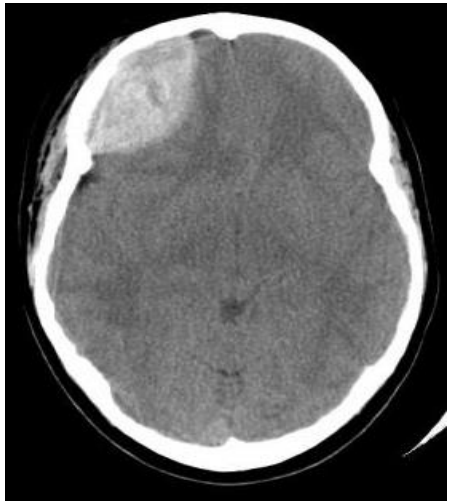


Epidural hematoma

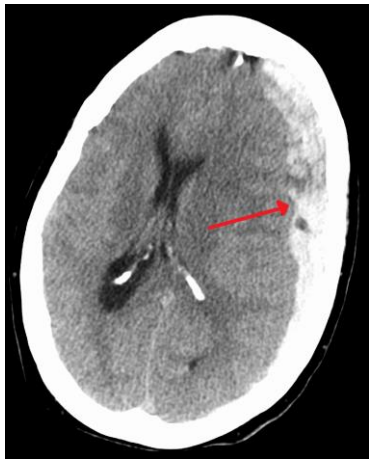
- **What is your diagnosis ?**
  - **Acute** epidural hematoma
- **What is the definitive management ?**
  - Craniotomy and evacuation
- **Which vessel is affected ?**
  - Middle meningeal artery
- **What are the findings in the third picture**
  - Non-contrast enhanced brain CT, axial view, that shows a lenticular shaped hyperdensity over the right frontal with mass effects in the form of effaced brain sulci and compressed frontal horn of the right lateral ventricle with minimal midline shift to the left







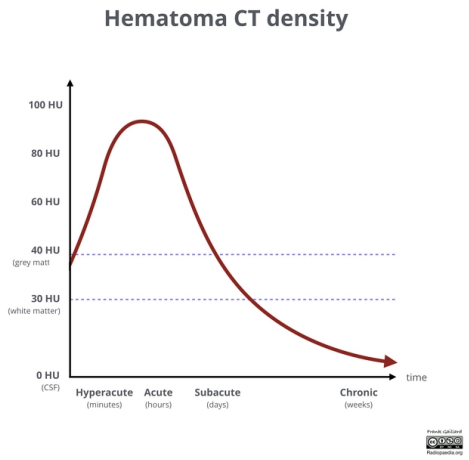
Acute subdural hemorrhage

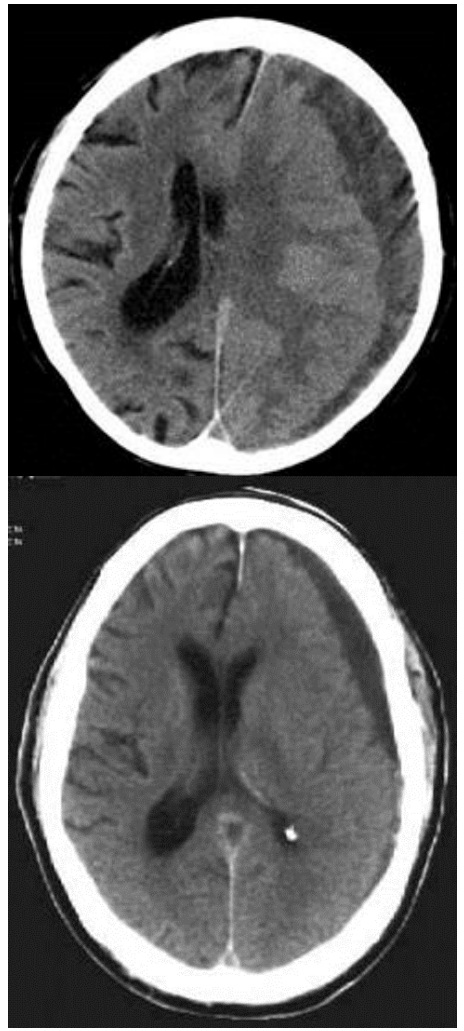


- **What is your diagnosis ?**
  - Left frontoparietal **acute** subdural hemorrhage
- **What is your management ?**
  - Craniotomy and dural slitting
- **Mention 2 differential diagnosis for this finding**
  - Blunt head trauma, Shaken baby syndrome, Acceleration-deceleration injury
- **If this patient came to the ER, opens eyes to painful stimulus, incomprehensive sounds, flexion to painful stimuli** (discussed in few slides)
  - What is your initial management in the ER ?
  - What is the GCS for this patient ?
  - What is the severity of the injury according to GCS ?

Chronic subdural hemorrhage

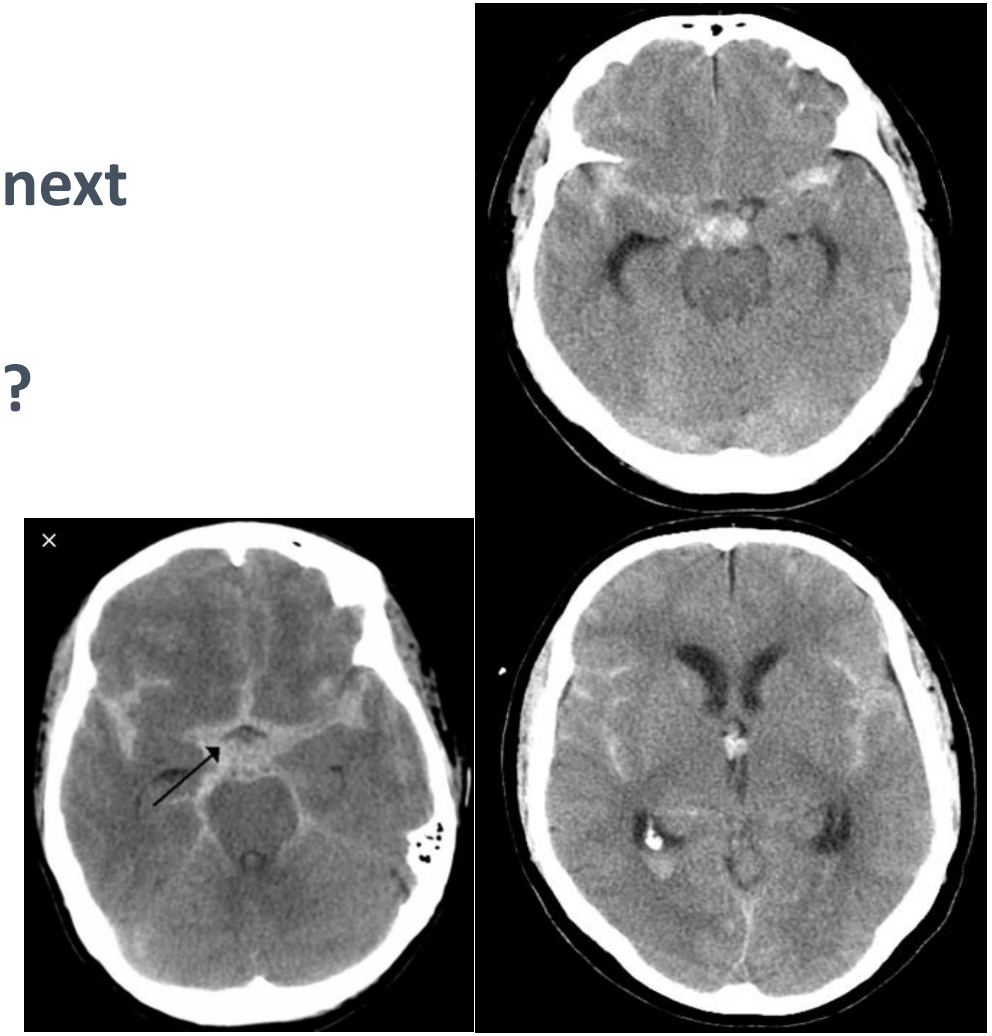
- **What is the diagnosis ?**
  - Left side chronic subdural hemorrhage
- **What is the treatment ?**
  - Burr holes
    - Acute: Craniotomy and evacuation
    - Chronic: Burr holes
- **Is there a midline shift ?**
  - Yes
- **What is the timing ?**
  - symptom onset ≥ 21 days after the inciting event





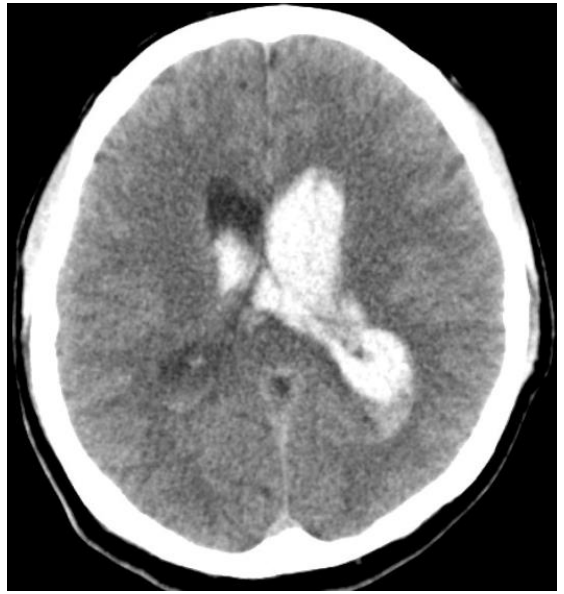
Subarachnoid hemorrhage

- **What is your diagnosis ?**
  - Acute spontaneous SAH
- **If the CT scan was negative, what is the next step to confirm the diagnosis**
  - Lumbar puncture
- **What is the gold standard investigation ?**
  - Digital subtraction angiography
- **What are the possible causes ?**
  - Ruptured arterial aneurysm
  - AV malformation
- **Mention 2 severity scale used**
  - Hunt-Hess classification of aneurysmal SAH
  - World Federation of Neurological Surgeons (WFNS) grading scale for SAH



Intraventricular haemorrhage

- **What is your diagnosis ?**
  - Intraventricular haemorrhage
- **Mention one complication for it ?**
  - Hydrocephalus
- **How to treat ?**
  - Drainage by extraventricular device



Intra Axial injuries

- **Intracerebral hemorrhage**
  - **Definition**: Refers to bleeding within the brain parenchyma
  - **Characteristic clinical features**: headache, focal neurological deficits, LOC
  - **Non-contrast CT**: Traumatic ICH usually present with multiple intraparenchymal hematomas or hemorrhagic contusions
  - **Management**: Usually resolves alone but might require evacuation
- **Cerebral contusion**: focal area of heterogeneous brain injury, varying from a bruise to a focal area of necrosis
- **Coup-contrecoup injury**
  - **Coup injury**: injury on the side of an impact
  - **Contrecoup injury**: additional injury (typically a contusion) on the opposite side of impact

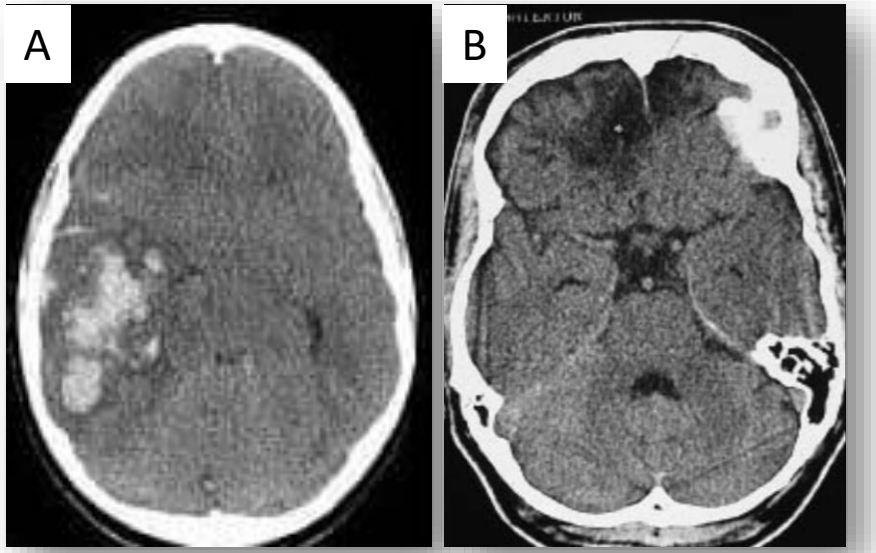
Acute hemorrhagic contusion

❖**What is your interpretation**

A. hyperdense area in the Rt parietal lobe
B. hypodense area in the frontal lobes

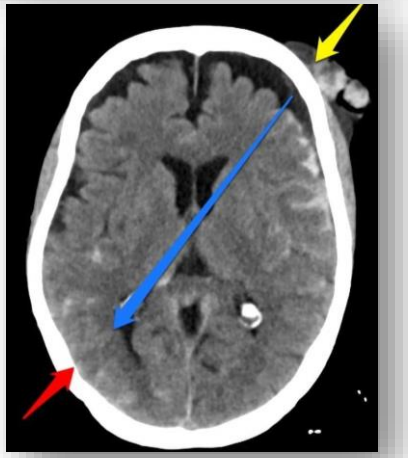
❖**What is your diagnosis ?**

A. Acute hemorrhagic contusion
B. Non-hemorrhagic contusion



❖**What is the diagnosis according to these CT scan ?**

○ Coup counter-coup hemorrhagic contusion



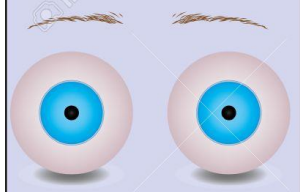
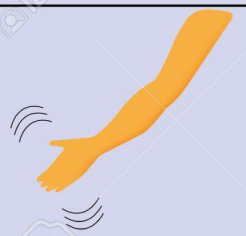
Diffuse primary brain injury

- **Mild traumatic brain injury (concussion)**
  - A trauma-induced disruption of brain function associated with a GCS ≥ 13-15 at least 30 minutes post-injury and ≥ 1 of the following: altered mental state at the time of the injury, loss of consciousness < 30 minutes, posttraumatic amnesia < 24 hours, or minor neurological abnormalities not requiring surgical intervention.
- **Cerebral edema**: early vasogenic then lately cytogenic
- **Diffuse axonal injury (DAI)**
  - Multifocal shearing tears and disruption of the axons of the brain due to rotational acceleration-deceleration trauma of the head; typically seen in high-impact road traffic accidents. (لما السيارة تقلب أكثر من مرة)
  - Commonly results in severe neurological injury (e.g., coma, persistent vegetative state)

Glasgow coma scale

- 14-15>> mild
- 9-13>> moderate; next step: urgent CT head
- 3-8>> severe; next step: intubate
- In case of tracheostomy, we add +T

Note: If you don't write /15 the answer is WRONG ☺

Behaviour	Response
 Eye Opening Response	4. Spontaneously 3. To speech 2. To pain 1. No response
 Verbal Response	5. Oriented to time, person and place 4. Confused 3. Inappropriate words 2. Incomprehensible sounds 1. No response
 Motor Response	6. Obeys command 5. Moves to localised pain 4. Flex to withdraw from pain 3. Abnormal flexion 2. Abnormal extension 1. No response

Calculate the GCS and determine the severity

1. **Patient open eye to painful stimuli, inappropriate words, and decerebrate on both side**
   - 7/15, severe, management: intubation
2. **Patient open only his left eye to painful stimuli, incomprehensible sounds, and localizes pain**
   - 9/15, moderate
3. **Patient right eye is fixed dilated and don't respond to light and the other eye response to pain, inappropriate words, and decerebrate on both side**
   - 7/15, severe, management: intubation
4. **Patient open eyes to pain, incomprehensive sound, decerebrate right side, decorticate left side**
   - 7/15, severe, management: intubation

Calculate the GCS and determine the severity

5. **Patient open eyes to speech, localize to pain, confused verbal response**
   - 12/15, moderate
6. **Patient open his eyes to pain, localized to pain, confused and disoriented**
   - 11/15, moderate
7. **Patient is permanent intubated, eyes open to pain, decerebrate, no verbal response**
   - 5/15+T, severe
8. **Patient opens his eye to pain, inappropriate words, decorticate**
   - 8/15, severe, management: intubation
9. **Patient opens his eye to pain, inappropriate words, decerebrate**
   - 7/15, severe, management: intubation

Calculate the GCS and determine the severity

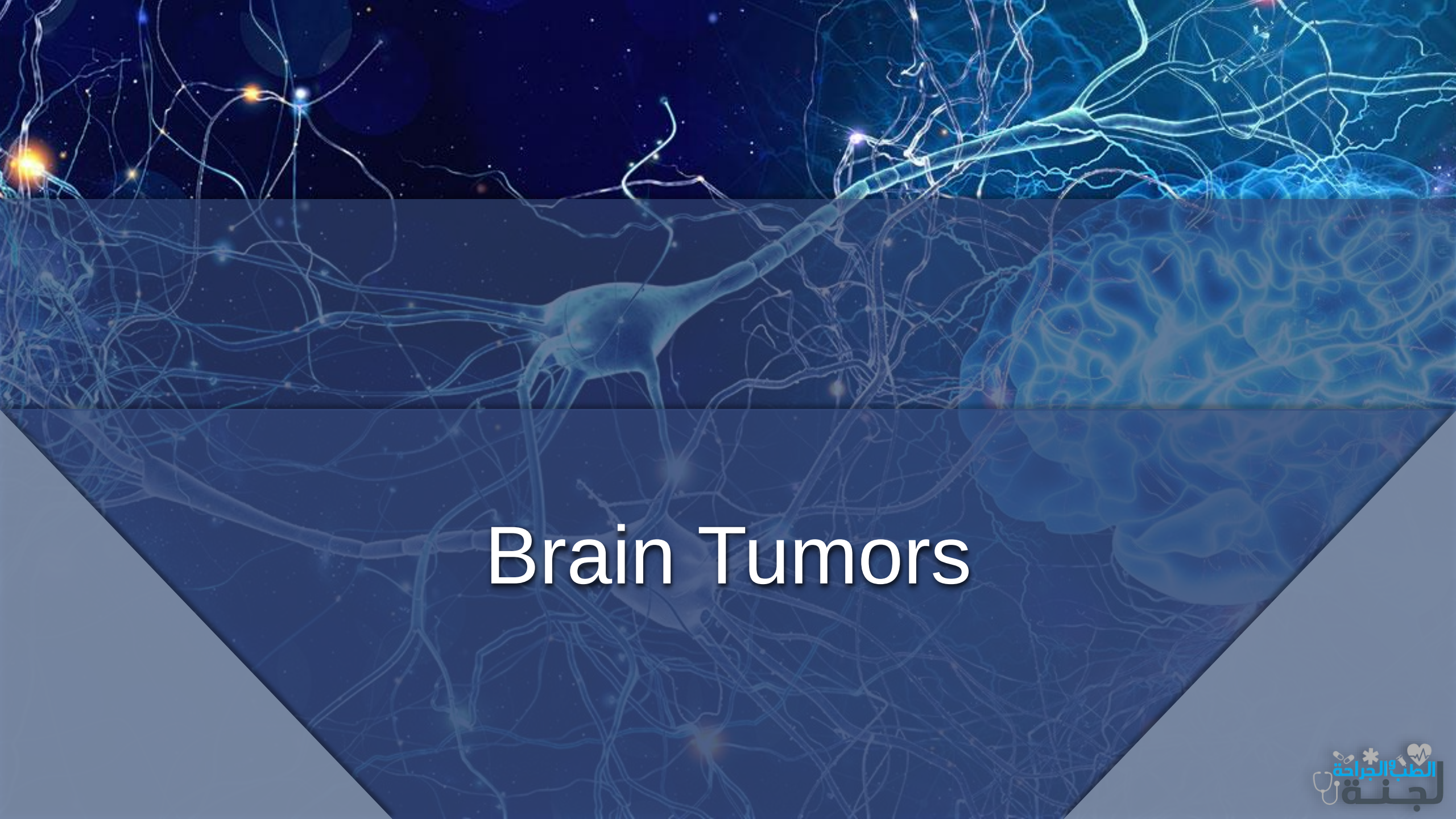
10. **Patient opens eyes to speech, confused, decerebrate right side and decorticate left side**
    - 10/15, moderate
11. **Patient open his eyes to painful stimulus, produce words, moves to localized pain**
    - 10/15, moderate, management: urgent CT
12. **Patient open only one of his eyes to pain, one side withdraws from pain, the other side decorticate position, confused**
    - 10/15, moderate
13. **Patient opens left eye spontaneously, incomprehensive sound, localize to pain right side, decorticate left side**
    - 11/15, moderate

Calculate the GCS and determine the severity

14. **Patient with HTN and DM came to ER after RTA with direct trauma to head and orbital area with chest injury and hypotension, O2 sat 60%. Patient opens his eyes when the doctor calls him, obeys command, disoriented to time place and person**
    - 13/15, moderate
    - What is your next step ? Managing his airway
15. **30 years old male patient came after falling down, His eyes do not respond to verbal or pain stimulations, produces sounds, extension of arms in response to pain and there is NO movement or sensation in lower limbs, on examination, doctor noticed bruises in his lower back, absent cremasteric reflex, anal examination reveals weak anal tone**
    - 5/15, severe, management: intubation

Calculate the GCS and determine the severity

16. **A 55-year-old patient with a history of laryngeal tumor and permanent tracheostomy presented to the ER after falling down from the 3rd floor. Physical examination revealed a fixed dilated right pupil, eye opening after painful stimulation and decerebrate posture to painful stimulus**
    - 5/15+T, severe, next step: intubation
17. **A 30-year-old male with a history of laryngeal cancer and permanent tracheostomy presented to the ER after falling down. Physical examination revealed *no sensory or motor response in his right leg*, opens his eyes to verbal command, localizes the pain**
    - 9/15+T, moderate, next step: emergent non-contrast brain CT
    - What is the type of spinal injury ? Incomplete

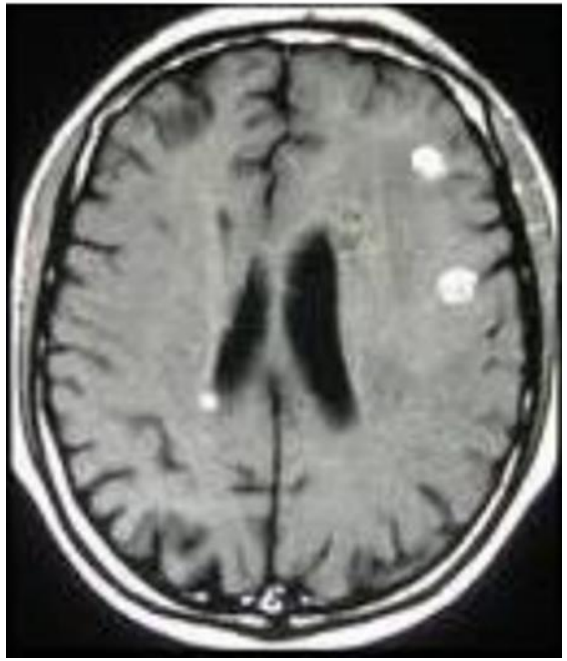


Brain Tumors

Brain tumors

- They can be primary (30%) or Secondary metastatic (70%), benign or malignant.
- **Secondary metastatic tumors**
  - **Most common sources of mets**: Lung, Breast, GI tract, Kidney, Melanoma
  - **Localization**: One or more lesions, Usually at gray-white matter junction
  - Generally, very poor survival (months)
  - **Good survival predictors**: age < 65, limited extracranial disease
  - **Management**
    - 1-3 lesions can be removed by surgery followed by radiation (>3 is palliative)
    - Multiple lesions often treated with radiation

Metastatic Melanoma



Adult primary brain tumors

Glioblastoma

Description

- Grade IV astrocytoma.
- Common, highly malignant 1° brain tumor with ~ 1-year median survival.
- Found in cerebral hemispheres.
- Can cross corpus callosum ("butterfly glioma" [A]).
- Associated with EGFR amplification.

