

# POST MODERNA VACCINE ASSOCIATED ACUTE DISSEMINATED ENCEPHALOMYELITIS (ADEM) - A CASE REPORT

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## ABSTRACT:

Due to pervasive pandemic of SARS CoV-2 the reports of rare neurological complications have turned up out of the ordinary. The public health concerns are raised due to SARS-CoV-2 infection and vaccinations as this recent pandemic has set the development and deployment of vaccines at large scale. The randomized controlled trials being carried were underpowered to foresee the rare adverse effects. Amongst other neurological complications acute disseminated encephalomyelitis (ADEM) has been reported with vaccination for SARS-CoV-2. Herein, we report a patient with a unique presentation of ADEM, a severe neuroinflammatory disorder developed shortly after mRNA based Moderna vaccine for SARS-CoV-2.

**KEY WORDS:** Acute disseminated encephalomyelitis (ADEM), COVID-19, Moderna

## INTRODUCTION

According to WHO report, approximately 10 million cases and 500 000 mortalities are ascribable to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), since 2019. There are escalating reports of neurological complications in the literature which are imposing serious health concerns worldwide. Amongst other neurological complications encephalopathy and meningoencephalitis are reported.<sup>1,2</sup> Acute disseminated encephalomyelitis (ADEM) is a demyelinating disease of CNS which has immune-mediated inflammatory basis. It has typically transitory presentation of encephalopathy and multifocal neurological deficits. Approximately three-quarters of cases of encephalomyelitis have etiological factors of vaccination and infection.<sup>3</sup> Post-vaccination ADEM has been associated with several vaccines. About 5%–10% of ADEM cases are post-vaccinations.<sup>4</sup> SARS-CoV-2 infection associated with ADEM is described in several cases, whereas no case has been reported after mRNA based Moderna vaccine administration.

Here we put forward the peculiar clinical presentation for ADEM in a female patient shortly after receiving first dose of Moderna vaccine.

## CASE PRESENTATION

A 30 years old female was referred to the tertiary care hospital with a 7-day old history of sub-acute onset of

right hemiplegia with altered level of consciousness and aphasia developed two weeks following the first dose of the mRNA-based Moderna vaccine to SARS-CoV-2 infection. During this post vaccination period of 14 days, she did not develop respiratory or gastrointestinal symptoms attributable to SARS-CoV-2 infectivity. SARS-CoV-2 PCR from nasal swab was also negative. Her clinical examination showed GCS of 11/15, power on the right side was 0/5, while on the left side, it was 5/5 with increased tone and upward right-sided Babinski sign. Brain Computed Tomography scan (Figure 1) showed multiple lacunar hypo densities. Initially at basic health unit she had been erroneously treated on the line of ischemic stroke for 5 days.



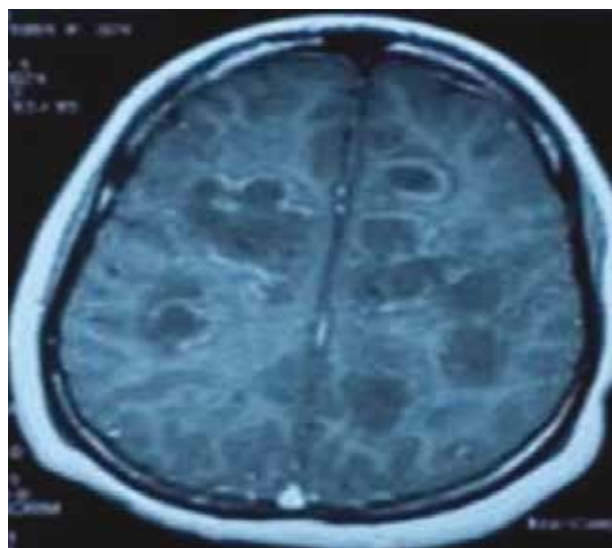
**Figure 1: Brain computed tomography scan (Day 1)**

Her workup is shown in Table 1. Her blood count, blood biochemistry, C-reactive protein, urine, and blood cultures were within normal limits. Her protein S, serum homocysteine, factor V Leiden, antithrombin-3, and Protein C were unremarkable. Transthoracic Echocardiography showed ejection Fraction of 55%. Bilateral Carotid doppler showed normal velocity and no plaque in situ. During admission her GCS further

deteriorated to 9/15 with persistent hemiplegia. Due to financial constraints instead of MRI brain patient underwent contrast enhanced CT scan brain (Figure 2) which showed subtle parenchymal and meningeal enhancement. This raised our suspicion of ongoing CNS inflammatory etiology for which we conducted MRI brain study.

