

Meningitis

Definition: inflammation of the membranes covering the brain & spinal cord.

Types:

- Bacterial
- Aseptic e.g. viral, fungal
- Tuberculous

Meningitis, inflammation of the leptomeninges, can be caused by bacteria, viruses, or—rarely—fungi. The term **aseptic meningitis** principally refers to viral meningitis, but **meningitis with negative cerebrospinal fluid (CSF) bacterial cultures** may be seen with other infectious organisms (Lyme disease, syphilis, tuberculosis), parameningeal infections (brain abscess, epidural abscess, venous sinus empyema), chemical exposure (nonsteroidal antiinflammatory drugs, intravenous immunoglobulin), autoimmune disorders, and other diseases, including Kawasaki disease.

First: Bacterial meningitis:

1. Epidemiology

- Highest incidence of bacterial meningitis is during the **first month of life**.
- Overall incidence during childhood has declined dramatically owing to the introduction of conjugate vaccines for *S. pneumoniae* and **HIB**. Before vaccination, HIB was the leading cause of bacterial meningitis outside the newborn period.
- Risk factors** for bacterial meningitis include the following:
 - Young age**
 - Immunodeficiency** (e.g., asplenia, humoral-mediated immunodeficiency, and terminal complement deficiency, which predisposes individuals to infections with *Neisseria meningitidis*)
 - Anatomic defects** (e.g., basilar skull fracture, ventriculoperitoneal shunt, cochlear implants), which increase the risk of meningitis caused by *S. pneumoniae* owing to direct extension from the nasopharynx and ear.

2. **Etiology.** Causes of infection are based on the age of the child (see Table 7-1).

Age	Bacterial Pathogens	AGE	MOST COMMON	LESS COMMON
0–1 month LES (b)	Group B streptococcus <i>Escherichia coli</i> <i>Listeria monocytogenes</i>	NEONATAL	Group B streptococci <i>Escherichia coli</i> <i>Klebsiella</i> <i>Enterobacter</i>	<i>Staphylococcus aureus</i> Coagulase-negative staph. <i>Enterococcus faecalis</i> <i>Citrobacter diversus</i> <i>Salmonella</i> <i>Listeria monocytogenes</i> <i>Pseudomonas aeruginosa</i> <i>Haemophilus influenzae</i> types a, b, c, d, e, f, and nontypable
1–3 months LSS (b)	Group B streptococcus <i>Streptococcus pneumoniae</i> <i>Listeria monocytogenes</i>			
3 months– 3 years SHN	<i>Streptococcus pneumoniae</i> <i>Neisseria meningitidis</i> <i>Haemophilus influenzae</i> type b	>1 MO	<i>Streptococcus pneumoniae</i> (with highest rate of complications) <i>Neisseria meningitidis</i>	<i>H. influenzae</i> type b (in areas without vaccine) Group A streptococci Gram-negative bacilli <i>L. monocytogenes</i>
3 years–adult SN	<i>Streptococcus pneumoniae</i> <i>Neisseria meningitidis</i>			

Pathophysiology

Pathways of infection

- Most pathogens that cause meningitis colonize the **nasopharynx** or the upper **airways** before entering the **CNS** via:
 - Hematogenous dissemination [22]
 - Contiguous spread of infections in nose, eyes, and ears
 - Retrograde transport along or within peripheral or cranial nerves
- Direct infection (e.g., due to trauma or head surgery) [23]

N.B. Peak of *H. influenzae* infection between 6–12 month → incidence declined by vaccination

Incubation periods

- Bacterial meningitis: usually 3–7 days [24]
- Viral meningitis: usually 2–14 days, depending on the type of virus

Transmission:

- Droplet infection mostly
- Blood borne ⇒ in neonatal sepsis

Clinical picture

1. Non specific

- High fever (may be hypothermia in neonates).
- Poor feeding
- Rose spots may appear on the trunk & extremities in meningococcal septicemia.

