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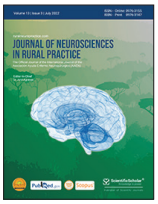

Images in Neuroscience

Cracking the nut open: The double-doughnut sign in flavivirus encephalitis

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A 27-year-old female was admitted with complaints of altered sensorium and 3–4 episodes of vomiting since 1 day during the period of an ongoing severe dengue epidemic in the district. The patient was in her usual state of health 7 days back when she developed a fever spike which was associated with chills. It was relieved on medication. The patient later resumed her daily activities at home; however, she complained of dizziness with a feeling of swaying to either side while carrying out the household chores. The swaying lasted for a few minutes and resolved on its own without the need for any medications and occurred around 3–4 times over a period of 4 days. The patient then developed vomiting on the 6th day after the illness started – 4–5 episodes with vomitus containing food particles, non-bilious and non-blood stained. It was associated with generalized weakness. The patient was then brought to the hospital, where she was found to have decreased responsiveness and altered sensorium. On clinical examination, the patient had neck rigidity, decerebrate posturing, and "sunset sign" of eyeballs suggestive of meningoencephalitis with raised intracerebral pressure. Hence, magnetic resonance imaging (MRI) brain (plain and contrast) was performed which showed areas of altered signal intensity in bilateral thalami, hippocampi, pons, and cerebellar hemispheres with areas of diffusion restriction and hemorrhages [Figures 1 and 2]. A computed tomography scan of the brain was not performed due to financial constraints; therefore, an MRI brain (plain and contrast) was obtained as the sole neuroimaging modality.

Routine blood investigations were sent which showed the presence of thrombocytopenia and transaminitis. Workup for Dengue NS-1 antigen and immunoglobulin M (IgM) antibody, malarial parasite, Weil-Felix test, and leptospira IgM antibody were negative. The detailed routine investigations are as follows –

- Complete hemogram – Unremarkable except for platelet count – 0.69 Lakh/Cumm, liver function test – total bilirubin/direct bilirubin- 0.44/0.2 mg/dL, total proteins – 5.8 g/dL, albumin – 3.1 g/dL, AST – 370 U/L, ALT – 312 U/L, ALP – 80 U/L, renal function test – urea/creatinine – 24/0.67 mg/dL, sodium/potassium/chloride- 139/4.2/108 mEq/L, uric acid – 0.9 mg/dL, random blood sugar – 108 mg/dL, serology – human immunodeficiency virus, hepatitis B surface antigen, hepatitis C virus - negative, dengue NS-1 antigen, dengue IgM Antibody, malarial parasite rapid diagnostic test, Weil-Felix test, leptospira IgM antibody, and scrub typhus IgM antibody were negative. Blood culture and urine culture yielded no growth.

Cerebrospinal fluid analysis was deferred in view of the involvement of posterior fossa structures, and the patient was started on injection of methylprednisolone 1 g intravenously once per day for a period of 5 days and later switched to oral steroids which were tapered and stopped. The patient's course in the hospital was uneventful and the patient recovered without any deficits. The altered signal intensity seen in bilateral thalami on the MRI brain report was found to be similar to the "Double doughnut" sign coined by Kumar *et al.*[1] in a case of dengue encephalitis.

Hemorrhagic foci within the basal ganglia-thalamus complex have also been reported in cases of Japanese encephalitis.[2,3]

The "double doughnut" sign is a distinctive MRI finding often associated with flavivirus encephalitis, particularly in conditions such as dengue and Japanese encephalitis. The sign refers to bilateral thalamic lesions, typically seen as hyperintensities on T2-weighted or fluid-attenuated inversion recovery MRI images, with central diffusion restriction, resembling two doughnuts side by side.[4]

