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From Viral Illness to Autoimmune Crisis: Atypical Presentation of MOG-Positive ADEM in a Young Child following a Meta-pneumovirus Infection

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Abstract

We report a case of a 3-year-old female who developed MOG-positive Acute Disseminated Encephalomyelitis (ADEM) following a Meta-pneumovirus infection. The patient presented with severe neurological symptoms, including acute encephalopathy, abducent nerve palsy, and rapid deterioration requiring intubation. Serum and cerebrospinal fluid (CSF) MOG antibodies were positive, and MRI revealed multifocal lesions in the brain and spinal cord. Treatment with high-dose steroids, intravenous immunoglobulin (IVIG), and plasmapheresis led to significant clinical improvement. This case underscores the diagnostic complexity of MOG-positive ADEM, particularly when associated with less commonly recognized viral infections like Meta-pneumovirus. The overlap of symptoms with viral encephalopathy emphasizes the need for a comprehensive diagnostic approach, including early MRI and MOG antibody testing, to differentiate from other CNS conditions. The involvement of Meta-pneumovirus, while not commonly reported as a trigger for ADEM, expands the spectrum of viral triggers and highlights the importance of considering a broad range of infectious agents in similar presentations. Early recognition and aggressive treatment were crucial for this patient's recovery, illustrating the necessity of prompt intervention in MOG-positive ADEM, especially when extensive CNS involvement is observed.

Keywords:- Acute Disseminated Encephalomyelitis (ADEM), Myelin Oligodendrocyte Glycoprotein (MOG) Antibodies, Autoimmune demyelination, Meta-Pneumovirus Infections, Autoimmune Encephalitis.

INTRODUCTION

Acute Disseminated Encephalomyelitis (ADEM) is an inflammatory demyelinating disorder predominantly affecting the central nervous system (CNS) in children. It is often triggered by viral infections or vaccinations and is characterized by multifocal neurological deficits and encephalopathy. The presence of Myelin Oligodendrocyte Glycoprotein (MOG) antibodies has been increasingly recognized in ADEM, particularly in cases that present with atypical features or a more severe clinical course.[1,2]

Meta-pneumovirus is a common respiratory pathogen in young children, typically causing mild to moderate respiratory illnesses. However, its association with CNS demyelinating disorders like ADEM is not well-

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established. This case report highlights the occurrence of MOG-positive ADEM following a Meta-pneumovirus infection in a preschool child and discusses the challenges in diagnosis and treatment, alongside a review of the relevant literature.

CASE REPORT

Patient History and Presentation: A 3-year-old female presented to the emergency department with acute encephalopathy, high fever, vomiting, staring episodes, floppiness, and left abducent nerve palsy. The patient's neurological status rapidly deteriorated, with a Glasgow Coma Scale (GCS) score of 6, prompting the need for intubation and mechanical ventilation.

Two weeks prior, the patient had been admitted to the Paediatric Intensive Care Unit (PICU) for a suspected CNS infection. She tested positive for Meta-pneumovirus. She was treated with a 10-day course of antibiotics. However, her condition continued to worsen, leading to the current presentation.

Diagnosis: On admission, the patient exhibited left-sided hypertonia, bilateral hyperreflexia, and bilateral extensor plantar responses. By Day 14, she developed hyperkinetic movements involving both the upper and lower limbs.

Serum MOG antibodies were found to be positive, with low positivity in the cerebrospinal fluid (CSF).[3,4] Extensive metabolic investigations, including tests for Mycoplasma, Epstein-Barr Virus (EBV), Influenza, and SARS-CoV-2 antibodies, as well as a viral CSF panel, were unremarkable. Initial MRI of the brain showed T2 hyperintense signals in the bilateral medial thalami and brainstem. Subsequent MRIs demonstrated progressive multifocal changes involving deep cortical and subcortical white matter bilaterally, along with a new short segment lesion at the T8 level of the spinal cord. Repeated EEG and ambulatory EEG showed a diffusely slow background with intermittent slow wave runs, indicative of generalized cerebral dysfunction.

Treatment: The patient was initiated on a combination of high-dose pulse steroids, which were gradually tapered over 10 weeks, along with Intravenous Immunoglobulin (IVIG) and 10 cycles of plasmapheresis. This regimen led to significant clinical and radiological improvement over a period of 10-12 weeks, with the patient exhibiting minimal focal neurological deficit at the time of discharge.

Outcome: The patient's neurological status improved remarkably following treatment, with gradual recovery of motor functions and resolution of encephalopathy. Follow-up MRI showed a reduction in the extent of brain lesions, and no further spinal cord involvement was observed. The patient was discharged with minimal residual neurological deficits and continues to be monitored closely.

DISCUSSION

MOG-positive ADEM is an uncommon yet significant variant of ADEM, characterized by severe neurological symptoms that can be challenging to differentiate from other central nervous system (CNS) infections or metabolic disorders.[5,6,7] In this case, the initial diagnostic challenge was exacerbated by the overlapping symptoms of acute encephalopathy and a recent Meta-pneumovirus infection. This highlights the need for a comprehensive diagnostic

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approach, including early MRI and MOG antibody testing, to distinguish between viral encephalopathy and autoimmune demyelination.

The presence of MOG antibodies in both serum and cerebrospinal fluid (CSF), along with the characteristic MRI findings, confirmed the diagnosis of MOG-positive ADEM. The preceding Meta-pneumovirus infection likely acted as a trigger for this condition, reinforcing the role of viral infections in precipitating demyelinating events. Although Meta-pneumovirus is not frequently reported as a trigger in ADEM cases, its involvement in this instance broadens the spectrum of known viral triggers and suggests that clinicians should consider atypical viral agents in similar cases.

The treatment regimen, including high-dose steroids, intravenous immunoglobulin (IVIG), and plasmapheresis, has shown favourable outcomes in the literature when administered early in the course of MOG-positive ADEM.[8,9] The patient's significant recovery underscores the importance of prompt and aggressive immunomodulatory therapy for this condition.

This case is notable for its extensive multifocal CNS involvement, which is less commonly reported in Meta-pneumovirus-associated ADEM. The rapid progression and severe neurological impairment observed highlight the critical need for early recognition and intervention. The case contributes to the growing evidence base for managing MOG-positive ADEM, emphasizing the necessity of considering a broad range of viral triggers and the potential for severe outcomes, especially when extensive CNS involvement is present. While the response to treatment is generally positive, the long-term prognosis can be variable, with some patients experiencing relapses or residual neurological deficits.

CONCLUSIONS

This case underscores the importance of early and accurate diagnosis in MOG-positive ADEM, especially in the context of preceding viral infections, which are frequently associated with the onset of ADEM. The case also emphasizes the need for a tailored therapeutic approach, as timely intervention with immunotherapy can lead to significant improvement in clinical outcomes. Although the association between viral infections and ADEM is well-recognized, further research is warranted to better understand the specific mechanisms by which viruses like Meta-pneumovirus may trigger MOG antibody production.[10] Establishing more precise treatment protocols could enhance the management of such cases and improve long-term prognosis.

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