Histology

- Astrocyte origin, GFAP +. "Pseudopalisading" pleomorphic tumor cells [B] border central areas of necrosis, hemorrhage, and/or microvascular proliferation.

Oligodendroglioma

Description

- Relatively rare, slow growing. Most often in frontal lobes [C].
- Often calcified
- Most common presentation is seizures

Histology

- Oligodendrocyte origin.
- "Fried egg" cells—round nuclei with clear cytoplasm [D].
- "Chicken-wire" capillary pattern.

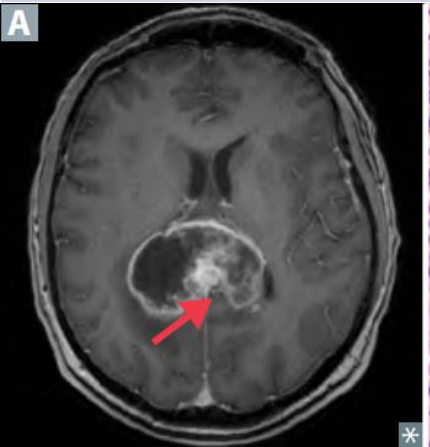
Meningioma

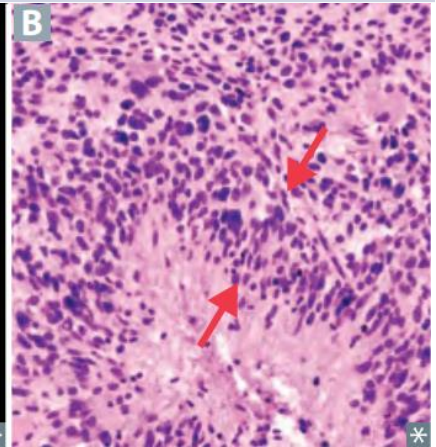
Description

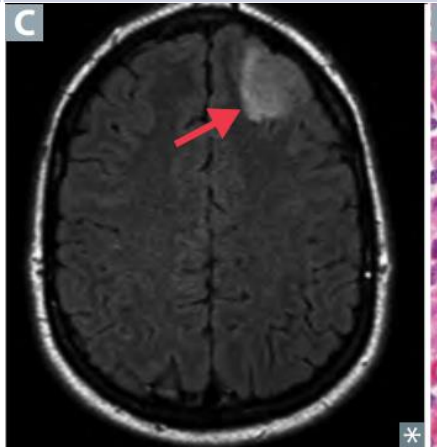
- Common, typically benign (grade I).
- Females > males.
- Occurs along surface of brain or spinal cord.
- Extra-axial (external to brain parenchyma) and may have a dural attachment ("tail" [E]).
- Often asymptomatic; may present with seizures or focal neurologic signs.
- Resection and/or radiosurgery.

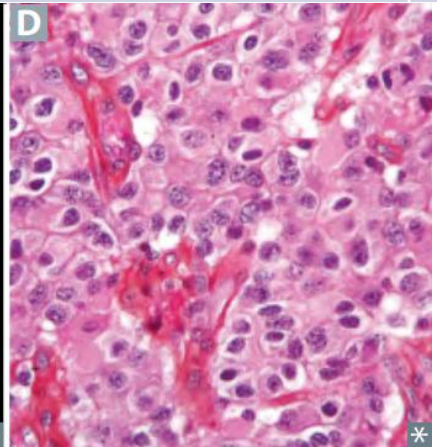
Histology

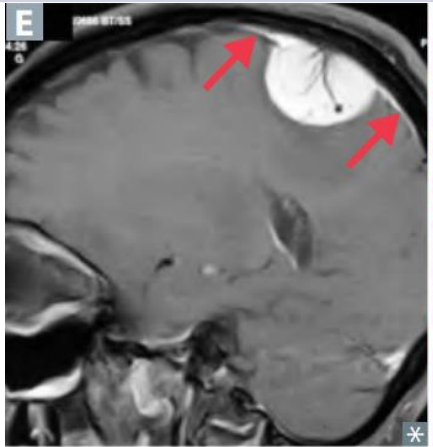
- Arachnoid cap cell origin.
- Spindle cells concentrically arranged in a whorled pattern [F]; psammoma bodies (laminated calcifications)

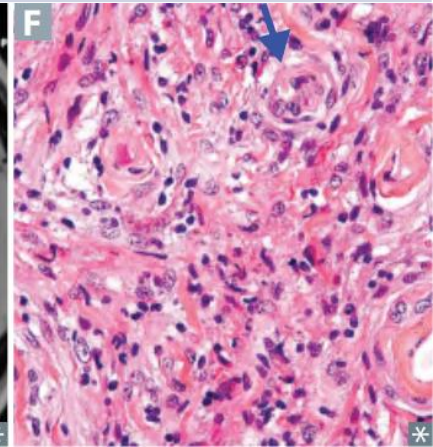












Adult primary brain tumors

Hemangioblastoma

Description

- Most often cerebellar [G].
- Associated with von Hippel-Lindau syndrome when found with retinal angiomas.
- Can produce erythropoietin → 2° polycythemia.

Histology

- Blood vessel origin. Closely arranged, thin-walled capillaries with minimal intervening parenchyma [H].

Pituitary Adenoma

Description

- May be nonfunctioning (silent) or hyperfunctioning (hormone-producing).
- Nonfunctional tumors present with mass effect (eg, bitemporal hemianopia; due to pressure on optic chiasm [I]).
- Pituitary apoplexy → hypopituitarism.
- **Prolactinoma** classically presents as galactorrhea, amenorrhea, ↓ bone density due to suppression of estrogen in females and as ↓ libido, infertility in males.
- **Treatment**: dopamine agonists (eg, bromocriptine, cabergoline), transsphenoidal resection.

Histology

- Hyperplasia of only one type of endocrine cells found in pituitary. Most commonly from lactotrophs (prolactin) [J]

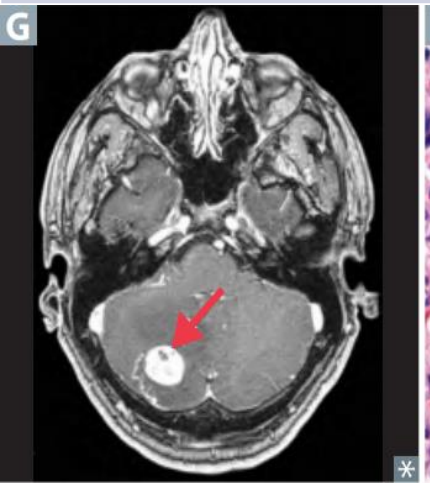
Schwannoma

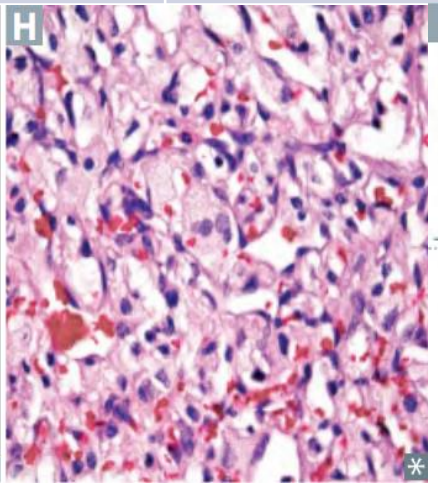
Description

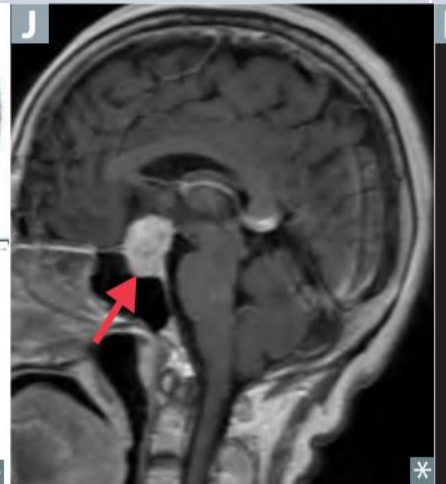
- Classically at the cerebellopontine angle [K], benign, involving CNs V, VII, and VIII, but can be along any peripheral nerve.
- Often localized to CN VIII in internal acoustic meatus → vestibular schwannoma (can present as hearing loss and tinnitus).
- Bilateral vestibular schwannomas found in NF-2.
- Resection or stereotactic radiosurgery.

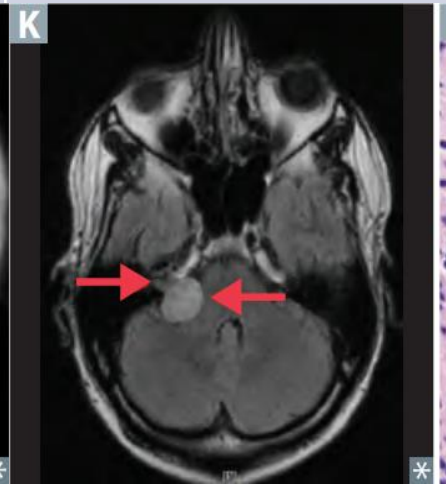
Histology

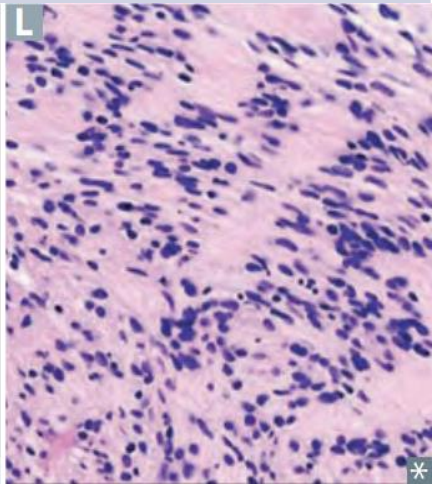
- Schwann cell origin, S-100 +.
- Biphasic, dense, hypercellular areas containing spindle cells alternating with hypocellular, myxoid areas [L].











Childhood primary brain tumors

Pilocytic astrocytoma

Description

- Low-grade (grade 1) astrocytoma.
- Most common 1° brain tumor in childhood.
- Usually well circumscribed.
- In children, most often found in posterior fossa [A] (eg, cerebellum).
- May be supratentorial.
- Benign; good prognosis

Histology

- Astrocyte origin, GFAP +.
- Bipolar neoplastic cells with hairlike projections.
- Associated with microcysts and Rosenthal fibers (eosinophilic, corkscrew fibers [B]). Cystic + solid (gross).

Medulloblastoma

Description

- Most common malignant brain tumor in childhood.
- Commonly involves cerebellum [C].
- Can compress 4th ventricle, causing noncommunicating hydrocephalus → headaches, papilledema.
- Can involve the cerebellar vermis → truncal ataxia.
- Can send "drop metastases" to spinal cord

Histology

- Form of primitive neuroectodermal tumor (PNET).
- Homer-Wright rosettes (small blue cells surrounding central area of neuropil [D]). Synaptophysin ⊕.

Ependymoma

Description

- Most commonly found in 4th ventricle [E].
- Can cause hydrocephalus.
- Poor prognosis.

Histology

- Ependymal cell origin.
- Characteristic perivascular pseudorosettes [F].
- Rod-shaped blepharoplasts (basal ciliary bodies) found near the nucleus

Craniopharyngioma

Description

- Most common childhood supratentorial tumor.
- May be confused with pituitary adenoma (both cause bitemporal hemianopia).
- Associated with a high recurrence rate.

Histology

- Derived from remnants of Rathke pouch (ectoderm).
- Calcification is common [G] [H]. Cholesterol crystals found in "motor oil"-like fluid within tumor.

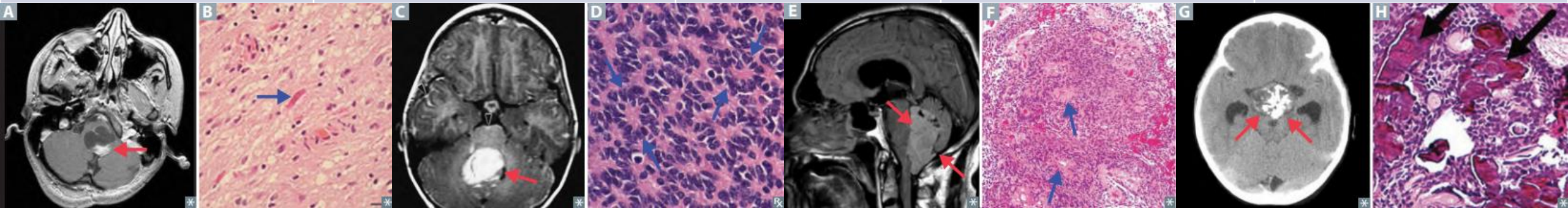
Pinealomas

Description

- Most commonly extragonadal germ cell tumors.
- ↑ incidence in males.
- Present with obstructive hydrocephalus (compression of cerebral aqueduct),
- Parinaud syndrome (compression of dorsal midbrain)—triad of upward gaze palsy, convergence-retraction nystagmus, and light-near dissociation.

Histology

- Similar to testicular seminomas



Essay Questions

(2) سنوات

❖What is the mechanism of early morning headache in brain tumor patients ?

Answer by ChatGPT

- Early morning headaches in brain tumor patients can occur due to a few different mechanisms. One possible explanation is increased intracranial pressure (ICP) caused by the tumor, which can cause headaches that are worse in the morning when the patient has been lying down for an extended period of time. This is because lying down can cause the ICP to increase due to the accumulation of cerebrospinal fluid in the brain.
- Another possible mechanism is related to the sleep-wake cycle. Brain tumors can disrupt the circadian rhythm, which can lead to headaches that are worse in the morning. This is because the body's natural painkillers, such as endorphins, are at their lowest levels in the early morning, which can make headaches feel more severe.

(4) سنوات

❖Mention 2 ways of spread of brain tumor to the spinal cord

- Hematogenous spread
- Direct invasion
- Drop metastasis

(2) سنوات

❖Which tumor is mostly associated with ossification and what are other ddx ?

- Meningioma
- Other ddx: Oligodendroglioma, ganglioma

Essay Questions

- **Mention one example on the following**
  - **Homogeneous enhancement lesion**
    - Meningioma/lymphoma
  - **Hourglass appearance lesion**
    - Schwannoma
  - **Brain tumor containing psammoma bodies**
    - Meningioma
  - **Tumor has dural tail**
    - Meningioma
  - **Example of nerve root tension sign**
    - Straight leg raising (SLR) test (Lasègue's sign)
    - Bowstring sign

True or false, and if false correct it

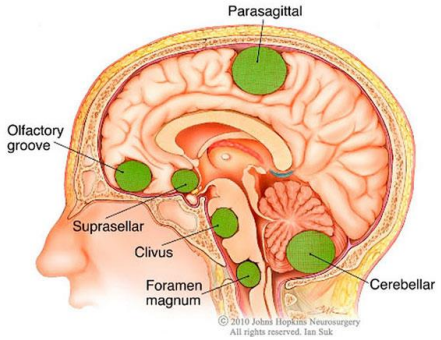
- **Meningioma originate from dermal cells**
  - False, originates from arachnoid cap cells
- **Meningioma is the most common primary tumor in adults**
  - False, Glioblastoma Multiforme is the most common primary tumor in adults
- **Psammoma bodies seen in GBM tumor**
  - False, it's seen in meningioma
- **GBM considered grade 3 tumor**
  - False, it's grade 4
- **GBM tends to calcify**
  - False, it doesn't calcify
- **GBM is most common primary brain tumor in children**
  - False, in adults

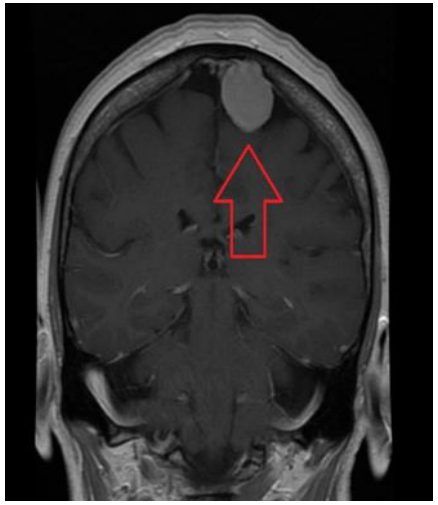
True or false, and if false correct it

- **Craniopharyngioma is a kind of tumor that can cause drop mets**
  - False, Medulloblastoma is a kind of tumor that can cause drop mets
- **Functioning pituitary adenoma is mostly a macroadenoma**
  - False, Functioning pituitary adenoma is mostly a microadenoma
- **Prolactinoma always considered macroadenoma**
  - False, 99% of functioning adenoma are microadenoma because patient seek care early due to the signs and symptoms of hormonal imbalance
- **CSF is reabsorbed into transverse sinus**
  - False, reabsorbed into superior sagittal sinus by arachnoid villi
- **Meningioma is most common extra axial brain tumor**
  - True

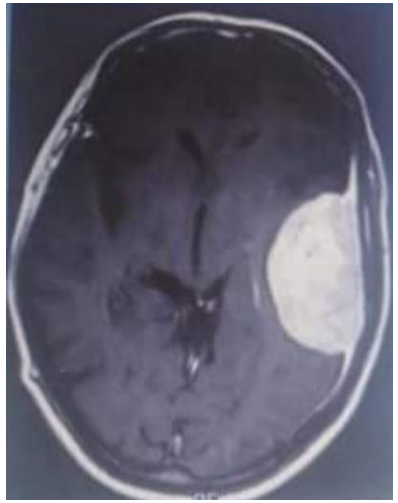
Meningioma

- **What is your diagnosis ?**
  - Meningioma
- **Where is it located ?**
  - Parasagittal
- **Is it more common in females or males ?**
  - In females

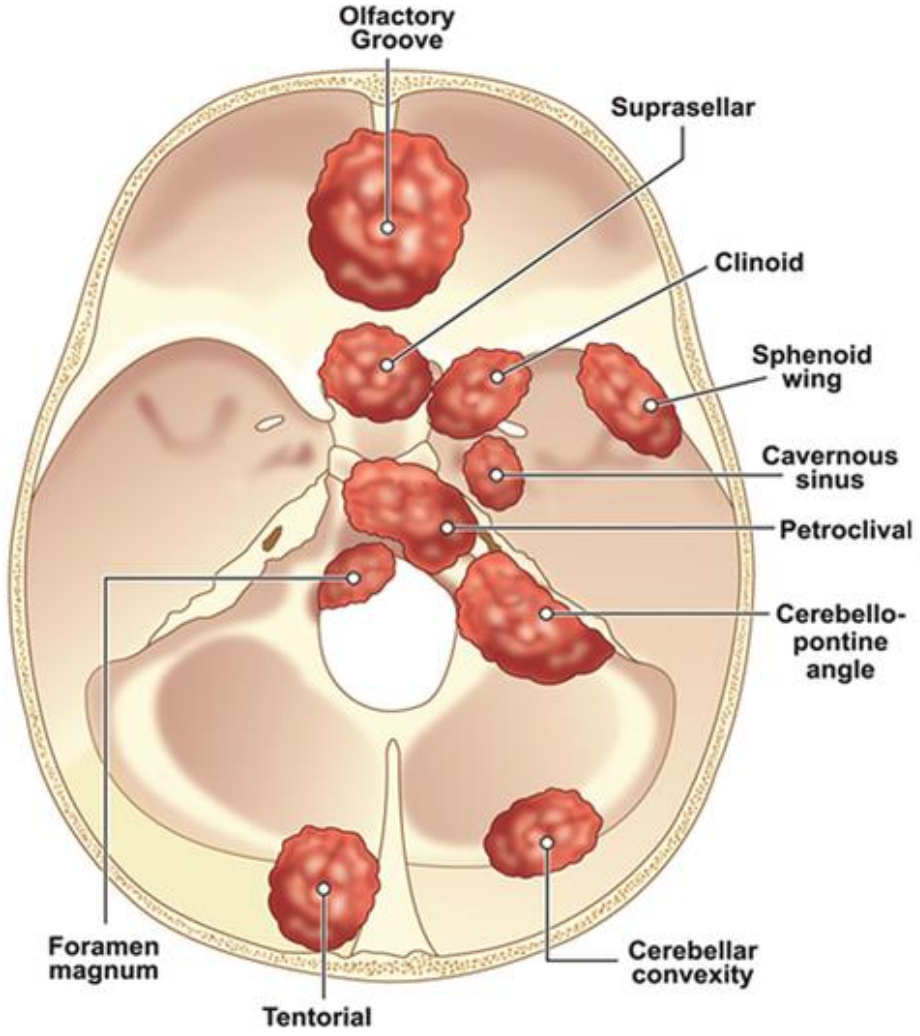


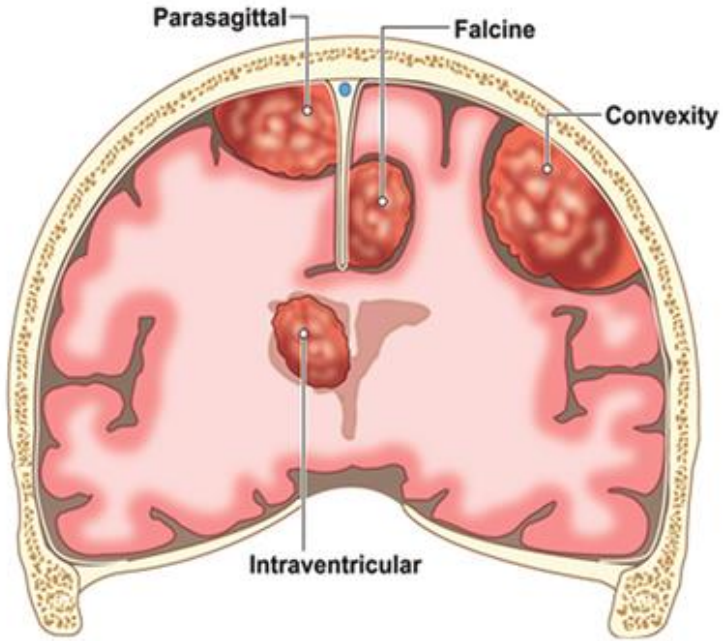


- **What is your diagnosis ?**
  - Meningioma
- **From what type of cells this tumor originate ?**
  - Arachnoid cap cells



