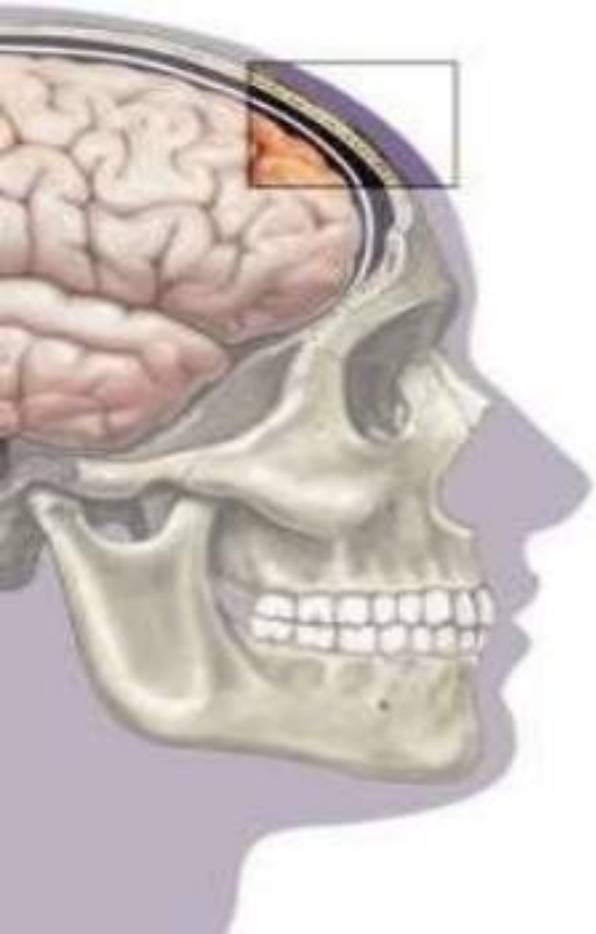
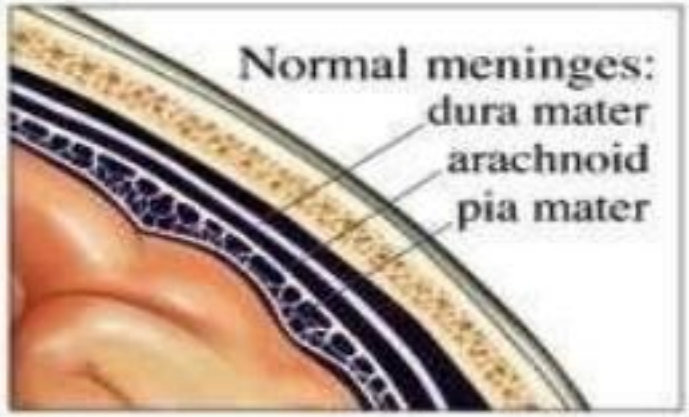
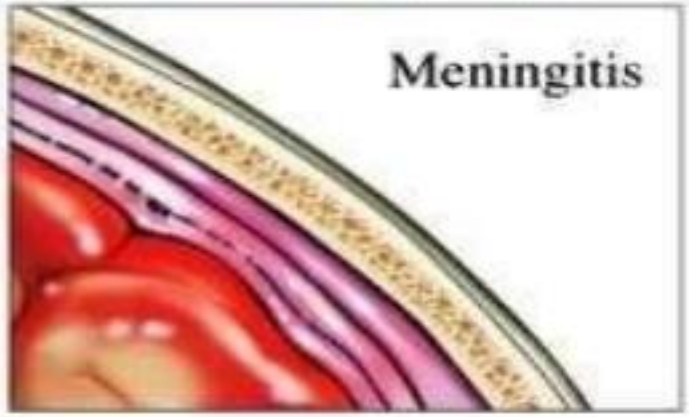
MENINGITIS AND ITS MANAGEMENT



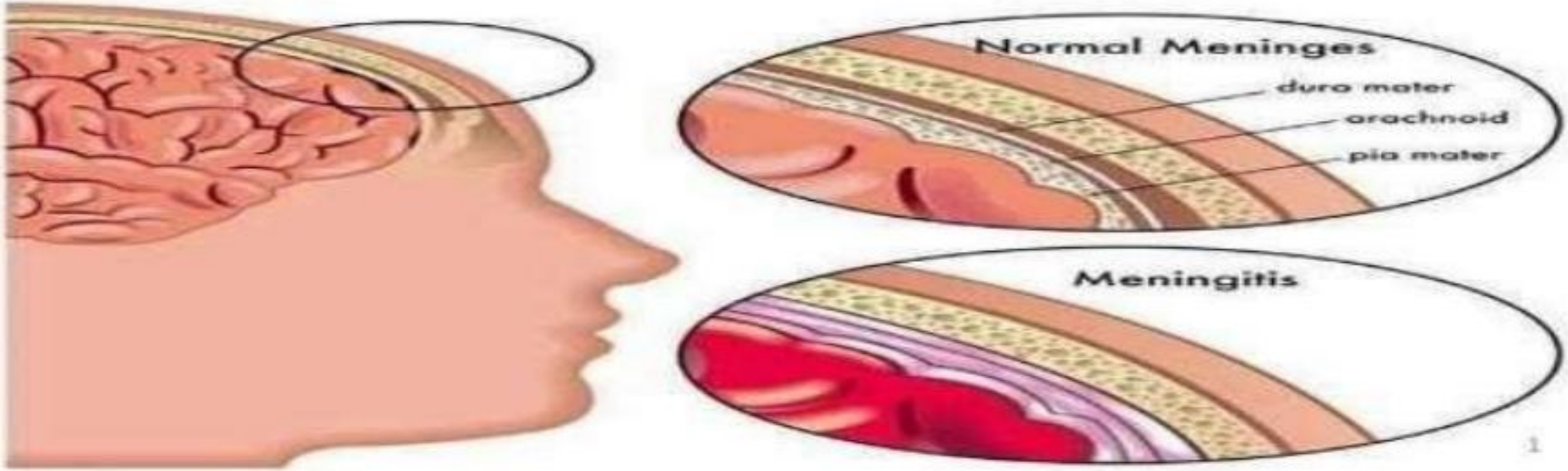




MENINGITIS:

DEFINITION:

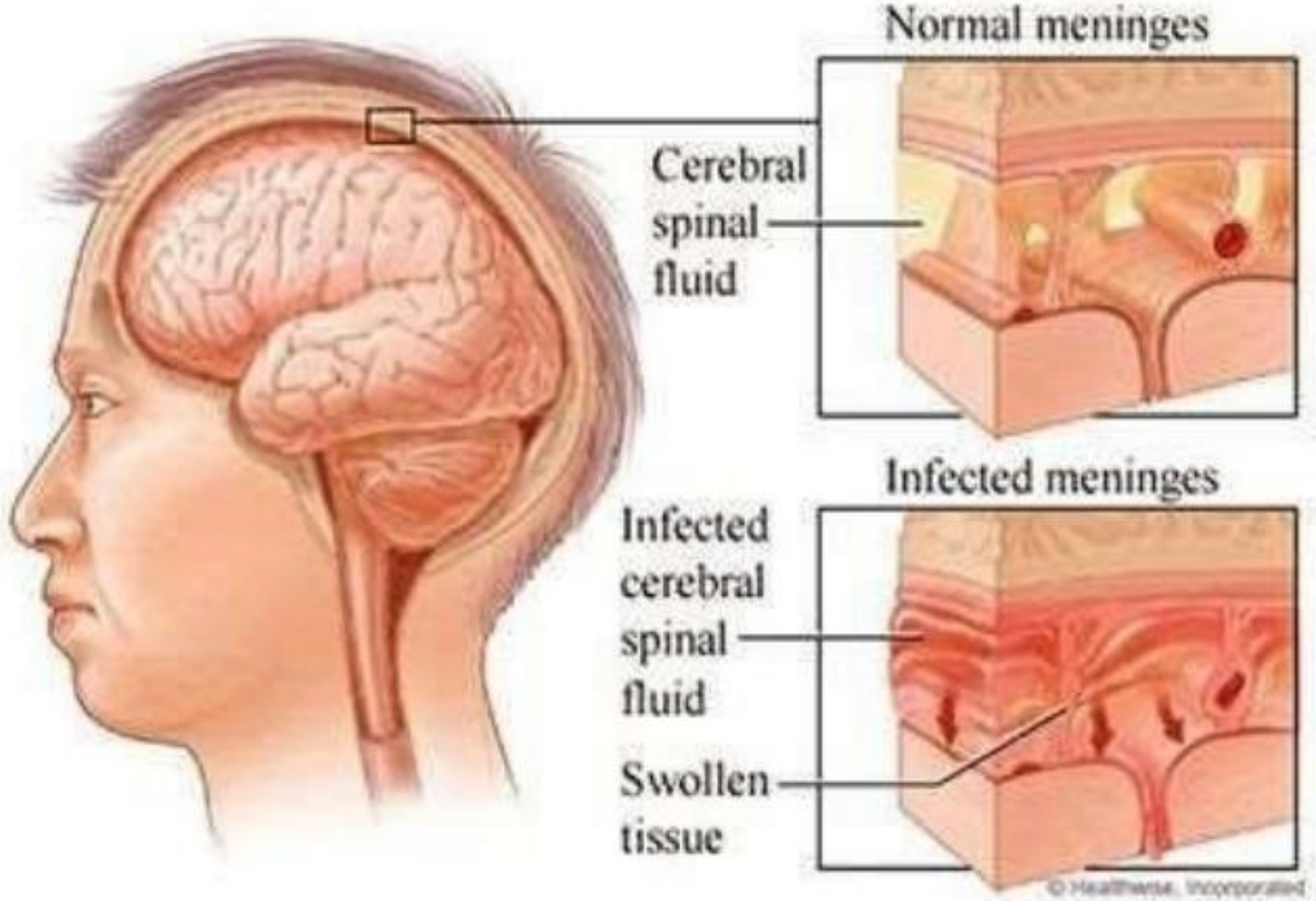
Meningitis is defined as an inflammation of the meninges covering the brain and spinal cord.

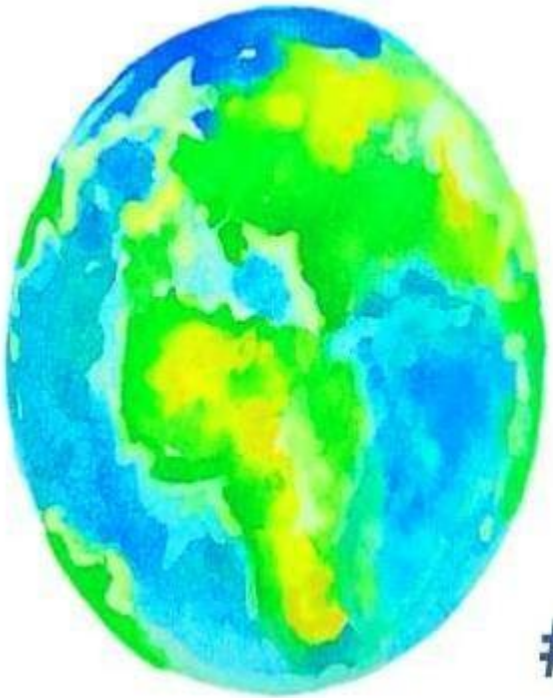


Meningitis is classified as:

- Septic
- Aseptic

The aseptic form may be viral or secondary to lymphoma, leukemia, or human immunodeficiency virus (HIV). The septic form is caused by bacteria such as Streptococcus pneumonia and Neisseria meningitidis.


Normal meninges
Cerebral spinal fluid
Infected meninges
Infected cerebral spinal fluid
Swollen tissue



24 April 2020

WORLD MENINGITIS DAY

Defeat Meningitis

#WorldMeningitisDay #DefeatMeningitis

EPIDEMIOLOGY

- Most likely to occur in dense community groups, such as college campuses and military installations.
- Though infections occur year round, the peak incidence is in the winter and early spring.
- Over the last 10 years in India, more than 50,000 cases have been identified for Meningococcal Meningitis, with more than 3,000 deaths.

Incidence rates of N.meningitidis

- Generally highest in children less than five years of age and in adolescents.
- Can cause a severe bacteremia, called meningococcaemia.
- Worldwide, the incidence of meningitis due to N. meningitidis is highest in a region of sub-Saharan African known as the “meningitis belt” where 350 million people are at risk for meningitis during these annual epidemics.

Incidence rates of H. Influenzae meningitis

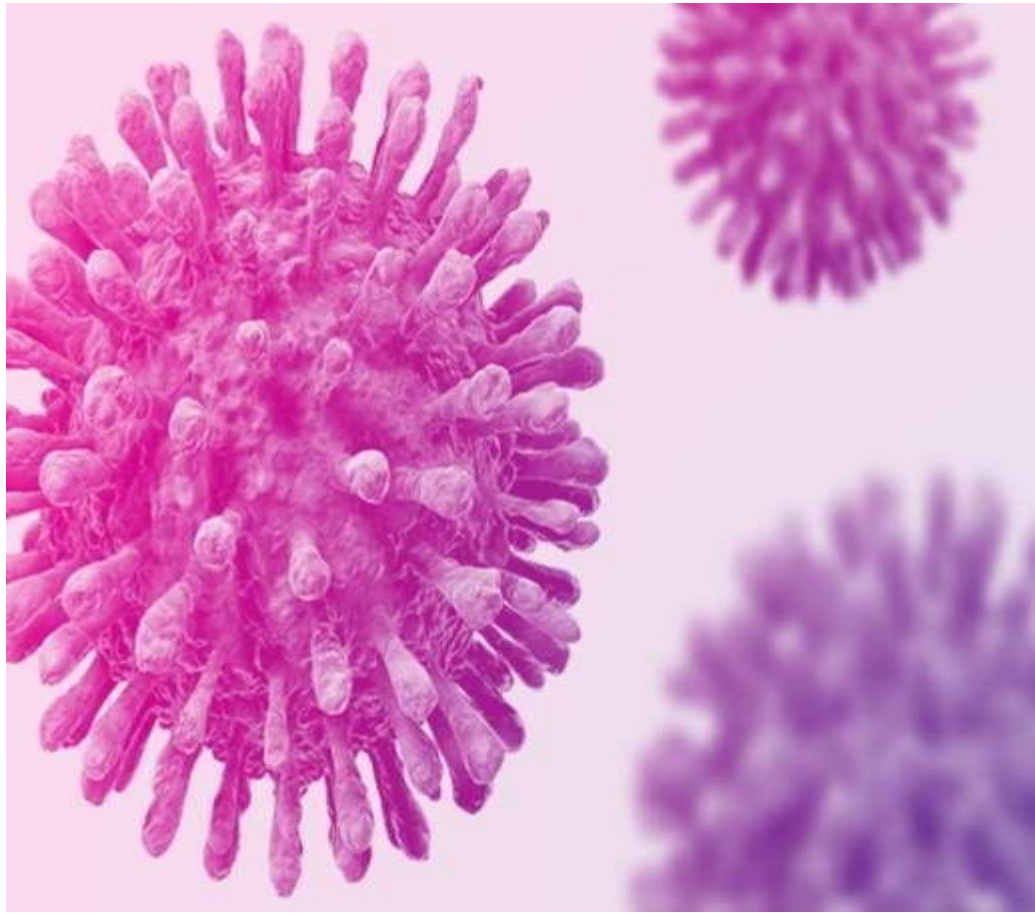
- Rare in adolescents and adults
- Rates are highest in children less than five years of age.

