Medicine
TEAM 437

MED437
KING SAUD UNIVERSITY

CNS Infections

Objectives :

Not given.

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Resources :

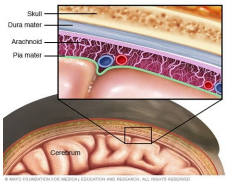
- 437 slides | Not Same 436's slides
- Teamwork 436
- Doctor notes | Dr.Abdulrazaq albilali

Meningitis

Video

Definitions:

- Meningitis – inflammation of the pia mater and the arachnoid mater (dura mater is usually spared),with suppuration of the cerebrospinal fluid.
- Encephalitis – infection of the brain parenchyma.
- Meningoencephalitis – inflammation of brain + meninges.
- Aseptic meningitis – inflammation of meninges with sterile CSF.



❖ Causes of meningitis:

Infectious:

- Viral
- Bacterial
- Mycobacterial
- Brucella (common in SA)
- fungal

Non-infectious:

- Aseptic meningitis
- Malignancy e.g. lymphoma
- sarcoid
- Behcet disease
- SLE

Symptoms	Signs

Early meningitis symptoms may mimic the flu (influenza). Symptoms may develop over several hours or over a few days.
Possible signs and symptoms:
• Sudden high fever
• Stiff neck
• Severe headache
• Headache with nausea or vomiting
• Confusion (usually with encephalitis) or difficulty concentrating
• Seizures
• Sleepiness or difficulty waking
• Sensitivity to light (Photophobia)
• No appetite or thirst
• Skin rash (sometimes, such as in meningococcal meningitis)
	• No focal neurologic deficits in the majority of cases.
	• **Focal neurologic signs**
	  ○ Isolated cranial nerve abnormalities (principally of cranial nerves III, IV, VI, and VII).
	  ○ Focal cerebral signs as a result of ischemia from vascular inflammation and thrombosis.
	  ○ Nuchal rigidity
	  ○ Papilledema
	• **Examination for nuchal rigidity**
	  ○ The Kernig sign, Brudzinski sign
	
	Most useful Sign:
	
	Jolt accentuation maneuver: ask patient to rapidly rotate his or her head horizontally: Headache worsens
	
	Sensitivity of 100%, specificity of 54%, positive likelihood ratio of 2.2, and negative likelihood ratio of 0 for the diagnosis of **meningitis**

❖ Differential Diagnosis

- Infectious encephalopathies
  - – Cerebral malaria
  - – Enteric encephalopathy
  - – Shigella encephalopathy
  - – Sepsis
- Structural lesions with fever eg stroke/ tumour
- Non infectious encephalopathy with fever eg Reye's, electrolyte encephalopathy

Bacterial Meningitis:

Acute bacterial Meningitis (ABM):

- Very common & serious
- Medical emergency
- 100% curable if treated adequately or 100% fatal
- High index of suspicion important
- Dx by CSF examination

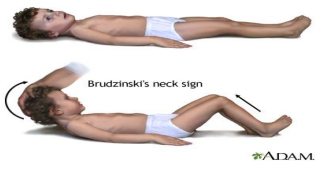
Symptoms of Bacterial Meningitis

- High grade sudden fever
- Severe Headache
- Altered level consciousness, irritability, photophobia
- Vomiting
- Seizures
- Stiff neck
- Bulging fontanel in infants
- ↑ICP: hypertension, bradycardia, bulging AF, 3rd/6th cranial nerve palsy, posturing, breathing abnormalities.

