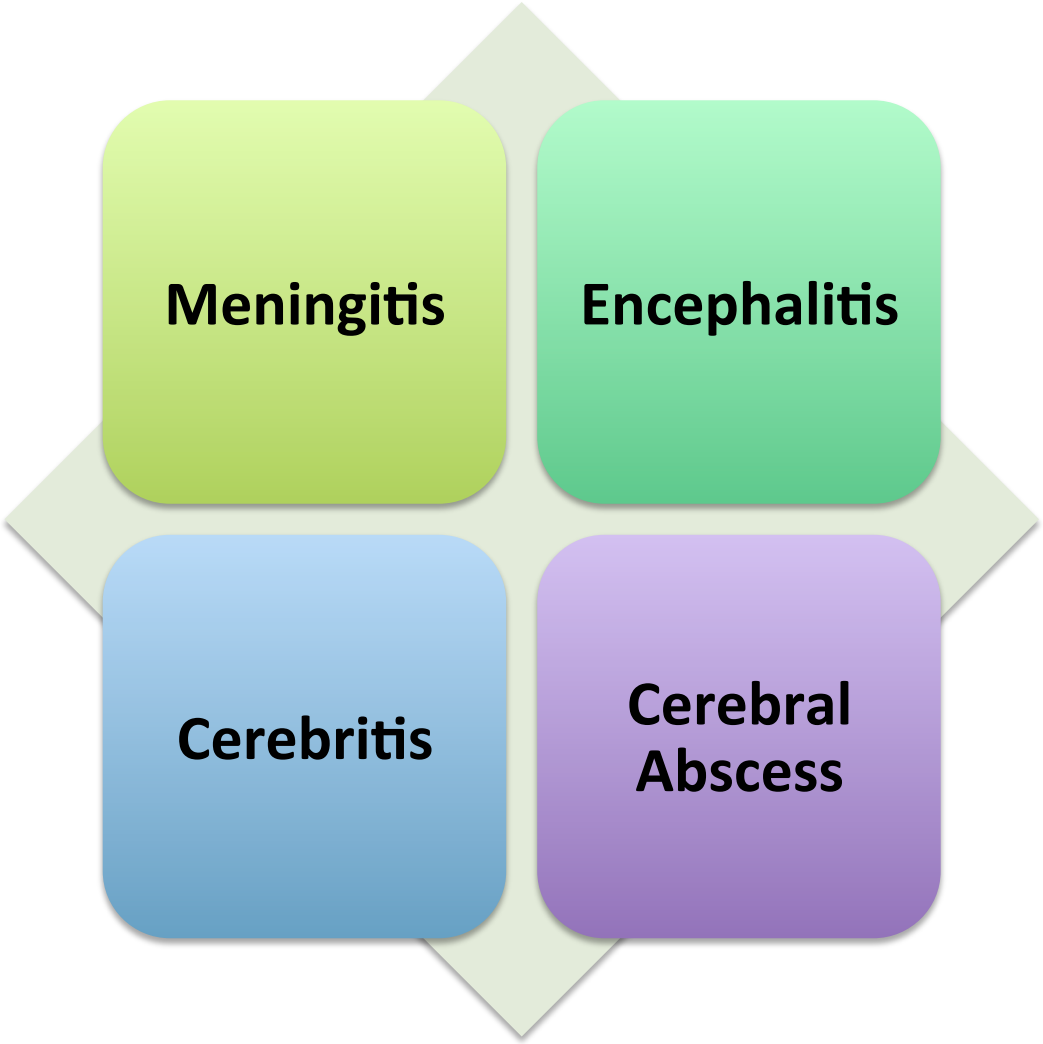
Meningitis

Presented By: Roaa Ridha Amer

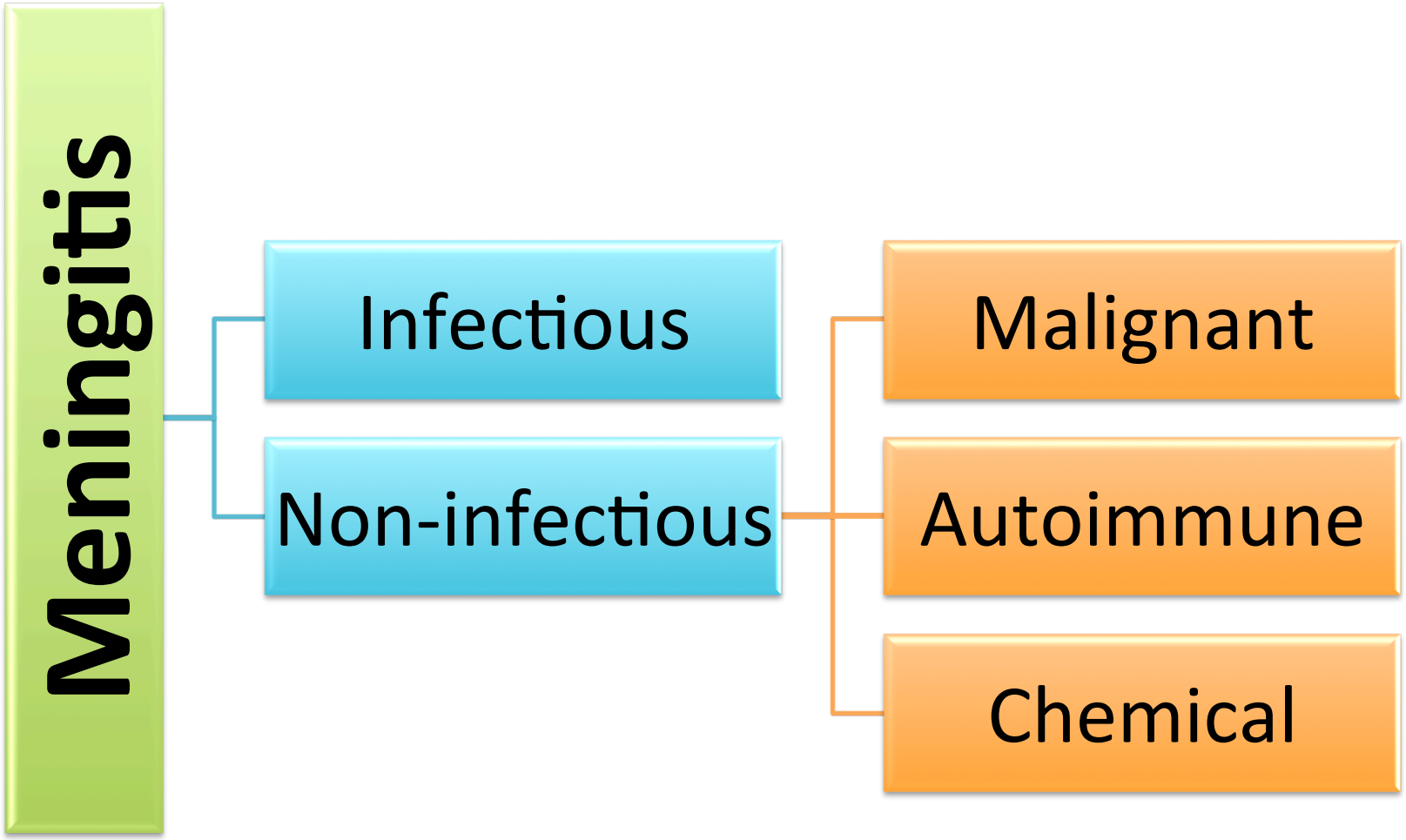
Outline:

- Definitions
- Routes for organisms to reach the CNS
- Types of meningitis and their organisms:
  - Acute pyogenic meningitis
    - Pathophysiology
    - Complications
  - Other types of meningitis:
    - Viral, fungal, protozoan, parasitic, malignant, and inflammatory.
- Diagnosis and CSF analysis
- Treatment
