

An interesting case of acute disseminated encephalomyelitis following *E. coli* infection

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ABSTRACT

Acute disseminated encephalomyelitis (ADEM) is a rare inflammatory demyelinating disease of central nervous system (CNS), characterized by multifocal white matter involvement with neurological deficits and accompanied by encephalopathy. ADEM is thought to be caused by autoimmune etiology. CNS autoantigens are produced by molecular mimicry triggered by an environmental stimulus, mostly infection (viral/bacterial) or post vaccination, in genetically susceptible individuals. ADEM is sometimes referred to as post/para-infectious or post-immunization ADEM. ADEM is characterized by multifocal neurological signs and occasionally it rapidly progresses to coma. Magnetic resonance imaging (MRI) is used to confirm the diagnosis. The treatment is based on intravenous high-dose methylprednisolone, which usually leads to a rapid improvement. Recently, the use of intravenous immunoglobulins and plasma exchange (PLEX) has also been suggested. We report a case of a 6-year-old girl who was admitted for urinary tract infection but developed neurological complications which was treated successfully.

Keywords: Acute disseminated encephalomyelitis, *Escherichia coli*, high-dose methylprednisolone, magnetic resonance imaging

Introduction

Acute disseminated encephalomyelitis (ADEM) is the disease of central nervous system (CNS) characterized by the inflammatory demyelination with multifocal white matter involvement and neurological deficits.^[1] The worldwide annual incidence is 0.07–0.4 per 100,000 population per year but the true incidence of ADEM in India is unknown and this is mostly because of the underreporting of the cases. ADEM is more common among young adults and children and it does not show any predilection for sex or ethnicity.^[2] The autoimmune etiology is being proposed in the majority of the cases that usually develops after the acute viral or bacterial infection, vaccination, or organ transplantation.^[3,4] Though there are many bacterial and viral pathogens that leads to ADEM, the development of

ADEM due to *Escherichia coli* (*E. coli*) has never been reported till now. Therefore, we report a case of para-infectious encephalomyelitis (ADEM) following urosepsis due to *E. coli*.

Case History

A 6-year-old female child, born to nonconsanguineous parents was brought to the hospital with 2 weeks history of dysuria, 7 days of fever, and lethargy for a day. At admission she had hypotension and was in sick-looking state but was conscious, oriented without any evidence of focal neurological deficit. Her hypotension was treated with intravenous fluids and was started on empirical cefotaxime, considering as urinary tract infection.

Her investigations revealed neutrophilic leukocytosis with plenty of pus cells in urine. She was euglycemic and her renal, hepatic parameters were within the normal range. Urine culture grew *E. coli* sensitive to cefotaxime and amikacin. Injection

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Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_402_18

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How to cite this article: Balamurugesan K, Ponprabha R, Davis P. An interesting case of acute disseminated encephalomyelitis following *E. coli* infection. J Family Med Prim Care 2019;8:292-5.

amikacin was added along with cefotaxime. On the second and third day of hospitalization she remained afebrile, conscious but complaining of myalgia. On the fourth day she remained conscious but developed neurological symptoms such as difficulty in walking, diminished vision, ataxia with broad-based gait. On examination she had involvement of the pyramidal tract (hypertonia, brisk reflexes in all four limbs with positive Babinski sign, and ankle clonus), cerebellum (ataxia with broad-based gait) with intact sensory system. Ophthalmological evaluation revealed decreased visual acuity of 6/18 with normal fundus. Immunological markers of inflammation such as antinuclear antibody, C-reactive protein were negative. CT brain and lumbar puncture was done immediately and the reports are shown in Table 1.

Neurology opinion was obtained. On the basis of history, examination, cerebrospinal fluid (CSF) analysis, possibility of ADEM was considered and MRI brain was suggested. MRI brain showed nonenhancing hyperintense foci in left thalamus as in Figures 1 and 2 and left cerebellar white matter on T2-weighted fluid-attenuated inversion recovery (FLAIR) as in Figure 3, suggestive of ADEM. Possible differential diagnoses considered were the first attack of multiple sclerosis, cerebrovascular accident, meningoencephalitis, and vasculitis.

The diagnosis was made according to the guidelines given by International Pediatric Multiple Sclerosis Study Group. The patient was started on intravenous methylprednisolone 20 mg/kg for 5 days, followed by oral steroid for 4 weeks along with other supportive measures. The patient had dramatic improvement and had complete recovery without any residual sequelae.

