MEDS Public Health and Preventive Medicine (2025)
Clausius Scientific Press, Canada
DOI: 10.23977/phpm.2025.050302
ISSN 2616-1915 Vol. 5 Num. 3

Case Report and Analysis of Herpesviral Encephalitis with MOG Antibody-Associated Autoimmune Encephalitis in Children

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Keywords: Children; Viral Encephalitis; MOG Antibody; Autoimmune Encephalitis; Diagnosis and Treatment Analysis

Abstract: This article reports a case of herpes viral encephalitis complicated with MOG antibody-associated autoimmune encephalitis in a child, detailing its clinical manifestations, diagnostic process, treatment measures, and prognosis. The patient presented with fever, bilateral lower limb weakness, and restlessness. Cerebrospinal fluid analysis confirmed the presence of herpes virus (human herpesvirus 7, HHV-7), while MOG antibody testing was positive. Imaging studies revealed multifocal cerebral lesions. After antiviral therapy, immunomodulatory treatment, and symptomatic supportive care, the patient's condition gradually improved, though long-term follow-up remains necessary. This case underscores the importance of early diagnosis and comprehensive management in such complex conditions, providing valuable clinical insights for physicians.

1. Introduction

Background: Herpes simplex virus (HSV) is a common pathogen causing sporadic viral encephalitis. HSV encephalitis (HSE), caused by its infection, typically presents with behavioral abnormalities and personality changes as initial symptoms, accompanied by varying degrees of neurological deficits and epileptic seizures, significantly impacting nervous system health [1]. Pediatric herpesviral encephalitis, another central nervous system disorder caused by herpesvirus infections, exhibits diverse clinical manifestations, rapid disease progression, and poor prognosis [2,3]. HHV-6 and HHV-7 (HHV-6/7), both belonging to the β-herpesvirus family, share similar genetic structures and high homology [4]. HHV-7 was first isolated from peripheral blood mononuclear cells of healthy individuals by Wyatt et al. in 1990 [5]. Approximately 70% of children contract HHV-7 before age 5, with peak incidence occurring between 6 months and 2 years [6,7]. MOG antibody-associated autoimmune encephalitis, an inflammatory central nervous system disorder linked to oligodendrocyte glycoprotein antibodies, has been observed in both children and adults. In pediatric patients with acquired demyelinating syndrome, initial detection rates can reach up to 50%, leading to growing attention in recent years [8,9,10]. However, combined occurrences of these two conditions are relatively rare, and their pathogenesis, clinical presentations, and treatment

strategies require further exploration.

Research significance: Through the report and diagnosis and treatment of this case, the purpose is to enrich the clinical case data, improve the level of diagnosis and treatment of pediatricians for such complex cases, and provide a reference for the future treatment of similar cases.

2. Case data

General information: The child, male, 3 years old, previously healthy, no special medical history.

Clinical Presentation: The child was admitted with "intermittent fever for over half a month, bilateral lower limb weakness for 2 days, and irritability for half a day." Five weeks prior (March 13,2025), the child developed fever with a peak temperature of 39℃°C accompanied by cough and rales, without headache, convulsions, cyanosis, or altered consciousness. After six days of treatment at an external hospital (March 13-20), the fever stabilized for two days before discharge. On the night of discharge, the child developed recurrent low-grade fever lasting six days (March 20-26) with temperatures fluctuating between 37.5℃°C and 37.7℃°C. Following symptomatic treatment at the same hospital, the fever remained stable for two days until recurrence (March 30-31), with temperatures again ranging between 37.5℃°C and 37.7℃°C. The child exhibited lethargy, self-reported pruritus without rash or neurological symptoms. On the 14th day of intermittent fever, bilateral lower limb weakness developed, accompanied by slow gait and progressive fatigue leading to reluctance to walk or stand. A lumbar puncture at the external hospital indicated central nervous system infection. Five weeks prior, the child showed persistent irritability and crying without abdominal pain, abnormal behavior, or cognitive decline. Admission revealed poor mental responsiveness, marked agitation, self-reported pruritus with involuntary mouth-opening movements, temperature 36.5℃°C, positive neck resistance, muscle strength grade 4+, positive Babinski sign on the left side, negative on the right, slightly diminished left knee reflex, and normal right knee reflex.

Accessory examination:

Laboratory tests: Cerebrospinal fluid analysis showed elevated white blood cell count (467×10^6/L, normal range 0-5), predominantly monocytes, mild protein elevation (26.9mg/L, normal range 0.15-0.45), slightly turbid cerebrospinal fluid, weakly positive glucose determination, and weakly positive Pan's test. Viral detection through second-generation whole-genome sequencing identified human herpesvirus 7 (HHV-7) nucleic acid. Serum MOG antibody testing was positive.

Imaging examination: Brain MRI/FLAIR sequence showed multiple patchy slightly high signal in brainstem, bilateral frontal and temporal lobes, hippocampus, basal ganglia and paraventricular areas. DWI sequence showed no diffuse restriction, and enhanced scanning pattern showed no abnormal enhancement.

Electroencephalogram: full background activity, indicating abnormal electroencephalogram.

3. Diagnosis and differential diagnosis

Diagnostic basis: The clinical manifestations of the child suggest central nervous system damage, and cerebrospinal fluid and virological examinations support the diagnosis of herpes virus infection. Meanwhile, the positive MOG antibody, combined with imaging manifestations, meets the diagnostic criteria for MOG antibody-associated autoimmune encephalitis.