  - Specific
  - Supportive
- Complications

Definitions



Causes of Meningitis



Type	Organisms	Notes

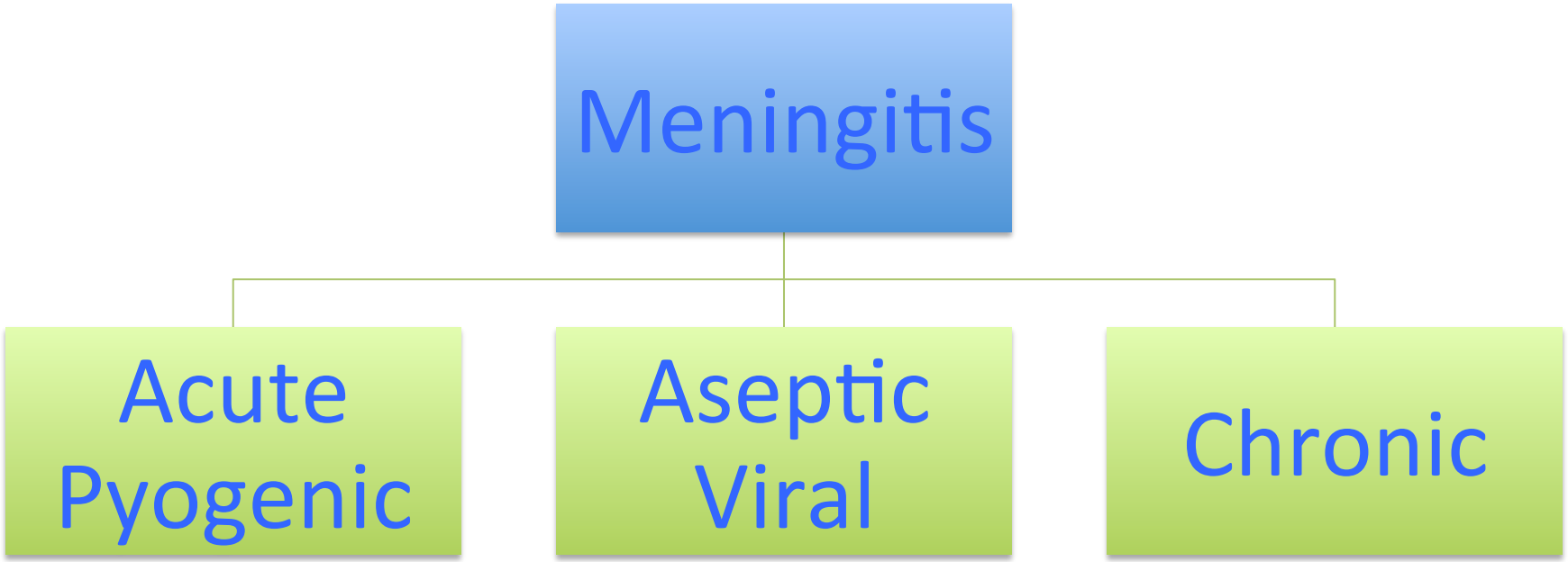
Bacterial	• Neonates (**BEL**):
	  o Group **B** strep.
	  o **E.coli**
	  o **L.monocytogenes**
	• Children and young adults: N.meningitides
	• Adults: S. pneumoniae
	• Elderly:
	  o S.pneumoniae
	  o L.monocytogenes
		• **S.pneumoniae is the most common cause of bacterial meningitis in general.**

