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DIFFERENTIAL DIAGNOSIS OF ACUTE DIFFUSE ENCEPHALOMYELITIS (ADEM) AND MULTIPLE SCLEROSIS (MS) - CASE REPORT

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ABSTRACT

Acute Disseminated Encephalomyelitis (ADEM) is an acute, immune-mediated demyelinating disorder of the central nervous system, primarily affecting children between 3 and 7 years of age. It typically occurs 1–3 weeks after a viral, bacterial, or post-vaccination infection. Clinically, it presents with multifocal neurological deficits and encephalopathy, which may include altered consciousness, seizures, or cognitive disturbances. MRI shows widespread demyelinating lesions, mainly in the subcortical white matter. Laboratory findings may include elevated CRP, ESR, leukocytosis, and CSF pleocytosis. Treatment involves high-dose intravenous corticosteroids, with intravenous immunoglobulin or plasma exchange used in severe or refractory cases. Though usually monophasic, up to 25% of patients may experience relapses. Some children may require ICU care and early rehabilitation to address cognitive, motor, or speech deficits, highlighting the importance of timely diagnosis and management.

KEYWORDS

Acute Diffuse Encephalomyelitis, Multiple Sclerosis, Diagnosis, Case Report

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Purpose

Acute Disseminated Encephalomyelitis (ADEM) is a multifocal, demyelinating inflammatory disease of the brain and spinal cord. The demyelinating lesions in ADEM primarily involve the subcortical white matter, but may also involve the grey matter. In 50-85% of cases, it is associated with a preceding viral, bacterial or vaccination infection occurring 1 to 3 weeks back. Although it is considered a monophasic disease it has been found that in approximately 5-25% of cases there are subsequent relapses. ADEM is diagnosed in an estimated 0.07 to 0.9 cases per 100 000 children per year and the peak incidence is between 3-7 years of age [1]. Diagnostic criteria are based on the presence of multifocal CNS symptoms and demyelinating changes on magnetic resonance imaging (MRI) and encephalopathy. Encephalopathy is a general term for brain conditions characterised by abnormalities of brain function. They can manifest as: disturbances of consciousness (ranging from mild mental fogginess to coma), changes in personality and behaviour, problems with memory and cognitive functions, seizures, movement disorders (tremors, ataxia or muscle rigidity). [2]. Patients usually present with prodromal symptoms such as fever, headache, malaise, nausea and vomiting. Predominant neurological symptoms include encephalopathy, ataxia, pyramidal symptoms (e.g. hemiparesis), cranial nerve neuropathies and headache. Approximately half of children with ADEM have an increased sedimentation rate, elevated C-reactive protein (CRP) and mild leukocytosis. CSF pleocytosis may also be present [3]. The differential diagnosis includes multiple sclerosis (MS) and post-infectious encephalomyelitis [4]. The standard of care for ADEM is non-specific immunosuppressive therapy including corticosteroids (CS)-methylprednisolone in high doses intravenously followed by lower doses orally; intravenous immunoglobulin (IVIG) and plasma exchange (PE) [5]. As many as 25% of children with ADEM may need hospitalisation in an intensive care unit due to neurological complications such as cognitive impairment, epilepsy, visual and movement problems (such as weakness, spasticity, ataxia) and speech difficulties. In such cases, it is important to implement an early rehabilitation programme to improve gait, muscle strength, coordination and cognitive abilities [6].

Metodology

This work is structured as a case report, aiming to present and analyze a specific clinical case encountered in medical practice. The primary objective is to describe the diagnostic process, therapeutic approach, and clinical outcome, while contextualizing the case within current medical knowledge. Additionally, a nomenclature review was conducted using PubMed to evaluate the terminology and classification used in the literature related to this condition.

Case Description

A 7-year-old female patient was admitted to the Children's Hospital in the evening due to muscle weakness in the left upper and lower limbs that had been present since the afternoon of the previous day. A few hours earlier, the patient had been sledging falling from her own height. On returning home, she complained of neck pain and left shoulder pain. On admission to the ED, the girl was conscious and critical parameters were normal. On physical examination, features of left hemiparesis on the Lovet scale 4- significantly impaired manual dexterity and independent gait were present. She had undergone an infection and antibiotic pharmacotherapy 4 weeks previously.

A CT scan was performed, which showed no abnormalities.

In the laboratory tests ordered, abnormalities appeared in platelets (490 thousand/ml), PDW (8.3 fl), P-LCR (11.6%) and lymphocytes (4.06 thousand/ul; 54%), neutrophils (29.5%), monocytes (13.6%).

