Free-living amoebae

An amoeba is a type of single-celled organism that is found in a variety of environments, including soil, water, and even in the bodies of other organisms. Amoebas are characterized by their ability to change shape and move using pseudopodia, which are temporary extensions of the cell membrane.

There are many different types of amoebas, some of which are harmless and others that can cause disease in humans and other animals. For example, Entamoeba histolytica is an amoeba that can cause a type of intestinal infection called amoebiasis, while Naegleria fowleri is an amoeba that can cause a rare and often fatal brain infection called primary amoebic meningoencephalitis (PAM).

Despite their small size and simple structure, amoebas are capable of carrying out a wide range of biological functions, including feeding, reproduction, and movement. Some species of amoebas are also capable of forming multicellular structures or colonies, in which individual cells work together to carry out specialized functions.

Amoebas have been the subject of much scientific research, and have contributed to our understanding of many fundamental biological processes, including cell division, signaling, and gene expression.

Clinical features

These free-living amebas can cause two distinct clinical syndromes, primary amebic meningoencephalitis (PAM) and granulomatous amebic encephalitis (GAE). The initial symptoms of PAM are indistinguishable from bacterial meningitis, while the symptoms of GAE can mimic a brain abscess, encephalitis, or meningitis. These infections are almost uniformly fatal. The mortality rate is above 90%, despite antimicrobial therapy ¹⁾.

Diagnosis

The diagnosis of such infections is challenging due to a lack of clinical suspicion and expertise in microscopic identification. We evaluated the performance of molecular assays for the timely and accurate detection of FLA-causing central nervous system (CNS) afflictions.

Methods: This study included samples from 156 patients with suspected encephalitis/meningoencephalitis, including 149 cerebrospinal fluid (CSF) samples, 5 brain tissue biopsies, and 2 brain abscess samples. All the samples were subjected to PCR-based detection of Acanthamoeba spp., N. fowleri, and B. mandrillaris. The diagnostic characteristics and the inter-rater reliability scores were evaluated for parasite-specific polymerase chain reaction (PCR) using culture on non-nutrient agar (NNA)/microscopy or histopathological examination as a confirmatory test for Acanthamoeba spp. and N. fowleri and histopathology for B. mandrillaris.

Results: We detected 11 samples positive for FLA, including 6 Acanthamoeba spp., 3 B. mandrillaris, and 2 N. fowleri. Furthermore, all 11 samples were positive according to the confirmatory tests, i.e., culture on NNA/microscopy/histopathology in the case of Acanthamoeba spp. and N. fowleri and histopathology of tissue biopsies for B. mandrillaris. The inter-rater reliability between the PCRs and

the confirmatory tests for the detection of Acanthamoeba spp., N. fowleri, and B. mandrillaris was 100%.

Conclusions: The PCR-based detection of FLA in patients suspected of encephalitis/meningoencephalitis was found to be fast, efficient, and reliable in our study. We suggest the use of these PCRs in laboratories to obtain additional data on their efficiency in diagnosing FLA infections of the CNS. The present study was conducted with a small sample size of 156 patient samples, and we found only six Acanthamoeba spp., three B. mandrillaris, and two N. fowleri. The present study should be conducted on a larger sample size for better evaluation of the primer pairs ².

Systematic reviews

Free-living amoebae (FLA) including Naegleria fowleri, Acanthamoeba spp., and Balamuthia mandrillaris can become pathogenic and cause severe cerebral infections, named primary amoebic meningoencephalitis (PAM), granulomatous amoebic encephalitis (GAE), and balamuthia amoebic encephalitis (BAE), respectively. FLA encephalitis has been reported across China, but the clinical data descriptions and analytical results of these different reports vary widely. Currently, no consensus treatment has been established. We conduct a systematic review to evaluate the exposure location, clinical symptoms, diagnosis, treatment, and prognosis of three FLA encephalitis and aim to reveal the differences between three FLA encephalitis in China.

Methods: We used MEDLINE (PubMed interface), EMBASE, China National Knowledge Infrastructure (CNKI), Wanfang database, and China Biology Medicine disc (CBMdisc) databases for literatures published and manually retrieve the hospital records of our hospital. The search time was up to August 30, 2022, with no language restrictions.

Results: After excluding possible duplicate cases, a total of 48 patients of three FLA encephalitis were collected. One from the medical records of our hospital and 47 patients from 31 different studies. There were 11 patients of PAM, 10 patients of GAE, and 27 patients of BAE. The onset of PAM is mostly acute or subacute, and the clinical symptoms are acute and fulminant hemorrhagic meningoencephalitis. Most patients with GAE and BAE have an insidious onset and a chronic course. A total of 21 BAE patients (77.8%) had skin lesions before onset of symptoms. Additionally, 37 cases (77.1%) were diagnosed with FLA encephalitis before death. And there were 4 of PAM, 2 of GAE, and 10 of BAE diagnosed using next generation sequencing. No single agent can be proposed as the ideal therapy by itself. Only 6 cases were successfully treated.

Conclusions: This review provides an overview of the available data and studies of FLA encephalitis in China and identify some potential differences. FLA encephalitis is a rare but pathogenic infection, and physicians should early identify this encephalitis to improve survival ³⁾.

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