Viral	• Entroviruses: echo, polio, coxasackie virus. • HSV: in children and young adults.	• **Most common cause of meningitis in general**. • HSV is common among ***college students in dorms***. • Most common cause of viral meningitis is **Entroviruses** causing 85-95% of all viral meningitis cases.
Fungal	• Cryptococcus (**AIDS**) • Mucor (in **diabetics**)	• ***Most common cause fungal meningitis is Cryptococcus.***
Protozoan	• Toxoplasma gondii	• Cat feces. • *Ring enhancing lesion on CT scan.*
Parasitic	Not common	_____
Malignant	Breast ca, bronchial ca, leukemia, and lymphoma.	_____
Inflammatory	SLE, Behchet disease, and sarcidosis.	_____

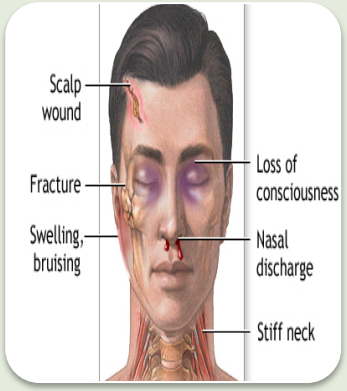
Bacterial infection most common by age

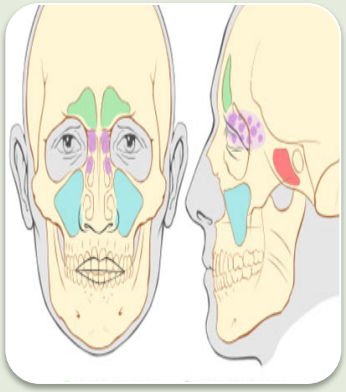
Age	Organism
Neonate < 1 month	1) Group B streptococcus 2) Escherichia coli 3) Listeria monocytogenes 4) Klebsiella species
1-23 months	1) Group B streptococcus 2) Escherichia coli 3) Haemophilus influenza 4) Streptococcus pneumoniae 5) Neisseria meningitidis
2-50 years	1) Streptococcus pneumoniae 2) Neisseria meningitidis
Over 50 years	1) Streptococcus pneumoniae 2) Neisseria meningitidis 3) Listeria monocytogenes 4) Aerobic gram negative bacilli
Immunocompramised	1) Streptococcus pneumoniae 2) Neisseria meningitidis 3) Listeria monocytogenes 4) Aerobic gram negative bacilli (including p.aeruginosa)

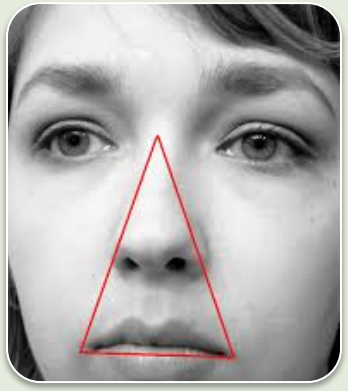
Types of Meningitis

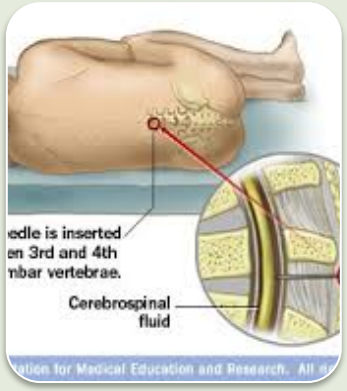


Infectious: How can the organism reach to the CNS?









Direct Implantation:

- Traumatic Injury
- Congenital (myelomeningocele)

Neighboring Structures:

- Paranasal sinuses
- Otitis media
- Teeth abscess
- Osteomyelitis

Hematogenous:

1-: **Arterial**:

-Pneumonia

- Bronchectasis
- Infective bacterial endocarditis

2-Retrograde Venous:

- Danger triangle in the face

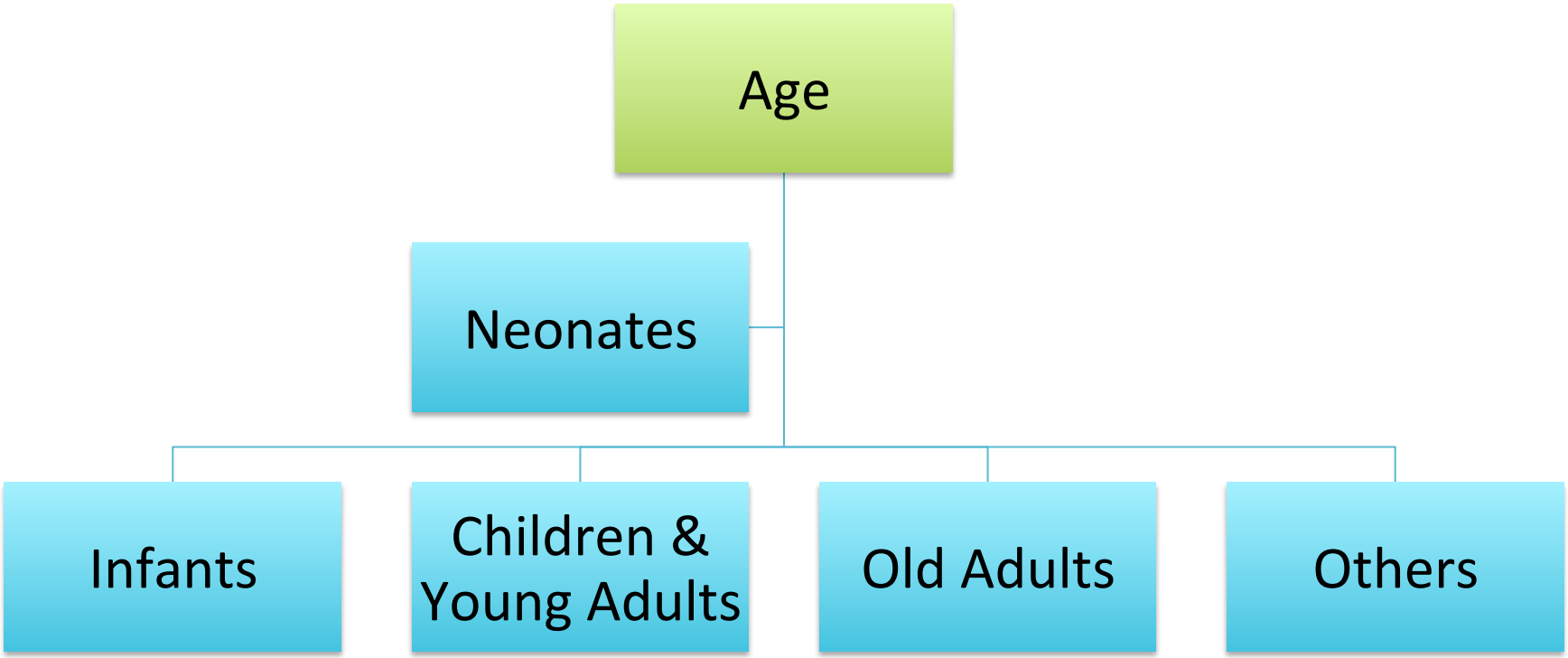
Retrograde PN:

- Herpes zoster
- Rabies

Iatrogenic:

- LP

Acute Pyogenic Meningitis



A. Neonates

B. Infants

- H. Influenzae
  - HiB vaccine
  - Was previously common
- S. Pneumoniae
  - **Most Common Cause of Meningitis in general!!!**
- N. Meningitides
  - Living in close quarters
  - Petcheal skin rash
  - Polyvalent vaccine

C. Young Adults

N. Meningitides

D. Old Adults

S. Pneumoniae

- L. monocytogenes

E. Others

- **Pregnant patient:**
  - L.monocytogenes.
- **Alcoholic patient:**
  - S.pneumoniae
  - L. monocytogenes.
- **Immunocomprimised patient:**
  - S.Pneumoniae
  - L. monocytogenes
  - Pseudomona aeruginosa
  - Mycobacterium tuberculosis
  - Mycobacterium avium.

Most common bacterial infections with certain risk factors

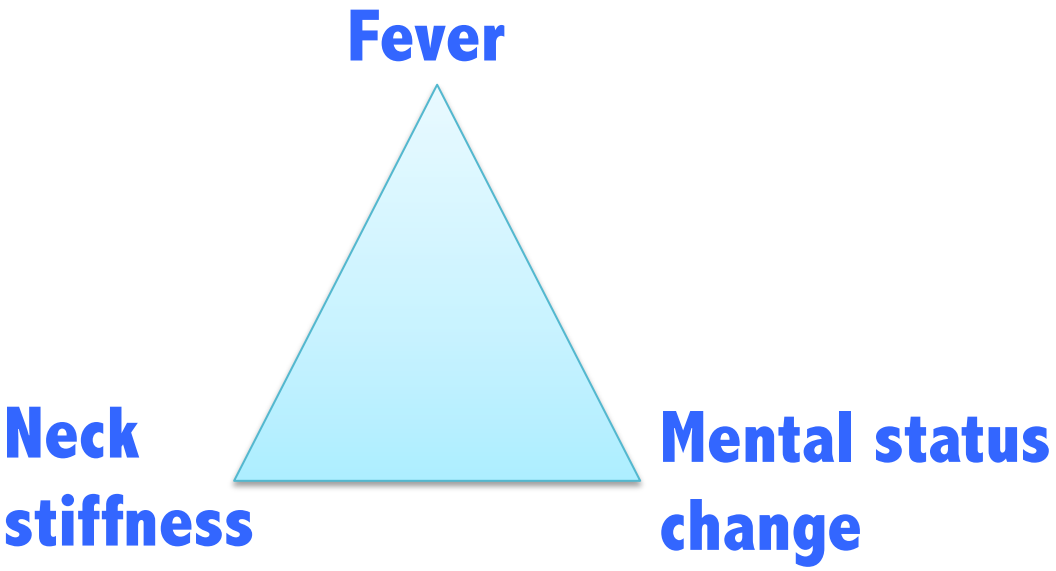
Risk factor	Organisms
Pregnancy	1) Listeria monocytogenes
Alcoholism	1) Listeria monocytogenes 2) Streptococcus pneumoniae
Diabetes	1) Streptococcus pneumoniae 2) Staphylococcus aureus 3) gram negative bacilli
Head trauma \ post neurosurgery	1) Staphylococcus aureus 2) Coagulase- negative staphylococcus 3) Aerobic gram negative bacilli (including p.aeruginosa)