After a neurological consultation, the patient was admitted to the Paediatric Neurology department. During her stay, the girl underwent an MRI of the head, which showed no abnormalities, and an MRI of the spine. Examination of the cervical region revealed 4 small hyperintense foci located in the white matter: at the level of the inferior part of the C2 vertebral body medially in the dorsal part, measuring 2x2x7mm , at the level of the C3 vertebral body on the left side, measuring 4x4x8mm. At the level of the C3/4 intervertebral disc and the upper edge of the C4 vertebral body medially in the dorsal part, measuring 3x2x6mm with discrete marginal contrast enhancement, a small hyperintense focus at the level of C2/3 in the posterior-right part, measuring 2x1mm. The image suggested demyelinating or inflammatory changes.MRI of the thoracic and lumbar spine showed no changes.

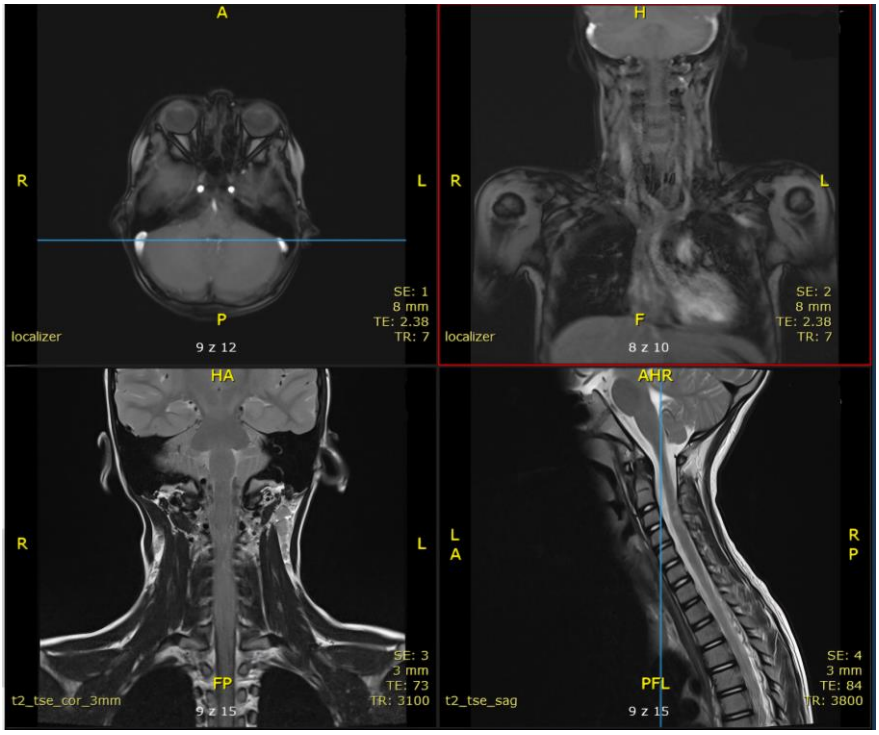

Fig. 1. *Hyperintense foci located in the white matter at the level of the C3 vertebral body on the left side.*

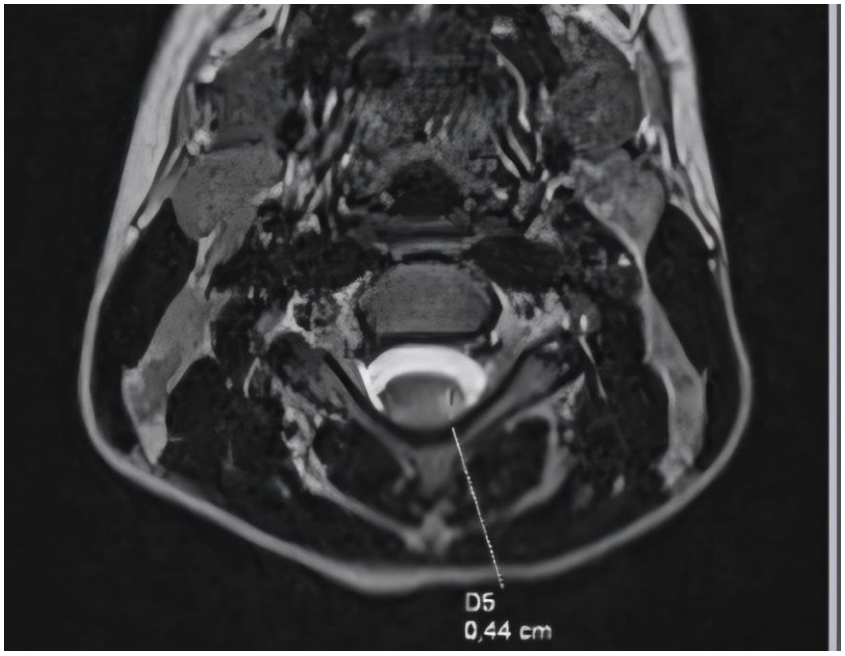

Fig. 2. *Hyperintense foci located in the white matter at the level of the C3 vertebral body on the left side.*