Signs:

The Kernig sign

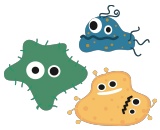
- Vital signs: **Fever**
- Nuchal rigidity
- **Kernig's sign:** while patient is lying supine, with the hip and knee flexed to 90 degrees pain limits passive extension of the knee.
- **Brudzinski's sign:** flexion of the neck causes involuntary flexion of the knee and hip. (both these signs appear late though so keep that in mind)
- Papilledema due to increased ICP
- Neurological deficit
- Don't forget source of infection: ears, sinuses, chest..etc
- Petechiae, ecchymosis



Brudzinski sign

- Absence of all 3 signs of the classic triad of fever, neck stiffness, and an altered mental status virtually eliminates a diagnosis of meningitis
- Changes in mental status are more common in bacterial than viral meningitis
- Kernig and Brudzinski signs have low sensitivity but high specificity

Bacterial Pathogens



- **Neonates**
  - Group B *Streptococci (colonized in maternal vagina)*49%, *E coli,* enterococci,*Klebsiella, Enterobacter, salmonella, Serratia, Listeria.*
- **Older infants and children**
  - *Neisseria meningitidis (common in crowded places and seen in epidemics), S. pneumoniae, M.tuberculosis, H. influenzae*
- **Adults**
  - *Streptococcus pneumonia*.....37% most common cause of bacterial meningitis in infants, young children and adults in the United States.
  - *Neisseria meningitidis*.....13% a highly contagious infection that affects mainly teenagers and young adults.
  - *Listeria monocytogenes*....10% Pregnant women, newborns, Alcoholics, older adults and people with weakened immune systems are most susceptible,
  - Other strept.species.....7%
  - Gram negative.....4%
  - *Haemophilus influenzae*.....4%
  - TB, Brucella

Keep in mind

- Global emergence and prevalence of Penicillin- Resistant *Streptococcus pneumoniae*
- Dramatic Reduction in invasive *Haemophilus influenzae* disease secondary to use of conjugate *Haemophilus Type B- vaccine*
- Group B – *Streptococci*: previously in neonate: now emerging as disease of elderly

ABM Pathology:

- Bacterial colonization of nasopharynx → bacteremia → choroid plexus → meninges.
- Meningeal exudates, ventriculitis, perivascular inflammatory exudates, venous occlusion, infarction, necrosis, ↑ICT.
- Role of cytokines.

Complications	Sequelae
• Hydrocephalus (in pediatrics) • Seizures • SIADH (present with persistent hyponatremia) • Subdural effusions & empyema • Septic sinus or cortical vein thrombosis • Arterial ischemia / infarction (inflammatory vasculitis) • CN Palsies (esp deafness) • Septic shock / multi-organ failure from bacteremia (esp meningococcus & pneumococcus) • Risk of adrenal hemorrhage with hypo-adrenalism (Waterhouse-Friderichsen syndrome)	• Deafness • Brain damage • Hydrocephalus sequela is very specifically something that is leftover after a disease

DDx:

– TBM

– Viral meningoencephalitis

– Aseptic meningitis

– Other

Investigations:

- High index of suspicion very important
- Confirm by CSF examination
- LP delayed if there is contraindication e.g. Skin infection near the site or raised ICP or bleeding tendency. (rule out high ICP by fundoscopy and CT, Ask for use of Anticoagulants before doing an LP)
- Start empirical antibiotics on suspicion and don't wait for the results of LP!
- CBC, Creatinine, electrolytes: Na
- Blood Culture
- CXR
- CT Head
- **CSF analysis (**unless there is evidence of a space-occupying lesion)
    - Remember to be careful:
    - Increased ICP may increase risk of herniation Lowering of CSF pressure from withdrawal of CSF could precipitate herniation of the brain.
    - Cellulitis at area of lumbar puncture
    - Bleeding disorder
- CSF: ↑Pressure, turbid, ↑cells (mostly polys), ↑protein, ↓sugar to < 40% of blood sugar, gram stain positive in 75% to 80% of patients with bacterial meningitis.