Pathophysiology of Acute Pyogenic Meningitis

Risk Factors

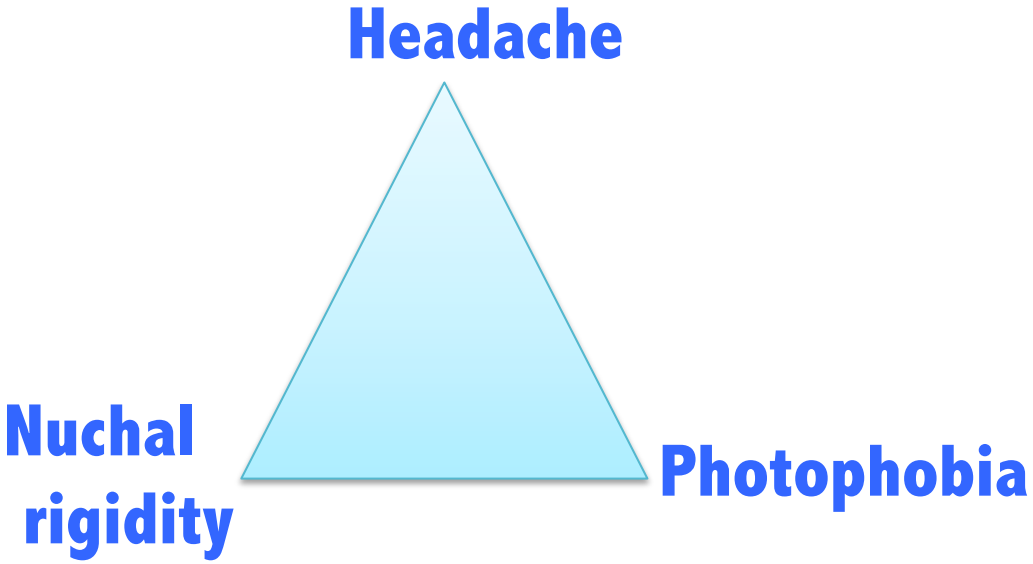
- Cancer
- Immunocompromised
- Sinusitis
- Age extremes
- Otitis
- Head trauma
- Parameningeal infection (osteomyelitis of the skull)
- Alcoholism
- Infections (systemic)
- Neurosurgical procedures
- Splenectomy

