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MR Imaging in Dengue Patients Presenting with Neurological and Ocular Manifestation: A Case Series in Tertiary Care Hospital

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ABSTRACT
Dengue fever, a mosquito-borne viral infection, has diverse manifestations, ranging from mild symptoms to severe complications, including rare neurological and ocular manifestations. This case series highlights the magnetic resonance imaging (MRI) findings in dengue patients with such manifestations, emphasizing its role in diagnosis and management. A retrospective study of 18 serologically confirmed dengue cases, conducted from August to December 2021, at Pacific Medical College and Hospital, Udaipur, Rajasthan included patients presenting with neurological or ocular symptoms. MRI scans were analyzed using 1.5 T Siemens Magnetom Essenza with various sequences. Data on clinical presentations, lab results and imaging findings were collected and reviewed. Out of 18 cases, 66.7% were male and 33.3% were female, with a mean hospital stay of 6.05 days. Fever was the universal presenting symptom, with neurological symptoms in 83.3% and ocular symptoms in 16.7%. MRI findings revealed capsulo-ganglionic region involvement (77.8%) as the most common, followed by cerebrum (38.9%) and cerebellum (16.7%). Hemorrhagic dengue encephalitis was noted in 44.4% of cases. Dengue encephalitis, though rare, necessitates early diagnosis and intervention. MRI, being superior to CT, aids in identifying specific anatomical involvement. Awareness of neurological and ocular complications is crucial for timely management, potentially improving outcomes in dengue-endemic regions.

INTRODUCTION

Dengue fever is a viral infection caused by the dengue virus, which belongs to the Flaviviridae family. There are four serotypes of this virus, namely-DENV-1, DENV-2, DENV-3 and DENV-4. Dengue virus transmits to humans via the bite of the infected Aedes species (Ae. aegypti or Ae. albopictus) mosquitoes[1-3].Young adults and children are commonly infected by the dengue virus. Dengue is of rising concern to the World Health Organization as well as the National Centre for Vector-Borne Diseases Control, India since the number of cases is increasing rapidly, especially in the endemic regions such as Southern Rajasthan. Such a sudden surge in dengue cases can cause a tremendous social, economic and mental burden on the affected population. It commonly occurs in tropical areas of the world[4]. Dengue infection goes through three phases namely, the febrile phase, critical phase and recovery phase. The febrile phase is characterized by myalgia, rash, petechiae, leukopenia and generally lasts for 3-7 days. This is followed by the critical phase which is characterized by capillary leak, shock, severe hemorrhage, severe organ involvement and generally lasts for 1-2 days. The final phase is the recovery phase which is characterized by fluid reabsorption and lasts for 3-5 days[5]. It has a highly variable presentation ranging from mild symptoms like fever to severe life-threatening complications such as dengue shock syndrome, dengue hemorrhagic fever and dengue encephalitis. Neurological involvement in patients suffering from dengue fever is rare and their incidence rates vary from 0.5%-6.2%[3]. CNS complications are diagnosed by isolating the virus from the CSF. The presence of anti-DENV immunoglobulin (Ig)M, viral RNA, or non-structural protein 1 (NS1) in the CSF is indicative of CNS complications. The DENV-2 and DENV-3 serotypes of the virus are most commonly associated with neurological complications.

MATERIALS AND METHODS

We retrospectively reviewed 18 patients of serologically proven diagnosis of dengue of all age groups and both genders from the period of August 2021-December 2021 in the Radio-Diagnosis and Imaging Department of Pacific Medical College and Hospital, Udaipur, Rajasthan, India. Ethical committee approval was granted before the start of the study. We reviewed medical histories such as clinical features and laboratory investigations of the patients and analyzed the Magnetic Resonance (MR) of the brain of all the patients involved in the study from our PACS system and the observations were filled as per the proforma. The data collected was kept confidential and were tabulated in form of columns with the help of Community Physicians. MRI Scans were performed on 1.5 T Siemens Magnetom Essenza with Tim+Dot technology. The following sequences were acquired for all the patients-T1 Weighted Imaging (T1WI), T2 Weighted Imaging (T2WI), Diffusion-Weighted Imaging (DWI), Fluid Attenuation Inversion Recovery (FLAIR), Gradient Recalled Echo (GRE) and Susceptibility-Weighted Imaging (SWI). Contrast-enhanced T1W scans were also obtained[6].

