COMMENTARY

GJMS Volume 2 | Issue 1 Jan - Apr 2022

Naegleria fowleri in the United States and Across the Globe Amidst the COVID-19

Jannel A. Lawrence[1], Harendra Kumar[2], Sarosh Sarwar[3], Mario Mekhail[2], Arpit Mago[4], Madeeha Subhan Waleed[2], Mona Sheikh[5], Efrain García[6]

1. Ross University School of Medicine, Bridgetown; 2. Division of Research & Academic Affairs, Larkin Community Hospital, South Miami, FL, USA;
3. Fazaia Medical College, Islamabad, Pakistan; 4. Jawaharlal Nehru Medical College, Belgaum, Karnataka, India;
5. University of North Texas Health Science Center, School of Public Health, Fort Worth, Texas, USA;
6. Infectious Disease Department, Larkin Community Hospital, South Miami, FL, USA*

Keywords: Naeglaria fowleri, Infectious Diseases, Covid 19, United States

*See End Note for complete author details

Dear Editor,

Naegleria fowleri, popularly known as the "Brain-eating Amoeba," is an amphibolic, thermophilic, and free-living amoeba that thrives in freshwater streams and tolerates temperatures of up to 45 degrees Fahrenheit.[1] Entering the brain via the nasal mucosa then the olfactory nerves, the organism reaches the cribriform plate, thus inducing a robust inflammatory response and generating cytotoxic enzymes, resulting in brain tissue destruction and necrosis, a lethal infection called Primary Amebic Meningoencephalitis (PAM). Naegleria fowleri also secretes pore-forming proteins (phospholipases and proteases), causing demyelination and immune system evasion. Those infected usually have a recent history of swimming, diving, or submersion, primarily in water streams, canals, or pools, and typically present with fever, nausea, headache, neck stiffness, and occasionally convulsions. Unfortunately, 95-97% of the cases result in death due to increased intracranial pressure and edema.[2]

The first-ever case of infection was found in Australia in 1965.[3] Since then, there have been 381 instances of PAM globally, 223 of which are non-US cases.[4] Although the amoeba is most commonly seen in warmer climates, it has also been documented in non-tropical areas like Japan, New Zealand, Belgium, and the Czech Republic.[5] Antarctica is the only continent where no case hasbeen documented so far.[6] An increased number of cases was found to have occurred during the hottest weather, mainly in young males.[4] Although continuous monitoring of cases is being done, nations without a PAM monitoring system or diagnostic tests may have a considerably greater undetected number of cases.[4] So far in 2021, there have been seven cases in North Karachi, Pakistan, with the most recent being a patient who became infected after drinking piped water which raises a profound health concern as the COVID-19 pandemic is currently at its fourth peak in south Asia region.[7]

In the United States, most instances have been reported in southern states (Texas and Florida), where the reservoir of Naegleria fowleri is frequently a warm or hot freshwater source.[8,9] While the disease is uncommon in the United States, most cases are fatal, with a fatality rate of 97 percent.[10] The Centers for Disease Control and Prevention (CDC) reported 182 cases between 1962 and 2019.[9] Males accounted for 75.6 percent of all infections over that period; additionally, the youngest case was a one year old, the oldest case was over 60 years, and most cases were between 10 to 14 years old, with fifty occurrences documented.[9]

Although once rare and mainly found in the northern states, cases of infection are suspected to be rising in the United States and spreading northward, potentially due to climate change and greater recreational water use.[11] Six cases of infection by Naegleria fowleri were documented in midwestern states (Kansas, Indiana, and Minnesota) between

Cite this article as: Lawrence JA, Kumar H, Sarwar S, Mekhail M, Mago A, Waleed MS, et al. Naegleria Fowleri in the United States and Across the Globe Amidst the COVID-19. Global Journal of Medical Students. 2022 May 16;2(1):30–2.

Submitted 30-03-2022 Accepted 31-03-2022 Published 16-05-2022

Access this Article Online

Scan this QR Code

https://doi.org/10.52314/gjms.2022.v2i1.48

Corresponding author:
Mona Sheikh
University of North Texas Health Science Center,
School of Public Health, Fort Worth, Texas, USA
E-mail: arztinmona@gmail.com

1978 and 2018, with five occurring after 2010.[12] In August 2021, two fatal cases were reported in Northern California and North Carolina.[13]

With burgeoning cases of COVID-19, the World Health Organization (WHO), on the 1st of April 2020, recommended a shift of focus on the management of COVID-19, which led to the interruption of actions focused on prevention and management of Neglected Tropical Diseases (NTD) across the world; this caused a significant reversal of the progress made at local, national, and international levels.[14] As new COVID-19 variants emerge, the ever-increasing number of COVID-19 patients continues to burden various health care systems and governments.[15] COVID-19 patients have an increased length of hospital stay in the hospital, increased use of health care resources, and higher mortality compared to other infectious diseases.[16]

While the pathophysiology of COVID-19 and Naegleria fowleri is different, similarities do exist in terms of their impending cytokine storm responsible for some of the common manifestations, especially loss of sense of taste and smell, leading to possible misdiagnosis and serious implications.[17,18]

There is a need for a specific intervention and approach that can help understand the sequence of the Naegleria fowleri strain in places where the disease is prevalent Moreover, international bodies like WHO and governments should work together in raising awareness about Naegleria fowleri, educating and sensitizing people about the importance of using clean and boiled water. Furthermore, as there is no cure for the infection, simple preventive measures like chlorine can help minimize the spread. In addition to that, contact tracing and tracking of Naegleria fowleri can help countries with a high disease burden understand the disease trend, improve the surveillance system, and trigger public health action.