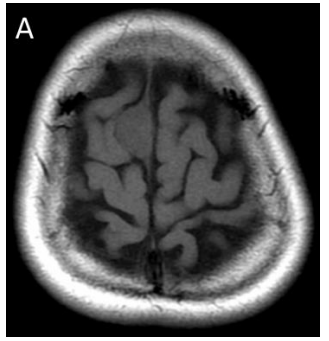
Meningioma locations

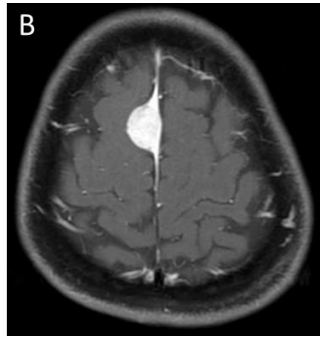


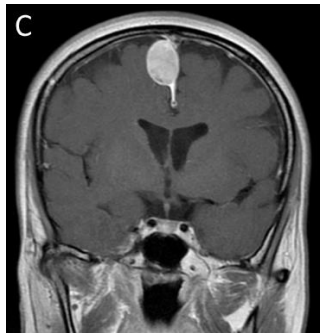


Meningioma

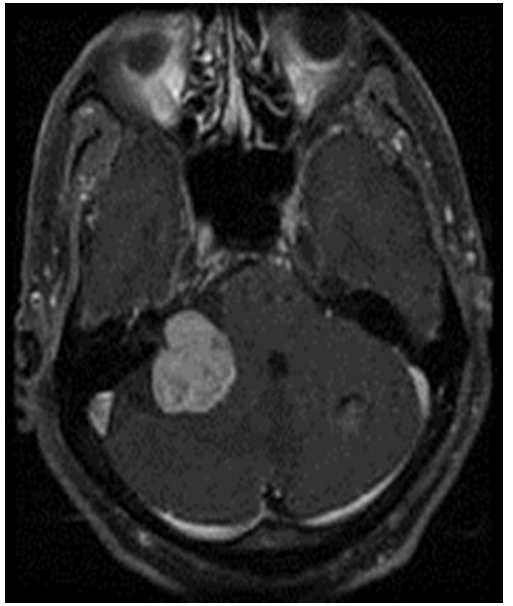
- **What is your diagnosis ?**
  - Meningioma
- **What imaging modality is used in each picture ?**
  A. T1 weighted without contrast, axial view
  B. T1 weighted with contrast, axial view
  C. T1 weighted with contrast, coronal view
- **What is the finding in image C ?**
  - Epidural tail
- **Treatment options**
  - Surgical excision
- **Stage according to WHO classification ?**
  - Stage 1







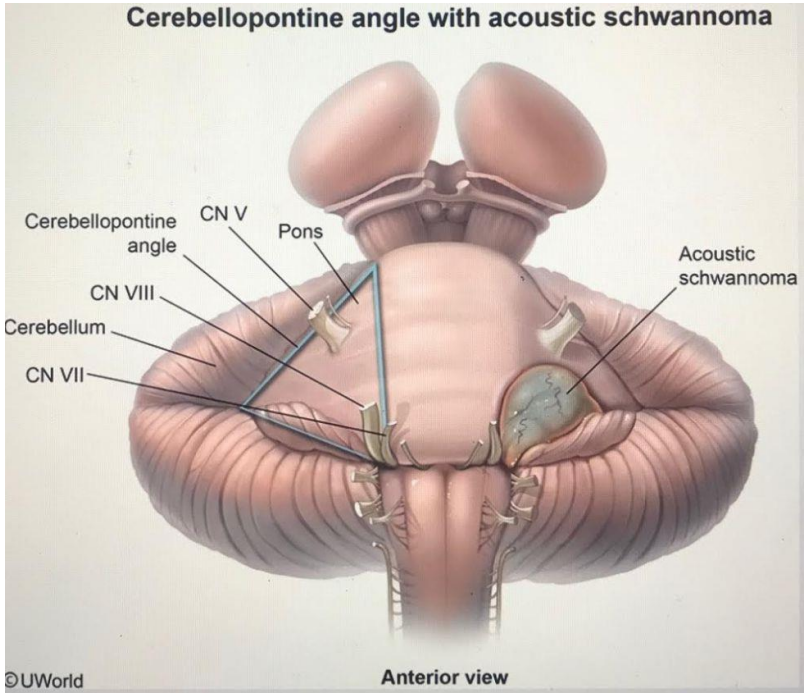
Cerebellopontine angle Masses



- **What is the anatomic location of the tumor ?**
  - Right side cerebellopontine angle
- **What are the differential diagnosis ?**
  - Vestibular schawanoma
  - Meningioma
  - Epidermoid cyst
  - Dermoid cyst
- **Mention 2 clinical symptoms**
  - Unilateral hearing loss, Tinnitus, Vertigo, Headache, Loss of facial sensation (late)
- **If this paient present with dizziness, vertigo and hearing loss in his right ear, what is the most probable diagnosis ?**
  - Vestibular schawanoma

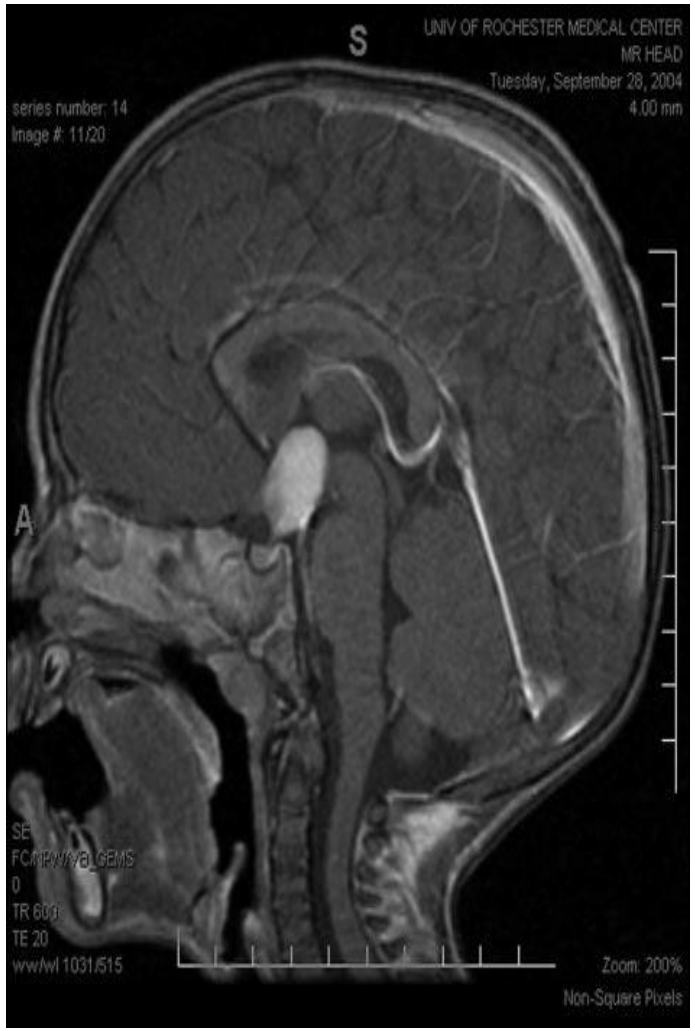
Cerebellopontine angle syndrome

- **Etiology**: most commonly vestibular schwannomas (acoustic neuroma), although other cerebellopontine angle tumors may result in the same presentation
- **Clinical features**
  - Symptoms are due to compression of
    - **CN 8**: Unilateral hearing loss, tinnitus, vertigo
    - **CN 5 (late)**: Loss of facial sensation
  - Cerebellopontine angle syndrome lacks signs of long tract lesions, thus indicating the lesion is outside the brainstem



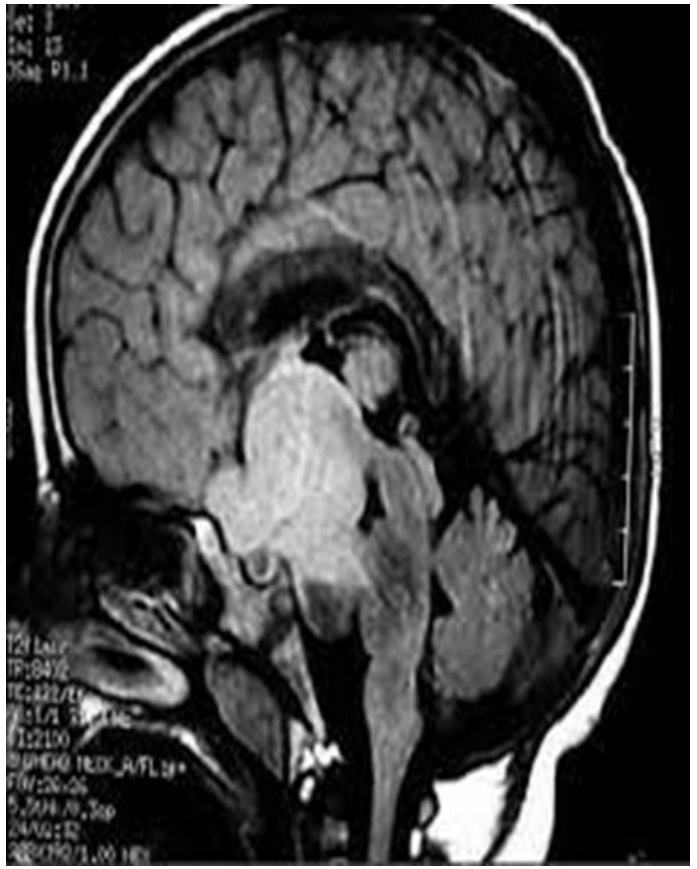
Suprasellar Masses

- **What is the anatomic location of the tumor ?**
  - Suprasellar
- **What is the most likely diagnosis ?**
  - Pituitary adenoma (homogenous mass)
- **What is the visual abnormality you expect to see in this patient ?**
  - Bitemporal hemianopia
- **Mention 2 surgical procedure?**
  - Trans sphenoidal hypophysectomy
  - Craniotomy



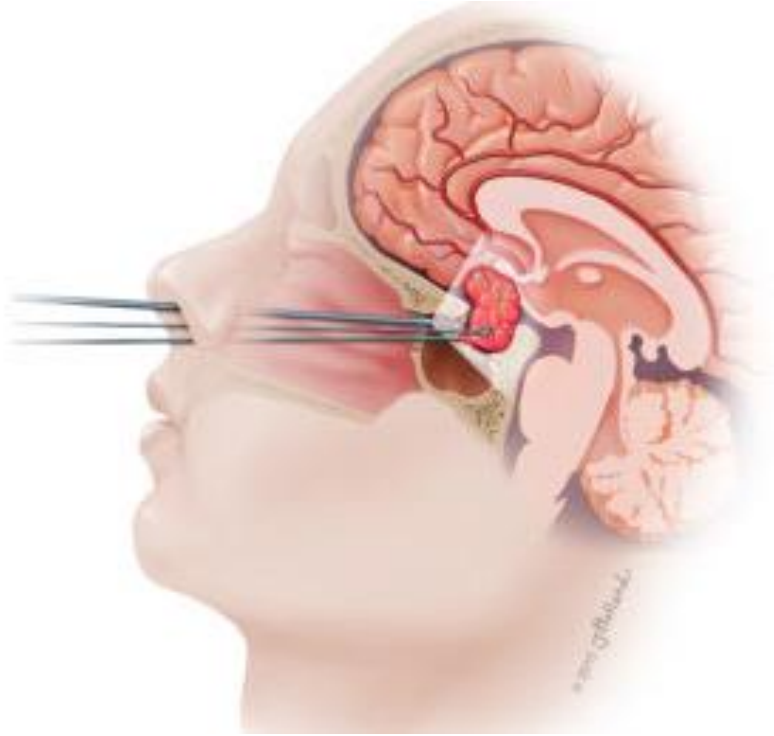
Suprasellar Masses

- **What is the anatomic location of the tumor ?**
  - Suprasellar
- **Mention 3 DDX**
  - Pituitary adenoma
  - Dermoid cyst
  - Ranthky's cyst
  - Craniopharyngioma
- **Mention 3 clinical manifestations**
  - Visual impairment
  - Endocrine dysfunction
  - Hydrocephalus, Vomiting, Headache



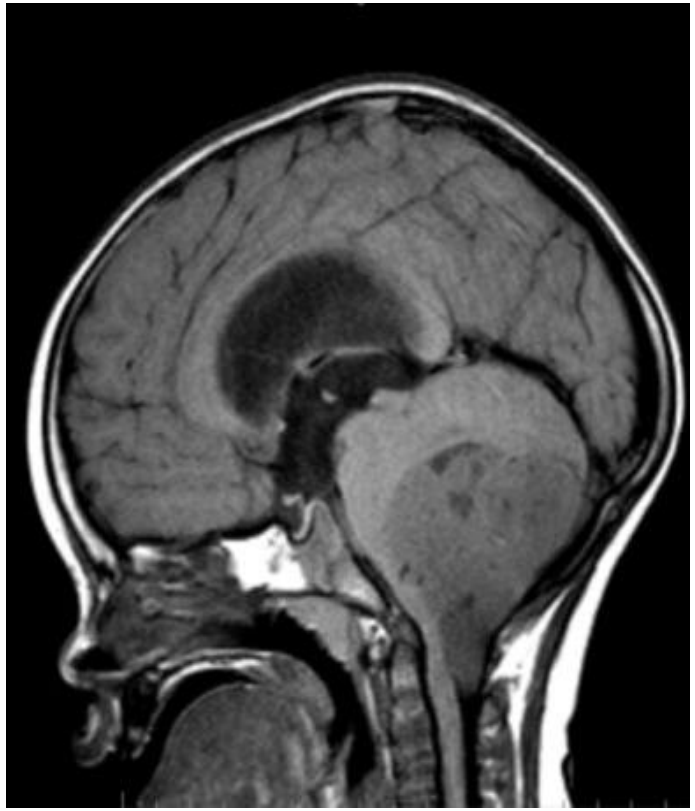
Transsphenoidal approach

- **What is this name of this approach ?**
  - Transsphenoidal approach
- **What is it used for?**
  - Pituitary resection/pituitary adenoma



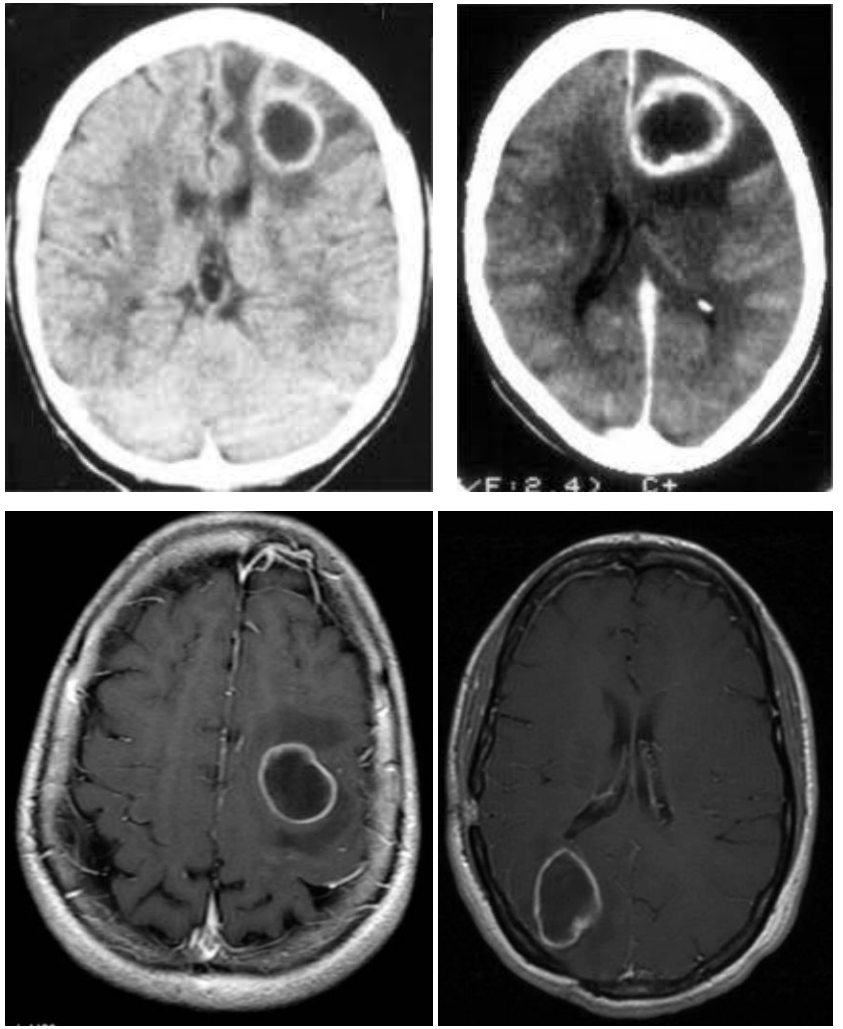
Infratentorial Masses

- **What is the anatomic location of the tumor ?**
  - Infratentorial (cerebellar tumor)
- **What type of hydrocephalus is seen in this patient**
  - Obstructive
- **Give 2 differential diagnosis**
  - Astrocytoma, medulloblastoma
- **What are the signs and symptoms expected to be seen in this patient ?**
  - Headache, Papilledema, Nausea/vomiting



Ring enhancement

- **What is the type of enhancement ?**
  - Ring enhancement
- **Mention 2 other enhancements**
  - Homogenous enhancement
  - Heterogeneous enhancement
- **Mention 2 DDx**
  - Abscess
  - brain mets
  - GBM
  - Resolving hematoma
- **What is the type of edema surrounding this lesion & what is the treatment ?**
  - Vasogenic edema, steroids (Dexamethasone)



Spinal Cord Tumors

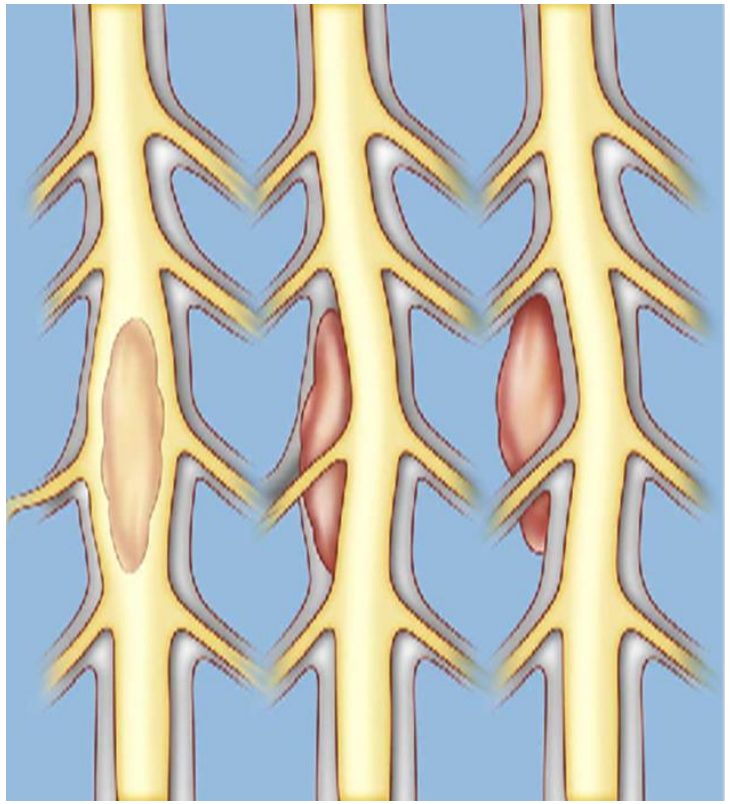
Spinal Cord Tumors

In spinal tumors the pain is nocturnal and worse in recumbent position **due to** venous congestion when pt is lying down and dural stretching. Whereas in degenerative disease pain is worse with movement

<table>
<tr><th colspan="2">Types for spinal tumors</th></tr>
<tr><th>Extradural tumors (55%)</th><th>Intradural Extramedullary (40%)</th></tr>
<tr><td rowspan="2">Benign
1. Hemangioma
2. Osteoid osteoma (most common benign tumor of bone)
3. Osteoblastoma (may cause scoliosis)
4. Osteochondroma
5. Chordoma (sacrococcygeal, bad prognosis, benign but it behaves as malignant)
Malignant
1. Mets
2. Osteosarcoma
3. Multiple myeloma
4. Spinal lymphoma
5. Osteocarcinoma</td><td>1. Meningioma
2. Neurofibroma
3. Schwannoma (hour-glass appearance on axial MRI)</td></tr>
<tr><td>Intradural Intramedullary (5%)</td></tr>
<tr><td>1. Astrocytoma
2. Ependymoma
3. Hemangioblastoma</td></tr>
</table>

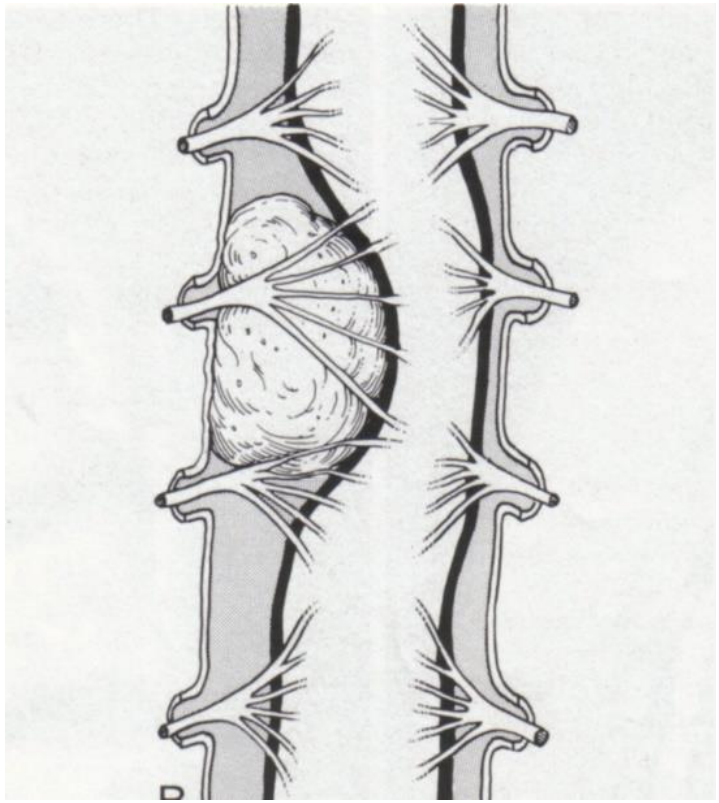
Spinal Cord Tumors

- How are spinal tumors classified according to the picture ? give one example on each one
  - **Extradural**: osteochondroma, osteoid osteoma
  - **Intradural Extramedullary**: meningioma, schwannoma
  - **Intradural Intramedullary**: astrocytoma, ependymoma, hemangioblastoma