RESULTS AND DISCUSSIONS

The study comprehensively reviewed clinical and imaging findings of 18 serologically confirmed dengue patients who presented with neurological or ocular manifestations. As shown in the (Table 1), the patient cohort consisted of 12 males and 6 females, with ages ranging from 3-58 years. The average duration of hospitalization was 6.05 days. Fever was a universal presenting symptom. Neurological manifestations were observed in 15 patients, including seizures (6 cases), altered sensorium (7 cases), headache (2 cases), and irritability (2 cases). Three patients presented with ocular symptoms, such as retro-orbital pain (3 cases), blurring of vision (2 cases) and vision loss (2 cases). Gastrointestinal bleeding per rectum was noted in 4 patients. Thrombocytopenia was prevalent, with platelet counts ranging from 55,000-1,34,000 per micro liter and the average count was 97,166.66 per micro liter. All patients tested positive for NS1 antigen, confirming dengue infection. MRI analysis result shown in (table 2), revealed distinct patterns of involvement across various anatomical regions. The capsulo-ganglionic region and thalamus were the most commonly affected areas, observed in 14 patients (77.8%). Abnormal signal intensities were noted in the cerebrum of 7 patients (38.9%), while pathological changes in the brainstem and cerebellum were each identified in 3 patients (16.7%). Similarly, orbital findings, correlating with ocular symptoms, were observed in 3 patients (16.7%). All patients demonstrated hyper intensities on T2-weighted and FLAIR sequences, along with restricted diffusion on DWI. Blooming artifacts on SWI, indicative of hemorrhage, were present in 8 patients (44.4%), who were classified as having hemorrhagic dengue encephalitis. The remaining 10 patients (55.6%) exhibited non-hemorrhagic encephalitis, underscoring the diverse neurological manifestations of dengue fever as captured through advanced imaging techniques. These results highlight the utility of MRI in identifying and localizing neurological and ocular complications in dengue fever, contributing to targeted diagnosis and management. Dengue fever, a significant public health concern in tropical and subtropical regions, has transitioned from being viewed as a self-limiting febrile illness to one associated with severe systemic, neurological and ocular complications. While neurological manifestations of

Table1:Summaryof Clinical Findings and Relevantlabin Vestigations

Pt. No.	Age	Gender	Presenting symptoms	Duration of hospital stay	Platelet Count (Plateletsper mcL)	Serum NS1 antigen
1.	21 years	Male	Fever, seizures, irritability	5 days	1, 24,000	Positive
2.	3 years	Female	Fever, seizures, bleeding PR	7 days	80,000	Positive
3.	32 years	Male	Fever, altered sensorium	4 days	1,30,000	Positive
4.	42 years	Male	Fever, altered sensorium, bleeding PR	9 days	55,000	Positive
5.	15 years	Female	Fever, altered sensorium	5 days	1,18,000	Positive
6.	30 years	Female	Fever, headache	4 days	1,30,000	Positive
7.	58 years	Male	Fever, chills with rigor	6 days	82,000	Positive
8.	26 years	Male	Fever, seizures, irritability	7 days	90,000	Positive
9.	17 years	Female	Fever, Retro-orbital pain, Blurring of vision	9 days	86,000	Positive
10.	30 years	Male	Fever, seizures,	3 days	1,34,000	Positive
11.	21 years	Male	Fever, altered sensorium	6 days	74,000	Positive
12.	28 years	Male	Fever, Retro-orbital pain, Loss of vision	8 days	80,000	Positive
13.	37 years	Male	Fever, altered sensorium,	4 days	1,30,000	Positive
14.	12 years	Male	Fever, irritability, bleeding PR	7 days	66,000	Positive
15.	22 years	Female	Fever, seizures,	5 days	80,000	Positive
16.	12 years	Female	Fever, headache,	4 days	1,20,000	Positive
17.	34 years	Male	Fever, Retro-orbital pain,			
Loss of vision, bleeding PR	11 days	60,000	Positive			
18.	37 years	Male	Fever, altered sensorium	5 days	1,10,000	Positive