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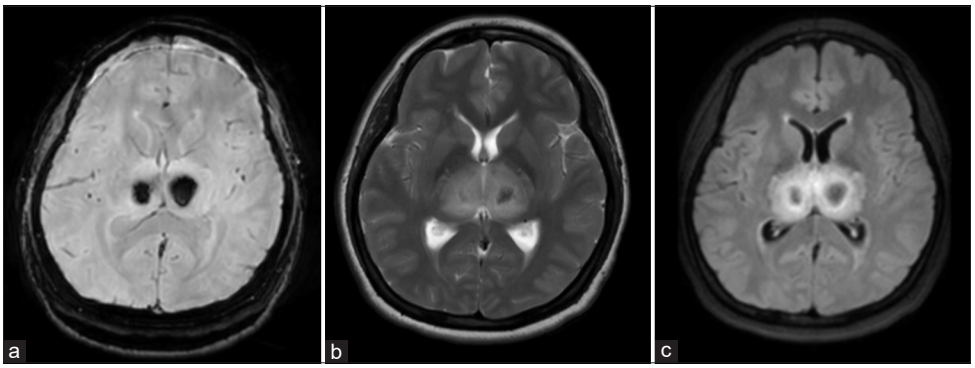

Figure 1: Magnetic resonance imaging (MRI) brain showing (a) areas of intense diffusion restriction with central blooming (hemorrhagic foci) in bilateral thalami on susceptibility-weighted imaging sequence and with (b) hyperintensities in bilateral thalami with adjacent edema on a T2-weighted MRI and (c) on T2/fluid-attenuated inversion recovery MRI.

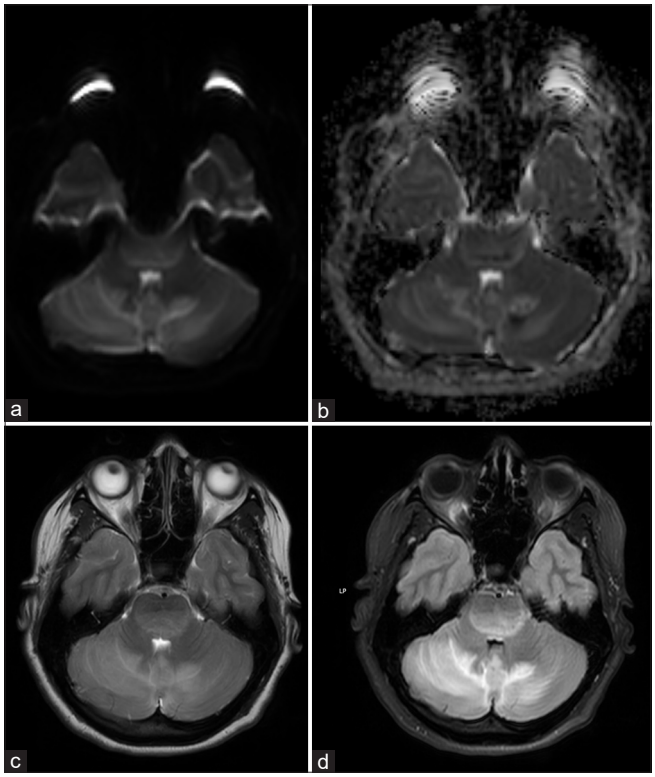

Figure 2: Magnetic resonance imaging (MRI) brain showing (a) areas of diffusion restriction seen in pons and bilateral cerebellar hemispheres in diffusion-weighted imaging and (b) apparent diffusion coefficient, sequences and (c) appearing hyperintense on T2-weighted, and (d) on fluid-attenuated inversion recovery, MRI sequences, respectively.

Hence, we would like to consider this as a case of flavivirus encephalitis (most probably dengue encephalitis even though the workup for dengue was negative since the patient hailed from a dengue-endemic area and was admitted during the period of an ongoing severe dengue epidemic in the district) and since the MRI brain findings seen in our patient correlate with the findings mentioned in the literature on flavivirus encephalitis.

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REFERENCES

1. Kumar AS, Mehta S, Singh P, Lal V. Dengue encephalitis: "Double doughnut" sign. Neurol India 2017;65:670-1
2. Mahale R, Mehta A, Rangasetty S. Bilateral isolated basal ganglia bleed: An atypical presentation of Japanese encephalitis. Neurol India 2015;63:456-7.
3. Sarkar A, Taraphdar D, Mukhopadhyay SK, Chakrabarti S, Chatterjee S. Molecular evidence for the occurrence of Japanese encephalitis virus genotype I and III infection associated with acute encephalitis in patients of West Bengal, India, 2010. Virol J 2012;9:271.
4. Suresh S, Pannu AK, Arora N, Chabra M. 'Double doughnut' sign in Japanese encephalitis. QJM 2022;115:241-2.

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