Clinical Presentation

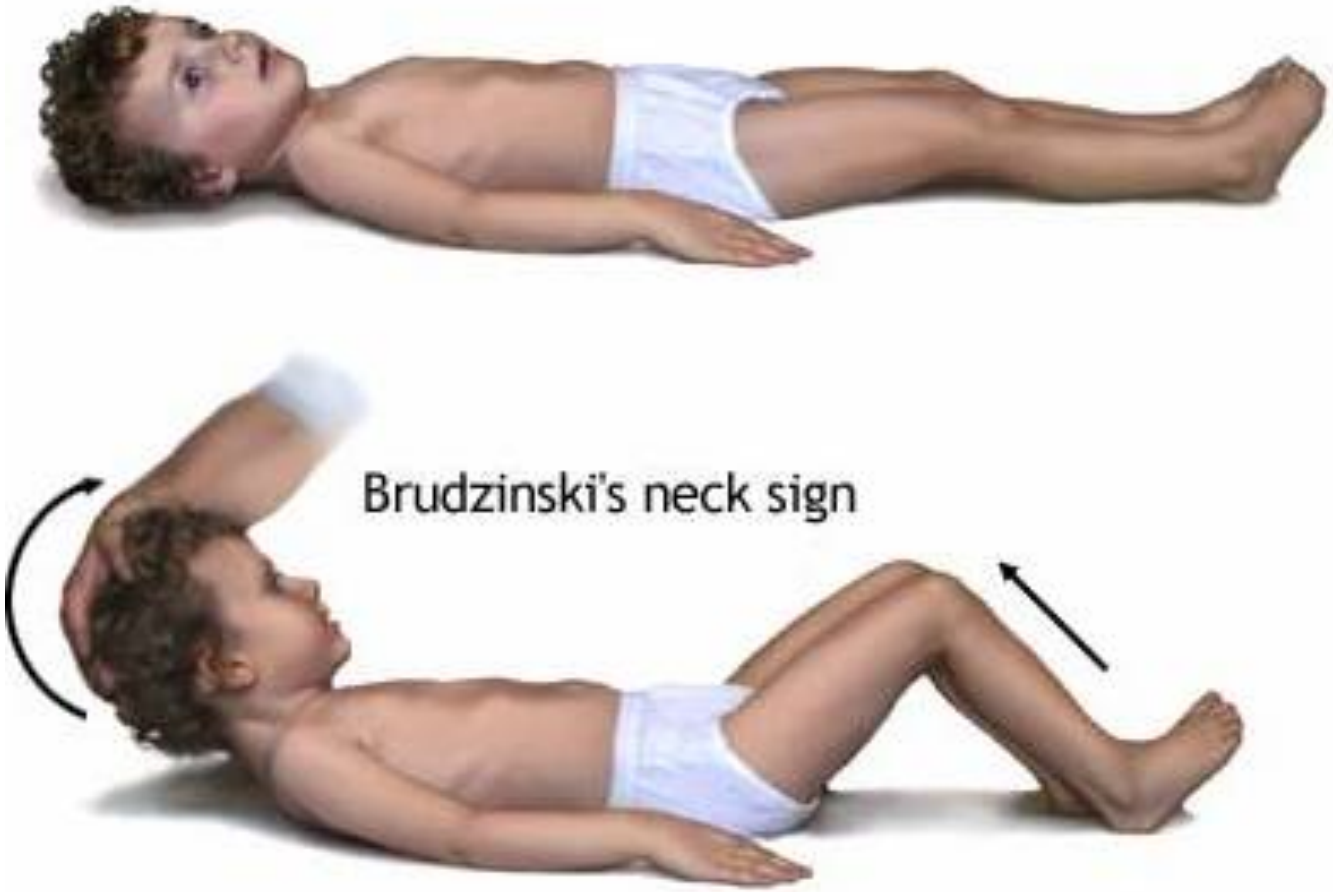


Any bacterial meningitis may develop acute septic shock.

Meningism



How to differentiate between nuchal rigidity in meningitis from neck stiffness in cervical spine osteoarthritis?



http://eegmed.com/html_files/musculoskeletal_neurological.html

https://www.nlm.nih.gov/medlineplus/ency/imagepages/19077.htm

Meningococcal skin rash

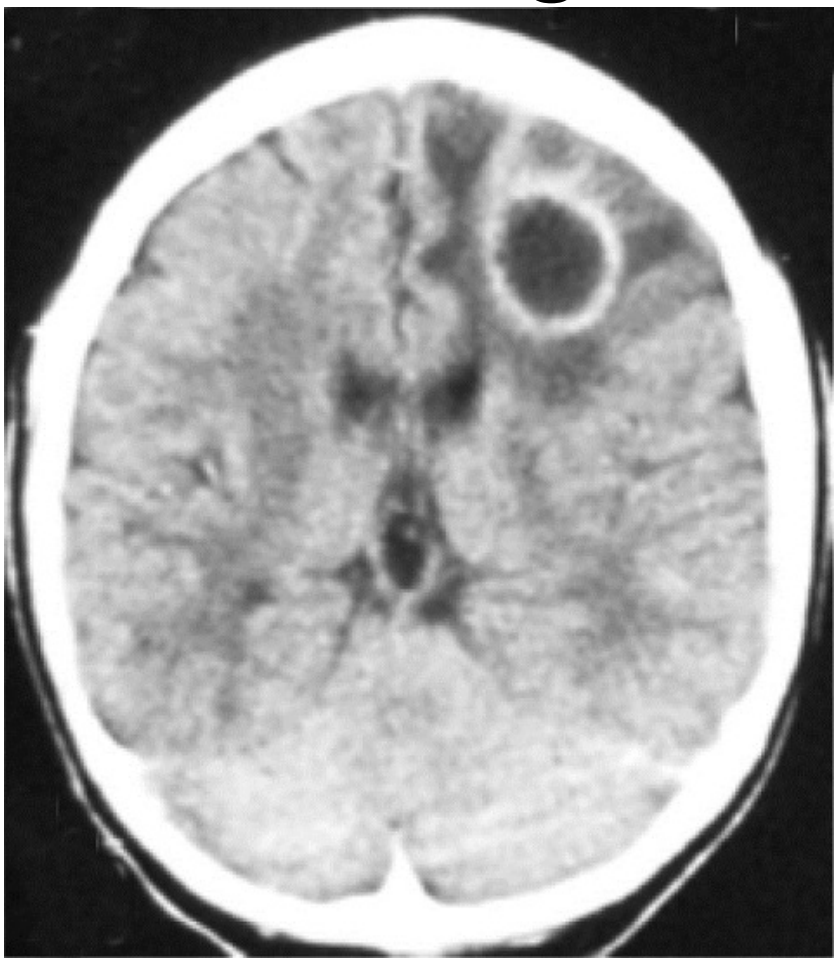
http://nursingcrib.com/communicable-diseases/faq-about-meningococccemia/

Diagnosis

- History & physical examination.
- Investigation:
  - CBC
  - Blood Cultures and gram staining (for bacterial meningitis)
  - PCR (for viral meningitis)
  - CT or MRI (toxoplasmosis, HSV, or to exclude any space occupying lesion)
  - ***India ink stain (Cryptococcus detection in CSF)***
  - **CSF analysis (*contraindicated with ↑ICP*) :**