2. Features of Increased Intracranial tension

- * Before fontanel closure → tense, bulging anterior fontanel
- * After closure of fontanels:
 - Severe bursting headache (irritability)
 - Blurr of vision
 - Projectile vomiting (in the morning, not preceded by nausea)
 - Cushing response (hypertension & bradycardia)

3. Features of meningeal irritation: (less sensitive in infants)

- * Neck rigidity (stiffness) → limited neck flexion
- * Opisthotonus → arched back
- * Kernig's sign → inability to extend the leg after the thigh is flexed to a right angle with the axis of the trunk.
- * Brudzinski leg sign: Passive flexion of one hip → flexion of the other hip and knee
- * Brudzinski neck sign: Passive flexion of the neck → flexion of the hip & knee.

3. Clinical features Depend on age:

a. Infants and young children often have minimal and nonspecific signs and symptoms (e.g., poor feeding, irritability, lethargy, respiratory distress). **Fever may be absent or minimal.** A bulging fontanelle may be found on physical examination.

b. Older children often present with fever and signs suggestive of meningeal irritation.

1. **Alteration in level of consciousness**, with irritability, somnolence, or obtundation
2. **Nuchal rigidity** and positive **Kernig** (inability to extend the knee when the thigh is flexed 90° at the hip) and **Brudzinski** (the thighs and legs involuntarily flex when the neck is flexed) **signs**. These signs indicate inflammation of sensory nerves and are less reliably present in infants and young children.
3. **Seizures** (20–30% of children have a seizure before or at the time of admission)
4. **Photophobia**
5. **Emesis**
6. **Headache**. Both emesis and headache are symptoms of increased intracranial pressure.

4. **Diagnosis.** Index of suspicion for bacterial meningitis should be especially high in **febrile, irritable infants**. Evaluation of all children with suspected bacterial meningitis should include the following:

a. **Lumbar puncture**, which may demonstrate

1. **Pleocytosis** with a predominance of **neutrophils**. The CSF WBC count often exceeds 5000 cells/mm³, but early in the course the cell count may be lower.
2. **Hypoglycorrhachia** (low CSF glucose) — ratio of CSF glucose to serum glucose <0.40 and CSF glucose typically <40 mg/dL.
3. **Increased protein**—typically 100–500 mg/dL
4. **Increased intracranial pressure** (in older children)
5. **Positive Gram stain and/or culture**
6. Bacterial antigens may be tested but have a low sensitivity and are not recommended on a routine basis.
7. Pretreatment with antibiotics may sterilize the CSF culture but should not alter the aforementioned CSF cellular and biochemical profile.
8. See **Table 7-3** for a comparison of the CSF profile in bacterial, viral, tuberculous, and fungal meningitis.
9. **Interpretation of a traumatic lumbar puncture:** Lumbar punctures that contain a large number of red blood cells (RBCs) are difficult to interpret, but a correction can be calculated that accounts for the ratio of WBCs and RBCs in the serum from the patient's CBC. For patients with a normal peripheral WBC count, a rough estimation is that one WBC in the CSF may account for every 500 RBCs in the CSF.

b. **Blood culture** is positive in most cases of bacterial meningitis.

c. **CT scan with contrast** to evaluate for brain abscess is often recommended, especially for patients with focal neurologic findings or altered mental status.

4. Neurologic signs

- * Stupor & drowsiness.
- * Convulsions → usually generalized
- * Coma

Clinical types

1- Meningitic form → the classic presentation as before.

2- Fulminant meningitis.

- Abrupt fever.
- Severe headache and convulsions.
- Rapidly progress to coma.
- Fatal within 48 hrs.

3- Septicemic form (usually complicating meningococcal form)

- Very bad general condition
- Shock
- Purpura & ecchymosis
- Meningitis develop within 1-2 days (or not at all)

Look at page 8, please

Condition	Appearance	Pressure (mmHg)	Protein (mg/dl)	Glucose (mg/dl)	Leukocytes / ml	Organism
Normal CSF	Clear	50 - 80	5 - 20	40-80	0-5 (monocytes)	Nil
Bacterial meningitis	Turbid	↑↑	↑↑ (> 100)	↓↓	↑↑ (100-60,000) Mainly PMNLs	* +ve Gram stain * +ve culture
TB meningitis	Web On stand	↑↑	↑↑ (> 100)	↓↓	↑ (10-500) Early PMNLs then lymphocytes	* Acid fast bacilli by zehl nelsen stain.
Viral meningitis	Clear	Normal or slightly ↑	Mild ↑ (< 100)	Normal or ↓↓	↑ (10-500) Early PMNLs later mononuclear cells predominate	* Viruses may be isolated

