بسم الله الرحمن الرحيم

تلخيص لمادة جراحة الأعصاب – سنة خامسة ،جامعة مؤتة

وقد تم هذا العمل بجهود : د. نور الحجاج ، عبدالرحمن وردات ، ساجدة وليد

”عندما نعيش لذواتنا فحسب، تبدو لنا الحياة قصيرة ضئيلة، تبدأ من حيث بدأنا نعي، وتنتهي بانتهاء عمرنا المحدود.

أما عندما نعيش لغيرنا، أي عندما نعيش لفكرة، فإن الحياة تبدو طويلة عميقة، تبدأ من حيث بدأت الإنسانية، وتمتد بعد مفارقتنا لوجه هذه الأرض“ !

- سيّد قطب

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1- AtICP

- CSF is produced mainly by **choroid plexus (50-70%)** , the rest is formed around blood vessels and along ventricular walls (ependymal cells) .
- **Rate of production 500-600 cc /day .**
- **CSF volume is 150 ml .**
- CSF circulation :
  Lateral ventricles > foramen of monro > 3rd ventricle > aqueduct of sylvius > 4th ventricle > foramen of magendie and luschka > subarachnoid space over the brain and spinal cord > CSF is reabsorbed by arachnoids villi into the superior sagital sinus .
- What determines the ICP ? (monro kellie hypothesis)
  1. Volume of the brain
  2. Volume of blood
  3. Volume of CSF
     ** their summation is constant , so any increase in any of them will increase the ICP **
- **Normal intracranial pressure ICP : in adults = 4-15 mmHg**
  In children = 3-7 mmHg
- **Moderate elevation > 20 mmHg**
  Severe elevation > 40 mmHg
- **Auto-regulation :**
  Initial rise in the ICP is maintained within normal range due to compensatory mechanism (autoregulation) , until a certain point , at this point the herniation of brain occurs , after that the ICP rises exponentially (any small rise in CSF volume will cause a great increase in ICP)
- Compensatory mechanism :
  1. Limit blood flow
  2. Move CSF to spinal canal
  3. Increase absorption of CSF
  4. Decrease production of CSF
     ** all these maintain normal ICP for a change in volume < 100-120 ml **
- cerebral perfusion pressure (CPP) = mean arterial pressure – ICP
  normal CPP = 50-150 mmHg
  <50 mmHg … ischemia
  >150 mmHg … hyperemia

- coughing , straining (increase thoracic pressure) leads to >> increase ICP, by decreasing the venous drainage of the brain . so in craniotomy the 1st step is to insert foly`s catheter.
- patients with brain tumors suffer from **early morning headache** , because during sleep the ventilation will decrease **(hypoventilation)** and this will lead to **increase in PCO2 ,** which causes vasodilatation and this will cause hypotension and increase ICP , so all of these will lead to headache .
- **Cushing triad : (opposite to hypovolemic shock)**
    1. **increase blood pressure**
    2. **decrease respiratory rate**
    3. **decrease pulse**
- **indications for monitoring ICP :**
    1. **patient with abnormal head CT (mass , edema , …), and GCS (3-8) after CPR patient with normal CT , GCS (3-8) ,with two of these (age over 40 , systolic blood pressure < 90 , unilateral or bilateral motor posturing)**
    2. **post operative**
    3. **hydrocephalus**
    4. **reye syndrome**
- Kocher`s point : landmark for placement of ICP monitor .
- Lumbar puncture is C/I if you suspect a mass in the brain .
- Wave form (مش مطلوب)
- Types of cerebral edema :
    1. **Vasogenic** >> due to tumors , it responds well to steroids
    2. **Cytotoxic** >> due to trauma
- **Symptoms** of increased ICP in adults :
    1. Headache
    2. Nuchal rigidity
    3. Vomiting
    4. Focal neurological deficit
- **signs** of increased ICP in adults :

  papilledema

Increased ICP	**Optic neuritis**
Bilateral papilledema	Unilateral papilledema
Painless	Painfull

- signs of increased ICP in children :
    1. Bulging fontanele
    2. Sun setting eyes
- Management : (sudden increase in ICP is emergency)