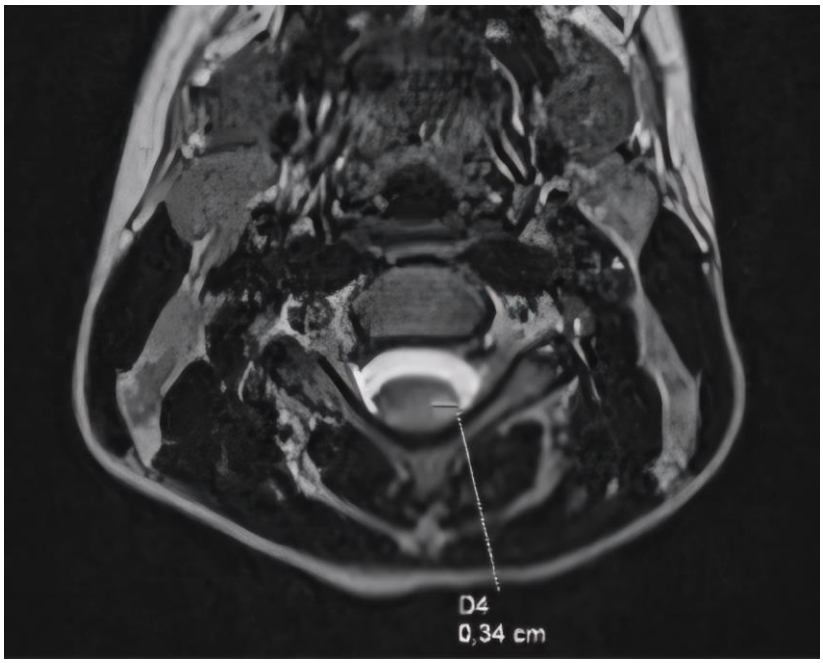

Fig. 3. *Hyperintense foci located in the white matter at the level of the C3/4 intervertebral disc and the upper edge of the C4 vertebral body medially in the dorsal part.*

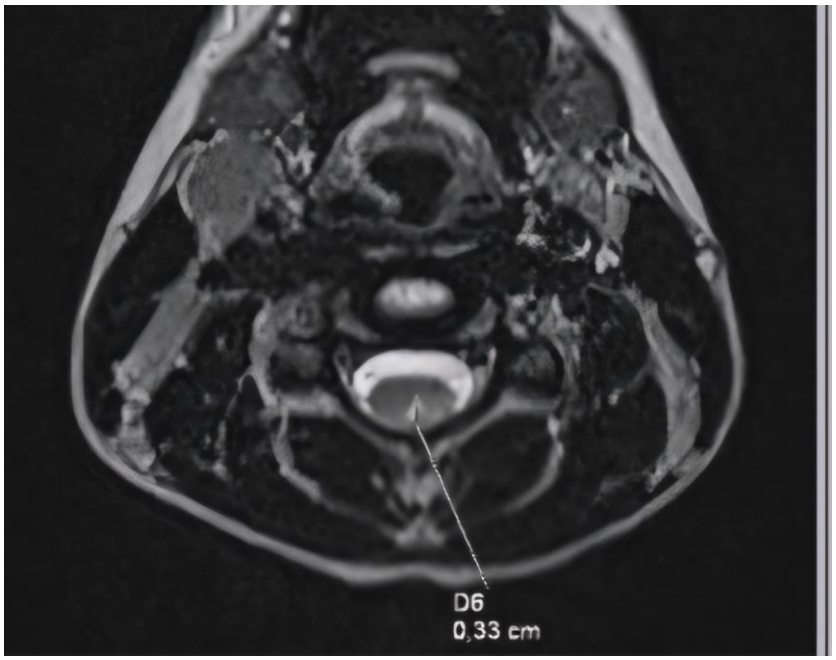

Fig. 4. *Hyperintense foci located in the white matter at the level of the C3/4 intervertebral disc and the upper edge of the C4 vertebral body medially in the dorsal part.*

A cerebrospinal fluid study was also ordered for a panel of 14 pathogens of PMR infection. It also assessed Pand's reaction , Nonne- Apelt's reaction; cultures for aerobic bacteria, EBV IgM , Lyme disease IgM and IgG were performed. The results of all the above tests were negative.