Table 2: MRI Findings in Patients with Dengue Encephalitis

Pt No.	Cerebrum	Capsulo-ganglionic region with thalamus	Brain stem	Cerebellum	Orbit
1.	+	+	-	-	-
2.	-	+	-	-	-
3.	-	+	-	-	-
4.	+	-	-	-	-
5.	-	+	-	-	-
6.	+	-	+	-	-
7.	-	+	-	+	-
8.	+	+	-	-	-
9.	-	+	+	-	+
10.	-	+	-	-	-
11.	+	-	-	+	+
12.	-	+	+	-	-
13.	-	+	-	-	-
14.	+	+	-	-	-
15.	-	+	+	-	-
16.	-	+	-	+	-
17.	-	+	+	-	+
18.	+	-	-	-	-
		(-) Absent, (+) Present			

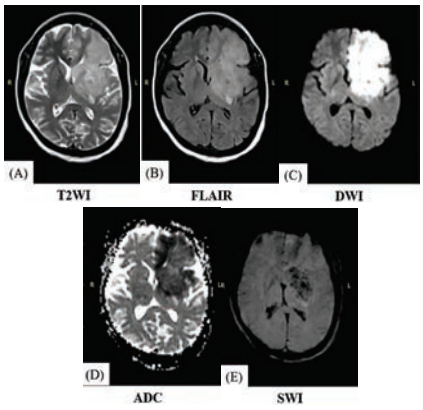

Fig. 1: 26-Year-Old Male with Dengue Encephalitis. Axial T2-Weighted image (A) and a Axial FLAIR Image (B) Showing Hyperintensity Involving the Left Frontal Lobe, Capsulo-Ganglionic Region with Thalamus, with Areas of Restricted Diffusion Apparent on DWI (C) and Apparent Diffusion Coefficient Maps with an Associated Mass Effect, as Evidenced by Effacement of the Frontal Horn of the Left Lateral Ventricle. Multiple Hemorrhaygic Foci Can Seen Within the Lesion on SWI Sequence (E)

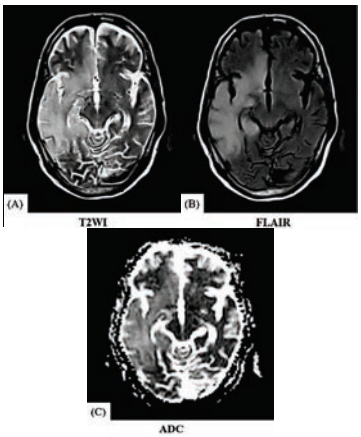

Fig. 2: 21-Year-Old Male with Dengue Encephalitis. Axial T2-Weighted Image (A) and a Axial FLAIR Image (B) Showing Hyperintensity Involving the Right Fronto-Temporal Lobe, with Areas of Restricted Diffusion Apparent Diffusion Coefficient Maps (C)

dengue fever are rare, their rising incidence, documented between 0.5% and 6.2%, underscores the importance of early recognition and diagnosis[7,8]. This