Incidence rates of Streptococcus pneumonia meningitis

- Occurs most commonly in the very young and the very old.

RISK FACTORS

- Extremes of age (< 5 or >60 years)
- Immunosuppression
- HIV infection, which predisposes to bacterial meningitis caused by encapsulated organisms, primarily Streptococcus pneumoniae, and opportunistic pathogens.



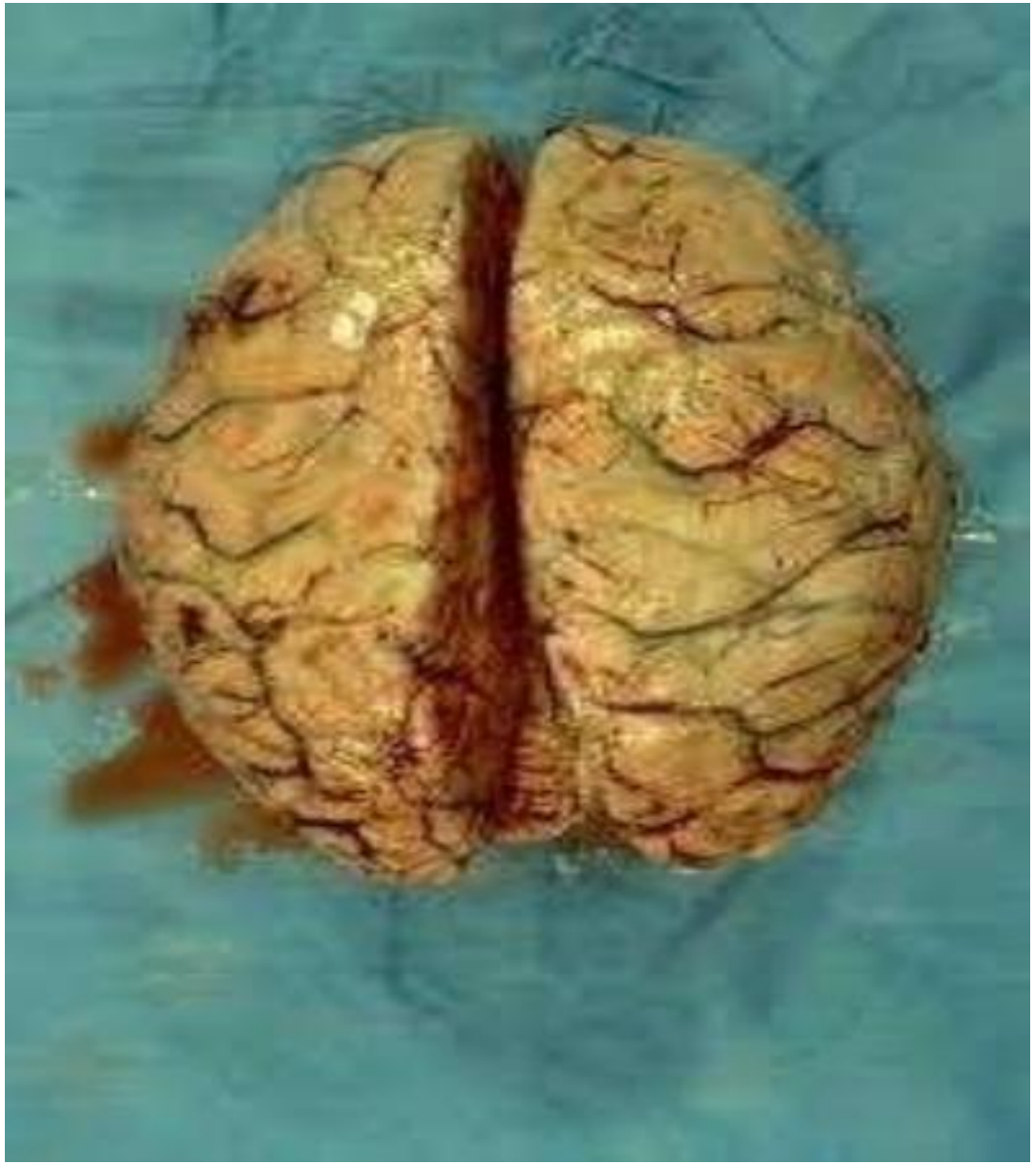
- Crowding (such as that experienced by military recruits and college residents), which increases the risk of outbreaks of meningococcal meningitis.
- Dural defect (e.g., traumatic, surgical, or congenital).
- Some cranial congenital deformities.

High-risk groups

1. Anyone who lives in close contact with many people.
2. Anyone who has frequent upper respiratory infections.
3. Anyone who has had trauma or an invasive procedure involving the brain, spinal cord, or sinuses.

ETIOLOGY

- Bacterial, viral, fungal, and parasitic organisms can all cause meningitis, but bacterial meningitis is by far the most common.



- Bacterial meningitis is caused by bacteria and is rare, but is usually serious and can be life-threatening if it's not treated right away.

- Common agents are:

✓Group B streptococcus

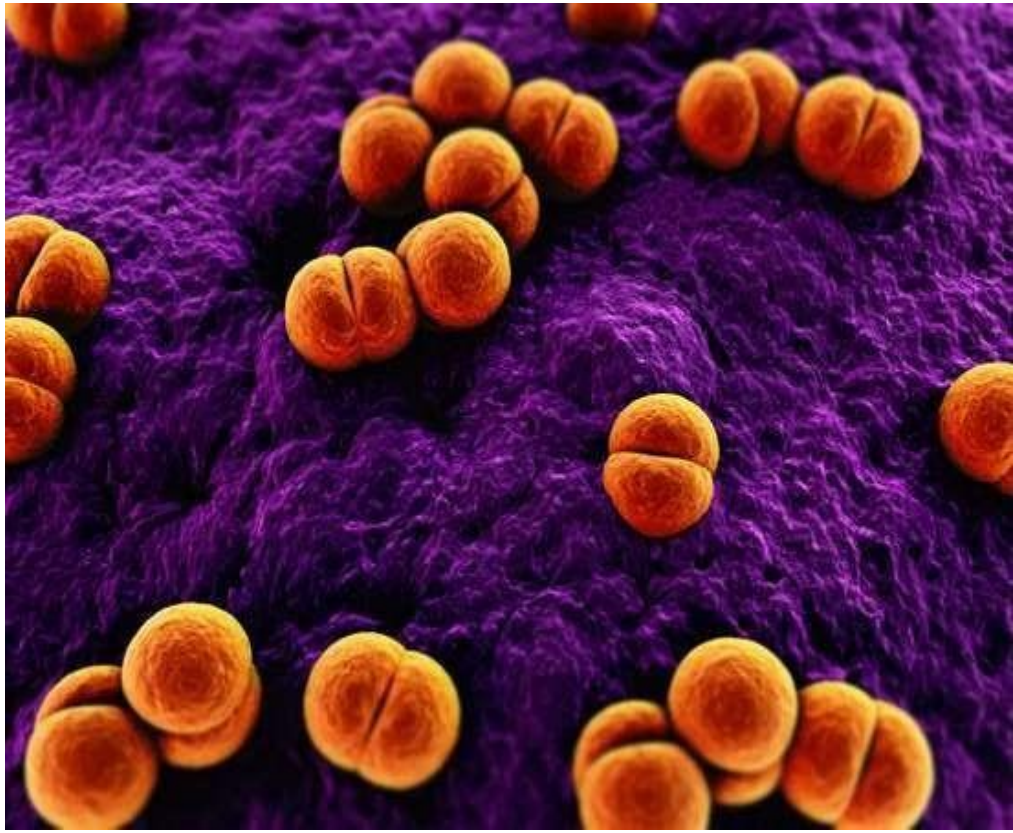
✓Escherichia coli

✓Listeria monocytogenes

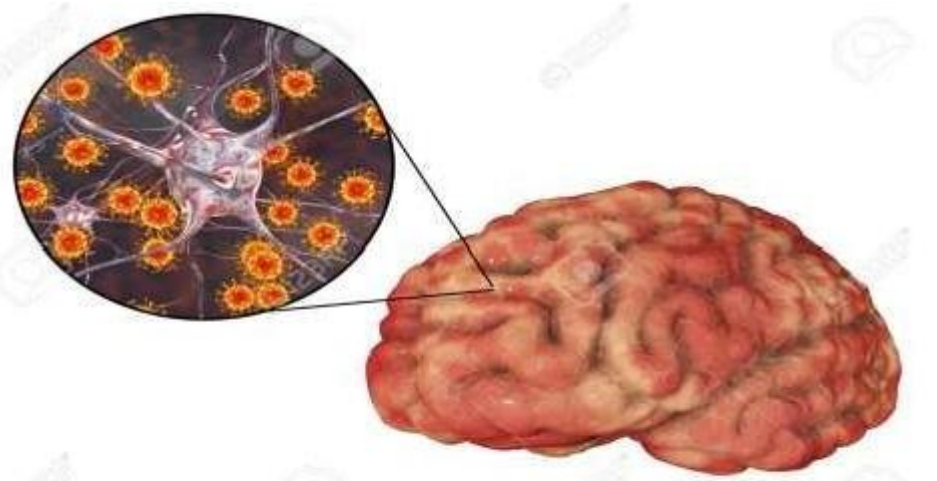
✓Streptococcus pneumoniae (pneumococcus)

✓Neisseria meningitidis (meningococcus)

✓Haemophilus influenza type b (Hib)



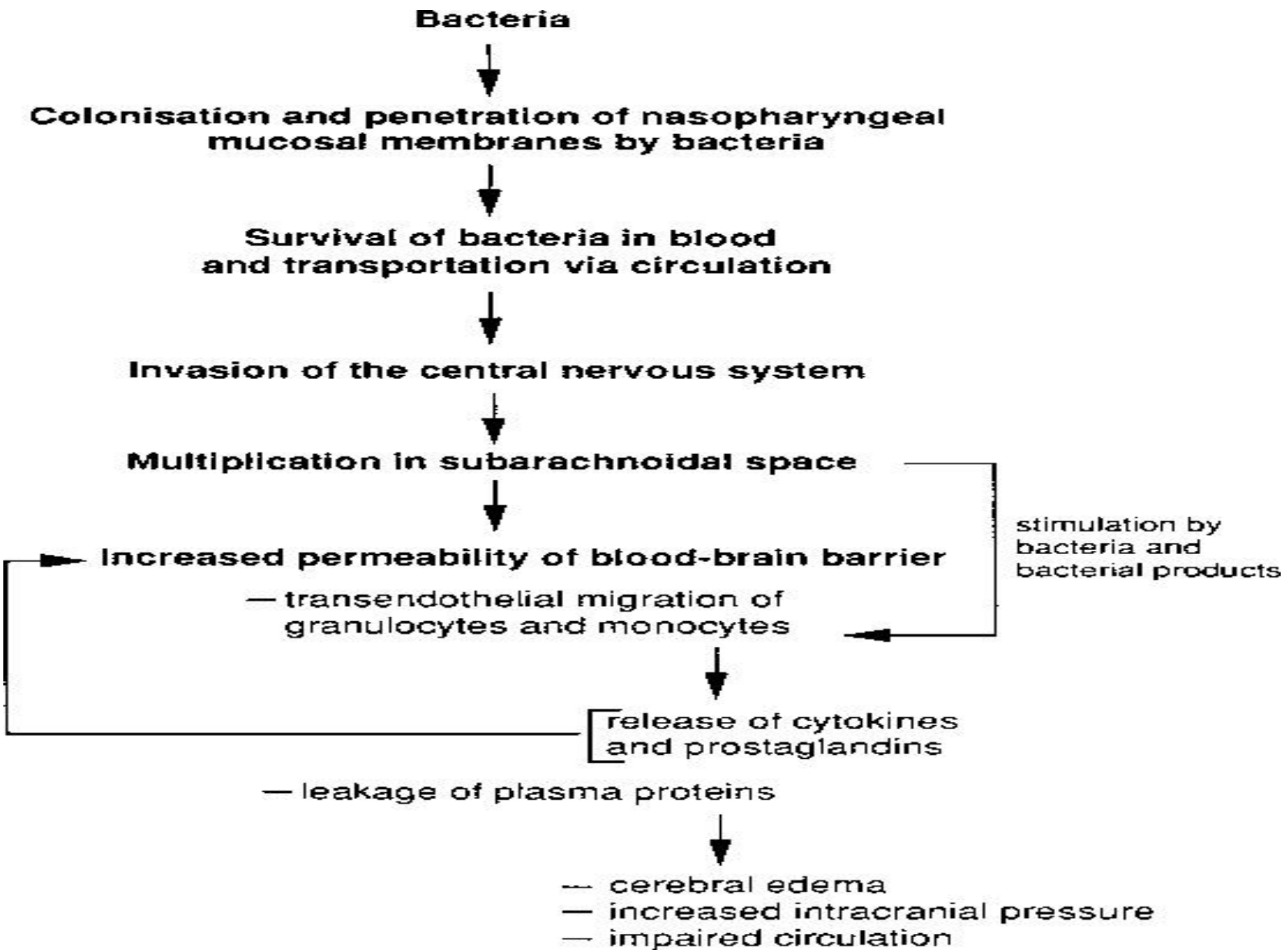
- **Viral Meningitis:** It is also known as Aseptic Meningitis caused by Mumps virus, Picornavirus, Enteroviruses, Arthropod borne virus, Herpes Simplex
- **Fungal meningitis:** It is also known as Granulomatous meningitis mainly caused by organism Cryptococcus.
- **Parasitic meningitis:** Cysticercosis and Toxoplasma gondii.