Before a lumbar puncture:

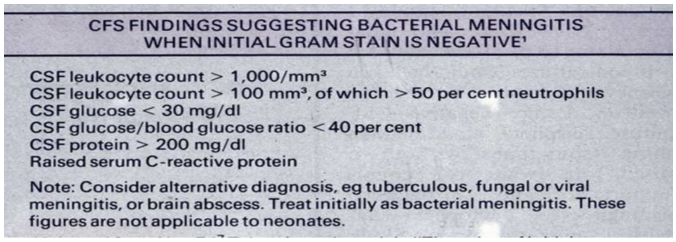
- Generally, patients with suspected meningitis require brain imaging before the LP

⚠ Warning signs that mandate an image:

  - Altered consciousness
  - Focal neurological deficits
  - Papilledema or cranial nerve palsies
  - Seizure
  - Neurological deficits

CSF analysis: (IMPORTANT)

- Appearance, opening pressure (done by connecting a barometer and checking the pressure as soon as you insert the needle, not specific)
- Cell count with differential (high neutrophils in Bacterial meningitis)
- Glucose (very specific for bacterial meningitis, compare it with glucose in the blood in DM), protein
- CSF appearance
- **Gram stain (takes time)**
- **Culture**
- TB AFB smear PCR and culture
- Brucella serology and PCR (in case of animal contact or unpasteurized milk)
- HSV PCR (for encephalitis)
- Multiplex viral PCR
- Cryptococcus antigen (fungal infection common in immunocompromised patients and HIV)



CFS FINDINGS SUGGESTING BACTERIAL MENINGITIS WHEN INITIAL GRAM STAIN IS NEGATIVE[1]

CSF leukocyte count > 1,000/mm³
CSF leukocyte count > 100 mm³, of which > 50 per cent neutrophils
CSF glucose < 30 mg/dl
CSF glucose/blood glucose ratio < 40 per cent
CSF protein > 200 mg/dl
Raised serum C-reactive protein

Note: Consider alternative diagnosis, eg tuberculous, fungal or viral meningitis, or brain abscess. Treat initially as bacterial meningitis. These figures are not applicable to neonates.

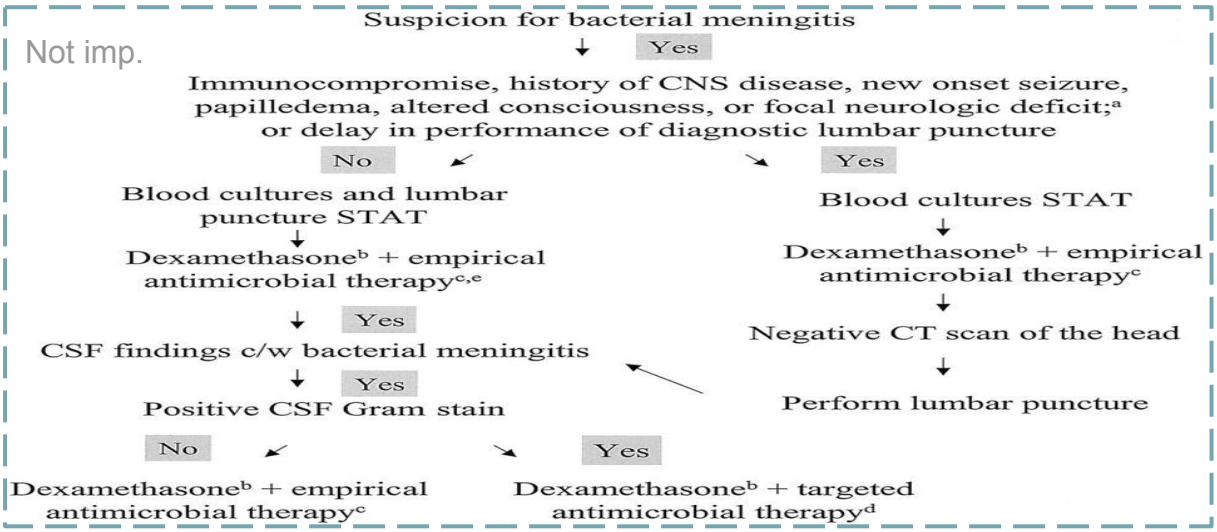
Table 1 | Typical cerebrospinal fluid (CSF) findings in infectious meningitis[1 3 14]