CONDITION	PRESSURE (cm H ₂ O)	LEUKOCYTES (cells/ μ L)	PROTEIN (mg/dL)	GLUCOSE (mg/dL)	COMMENTS
Normal	10-20	<5; 60-70% lymphocytes, 30-40% monocytes, 1-3% neutrophils	20-45	>50% of serum glucose	WBC up to 10-20 cells/ μ L can be normal in neonates
Acute bacterial meningitis	Usually elevated (>25)	>100; usually thousands; PMNs predominate	100-500	Usually <40 or <40% of serum glucose	Organisms may be seen on Gram stain and recovered by culture
Partially treated bacterial meningitis	Normal or elevated	1-10,000; PMNs usual but mononuclear cells may predominate if pretreated for extended period	>100	Depressed or normal	Organisms may be seen; pretreatment may render CSF sterile but bacteria may be detected by PCR
Tuberculous meningitis	Usually elevated; may be low because of CSF block in advanced stages	10-500; PMNs early but lymphocytes and monocytes predominate later	100-500; may be higher in presence of CSF block	Usually <50; decreases with time if treatment not provided	Acid-fast organisms may be seen on smear; organisms can be recovered in culture or by PCR. Adenine deaminase or gamma interferon levels can be used to aid in the diagnosis.
Fungal	Usually elevated	10-500; PMNs early; mononuclear cells predominate later	20-500	Usually <50; decreases with time if treatment not provided	Budding yeast may be seen; organisms may be recovered in culture; India ink preparation and antigen may be positive in cryptococcal disease
Viral meningitis or meningoencephalitis	Normal or slightly elevated	10-1,000; PMNs early; mononuclear cells predominate later	<50	Generally normal; may be depressed to 40 in some viral diseases (in 15-20% of mumps)	Viruses may be detected by PCR
Abscess (parameningeal infection)	Normal or elevated	0-100 PMNs unless rupture into CSF	20-200	Normal	Profile may be completely normal

5. Management. Early, empiric treatment of bacterial meningitis is critical.

a. Antibiotic therapy varies based on age of child and the most likely pathogens, as follows:

1. **Newborns (0–28 days):** Ampicillin plus aminoglycoside or a third-generation cephalosporin. Intravenous acyclovir for possible HSV infection should also be considered for ill neonates, especially those presenting with apnea, seizures, or cutaneous vesicles.
2. **Young infants (1–3 months):** Ampicillin (for *Listeria monocytogenes* coverage) plus a third-generation cephalosporin. Vancomycin should be added if bacterial meningitis is highly suspected, to cover for highly resistant *S. pneumoniae*.
3. **Older infants and children (>3 months):** Third-generation cephalosporin. Vancomycin should be added if bacterial meningitis is highly suspected, to cover for highly resistant *S. pneumoniae*.

* Parenteral antibiotics according to culture and sensitivity for 2- 4 weeks

* While waiting for culture results ;the following combination is recommended:
Ampicillin 200 mg/kg/d + 3rd generation cephalosporins 100- 200 mg/kg/d

* In suspected organisms:

Meningococci	- Penicillin G 400.000 unit/kg/d.
H.influenza	- Ceftriaxone100mg/kg/day
Pneumococci	- Vancomycin 60 mg/kg /day + 3 rd generation cephalosporin (cefotaxime 200mg/kg/day or ceftriaxone) - Chloramphenicol 100mg/kg/day
Pseudomonas	- Ceftazidime
Listeria	- Ampicillin

Table 7-1

Typical Bacterial Pathogens and Empiric Antibiotics for Infants and Children with Suspected Sepsis or Meningitis

Age	Bacterial Pathogens	Empiric Intravenous Antibiotics
0–1 month	Group B streptococcus	Ampicillin + gentamicin or ampicillin + cefotaxime
	<i>Escherichia coli</i>	
	<i>Listeria monocytogenes</i>	
1–3 months	Group B streptococcus	Ampicillin + cefotaxime (add vancomycin* if bacterial meningitis is suspected)
	<i>Streptococcus pneumoniae</i>	
	<i>Listeria monocytogenes</i>	
3 months–3 years	<i>Streptococcus pneumoniae</i>	Cefotaxime (add vancomycin* if bacterial meningitis is suspected)
	<i>Neisseria meningitidis</i> <i>Haemophilus influenzae</i> type b	
3 years–adult	<i>Streptococcus pneumoniae</i>	Cefotaxime (add vancomycin* if bacterial meningitis is suspected)
	<i>Neisseria meningitidis</i>	