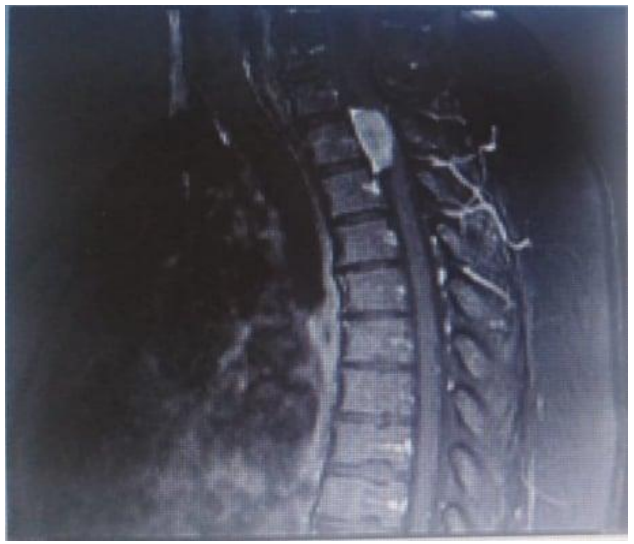
Spinal Cord Tumors

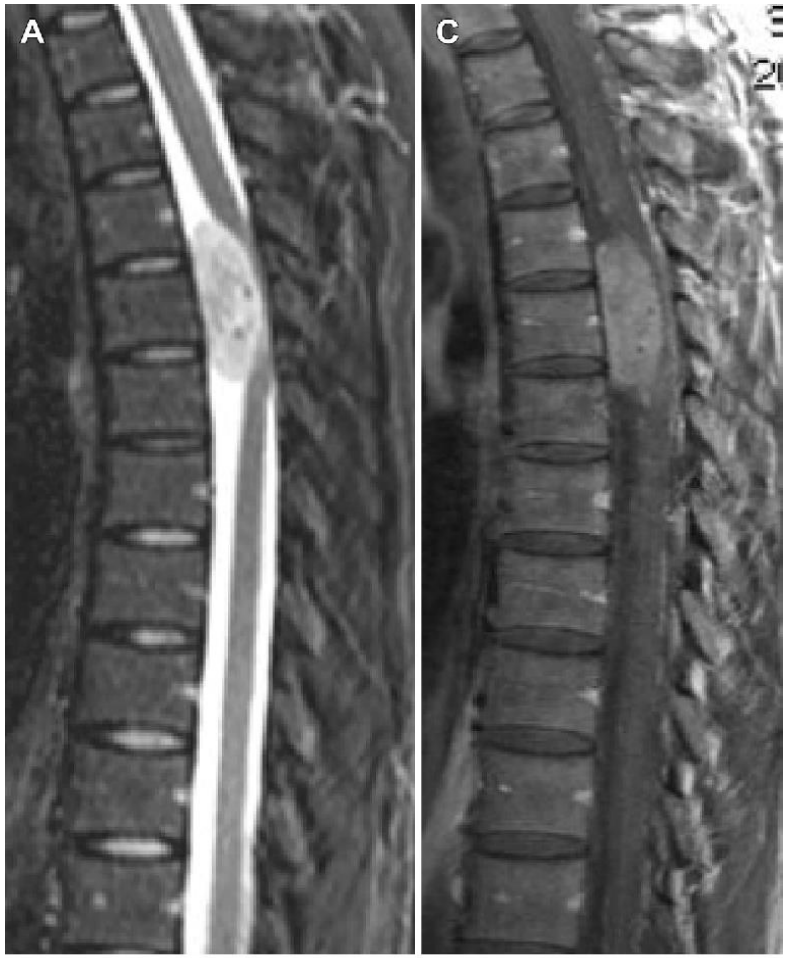
- **What is your diagnosis ?**
  - Intradural extra medullary tumor
- **Mention 2 differential diagnosis**
  - Meningioma, schwannoma and neurofibroma
- **Mention 2 indications of surgery in spinal tumors ?**
  - Myelopathy
  - Progressive neurological deficit
  - Intractable pain



Spinal Cord Tumors

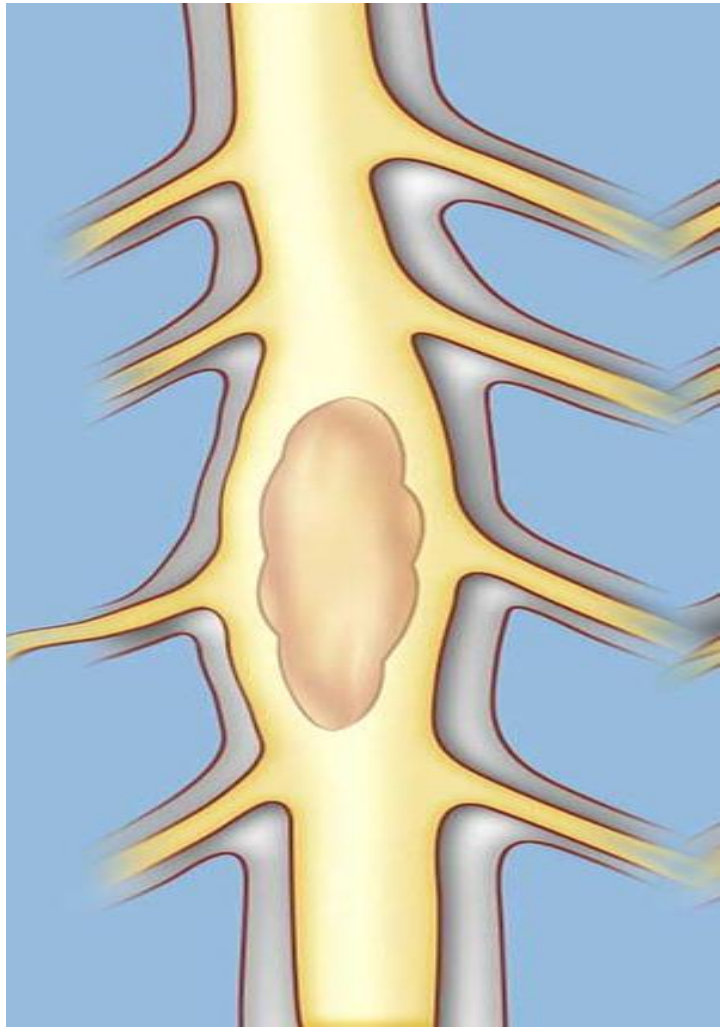
- **What is your diagnosis ?**
  - Intradural extra medullary tumor
- **Mention 2 differential diagnosis**
  - Meningioma, schwannoma and neurofibroma





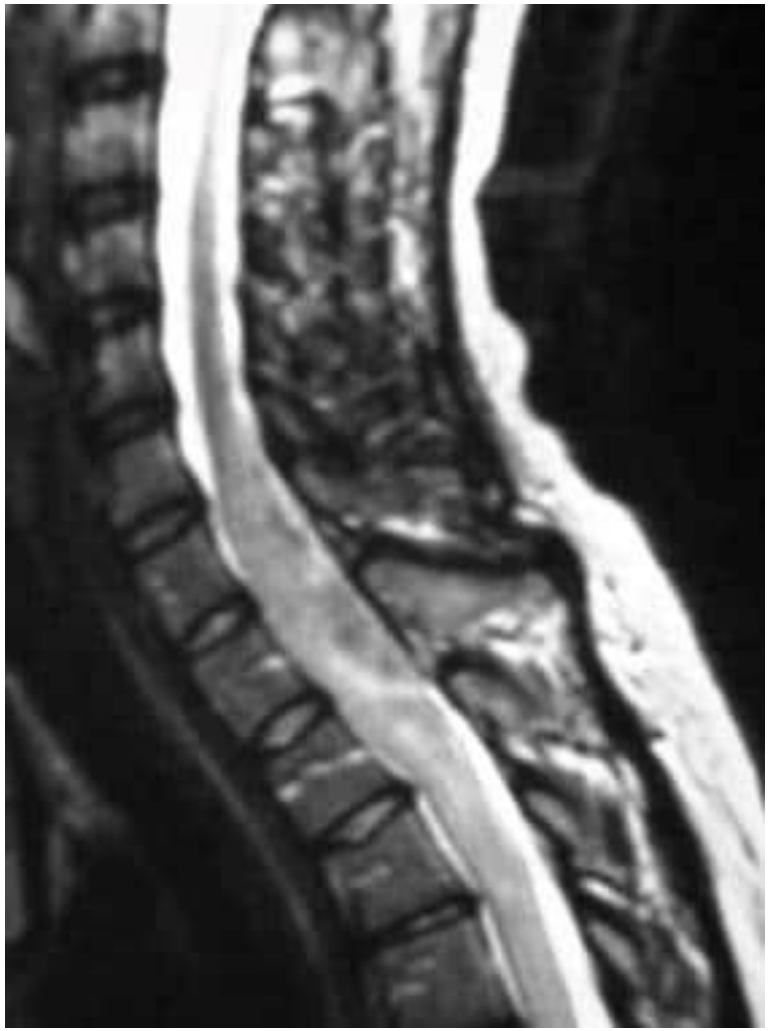
Spinal Cord Tumors

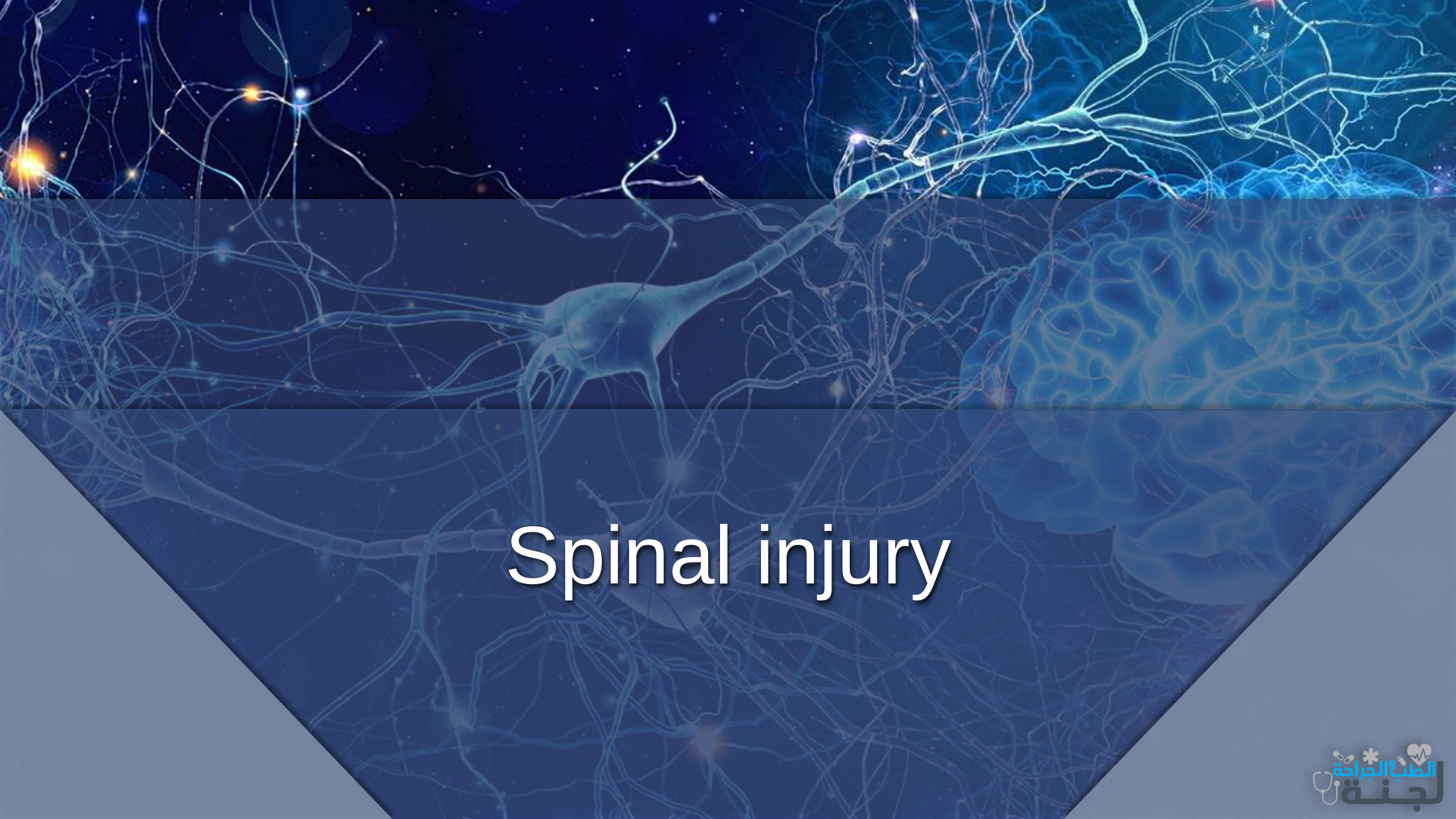
- **What is your diagnosis ?**
  - Intradural Intramedullary
- **Mention 2 differential diagnosis**
  - Astrocytoma, ependymoma, hemangioblastoma
- **Mention 2 clinical features**
  - Back pain
  - Neurological deficit
  - Deformities



Spinal Cord Tumors

- **What is your diagnosis ?**
  - Intradural Intramedullary
- **Mention 2 differential diagnosis**
  - Astrocytoma, ependymoma, hemangioblastoma
- **What is the most likely diagnosis?**
  - Astrocytoma
- **Mention 4 upper motor neuron lesion symptoms ?**
  - Spasticity, Muscle weakness, Babinski sign, Fasciculation, Hyperreflexia, Clonus

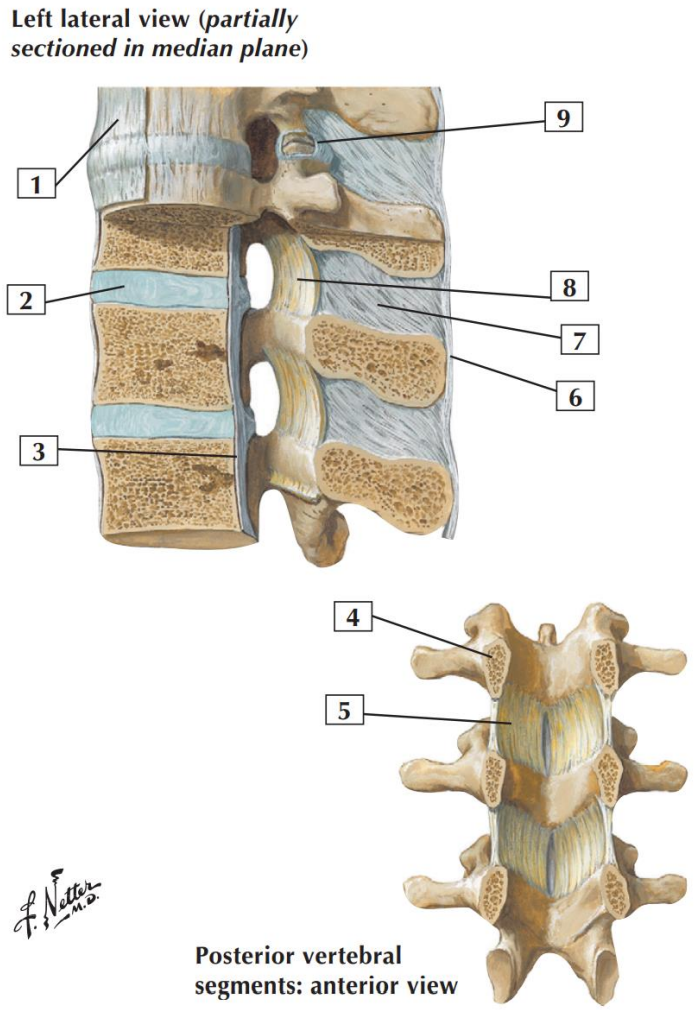




Spinal injury

Vertebral Ligaments: Lumbar Region

1. Anterior longitudinal ligament
2. Intervertebral disc
3. Posterior longitudinal ligament
4. Pedicle (cut surface)
5. Ligamentum flavum
6. Supraspinous ligament
7. Interspinous ligament
8. Ligamentum flavum
9. Capsule of zygapophysial joint (partially opened



Vertebral fractures

- **Epidemiology**: Common in elderly women (osteoporotic fractures) and young men (traumatic injuries)
- **Location**: 50% in the cervical spine
- **Etiology**: Trauma, Pathological fractures (Osteoporosis, Malignancy, Infection)
- **Clinical features**
  - Local pain on pressure, percussion, and compression
  - Palpable unevenness or disruption of the vertebral process alignment
  - Paravertebral hematoma
  - Weakness or numbness/tingling
  - Neurogenic shock
- **Stability of vertebral fractures**
  - **Stable vertebral fracture**: The structural stability of the spine remains intact
    - No neurologic deficits
    - Fractures of the anterior column of the spine
  - **Unstable vertebral fracture**: The structural stability of the spine is compromised
    - The spine can move as two or more independent units, which may cause spinal cord injury.
    - Mid-column and posterior column fractures

Vertebral fractures

❖Complications

- Spinal cord injury
- Vessel injury
- Posttraumatic deformation of the spine: loss of height, scoliosis, or kyphosis
- Gibbus (A hump or kyphotic deformity in the spine (usually thoracolumbar spine))

❖Diagnostics

- **Physical exam**: Detailed neurologic exam, Rectal exam to assess sphincter activation
- **Imaging**: Anterior-posterior and lateral x-ray, CT axial image, MRI

❖Treatment

- **Stable fractures**: Conservative treatment (Pain medication, Physical therapy)
- **Unstable fractures** or **neurological symptoms**: Surgical treatment (Spondylodesis)

Vertebral fractures classification

- **Vertebral compression fracture** (most common type)
  - **Causes**: Pathological fractures, Trauma
  - **Clinical features**
    - Usually, stable. Often asymptomatic, but may cause acute back pain and point tenderness
    - **Long-term findings after multiple vertebral compression fractures**: Progressive thoracic kyphotic deformity if multiple vertebrae are affected (stooped posture with a “dowager's hump”), Decreased height (loss of 2–3 cm with each fracture)
  - Subtypes
    - Wedge fracture: characterized by a loss of height, predominantly of the anterior part of the vertebral body, which results in a wedge-shaped vertebra
    - Vertebra plana: advanced compression fracture with a loss of height of the entire vertebral body, both anteriorly and posteriorly
    - Codfish vertebra: characterized by loss of height of the central part of the vertebral body, resulting in a biconcave vertebral body
- **Burst fracture**: fracture of the vertebra in multiple locations
  - Result of compression trauma with severe axial loading
  - Possible displacement of bone fragments into the spinal canal
- **Fracture-dislocation**: fractured vertebra and disrupted ligaments; instability may cause spinal cord compression

Subtypes and variants

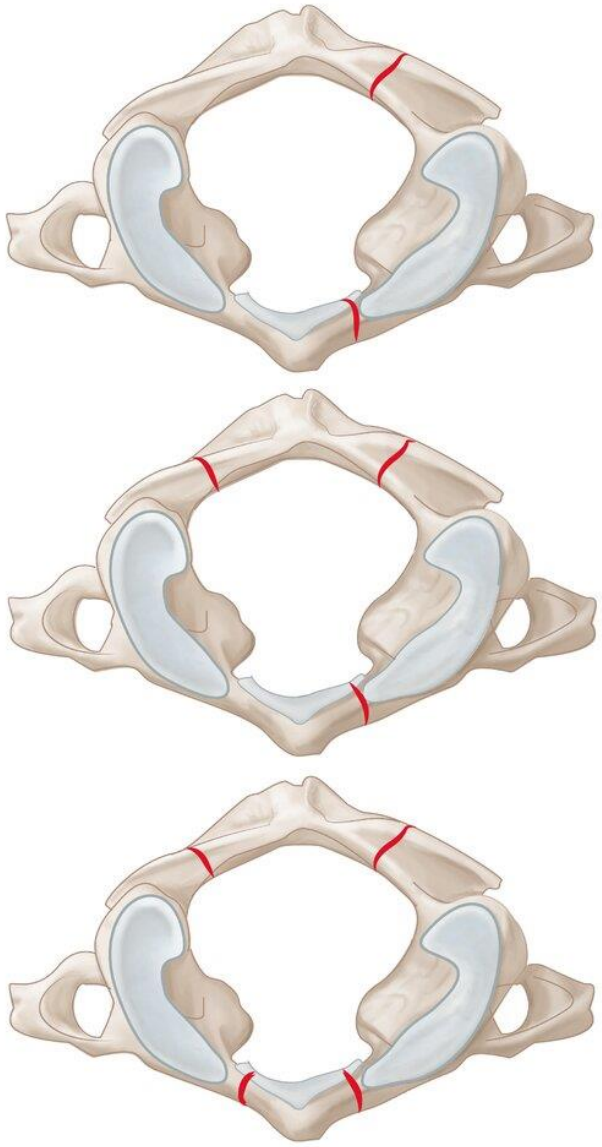
Atlas fracture	Dens fracture
Definition: fracture of the atlas (first cervical vertebra) • Injury mode: axial force (e.g., swimming accident caused by jumping head-first into shallow water) • Jefferson fracture: combined fracture of the anterior and posterior arches **Symptoms** • Painful restriction of movement • Neck ache, paravertebral hematoma with dysphagia • Neurologic deficits, such as Horner syndrome • An asymptomatic course is also possible. **Diagnostics** • Cervical spine x-ray: fractures and dislocations • CT: best for Jefferson fractures • Arteriography: in cases of vascular compromise **Treatment**: immobilization for stable fractures; surgery for dislocations	**Definition**: fracture of the dens axis (second cervical vertebral body) **Epidemiology**: 10–15% of all cervical fractures **Etiology** • Head or neck injury as a result of a fall or blunt trauma • A contributing factor is loss of bone substance as a result of osteoporosis (mostly seen in elderly patients). **Symptoms** • Movement-induced pain • Neurological problems ranging from local sensory loss to paralysis due to complete spinal cord injury **Specific forms**: hangman's fracture • **Definition**: bilateral fracture of the axis arch • **Etiology**: trauma with hyperextension and distraction (e.g., car accident) **Diagnostics**: x-ray of the spinal cord to discern an atlantoaxial dislocation , CT, or MRI **Treatment**: immobilization for stable fractures, surgery for dislocations

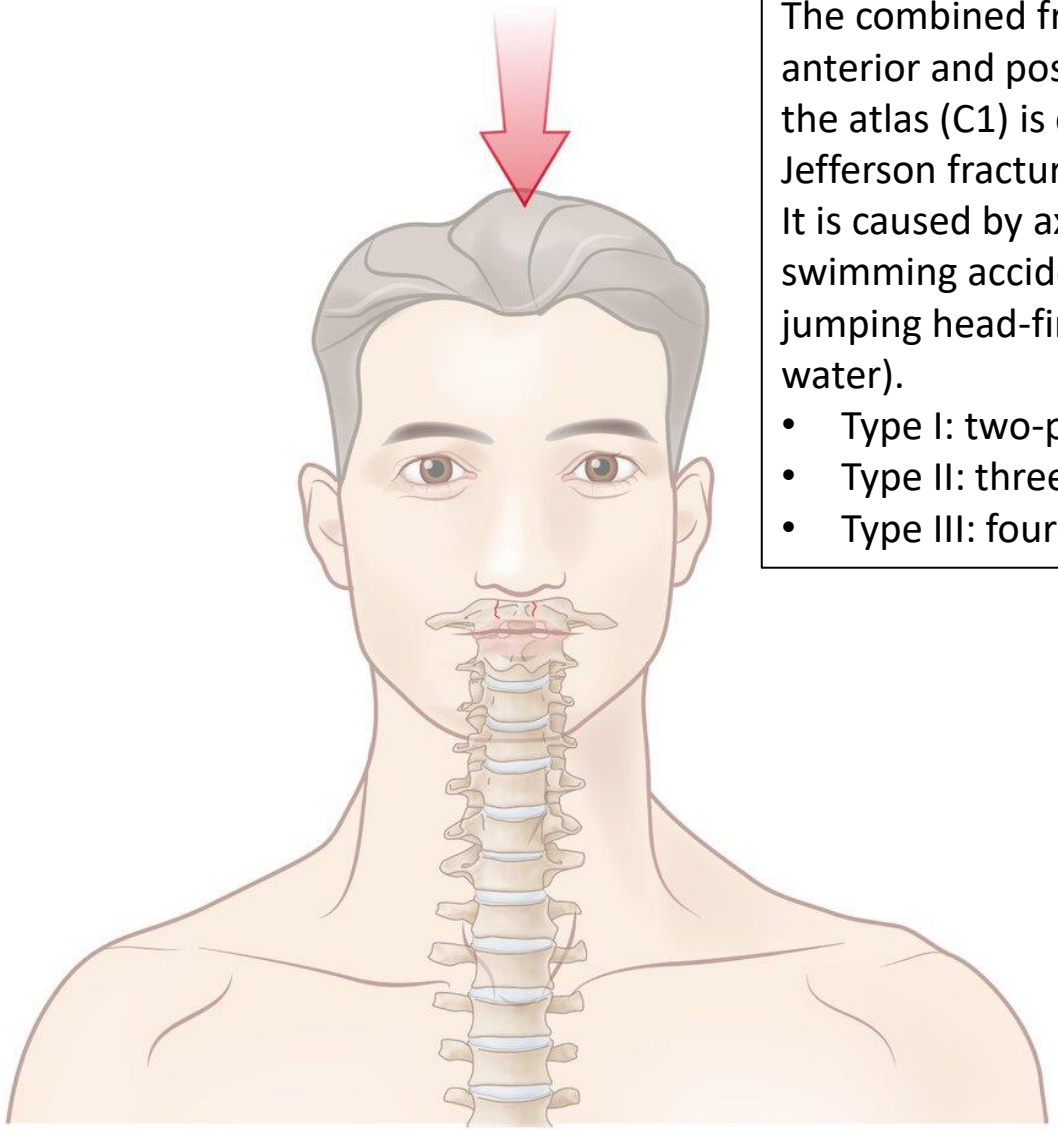
Jefferson fracture

Type I

Type II

Type III



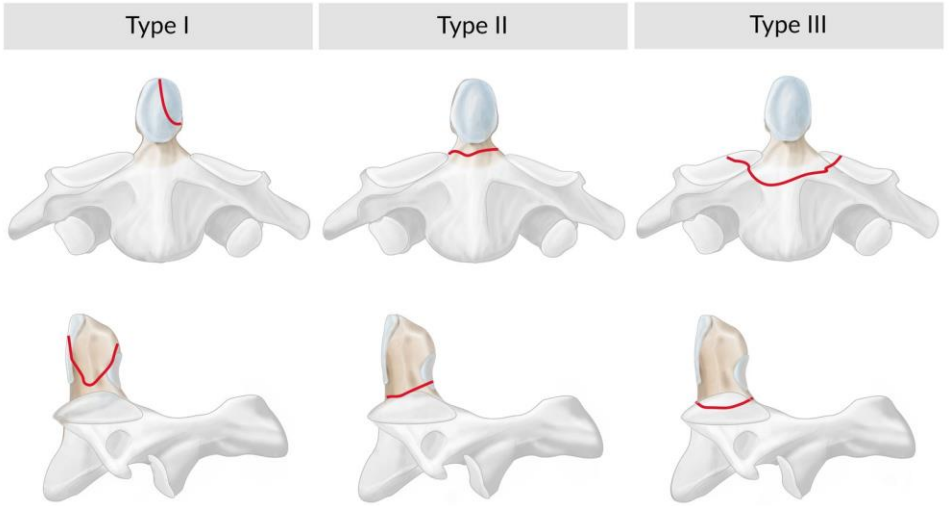


The combined fracture of the anterior and posterior arch of the atlas (C1) is called a Jefferson fracture.
It is caused by axial force (e.g., swimming accident caused by jumping head-first into shallow water).