Discussion

ADEM is a rare disease characterized by an immune-mediated inflammatory demyelination of the CNS, which predominately affects the white matter of the brain and spinal cord.^[1] The ADEM is characterized by the development of acute onset encephalopathy with multifocal neurological deficits.^[3,5] The ADEM usually develops following the acute viral etiology, especially exanthematous disease, bacterial as well as due to vaccination and rarely after the immune sera.^[3,4] Approximately 50–75% of the ADEM is due to postinfectious cause, following measles, mumps, coronavirus, coxsackie B, dengue virus, Epstein-Barr virus, hepatitis A and C virus, *Borrelia burgdorferi*, *Chlamydia*, *Legionella*, *Mycoplasma pneumoniae*,

Rickettsia rickettsi, *Streptococci*, *Plasmodium vivax*.^[6,7] Nearly 5% of the ADEM occurs following the vaccination. The vaccines that are associated with the development of ADEM are hepatitis B, Japanese B encephalitis, measles, mumps,

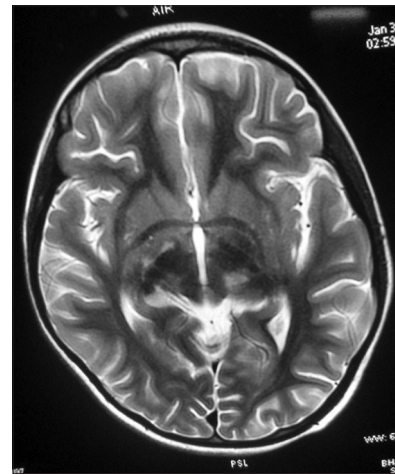


Figure 1: MRI brain T2-weighted image showing Lt thalamic hyperintensity

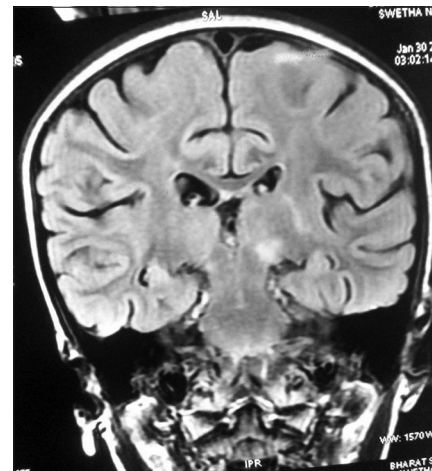


Figure 2: MRI brain sagittal section showing Lt thalamic hyperintensity

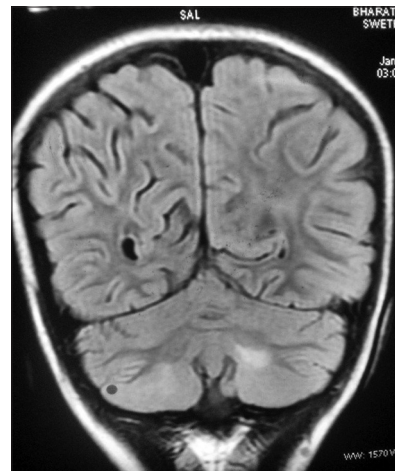


Figure 3: MRI brain showing Lt cerebellar hyperintensity

Table 1: CT brain and CSF analysis

CT brain plain	Normal study
CSF analysis	
Total count	6-8 WBC/hpf
Cytology	Predominantly lymphocytes
Protein	48 mg/dl
Sugar	71 mg/dl
Viral serology	Negative for JE, HSV, CMV
Culture and sensitivity	No growth

Table 2: Clinical and radiological features that may distinguish ADEM from first attack of multiple sclerosis (MS)

	ADEM	MS
Age	<10 years	>10 years
Stupor/coma	+	-
Fever/vomiting	+	-
Family history	No	20%
Sensory complaints	+	+
Optic neuritis	Bilateral	Unilateral
Manifestations	Polysymptomatic	Monosymptomatic
MRI imaging	Widespread lesions: basal ganglia, thalamus, cortical gray-white junction	Isolated lesions: periventricular white matter, corpus callosum
CSF	Lymphocytic pleocytosis	Oligoclonal bands
Response to steroids	+	+
Follow - up	No new lesions	New lesions

+: More likely to be present; -: Less likely to be present

Table 3: Diagnostic criteria given by International Pediatric Multiple Sclerosis Study Group

1. A first clinical attack of CNS demyelinating disease with acute or subacute onset, polysymptomatic neurologic features, and encephalopathy
2. Brain MRI showing focal or multifocal lesions, predominantly involving the white matter, without evidence of previous white matter changes
3. Encephalopathy as a presenting symptom, with the onset of encephalopathy corresponding with the occurrence of the disease state (encephalopathy is defined to include behavioral changes, such as lethargy or irritability, or severe changes in the level of consciousness such as coma)