1. Vital signs should be stabilized
2. CT , MRI to know the cause
3. Treat the primary cause
4. ICP HEAD (conservative)
   I >> **I**ntubate
   C >> **C**alm (sedation)
   P >> **P**lace drain / **p**aralysis (vecuronium**)**
   H >> **H**yperventilate (PCO2 not less than 30)
   E >> **E**levate head (30 degree)
   A >> **A**dequate blood pressure (vasopressor to avoid hypotension)
   D >> **D**iuretic (mannitol , acetazolamide)
5. Steroids >> decrease edema
6. Surgical :
   - resection of space occupying lesion
   - CSF shunt in case of hydroceph
   - Craniotomies (last resort) :
     Craniotomy :Bone flap is removed and kept in a freezer or the patient`s abdomen until the ICP is normal
     Decompressive craniotomy :part of skull is removed and the dura is expanded (Indicated in traumatic brain injury)

2- Hydrocephalus

- It is the enlargement of ventricles due to excessive accumulation of CSF .
- It`s either :
  1. Obstructive (tumors , aqueductal stenosis , colloid cyst)
  2. Communicating (infection , subarachnoid hemorrhage)
- **Aqueductal stenosis : most common cause of congenital hydroceph**
- Hydroceph occurs in lateral and 3rd ventricle , but **not in the 4th ventricle**
- Two types :
  1. Primary
  2. Secondary (acquired)
- Clinical features :
  1. Macrocephaly
  2. Symptoms of increased ICP (headache , nausea and vomiting)
  3. Sun setting appearance (defect upward gaze) : due to pressure on the superior collecular tract

- Imaging : CT , MRI (ultrasound in newborn)
    1. In MRI you must differentiate between T1 and T2
       T1 >> CSF is black (hypointense)
       T2 >> CSF is white (hyperintense)
    2. In CT the bone is very clear , unlike the MRI
- Treatment :

1. VP shunt :

insertion of a catheter into the **lateral ventricle** , then it`s connected with a valve under the scalp and tunneled under the skin until it reaches the **peritoneum**.
Other sites for the shunt : right atrium (ventriculo-atrial shunt) , lumboperitoneal shunt (thecoperitoneal shunt).
Complications of the shunt :

a) Infection :most commonly caused by **staph epidermidis , aureus** (skin flora)
   Tx : remove VP shunt , put EVD shunt , give Ab
b) Shunt blockade : by choroid plexus adhesions , blood , cellular debris , misplaced catheter (the distal end can move with peristalsis of the intestine , could appear at the mouth , scrotum , vagina
   Tx : replace VP shunt

2. **External drain EVD :** temporary CSF drain , administration of Ab (The EVD is preferred in case of ventricular hemorrhage and meningitis).
3. **Endoscopic third ventriculostomy ETV** :
   Via a neuroendoscope , a stoma is created in the floor of the **3rd ventricle** , the CSF then communicate between the ventricular system and **subarachnoid space** .
   Complications : blockade (rare but serious) , injury to basilar artery , memory impairment due to injury to the fornix

- Difference between normal pressure hydroceph and BIH

	Normal pressure hydroceph	**benign intracranial hypertension**
Pressure	Normal , no S & S of increased ICP	Very high
Volume	Very high	Normal or low
Epidemiology	Old age males	Young obese females
Presentation	(3 W`s triad) : **W**acky >> Dementia , **W**ubbly >> ataxia , **W**et >> incontenence	S & S of increased ICP : headache , **blurred vision** , papilloedema

Imaging	Dilated ventricles	Normal size or small ventricles
Treatment	VP shunt	-conservative : 1-weight loss (sucsess rate 20%) 2-dimox (acetazolamide) 30% respond -surgery : theco-peritoneal shunt

3- Head trauma

- Glasgow coma scale :
  - **Eye response :**

Eyes open spontaneously	4
Eyes opening to speech	3
Eyes opening in response to pain stimulus	2
No eye opening	1

  - **Verbal response :**

Oriented	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1

  - **Motor response:**

Obeys commands	6	
Localizes to pain	5	
Withdrawal from pain	4	
Decorticate posturing	3	>> flexion
Decerebrate posturing	2	>> extension
No motor response	1	

- Degree 14 and 15 are mild
  Degree 9 , 10 , 11 , 12 , 13 are moderate
  Degree 3 , 4 , 5 , 6 , 7 , 8 are severe and must be intubated
- Most common cause of SAH is trauma .
- Epidural and subdural hematoma :

	Epidural hematoma	Subdural hematoma
Etiology	laceration of arterial vessels (MMA)	rupture of the bridging veins
Site	Between skull and dura	Between dura and arachnoid
Symptoms	Lucid interval followed by unconsciousness	Gradual increase headache and confusion
CT appearance	Biconvex lens (lentiform) , **doesn't cross suture lines**	Cresent shape , **cross suture** lines
	Mostly acute , there is demarcation between hematoma and brain tissue	Acute or chronic
Treatment	Craniotomy	**Burr hole if chronic , craniotomy if acute**