- Type I: two-part fracture
- Type II: three-part fracture
- Type III: four-part fracture

Dens fractures

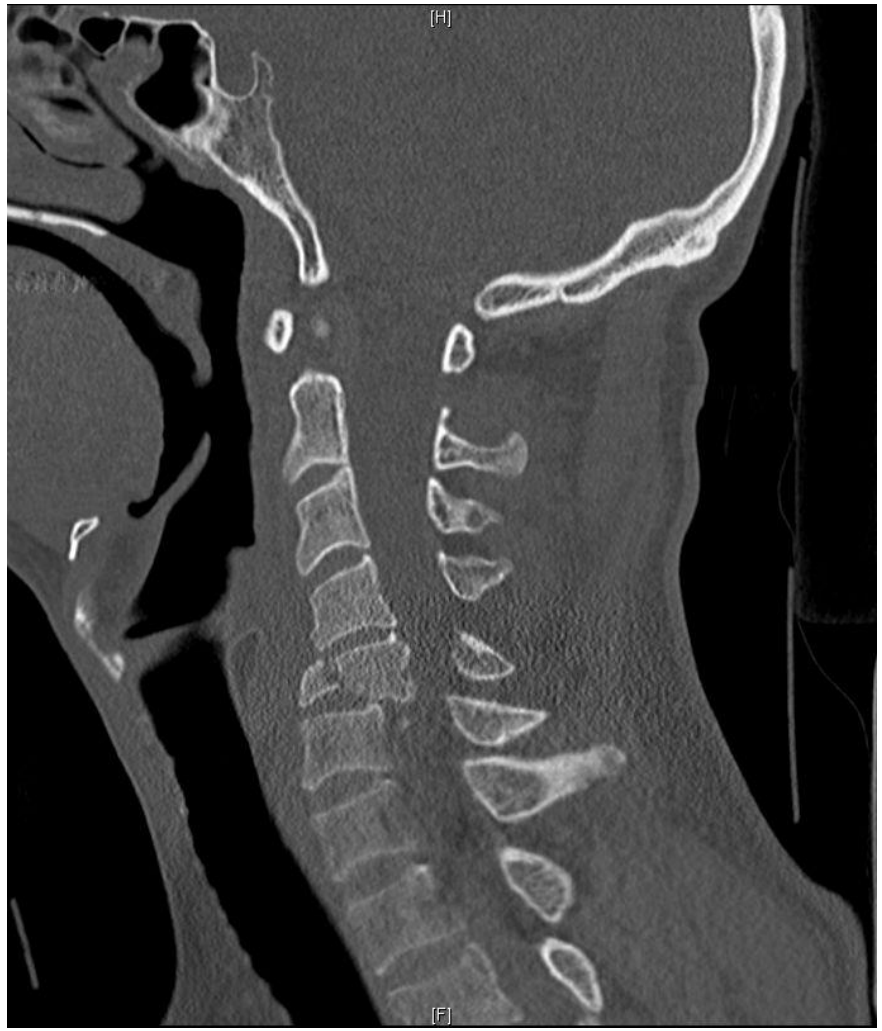
- **What's this ?**
  - Anderson's dens fracture classification
- **What is the treatment of the third type ?**
  - Spondylodesis
- **What is the prognosis of the third type ?**
  - Unstable fracture might damage the spinal cord



Type	Characteristics	Stability
Type I	Oblique fracture through the cranial part of the dens (rare)	Stable
Type II	Fracture at the base of the dens (most common)	Frequently unstable
Type III	Dens fracture and affected corpus axis	Unstable

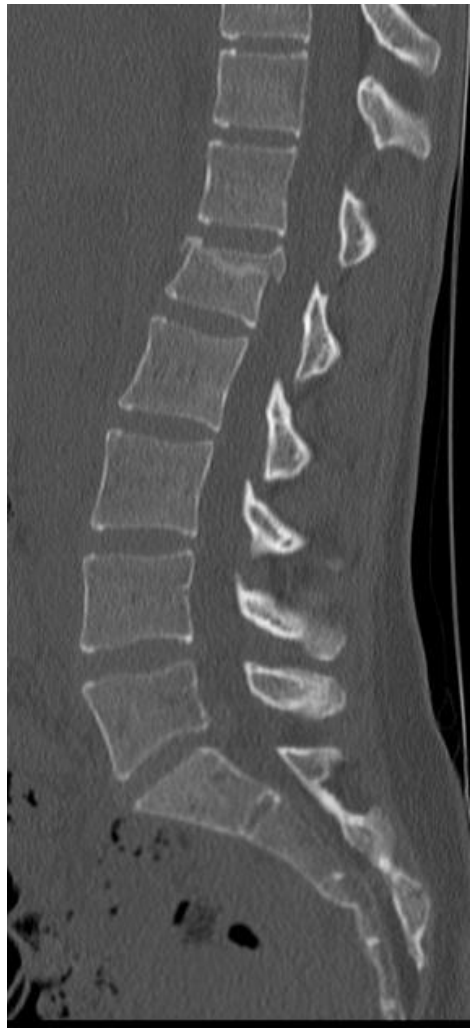
Cervical spine burst fracture

- **What is the type of this fracture ?**
  - Cervical spine burst fracture
- **At what level is it ?**
  - C5
- **Mention 3 complications**
  - Spinal cord injury
  - Vascular injury
  - Nerve root compression
  - Upper limb weakness



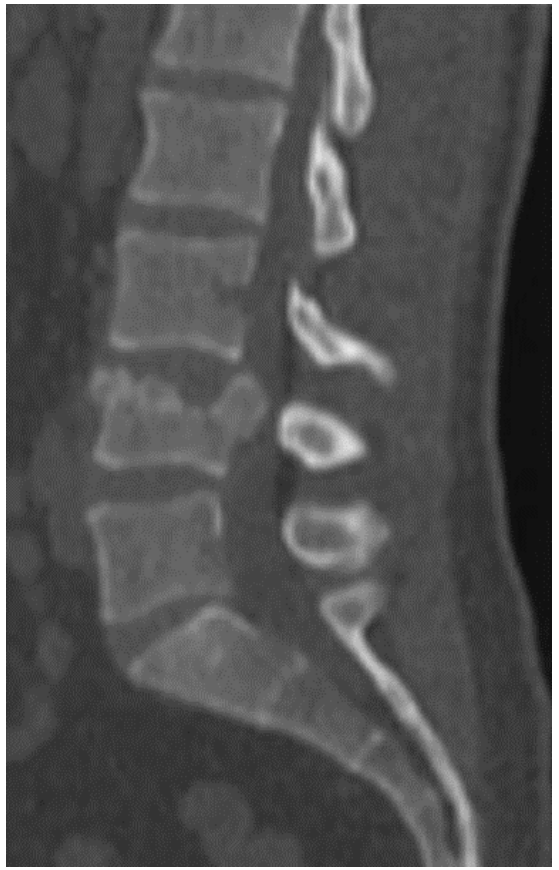
Lumber spine burst fracture

- **What is the type of this fracture ?**
  - Lumber spine burst fracture
- **At what level is it ?**
  - L1
- **What is your initial management to this patient ?**
  - Spinal lift-log roll. + fixation and immobilization



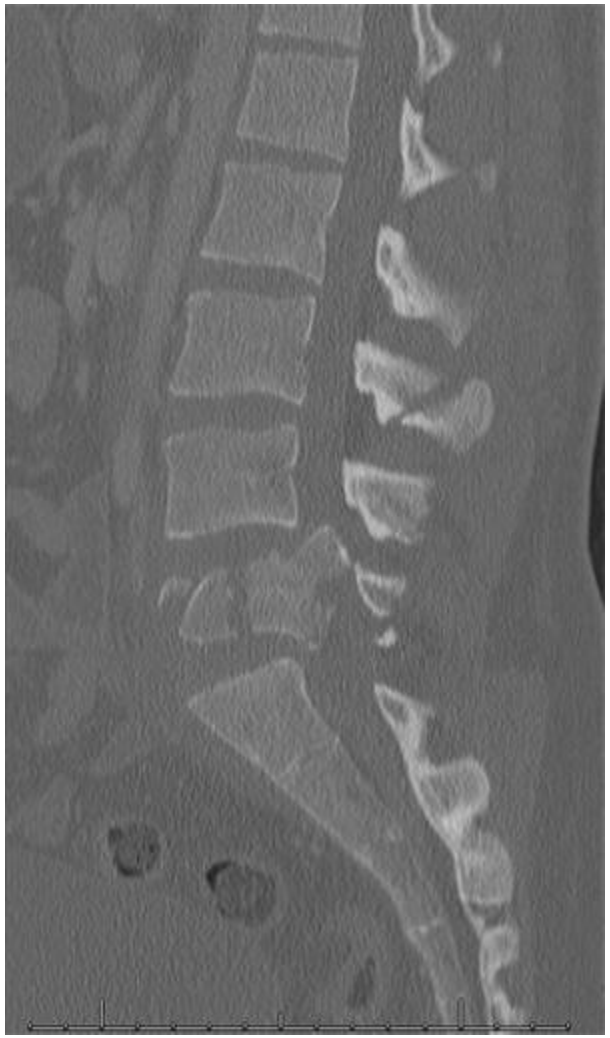
Lumber spine burst fracture

- **What is the type of this fracture ?**
  - Lumber spine burst fracture
- **Will this fracture cause hyperreflexia ? and why ?**
  - No, it will cause hyporeflexia
  - Because it will cause compression on the nerve root and not the spinal cord, because the spinal cord ends at the level of L1



Lumber spine burst fracture

- **What is your diagnosis ?**
  - Burst fracture at L5
- **Mention 2 indications for surgery ?**
  - Progressive neurological deficit
  - Intractable pain
  - Unstable fracture
  - Cauda equina syndrome
- **What is the type of spinal injury in this patient ?**
  - Incomplete (see next slide)



Complete spinal cord injury

- **Definition**: the complete sensory and motor loss below the site of spinal cord injury following acute or chronic destruction, compression, or ischemia of the spinal cord.
- Initially, this may manifest as spinal shock, which is an acute physiological loss or depression of spinal cord function. It manifests as a flaccid areflexic paralysis below the level of the injury with autonomic features (e.g., hypotension, bradycardia).
- After some days to weeks the spinal shock wears off and a complete spinal cord injury may remain which manifests with spastic paresis, hyperreflexia, and continued sensory loss.
- **Treatment** involves acute care (e.g., analgesia, urinary catheterization) and definitive treatment (bracing or surgery). < 5% of cases fully recover after complete spinal cord injury.
- **Autonomic dysreflexia** is a long-term complication from thoracic spinal cord injury, leading to life-threatening episodes with cardiovascular instability.

Essay Question

- 22-year-old patient come to ER with RTA

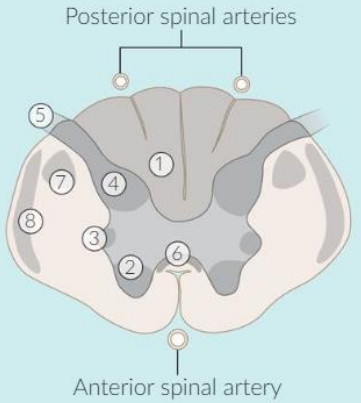
- **What is your management ?**
  - ABC / vital signs / IV fluids / GCS / >>>

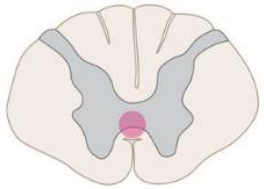
- **On examination RR :45 and BP:80/40 what is the type of shock ?**
  - Spinal shock

- **Patient with spinal injury no motor or sensory response, no anal sphincter tone, what's the type of injury ?** سنوات (2)
  - Complete

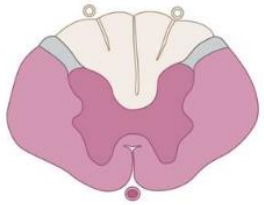
Incomplete spinal cord syndromes

Caused by lesions of the ascending or descending spinal tracts that result from trauma, spinal compression, or occlusion of spinal arteries.

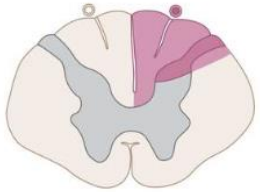




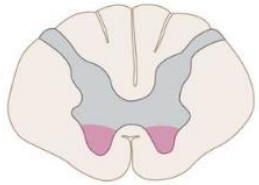
Central cord syndrome
(e.g., due to syringomyelia)



Anterior cord syndrome
(e.g., due to anterior spinal artery occlusion)

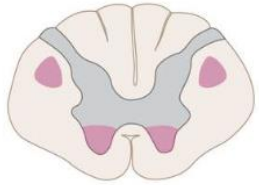


Posterior cord syndrome
(e.g., due to posterior spinal artery occlusion)

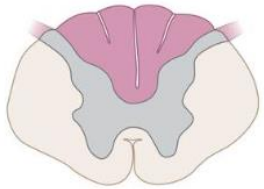


Diseases of the anterior horn:

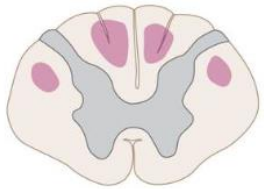
a) Spinal muscular atrophy, polio



b) Amyotrophic lateral sclerosis

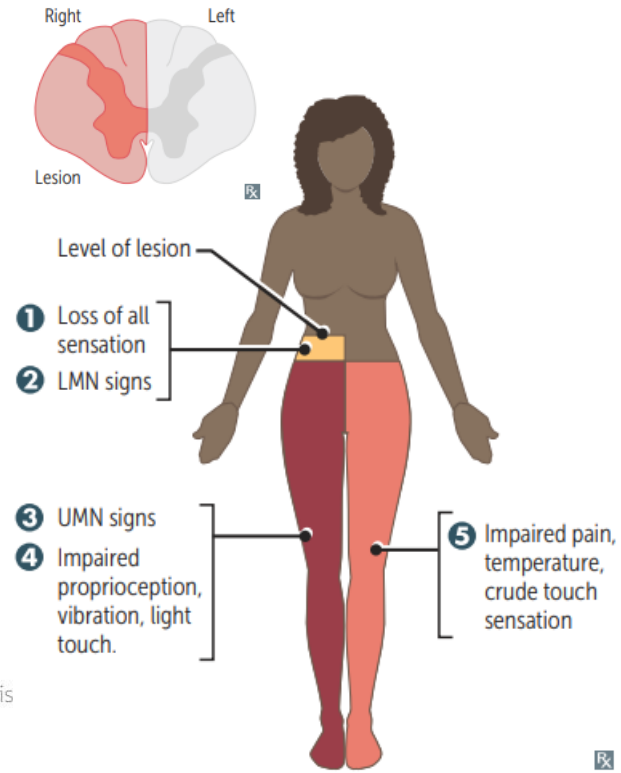


Tabes dorsalis
(due to syphilis)



Vitamin B_{12} deficiency
(e.g., due to atrophic gastritis

Brown-Séquard syndrome



Incomplete spinal cord syndromes			
Syndrome	**Affected spinal tracts**	**Etiology**	**Clinical features**
Central cord syndrome (most common)	Bilateral central corticospinal tracts and lateral spinothalamic tracts	• Hyperextension injury (e.g., car crash) associated with chronic cervical spondylosis • Syringomyelia • Spinal cord compression	Bilateral paresis: upper > lower extremities
Anterior cord syndrome	Corticospinal tracts and spinothalamic tracts	• Trauma (e.g., penetrating injury, burst fracture of vertebra) • Occlusion of anterior spinal artery	Bilateral motor paralysis, loss of pain and temperature sensation, and autonomic dysfunction below the level of the lesion
Posterior cord syndrome	Posterior columns	• Trauma (e.g., penetrating injury) • Occlusion of the posterior spinal artery • Multiple sclerosis	Bilateral loss of proprioception, vibration, and touch sensation below the level of the lesion
Brown-Séquard syndrome (hemisection syndrome)	Hemisection of the cord	• Trauma (e.g., penetrating injury) • Spinal cord compression	**Ipsilateral** • Loss of proprioception, vibration, and tactile discrimination below the level of the lesion • Segmental flaccid paresis at the level of the lesion • Spastic paralysis below the level of the lesion, and ipsilateral Babinski sign • Horner syndrome in lesions above T1 **Contralateral**: loss of pain and temperature sensation one or two levels below the lesion
All syndromes present with dissociated sensory loss: a pattern of selective sensory loss (“dissociation of modalities”), which suggests a focal lesion of a single tract within the spinal cord (or brainstem).			

Essay question

❖ **Mention 3 types of incomplete spinal injuries** سنوات (1)

- Central cord syndrome
- Anterior cord syndrome
- Posterior cord syndrome
- Brown-Séquard syndrome (hemisection syndrome)

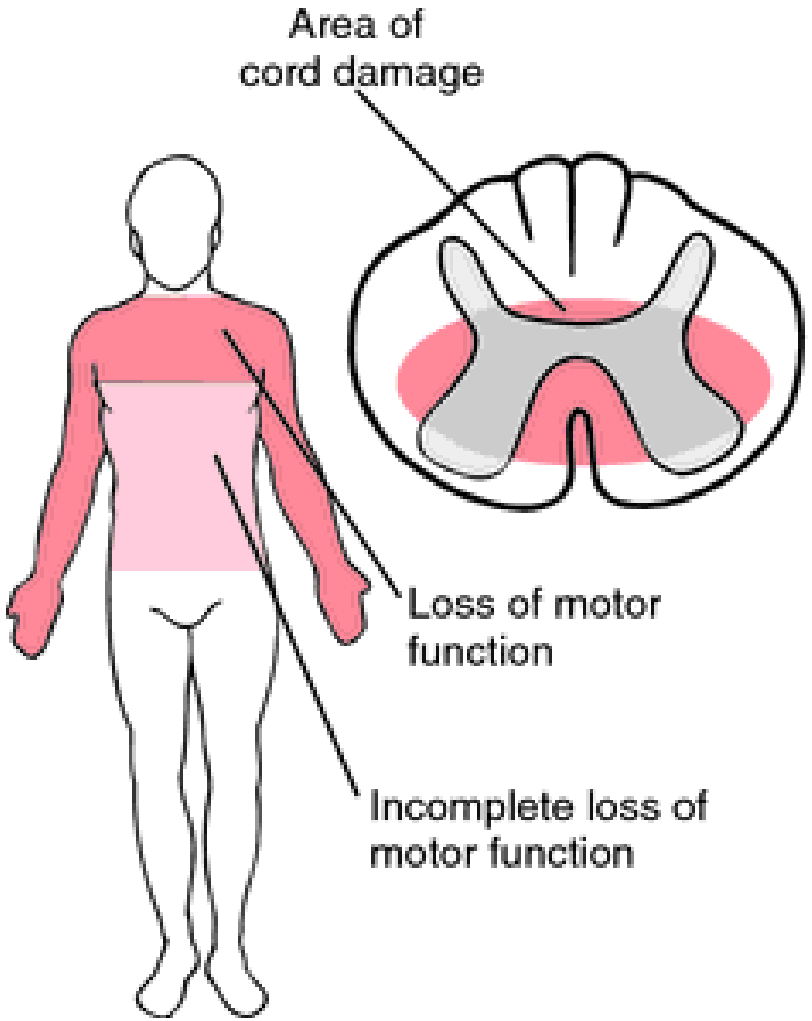
❖ **Which spinal cord injury has the best prognosis ?** سنوات (1)

1. Anterior Cord Syndrome has the best prognosis due to retention of sacral sensation at the S4 - S5 dermatome, especially pinprick, with 75% regaining the ability to walk at 72 hours to 1-week post-injury.
2. Spinal cord injuries that occur in the lower part of the spinal cord, tend to have a better prognosis than injuries that occur higher up in the spinal cord. This is because the nerves in the lower part of the spinal cord are less vital to bodily functions like breathing and upper body mobility.