The girl was consulted by a doctor in the Rehabilitation Department; during the physical examination, a slight drooping of the eyelid of the left eye, observed by her mother since the fall, weakened muscular strength of the left limbs on the Lovet scale of 4, in the area of the left lower limb, a stop tremor and an exaggerated ankle reflex were observed. No pathological symptoms were found.

Based on the history, physical examination and additional tests, acute encephalomyelitis (ADEM) was suspected in the girl for differentiation with multiple sclerosis. The diagnosis of acute encephalomyelitis was supported by the patient's age and the history of an infectious disease 4 weeks ago. ADEM is one of the causes of acute encephalopathy, which manifests itself by disturbances affecting the level of consciousness or cognitive processes. After a cycle of 5 days of steroid therapy and the start of rehabilitation, physical improvement was achieved - gait was more efficient, muscle strength with slight L<P asymmetry, symmetrical tendon reflexes present.

A vitamin preparation containing, among others, vitamin B1, B2, B6 was recommended. The patient was discharged home in good general condition with a recommendation to continue rehabilitation.

Comment and Discussion

Neurological disorders in the paediatric population present both therapeutic and diagnostic challenges to clinicians. In the above paper, a case of a 7-year-old female patient is presented that highlights the importance of performing imaging and laboratory tests when conducting the differential process of disease entities [7]. Multiple sclerosis is one of the most common chronic neurological diseases of young adults worldwide. The peak incidence is between 20 and 40 years of age, but in the paediatric population it is most common above 10 years of age. The symptoms of MS often manifest as motor or sensory dysfunction, as well as symptoms of cerebellar syndrome, which may suggest multifocal central nervous system damage. The criteria for the diagnosis of MS are the Mc Donald criteria, taking into account the Barkhof and Tintore criteria : 1) at least 9 lesions on T2-weighted images or at least one enhancing lesion after administration of a contrast agent, 2) at least 3 lesions located periventricularly 3) at least one lesion located subventricularly 4) at least one lesion located subarachnoidly or in the spinal cord. The diagnosis requires at least three of these features. Considering all the above-mentioned symptoms, the initial focus of the differential diagnosis should be on ADEM [8]. The multiphasic form of this disease entity should draw particular attention of the diagnostician, as recurrence occurs shortly after corticosteroid withdrawal or after a subsequent infection (even after full or partial resolution of the

first-episode symptoms). Acute disseminated encephalomyelitis is a complication of viral infections, so an accurate diagnosis requires exclusion of infectious diseases and malignancy [7]. ADEM is characterised by a multifocal course of initial symptoms, usually the absence or rapid disappearance of oligoclonal bands in the PMR, features of encephalopathy, leukocytosis and with rare occurrence of subsequent flares. Magnetic resonance (MR) images show large, widespread lesions with blurred borders, concentrated in the region of the nucleus accumbens, which may sometimes undergo contrast enhancement in the acute and subacute periods of the disease. In MS, multifocal initial symptoms and signs of encephalopathy and leukocytosis are rarely present, while subsequent episodes of the disease are always present, and oligoclonal bands in the CSF are often present and do not disappear in subsequent examinations [9]. Paolilo R et al. conducted a study on a group of 44 patients collecting cerebrospinal fluid for examination during the diagnosis of ADEM. Elevated CRP protein values and pleocytosis of the fluid were observed in about 50 % of them. Oligoclonal bands were found in less than 10 % of them. However, they are much more frequently observed in multiple sclerosis. Laboratory findings included leucocytosis and an increase in CRP [7]. The treatment of patients with neurological complications, mainly depends on their initial clinical condition. Severe cases may require hospitalisation in the intensive care unit, intubation and ventilator therapy. Early initiation of treatment contributes to reducing the risk of permanent neurological complications. A growing body of research suggests that patients who have undergone ADEM may develop permanent neurocognitive deficits. If neurological symptoms persist, rehabilitation is also recommended [10].

Conclusions

In the case presented to us, there were severe neurological complications following an infection several weeks earlier. ADEM is a difficult disease entity to diagnose due to its rare occurrence in the population and its similarity to MS. For the diagnosis of ADEM, the presence of acute cerebral and/or spinal symptoms and the presence of fever after a recent infection should be considered as clinical criteria. The treatment and diagnosis of the above neurological diseases in children still presents many challenges.

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