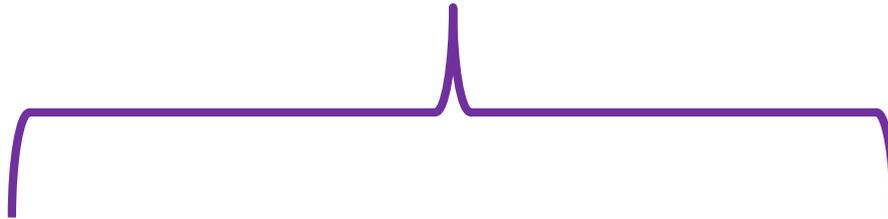

Fungal & Amebic Meningitis
NS1 Module
2025-2026

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Classifications

The phylum Sarcomastigophora



The Amebas groups

Entamoeba histolytica

Entamoeba dispar

Naegleria fowleri

Acanthamoeba spp.

Balamuthia spp.

The Flagellates group

Trichomonas vaginalis

Giardia duodenalis

Leishmania spp.

*Trypanosoma brucei gambiense and
rhodesiense*

Trypanosoma cruzi



The Amebas groups

- ▶ Amoeba are single celled protozoa.
- ▶ Most protozoa are free-living and have little or no impact on human health.
- ▶ They are found throughout the environment, particularly in soil and water.
- ▶ However, there are three free-living amoeba that have been associated with serious human infections.



Pathogenic free-living amoeba

Three genera have been associated with disease in humans.

▶ These are:

▶ *Acanthamoeba* spp. and *Balamuthia mandrillaris*:

Causing Granulomatous Amebic Encephalitis (GAE).

▶ *Naegleria fowleri* (brain-eating amoeba):

Causing Primary Amebic Meningoencephalitis (PAM)



Pathogenic free living amoebae are

Naegleria fowleri

Causative parasite of

Primary amoebic meningo-encephalitis.

Acanthamoeba species

Causative parasite of

Granulomatous amoebic encephalitis

keratitis

Chronic granulomatous infection of the skin.

Distribution

Acanthamoeba species are found worldwide:

- ▶ Most commonly in soil, dust, fresh water, marsh, and sea water.
- ▶ In swimming pools, hot tubs and drinking water systems (e.g., slime layers in pipes and taps)
- ▶ In heating, ventilating and air conditioning (HVAC) systems and humidifiers.

Balamuthia mandrillaris:

- Found in soil.

Naegleria fowleri:

- Is a heat-loving (thermophilic).
 - Commonly found around the world in warm fresh water (e.g., lakes, rivers, hot springs).
 - In soil.
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Transmission

N. fowleri:

- ▶ Occurs when water containing amebae enters the nose.
- ▶ Trophozoites penetrate the nasal tissue and migrating to the brain via the olfactory nerves causing PAM.