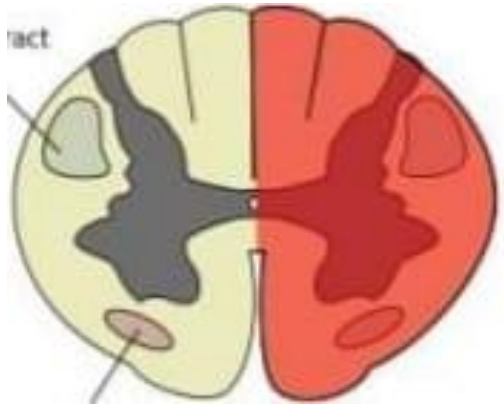
Adult male came after RTA

❖ **What Is The Name Of This Pathology ?**

- Central cord syndrome



Brown Sequard Syndrome



- **What Is The Name Of This Pathology ?**
  - Brown Sequard Syndrome
- **Mention 3 Spinal Tracts That Are Affected In This Pathology**
  - Spinothalamic Tract
  - Corticospinal Tract (Anterior & Lateral)
  - Dorsal Column
- **Mention 3 clinical presentations with this syndrome**
  - Ipsilateral motor loss (paralysis)
  - Ipsilateral sensory loss (vibration, proprioception, light touch).
  - Contralateral sensory loss (pain ,temperature)

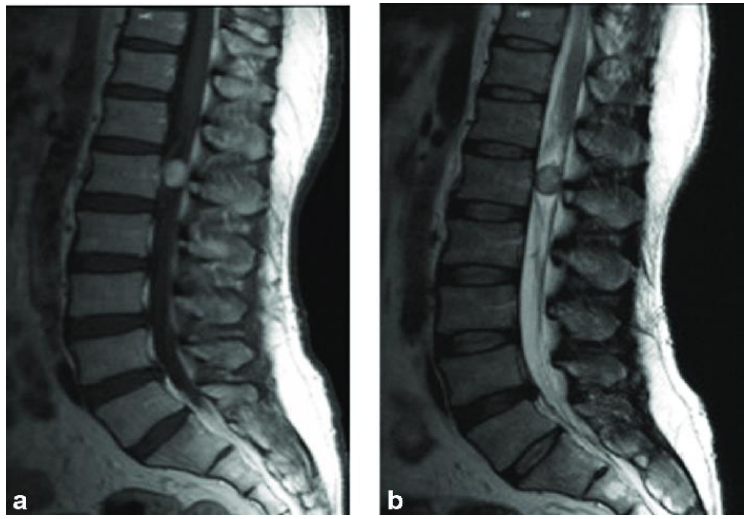
Overview of compressive spinal emergencies

	Spinal cord compression	Conus medullaris syndrome	Cauda equina syndrome
Etiology	• Damage to or compression of the spinal cord at any level • Apart from degenerative disk diseases, can also be caused by vertebral metastases, trauma (epidural hematoma, vertebral fracture), and epidural abscess	• Damage to or compression of the spinal cord at the vertebral level T12–L2, resulting in injury to the conus medullaris (sacral and coccygeal spinal segments) • **Common causes include** tumors, spondylolisthesis, and trauma (e.g., vertebral fracture).	• Damage to or compression of the cauda equina (nerve fibers L3–S5) located below L2 • **Common causes include** large posteromedial disk herniation, trauma, and tumors.
Onset	Variable, bilateral	Sudden, bilateral	Gradual, typically unilateral
Pain	Localized neck or back pain	• Lower back pain • Less severe radicular pain	• Lower back pain • Severe radicular pain
Motor symptoms	• Bilateral paralysis below the affected level of the spinal cord • Hyperreflexia • Positive Babinski sign	• Symmetric, hyperreflexic distal paresis of lower limbs, possibly fasciculations • Achilles reflex may be absent.	• Asymmetric, areflexic, flaccid paresis of the legs • Muscle atrophy
Sensory symptoms	Loss or reduction of all sensation below the affected level of the spinal cord	• Symmetric bilateral perianal numbness • Sensory dissociation	• Saddle anesthesia • Asymmetric unilateral numbness and/or paresthesia in lower limb
Urogenital and rectal symptoms	Sphincter dysfunction with urinary or bowel urgency, retention, or incontinence	• Early onset of bladder and fecal incontinence • Erectile dysfunction	• Late onset of urinary retention • Change in bowel habits • Decreased rectal tone • Erectile dysfunction

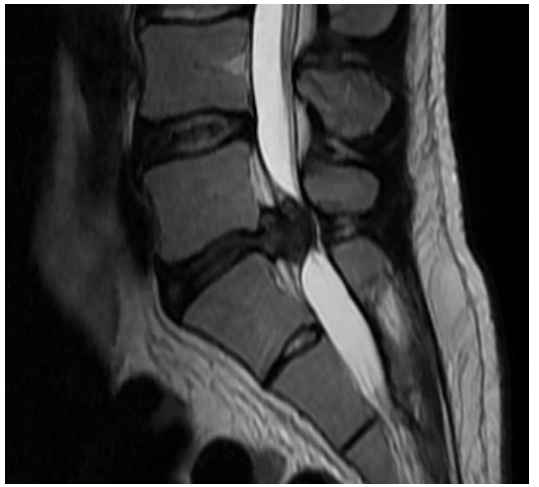
The table outlines common symptoms following compression of the spinal cord or cauda equina. Patients may also present with symptoms of incomplete spinal cord syndromes depending on the location of the herniated disk. (بالعربي الي بدي احكيه انه هذا الجدول مفروض يكون بجزئية الديسكات بس طالما انشرح بالمحاضرات مع هذه الجزئية حطيته معها)

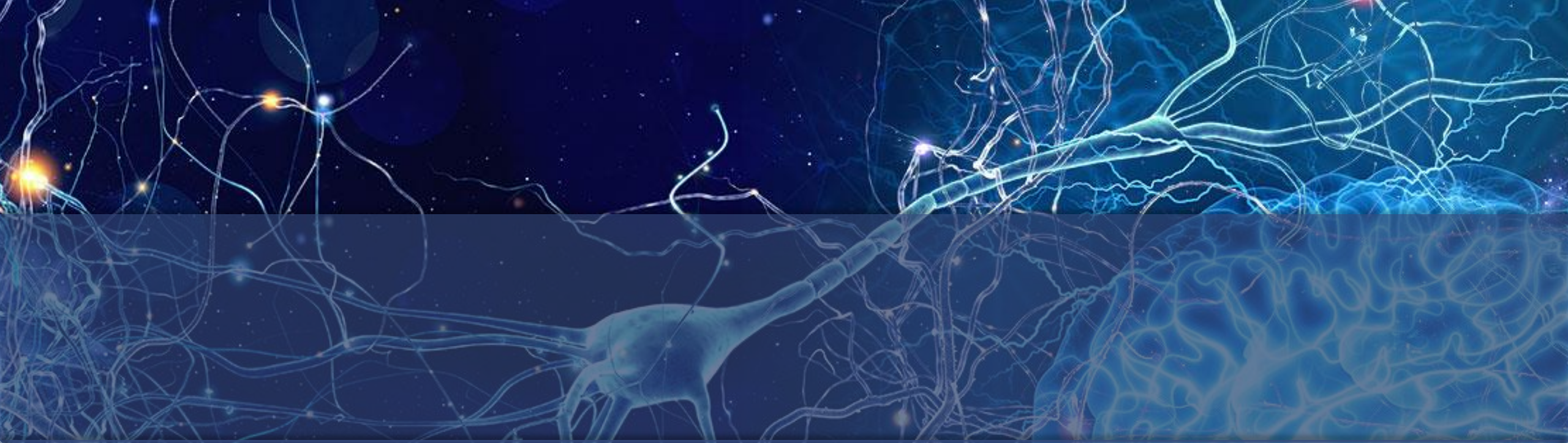
Compressive spinal emergencies

- **What is the name of the lesion / syndrome at this level ?**
  - Conus medullaris syndrome



- **What is the name of this syndrome ?**
  - Cauda equina syndrome
- **Mention 3 symptoms the patient could have**
  - Severe low Back pain
  - Bladder disturbances
  - Saddle numbness





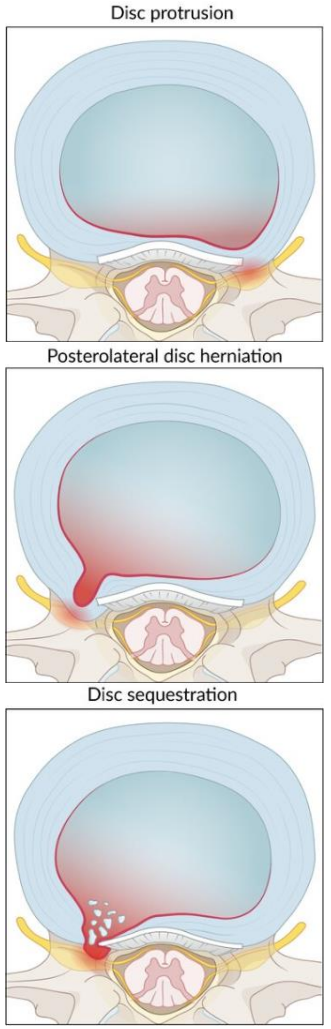
Degenerative disk disease

Same slides as Orthopedics dossier

Degenerative disk disease

❖Classifications Of Herniations

- **Disk protrusion**: protrusion of the vertebral disk nucleus pulposus through the annulus fibrosus (intact)
- **Disk herniation** (disk extrusion or disk prolapse): complete extrusion of the nucleus pulposus through a tear in the annulus fibrosus
- **Disk sequestration**: extrusion of the nucleus pulposus and separation of a fragment of the disk
- **Spondylosis**: a broad term used to describe degenerative changes of the spine that may result in irritation and/or damage of the adjacent nerve roots or spinal cord



Degenerative disk disease

- **Epidemiology**
  - Age: most common at 30–50 years
  - Sex: ♂ > ♀
  - Cervical and thoracic disk herniations: rare
  - Lumbosacral disk herniation
    - L5–S1 (most common site)
    - L4–L5 (second most common site)
- Intervertebral disks usually protrude/herniate posterolaterally, as the posterior longitudinal ligament is thinner than the anterior longitudinal ligament.

Degenerative disk disease – Clinical features

- Asymptomatic and detected incidentally
- Acute onset of severe neck or back pain
  - Radicular pain: pain that radiates to the legs (sciatic pain) or arms
  - The pain is either stabbing in nature or resembles an electric shock
- Features of radiculopathy: lower motor neuron signs of the affected nerve root (typically unilateral)
  - Paresthesia of the affected dermatome
  - Muscle weakness and atrophy of the related myotome
  - Absent or diminished deep tendon reflexes
- Features of compressive myelopathy (typically bilateral) or cauda equina syndrome
  - Paresthesia below the level of compression
  - Motor deficits

Overview of cervical radiculopathies

Overview of cervical radiculopathies [9]				
Radiculopathy	Causative disk	Sensory deficits	Motor deficits	Reduction of reflexes
C3/4 radiculopathy	• C2–C4	• Shoulder and neck area	• Scapular winging	• None
C5 radiculopathy	• C4–C5	• Anterior shoulder	• Biceps and deltoid	• Biceps reflex
C6 radiculopathy	• C5–C6	• From the upper lateral elbow over the radial forearm up to the thumb and radial side of index finger	• Biceps and wrist extensors	• Biceps reflex • Brachioradialis reflex
C7 radiculopathy	• C6–C7	• Palmar: fingers II–IV (II ulnar half, III entirely, IV radial half) • Dorsal: medial forearm up to fingers II–IV	• Triceps, wrist flexors, and finger extensors	• Triceps reflex
C8 radiculopathy	• C7–T1	• Fingers IV (ulnar half) and V, hypothenar eminence, and ulnar aspect of the distal forearm	• Finger flexors	• None

Overview of lumbosacral radiculopathies

Overview of lumbosacral radiculopathies [9]

Radiculopathy	Causative disk	Sensory deficits	Motor deficits	Reduction of reflexes
L3 radiculopathy	• L2–L3	• Anterolateral area of the thigh	• Hip flexion • Knee extension • Hip adduction	• Adductor reflex • Patellar reflex
L4 radiculopathy	• L3–L4	• Anterolateral thigh, area over the patella, medial aspect of the leg, medial malleolus	• Knee extension • Hip adduction	• Patellar reflex
L5 radiculopathy	• L4–L5	• Lateral aspect of the thigh and knee, anterolateral aspect of the leg, dorsum of the foot, and the big toe	• Tibialis anterior muscle (foot dorsiflexion): difficulty heel walking (foot drop) • Extensor hallucis longus muscle (first toe dorsiflexion)	• Posterior tibial reflex (medial hamstring)
S1 radiculopathy	• L5–S1	• Dorsolateral aspect of thigh and leg, and the lateral aspect of the foot	• Peroneus longus and brevis muscle (foot eversion) and gastrocnemius muscle (foot plantarflexion): difficulty toe walking	• Achilles reflex • Lateral hamstring reflex
S2 radiculopathy, S3 radiculopathy, S4 radiculopathy	• S1–S4	• Posterior aspect of the thigh and leg (S2), perineum (S3–S4), perianal (S4)	• None	• Bulbocavernosus reflex • Perineal reflex

Diagnostics

1. **Perform clinical evaluation focusing on red flags for acute back pain**
   - **Patient characteristics**: Age < 18 or > 50 years, Immunosuppression
   - **History of** cancer, unexplained weight loss, abdominal aortic aneurysm, bacterial infection, spinal anesthesia, spinal surgery, or significant trauma
   - **Medications**: Long-term steroids, Anticoagulants, IV drugs
   - **Signs of cord compression syndromes**: (Motor weakness, Paresthesia or anesthesia (including saddle anesthesia), Bladder, bowel, or sexual dysfunction)
2. **Determine the need for imaging**
   - Red flags for acute back pain: MRI spine without IV contrast is preferred
   - No red flags for acute back pain: Urgent imaging is typically not required

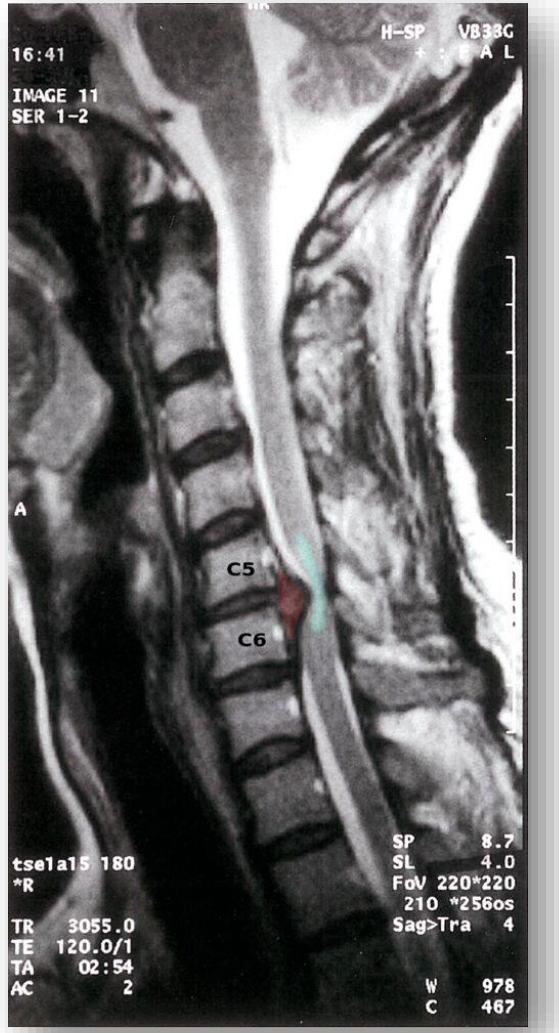
MRI spine without IV contrast

❖Indications

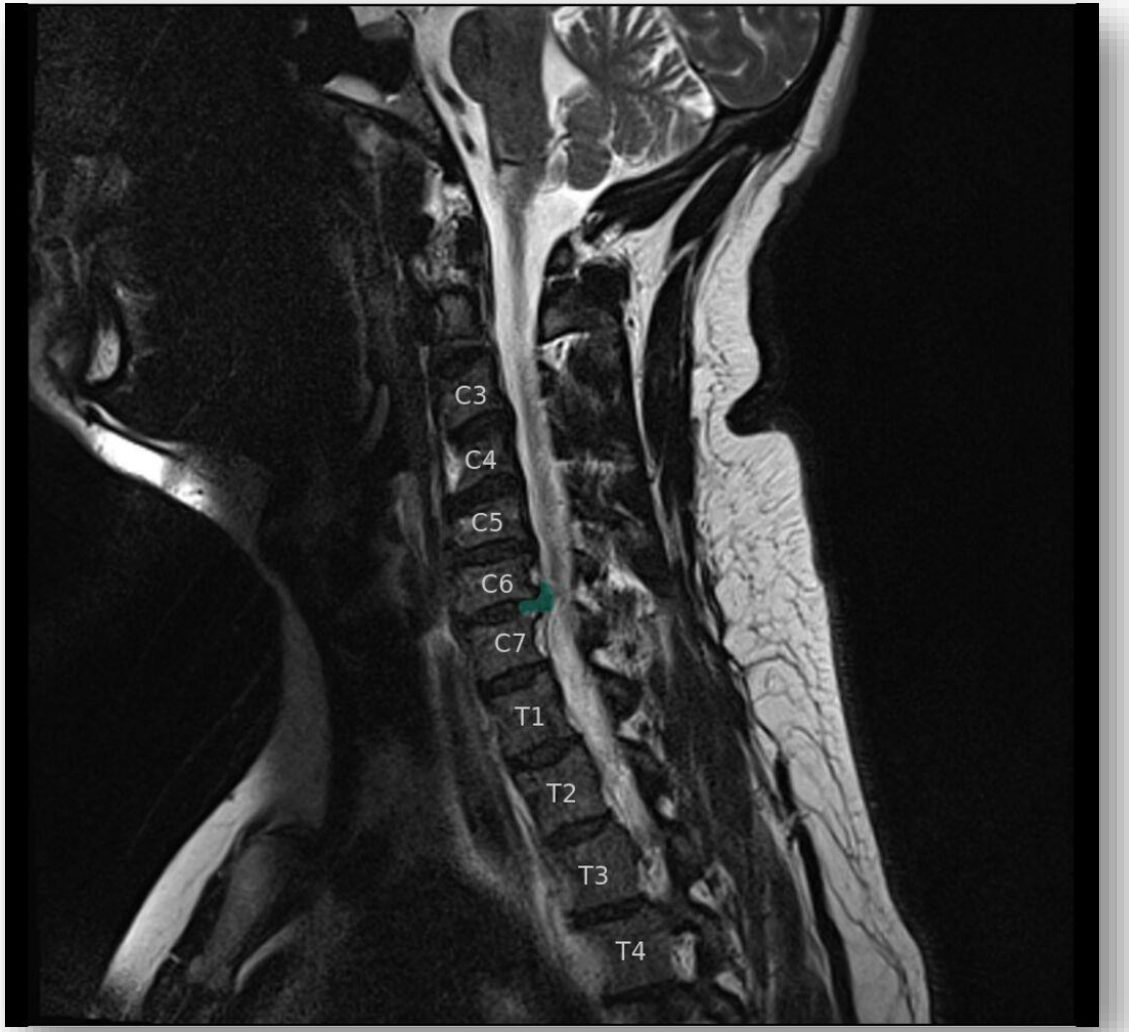
- preferred initial imaging modality for suspected radiculopathy, myelopathy, or cauda equina syndrome

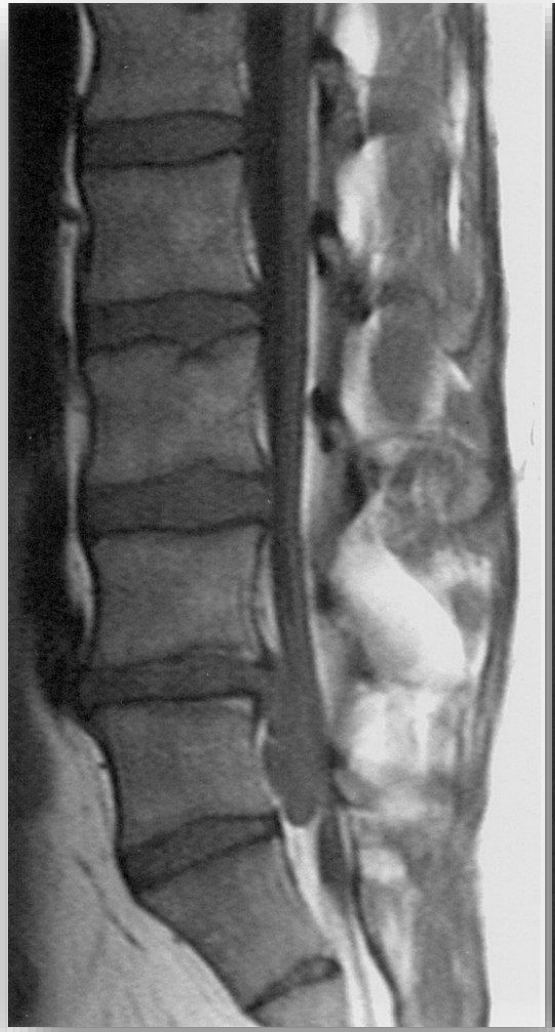
❖Supportive findings

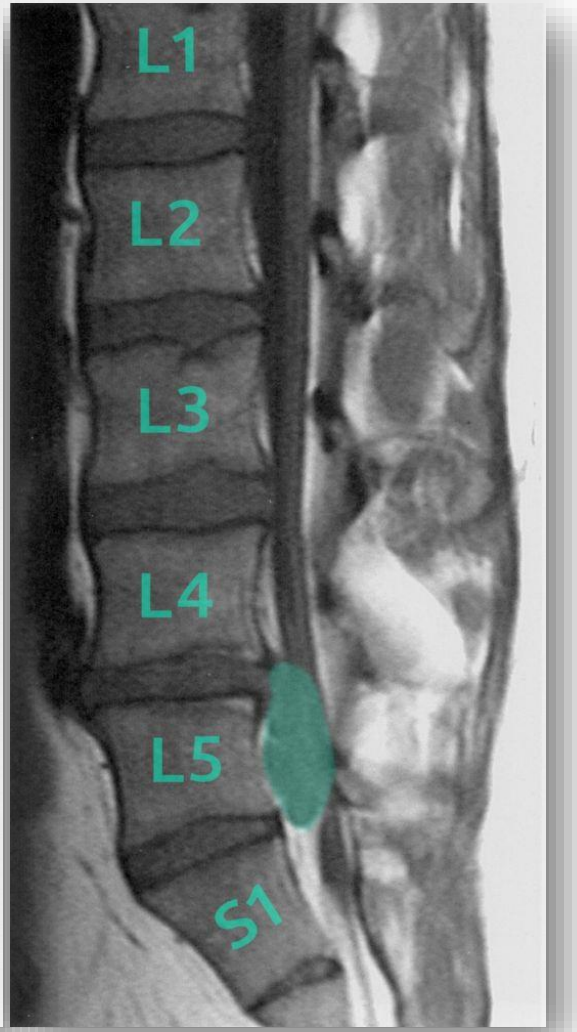
- Disk degeneration: sclerosed, dehydrated disk that appears hypointense on T2-weighted images
- Disk prolapse/herniation: herniation of disk tissue with surrounding edema
- Evidence of impingement/compression of a spinal nerve or the spinal cord may be visible, e.g.:
  - Focal narrowing of the spinal canal
  - Compression of the thecal sac
  - Edema of the spinal cord (appears hyperintense on T2-weighted images)



MRI spine without IV contrast







Treatment

❖Approach

- Identify and treat compressive spinal emergencies immediately, if present
- For isolated radiculopathy without any red flags for acute back pain:
  - Initiate conservative management
  - Urgent imaging is typically not required