Cause of meningitis	White blood cell count (cells/mm³/10⁶ cells/l)	Predominant cell type	CSF: serum glucose (normal ≥0.5)	Protein (g/l) (normal 0.2-0.4)
Viral	50-1000	Mononuclear (may be neutrophilic early in course)	>0.5	0.4-0.8
Bacterial	100-5000	Neutrophilic (mononuclear after antibiotics)	<0.5	0.5-2.0
Tuberculous	50-300	Mononuclear	<0.3	0.5-3.0
Cryptococcal	20-500	Mononuclear	<0.5	0.5-3.0

Bacterial Meningitis - Empiric Treatment (Gram stain Negative) **(no need to know the doses)**

- Ceftriaxone 2gm **IV** Q12h
  – High CSF levels
- Vancomycin 500-750 mg IV Q6h (for highly penicillin resistant *pneumococcus*)
- Dexamethasone (to suppress acute inflammation not used in chronic (0.15mg/kg IV Q6h) for 2-4 days :
  - 1st dose 15-20 min prior to or concomitant with 1st dose antibiotic to block TNF production
- Ampicillin IV if Listeria suspected (age >55 yrs, immunosuppressed)
- Management of ↑ICT : mannitol, glycerine, acetazolamide
- Tt of Seizures, pyrexia
- Treat shock, DIC if present
- Add Acyclovir for herpes Encephalitis
- Add amphotericin B or fluconazole for fungal infections

Not imp.



- Vaccination:
  - Vaccinate all adults >65 years for S. pneumoniae.
  - Vaccinate asplenic patients for S. pneumoniae, N. meningitidis, and H.
  - influenzae (encapsulated organisms).
  - Vaccinate immunocompromised patients for N. meningitidis.
- Prophylaxis (e.g., rifampin or ceftriaxone)—for all close contacts of patients with meningococcus.

Meningococcus

(Neisseria meningitidis, more common in children and adolescents)

- Fulminant meningococcemia with purpura:
  - Overwhelming sepsis, DIC
- Meningitis with rash (Petechiae) classic
- Meningitis without rash
- Mortality 3 - 10 %

Treatment & Chemoprophylaxis

- Droplet Isolation: 48h post antibiotics
- **Treatment: Ceftriaxone or Pen G 7 days**
- Eradicate nasopharyngeal carriage:
  - Household contact
  - Health care providers who examined patient closely
- Rifampin 600 mg for 2 d
- Or Ciprofloxacin 500mg once
- Or Ceftriaxone 125 mg I.M once

Pneumococcal meningitis *(S. pneumoniae)*

- The most common Cause
- Highest mortality 20 – 30%
- May be associated with other Focus: Pneumonia, Otitis Media, Sinusitis
- Head Trauma & CSF Leak
- splenectomy and Sickle cell disease
- Global emergence of Penicillin – Resistant

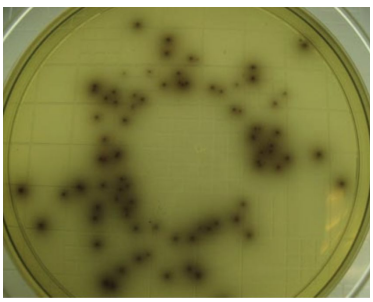
Listeria Monocytogenes

Risk groups:

- Age <1y or >50y
- Alcoholics
- Pregnancy: up to 30%
- Immunocompromised 70 %

Routes of transmission:

- Mainly food borne: survives refrigeration, linked to poultry, hotdogs, cold cuts, coleslaw, ice-cream. Cheese.
- Transplacental /vertical
- Cross contamination(nursery)
- Inoculation(skin) farmers
- Colo/ sigmoidoscopy ⇨ bacteremia / meningitis (up to 5% healthy: Normal flora)
- Inform micro lab: special media (Mueller-Hinton agar)
- Causes GI symptoms
- Usually causes encephalitis specially in the brainstem



Treatment:

- Ampicillin 2gm IV Q4h +/- Gentamicin 2mg/kg loading dose then 1.7mg/kg Q8h
- 21 day duration Longer than others
- Penicillin allergy patients: TMP-SMX or Meropenem

What Other Tests?