- Basal skull fracture features :
    1. Rackoon eyes
    2. Battle sign
    3. CSF rhinorrhea and otorrhea
    4. 7th and 8th cranial nerve damage (8th is worse and has bad prognosis)
- Subgleal and subperiosteal hematoma

	Subgleal	Subperiosteal
Etiology	Vacuum during delivery	delivery traumas
Site	Between aponeurosis of the scalp muscle and periosteum	under the periosteum
Cross suture	Cross sutures	Doesn't cross
Treatment	Observation ,	analgesia + observation
		avoid aspiration due to risk of infection and abscess

4- Spinal injuries

- **Anatomy** :
    - ❖ Vertebral column : 33 vertebrae (7 cervical , 12 thoracic , 5 lumbar , 5 sacral fused , 4 coccygeal)
    - ❖ Spinal cord ends at the level of the inferior border of L1/L2 . any lesion below this level will lead to lower motor neuron lesion (LMNL) . while any lesion above this level will lead to UMNL or mixed .
    - ❖ The spinal cord ends with the conus medullaris , the spinal nerves continue seeking their intervertebral foramen forming cauda equina .

- ❖ The pia matter that surrounds the spinal cord continues projecting downward forming the Filum Terminale , which stabilizes the spinal cord in its place .
- ❖ Grey matter consists of cell bodies while white matter consists of cell axons .
- ❖ The meninges are :
    1. Dura matter (outer most , it ends at S2)
    2. Arachnoid matter (the space between arachnoid matter and pia matter is called Subarachnoid space , it contains CSF)
    3. Pia matter (associated with surface of the spinal cord)
- ❖ Another stabilizing ligament >> denticulate ligament , which extends from the Pia laterally .
- ❖ The anterior 2/3 of spinal cord are supplied by anterior spinal artery , while posterior 1/3 is supplied by posterior spinal artery .
- ❖ C1-C7 nerves emerge above their respective vertebrae .
- ❖ يعني بين C2 و C3 شو النيرف اللي بطلع ؟ الجواب هو C3 (يعني بنوخذ الرقم الاكبر)
- ❖ C8 emerges between C7 and T1 , after that nerves emerge below their respective vertebrae .
- ❖ يعني بين T1 و T2 شو النيرف اللي بطلع ؟ الجواب هو T1 (يعني بنوخذ الرقم الاصغر)

- **Spinal injuries :**
    1. Bony injuries :
        A. Cervical spine injuries:
            ☒ Flexion rotation injuries :
            RTA , diving . **C5/6 most common** .Usually facet dislocation sublaxed , and maybe locked in case of <u>posterior</u> ligament damage .Injury is on **nerve root** .
            ☒ Compression :
            Vertebral body is decreased by height , intervertebral disc displacement or / and nucleus pulposus rupture and adds pressure to the spinal cord .
            Ligaments are usually intact .

            ☒ Hyperextension :
            More common in **elderly** , with spinal stenosis . Usually associated with **central cord syndrome** . Rupture of the <u>anterior</u> ligament .

        B. Thoraco-lumbar spine injuries :
            ☒ Flexion rotation injuries :
            Most common site **T12-L1** (thoraco-lumbar junction) , thoracic vertebrae stabilized by the ribs so they are rarly affected .
            Disruption of the **posterior** ligament and bony parts .
            ☒ Compression :
            Common . no significant neurological damage .

☒ Hyperextension :
Uncommon . disruption of **anterior** ligament . rupture of intervertebral disc. could lead to severe cord injury .

2. Spinal cord injuries :

- Neurogenic shock >> low pulse , low BP and loss of all reflexes .
- Hypovolemic shock >> high pulse , low BP .
- Any patient with cervical fracture + quadriplegic >> should be admitted to the ICU for observation to exclude **phrenic** nerve injury or development ascending edema that could lead to respiratory compromise .
- Initial management :
    a. CABCDE (A : airway patency with fixation of cervical spine , C : pulse and BP, D : disability >> calculate GCS)
    b. Maintain BP
    c. NG tube
    d. Urinary catheter (foley`s)
    e. No steroids
- Investigations :
    Plain films , CT scan , MRI (soft tissue)
- Spinal cord injuries are either :

A. Complete lesions :
    - All neurological functions are lost below the level of the lesion .
    - Patients are either quadriplegic or paraplegic depending on the level of the lesion.
    - The patient will lose bowel / bladder function (autonomic)

B. Incomplete lesions :
    1. Anterior cord syndrome :
        - Tract affected :corticospinal , spinothalamic
        - Effect : motor loss (quadriplegia / paraplegia) , sensory loss (pain , temperature and crude touch) , preserved sensory (proprioception , light touch and vibration).
    2. Central cord syndrome :
        - Associated with hyperextension cervical spine injury in elderly .
        - Tract affected : grey matter
        - Effect : loss of motor function mainly in the upper limbs , with loss of sensory function mainly in the upper limbs more than the lower , why? >> Because of the orientation of the fibers in the grey matter , the upper limb fibers are located more centrally than the lower .