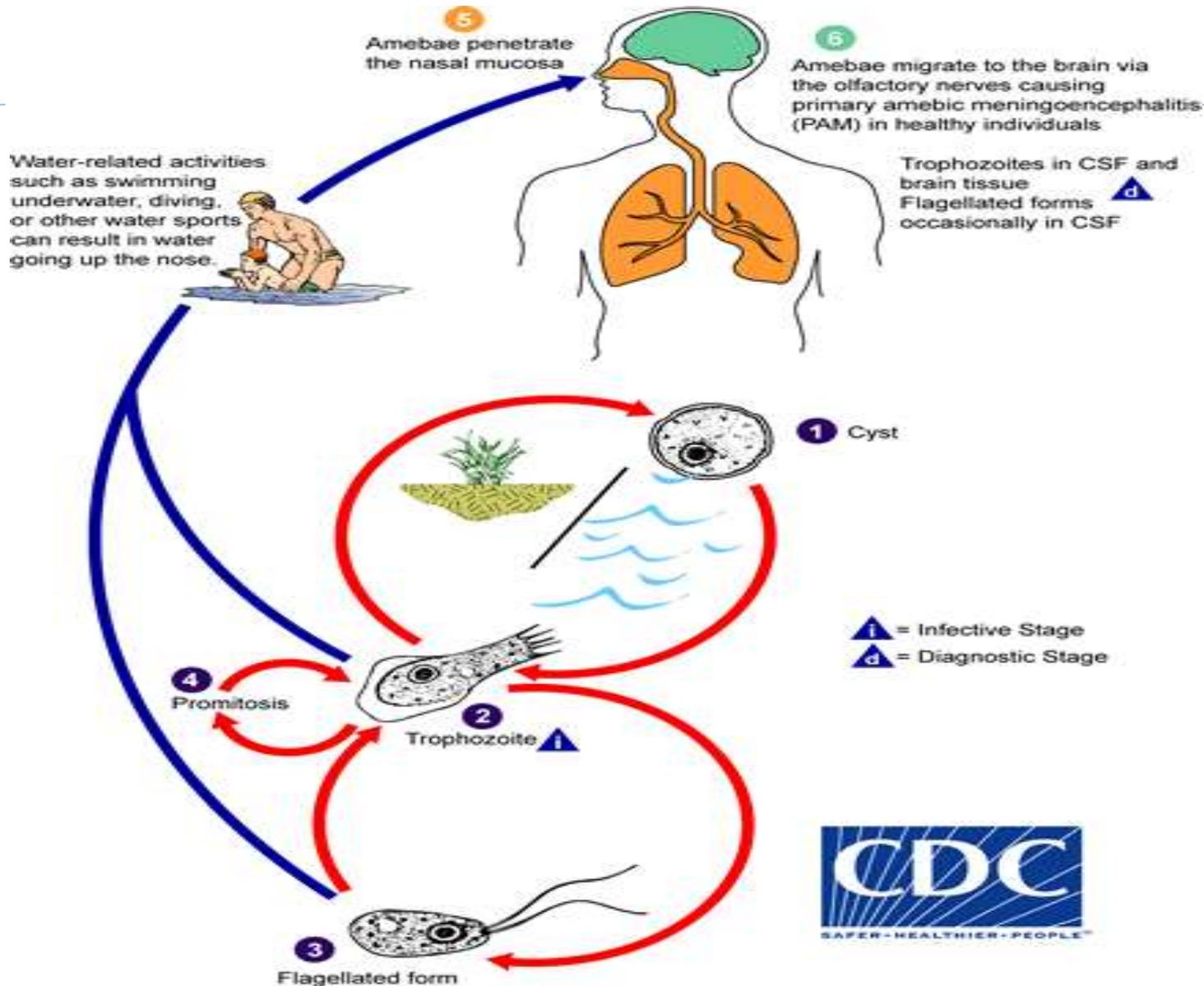
Acanthamoeba spp:

- ▶ The trophozoites are the infective forms.
- ▶ Through eye, the nasal passages, cuts or skin wounds or by being inhaled into the lungs, it can invade the CNS by hematogenous dissemination in individuals with **compromised immune systems**..
- ▶ When enter the eye they can cause severe keratitis in **healthy individuals**, particularly contact lens users.

Balamuthia mandrillaris:

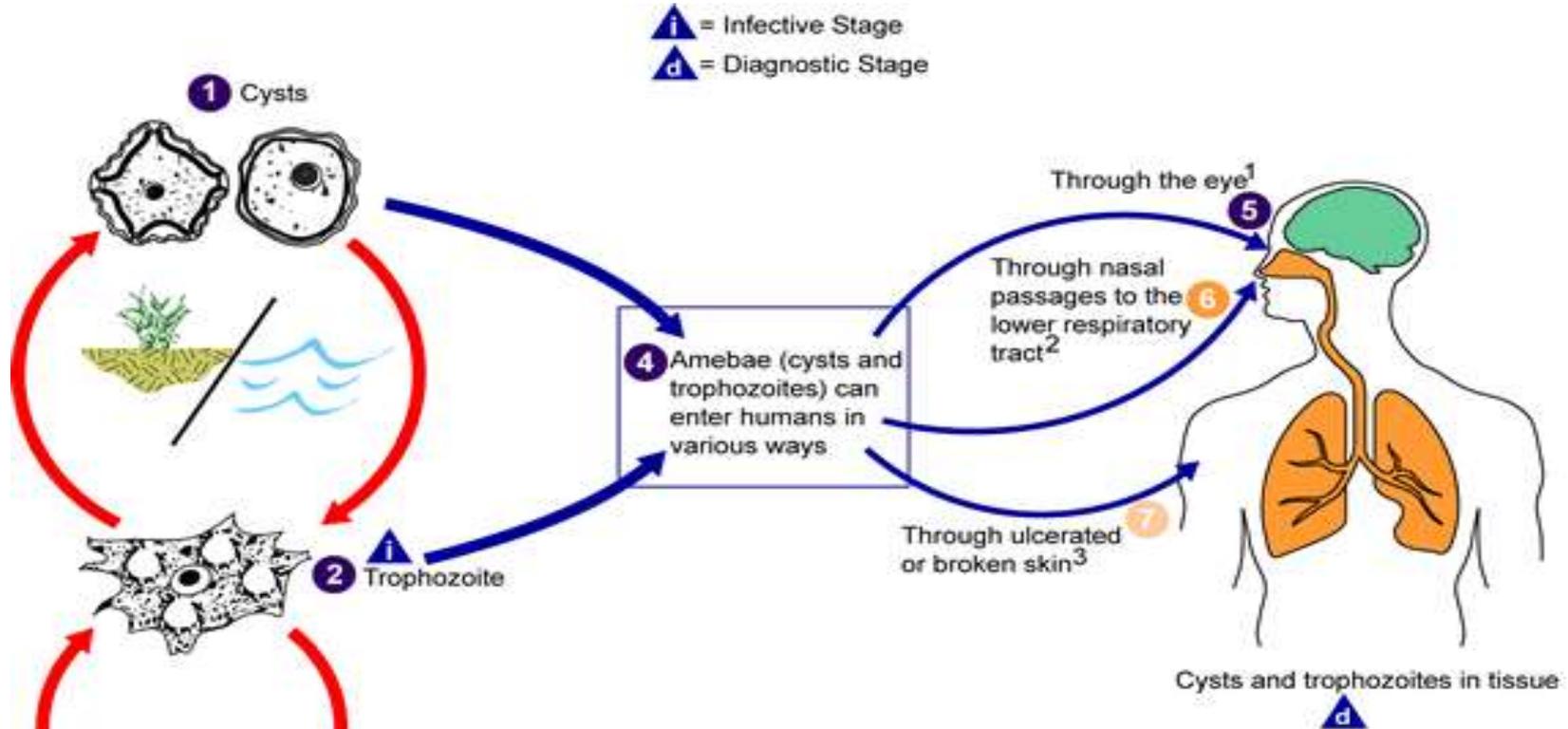
- ▶ When dust containing the trophozoites enter the respiratory system or through the skin, it can invade the CNS by hematogenous dissemination causing GAE or disseminated disease, or skin lesions in individuals with **compromised immune systems**.
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Transmission- *N. fowleri*



Transmission

Acanthamoeba spp & Balamuthia mandrillaris



- ¹ Results in severe keratitis of the eye. **8**
- ² Results in granulomatous amebic encephalitis (GAE) and/or disseminated disease **10** in individuals with compromised immune systems. **9**
- ³ Results granulomatous amebic encephalitis (GAE), disseminated disease **10**, or skin lesions in individuals with compromised immune systems. **11**

Incubation Period and Illness Duration

Naegleria fowleri:

- ▶ Incubation period: Symptoms start 1-14 days (median 5 days) after exposure.
- ▶ Duration of illness: Death occurs 1-18 days (median 5 days) after symptoms begin

B. mandrillaris and Acanthamoeba spp:

- ▶ Incubation period: Weeks to months (or longer).
- ▶ Duration of illness: Weeks to months



Communicability of Amebic meningitis/encephalitis

Amebic meningitis/encephalitis is not spread from person-to-person (except in the case of transmission through transplantation of organs from an infected donor).