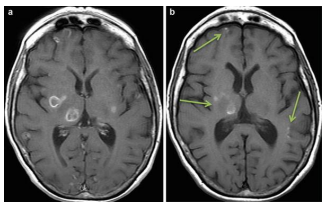
- AFB: diagnostic yield increase to 87% when four serial specimens examined
- Use last fluid & large volume (10 to 15 mL)
- Culture: gold standard
- PCR: NAAT sensitivity %56 percent and specificity 98%

Neurobrucellosis

- Neurobrucellosis is an endemic zoonotic infection caused by bacterial genus *Brucella*.
- It is transmitted to humans by infected animals (sheep, cattle, goats, pigs, and dogs) urine, milk, and other fluids.
- Additional Clinical History: Had a pet cow; often drank unpasteurized milk
- **Clinical Presentation:**
- The symptoms of neurobrucellosis may include symptoms like headache, fever, or muscle or joint pain, along with neurologic symptoms such as confusion, meningoencephalitis, myelitis, peripheral and cranial neuropathies, and psychiatric manifestations.
- Diagnosed by CSF PCR.
- **Treatment**
  - Doxycycline 100mg IV/po bid
  - Rifampin 600-900 mg po od
  - Ceftriaxone 2gm IV q12h
  - Duration? Continue until CSF is normal (3-12 months)

CNS Toxoplasmosis in HIV/AIDS

Toxoplasmosis is the leading cause of focal central nervous system (CNS) disease in AIDS. CNS toxoplasmosis in HIV-infected patients is usually a complication of the late phase of the disease. Happens with CD4 less than 100, on CT it will have a Ring enhancement Appearance.



- **Treatment:**
  - Pyrimethamine 200mg once po then 75mg od
  - Sulfadiazine 1.5 gm po Q6h
  - Folinic acid 25 mg po od
- Duration? Minimum 6 wks after resolution of signs/symptoms

- **Prophylaxis**
- Chronic Suppression (**secondary prophylaxis**):
  - Sulfadiazine 2-4gm po divided in 2-4 doses/day
  - Pyrimethamine 25-50mg po od
  - Folinic acid 10-25mg po od
- When to stop? CD4 > 200 for 6 months

- **Primary Prophylaxis**
  - TMP-SMX-DS 1 tab po od
- Sulfa allergy:
  - Dapsone and pyrimethamine and folinic acid
  - Atovaquone 1500 mg po od
- Can stop if CD4 > 200 for 3 months

Chronic meningitis:

- Slow-growing organisms (such as fungi and Mycobacterium tuberculosis) that invade the membranes and fluid surrounding your brain cause chronic meningitis.
- Develops over two weeks or more.
- The signs and symptoms of chronic meningitis — headaches, fever, vomiting and mental cloudiness — are similar to those of acute meningitis.

Aseptic Meningitis

Aseptic meningitis is most commonly caused by a variety of non bacterial pathogens, frequently viruses such as enterovirus and herpes simplex virus (HSV). It can also be caused by certain bacteria, parasites, and fungi.

- **CSF: pleocytosis 100s, Normal Glucose, Protein normal or slightly elevated, Neg Culture**
- Enteroviruses: most common cause 80%
- HSV-2 (HSV-1 can cause it but it usually causes encephalitis)
- Dengue, Zika (can also cause PNS infections), Chikungunya, yellow fever
- HIV
- Partial Rx Bacteria (Patient takes Abx thus delaying LP for 3-4 days and when you get the results they will be confusing as you will see lymphocytes and other features not consistent with bacterial meningitis)
- Drugs: Metronidazole, TMP-SMX, NSAIDs, carbamazepine, IVIG
- Rare: leptospirosis (spirochaete)

Clinical features:

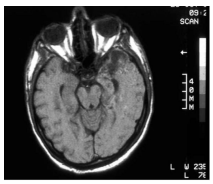
–Fever
–Headache
–Irritability
–Vomiting
–Convulsion (rare)
–Meningeal signs

Treatment:

- No specific therapy other than supportive care is required. The disease is self-limited.
- Analgesics and fever reduction may be appropriate.