*Vancomycin is added to empiric coverage if bacterial meningitis is suspected to cover for highly resistant *S. pneumoniae*.

b. **Corticosteroids** given before or with the first dose of antibiotics have been shown to be effective at reducing the incidence of hearing loss in HIB meningitis. Efficacy in other causes of bacterial meningitis has not been as clearly demonstrated. If corticosteroids are given, they should be administered before or with the first dose of antibiotics for maximum benefit, and should only be administered to children outside the neonatal period. Dexamethasone is given for a 2–4-day regimen (0.6 mg/kg per day) divided into four daily doses.

c. **Supportive care.** Children presenting with meningitis typically have been ill for a few days and may be moderately dehydrated. Management should include attention to fluids with rehydration to normovolemic status, followed by administration of maintenance fluids with close attention to vital signs, urine output, specific gravity, and serum sodium to monitor for the development of the syndrome of inappropriate release of antidiuretic hormone (SIADH).

✧ Measures to ↓ ICT:

- Hyperventilation to keep paco₂ at 25 mmHg
- Mannitol 0.5 – 1gm/kg iv
- Furosemide 1mg/kg iv

✧ Corticosteroids

Indications:

a- H. influenza meningitis:

- Value: Reduce inflammatory response caused by cell lysis
- Use dexamethazone 0.15 mg/kg/dose every 6 hours for 2 days

b- Septic shock to improve general condition.

c- Adrenal failure

✧ Treatment of convulsions:

- Immediate relief by diazepam or lorazepam
- Then phenytoin loading and maintenance

✧ Treatment of complications

B. Prevention:

- Isolation of the case
- Vaccination against H.influenza, meningococci, pneumococci.
- Chemoprophylaxis for contacts: e.g. rifampicin 10-20 mg/kg/day ⇒ for 2-4 days.

Prognosis Depends on:

- 1- Age: the younger the age, the worse the prognosis.
- 2- Course: fulminant meningitis has worse prognosis.
- 3- Cause:
 - E.coli & staph → ↑ fatality & ↑ long term sequelae.
 - H.influenza & pneumococci → moderate prognosis.
 - Meningococci → < 5% fatality & no residual disability.

6. **Complications.** Complication rates are highest following meningitis caused by Gram-negative organisms, followed by *S. pneumoniae*, HIB, and finally, *Neisseria meningitidis*.

Mortality rates range from 5 to 50% depending on the infecting bacterial species.

- a. **Hearing loss** is the most common complication, occurring in up to 25% of patients.
- b. **Global brain injury** occurs in 5–10% of patients.
- c. Other complications include **SIADH**, seizures, hydrocephalus, brain abscess, cranial nerve palsy, learning disability, and focal neurologic deficits.

Second: Aseptic meningitis:

C. Aseptic meningitis

1. **Definition.** Aseptic meningitis is the inflammation of the meninges with a CSF lymphocytic pleocytosis and, if caused by a virus, normal CSF glucose and normal to minimally elevated CSF protein.
2. **Etiology** (Table 7-4). Most causes of aseptic meningitis are viral.

