STUDENTS' CORNER
LETTER TO THE EDITOR

# Emergence of *Naegleria fowleri* as a fatal parasite in Pakistan

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*Madam*, *Naegleria fowleri*, a life-threatening flagellate, causes a fulminating disease called Primary Amoebic Meningoencephalitis (PAM) which rapidly becomes fatal. The symptoms of PAM include headache, vomiting, stiff neck, seizures, and cerebral haemorrhages, eventually leading to death within 48 hours after the onset. The discovery of the first case of Naegleriasis in the US has led to considerable attention to research towards it. Since then, 39 other countries have fallen prey to the brain-eating parasite with Pakistan being the 2nd most affected country after the Southern US.[1] Statistically, Pakistan recorded 105 deaths from PAM exclusively from 2008-2017 with the highest yearly toll of 22 registered deaths solely in 2012.[2]

**The aforementioned concerning facts raise a noteworthy inquiry:** Why is *N. fowleri* becoming increasingly fatal in Pakistan? Substandard primary prevention and misdiagnosis of PAM appear to be the primary factors at play.

In Pakistan, inadequate chlorination of swimming pools, storage of water in overhead tanks exceeding the temperature of 44°C and improper sanitation of drinking water are primary factors fuelling the spread of the thermophilic parasite. The mounting rise in global warming, severe heat waves and newfound resistance to drugs are the latest contributing factors to the escalating mortality rates due to *N. fowleri*. It is, however, noteworthy that the leading predisposing cause of PAM in Pakistan is ablution with tap water while a history of swimming/diving is essentially absent in most clinical scenarios. Amphotericin B and Miltefosine show positive results against PAM, however, further research is needed to conclude their effectivity.[3] Vaccines play a vital role in therapeutic interventions and can help prevent the spread of *N. fowleri*.[4] However, due to lack of resources and funding, Pakistan has failed to be on the front lines in the development of the vaccine.

The misdiagnosis of PAM can be considered as yet another pillar of inadequate secondary prevention.[5] It is due to the close resemblance of the clinical picture with Acute Bacterial Meningitis (ABM) which is far more widespread and requires an entirely different approach towards management. Secondly, a prevalent occurrence among patients is to inadvertently or intentionally omit vital information while providing medical history which leads to oversight of details like recent recreational water activities.[6] The short incubation period of the disease also highlights the importance of prompt diagnosis. Lastly, the government hospitals in Pakistan are not adequately facilitated with equipment like cytocentrifuge, smear prep and PCR thermocycler to diagnose Naegleria. This leads to an inevitable delay in the disease diagnosis enabling the patient's symptoms to exaggerate significantly, worsening the prognosis of the disease.

To conclude, USA (9.58%) and Mexico (4.06%) have been at the forefront of scientific research on *N. fowleri*. Research collaboration of these countries with Pakistan can be particularly productive. Primary prevention of *N. fowleri* in Pakistan must follow a structured protocol, specifically during summers when the prevalence of PAM skyrockets. Chlorine concentration of 0.5 mg/L or more must be maintained throughout the water distribution systems at a specific pH of 8.0, as provided by the WHO guidelines. Distilled or boiled water must be used for nasal irrigation during ablution. Banning water sports during high-risk periods can mitigate the rise in PAM. Efforts must be concentrated towards development of a vaccine against the lethal amoeba. Intranasal approach to treatment must also be considered. Timely and accurate diagnosis of PAM must be high-priority. Giving appropriate media attention to *N. Fowleri* for public awareness and improving the infrastructure of the government hospitals represents yet another crucial step in eradication of *N. fowleri*. Misdiagnosis of *N. fowleri* forms a solid ground for further research opportunities in Pakistan alongside the reasons that predispose patients to delay seeking medical attention.

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