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ANGIOSTRONGYLUS CANTONENSIS EOSINOPHILIC MENINGITIS MIMICKING TUBERCULOUS MENINGITIS CONFIRMED BY CEREBROSPINAL FLUID PCR: A DIAGNOSTIC CHALLENGE IN A TROPICAL COUNTRY

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ABSTRACT

Background: *Eosinophilic meningitis is a rare clinical syndrome most commonly caused by Angiostrongylus cantonensis, particularly in tropical regions. Because clinical manifestations and cerebrospinal fluid findings may overlap with tuberculous meningitis, misdiagnosis may occur, especially in tuberculosis-endemic countries.* ***Clinical Case:*** *We report a 45-year-old woman presenting with prolonged fever and headache. Cerebrospinal fluid analysis revealed marked pleocytosis, elevated protein levels, and reduced glucose concentration, with a small proportion of eosinophils. Initial microbiological investigations were negative, and the patient was empirically treated for tuberculous meningitis with adjunctive corticosteroids, resulting in transient clinical improvement. However, subsequent molecular testing of cerebrospinal fluid detected Angiostrongylus cantonensis DNA by polymerase chain reaction, establishing the diagnosis of eosinophilic meningitis. Anti-tuberculosis therapy was discontinued, and the patient recovered completely with supportive management.* ***Conclusion:*** *This case highlights the diagnostic challenge of eosinophilic meningitis mimicking tuberculous meningitis in tuberculosis-endemic settings. Molecular detection of Angiostrongylus cantonensis in cerebrospinal fluid plays a crucial role in establishing the correct diagnosis and preventing unnecessary anti-tuberculosis treatment.*

Keywords: *Eosinophilic meningitis, Angiostrongylus cantonensis, Tuberculous meningitis, Polymerase chain reaction.*

I. INTRODUCTION

Eosinophilic meningitis (EM) is defined by the presence of ≥10% eosinophils in the cerebrospinal fluid (CSF) differential count or an absolute eosinophil count of ≥10 cells/mm³. Although rare, EM is a clinically significant syndrome that is most commonly associated with parasitic infections, particularly in tropical and subtropical regions [1], [2]. Among the causative agents of EM, *Angiostrongylus cantonensis* (rat lungworm) is recognized as the most common worldwide. Humans become infected through ingestion of third-stage larvae present in raw or undercooked snails, freshwater seafood, or contaminated vegetables. After ingestion, the larvae migrate to the central nervous system, inducing an inflammatory response characterized by eosinophilia in both peripheral blood and CSF [1], [2], [3].

The clinical manifestations of *Angiostrongylus cantonensis* meningitis are often nonspecific. CSF findings usually demonstrate pleocytosis with lymphocytic predominance, elevated protein levels, normal or mildly decreased glucose concentrations,

and the presence of eosinophils. Due to overlapping clinical and laboratory features with tuberculous or viral meningitis, early and accurate diagnosis remains challenging [1], [2], [4], [5]. Definitive diagnosis relies on epidemiological exposure, eosinophilia in blood and CSF, and confirmatory serological or molecular tests. In recent years, polymerase chain reaction (PCR) detection of *Angiostrongylus cantonensis* deoxyribonucleic acid (DNA) in CSF has demonstrated high diagnostic value, particularly in cases with negative serology or atypical clinical presentations [1], [6].

Reports of eosinophilic meningitis caused by *Angiostrongylus cantonensis* remain limited and are mostly isolated case reports. Lack of awareness may lead to misdiagnosis as tuberculous meningitis and unnecessary prolonged anti-tuberculosis treatment. Therefore, reporting typical clinical cases is essential to enhance physician awareness and improve diagnostic and therapeutic strategies. We report a case of eosinophilic meningitis caused by *Angiostrongylus cantonensis*, initially misdiagnosed as tuberculous meningitis, in which the definitive diagnosis was established by CSF PCR, emphasizing the diagnostic value of molecular techniques.

