Naegleria fowleri
Primary Amoebic Meningoencephalitis (PAM)

General Information

What is *Naegleria fowleri*?

*Naegleria fowleri* is an amoeba that lives predominately in warm freshwater.

In the popular press, *Naegleria fowleri* is sometimes called the "brain-eating amoeba" and although there are many species of *Naegleria*, only *Naegleria fowleri* causes human infection. There are other free-living amoebas that cause human disease, including *Acanthamoeba*.

How does infection with *Naegleria fowleri* occur?

*Naegleria fowleri* infects people when water containing the amoeba enters the body through the nose. This typically occurs when people go swimming or diving in warm freshwater places, such as lakes and rivers. The *Naegleria fowleri* amoeba then travels up the nose to the brain where it destroys the brain tissue.

You cannot get infected from drinking water contaminated with *Naegleria fowleri*. You can only be infected when contaminated water goes up into your nose.

In very rare instances, *Naegleria fowleri* infections may also occur when contaminated water from other sources (such as inadequately chlorinated swimming pool water or contaminated tap water) enters the nose.

What does *Naegleria fowleri* present as?

*Naegleria fowleri* causes the disease primary amoebic meningoencephalitis (PAM), a brain infection that leads to the destruction of brain tissue. In its early stages, symptoms of PAM may be similar to symptoms of bacterial meningitis.

Initial symptoms of PAM start about 5 days (range 1 to 7 days) after infection. The initial symptoms may include headache, fever, nausea, or vomiting. Later symptoms can include stiff neck, confusion, lack of attention to people and surroundings, loss of balance, seizures, and hallucinations. After the start of symptoms, the disease progresses rapidly and usually causes death within about 5 days (range 1 to 12 days).

Where is *Naegleria fowleri* found?

*Naegleria fowleri* is found around the world and thrives in warm areas. In Australia this microbe occurs naturally in the Northern Territory but in the 1970s infections were being detected in South Australia and Western Australia via solar-warmed water travelling long distances in overland pipes. Both states monitor their reticulated water carefully as a result.
The amoeba can also be found in:

- Bodies of warm freshwater, such as lakes and rivers;
- Geothermal (naturally hot) water, such as hot springs;
- Warm water discharge from industrial plants; or
- Swimming pools that are poorly maintained.

*Naegleria fowleri* grows best at high temperatures, up to 46°C, and can survive for short periods at higher temperatures.

*Naegleria fowleri* is not found in salt water, such as the ocean.

**What swimming behaviours have been associated with *Naegleria fowleri* infection?**

Behaviours associated with the infection include diving or jumping into the water, submerging the head under water or engaging in other water-related activities that cause water to go up the nose.

**How can I reduce the risk of infection with *Naegleria fowleri***?

*Naegleria fowleri* can grow in pipes, hot water heaters, and water systems, including treated public drinking water systems.

Personal actions to reduce the risk of *Naegleria fowleri* infection should focus on limiting the amount of water going up the nose and decreasing the chances that *Naegleria fowleri* may be in the water.

**References:**

Department of Health Western Australia (2010), *Amoeba Response Protocol*, Environmental Health Directorate, Public Health Division.