3. Brown-Sequard syndrome :
    - Caused by penetrating injury .
    - Tract affected : Spinothalamic Tract + Corticospinal Tract + Dorsal Column
    - Hemisection of the spinal cord .
    - Effect : ipsilateral motor loss (paralysis) + **Ipsilateral sensory loss (vibration , proprioception, light touch)**. **Contralateral sensory loss (pain , temperature**).
4. Posterior cord syndrome :
    - Tract affected : posterior column and posterior grey horns .
    - Effect : **Motor preserved**, **sensory preserved (pain , temperature**), **sensory loss (vibration , proprioception, light touch**) distally .

5- Brain tumors

- Epidemiology :
    - Most common brain tumor in adults is > Mets
    - Most common primary brain tumor in adults > GBM and meningoma
    - Most common brain tumor in children > medulloblastoma and astrocytoma
    - Most common site of brain tumor in adults > supra-tentorial
    - Most common site of brain tumor in children > infra-tentorial
- Familial syndrome associated with CNS tumors :
    - Tuberous Sclerosis → astrocytoma
    - Neurofibromatosis type 1 → astrocytoma
    - Li-Fraumeni → astrocytoma
    - Von Hippel-Lindau → hemangioblastoma
    - NF type 2 → schwannoma (acoustic neuroma) , meningioma
    - Turcot syndrome → glioblastoma multiforme
    - Multiple Endocrine Neoplasia type 1 (MEN-1) → pituitary adenoma
- Clinical picture :
    1. S & S of increased ICP
    2. S & S specific to tumor size (memorize each lobe and what symptoms it make) >> Seizures are caused by **cortical** tumors .
- Diagnosis :
    - MRI could detect 80 % of tumors while the remaining 20 % can be detected by biopsy .
    - The diagnosis is made by the behavior of each tumor on different sequence on MRI .
- DDx for ring enhancement lesion :

1. Mets
2. GBM
3. brain abscess
4. active demylenation
5. resolving hematoma

- DDx for homogenous enhancement pattern :
    1. meningioma
    2. lymphoma
       the enhancement is given only on T1
- brain tumors don't metastasize because there is no lymphatic drainage , except for tumors at the base of the skull which are : Medulloblastoma and Ependymoma , so in these cases you should do MRI for the spinal cord too and vice versa , they cause something called drop mets .
- pituitary adenoma are classified according to :
    1. size : micro < 1cm , macro > 1 cm
    2. function : functional (prolactinoma , cushing and acromegaly) , non-functional
       A functioning pituitary adenoma is 99 % microadenoma , because patient seek help early due to symptoms of hormonal imbalance , so it`s diagnosed early before it becomes macroadenoma .
- grade 1 astrocytoma can be totally removed surgically , grade 2 astrocytoma is associated with seizures .
- GBM has 2 peaks : 20-30 & 50-60
- DDx of cerebellopontine angle CPA lesion :
    1. Vestibular schwannoma
    2. Archnoid cyst
    3. Meningioma
    4. Epidermoid cyst
    5. Dermoid cyst
- Vestibular schwannoma (acoustic neuroma) : arise from schwan cells which produce mylene , patients present with (hearing loss , vertigo , ipsilateral tinnitus), damage to 8^{th} cranial nerve , well homogenous enhancement on MRI .
- Stereotactic biopsy :under GA , coordinations of a mass are obtained by GBS system . it`s used to know the histopathology of an unknown brain tumor / mass and surgery isn't the first choice like if it`s in inappropriate site or the surgery will cause harm more than benefit .
- Stereotactic frame uses :
    1. Biopsy
    2. Deep brain stimulation in case of movement disorder
-

UMNL	LMNL
Late (disuse) atrophy	Early atrophy
Hypertonic	Hypotonic
Hyperreflexia	Hypo/A reflexia
Spastic paralysis	Flaccid paralysis

- DDx of posterior fossa (infra-tentorial) lesions in children :
    1. Astrocytoma
    2. Medulloblastoma
    3. Ependymoma
    4. Arachnoid cyst
    5. arnold chiari malformation