Causes of Aseptic Meningitis

Viral meningitis (most common cause of aseptic meningitis). If infection also involves the brain, it is termed a meningoencephalitis.
Enteroviruses (most common cause of viral meningitis in the United States; most common in the summer and fall)
Mumps
Lymphocytic choriomeningitis
Herpes viruses (herpes simplex virus, Epstein-Barr virus, cytomegalovirus, varicella zoster virus, human herpes viruses 6 and 7) Human immunodeficiency virus Parechoviruses
Viruses that commonly cause encephalitis include arboviruses (St. Louis, Western equine, Eastern equine, and West Nile virus), influenza , and the herpes viruses
Bacterial causes (some bacteria may cause an aseptic picture)
Mycobacterium tuberculosis (most commonly seen in children younger than 5 years of age)
Borrelia burgdorferi (Lyme disease)
Treponema pallidum (syphilis) <i>Brucella</i> spp.
Fungal causes
Coccidioides immitis
Cryptococcus neoformans
Histoplasmosis capsulatum
Parasitic causes
Taenia solium (etiologic agent of cysticercosis)
Toxoplasma gondii (in immunocompromised patients) Roundworms: <i>Baylisascaris procyonis</i> causes an eosinophilic meningitis <i>Naegleria fowleri</i>
Noninfectious causes
Kawasaki disease
Medications (sulfa, intravenous immune globulin [IVIG])
Autoimmune conditions (systemic lupus erythematosus [SLE])

4. **Diagnosis** (see **Table 7-3** for the CSF findings commonly seen in viral, fungal, tuberculous, and bacterial meningitis)

a. **Viral meningitis**

1. **Viral culture of the CSF** may be performed; however, the virus may not grow for 10–14 days, if it grows at all.
2. **PCR technology** is available for the detection of EBV, CMV, HSV, VZV, and enteroviruses.
3. **Positive surface cultures** for enterovirus from throat and/or rectum may be suggestive in cases of enteroviral meningitis.

b. **TB meningitis.** CSF findings include lymphocytic pleocytosis, hypoglycorrhachia, and dramatically elevated protein. Brain imaging shows a characteristic **basilar enhancement**. Positive CSF acid-fast bacilli (AFB) stains (although rarely positive in TB meningitis), positive culture (may take as long as 6 weeks for growth), or positive PCR findings are diagnostic. **Fifty percent of patients have a negative chest radiograph and tuberculin skin test at the time of presentation.**

c. **Diagnostic studies that may identify other causes of aseptic meningitis** include CSF rapid plasma reagent (RPR) for syphilis; India ink for fungus (cryptococcus) and cryptococcal antigen tests; and CSF and serum antibody testing for coccidioidomycosis, Lyme disease, rickettsial disease, and cysticercosis.

Cerebrospinal Fluid Profiles in Meningitis

Pathogen	WBC Differential (cells/mm ³)	Protein	Glucose	Gram Stain, Culture, and Other Definitive Tests
Acute bacterial	100–50,000	High	Low	Positive culture and Gram stain
	PMNs predominate			
Partially treated bacterial	1000–10,000 Monos predominate	Normal to high	Low normal	Negative culture and usually negative Gram stain (+) CSF bacterial antigens
Viral	10–1000 PMNs early, then monos + lymphs HSV encephalitis may show RBCs	Normal to minimally elevated	Normal	Enterovirus may be recovered by culture
				Enterovirus and HSV may be identified by PCR
Tuberculosis	10–500 Lymphs predominate	Very high	Low to very low	AFB smear and culture rarely positive PCR may be positive
Fungal	25–500 Lymphs predominate	Normal to high	Low	Culture may be positive
				For cryptococcal meningitis, India ink and cryptococcal antigen are positive
				For coccidioidal meningitis, cocci antibody is positive
Parameningeal focus (brain abscess)	10–200	High	Normal	Negative culture
	PMNs or monos predominate			

AFB = acid-fast bacilli; PMNs = polymorphonuclear cells; monos = mononuclear cells; lymphs = lymphocytes; CSF = cerebrospinal fluid; PCR = polymerase chain reaction; RBCs = red blood cells; HSV = herpes simplex virus; WBC = white blood cell.

5. **Management**

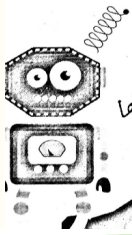
- a. Most causes of viral meningitis are self-limited.
- b. TB meningitis is treated with four medications, including isoniazid, rifampin, pyrazinamide, and streptomycin or a fluoroquinolone (levofloxacin). Corticosteroids are also commonly used to manage brain inflammation and elevated intracranial pressure.

6. **Prognosis** of aseptic meningitis is dependent on the causative agent, and ranges from excellent in enteroviral meningitis to poor in TB meningitis (20% mortality in young children).