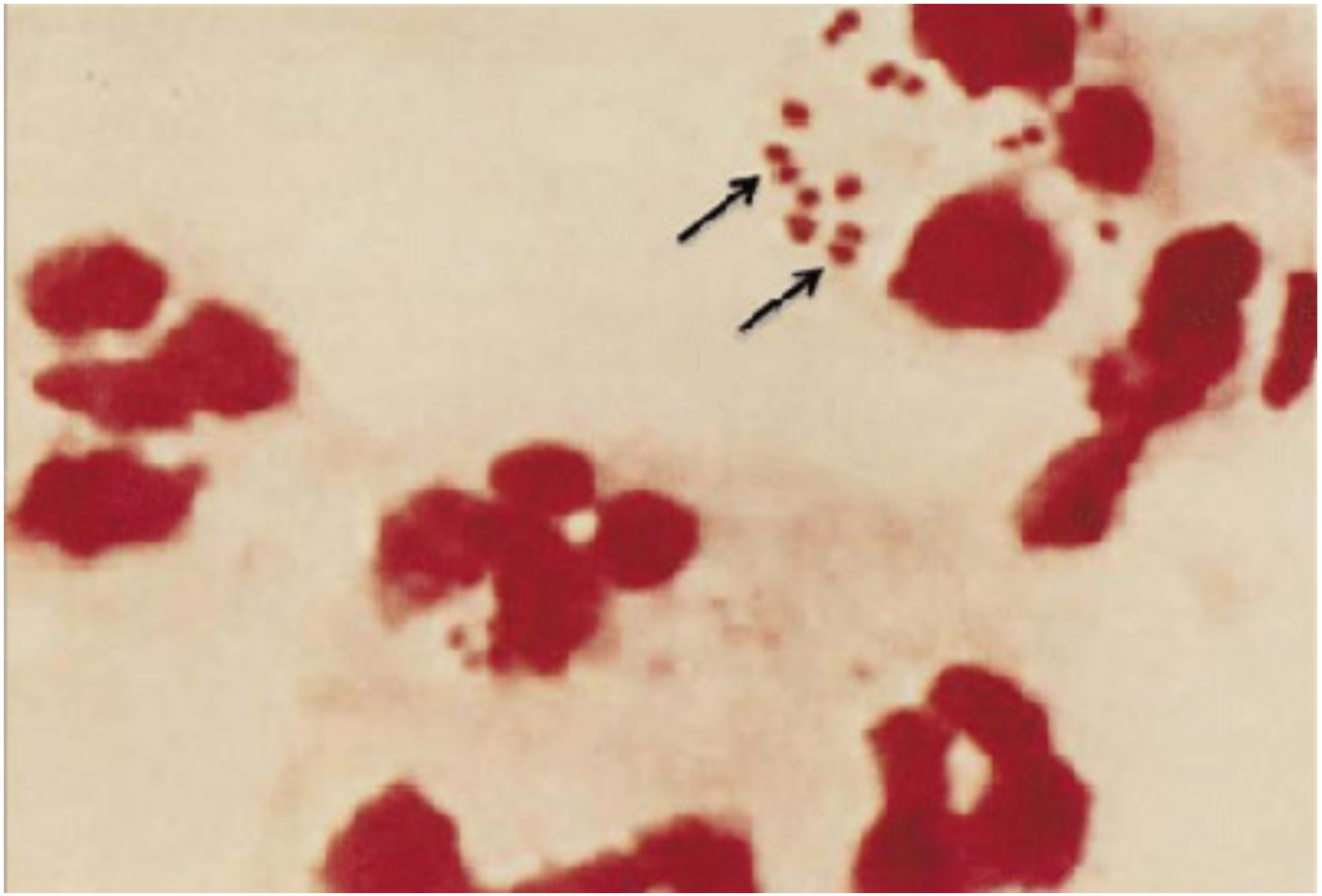
Meningitis is a ***Clinical*** Dx!
Never a radiological Dx!

CT Showing Ring Enhancing Lesion in T.gondii



http://www.nigeriamedj.com/article.asp?issn=0300-1652;year=2012;volume=53;issue=4;spage=231;epage=235;aulast=Eze

Picture of N. meningitides in WBCs



http://www.cdc.gov/meningitis/lab-manual/chpt06-culture-id.html

CSF Findings

Type of Meningitis	CSF color	WBCs	Protein	Glucose
Bacterial Meningitis	Turbid	↑↑Polymorphs (neutrophils)	↑↑	↓↓
Viral Meningitis	Clear	↑↑Lymphocytes	Normal/↑	Normal/↓
TB Meningitis	Turbid/clear/viscous	↑↑Lymphocytes	↑↑↑	↓↓↓