- DDx of posterior fossa (infra-tentorial) lesion in adults :
    1. Mets
    2. Astrocytoma
    3. Medulloblastoma
    4. Meningioma
- DDx for supratentorial lesion :
    1. Mets
    2. Meningioma
    3. GBM
- DDx for calcification :
    1. Oligodyndrioglioma (frontal lobe)>> it appears hypointense on MRI and hyperdense on CT .
    2. Meningioma
    3. Craniopharyngioma
    4. Ganglioma
- DDx for suprasellar lesion :
    1. Pituitary adenoma
    2. Rathkeys cleft cyst
    3. Dermoid cyst
    4. Craniopharyngioma
- Craniotomy is used in :
    1. Tumor removing
    2. Acute bleeding (epidural hematoma)
- Sites of meningioma (it arise from arachnoid cap cells) :
  Parasagital > convexity > sphenoid wing > olfactory groove > suprasellar
- Meningioma >> cranial nerve deficit , very benign , Tx is surgery

- Foster kennedy syndrome (meningioma in the olfactory groove) :
    1. Ipsilateral optic nerve atrophy
    2. Contralateral papilledema
    3. Anosmia
- Hyperostosis of bone >> meningioma
- Prolactinoma is treated medically by dopamine agonists (bromocriptine)
- Clinical features of supratentorial tumors :
    1. Focal neurological signs
    2. S & S of increased ICP (Headache , Papilledema , Nausea/vomiting)
    3. Seizures
    4. Organic mental changes (Depression , apathy)
- Clinical features of infratentorial tumors :
    1. S & S of increased ICP due to hydrocephalus (Headache , Papilledema , Nausea/vomiting)
    2. S/S indicative of mass effect (Dysmetria , Intention tremor , ataxia)
- Pituitary apoplexy (bleeding in pituitary adenoma) clinically :
    1. Severe headache
    2. Ophthalmoplegia
    3. Abnormal level of consciousness
- When the presence of Primary CNS Lymphoma is suspected, no steroids are given before tissue diagnosis is established

6- Spinal tumors

- Brain cortex is grey matter and the parenchyma is white matter (opposite to spinal cord)
- With spinal tumors the pain is **nocturnal** and worse in recumbent position due to :
    1. Venous congestion when pt is lying down
    2. Dural stretching
       But in degenerative disease pain is worse with movement

- types for spinal tumors :
    1. Extradural (55 %)
    2. Intradural extramedullary (40 %)
    3. Intradural intramedullary (5 %)

- DDx for **extradural lesion** :
    - Benign :
        1. **Hemangioma**

2. **Osteoid osteoma (**most common benign tumor of bone)
3. **Osteoblastoma (may cause scoliosis)**
4. **Osteochondroma**
5. **Chordoma (sacrococcygeal , bad prognosis)**

- Malignant :
  1. Mets
  2. Osteosarcoma
  3. Multiple myeloma (most common primary malignant)
  4. Spinal lymphoma
  5. **Osteocarcinoma**

- DDx for **Intradural extramedullary** lesion :
  1. **Meningioma**
  2. **Neurofibroma**
  3. **Schwanomma (hour-glass appearance on axial MRI)**

- DDx for **Intradural intramedullary** lesion :
  1. **Astrocytoma**
  2. **Ependymoma**
  3. **Hemangioblastoma**

- Osteoid osteoma is most common benign tumor of bone , and has rare recurrence .
- MRI is gold standard diagnosis
- Spinal arteriography in **Hemangioblastoma** .
- In case of hemangioma we rarely intervene except if its large , and mostly its incidental finding .
- Chordoma occurs in sacrum , its benign but it behaves as malignant .
- If the tumor is on the dorsal part of vertebral column it's easier to remove .

7- Spinal degenerative disease

- Anatomy :
  - Ligaments that support the vertebrae :
    1. Anterior longitudinal ligament
    2. Posterior longitudinal ligament
    3. Interspinous ligament
    4. Intertransverse ligament
    5. Supraspinous ligament
    6. Legamentum flavum (between lamina)

- Facet joint : superior articular facet joint (pedicle) } Synovial joint
  Inferior articular facet joint (lamina) }

- Degeneration of the disc : (process of dehydration)
  The intervertebral discs are composed of 90% water , with age the water content decreases thus the elasticity will decrease and this will increase the tendency for disc prolapse .
- Facet joint prolapsed : they are synovial joints so they dehydrate with age .
- Ligament degeneration : the ligament become hypertrophied causing pressure on spinal cord and nerve root or thecal sac .
- Bone degeneration : osteophyte formation , when they present on the posterior side they cause more symptoms than anterior .
- Spondylolysis : associated with **pars interarticularis** fracture ,
- Spondylolithiasis : appears on oblique view X-ray as (decapitated scoty dog appearance)
- Most common disc prolapse (herniation) is lumbar