Transmission

Meningitis is spread by direct contact with a carrier's secretions, especially by respiratory droplets. People may be carrier's only, without having he actual disease.

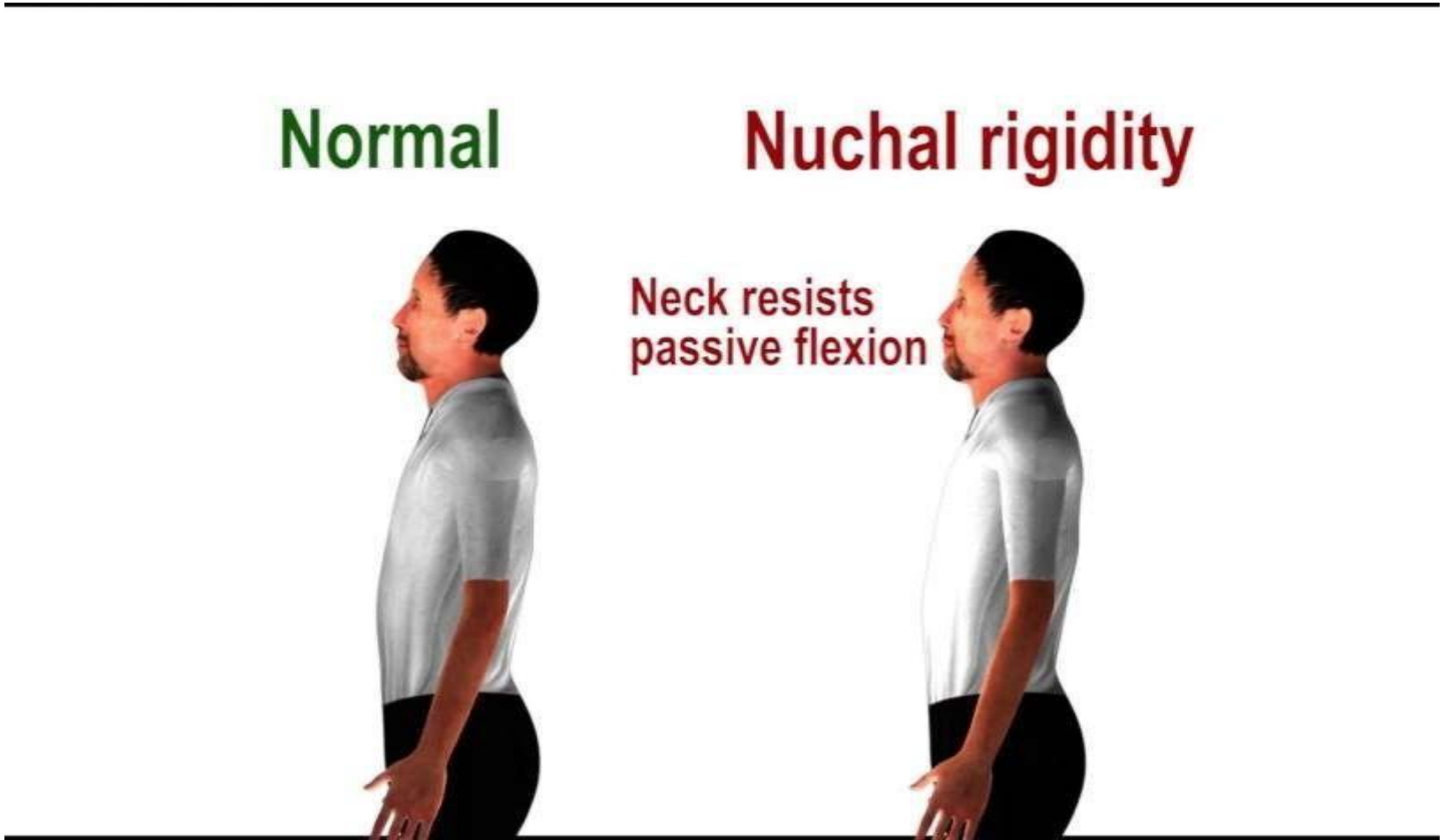
PATHOPHYSIOLOGY


Bacteria
Colonisation and penetration of nasopharyngeal mucosal membranes by bacteria
Survival of bacteria in blood and transportation via circulation
Invasion of the central nervous system
Multiplication in subarachnoidal space
Increased permeability of blood-brain barrier
— transendothelial migration of granulocytes and monocytes
stimulation by bacteria and bacterial products
release of cytokines and prostaglandins
— leakage of plasma proteins
— cerebral edema
— increased intracranial pressure
— impaired circulation

CLINICAL MANIFESTATIONS OF MENINGITIS

- The classic manifestation of meningitis is meningeal irritation which has well recognized signs including **nuchal rigidity (rigidity of neck), Brudzinski's sign, Kernig's sign, and photophobia.**

Nuchal rigidity: A stiff and painful neck because of spasms in the muscles of neck. Usually, the neck is supple, and the patient can easily bend the head and neck forward.



Kernig's Sign

Kernig's Sign

When the patient is lying with the thigh flexed on the abdomen, the leg cannot be completely extended

Brudzinski's Sign

Brudzinski's Sign

When the patient's neck is flexed (after ruling out cervical trauma or injury), flexion of the knees and hips is produced; when the lower extremity of one side is passively flexed, a similar movement is seen in the opposite extremity