Meningococemia

meningococemia :

① clinical manifestation : Fever, sore throat, cough, arthralgia, myalgia, URTI



② petechial rash : Diagnostic
7% maculopapular rash
Not appear

Droplet infection
week
(خفاف العنق / الكبار / الكبار / الكبار)

③ poor prognostic factors = Fulminant meningococemia :

- WBC low / Normal
- ESR low / normal
- rash appear < 12h
- platelet low < 100,000
- No meningitis
- shock / hypotension
- age < 2 years

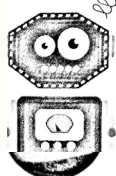
rash :
- purple
- palpable
- nonblanchable
extravasation
petech : < 2 m
purpura : > 1 cm
echymosis : > 1 cm

④ meningococemia Neisseria meningitidis

- gram - diplococci
- alot of strains, 5 strains for humans :
A B C W135 Y

vaccine
non-immunogenic

quadrivalent vaccine
conjugate polysaccharide vaccine



Risky for fulminant N. in adult
C5 - C6 - C7 - C8 - C9 deficiency
Previously healthy

Shock

meningitis
LP

gram - diplococci
N. meningitidis

Sepsis

⑤ investigation : CBC : WBC / platelet / Hgb

Blood gases : metabolic acidosis
in shock

Full chemistry : Na⁺ / K⁺ / Ca⁺ / sugar

Sepsis / septic shock / severe sepsis can be complicated by electrolyte imbalance

Kidney fun / liver fun

PTT / PT : prognostic for DIC

CXR : infiltration / ARDS

CST : meningitis

⑥ management : 3rd generation cephalosporins

penicillin
meningitis

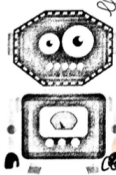
Brain Barrier

vital sign, if shock

give shock therapy (3-4 times) can be repeated

central venous pressure

fluid therapy



antibiotic

Fluid therapy

therapy Dopamine adrenaline

Corticosteroid therapy, used in Resistant hypotension

Not respond to fluid therapy

Complication

suprarenal gland hemorrhage

Nessiria hemophilus

Shock + sepsis = stress condition

physiologic dose

10-20 mg/m²

stress dose

50-100 mg/m² once daily

duration of treatment = 5-7 days

Complication of meningococemia

Pneumonia pericarditis

4-5 days

develop fever / arthritis / pericardial effusion

immune mediated reaction on Ness

Joint swelling

heart enlarge => x-ray

pericardial effusion => Echo

purpura fulminans

hypercoagulation

periphery

gangrenous lesions

consumption of platelets

coagulation factors

DIC

Shock therapy

meningitis / UTI

convulsion / Ricketts

Waterhouse-Friderichsen Syndrome

- Neisseria meningitidis sepsis
- Septic Shock and bleeding into adrenal gland
- Petechial skin lesions (bleeding into skin)
- Death within 12-48 hours



- N.B:
- In an infant with meningococemia, watch out for Waterhouse-Friderichsen syndrome, which is characterized by a sudden vasomotor collapse and skin rash (large purpuric lesions on the flanks) due to adrenal hemorrhage.
- Fulminant meningococemia can occur after a meningococcus infection, and approximately 10-20% of infants present with vasomotor collapse, large petechiae and purpuric lesions. The condition carries an almost 100% mortality.

يلا نمر ع تلخيص النصر ع السريع مع هايلات

على النقاط الإضافية

(As revision)

Meningitis = inflammation of meninges

⊛ Etiology:

1. Non-infectious: - IVIG = cause aseptic meningitis and anaphylactic shock

IVIG (تصليب الـ adolescent بعد 10 أيام من أخذ الـ)

- Malignancy = leukemia, lymphoma, mets

It cause infiltration in meninges.

- Autoimmune = SLE, Sarcoid, Behcet.

- Drugs = NSAIDs, vaccination.

2. Infectious: - viral infection = most common

* Enterovirus = Polio, Coxsacki, Echovirus

* Others = Parainfluenza, Influenza, adenovirus

Echovirus & coxsacki are common causes of meningitis

Polio is a rare cause of meningitis

Polio cause Flaccid paralysis, but decreased by vaccine.