- **Cervical disc prolapse**
  - Most commonly affected are C6/7 (because they are most mobile and most of body weight is on them .
  - The prolapse is usually posterolateral direction causing compression on the nerve **root** which leads to **radiculopathy** .
  - If it causes compression on the spinal cord >> this will lead to **myelopathy** (spinal cord ends at level of L1 , and myelopathy means damage to spinal cord , so it's wrong to say that lumbar disc prolapse will cause myelopathy because there is no spinal cord at that level)
  - Physical exam leads you to the level of the disc .
- Can a patient come with myelopathy with lumbar disc prolapse at L3/4 ?

No because the spinal cord ends at level of L1 , so any lesion below will cause radiculopathy .

- Diagnosis : CT , MRI
- Treatment : conservative , except in two cases we do surgery :
    1. If conservative treatment fails
    2. Myelopathy
    3. If red flags are present
- Red flags : (in lumbar only)
    1. Radiculopathy
    2. Significant weakness
    3. Intractable pain .
    4. Hx of malignancy
    5. Extremes of age
    6. Fever and night sweat
    7. Steroid
- Surgery :
    - Anterior cervical discectomy
    - Cervical foramenotomy
- CSM (cervical spondylosis myelopathy) : spondylosis +myelopathy

- **Thoracic disc prolapse :**
    - Rare , they are supported by rib cage , not much movement .
    - Symptoms : intercostals pain , sensory disturbance , myelopathy , radiculopathy.
    - **Myelopathy** present first before other symptoms , why ?
      Because vertebral foramen is smaller than others , the space is limited more
    - Indications of surgery are the same .

- **Lumbar disc prolapse :**
    - Most common , because its most mobile , and carry more body weight .
    - The disc usually prolapse posterolateraly which cause compression on the nerve root >> radiculopathy.
    - Central cord prolapse >> compression on cauda equina .

- Cauda equina syndrome :
    - Acute condition , symmetrical LMNL , parasthesia , urinary retention , stool incontinence , foot drop.
    - Top emergency , needs to be treated in < 48 hours or it will become permanent .
    - Cause : trauma , tumor , herniated disc , infection .

- If urinary incontinence occur its >> overflow incontinence .

- Physical exam for lumbar disc :
  - Nerve root tension sign
  - Straight leg raising test (patient in supine position the lower limb is raised while fully extended , this will cause pain).
  - Bowstring sign
- Treatment : if red flag present >> surgery .
- Lumbar canal stenosis :
  - Ligament hypertrophy causes compression on thecal sac
  - Patient present with nuerological claudication (which is pain on walking) , and its releaved by changing posture unlike vascular claudication that is releaved by rest , and the patient have 5 P`s : pain , pallor , parasthesia , paralysis , pulselessness)
  - Inx : MRI myelography
  - Treated by decompression surgery

Done by : Noor Daher Alhijjaj ☺ 2018

8- Congenital anomalies

✓ Spina bifida

1-spina bifida occulta (in which there is **no apparent defect** on the surface of the body), **it's just A bony deficit** usually found in the laminae of the **lumbosacral spine**, discover **accidentally** (asymptomatic throughout life)

ASSOCIATED with **CUTANEOUS LESIONS** such as :
- Subcutaneous mass or lipoma -Hairy patch -Dermal sinus
-dimples -Vascular lesion, e.g., hemangioma or telangiectasia
-Skin appendages, e.g., skin tags, tail-like appendages

2-spina bifida aperta : (we can detect an anomaly on the surface of the skin)

A) meningocele : It's herniation of **meningeal tissue and CSF** through a defect in the spine , but **NO neural tissue**
Most commonly in **lumbosacral area** , the **trans illumination test will be positive**, on examnation **no neurological deficits**

B) Myelomeningocele: it's herniation of **meningeal tissue and CNS tissue** through a defect in the spine, usually this nervous tissue is **nonfunctiong** leading **to neurological deficits**
-the skin is usually very thin and transparent

(BOTH A&B Treated by **Surgical excision** …… the aim of surgery is cosmetic and there is no improvement of motor function and not correct the Neural deficit.)