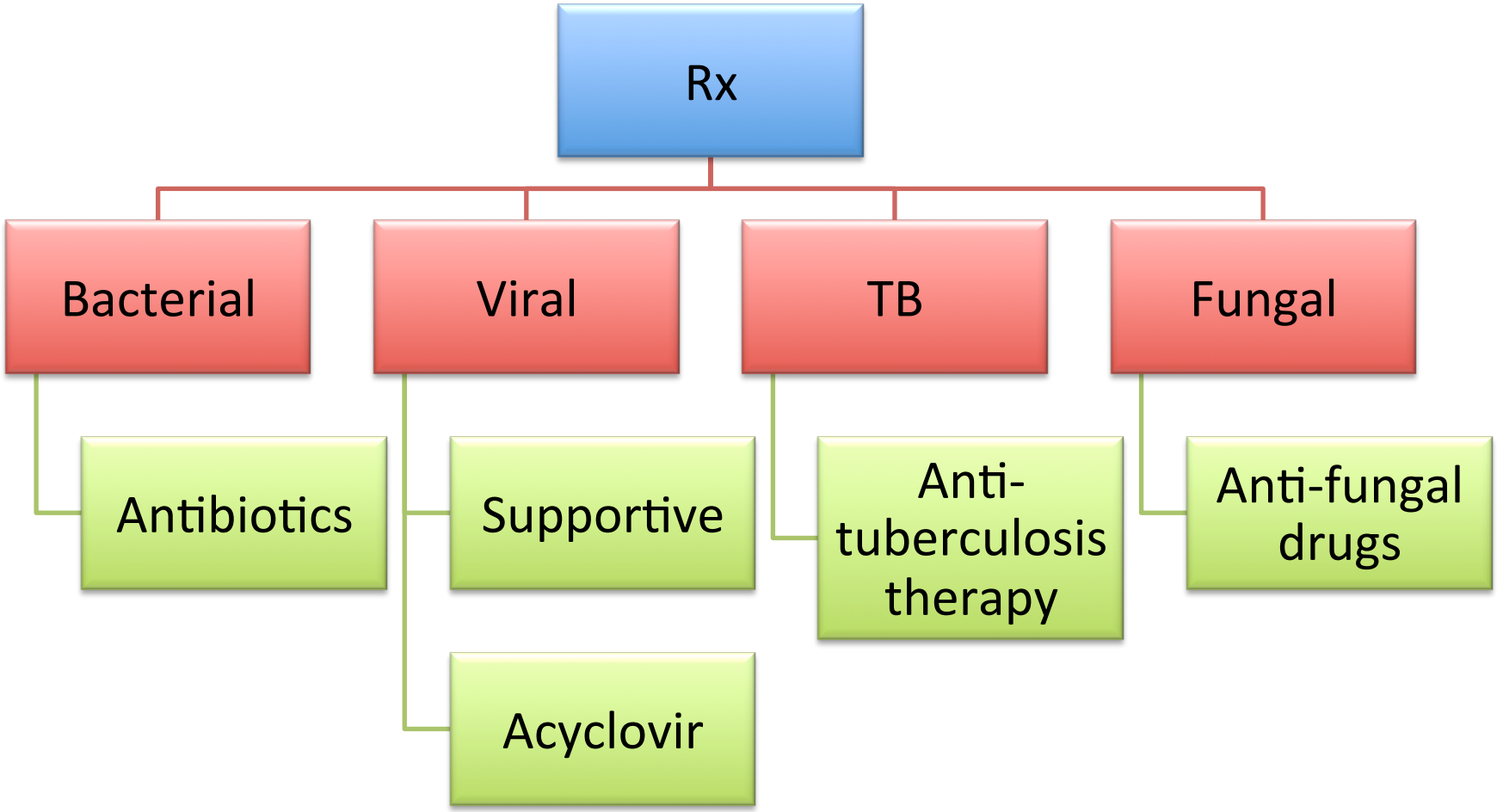
CSF Fluid

http://www.gettyimages.ae/detail/photo/cerebrospinal-fluid-samples-the-one-on-the-high-res-stock-photography/128577789

Management General Status

- ↑ICP:
  - Mannitol
  - Steroids

Management


Rx
Bacterial
Viral
TB
Fungal
Antibiotics
Supportive
Acyclovir
Anti-tuberculosis therapy
Anti-fungal drugs

Antibiotics for Bacterial Meningitis

- Antibiotics for bacterial meningitis should start even before identifying the organism
- Start empirical enough to cover the suspected organism!

Before Culture Results:

Age	Organisms suspected	Antibiotics
<3 months	BEL organisms	Ampicillin+ ceftriaxone/ cefotaxime
3 months -50 years	N.Meningitedes H.Influenzae S.Pneumoniae	ceftriaxone/ cefotaxime +Vancomycin
>50 years	Same as above + L.monocytogenes	ceftriaxone/ cefotaxime +Vancomycin+ Ampicillin

After Culture Results: Adjust!

Organism	Antibiotic
N.Meningitedes	Ceftriaxone/cefotaxime + Penicillin
S.Pneumoniae	Ceftriaxone/cefotaxime + Vancomycin
H.Influenzae	Ceftriaxone/cefotaxime
L.Monocytogenes	Ampicillin

Complications

- ***Hearing loss (most common long-term complication in children).***
- Cerebral abscess.
- Hydrocephalus.
- Increased ICP.
- Focal seizures and epilepsy.

Hearing loss:

- **S. pneumoniae**
- **N. meningitides**
- **Hib**

Prophylaxis

- Chemoprophylaxis (following exposure):
  - Rifampin for close contact (N.meningitides and Hib).
- Immunoprophylaxis:
  - Hib vaccine
  - PCV13 and PCV23
  - Polyvalent Meningococcal vaccine

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- Le, Tao et al. *First Aid For The® USMLE*. Print.
- Dr. Najeeb lecture for meningitis.

For any questions or comments please contact us at:

info@letstalkmed.com