Differential Diagnosis: This condition should be differentiated from other viral encephalitides (e.g., EB virus encephalitis), bacterial meningitis, and intracranial tumors. EB virus encephalitis is typically characterized by peripheral blood lymphocytosis with detectable EB virus DNA in cerebrospinal fluid. Bacterial meningitis demonstrates higher leukocyte counts (predominantly

neutrophils) and reduced glucose levels in cerebrospinal fluid. Imaging studies of intracranial tumors reveal mass effect, with non-uniform enhancement observed on contrast-enhanced scans.

4. Treatment plan

Antiviral therapy: Acyclovir was administered at 10mg/kg every 8 hours for 3 weeks.

Immunotherapy: In accordance with the 2023 Clinical Practice Guidelines for Pediatric Myelin Oligodendrocyte Glycoprotein Antibody-Related Disorders, the treatment protocol includes methylprednisolone pulse therapy (20 mg/kg/day for 7 consecutive days) followed by gradual dose reduction over a 6-month course. Intravenous immunoglobulin infusion (2 g/kg, administered over 5 days in combination with corticosteroids).

Symptomatic support: use mannitol and other drugs to reduce intracranial pressure, and omeprazole was used to protect gastric mucosa during high dose hormone application.

Efficacy observation:

Symptom improvement: after the above treatment, the child's mental symptoms gradually improved, irritability and involuntary mouth movement disappeared, pathological reflex was negative, physiological reflex was normal.

Re-examination indicators: The routine biochemical index of cerebrospinal fluid returned to normal, the MOG antibody titer decreased from 1:3200 to 1:320, which was significantly improved compared with before, and the MRI lesions were significantly absorbed.

Follow-up results: One month after discharge, the MOG antibody titer was 1:100. The child showed no convulsions or special discomfort, and the hormone dosage was reduced to 15mg/kg/day. Three months after discharge, the MOG antibody titer was 1:30. The child's general condition was normal, and the hormone dosage was reduced to 10mg/kg/day. As show Figure 1.

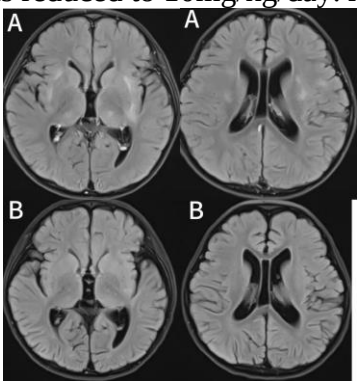

Figure 1: Brain enhancement MRI image of the patient

5. Discussion

While pediatric patients are not uncommon in MOG antibody-related disorders, the co-occurrence of HHV-7 infection in a 3-year-old child presents unique clinical features. Literature review reveals that cases involving dual infections or immunocompromised states exhibit diverse patterns of symptom overlap and sequential presentation [10]. In this case, the child initially developed viral symptoms such as fever and cough, followed by central nervous system manifestations including lower limb weakness and irritability . Although this sequence of symptoms shows representativeness among similar cases, the specific severity and duration of these manifestations remain distinctively characteristic.

Some studies suggest that after viral infection, the virus antigen and self-antigen have similar epitopes. In the process of clearing the virus, the immune system may mistakenly identify the

self-antigen as foreign antigen, thus inducing autoimmune response and leading to the production of MOG antibody [11,12].

Within the herpesvirus family, many members are known to exhibit strong neurotropic properties and can induce symptoms affecting both the central and peripheral nervous systems. However, it remains largely unclear whether these manifestations primarily result from direct cytotoxic effects of the viruses or inflammatory responses triggered by activated immune systems. Similar to other neurotropic viruses, HHV-7's impact on the central nervous system (CNS) has received limited attention until recent studies [13,14,15,16,17,18]. Research indicates that HHV-7 possesses neuroinvasive capabilities; once entering the CNS, it replicates within the brain and activates immune/inflammatory responses, ultimately leading to neurological disorders. Notably, herpesvirus infections may compromise the blood-brain barrier, allowing peripheral immune cells to infiltrate the CNS and attack self-antigens, thereby causing autoimmune encephalitis [19,20]. While these mechanisms have been established, it cannot be definitively ruled out that HHV-7 infection and MOG antibody positivity could independently contribute to disease pathogenesis. Further research is needed to clarify the relationship between these factors.

Independent pathogenicity: Although the above mechanisms are based on some evidence, it cannot be completely ruled out that HHV-7 infection and MOG antibody positivity are independent pathogenicity, and further studies are needed to clarify the relationship between them.

Antiviral therapy serves as the cornerstone treatment for HHV-7 infection, while immunotherapy targets the autoimmune response. In this case, both approaches are being used concurrently, though careful risk-benefit analysis is required. Since immunotherapy may increase viral replication risks, it should only be initiated after confirming that antiviral therapy has achieved significant efficacy and effectively controlled viral activity.

6. Conclusion and outlook

First of all, timely initiation of immunotherapy on the basis of antiviral therapy in this case achieved good results. This suggests that in similar cases, antiviral and immunotherapy regimens should be flexibly adjusted according to the specific condition of patients, and viral load and autoantibody levels should be dynamically monitored.

Secondly, this case highlights the need to simultaneously investigate infectious pathogens and autoantibodies in complex encephalitis cases. The risk lies in either missing autoimmune diseases by focusing only on infectious factors, or ignoring infections by focusing only on autoimmune factors.

In clinical practice, similar cases should be comprehensively evaluated through a combination of clinical manifestations, laboratory tests, and imaging studies to establish a diagnosis. Based on these findings, doctors should develop personalized treatment plans that address the child's long-term prognosis. Regular neurological assessments are crucial for early detection and intervention of potential complications such as cognitive impairments or motor dysfunction, thereby significantly improving the child's quality of life.

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