Other symptoms

Fever

Neck pain

Sleepiness

Vomiting

Joints Pain

Rash

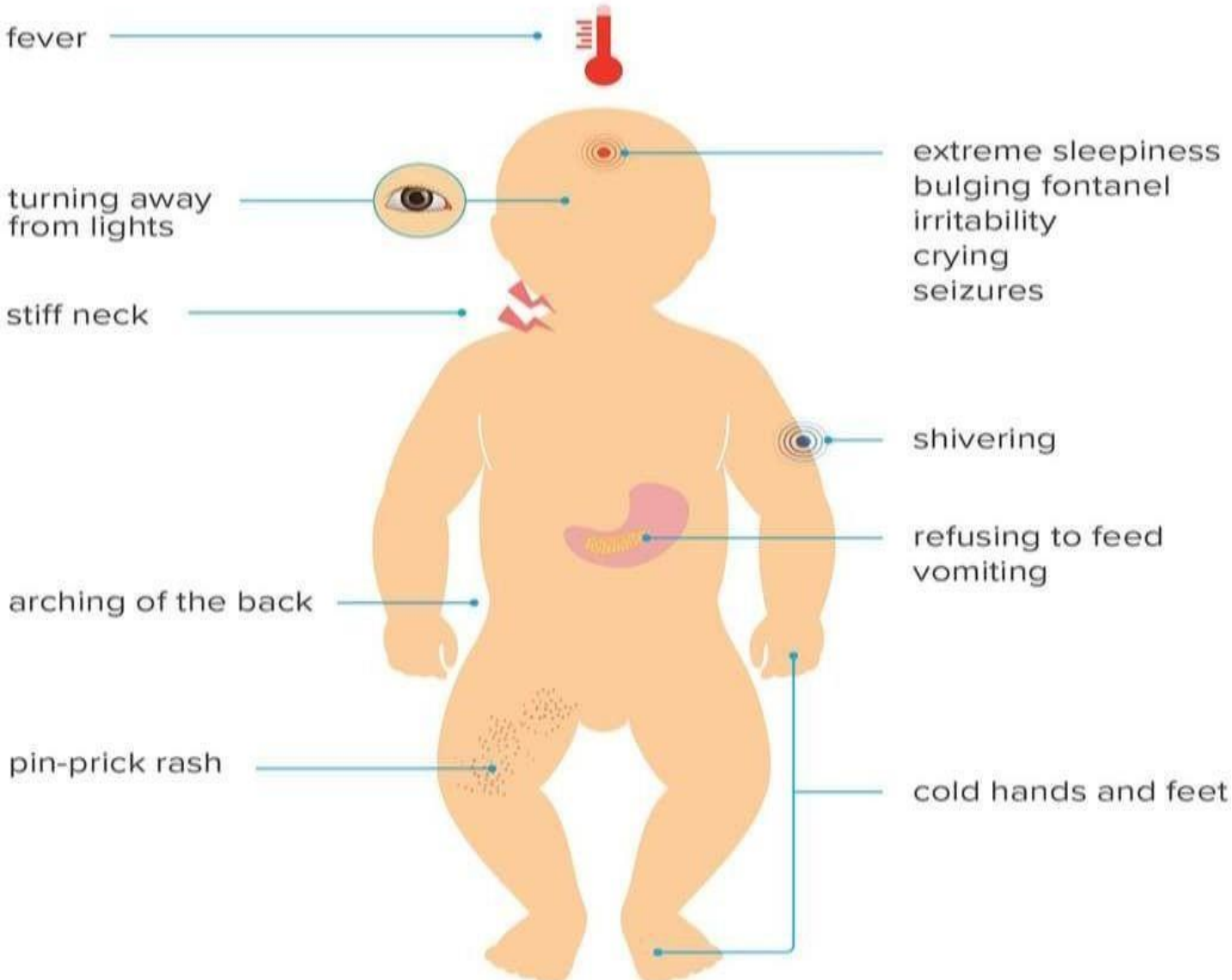
Headache

Seizures

Light Sensitivity

Effects on the Body

Meningitis in Infants



DIAGNOSTIC FINDINGS

- **CT scan Or MRI:** Used to detect a shift in brain contents (which may lead to herniation) prior to a lumbar puncture in patient with altered LOC, papilledema, neurologic deficits, new onset of seizure, immunocompromised state, or history of central nervous system disease

MRI Scan	CT Scan
Detail pictures in soft tissues	Less detailed compared to MRI scans
Bony structures are less detailed as compare to CT	Bony structures are more clear and detailed
No known side effects on radiation and very few side effects on MRI contrast scans	Little side effects. Frequent radiations with CT scans might rarely cause cancer
Due to the structure and sound, Claustrophobia patients may need to take anesthesia	Scan procedure is very simple and does not require anesthesia
Duration of MRI scan is much longer than CT	CT scan procedure is quick compared to MRI
Higher Cost	CT Scans are less expensive than MRI scans
You may be asked to hold your breath from time to time	Holding breath is not required as much
Patients with metal or certain medical implants are not able to undergo MRI's due to the magnetic field pulses	CT scan can be performed with no risk to medical implants or metal

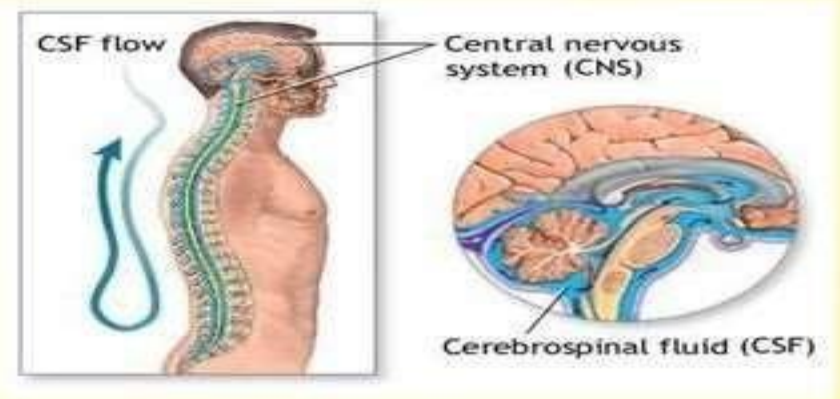
GLASS TEST

Bacterial Culture and Gram Staining of CSF and Blood: It allows the rapid identification of the causative bacteria and initiation of appropriate antibiotic therapy.

CSF Culture

❖ Aim of the test

Diagnosis of the bacteria or fungal meningitis by microscopic examination and culture with identification and susceptibility test of the isolated organism.



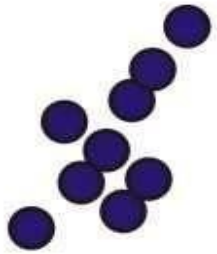
❖ Types of specimen

- CSF

❖ Criteria of specimen rejection

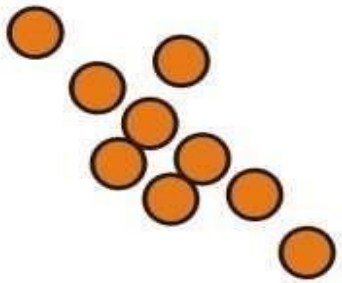
- Non sterile container and the general causes for rejection stated in the introduction as mislabeling, un-labeling, insufficient amount.
- Specimen more than 30 minutes.