C) Rachischisis (posterior neuropore of the neural tube fails to close)
it's the worst type of spina bifida

Prevention
- **0.4mg** for all women who want to be pregnant AND **4 mg** of **folic acid** (for high risk women)
-Stop the folic acid antagonist (such as Depakine)
- Control glucose level in diabetic patients

✓ Tethered cord

most commonly at)spinal cord is abnormally attached to tissues around
(the **base of spine**
Children may have several symptoms of tethered spinal cord, including:
-Foot and spinal deformities -Weakness in the legs -Change in or abnormal gait
-Low back pain -Scoliosis -Urinary irregularities (incontinence or retention)
Treatment? surgery to free (detether) the spinal cord

NOTE !!
anterior neuropore close at day 26 … posterior neuropore close at day 28

✓ Anencephaly

Due to failure of fusion of the anterior neuropore.
Neither cranial vault nor scalp covers the partially destroyed brain
identified from **13 week gestation** , these babies usually die at, or soon after birth

✓ Chiari malformation

(**Herniation of cerebellum through foramen magnum)**

Chiari 1	• Herniation of the cerebellar tonsils • Syringomyelia
Chiari 2 (Arnold-Chiari Malformation)	• Downward displacement of medulla and cerebellar tonsils • Hydrocephalus • Kink in the medulla • (Myelo)meningocele • Syringomyelia **Best to do is axial T1 MRI**
Chiari 3	• Further herniation of the cerebellum below the foramen magnum forming an encephalocele in addition to spina bifida
Chiari 4	• Hypoplasia/Aplasia of the cerebellum with spina bifida

Most common surgery to treat Chiari malformation is **posterior fossa decompression**

✓ Dandy-Walker Malformation

Characterised by :

1 - Complete or partial agenesis of the **cerebellar vermis** .

2- Cystic dilatation of the 4th ventricle

3- An enlarged posterior fossa with upward displacement of tentorium

. Approximately **70-90%** of patients have **hydrocephalus**

✓ CRANIOSYNOSTOSIS

premature fusion of 1 or more cranial sutures, often resulting in an abnormal head shape.

1. primary (defect of ossification)
2. secondery (failure of brain growth)

-Scaphocephaly - Early fusion of the sagittal suture
-Anterior plagiocephaly - Early fusion of 1 coronal suture
-Brachycephaly - Early bilateral coronal suture fusion
-Posterior plagiocephaly - Early closure of 1 lambdoid suture
-Trigonocephaly - Early fusion of the metopic suture

✓ Arachnoid Cysts

benign congenital cysts that occur along the cerebrospinal axis.
they usually contain clear, colorless fluid that is most likely normal CSF

mostly **asymptomatic**

Clinical features :

1- ↑ICP : headache , Nausea , Vomiting.

2- Seizures

3- with minor head trauma > hemorrhage

Locations :

-Sylvian fissure 50%

-Cerebellopontine angle 10%

(Clinical features as in **acoustic neuroma** - SN hearing loss - Tinnitus - Vertigo)

-Quadrigeminal 10%

-Suprasellar 10% (Clinical features 1- hydrocephalus 2- visual impairment
3- Endocrine Dysfunction.)

-Vermian 8%

-Cerebral convexity 5%

-Other 7%

Management :

- asymptomatic : follow up at regular intervals.
- otherwise :

1- Craniotomy, excision of the cyst wall

2- Shunt : cyst – peritoneum

Done by : Sajeda Waleed

9- Subarachnoid hemorrhage

- Subarachnoid hemorrhage is defined as bleeding into the subarachnoid space within the intracranial vault.
- Risk factors:
  - Modifiable:
    - Hypertension
    - Smoking
    - Alcohol Abuse
    - Drug Abuse
    - Stress
    - Low BMI

nonmodifiable:

- Female Sex
- History of previous SAH
- Family history
- Polycystic Disease
- Age

- M. C.C of SAH is traumatic
- M.C.C of non traumatic is Aneurysm, other non traumatic cause arteriovenous malformation
- Types of aneurysm :
  - Berry (saccular)aneurysm
  - Giant (fusiform) aneurysm
  - Mycotic aneurysm
  - Charcot –Bouchard aneurysm
  - Traumatic aneurysm
- Clinical presentation:
  - Headache (Sudden, severe onset with or without LOC "***The worst headache of my life***" , Generally associated with nausea and vomiting, stiff neck, photophobia, restlessness and agitation) -
  - Dizziness
  - Orbital pain, diplopia, visual loss
  - Seizures may occur (most commonly in first 24 hours)
  - Symptoms of meningeal irritation, including nuchal rigidity and pain, back pain, and bilateral leg pain
  - Signs:
    - Signs of meningeal irritation: Neck stiffness, Kernig's sign, Brudzinski's sign
    - Impaired level of consciousness in some patients
    - Subhyaloid haemmorhage on optic funduscopy
- Diagnosis:
  - Non contrast head CT (gold standard)
    - Finding on CT: hyperdensity on sylvian fisher, hyperdensity on basal cistern (**star sign**) and may show hydrocephalus.
  - Lumbar Puncture – to show xanthochromia
  - MRI of the head
  - Cerebral angiography