Clinical Illness-(PAM)

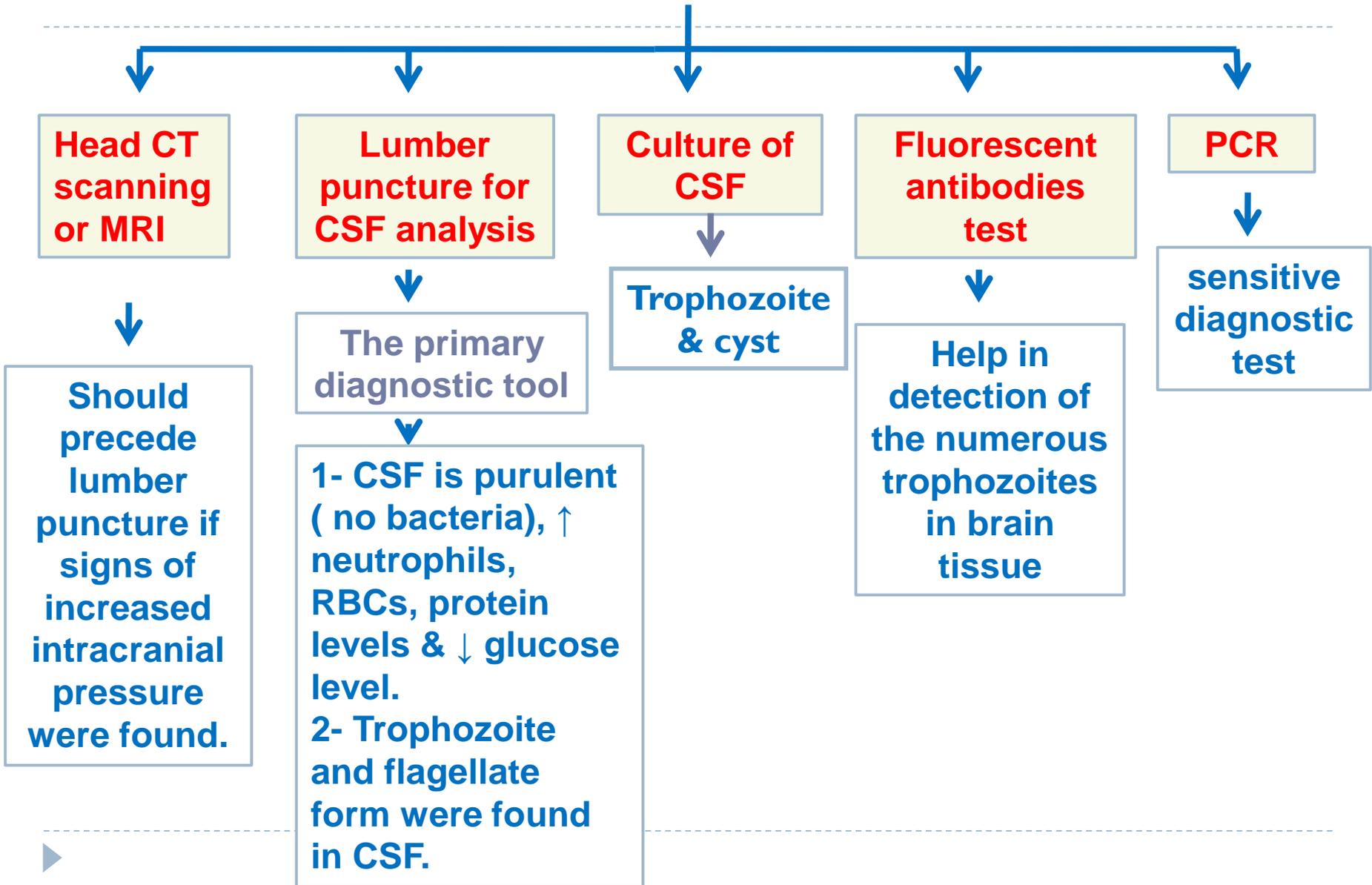
Primary Amebic-Meningoencephalitis (PAM)

▶ Clinical Case Definition:

- ▶ An infection presenting as meningoencephalitis or encephalitis.
- ▶ The clinical course:
 - ▶ **Stage 1 Symptoms:** begin within 1 to 14 days post amebic exposure and include severe **headache, fever, nausea and vomiting.**
 - ▶ **Stage 2 Symptoms:** include stiff neck, confusion, lack of attention to people and surroundings, loss of balance, seizures, and hallucinations.
- ▶ After the start of symptoms, death usually occurs within 1 to 18 days (median 5 days) of onset of stage 2 symptoms. Final cause of death is brain swelling and deterioration of tissue.