II. CASE PRESENTATION

A 45-year-old woman was admitted with prolonged fever and headache. She had no significant chronic illnesses. Her medical history was notable for an allergy to freshwater crabs. She reported periodic deworming with mebendazole (500 mg every six months) and denied consumption of raw snails, raw freshwater seafood, or undercooked food. The illness began approximately 18 days before admission with low-grade fever (38-39°C) and generalized myalgia, without headache or vomiting. Symptoms temporarily improved with paracetamol. Empirical treatment with cefpodoxime for five days produced no clinical improvement. A complete blood count on day 5 of illness showed a white blood cell count of 9,440/mm³, including eosinophils of 470/mm³, hemoglobin of 11 g/dL, and platelets of 335,000/mm³. Between days 14 and 18, fever persisted and was accompanied by headache and nausea, prompting hospital admission. On admission, the patient was alert and oriented. Vital signs were stable, with a temperature of 37.5°C, heart rate of 90 beats/min, blood pressure of 120/70 mmHg, and respiratory rate of 20 breaths/min. She reported mild headache, nausea, tinnitus, and mild numbness in the left hand. Neurological examination revealed no focal deficits. Neck stiffness was absent, and Kernig's and Brudzinski's signs were negative.

Peripheral blood analysis demonstrated marked eosinophilia (1,610/mm³). Lumbar puncture was performed. The cerebrospinal fluid (CSF) appeared turbid, with mildly elevated opening pressure. CSF analysis showed 1,750 cells/mm³, predominantly lymphocytes (90%), with 4% neutrophils and approximately 5-6% eosinophils. Protein concentration was markedly elevated (1,358 mg/L), and the CSF-to-serum glucose ratio was reduced (1.25/4.12 mmol/L). Polymerase chain reaction (PCR) and GeneXpert testing for Mycobacterium tuberculosis were negative. Serum immunoglobulin G antibodies against multiple parasites, including *Angiostrongylus cantonensis*, were also negative. After multidisciplinary consultation, a diagnosis of tuberculous meningitis was initially made, and anti-tuberculosis therapy (2RHZE/10RH) combined with dexamethasone (0.4 mg/kg/day) was started. After nine days of treatment, the patient became afebrile and headache markedly improved. Follow-up laboratory tests showed a white blood cell count of 14,100/mm³ and eosinophils of 817/mm³. The laboratory findings are summarized in table 1.

Table 1. Summary of Laboratory Findings

Test / Timing	Day 5 of illness	Day 18 of illness (on admission)	Day 27 (Post-treatment)
Hematology (CBC)	WBC: 9,440/mm³ Eos: 470/mm³ Hb: 11 g/dL PLT: 335,000/mm³	Eos: 1,610/mm³ (Elevated)	WBC: 14,100/mm³ Eos: 817/mm³
CSF Cytology	—	1,750 cells/mm³ (90% Lympho, 5-6% Eos)	—
CSF Biochemistry	—	Protein: 1,358 mg/L Glu (CSF/Serum): 1.25/4.12 mmol/L	—
CSF Microbiology	—	PCR: Negative GeneXpert MTB: Negative	—
Serology (IgG)	—	Parasitic IgG (including *Angiostrongylus cantonensis, Toxocara canis, Strongyloides stercoralis, Gnathostoma spinigerum, Taenia solium, Fasciola hepatica*): Negative	—

Abbreviations: CBC: Complete Blood Count, CSF: Cerebrospinal Fluid, Eos: Eosinophils, Glu: Glucose, Hb: Hemoglobin, IgG: Immunoglobulin G, Lympho: Lymphocytes, MTB: Mycobacterium tuberculosis, PCR: Polymerase Chain Reaction, PLT: Platelets, WBC: White blood cell count.

A second CSF examination showed clear fluid with a decreased cell count of 20 cells/mm³, predominantly lymphocytes, and no eosinophils. Protein concentration decreased to 820 mg/L, and the CSF-to-serum glucose ratio improved (2.5/4.7 mmol/L). PCR assays for bacteria, viruses, fungi, and Mycobacterium tuberculosis were negative. However, CSF PCR detected *Angiostrongylus cantonensis* deoxyribonucleic acid (DNA) with a load of 5.32×10^4 copies/mL (*Figure 1*), while other parasitic PCR tests were negative. A definitive diagnosis of eosinophilic meningitis caused by *Angiostrongylus cantonensis* was established. Anti-tuberculosis therapy and dexamethasone were discontinued, and the patient was discharged in stable condition. At follow-up two weeks later, she was asymptomatic, and peripheral eosinophil counts had normalized. No further treatment was required.