Bacteria



Gram positive cocci

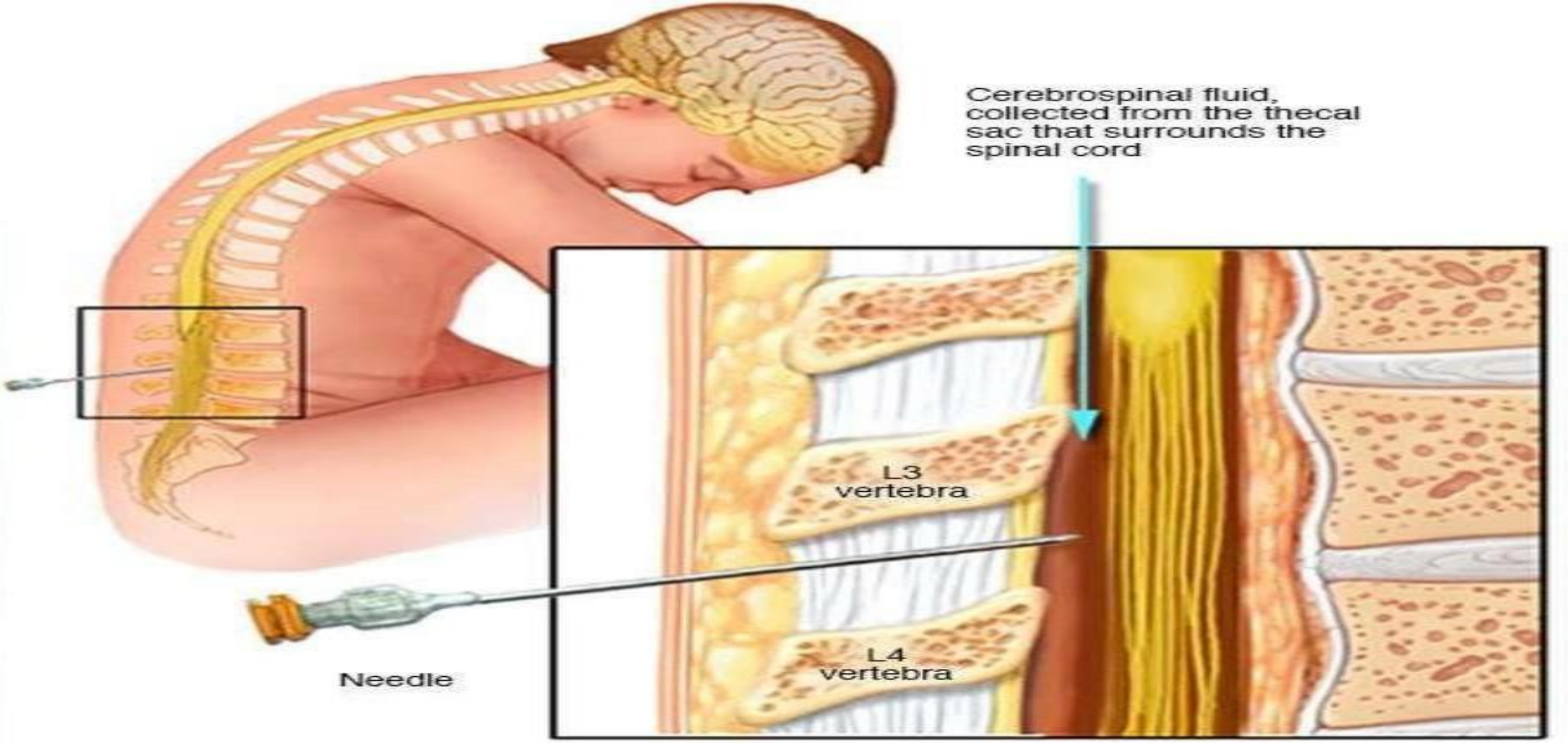
Gram positive bacilli



Gram negative cocci

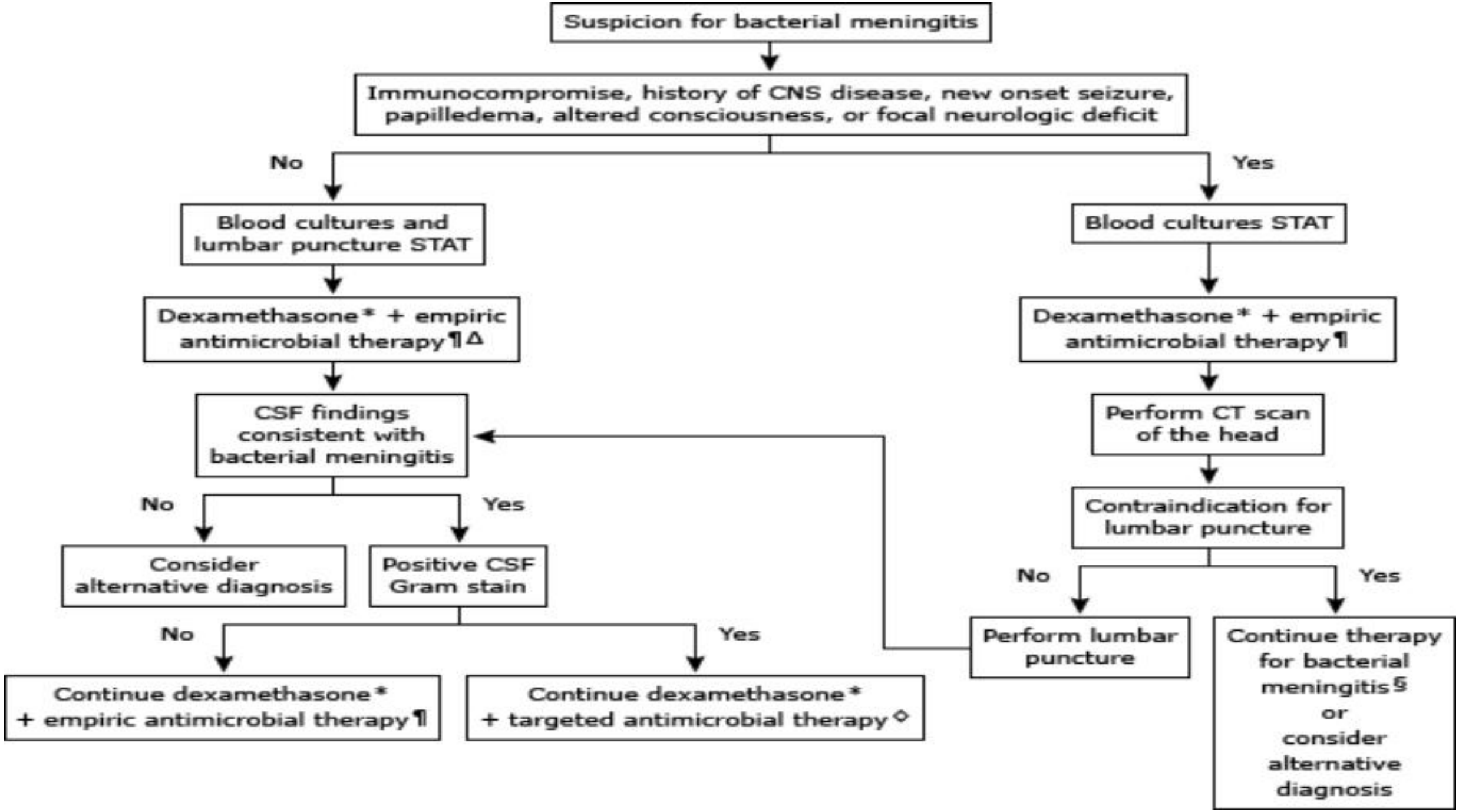
Gram negative bacilli

LUMBAR PUNCTURE



Typical CSF Parameters in Patients with Meningitis

Etiology	WBC Count (cells/mm^3)	Predominant cell type	Protein (mg/dL)	Glucose (mg/dL)	Opening Pressure (cm H_2O)
Normal	0-5	Lymphocyte	15-40	50-75	8-20
Viral	10-500	Lymphocyte	Normal	normal	9-20
Bacterial	**100-5000**	**Neutrophil**	**>100**	**<40**	**20-30**
Tubercular	50-300	Lymphocyte	<100	<40	18-30
Cryptococcal	20-500	Lymphocyte	50-200	<40	18-30


Suspicion for bacterial meningitis
Immunocompromise, history of CNS disease, new onset seizure, papilledema, altered consciousness, or focal neurologic deficit
No
Yes
Blood cultures and lumbar puncture STAT
Dexamethasone* + empiric antimicrobial therapy¶Δ
CSF findings consistent with bacterial meningitis
No
Yes
Consider alternative diagnosis
Positive CSF Gram stain
No
Yes
Continue dexamethasone* + empiric antimicrobial therapy¶
Continue dexamethasone* + targeted antimicrobial therapy◇
Blood cultures STAT
Dexamethasone* + empiric antimicrobial therapy¶
Perform CT scan of the head
Contraindication for lumbar puncture
No
Yes
Perform lumbar puncture
Continue therapy for bacterial meningitis§ or consider alternative diagnosis