Meanwhile, treatment and management of Naegleria fowleri should start as soon as the disease is identified. Governments need to venture and fund research that could help develop drugs and solutions effective enough to tackle Naegleria fowleri.

END NOTE

Author Information

1. Jannel A. Lawrence, Ross University School of Medicine, Bridgetown
2. Harendra Kumar, Division of Research & Academic Affairs, Larkin Community Hospital, South Miami, FL, USA
3. Sarosh Sarwar, Fazaia Medical College, Islamabad, Pakistan
4. Mario Mekhail, Division of Research & Academic Affairs, Larkin Community Hospital, South Miami, FL, USA
5. Arpit Mago, Jawaharlal Nehru Medical College, Belgaum, Karnataka, India
6. Madeeha Subhan Waleed, Division of Research & Academic Affairs, Larkin Community Hospital, South Miami, FL, USA
7. Mona Sheikh, University of North Texas Health Science Center, School of Public Health, Fort Worth, Texas, USA
8. Efrain García, Infectious Disease Department, Larkin Community Hospital, South Miami, FL, USA

Conflict of Interest: The authors declare no conflict of interest

Funding: This study was not funded

Acknowledgement: We are thankful to the Larkin Health System and Lakshmi Deepak Bethineedi for their support.

REFERENCES

1. Jahangeer M, Mahmood Z, Munir N, Waraich UEA, Tahir IM, Akram M, et al. Naegleria fowleri: Sources of infection, pathophysiology, diagnosis, and management; a review. Clin Exp Pharmacol Physiol. 2020 Feb;47(2):199–212.
2. Pugh JJ, Levy RA. Naegleria fowleri: Diagnosis, Pathophysiology of Brain Inflammation, and Antimicrobial Treatments. ACS Chem Neurosci. 2016 Sep 21;7(9):1178–9.
3. Martínez-Castillo M, Cárdenas-Zúñiga R, Coronado-Velázquez D, Debnath A, Serrano-Luna J, Shibayama M. Naegleria fowleri after 50 years: is it a neglected pathogen? J Med Microbiol. 2016 Sep;65(9):885–96.
4. Gharpure R, Bliton J, Goodman A, Ali IKM, Yoder J, Cope JR. Epidemiology and Clinical Characteristics of Primary Amebic Meningoencephalitis Caused by Naegleria fowleri: A Global Review. Clin Infect Dis. 2021 Jul 1;73(1):e19–27.
5. Mole B. Brain-eating amoeba kills again-here's how it kills and how to avoid it. Ars Technica. Accessed August 26, 2021.
6. De Jonckheere JF. Origin and evolution of the worldwide distributed pathogenic amoeboflagellate Naegleria fowleri. Infect Genet Evol. 2011 Oct;11(7):1520–8.
7. Reporter TNS. Deadly Naegleria in 'piped water' infects man in Karachi [Internet]. DAWN.COM. 2021 [cited 2022 May 23].
8. Minnesota Department of Health. Naegleria Fowleri and primary amebic meningoencephalitis [Internet]. Accessed Aug 29, 2021.
9. Case Report Data & Graphs. CDC. Parasites — Naegleria Fowleri — primary amebic meningoencephalitis (PAM) — amebic encephalitis. Accessed Aug 29, 2021.
10. Public Health Environmental Health Services. Naegleria fowleri. Accessed Aug 29, 2021.

11. Julia Jacobo. Risk of brain-eating amoeba, flesh-eating bacteria may increase due to climate change: Experts - ABC News [Internet]. [cited 2022 May 23].
12. Rachael Rettner. Deadly "brain-eating amoeba" has expanded its range northward [Internet]. livescience.com. 2020 [cited 2022 May 23].
13. Michael Bartiromo. Brain-eating amoeba: Where are infections most common, and who is at risk? [Internet]. WBOY.com. 2021 [cited 2022 May 23].
14. Adepoju P. NTDs in the time of COVID-19. Lancet Microbe. 2020 Oct;1(6):e244.
15. Gupta AG, Moyer CA, Stern DT. The economic impact of quarantine: SARS in Toronto as a case study. J Infect. 2005 Jun;50(5):386–93.
16. Bartsch SM, Ferguson MC, McKinnell JA, O'Shea KJ, Wedlock PT, Siegmund SS, et al. The Potential Health Care Costs And Resource Use Associated With COVID-19 In The United States. Health Aff (Millwood). 2020 Jun;39(6):927–35.
17. Garvin MR, Alvarez C, Miller JI, Prates ET, Walker AM, Amos BK, et al. A mechanistic model and therapeutic interventions for COVID-19 involving a RAS-mediated bradykinin storm. Elife. 2020 Jul 7;9:e59177
18. Van de Beek D, de Gans J, Spanjaard L, Weisfelt M, Reitsma JB, Vermeulen M. Clinical features and prognostic factors in adults with bacterial meningitis. N Engl J Med. 2004 Oct 28;351(18):1849–59.