Encephalitis/Encephalopathy

Encephalitis is a diffuse inflammation of the brain parenchyma and is often seen simultaneously with meningitis. It is usually viral in origin. Non Viral causes, however, must also be considered.



- Herpes simplex: PCR, Acyclovir (start treatment immediately)
- Arboviruses: e.g dengue
- Rabies
- Rare: *Listeria*, cat scratch disease, amebic
- Nonviral infectious causes:
    a. Toxoplasmosis
    b. Cerebral aspergillosis
- AIDS—patients with AIDS are especially at risk for toxoplasmosis when the CD4 count is <200

From team 436 (not in our slides)

VIRAL MENINGOENCEPHALITIS (VME)

Encephalitis and meningitis are 2 ends of the spectrum

•Neurotropic & non neurotropic viruses can cause VME:

–Arbo: JE/ west nile/ dengue

–Entero

–Herpes: HSV1, EBV, CMV, HHV-6, Varicella zoster

–Myxo

–Paramyxo

–Adeno

–Rhabdo

Clinical features (3 stages):

–**Prodromal**: fever, vomiting, diarrhea, anorexia, malaise

–**Acute encephalitic stage:** convulsion. Coma, neurodeficits, raised ICT, death

–**Convalescent stage:** improving coma, extrapyramidal

Dx: Neutrophilia +/-

-CSF clear, pleocytosis +/-. Normal or ↑protein, normal sugar

- Specific Dx by PCR

- Imaging: normal/ edema/ patchy hypodensity/ specific changes

-EEG: nonspecific diffuse slowing

Treatment:

- Specific Treatment only for Herpes: HSV1 (HSE)
- Supportive:
    - –Treat pyrexia
    - –Treat seizures
    - –Treat ↑ICP:
        1. Raise head end
        2. Mannitol
        3. Diuretics
        4. Diamox
        5. Glycerine
        6. Ventilation

- Fluids & electrolytes
- Nutrition
- Nursing
- Treatment of movement disorder
- Physiotherapy & rehabilitation

Brain Abscess:

Predisposing features:
– Congenital cyanotic heart disease
– Meningitis
– Penetrating head injury
– Local extension from mastoid, otitis, sinusitis, soft tissues of face and scalp
Etiology:

- *Streptococci* (60-70%), *Bacteroides* (20-40%), *Enterobacteriaceae* (25-33%), *S.Aureus* (10-15%), S.Milleri.
- Rare: *Nocardia*, *Listeria*

Clinical Features:
– Fever
– Headache
–Vomiting
– Focal deficits (motor, sensory, speech, confusion)
– ↑ICT

Lab
– Blood counts non specific
– EEG: focal slowing
– CT scan diagnostic
Treatment:

- CT brain: If abscess more than **2.5cm** then surgical drainage. And if patient neurologically unstable or decrease LOC drain regardless of size.
- Antimicrobials: empirically Ceftriaxone with metronidazole, otherwise according to susceptibility.
- Duration until response by neuroimaging (MRI with contrast).

Subdural Empyema

Is an intracranial focal collection of purulent material located between the dura mater and the arachnoid mater.

- In adults 60-90% are extension of:
  - Sinusitis
  - Otitis media
- Surgical emergency: must drain
- Antibiotics same as brain abscess

Spinal Epidural abscess: **(Not in our slides but doctor says it's important)**

- **Clinical Features**: Patient will present with BACK PAIN, fever, with sensory and motor loss in the lower limbs.
- **Investigations:** MRI with or without gadolinium (Gold standard) or CT with contrast, to locate the abscess for surgical drainage.

- **Risk factors:** Old age, IV drug use (most imp risk factor), concurrent infections like cellulitis for example.
- **Treatment:** Surgical drainage and Antibiotics.
- N.B LP is contraindicated in spinal epidural abscesses!

