Primary amebic meningoencephalitis (PAM)

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(update from original work by Bill Bigler, PhD. Bureau of Epidemiology)

Naegleria is an ameba commonly found in the environment worldwide. Most commonly, the ameba is found in warm bodies of fresh water, (such as lakes, rivers, and hot springs), warm water discharge from industrial plants, under-chlorinated swimming pools, and soil. Only one species of *Naegleria* has been found to infect humans. Although Naegleria is commonly found in the environment, infection occurs rarely. Only 24 infections were documented in the U.S. between 1989 and 2000. However, this disease has public health importance because of its high fatality rate. *Naegleria* infection cannot be spread from person to person contact.

Infection with *Naegleria* is most common during the dry, summer months, when the temperature is above 80°F and the water is warm and water levels are low. Infection with *Naegleria* occurs when the ameba enters the body through the nose while the person is swimming underwater or diving. The ameba then travels to the brain and spinal cord.

Infection with *Naegleria* causes the disease primary amebic meningoencephalitis (PAM), a brain inflammation, which leads to the destruction of brain tissue.

Initial signs and symptoms of PAM include headache, fever, nausea, vomiting, and stiff neck. As the ameba causes more extensive destruction of brain tissue this leads to confusion, lack of attention to people and surroundings, loss of balance and bodily control, seizures, and hallucinations. The disease progresses rapidly and infection usually results in death within 3 to 7 days.

Several drugs are effective against *Naegleria* in the laboratory. However, a variety of treatments have been used to treat infected persons, although their effectiveness is unclear since most infections have still been fatal. Prompt diagnosis and treatment may help.[1]

The Centers for Disease Control and Prevention (CDC) provided the following guidelines to help prevent and reduce the risk of *Naegleria* infection:

- Avoid swimming or jumping into bodies of warm fresh water
- Avoid swimming in thermally polluted water (water around power plants)
- Do not swim in areas posted as "no swimming."
- Hold the nose shut or use nose clips when jumping or diving into bodies of fresh water

For further information on protecting yourself from recreational water illnesses, go to www.healthyswimming.org .

Primary Amebic Meningoencephalitis is not a reportable disease in Florida therefore complete data are not available. According to data from CDC's Waterborne Disease

[1] CDC, Division of Parasitic Diseases – *Naegleria* Infection Fact Sheet
http://www.cdc.gov/ncidod/dpd/parasites/naegleria/factsht_naegleria.htm

Surveillance Summaries, public health authorities were made aware of 14 cases of PAM in Florida between 1978-2007 (Table 1).

Table 1: Number of PAM cases in Florida 1978-2007, based on information from CDC Waterborne Disease Surveillance Summaries

County	Year	# of Cases
Orange	2007	3
Brevard	2002	1
Seminole	2002	1
Putnam	2000	1
Unknown	1999	1
Orange	1998	1
Lee	1995	1
Unknown	1991	1
Citrus	1986	1
Orange	1985	1
Pasco	1978	1
Unknown	1978	1

Note: Since this is not a reportable disease in Florida, complete data are not available; for the years not listed, there were no cases or no known cases.

For additional information on outbreaks involving PAM, go to
http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5512a1.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5108a1.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5308a1.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/ss4904a1.htm
http://www.cdc.gov/mmwr/preview/mmwrhtml/00055820.htm

Other Resource Articles:

1. Wellings, F. M., et al. (1977). Isolation and Identification of Pathogenic *Naegleria* from Florida Lakes: Applied and Environmental Microbiology, Dec. 1977, Vol. 34, No. 6, p. 661-667. American Society for Microbiology
2. Craun, G. F., et al, (2005). Outbreaks associated with recreational water in the United States: International Journal of Environmental Health Research, August 2005; 15(4): 243-262
3. Rose, J. B., et al, (2001). Climate Variability and Change in the United States: Potential Impacts on Water and Foodborne Diseases Caused by Microbiological Agents: Environmental Health Perspectives, May 2001; 109(suppl 2); 211-220
4. Cabanes, P. A., et al, (2001). Assessing the Risk of primary Amoebic Meningo-encephalitis from Swimming in the Presence of Environmental *Naegleria fowleri*: Applied and Environmental Microbiology, July 2001, Vol. 67, No. 7, p. 2927-2931. American Society for Microbiology
5. Chang, Shih-Lu, (1978). Resistance of Pathogenic *Naegleria* to Some Common Physical and Chemical Agents: Applied and Environmental Microbiology, (1978), Vol. 35, No. 2, p., 368-375. American Society for Microbiology
6. Grate, Isaac Jr., MD (2006). Primary amebic meningoencephalitis: a silent killer: Can J Emerg Med 2006; 8(5):365-9. JCMU