

A Glimpse on Brain Eating Amoeba

Dr. Anand P.S.¹, Adarsh.S², Ramjith.U.S^{1*}

¹ Family Health Centre, Angamoozhy, Pathanamthitta-689662.

² National Institute of Technology, Kozhikode-673601.

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ABSTRACT

Primary amoebic meningoencephalitis (PAM), or 'brain-eating amoeba' is caused by a free-living protozoa called *Naegleria fowleri*. It is, though notably uncommon, a condition that carries a high mortality risk. The clinical features of *N. fowleri* Primary amoebic meningoencephalitis (PAM) may resemble those of bacterial meningitis, thus rendering an initial diagnosis difficult.

The research regarding drug discovery is based on symptoms experienced by the patient.

Key words: Primary amoebic meningoencephalitis, *N. fowleri*, brain-eating amoeba'.

I. INTRODUCTION

Amoeba is a **type of cell or unicellular organism with the ability to alter its shape, primarily by extending and retracting pseudopods.**

What are the symptoms of a brain-eating amoeba infection?

Within two to 10 days after exposure, initial symptoms include **fever, headache, nausea or vomiting**. Later symptoms include stiff neck, loss of balance, confusion, lack of attention to surroundings and people, hallucinations and seizures.

The mild form of amebiasis includes nausea (a feeling of sickness in the stomach), diarrhea (loose stool/poop), weight loss, stomach tenderness, and occasional fever. **Rarely, the parasite will spread the body beyond the intestines and cause a more serious infection, such as a liver abscess (a collection of pus).**

Characteristics of Amoeba

- Irregular cell shape.
- Ability to constantly alter the cell shape.
- Pseudopods for locomotion.
- Pseudopods and ectoplasmic tubes for feeding.
- Two protoplasmic layers.
- Single nucleus.
- Contractile vacuole.
- Reproduction.



Structure of Amoeba

Scientific classification of Amoeba

Domain: Eukaryota
Phylum: Amoebozoa
Class: Tubulinea
Order: Euamoebida
Family: Amoebidae
Genus: Amoeba

Species of Amoeba

- *Amoeba agilis* Kirk,
- *Amoeba gorgonia* Pen.
- *Amoeba limicola* Rhumb.
- *Amoeba proteus* Pal.
- *Amoeba vespertilio* Pen.
- *Amoeba naegleria fowleri*.

N. fowleri is named after Malcolm Fowler, who described the earliest reported cases of *N. fowleri* PAM in 1965 in Australia. The organism thrives in freshwater lakes, hot water springs, poorly chlorinated pools, and other bodies of water that rapidly fluctuate in temperature due to thermal pollution.¹

Free-living amoebae are protozoan environmental parasites, found mainly in freshwater, ponds, lakes, and rivers. There are four main genera of amoebae implicated in human disease, namely *Naegleria* (only *Naegleria fowleri*), *Acanthamoeba* (several species), *Sappinia* (only *S. pedata*), and *Balamuthia* (only *Balamuthia mandrillaris*). Rarely other free-living amoebae (FLA) such as *Vermamoeba* [*hartmanella*]

vermiformis have also been implicated in human disease.¹

Source for infection

Aomeba water.

Life cycle of Naegleria fowleri

The life cycle of *N. fowleri* consists of 3 stages: trophozoite, a temporary flagellar stage known as amebo-flagellate, and cyst. The active replicating form is a trophozoite that can reproduce asexually. Trophozoite is the vegetative or feeding stage of the amoeba and is the infective form. In

humans, this form is found in CSF or in tissue. Cysts are usually absent in clinical specimens, as the infection is so rapid and fatal that the patient typically dies before the trophozoites encyst. The trophozoite can transform into a flagellate stage, in which state it can survive without nutrition. This is also the stage in which the amoeba is distributed through water bodies In harsher climates, the flagellated form can undergo encystation into a double-walled cyst and withstand unfavourable conditions. This enables the *N. fowleri* to survive cold temperatures and hostile conditions.(Figure 1).