- Bacterial infection

< 3 months = Group B strept. [GBS]

> 3 months = Strept. pneumonia & MCC

N. meningitidis

H. influenzae

post. surgical/head injury = Staph aureus/epidermidis

post. VP shunt = S. epidermidis

post cochlear implant = S. pneumonia

⊛ Clinical manifestation:

- Fever 99% (early infancy could be afebrile)

- Vomiting - irritability

- Poor intake - bulging fontanelle } in neonate

- Convulsion - poor suckling

- headache

- photophobia

- Neck stiffness 70%

من كل مرض الـ meningitis بجوا أعراض الـ meningitis واحدة

خاصة بالأطفال في عمرهم أقل من سنتين

* Neck stiffness: 70% ⊕

عشان أختبرها هل + أو لا -

تأجيل الطفل نينا. وبأشبه عشان ما يشد على حلقه

وبأشبه Flexion of Neck إذا كانت أكثر من 90°

Smooth Normal ⊕

⊕ Neck stiffness: resistant أو لو صار يهبط مثلاً

لو بيجبره هيلك. لأنه هيكون مؤلم

بالأطفال الأكبر سنًا بجرط ايدي على عنقه وبأشبه يجيب قفله على أيديه

other causes of Neck stiffness:

- trauma

- Rt upper lobe pneumonia

- Retropharyngeal abscess

- Severe tonsillitis

* Brudzinksi's Sign: 30% ⊕

- Neck to Leg = When I flex the neck the pt. will flex his hip & knee.

- Leg to Leg = flexion of hip & knee cause flexion of other hip & knee.

* Kerning's Sign:

flexion of hip & knee then extension of lower limb

if ⊕ will cause pain in the back and thigh.

⊛ Triad of meningitis in children:

1. Fever

signs الـ fever

2. vomiting

Don't exclude meningitis

3. headache

without other focus of fever [as pneumonia]

⊛ Investigations:

1. CBC = ↑ WBC

if WBC > 25×10^3 with 90% neutrophils it suggest bacterial infec.

Normal WBC don't exclude meningitis.

2. Chemistry = Na^+ , Sugar, urea ⇒ average

K^+ , Ca^{2+} ⇒ as routine

3. Lumbar puncture LP =

* Contraindications of LP

Absolute

- ↑ ICP

- cardiopulmonary compromise

- infected skin of area L3 & L4 أو L2 & L3

Relative

- Thrombocytopenia = in neonate $< 100 \times 10^3$

child $< 50 \times 10^3$

This relative, because I can transfuse Platelets

then do LP.

⊕ ICP في الـ 8

* If age < 1 year with

- open fontanelle either bulged or not → Do LP. عادي

closed fontanelle → Don't

* لو كانت الـ Fontanelle فاتحة أو الـ sutures مش مسكرة

يعني لما يزيد الـ ICP كل الـ pressure الزايد بطلع لفرق

فلما أعمل LP ما بيجبر. hernia

لكن لو كانت الـ Fontanelle مسكرة فمخاطرة hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

في الـ LP. risk for hernia

④ Significant ↑ ICP signs:

1. C.T. shows Brain edema.
2. Fundoscopy shows papillary edema.
3. cranial Nerve palsies.
4. Significant alteration of consciousness [coma].
5. Focal lesions [paralysis in arm or leg].
6. Focal or intractable convulsions.

قبل الـ LP لازم تعمل C.T. لكون لوطلع الـ C.T. يمنع.

لما مش هاعمل LP حتى لو علمنا بنفع عمل.

بالفعل لازم أعماله stabilization

وبأعطيه 3rd g. cephalo

vancomycin

acyclovir

④ How LP done?

- Sitting position OR - lying position

لو كان الطفل unstable بنجده على بطنه وبنقوم

أصغر canula وناخذ أقل كمية مطلوبة من الـ CSF

- needle inserted in L₃-L₄ space at line between iliac creases.

Three CSF specim collected:

① Cells, proteins, Sugar = النتيجة بعد ساعة ونصف

② culture & sensitivity = 2-3 days

③ Gram stain = النتيجة بعد few hours

④ CSF profile:

	Normal	abnormal
- Pressure	50-80 mmHg (by manometer)	150 = mild elevation >300 = significant
- Color	colorless	any color
- protein	20-45 mg/dl	>120 = elevated
- Sugar	50-70% of Bld sugar	<50% is hypoglycorrhachia suspect bacterial infection
- cells No	<5	>5
- " type	lymphocytes	>25% Neutrophils

① Pressure:

وأنا ياخذ العينه لازم يكون dripping من gush مرة واحدة
لازم هادة يكون دليل على ↑ ICP

② Color:

Normal is clear or colorless, any color or turbid is abnormal.