From team 436 (not in our slides)

Tuberculous meningitis (TBM)

Most dreaded and dangerous form of TB

Risk Factors:

–Young age

–Household contact

–Recent infection

–Measles

Pathophysiology:

–Primary infection → bacillemia → hematogenous seeding of meninges (Rich's foci) → rupture

–Thick exudates in basal cisterns

–Arteritis

Clinical Features

*3 stages

–Stage 1: prodromal stage with nonspecific symptoms 1-4 weeks

–Stage 2: neurological manifestations – seizures, deficits, meningeal signs

–Stage 3: coma

*Decerebrate posturing, cranial nerve palsies, optic atrophy, extrapyramidal signs, hydrocephalus (communicating or obstructive) more common

Diagnosis

-CSF examination - ↑pressure, cells up to 500 /cu mm, mostly lymphos, ↑protein, sugar ↓upto ½ of concomitant blood sugar

-AFB

-Culture

-CXR

-Skin test

Newer Tests:

1. Tuberculostearic acid
2. Adenosine deaminase test
3. Bromide partition test
4. NBT
5. ELISA for antibody/antigen
6. PCR
7. Interferon gamma release assays

Treatment

-4 anti TB drugs for initial 2 months + 3 drugs for 6-7 months

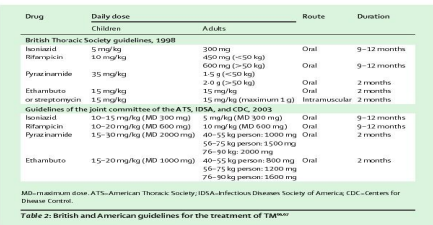
–DOTS ??

–Steroids initially for 6 weeks

–Shunt surgery for hydrocephalus

Complications & sequelae

- Hydrocephalus
- Optic neuritis
- Focal deficits
- Epilepsy
- MR
- Spinal block/ arachnoiditis
- Endocrine



Drug	Daily dose		Route	Duration
	Children	Adults		
British Thoracic Society guidelines, 1998				
Isoniazid	5 mg/kg	300 mg	Oral	9–12 months
Rifampicin	10 mg/kg	450 mg (<50 kg) 600 mg (>50 kg)	Oral	9–12 months
Pyrazinamide	35 mg/kg	1·5 g (<50 kg) 2·0 g (>50 kg)	Oral	2 months
Ethambuto	15 mg/kg	15 mg/kg	Oral	2 months
or streptomycin	15 mg/kg	15 mg/kg (maximum 1 g)	Intramuscular	2 months
Guidelines of the joint committee of the ATS, IDSA, and CDC, 2003				
Isoniazid	10–15 mg/kg (MD 300 mg)	5 mg/kg (MD 300 mg)	Oral	9–12 months
Rifampicin	10–20 mg/kg (MD 600 mg)	10 mg/kg (MD 600 mg)	Oral	9–12 months
Pyrazinamide	15–30 mg/kg (MD 2000 mg)	40–55 kg person: 1000 mg 56–75 kg person: 1500 mg 76–90 kg: 2000 mg	Oral	2 months
Ethambuto	15–20 mg/kg (MD 1000 mg)	40–55 kg person: 800 mg 56–75 kg person: 1200 mg 76–90 kg person: 1600 mg	Oral	2 months

MD=maximum dose. ATS=American Thoracic Society; IDSA=Infectious Diseases Society of America; CDC=Centers for Disease Control.

Table 2: **British and American guidelines for the treatment of TM**[MA07]

(In our slides but not important just know that it's the same treatment as pulmonary TB but prolonged for up to a year, and that you add pyridoxine with INH)

Antibiotic Chemotherapy:

CSF concentrations:

•INH, Pyrazinamidine, pass freely into the CSF

•Rifampin has 10% the concentration as in Plasma

•Streptomycin or ethionamide do not pass BBB in absence of Inflammation.