- There are two grading systems:
  - **Hunt and Hess grading system** (based on sign and symptom)
  - **Fisher grading system** (based on the amount of blood shown on initial CT scans)

Hunt and Hess grading system

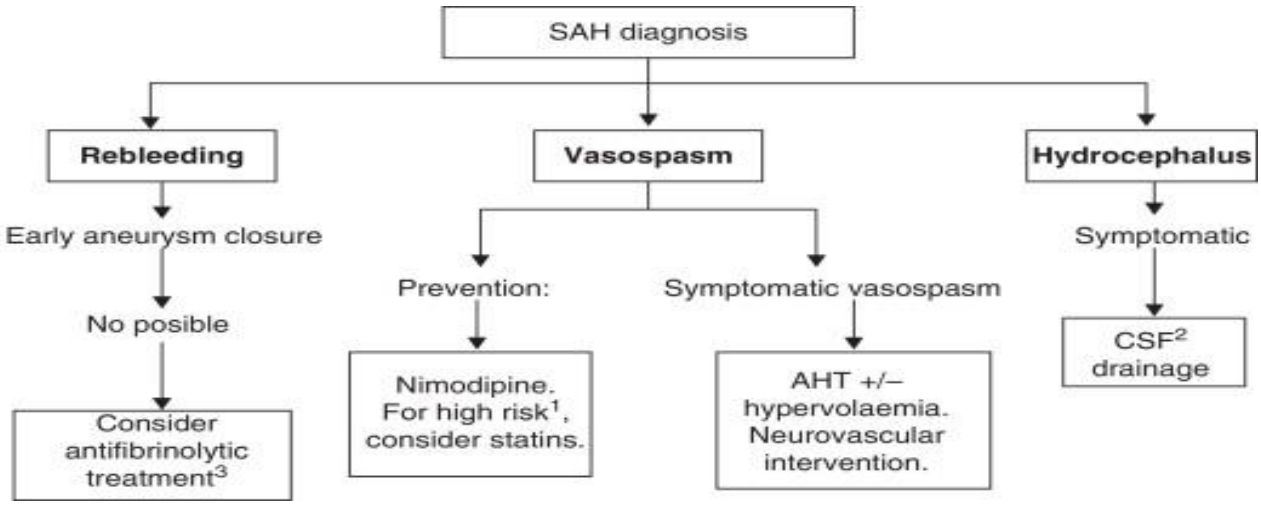
GRADE	DESCRIPTION
I	Asymptomatic or mild headache
II	Moderate to severe headache
III	Confused, drowsy, or mild focal signs
IV	Stupor (localizes pain)
V	Coma (posturing or no motor response to pain)

Fisher CT Grading Scale

Fisher Group	Blood Pattern on Nonenhanced CT
1	No subarachnoid blood detected
2	Diffuse or vertical layers <1 mm thick*
3	Localized clot or vertical layers ≥1 mm thick
4	Intracerebral or IV clot with diffuse or no SAH

*"Vertical" cisterns: interhemispheric, insular, and ambient.

- Delayed cerebral ischemia from arterial smooth muscle contraction is the most common cause of death and disability following aneurysmal SAH. **Vasospasm** can lead to impaired cerebral autoregulation and may progress to cerebral ischemia and infarction.
- The goal of treatment is to **prevent rebleeding** and cerebral **vasospasm**



- To prevent rebleeding by aneurysm closure by:
  - **clipping of aneurysm**
  - **Coiling of aneurysm**
- coiling is the goldstandered nowadays (clipping is not use now)
- To prevent vasospasm by CCB -- nimodipine
- To prevent seizures – levetiracetam or phenytoin

- SAH complications :
  - Rebleeding
  - Cerebral vasospasm
  - Hydrocephalus
  - Seizures
  - Venous Thrombo Embolism

- Cardiovascular complication (arrhythmia)
- Fluid and electrolyte disturbance (Hyponatraemia)
- Intraventricular haemorrhage
- Increased intracranial pressure

➢ Differential Diagnosis for SAH:

- Migraine
- Drug Abuse
- Arterial dissection
- Vasculitis
- Anticoagulant Use

Done by : Abdulrahman Alwardat