③ Cells:

Number = <5 normal

>5 abnormal

Type = lymphocytes is abnormal

>25% Neutrophil is abnormal

④ protein ⑤ Sugar

⑥ Gram stain: G- diplococci = N. meningitidis

G+ diplococci = Staph

* hypoglycorrhachia =

suspect bacterial infection

herpes virus

mumps [if <20%]

* لما أسحب عينة الدم والـ CSF من أسحب قبل 2

بأسحب عينة الدم قبل 30-60 دقيقة من الـ CSF

لاي لفت أسحب الـ LP بأعمل stress هيعاني السكر بالدم

فوقها الـ CSF مش هياخد يعني لو ع 2 ساعة هيك استن عليه

* كيف أختر هل عندي السبب viral ولا bacterial?

① Definitive tests are PCR (antigen)

or Latex agglutination test (antibody)

لكن هيفل مش موجودين عننا

② From CSF =

	Viral (mostly aseptic)	Bacterial
- cells No	<1000	>1000
- " type	lymphocytes	Neutrophils mainly
- Sugar	Normal	low
- protein	Normal	high

④ How to manage?

cells <1000 = 3rd g. cephalo for 2 days

>5000 = 3rd g. cephalo

+ vancomycin + dexamethasone

cells <500 = viral 3rd g. cephalosporin

>500 = Bacterial 3rd g. cephalo

+ vancomycin

+ dexamethasone

105

vanco → For resistant Staph (Strep pneumonia)

dexam → to prevent deafness

* if hemophylus

* Any case of meningitis should be admitted

④ meningitis score:

- Convulsion = 1 point

- Neutrophils >10 x 10³ = 1 point

- Protein >80 = 1 point

- Gram (+) = 2 point

→ Score 0 = viral infection

1 = suspected bacterial

2 = Bacterial

gram (-) Bacterial لو كانت

dexam 10 / vanco الـ 3rd g. cephalo

* لو كان conscious و convulsion و toxic look

بأعطيه كل اشئ مع acyclovir

حتى لو كانت cells أقل من 500

وبأعطيه meningococcalitis

④ Duration of ttt:

لما تطع المزرعة بعد على نوع الـ organism

① N. meningitidis: 5-7 days cephalosporin

بحيث يكون 3-5 أياما ببعث حرارة وبأوقف

dexa & vanco الـ

② H. influenzae: 7-10 days

بحيث يكون 3-5 أياما بدون حرارة

③ S. pneumonia: 10-14 days

بحيث يكون 3-5 أياما بدون حرارة

- 7/11/2019 11:00 AM

نوعه * Rifampin : 20 mg / kg / dose
twice daily for 2 days.

adult dose = 300 mg , twice for 2 days.

SE = ① gastric upset

② discoloration of all body secretions.

if pregnant = cephtriaxone

250 mg IM for once

أو cefepoxacin

500 mg tablet for once

② S. pneumonia = No prophylaxis

③ H. influenza =

نوعه * Rifampicin : 20 mg / kg / once per day
for 4 days.

بشوف هل عنده أخوة عمرهم أقل من 4 سنوات

① إذا عنده

هل هو vaccinated أم لا

إذا لا يأخذ لقاحه و يأخذ اللقاح

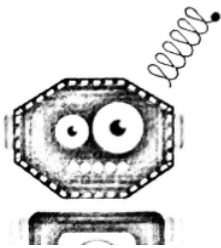
② إذا عنده لا immunodeficiency

أو لا spleen أو قديم

→ SC Anemia , 1

nephritic & أو ITP أو

في أخذ لقاحه أو يأخذ اللقاح



* Spleen produce properdin complex that activate
the alternative pathway of complements

if not present → pt become risk for

Bacterial infection

* *Neisseria* can be fatal for adults causing fulminant
meningococemia

- Fatal for pt with immunodeficiency C6, 7, 8, 9

- Risk for S. pneumonia " C2, C4