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Analysis of Primary Amoebic Meningoencephalitis and Its Therapeutic Approaches

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Abstract

Primary amoebic meningoencephalitis (PAM) is a rare but devastating infection of the central nervous system caused primarily by *Naegleria fowleri*, a free-living thermophilic amoeba found in warm freshwater environments. This fulminant disease exhibits an exceptionally high mortality rate, exceeding 95%, with death typically occurring within 3-7 days of symptom onset. The pathogen enters the central nervous system through the nasal mucosa, traversing the cribriform plate to reach the olfactory bulbs and subsequently spreading to the brain parenchyma. Clinical manifestations include severe frontal headache, high fever, nausea, vomiting, altered mental status, and seizures, often mimicking bacterial meningitis. Diagnosis remains challenging due to the rapid disease progression and non-specific initial symptoms, requiring high clinical suspicion and specialized laboratory techniques including cerebrospinal fluid microscopy and polymerase chain reaction. Current therapeutic approaches primarily involve amphotericin B, often combined with azithromycin, fluconazole, miltefosine, and rifampin. Despite aggressive treatment, survival remains exceedingly rare. Herbal medicines, including compounds derived from *Allium sativum* (garlic), *Azadirachta indica* (neem), *Artemisia annua* (sweet wormwood), and various essential oils, have demonstrated *in vitro* amoebicidal activity, representing potential complementary therapeutic avenues. This review comprehensively analyzes the epidemiology, pathophysiology, clinical features, diagnostic methodologies, conventional pharmacological interventions, and emerging herbal therapeutic strategies for PAM, emphasizing the critical need for early recognition, prompts treatment initiation, and continued research into novel therapeutic agents to improve patient outcomes in this devastating neurological infection.

Keywords: Primary amoebic meningoencephalitis, *Naegleria fowleri*, Amphotericin B, Herbal therapeutics, Central nervous system infections