❖Conservative management

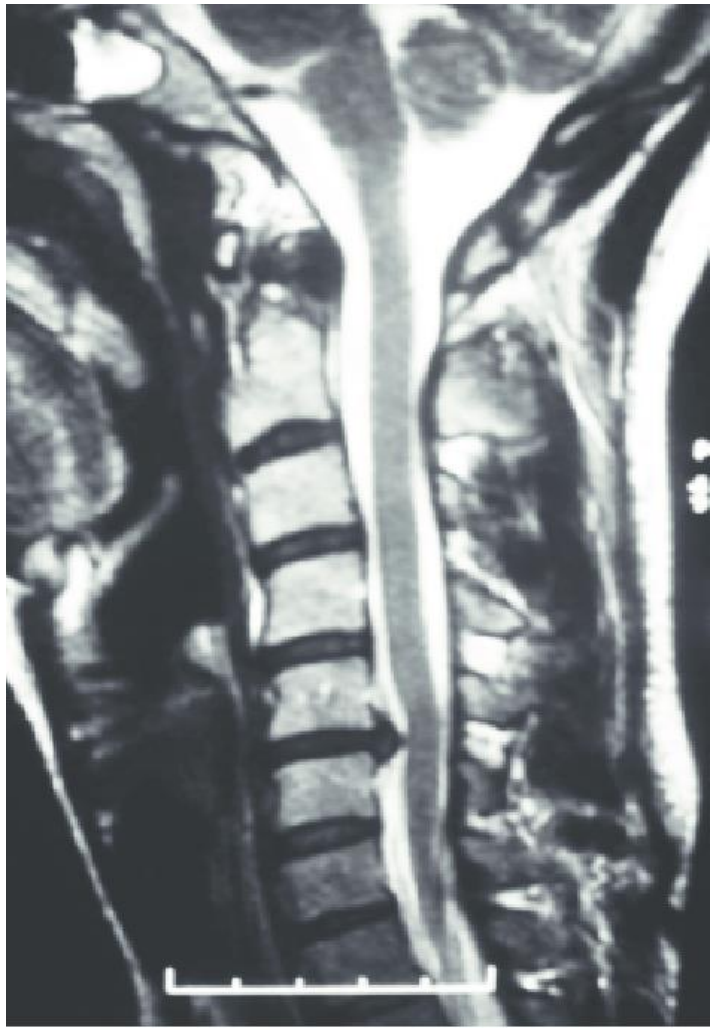
- Physiotherapy, Continuation of daily activities (minimize bed rest), Analgesics

❖Surgery

- **Indications**
  - **Urgent**: significant or progressive neurological deficits, bowel or bladder incontinence, compressive spinal emergencies
  - **Elective**: persistent or progressive radiculopathy despite conservative management
- **Procedure**: diskectomy (Surgical removal of the herniated portion of the intervertebral disk)

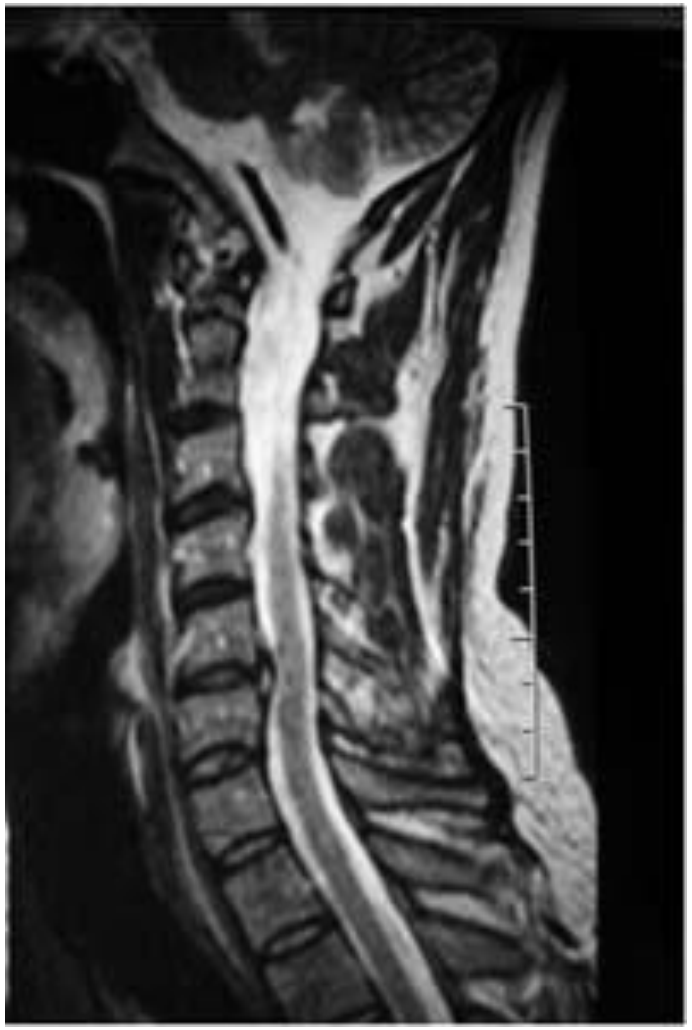
Cervical disc prolapse

- **What is your diagnosis ?**
  - Cervical disc prolapse
- **Which dermatome is affected ?**
  - C6 radiculopathy
- **Which nerve (not dermatome) is affected ?**
  - Thoracodorsal nerve
- **Mention 3 indications for surgery**
  - Myelopathy
  - Intractable pain
  - Focal neurological signs
  - History of malignancy



Cervical disc prolapse

- **What is your diagnosis and at which Level ?**
  - Cervical herniated disc at C5-6
- **Mention 2 indications for surgery**
  - Myelopathy
  - Intractable pain
  - Focal neurological signs
  - History of malignancy



Cervical disc prolapse

- A female patient complaining of neck pain radiating to left arm, forearm, middle and index finger, the pain associated with numbness and paresthesia, sensory examination normal, motor examination is normal.

❖ **What is the dermatomal distribution of pain ?**

- C7

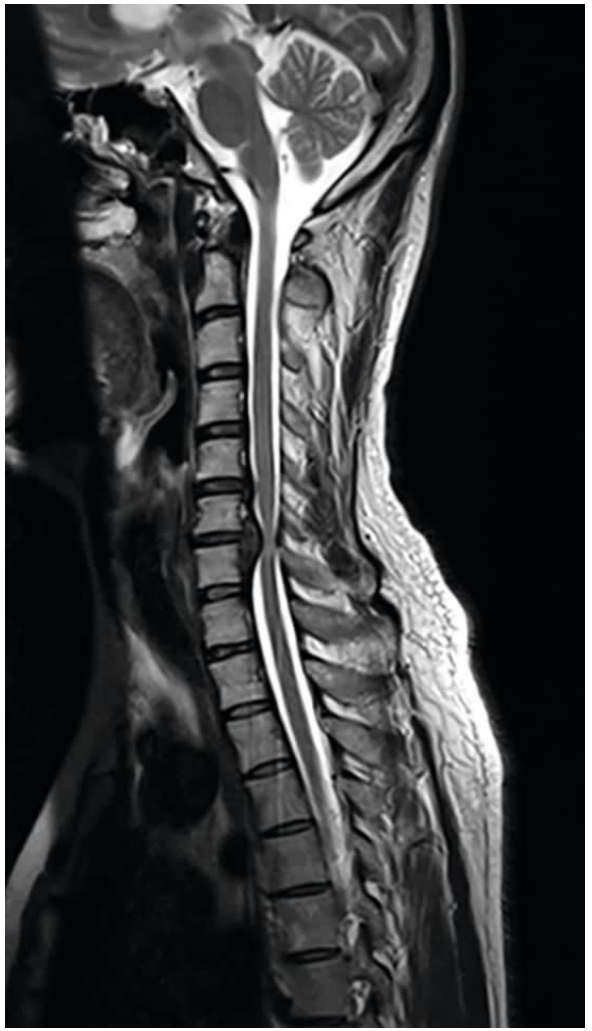
❖ **What is the level, site & diagnosis of the lesion ?**

- C6-C7 left disc herniation

❖ **Is the pain due to radiculopathy or myelopathy ?**

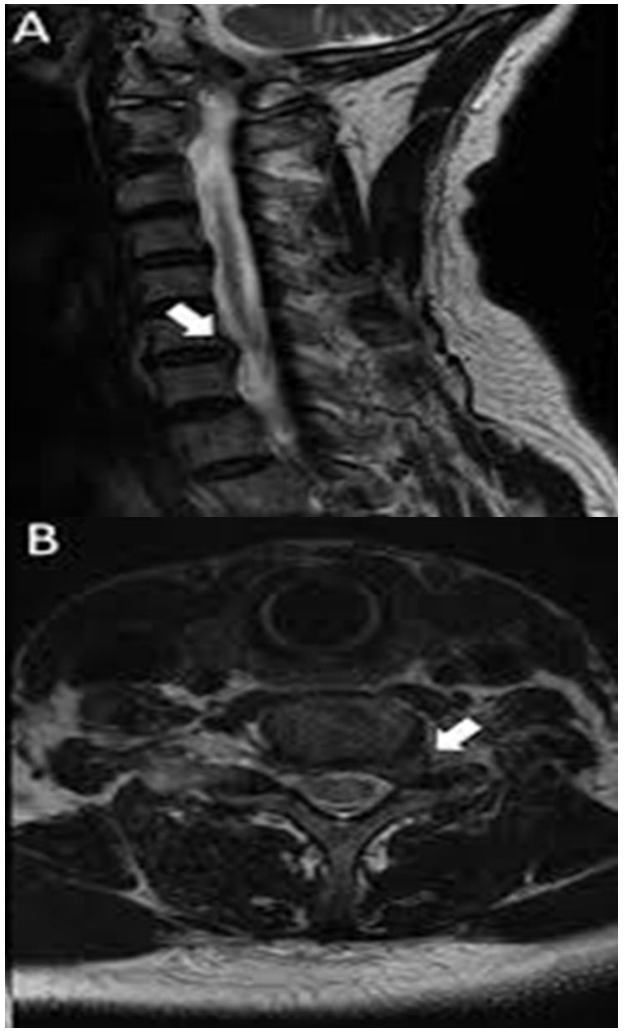
- Radiculopathy

❖ **Which reflex is affected ?** Triceps reflex



Cervical disc prolapse

- **What is your diagnosis ?**
  - Cervical Disc prolapse
- **What is the level and site ?**
  - Right side C6-C7
- **What is the dermatome affected ?**
  - Right C7
- **Mention 3 Indications For surgery**
  - Myelopathy
  - Intractable pain
  - Focal neurological signs
  - History of malignancy

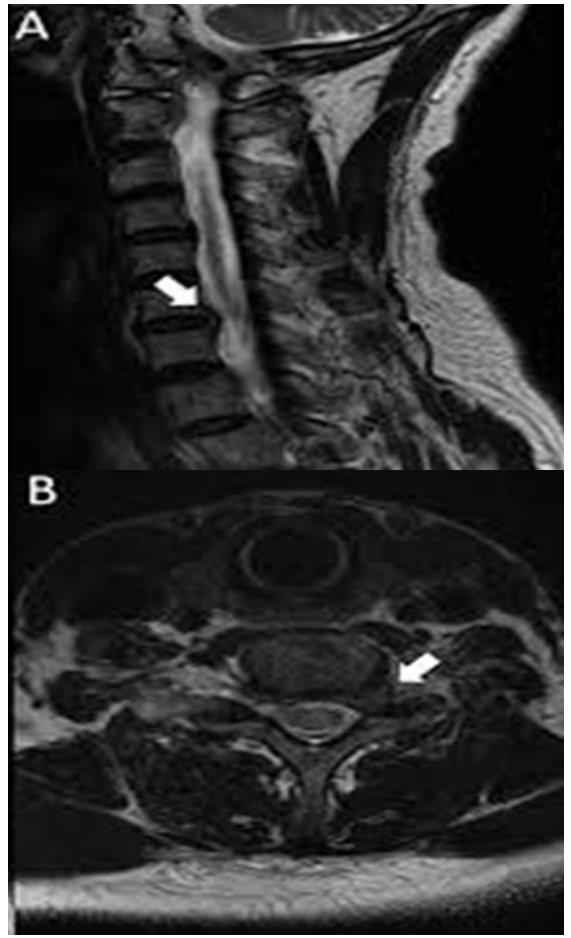


Case Scenario

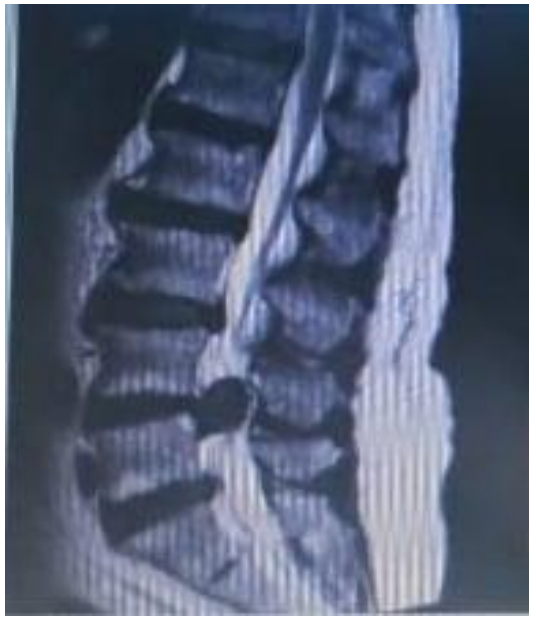
- A female patient presented with neck pain radiated to the right shoulder reaching the right middle finger, associated with decreased sensation. Physical examination revealed upper limb reflexes +++, positive hoffman sign, spasticity in upper and lower limbs

- **This patient has which o0f the following ?(MCQ)**
  a. Radiculopathy
  b. Myelopathy
  c. Myeloradiculopathy

- **Post op evaluation for this patient by physical examination revealed bilateral upper limb weakness (triceps and interossei muscles) and loss of sensation but lower limbs were preserved . What's your DX ?**
  - Central cord syndrome



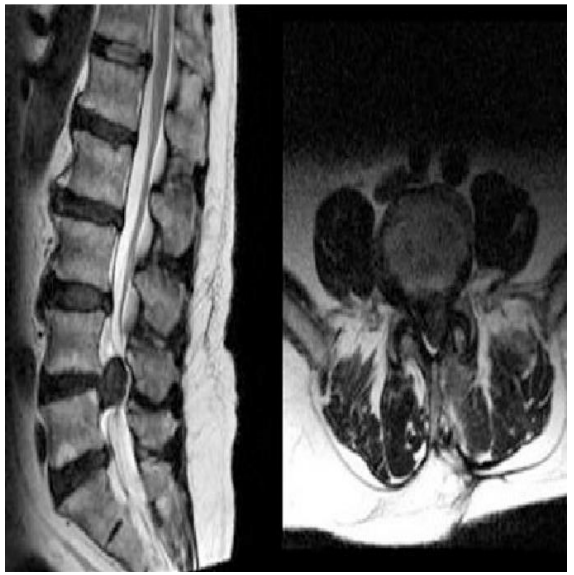
Lumber disc herniation



- **What is your diagnosis ?**
  - L4-L5 disk prolapse
- **Which dermatome is affected ?**
  - L5
- **Which reflex is affected ?**
  - Posterior tibial reflex
- **Mention 2 complications of lumber Spine surgery**
  - Infection
  - CSF leakage
- **Mention one Sign used for the diagnosis of lumbar PID**
  - Bowstring sign

Case Scenario

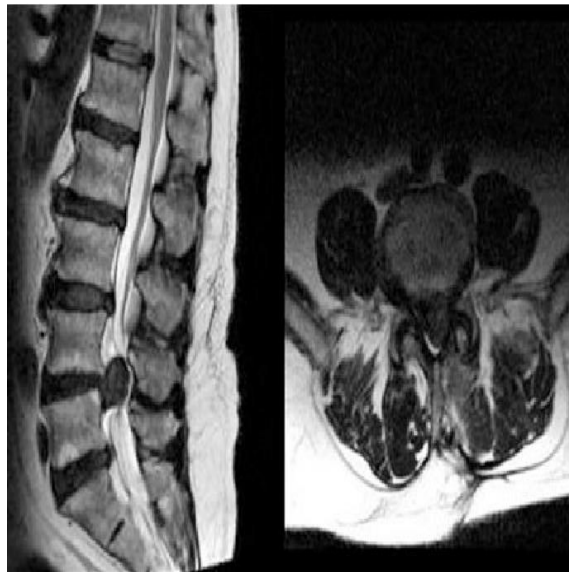
- **45 years old female patient presented back pain, and right leg pain, numbness and paresthesia on the posterior aspect of the thigh and big toe, along with urinary incontinence. These symptoms developed following heavy lifting 5 days ago**



- **What is the dermatomal distribution ?**
  - Right L5
- **What is the Diagnosis and the level of the lesion?**
  - Right L4-L5 disk prolapse
- **What is your management ?**
  - Immediate surgery

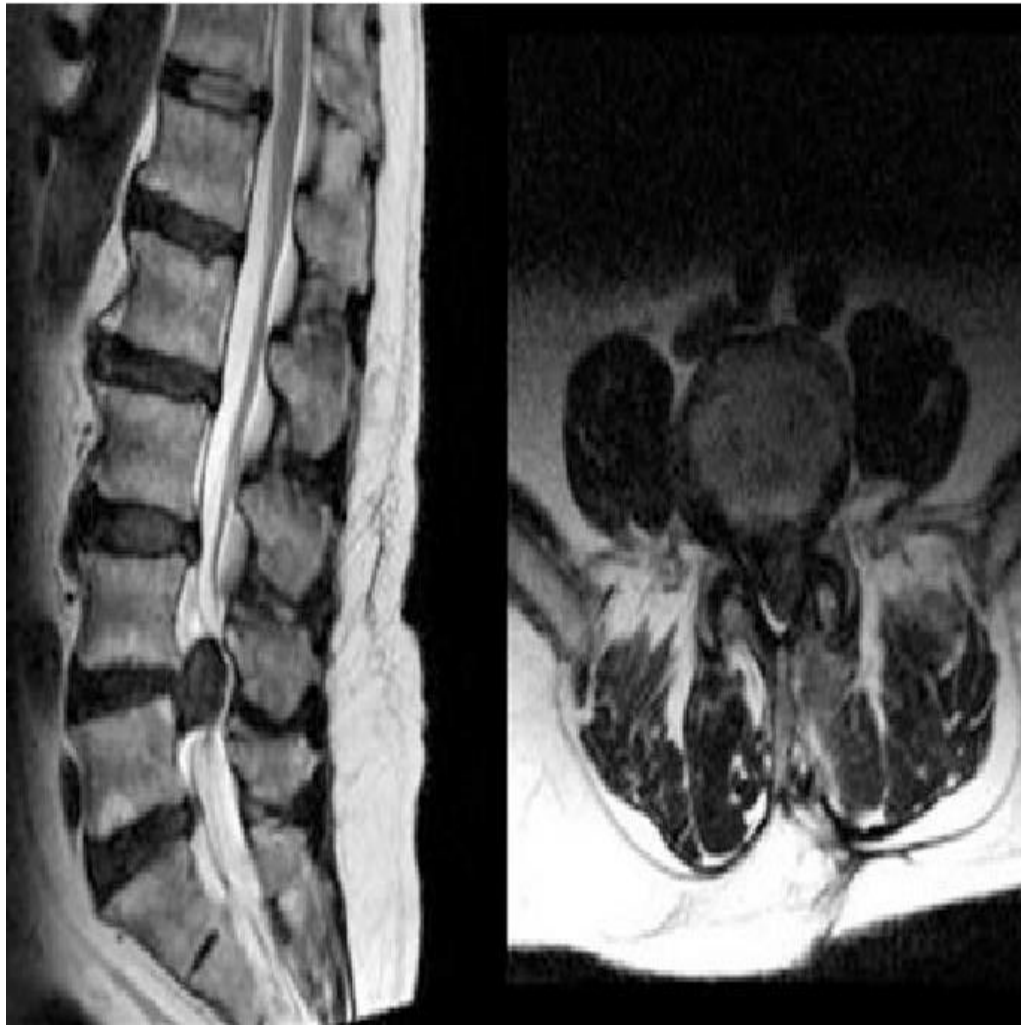
Lumber disc herniation

- **What is your diagnosis ?**
  - L4-L5 disk prolapse
- **The clinical picture of this patient is (MCQ)**
  a. Radiculopathy
  b. Myelopathy
  c. Radiculopathy and myelopathy
- **What is the affected dermatome ?**
  - Right L5
- **What is the key muscle for this dermatome ?**
  - Extensor hallucis longus
- **What is your next step ?**
  - Immediate surgery



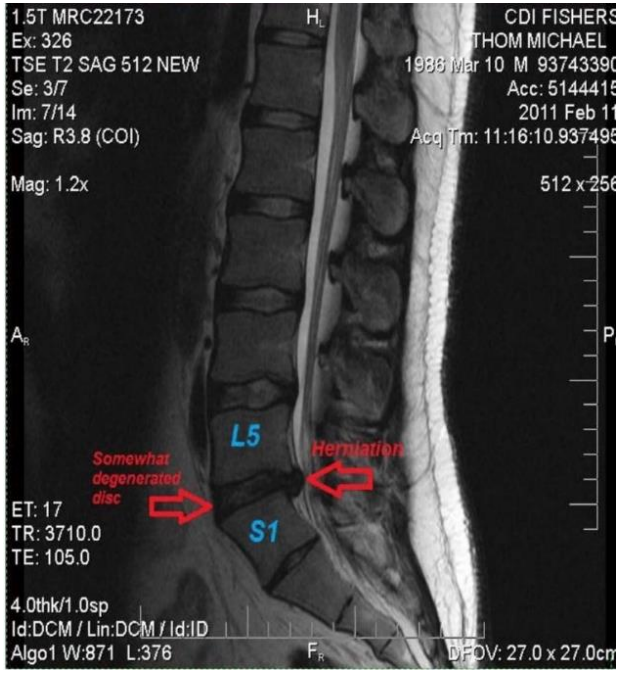
Lumber disc herniation

- **What is the diagnosis ?**
  - Lumber disc herniation
- **What is your management ?**
  - excision of the disc prolapse
- **If the patient had a paresthesia, urinary retention, stool incontinence what we call this syndrome?**
  - Cauda equina syndrome



Lumber disc herniation

- **What is the diagnosis ?**
  - Lumber disc herniation
- **What is the site ?**
  - L5-S1
- **Mention 2 indications for surgery**
  - Progressive neurological deficit
  - Intractable pain
  - Unstable fracture
  - Cauda eqina syndrome
- **What are the expected presentation in this patient?**
  - Numbness, weakness, urinary incontinence
- **Is the knee reflex affected ?** No



Lumber disc herniation

- Patient complain of long-term severe low back pain, retention of urine and numbness in the lower limb