pertussis, polio, rubella, tetanus, rabies (Semple vaccine).^[8] There are two proposed concepts for the development of ADEM. The first one is the inflammatory cascade concept which is by the direct invasion of the neurotropic pathogens into the CNS. The second concept is the molecular mimicry between the pathogen and myelin proteins of the host.^[9] The ADEM is characterized by the onset of fever, malaise, myalgia, headache, and vomiting but encephalopathy is the hallmark feature of the ADEM, which ranges from simple confusion to coma. Within a period of 4–13 days after the infection or vaccination, the neurological signs and symptoms will develop.^[10,11] In addition to encephalopathy, other neurological signs such as hemiparesis, cranial nerve palsies, paraparesis, meningismus, ataxia, and optic neuritis may occur.^[12,13] The diagnosis of the ADEM is mainly based on the clinical and radiological features. CT brain is usually normal. Cranial MRI is the imaging study of choice. T2 and FLAIR images show patchy areas of increased intensity in the white matter regions. Deep gray matter structures such as thalami, basal ganglia are often involved.^[14] The CSF examination shows nonspecific changes such as increased pressure, lymphocytic pleocytosis, and raised protein. Increased amount of IgG specific for

myelin protein can be noted.^[14] The clinical and radiological features that distinguish ADEM from the first attack of multiple sclerosis is given in Table 2.

The International Pediatric Multiple Sclerosis Study Group gave a diagnostic criterion to diagnose ADEM in children,^[15] as shown in Table 3. This criterion is very helpful to distinguish ADEM from other clinically isolated syndromes. The treatment options available for the ADEM are corticosteroids, plasma exchange, and intravenous immunoglobulins. High dose of intravenous corticosteroids is widely accepted as the first line of treatment, especially the methylprednisolone with a dose of 20–30 mg/kg per day with a maximum dose of 1 g per day should be given for 3–5 days followed by oral prednisolone for 3–6 weeks. Other modalities of treatment include intravenous immunoglobulin at a dose of 2 g/kg over 2–5 days and plasma exchange are very useful in case of steroid nonresponders.^[1,11] The long-term prognosis of the ADEM is good. About 60–90% of the patients recovered without any neurological deficit in an average period of 1–6 months.^[10,11]

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Wender M. Acute disseminated encephalomyelitis (ADEM). *J Neuroimmunol* 2011;231:92-99.
2. Lotze TE, Chadwick DJ. Acute disseminated encephalomyelitis in children: Pathogenesis, clinical features, and diagnosis. UpToDate 2009.
3. Tenenbaum S, Chitnis T, Ness J, Hahn JS. Acute disseminated encephalomyelitis. *Neurology* 2007;68(Suppl 2):S23-36.
4. Weng WC, Peng SS, Lee WT, Fan PC, Chien YH, Du JC, *et al.* Acute disseminated encephalomyelitis in children: One medical center experience. *Acta Paediatr Taiwan* 47:67-71.
5. Rust RS. Multiple sclerosis, acute disseminated encephalomyelitis and related conditions. *Semin Neurol* 2000;7:66-90.
6. Menge T, Hemmer B, Nessler S, Wiendl H, Neuhaus O, Hartung HP. Acute disseminated encephalomyelitis an update. *Arch Neurol* 2005;62:1673-80.
7. Sidhu J, Maheshwari A, Gupta R, Devgan V. Acute disseminated encephalomyelitis after plasmodium vivax

- infection: Case report and review of literature. *Pediatr Rep* 2015;7:5859.
8. Hemachudha T, Griffin DE, Giffels JJ, Johnson RT, Moser AB, Phanuphak P. Myelin basic protein as an encephalitogen in encephalomyelitis and polyneuritis following rabies vaccinations. *N Engl J Med* 1987;316:369-74.
 9. Fujinami RS, Oldstone MB. Amino acid homology between the encephalitogenic site of myelin basic protein and virus: Mechanism of autoimmunity. *Science* 1985;230:1043-5.
 10. Murthy SN, Faden HS, Cohen ME, Bakshi R. Acute disseminated encephalomyelitis in children. *Pediatrics* 2002;110:e21.
 11. Hynson JL, Kormberg AJ, Coleman LT, Shield L, Harvey AS, Kean MJ. Clinical and neuroradiologic features of acute disseminated encephalomyelitis in children. *Neurology* 2001;56:1308-12.
 12. Murthy JMK, Yangala R, Meena AK, Reddy JJ. Clinical, electrophysiological and magnetic resonance imaging study of acute disseminated encephalomyelitis. *J Assoc Physicians India* 1999;47:280-3.
 13. Schwarz S, Mohr A, Knauth M, Wildemann B, Storch-Hagenlocher B. Acute disseminated encephalomyelitis: A follow-up study of 40 adult patients. *Neurology* 2001;56:1313-8.
 14. Garg RK. Acute disseminated encephalomyelitis. *Postgrad Med J* 2003;79:11-7.
 15. Krupp LB, Banwell B, Tenembaum S; International Pediatric MS Study Group. Consensus definitions proposed for pediatric multiple sclerosis and related disorders. *Neurology* 2007;68:S7-12.