study highlights the utility of Magnetic Resonance Imaging (MRI) in identifying and characterizing the diverse spectrum of complications, providing critical insights into their pathogenesis, prevalence and implications for patient management. The capsulo-ganglionic region and thalamus emerged as the most frequently affected areas in this study, observed in 77.8% of patients. These findings align with those of previous studies, who identified these regions as predilection sites due to their high metabolic demand and susceptibility to hypoxia and inflammation[9,10]. This vulnerability is compounded by the dense vascular supply, which may facilitate viral invasion and inflammatory mediator deposition. Additionally, the involvement of the cerebrum (38.9%), brainstem (16.7%) and cerebellum (16.7%) underscores the widespread neuroinflammatory potential of dengue fever. Compared to previous studies, this study adds to the understanding of anatomical variability in neurological involvement, reinforcing the need for comprehensive imaging in all suspected cases[11]. The differentiation of hemorrhagic and non-hemorrhagic encephalitis was a significant finding. Hemorrhagic dengue encephalitis, characterized by blooming artifacts on SWI, was identified in 44.4% of cases, reflecting intracranial hemorrhage secondary to increased vascular permeability and capillary leakage. These findings corroborate those of Nadarajah *et al.* (2015) and underscore the utility of SWI in detecting subtle hemorrhagic changes that may not be evident on other imaging modalities[12]. Non-hemorrhagic encephalitis, present in 55.6% of patients, demonstrated hyperintensities on T2-weighted and FLAIR sequences and restricted diffusion on DWI, indicative of cytotoxic edema and neuronal damage. The study reaffirms the superiority of MRI over CT in identifying such nuanced pathological changes, as highlighted in previous research[13]. Ocular manifestations, although less frequent, were noted in 16.7% of patients, presenting as retro-orbital pain, blurring of vision and vision loss. These findings align with studies done in previous, which emphasize thrombocytopenia and immune-mediated responses as key drivers of ocular involvement[14,15]. The anterior segment complications, including uveitis and anterior chamber hemorrhage, along with posterior segment issues such as maculopathy and vitreous hemorrhage, highlight the diverse impact of dengue fever on ocular structures. The favorable prognosis for most ocular complications, with spontaneous resolution in many cases, is tempered by the need for systemic steroids or immunoglobulins in severe instances of vision loss[15]. Pathophysiologically, the neurological and ocular complications of dengue fever result from a combination of direct viral neurotropism, systemic inflammatory responses and vascular damage. Direct neuroinvasion, supported by the detection of dengue IgM antibodies and viral RNA in cerebrospinal fluid, has been well-documented in studies by Hendarto and Hadinegoro[3]. Systemic factors such as capillary leak syndrome, cytokine storms and immune complex deposition further contribute to the ischemic and hemorrhagic changes observed in affected patients. These overlapping mechanisms complicate the clinical and radiological landscape, necessitating a multi disciplinary diagnostic approach. The study also draws attention to discrepancies in radiological findings compared to previous research. For instance, while Arora *et al.* (2021) described the “double donut” sign as a characteristic MRI feature of dengue encephalitis, no such findings were observed in this cohort[16]. This variability underscores the heterogeneity of dengue-associated complications and the influence of disease severity, regional factors and sample size on clinical presentations. In terms of clinical management, the study highlights the need for early recognition of neurological and ocular complications to optimize patient outcomes. MRI, with its superior resolution and sensitivity, should be the imaging modality of choice in suspected cases of dengue encephalitis, as it aids in early detection and guides targeted treatment strategies. Symptomatic management, including anticonvulsants for seizures and systemic steroids for vision impairment, remains the cornerstone of therapy, given the lack of specific antiviral treatments. Prevention, however, remains the most effective strategy, emphasizing vector control through protective measures, environmental sanitation and public health education[17]. In conclusion, this study contributes to the growing body of evidence on the neurological and ocular complications of dengue fever. While it corroborates findings from earlier research, it also emphasizes the diversity in clinical and radiological presentations[18-22]. Future multicenter studies with larger sample sizes are essential to validate these findings, refine diagnostic strategies and explore targeted therapeutic interventions. The increasing burden of severe dengue complications also calls for intensified prevention efforts, including vector control, public health education and the development of effective antiviral therapies.

CONCLUSION

Magnetic resonance imaging (MRI) is a better imaging modality as compared to Computed Tomography (CT) to diagnose dengue encephalitis. The commonly involved anatomical areas of the brain of patients suffering from neurological complications of dengue encephalitis are a capsule-ganglionic region with the thalamus, followed by the cerebrum and cerebellum. These abnormal signal intensity areas appear hypointense on T1-weighted sequences and appear

hyperintense on T2-weighted and FLAIR sequences. Even though, the treatment of dengue is mainly symptomatic, with the help of MRI early diagnosis of dengue encephalitis will lead to better and timely care of the patient. Thus, an MRI of the Brain should always be performed in patients suffering from dengue fever presenting with symptoms suggestive of neurological involvement.

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