ISSN: 2583-8288
Popular Article
Published on: 11.08.2024

Public Health Risks in Recreational Waters: The Menace of Deadly Brain eating Amoeba

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https://doi.org/10.5281/zenodo.13294130

Introduction: Recreational water-borne diseases (RWBDs) are infections that individuals acquire from water-based activities such as swimming, diving, and other recreational activities in contaminated water, like swimming pools, ponds, lakes, rivers etc. These diseases are predominantly caused by a diverse range of pathogens, including bacteria, viruses, parasites, and fungi. Diarrhoea is most commonly reported recreational waterborne diseases, often caused by Cryptosporidium, Giardia, amoeba, Shigella, norovirus etc. Occasionally, improper dose of chemicals used for treatment of recreational water bodies can lead to illness or injury through direct contact or inhalation. These illnesses can also affect the nervous systems, caused by *Naegleria fowleri,* a single celled free living amoeba mostly live in fresh water.

N. fowleri is ubiquitous in nature and distributed worldwide in various aquatic bodies such as, ponds, swimming pools, lakes, rivers, aquarium and in soil. *N. fowleri* is a thermophilic organism and can tolerate temperatures up to 45°C, and proliferate rapidly during warmer months when ambient temperatures are high, *but not* found in salt water, like the ocean. This protozoon is commonly called the "brain-eating amoeba" as it can destroy brain tissue and cause the swelling of brain, and leading to a condition called primary amoebic meningoencephalitis (PAM). The first *N. fowleri* infection had been detected in 1965 and since then more than 400 cases have been reported from 39 countries and only seven individuals are survived [5]. PAM is an extremely rare but almost always fatal disease of the central nervous system (CNS), often reported in healthy children and youth following exposure to contaminated recreational or domestic water sources. It is also likely that many cases go unreported, as medical awareness of the condition is low and symptoms mimic those of bacterial and viral meningitis infections. As of July, 2024, there were 20 reported cases of *N. fowleri* in India, out of which 06 cases were reported from Kerala in 2024 till July. The most cases were reported from the southern states of India, possibly due to biodiversity including the large number of water bodies as well as favourable weather for the multiplication and survival of the organisms. The biodiversity including the large number of water bodies as well as hot and humid weather in the southern states of India are providing the suitable for the propagation and survival of this free living organisms.

An Indian teenager is now among a handful of people in the world to survive a rare brain-eating amoeba. Just this year, six cases have been recorded in Kerala. six cases have been recorded in Kerala of these, three have died and one is in a critical condition. While Afnan has been discharged, the sixth person has also responded to treatment and is recovering.

Transmission Pathways and pathogenesis: Direct Contact: Individuals, primarily children and youths, who are more active in aquatic activities such as diving, jumping into water, and underwater swimming, can acquire infections through direct contact or accidental exposure with contaminated water, which can enter the body through the nose. Infections are most often associated with

swimming or diving during the summer in swimming pools, lakes and rivers, etc. Sometimes infections occur after people put their head under water in springs.

Infection can also occur when people use contaminated water to cleanse their nasal passages and habit of uses contaminated tap water in a neti pot or other device to rinse sinuses through the nose. Naegleria can also survive in soil by forming cysts, and infections may be transmitted through aerosol route by inhalation of contaminated dust.

After enters in the nasal cavity, the organism migrates through the cribriform plate - which is located at the base of the skull, afterwards, travels through the olfactory neuroepithelium to the CNS and reach into the brain where it causes a fatal infection with symptoms similar to acute bacterial meningitis and causes the disease primary amoebic meningoencephalitis (PAM)

N. fowleri cannot causes diseases by drinking contaminated water, and the infection cannot spread from one person to another.

Clinical Manifestations: The first symptoms (incubation period) is generally appear after 5 days but sometimes may varies from 1-12 days. The Symptoms can be mild at first, but diagnosis of the disease is challenging which leads to rapid progression and worsen very quickly. The early symptoms of PAM may include headache, fever, nausea, or vomiting and Changes in smell and taste. In later stage the disease is characterized by stiff neck, fatigue, confusion, sensitivity to light, changes in personality, loss of balance, hallucinations, seizures, coma and death mainly due to intolerable intracranial pressure. After the onset the symptoms, death may usually occur within 5 days but may range from 1 to 18 days.

Diagnosis: The condition of PAM is difficult to diagnose and progresses very quickly, therefore selection of effective treatments is very different.

In early suspected cases, *N. fowleri* can be detected in cerebrospinal fluid (CSF) by spinal tap or lumbar puncture. Brain Biopsy can be performed to check for the presence of the amoeba in brain tissue. PCR can also use to detect *N. fowleri*.

Management and Treatment: In the USA, the survivors were treated with a combination of antibiotics, anti-fungals and steroid drugs.

The antifungal amphotericin B is the treatment of choice for primary amoebic meningoencephalitis (PAM). Some survivors in North America were treated with a combination of drugs that included amphotericin B, rifampin, fluconazole and miltefosine.

The best results (in two children who recovered completely) came from early diagnosis and treatment with the recommended drugs, along with cooling the body to below-normal temperature to treat brain swelling.

Risk Factors: The risk factors for the disease are as follows:

- **Environmental Factors:** Contaminated water bodies, inadequate water treatment, and poor sanitation practices.
- **Behavioural Factors:** Swimming in polluted water, lack of personal hygiene, and use of untreated water in neti pot for cleaning the nasal passage.
- **Demographic Factors:** Age (children and elderly are more susceptible), immune status (immunocompromised individuals are at higher risk) etc.

Prevention and Control:

1. **Personal Protection and Hygiene:** People should accept that there is always a low level of risk of *N. fowleri* infection whenever they enter for swimming in freshwater lakes, rivers, hot springs, swimming pools etc.

   The following measures can be practice to prevent the infection:

   - Avoid water-related activities specially jumping and diving into contaminated water bodies during the periods of high water temperatures.
   - The disease can be prevented by limiting the amount of water that goes up the nose during swimming and by nose shut, or keeping head above water when taking part in water-related activities.
   - Use safe water in neti pots for rinsing sinuses. After each use the neti pot should be wash with clean water, and leave the pot open to air dry completely.
2. **Monitoring of Water Quality:** Regular testing of recreational water bodies for microbial contamination is necessary to ensure safety.

3. **Public Health awareness:** Raising awareness about the risks of disease and preventive measures for RWBDs among the public is essential.
4. **Water Treatment:** Proper disinfection of swimming pools and other recreational water bodies is required in regular interval.

Conclusion

Public health measures, including water quality monitoring, education, and proper water treatment, are crucial in mitigating the risk of RWBDs. Water activities should not be overshadowed by fear, it's important to be aware of the potential hazards. Understanding the risks associated with recreational water-borne illnesses, particularly the rare but deadly brain-eating amoeba, can help us take the necessary precautions to protect ourselves and our society as a whole.