***Supplemental Pyrodoxine with INH Therapy**

Summary

	Most common organism	Investigations	Management	Other notes
Bacterial Meningitis	-Neonates: Group B streptococcus -Older infants and Children: Neisseria meningitides -Adults: Streptococcus Pneumonia **Listeria risk factors:Age <1y or >50y,Alcoholics, Pregnancy,Immunocompromised**	CSF analysis: -Pleocytosis (1000s) mainly PMNs -Glucose <30 (VERY LOW) -Protein >200	1-Empirical abx: Ceftriaxone + Vancomycin + Ampicillin. 2- CT head 3- LP Note: in cases of N.meningitidis treat all household contacts with Rifampin or Ciprofloxacin.	- High grade sudden fever - Severe headache - Nuchal rigidity - Altered mental status - Petechiae/ecchymosis: in cases of N.meningitdis - +ve kernig's and Brudzinski signs. Listeria tx: ampicillin +gentamicin Meningococcal tx: ceftriaxone+pen G Neurobrucellosis tx: Doxycycline
Aseptic meningitis	Enteroviruses	CSF analysis: -Pleocytosis (100s) -Normal glucose and protein. -Negative culture	Supportive care	–Fever –Headache –Irritability –Vomiting –Convulsion (rare) –Meningeal signs
Encephalitis	Herpes Simplex virus	-Lumbar Puncture - HSV PCR	Acyclovir	Mainly temporal lobe
CNS toxoplasmosis	Toxoplasma Gondii	Serology MRI: ring enhancements	Pyrimethamine PLUS sulfadiazine.	AIDS patients are especially at risk for toxoplasmosis when the CD4 count is <200 -
Brain Abscess	streptococci	CT with Contrast	Start antibiotics (ceftriaxone with metronidazole) + consider surgical drainage	Similar presentation as bacterial meningitis but more focal neurological deficits and seizures
Spinal epidural abscess	-	CT or MRI with contrast -LP is contraindicated	Surgical emergency: must drain + Antibiotics	The classic presentation (mentioned by doctor): first fever then develop weakness in both legs. on exam: decreased sensation, decreased reflexes. Risk factors include IVDU.

Questions

Q1: A 23-year-old male complaining of fever and headache. Examination shows temp 38 and neck stiffness. Neural examination and funduscopic examinations are normal. Which one of the following is the appropriate step?

A. CT scan if normal Do LP if CSF abnormal start combination antibiotics
B.Urgent LP if abnormal CSF start combination antibiotics.
C.Urgent LP and start combination antibiotics.
D.Start antiviral therapy

Answer: C

Q2:A 20 years old previously healthy male is admitted with bacterial meningitis. He is empirically started immediately on vancomycin and high dose of ceftriaxone for bacterial Meningitis.
Which one of the following reasons vancomycin was added to the treatment regimen of the patient?

A) Meningitis with Listeria monocytogenes resistant to ceftriaxone
B) Meningitis with methicillin resistant staphylococcus aureus (MRSA)
C) Penicillin and cephalosporin resistance in meningococci
D) Penicillin and cephalosporin resistance in Pneumococcus

Answer: D

Q3: a 20 year old man was brought by his family to the Emergency department with one day history of fever, confusion , aggressive behavior and personality changes. Which of the following is the best initial management?

A. start the patient on ceftriaxone and vancomycin , get a CT head, then perform urgent LP
B. start the patient on Acyclovir ,get a CT head , and perform urgent LP
C. CT head, urgent LP then wait for the CSF results
D. Blood culture and immediate LP

Answer: B

Q4: the presence of petechiae/purpura in the setting of meningitis is indicative of which organism ?

A. Group B streptococcus
B. Neisseria Meningitidis
C. Haemophilus Influenzae
D. streptococcus pneumoniae

Answer: B

Q5: Which of the following is the most prominent finding in the CSF analysis of bacterial meningitis?

A. very low glucose
B. very low proteins
C. pleocytosis with lymphocytic predominance
D. normal glucose and protein

Answer: A