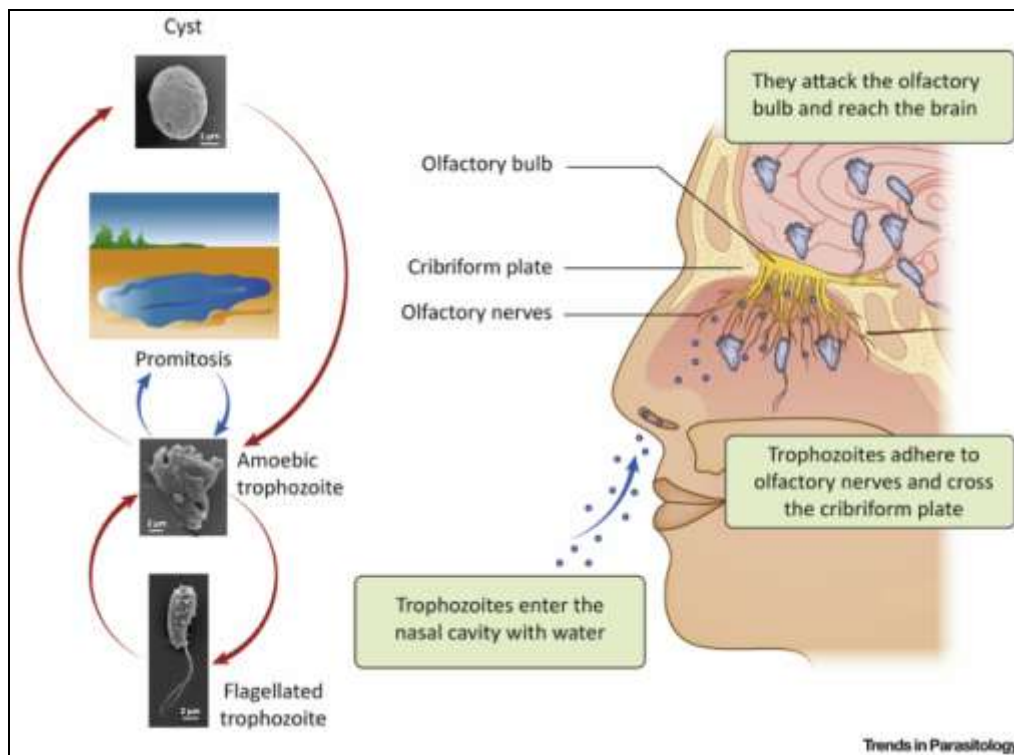


Fig:1 (Life cycle of Naegleria fowleri)

How the infection spreads?

Infection with *N. fowleri* occurs when freshwater enters the nasal cavity under pressure, such as during diving or swimming, etc. Following inoculation, the amoeba penetrates the olfactory mucosa and respiratory epithelium, then enters through the cribriform plate into the central nervous system. The result is extensive cortical hemorrhage, tissue necrosis, and edema of the brain tissue, with the olfactory bulb and cerebellum being the most affected parts.²

Incubation period:

The duration of incubation varies between 1 and 14 days.²

Clinical Features

The clinical features of *N. fowleri* Primary amoebic meningoencephalitis (PAM) may resemble those of bacterial meningitis, thus rendering an initial diagnosis difficult.

Initial symptoms include nausea, vomiting, fever, headaches, and lethargy. With the rapid progression of the disease, more severe symptoms of confusion, neck stiffness, photophobia, seizures, and cranial nerve

abnormalities develop. In most cases, the disease subsequently progresses to coma and death.³

Research studies

Primary amoebic meningoencephalitis (PAM), or 'brain-eating amoeba' is caused by a free-living protozoa called *Naegleria fowleri*. It is, though notably uncommon, a condition that carries a high mortality risk. In Kerala, India, the first reported case of PAM in 2024 was on May 21, involving a five-year-old girl. The second case, reported on June 25, involved a 13-year-old girl. Two additional cases were reported in July, involving two fourteen-year-old boys, making it to a total of four cases in Kerala this year. All four children affected by the disease passed away.

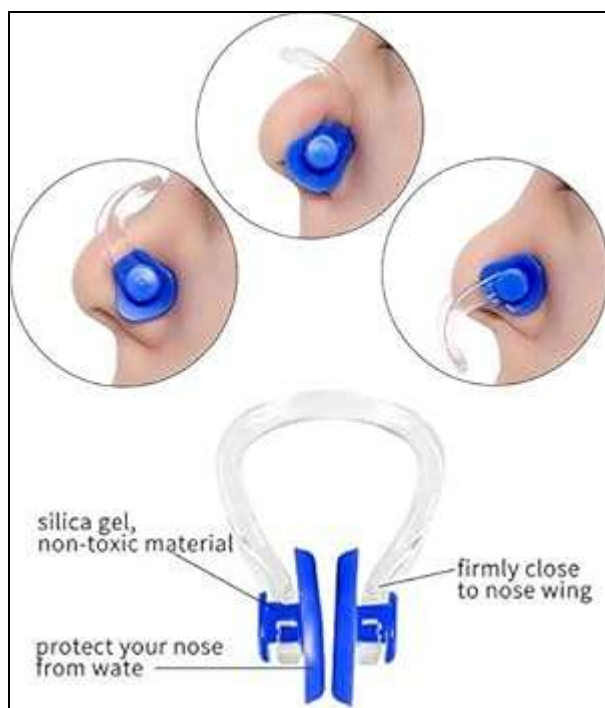
Sporadic cases of PAM have been reported from many parts of Kerala in the last decade. As of July 7, 2024, over the last 2 months, five cases of PAM have been reported from North Kerala. Clinical features were suggestive of PAM. The cases over the last 2 months have been reported in children aged 5,13,12, 13 and 15 years respectively with a male-to-female ratio of 3:2 [n=5]. The organism has been detected in every

country except Antarctica. Worldwide, between 1965 and 2018, a total of 381 PAM cases were reported in international literature and to the CDC, and the number of reported cases increased by 1.6 % each year from 1965 to 2016.⁴

II. CONCLUSIONS

The high fatality rate of *N. fowleri*-associated Primary amoebic meningoencephalitis (PAM) necessitates the importance of health promotional activities at high-risk areas.

The urgency to educate the public regarding protective habits for those going into contact with freshwater bodies. The public should be urged not to engage in water-based activities near warm, stagnant water and to pinch the nose or use a nose clip/nose plug during water-based activities. Public should be advised to avoid diving and jumping into stagnant freshwater and to keep their heads above the water level when swimming in freshwater and untreated thermal bodies of water. The research regarding drug discovery is based on symptoms experienced.



Nose plug

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal

relationships that could have appeared to influence the work reported in this paper.

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