TREATMENT

Population	*Likely pathogen*	*Empiric therapy*
Infants younger than one month	*Streptococcus agalactiae* (group B streptococcus), *Listeria monocytogenes, Escherichia coli,* other gram-negative bacilli	Ampicillin and cefotaxime (Claforan)
Children one to 23 months of age	*Streptococcus pneumoniae, Neisseria meningitidis, S. agalactiae, Haemophilus influenzae, E. coli*	Vancomycin and ceftriaxone (Rocephin)
Children and adults two to 50 years of age	*N. meningitidis, S. pneumoniae*	Vancomycin and ceftriaxone
Adults older than 50 years, with altered cellular immunity, or with alcoholism	*S. pneumoniae, N. meningitidis, L. monocytogenes,* aerobic gram-negative bacilli	Vancomycin, ceftriaxone, and ampicillin
Patients with basilar skull fracture or cochlear implant	*S. pneumoniae, H. influenzae,* group A beta-hemolytic streptococci	Vancomycin and ceftriaxone
Patients with penetrating trauma or postneurosurgery	*Staphylococcus aureus,* coagulase-negative staphylococci, aerobic gram-negative bacilli (including *Pseudomonas aeruginosa)*	Vancomycin and cefepime (Maxipime)
Patients with cerebrospinal fluid shunt	Coagulase-negative staphylococci, *S. aureus,* aerobic gram-negative bacilli (including *P. aeruginosa), Propionibacterium acnes*	Vancomycin and cefepime

Treatment acute viral meningitis

- Viral meningitis is treated symptomatically
  - antipyretics, antiemetics, and analgesics.
  - Amytriptyline and NSAIDs are often required for months to treat headache from viral meningitis.
- Patients with HSV-2 meningitis can be treated with
  - acyclovir 800 mg 5 times daily, or
  - famciclovir 500 mg 3 times daily, or
  - Valacyclovir 1000 mg 3 times daily for 7 to 14 days.

TREATMENT OF FUNGAL MENINGITIS

- **14-day induction phase** of amphotericin B, 0.7 to 1 mg/kg/day IV, with or without flucytosine, 100 mg/kg/day PO dosed every 6 hours.
- **Consolidation therapy with fluconazole**, 400 mg daily, should be continued for 8 weeks following induction.
- **Maintenance (or suppressive) therapy with fluconazole,** 200 mg per day.

Treatment of Parasitic Meningitis

- Primary amebic meningoencephalitis (PAM), caused by *N fowleri, is usually fatal.*
  - IV and intrathecal amphotericin B or miconazole and rifampin

- Helminthic eosinophilic meningitis (*Acantonensis or G spinigerum) : adequate analgesia,* therapeutic CSF aspiration, and the use of antiinflammatory agents, such as corticosteroids.
  - Anthelmintic therapy may be contraindicated, because clinical deterioration and death may occur as a consequence of severe inflammatory reactions to the dying worms.

- Dehydration and shock are treated with fluid volume expanders.
- Seizures, which may occur early in the course of the disease, are controlled with phenytoin (Dilantin).
- Increased ICP is treated as necessary.

- Mannitol is given:

✓Adult dose- 0.25 g/kg/dose infused IV over 30 min, may repeat every 6-8hr.

✓Paediatric dose- 0.25 – 1 g/kg/dose infused over 20 – 30min.

COMPLICATIONS

Neurological	Systemic (Non Neurological)
Acute onset Altered mental status/ coma Cerebral edema and raised intracranial pressure Acute onset Seizures Subdural effusion or empyema Cranial nerve palsies Hydrocephalus Sensorineural deficit Hemiparesis or quadriparesis Blindness **Late onset** Late onset seizure (epilepsy) disorder Ataxia Cerebrovascular abnormalities Neuropsychological impairment Developmental disability Intellectual deficit	Prolong fever Septic shock and DIC Vasomotor collapse Loss of airway reflexes Respiratory arrest Pericardial effusion Hypothalamic and other endocrine dysfunction Hyponatremia Bilateral adrenal hemorrhage Death

PROGNOSIS

- The prognosis in patients with meningitis caused by opportunistic pathogens depends on the underlying immune function of the host.
- Many patients who survive the disease require lifelong suppressive therapy.
- If severe neurologic impairment is evident at the time of presentation (or if the onset of illness is extremely rapid), mortality is 50-90% and morbidity is even higher.

PREVENTION

- **Vaccination-** Protect against bacterial meningitis, pneumococcal meningitis and Haemophilus Influenzae meningitis.
- People in close contact with patients with meningococcal meningitis should be treated with antimicrobial chemoprophylaxis using rifampin (Rifadin), ciprofloxacin hydrochloride (Cipro), or ceftriaxone sodium (Rocephin).
- Therapy should be started as soon as possible after contact; a delay in the initiation of therapy will limit the effectiveness of the prophylaxis.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1 Dose
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Meningococcal (Groups A, C, Y and W-135) Polysaccharide Diphtheria Toxoid Conjugate Vaccine
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Nursing Management

Nursing Assessment

1. Obtain history regarding progression of disease: presence of headache, fever, confusion, nausea and vomiting, neck stiffness.

2. Monitor the vital signs.

3. Monitor the neurological status.

4. Monitor arterial blood gas values.

5. Assess the arterial blood pressure.

6. Assess the knowledge of meningitis, experiences with family, and present coping.

Nursing Diagnosis

Hyperthermia related to infection.

Acute Pain related to headache, fever, neck pain secondary to meningeal irritation.

Impaired Physical Mobility related to intravenous infusion, nuchal rigidity and restraining devices.

Risk for ineffective cerebral tissue perfusion related to increased ICP.

Risk for Injury related to restlessness and disorientation secondary to meningeal irritation.

Interrupted Family Process related to critical nature of situation and uncertain prognosis.

Nursing Interventions

Managing hyperthermia

1. Assess vital signs.
2. Perform tepid sponge.
3. Eliminate excess clothing and covers.
4. Maintain adequate fluid intake as tolerated.
5. Provide high caloric diet or as indicated by the physician.
6. Administer antibiotics and antipyretics as indicated.

Controlling Pain

1. Assess the patient's pain experience.

2. Provide comfortable and quite environment to the patient.

3. Dim lights of the patient's area.

4. Limit the noise.

5. Administer analgesics as prescribed by the physician.

Maintaining Adequate Cerebral Tissue Perfusion

1. Assess, monitor and document patient's neurological status, vital signs and oxygen saturation every hourly.
2. Monitor arterial blood gas levels.
3. Monitor input and output with urine specific gravity.
4. Elevate the head of the bed at 30 degree and keep the head in neutral alignment.
5. Limit activities that increase ICP.
6. Administer mannitol as prescribed.
7. Monitor the effects of each medications.

Preventing Injury

1. Assess the neurological status of the patient.
2. Assess GCS-P score.
3. Prevent patient from falling by providing protective equipment's.
4. Monitor the patient carefully.
5. Keep room quiet and lights dim.
6. Provide medication as prescribed.

Enhance family coping and functioning

1. Explain the prognosis of patient to the family.

2. Provide psychological support to the family.

3.Reduce the fear of the family by explaining the condition of the patient.

4. Permit the family to meet the patient at intervals.

CONCLUSION

- Meningitis is an inflammation of the subarachnoid space and meninges; it can be classified as septic or aseptic. Exudate formation causes meningeal irritation and increased ICP.
- Infecting organisms gain entry to the subarachnoid space through basilar skull fractures with dural tears, chronic otitis media or sinusitis, neurosurgical contamination, penetrating head wounds, septicemia, or bloodstream infections.
- Meningitis can be prevented by pneumococcal and H. influenza vaccine. Outcome depends on efficacy of therapy, the virulence of the bacteria, and the physical status of the patient.


Thank
YOU!