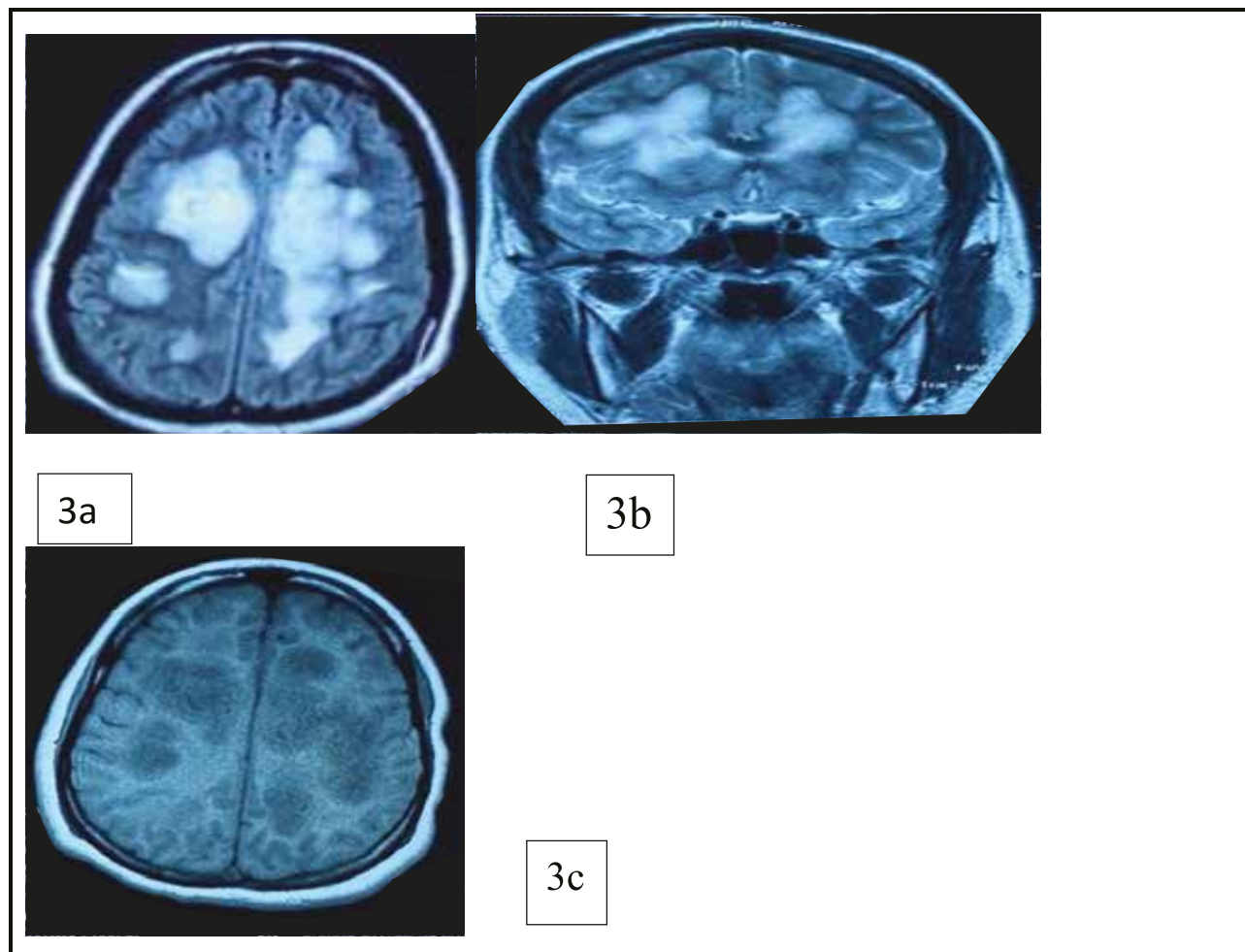
**Table 1: Lab investigations**

Complete blood profile		Renal function tests	
Wbc	10400	Urea	6.7
Hb	14.6	Creatinine	1.3
PLT	409000	Na	147
		K	4.3
Coagulation profile			
Protein S	104.1	ESR	27
Serum homocysteine	11.21	CRP	<6



**Figure 2 Contrast enhanced CT brain performed on day 4**

Magnetic Resonance Imaging brain (Figure 3) showed altered MR signals involving deep white matter with sparing of subcortical fibers along bilateral frontal lobes, bilateral parietal lobes in the region of centrum semiovale, and bilateral occipital lobes showing peripheral “open” ring enhancement and peripheral areas of restricted diffusion representing acute disseminated encephalomyelitis (ADEM). Magnetic Resonance Venography MRV brain was normal. The cerebrospinal fluid (CSF) analysis revealed mild lymphocytosis (cell count 3), Glucose (3.9 mmol/L), and proteins 558mg/dl. Oligoclonal bands were negative. Microbial culture in CSF was negative. TORCH profile, HIV serology was negative. Anti-aquaporin-4 (AQP4) and anti-myelin oligodendrocyte glycoprotein (MOG) antibodies, anti-nuclear antibody, anti-extractable nuclear antigens, anti-neutrophil cytoplasmic antigen, all showed negative results.



