

# Brain Eating Amoeba: Alarming Rise of Naegleriasis in Pakistan

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## Abstract

Naegleriasis also known as primary amoebic meningoencephalitis (PAM) is a fulminant brain infection is caused by a single-celled, ameboflagellate known as *Naegleria fowleri*. *Naegleria fowleri* has been difficult to eradicate since its growth is typically found in bodies of warm freshwater, unchlorinated, piped water, swimming pools and moist soil. This letter focuses on characteristics and route of spread of infection caused by *Naegleria fowleri* and preventative measures that can be taken to limit its spread. A thorough literature review was performed to identify different route of spread of *Naegleria fowleri* infection and specific measures that should be taken to limit its spread. We found that *Naegleria* follows a nasal route of infection, migrating along the olfactory nerve, through the cribriform plate into the brain where it evokes a substantial immune response causing a widespread inflammation, hemorrhage and necrosis eventually leading to death. The at-risk population includes individuals associated with swimming, diving and water skiing in freshwater and poorly chlorinated swimming pools and individuals performing ablution. Therefore, specific measures should be taken to limit the spread of *Naegleria fowleri* infection which includes education and awareness of the public as well as of the health professionals regarding Naegleriasis and its preventative measures.

**Keywords:** Naegleriasis; Brain Eating Amoeba

## Editorial

Naegleriasis also known as primary amoebic meningoencephalitis (PAM) is a fulminant brain infection characterized by headache, high grade fever, neck rigidity, seizures, photophobia, vomiting, altered mental status, positive Kernig's sign and positive Brudzinski's sign. CSF analyses show low glucose levels, high protein levels and significant leukocytosis.<sup>[1,2]</sup>

Naegleriasis is caused by a single-celled, ameboflagellate known as *Naegleria fowleri*. The brain eating amoeba has been difficult to eradicate since its growth is typically found in bodies of warm freshwater, unchlorinated, piped water, swimming pools and moist soil. It follows a nasal route of infection, typically when water is rushed into nostrils during deep inhalation.<sup>[3]</sup> It migrates along the olfactory nerve, through the cribriform plate into the brain where it evokes a substantial immune response causing a widespread inflammation, hemorrhage and necrosis eventually leading to death.<sup>[1,2]</sup>

Although, *Naegleria* is seen to have a worldwide distribution, the at-risk population includes individuals associated with swimming, diving and water skiing in freshwater and poorly chlorinated swimming pools. Another important cause is ablution, which involves taking water into the nostrils, performed by Muslims before their prayers at least five times a day and has been increasingly associated with *N. fowleri* infection.<sup>[3,4]</sup>

Since 1962, 147 cases of *Naegleria fowleri* have been reported in the United States with only four survivors.<sup>[5]</sup> To date, there have been only seven survivors worldwide.<sup>[3]</sup>

In Pakistan deaths related to PAM have been reported from

Tertiary care hospitals of Karachi regularly since 2008, especially during the summer. In the last 10 years around 88 cases have been recorded, with a fatality rate of 100%. In 2019, 16 new cases have been reported.<sup>[6,7]</sup>

In majority of the cases, victims denied any history of recent swimming or other recreational water activities. However, almost all patients were Muslims, so the infection likely occurred through ablution with tap water.<sup>[4]</sup>

Specific measures should be taken to limit the spread of *Naegleria fowleri* infection. These measures include education and awareness of the public as well as of the health professionals. When performing ablution, water that is boiled for one minute and left to cool, or filtered to remove small organisms, or disinfected appropriately should be utilized, together with cautious ablution (not pushing water inside nostrils vehemently), in order to avoid serious consequences for communities living in developing countries. Water disinfected appropriately can minimize the risk for infection. Swimming pools, water tanks and domestic water supplies should be effectively disinfected and chlorinated. Jumping and diving into warm freshwater or swimming pools should be avoided and head should be kept above water.<sup>[1,2]</sup>

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## Competing Interests

The authors declare that they have no competing interests.

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