Laboratory Diagnosis- (PAM)



Treatment- (PAM)

Medical:

- ▶ Amphotericin B intrathecally in severe cases + Miconazole (IV injection) + Rifampicin (orally).

Surgical:

- ▶ Hydrocephalus may necessitate shunting.



Clinical Illness

Granulomatous amebic encephalitis (GAE)

▶ Clinical Case Definition

- ▶ An infection presenting as meningoencephalitis or encephalitis.
- ▶ GAE can include general symptoms and signs of encephalitis.

Laboratory Confirmation:

- ▶ Same as *Naegleria*
-



Treatment- (GAE)

Medical:

- ▶ Ketoconazole and amphotericin B (alone or in combination).
- ▶ Sulfadiazine may be indicated.

Surgical:

- ▶ Same as *Naegleria*.

Severity of PAM and GAE

- More than 95% of PAM and GAE cases are fatal.



Control Measures

Naegleria fowleri

- ▶ Avoid water-related activities in bodies of warm freshwater during **periods of high water temperature** and low water levels.
- ▶ Hold the nose shut or use nose clips when taking part in water-related activities.

Balamuthia mandrillaris and Acanthamoeba spp. :

- ▶ There are no specific prevention and control measures.
- ▶ Recommend that anyone experiencing symptoms be evaluated by a physician.
- ▶ They mainly affects those who are immunocompromised.



Fungal meningitis (Cryptococcosis)

- ▶ **It is a fatal fungal disease caused by *Cryptococcus neoformans*.**
 - ▶ **General characters of *C. neoformans*:**
 - ▶ Yeast cells, oval in shape with a gelatinous capsule.
 - ▶ Found in soil contaminated with the excreta of birds specially pigeons' feces.
 - ▶ It is an opportunistic fungus affecting mainly immunosuppressed persons specially **AIDS** patients.
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Cryptococcosis-Risk groups

- ▶ Diseases as AIDS, lymphoma, sarcoidosis, liver cirrhosis, lung & heart diseases.
- ▶ Long term corticosteroids therapy.
- ▶ Diabetes.
- ▶ Pregnancy.

Cryptococcosis- Mode of infection

- ▶ Infection occurs by inhaling microscopic airborne spores of this fungus.
- ▶ Infection does not spread from person to person.



Cryptococcosis-Pathogenesis & Symptomatology

- ▶ Depending on the **virulence** of the yeast strain and the **immune status of the host**, *C. neoformans* can either cause latent infection (in which the yeast cells remain dormant in the body) or symptomatic disease.

Treatment

Combination of amphotericin B and flucytocine.



Clinical pictures

**Respiratory symptoms
(pneumonia like illness)**

**Fever, cough, chest
pain & dyspnea**

**Dissemination of the
infection mainly with AIDS**

**To CNS causing
meningoencephalitis**

**To skin, eyes, bones
& joints**

- **Headache, fever.**
- **Neck pain.**
- **Nausea and vomiting.**
- **Sensitivity to light**
- **Mental status range from confusion to coma.**
- **If left untreated, cryptococcal meningoencephalitis may lead to brain damage, hearing loss & hydrocephalus**

Diagnosis

Specimens:

Sputum, CSF, blood

Microscopic Examination

Blood or CSF culture

Detection of *Cryptococcosis* antigen in CSF by

PCR

Dipstick test

CSF examination by using **India ink** showing the oval yeast surrounded by unstained capsule.

Latex agglutination test & ELISA.

A new method for detecting *Cryptococcal* antigen in patient's serum

Rapid & sensitive methods for diagnosis

Rapid (takes 10 minutes), sensitive & inexpensive