**Figure 3: Magnetic Resonance Imaging brain showed altered MR signals involving bilateral frontal lobes, bilateral parietal lobes and bilateral occipital lobes showing peripheral “open” ring enhancements.**

**3a) MRI BRAIN FLAIR sequence    3b) MRI BRAIN T2WI    3c) MRI BRAIN T1WI**

We initiated our management via 5 days therapy with injection methyl Prednisolone 1g/ day. However, her condition did not improve with corticosteroids. After two weeks of disease onset, the patient was given treatment choice of intravenous immunoglobulins or plasmapheresis. Considering cost effective option for our patient we provided her with five sessions of plasma exchange subsequently. She was fortunately discharged on 15th day of admission with improved power and alert and conscious status.

## DISCUSSION

The clinical syndrome of ADEM usually consists of prodromal signs which are followed by generalized tonic clonic seizures. Surprisingly, this patient had no relevant

history throughout her disease course which put her timely diagnosis at disadvantage. The onset of neurological signs in up to 75 % of ADEM cases is preceded by a febrile gastrointestinal or upper respiratory disease.<sup>5,6</sup> This patient had acute onset of right sided hemiplegia and aphasia with no febrile history.

The post-vaccination ADEM unlike the post-infectious variant, affects patients of all ages with male predominance.<sup>7</sup> However, we are reporting a female patient. The first case of ADEM associated with the SARS-CoV-2 vaccine was reported against the Sinovac vaccine. The patient had a typical clinical course of ADEM, having prodromal symptoms of headache, low-grade fever, muscle aches, and persistent poor

memory with subsequent development of generalized tonic-clonic seizure.<sup>8</sup> Kenangil et al. also reported a case of ADEM following Sinovac vaccine who had developed generalized tonic clonic seizures.<sup>9</sup> Vogrig et al. reported a case of 56-years old female who had observed post-vaccination ADEM with the Pfizer vaccine.<sup>10</sup> She had hemi- ataxia and dysmetria with the antecedent prodromal symptoms. Another case of ADEM was reported with symptoms of blurred vision and quadriparesis developed after the Oxford/ AstraZeneca vaccine.<sup>11</sup> This is the first case reporting m RNA based Moderna vaccine related to ADEM in a young lady presenting in a unique presentation. Our case puts forward the variation in presenting symptoms for ADEM associated with the COVID-19 vaccine. These findings impart clear implications in terms of clinical benefits for diagnosing rare post-COVID vaccination neurological complications.

A recent systemic review (2021) showed 102 cases of CNS demyelination having temporal association with SARS-CoV-2 infection and 32 cases with SARS-CoV-2 vaccine which is actually a relative low risk in comparison

with SARS-CoV-2 infection associated with CNS demyelination .<sup>12</sup> In a nutshell, this study provides significant insight to enable timely decision-making and to facilitate prompt management. More frequently, ADEM is associated with primary vaccination even though relapses have been described following booster dose.<sup>4</sup> However, the benefits of vaccination programs surpassed the risks as these neurological complications following SARS-CoV-2 infection are much more significant than those associated with vaccination.<sup>13</sup>

## CONCLUSION

ADEM is a rare post SARS-CoV-2 vaccination sequelae that can unveil its etiology with various presentations. Apart from clinical criteria for diagnosis, the magnetic resonance imaging of brain is the most sensitive study for diagnosis of ADEM. Although experimental trials conducted for SARS-CoV-2 vaccines do not assure complete risk-free use; it certainly reduces rare complications. The SARS-CoV-2 vaccine-associated encephalomyelitis is still very rarely reported, and the advantages of vaccinations surpass the potential risks of CNS inflammation.

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**Sajid Ali;** data collection, data analysis, manuscript writing, manuscript review

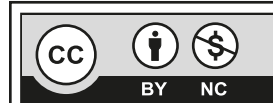
**Hafsa Mobeem;** data collection, data analysis, manuscript writing, manuscript review

**Soban Khan;** data collection, data analysis, manuscript writing, manuscript review

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