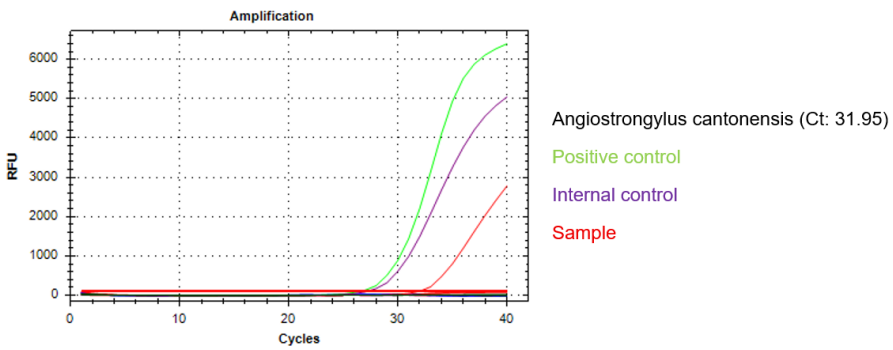

Figure 1. Real-time polymerase chain reaction (PCR) amplification curves for *Angiostrongylus cantonensis* in cerebrospinal fluid. The sample (red curve) showed a positive amplification signal with a cycle threshold (Ct) value of 31.95, confirming the presence of

Angiostrongylus cantonensis DNA. The positive control (green curve) demonstrated expected amplification, while the internal control (purple curve) verified assay validity.

- Ethical Approval: Written informed consent was obtained from the patient for publication of this case report.

III. DISCUSSION

Eosinophilic meningitis is a rare syndrome in which *Angiostrongylus cantonensis* is considered the most common etiological agent worldwide, particularly in tropical and subtropical regions. Infection is typically associated with ingestion of parasite larvae through raw snails, freshwater seafood, or contaminated food. However, not all patients report clear epidemiological exposure, complicating early diagnostic suspicion [1]. In our case, the disease initially presented with nonspecific symptoms such as prolonged fever and myalgia, followed by headache and nausea. Neurological examination revealed no focal deficits or overt meningeal signs. This clinical pattern is consistent with previous reports, in which headache is the most frequent symptom, followed by fever, nausea, paresthesia, and rarely altered consciousness [2], [6]. Such nonspecific presentations increase the risk of misdiagnosis as other central nervous system infections, particularly tuberculous or viral meningitis. CSF analysis revealed marked pleocytosis, elevated protein levels, mildly decreased glucose, and the presence of eosinophils (5-6%). Although the proportion of eosinophils did not reach 10%, the absolute eosinophil count exceeded the diagnostic threshold, and peripheral eosinophilia further supported a parasitic etiology. Previous studies have shown that CSF eosinophil percentages may vary depending on disease stage and host immune response [2], [4], [7].

In tuberculosis-endemic countries, patients with lymphocytic meningitis, elevated protein, and low glucose are often empirically treated for tuberculous meningitis. Several reports have documented cases of *Angiostrongylus cantonensis* meningitis mimicking tuberculous meningitis, leading to unnecessary prolonged anti-tuberculosis treatment [8], [9]. Definitive diagnosis relies on a combination of clinical suspicion, laboratory findings, and confirmatory tests. Serological assays may be helpful but have variable sensitivity and may be negative early in the disease course. In this case, all parasitic serologies were negative, whereas CSF PCR successfully detected *Angiostrongylus cantonensis* DNA. This finding supports previous studies demonstrating the high sensitivity and specificity of PCR for detecting *Angiostrongylus cantonensis* in CSF, especially in atypical or seronegative cases [2], [4], [7].

There is no standardized treatment regimen for eosinophilic meningitis caused by *Angiostrongylus cantonensis*. Management is primarily supportive, with corticosteroids commonly used to reduce inflammatory response, headache, and cerebral edema. The role of antiparasitic agents such as albendazole remains controversial due to concerns that larval death may exacerbate inflammation [4], [10]. In our case, the patient improved rapidly with corticosteroid therapy alone and achieved complete recovery without antiparasitic treatment, consistent with reports describing the self-limiting nature of the disease in many patients [1], [10].

This case contributes additional evidence supporting *Angiostrongylus cantonensis* as an important cause of eosinophilic meningitis in tropical countries and highlights the crucial role of CSF PCR in establishing a definitive diagnosis.

IV. CONCLUSION

Eosinophilic meningitis caused by *Angiostrongylus cantonensis* is a rare condition and can easily be misdiagnosed as tuberculous meningitis due to its nonspecific clinical manifestations. This case highlights the important role of cerebrospinal fluid PCR testing in establishing the etiological diagnosis when serological tests are negative. Early recognition of the disease helps avoid unnecessary anti-tuberculosis treatment and improves patient prognosis. This case report contributes to increasing awareness of parasitic meningitis in clinical practice in Vietnam.

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