❖ **What physical examination would be crucial in this case ?**

- Nerve root tension signs, straight leg raising test, bowstring sign

❖ **What is the diagnosis and the cause ?**

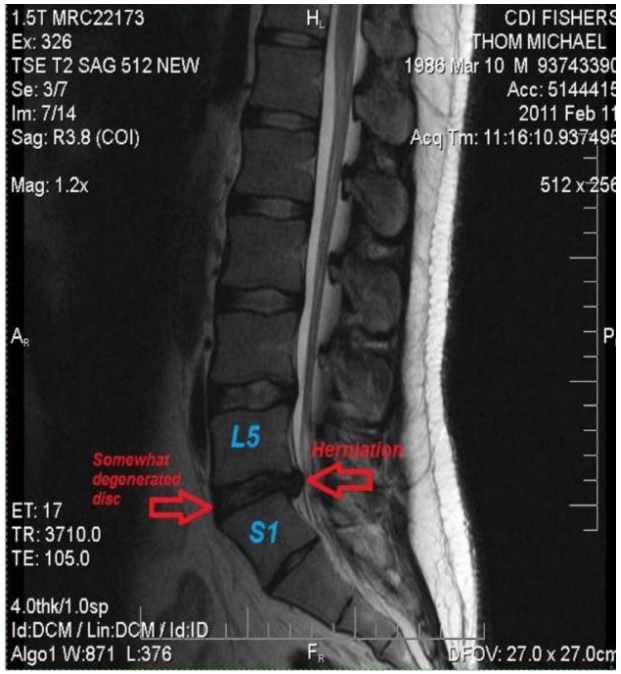
- Cauda equina syndrome, L5–S1 disc prolapse

❖ **Mention 2 other causes of this clinical condition**

- Spinal tumour, spinal trauma

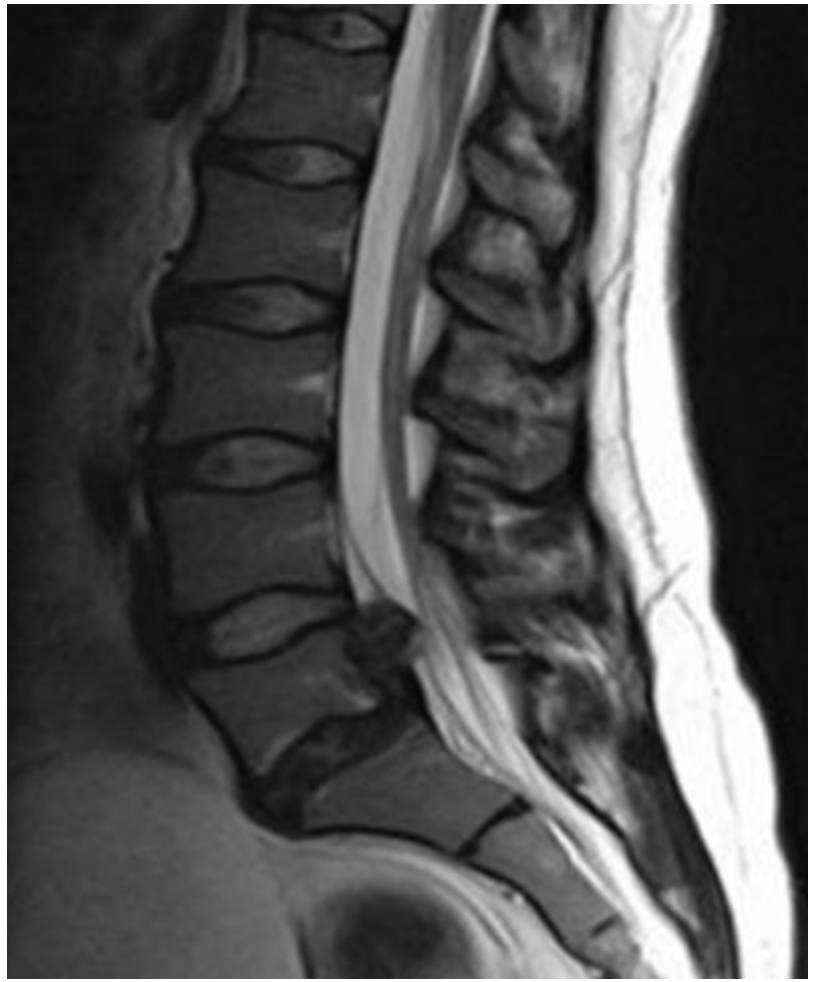
❖ **What is your immediate treatment ?**

- Surgery (Disc prolapse excision)



Lumber disc herniation

- **What is the site of prolapse ?**
  - L5-S1
- **Mention 2 indication for surgery**
  - Cauda equina syndrome
  - Intractable pain
  - History of malignancy
  - Progressive neurological deficit
- **Can it cause hyperreflexia in the knee join ? Why ?**
  - No, the compression is on the nerve root and not the spinal cord (the spinal cord end at L1)



Spondylolisthesis – Definitions

- **Spondylolisthesis**: anterior slippage of a vertebral body over the subjacent vertebra
- **Isthmic spondylolisthesis (spondylolytic form)**: spondylolisthesis resulting from an abnormality in the pars interarticularis
- **Degenerative spondylolisthesis**: spondylolisthesis resulting from degenerative changes, without an associated disruption or defect in the vertebral ring
- **Congenital spondylolisthesis**: spondylolisthesis secondary to congenital anomalies (e.g., hypoplastic facets, sacral deficits, poorly developed pars interarticularis).

Spondylolisthesis

❖Epidemiology

- Most common in children and adolescents < 18 years (congenital and isthmic spondylolisthesis) and adults aged > 50 years (degenerative spondylolisthesis)
- Sex: ♂ > ♀ (congenital and isthmic spondylolisthesis); ♀ > ♂ (degenerative spondylolisthesis)
- Defect most commonly occurs in the lumbar spine (typically L5-S1 in isthmic spondylolisthesis, L4-L5 in degenerative spondylolisthesis)

❖Risk factors include:

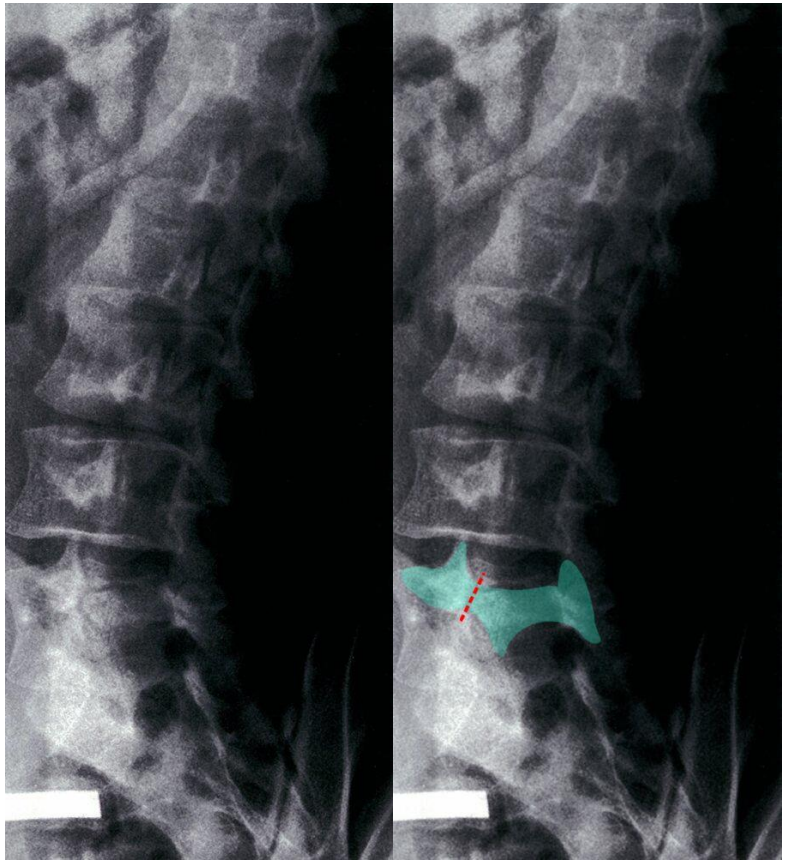
- Congenital malformation (dysplasia or hypoplasia) of the lumbosacral joints in L5–S1
  - Repetitive hyperextension and rotation movements at L5–S1
  - Commonly associated with gymnastics, swimming, and weightlifting
- **Spondylolysis**: lytic defect in the pars interarticularis, permitting forward slippage of the superjacent vertebra
  - Leads to isthmic spondylolisthesis if spondylolysis is bilateral
  - Scheuermann disease can be the underlying cause of spondylolysis or spondylolisthesis
- Degenerative disease: most commonly in the elderly at L4–L5
- Trauma
- Local or systemic pathology (e.g., tumor, Paget's disease, osteogenesis imperfecta, TB)

Spondylolisthesis – Clinical features

- Asymptomatic (majority of patients)
- Acute or chronic lumbar pain that worsens with activity and/or with spine extension
- Gait problems (e.g., waddling gait)
- Possible physical examination findings
  - Spine
    - Reduced lumbar range of motion and reduced lumbar lordosis
    - Step-off sign (seen in advanced stages)
    - Procedure: Observe and palpate the spinous processes to identify any slippage of the vertebrae.
    - Positive sign: visible or palpable step-off sign at the lumbosacral area
  - Lower limbs
    - Tight, contracted hamstring muscles
    - Weakness and atrophy in lower legs; reduced sensation and reflexes
    - Straight leg raise test: A positive test indicates lumbar radiculopathy.

Spondylolisthesis – X-ray lumbosacral spine

- **Indications**: initial test for all patients in whom spondylolisthesis is suspected
- **Views**
  - Lateral, PA, and oblique
  - Dynamic flexion-extension (lateral view): Consider performing to assess for spinal instability.
- **Supportive findings**: anterior vertebral displacement (anterolisthesis)
  - L4 over L5: most common in degenerative spondylolisthesis
  - L5 over S1: most common in isthmic spondylolisthesis
- **Additional findings**
  - Degenerative changes, e.g., disk space narrowing, vacuum phenomenon, endplate sclerosis
  - Spondylolysis: in the isthmic form
    - Scottie dog with a collar sign
    - High-grade spondylolisthesis of L5 over S1 due to bilateral spondylolysis (inverted Napoleon hat sign)
  - Spinal instability



Scottie dog with a collar sign

Spondylolisthesis – Additional imaging studies

Order to assess for spinal stenosis and impingement of nerve roots in patients with signs of neurological involvement.

❖Indications

- Clinical features of radiculopathy or myelopathy
- Suspected underlying condition (e.g., metastatic disease)
- Suspected cauda equina syndrome (i.e., bladder or bowel complaints)

❖Options

- First-line: MRI lumbosacral spine
- Second-line
  - CT myelography or CT lumbosacral spine
  - For patients with contraindications to MRI; can also be used as a guide to surgical treatment

Spondylolisthesis – Treatment

❖Conservative treatment

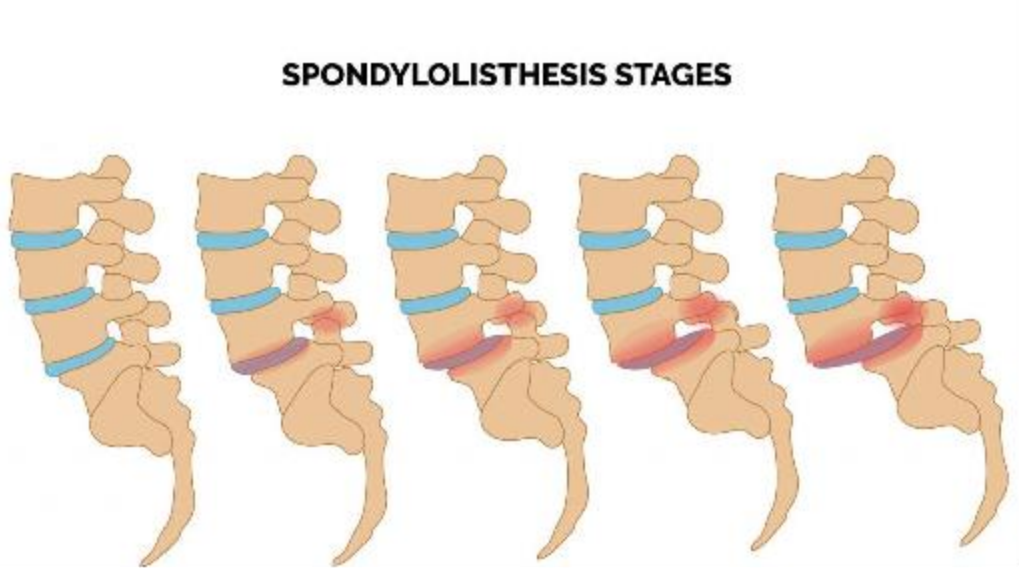
- Indications
  - Initial treatment for patients with low-grade slippage and no significant neurological involvement
  - Consider as initial treatment for high-grade degenerative spondylolisthesis with no significant neurological involvement
- General recommendations
  - Physical therapy, Physical activity restriction, Management of comorbidities
- Pain management

❖Surgical treatment

- Common indications
  - High-grade spondylolisthesis (Meyerding classification grades ≥ III)
  - Significant neurogenic claudication or radiculopathy
  - Progressive or persistent symptoms (e.g., after 3–6 months) despite conservative treatment
  - Traumatic spondylolisthesis and spinal instability
  - Bladder or bowel symptoms
- Treatment options: Vertebral fusion: standard procedure

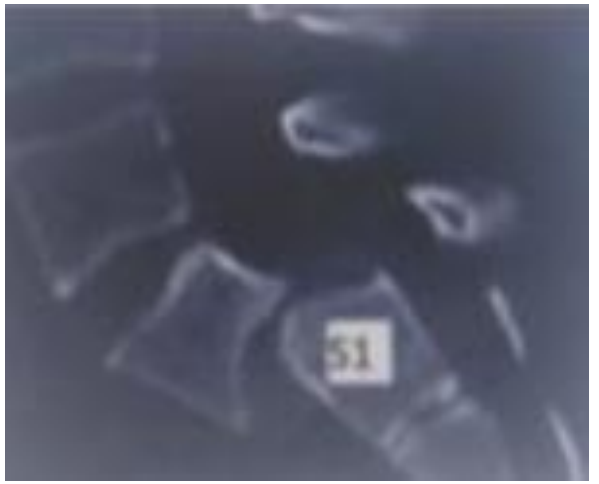
Spondylolisthesis

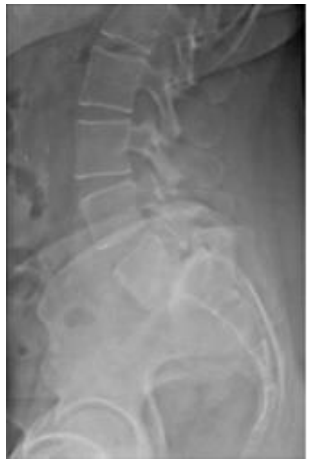
- **What is your diagnosis?**
  - Spondylolisthesis
- **What is the name of this staging system ?**
  - Myerding classification system (according the degree of displacement of the vertebral body)
- **Mention 2 types**
  - Pathologic
  - Postsurgical
  - Post-traumatic
  - Degenerative
  - Dysplastic
  - Isthmic

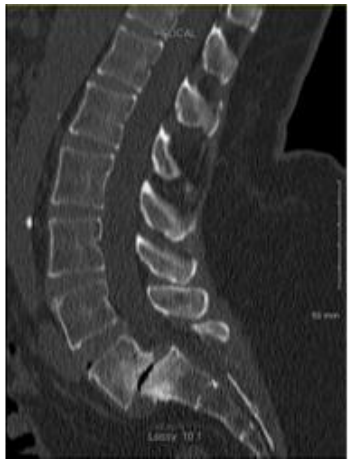


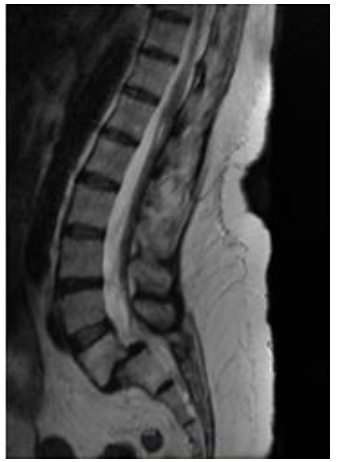
Patient with history of sciatica

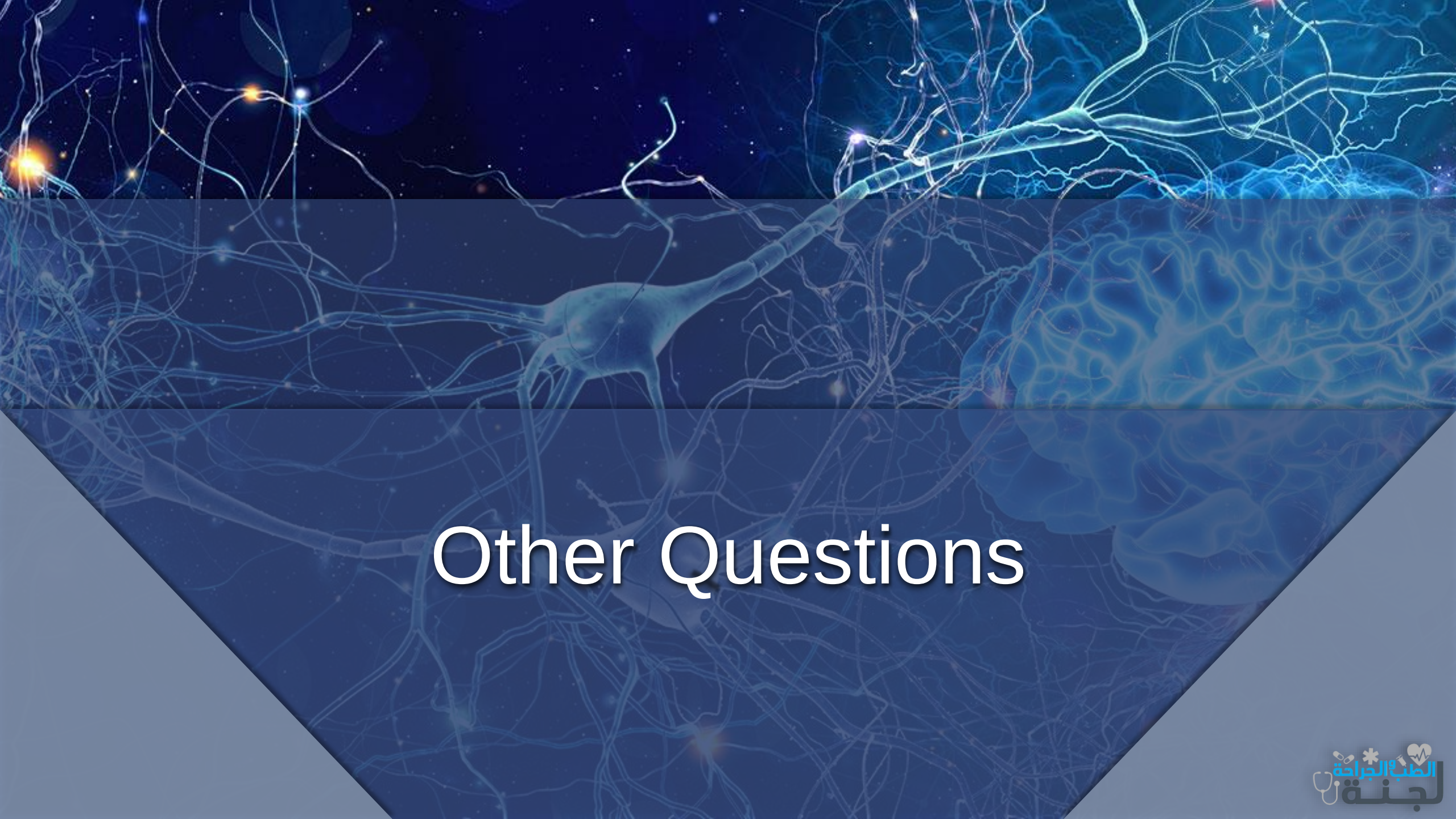
- **What is your diagnosis ?**
  - L5-S1 Spondylolisthesis
- **What is the affected dermatome ?**
  - S1
- **What is the clinical picture ?**
  - Difficulty toe walking
  - Reduction of Achilles reflex
  - Reduction of lateral hamstring reflex
  - Sensory deficits in the dorsolateral aspect of thigh and leg, and the lateral aspect of the foot





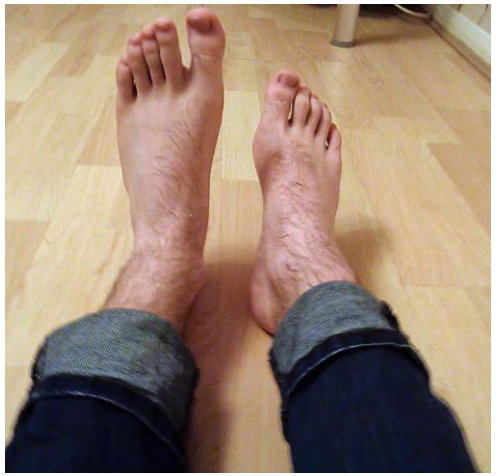






Other Questions

Deep peroneal nerve injury



- A 23 years old male complaining of numbness in his left big toe

- **What is the clinical name for this neurological sign?**
  - Foot drop

- **Mention 4 questions in the history for this patient**
  - Previous fibular fracture
  - Knee or hip replacement surgery
  - Pain
  - Decreased sensation tingling
  - Numbness and tingling of the skin between the big toe and second toe

- **Mention the expected physical exam findings**
  - Slapping" gait (walking pattern in which each step makes a slapping noise
  - Inability to point the toes upward or lift the ankle up (dorsiflexion)
  - Muscle loss (atrophy) in the outer edge of the leg
  - Loss of ability to move the foot

- **What is your diagnosis ?**
  - Deep peroneal nerve injury

Stereotactic frame

- **What is this ?**
  - Stereotactic frame
- **Mention its uses**
  - Biopsy
  - Deep brain stimulation in case of movement disorder

Mention 2 differences between neurogenic and vascular claudication

Evaluation	Vascular	Neurogenic
Walking distance	Fixed	Variable
Palliative factor	Standing	Sitting/bending
Provocative factor	Walking	Walking/standing
Walking uphill	Painful	Painless
Bicycle test	Positive (painful)	Negative
Pulse	Absent	Present
Skin	Loss of hair; shiny	-
Weakness	Rarely	Occasionally
Back pain	Occasionally	Commonly
Back motion	-	Limited
Pain character	Cramping—distal to proximal	Numbness, aching—proximal to distal
Atrophy	Uncommon	Occasionally

Drugs

سنوات (2) ❖**What is phenytoin ?** Anticonvulsant

سنوات (2) ❖**Mention 3 side effects of phenytoin**

- Gingival hyperplasia
- Megaloblastic anemia
- Neural tube defect

سنوات (6) ❖**What is Acetazolamide ?** Carbonic Anhydrase inhibitor

سنوات (6) ❖**Mention one indication for it in neurosurgery**

- Increased ICP to decrease CSF production

سنوات (1) ❖**What is dexamethasone ?** Steroid

سنوات (1) ❖**Mention one indication for it in neurosurgery**

- Vasogenic edema

Anatomy

- **Mention 2 nerves exit from superior orbital fissure**
  - Oculomotor, trochlear, abducent
- **Mention structure exit from foramen spinosum**
  - Middle meningeal artery
- **Mention structure exit from foramen rotundum**
  - Maxillary division of trigeminal nerve
- **Mention an example of pure sensory cranial nerve**
  - Olfactory nerve
- **The medial rectus muscle of the eye is innervated by which nerve ?**
  - Oculomotor nerve

سنوات (1)

Miscellaneous

سنوات (2)

❖ Define motor aphasia

- A form of aphasia caused by lesions in the inferior frontal gyrus of the dominant hemisphere. Language production is greatly limited, resulting in non-fluent, telegraphic, and grammatically incorrect speech. The patient is unable repeat after the examiner. Language comprehension, however, is intact.