

# Double Doughnut” Sign in Dengue Encephalitis - A Unique MRI Finding

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**Abstract:** Dengue virus, an RNA virus of family Flaviviridae, is typically considered non-neurotropic. However, increasing number of cases with neurological manifestations of dengue virus are being reported from India with significant morbidity and mortality. Dengue encephalitis is a seasonal disease in tropical countries and its imaging features are not widely known. We wish to discuss the MR imaging findings in two patients with dengue encephalitis. Our cases with dengue encephalitis showed bilateral symmetrical FLAIR and T2 hyperintensities in thalami, pons, and cerebellum on MR imaging. Concentric differential signal intensity of lesions in thalami resulting in “double doughnut” sign is a unique feature observed in both our cases. MRI features of dengue encephalitis are fairly characteristic and contribute to the early diagnosis and prompt management of cases. It is therefore very important that radiologists and treating clinicians be aware of these findings suggesting the possibility of dengue infection as a cause of encephalitis.

**Keywords:** Dengue encephalitis, Double doughnut sign.

## 1. Introduction

Dengue virus, an RNA virus of family Flaviviridae is considered as a non-neurotropic virus. There are many studies and case reports in literature describing the neurological manifestations and imaging findings of dengue virus infection. We wish to share interesting imaging findings in two patients with dengue encephalitis. These imaging features when observed in a relevant clinical setting should raise the suspicion of dengue infection.

### Pathophysiology

The CNS involvement by dengue infection can result either from the direct neurotropic effect of the virus or secondary to its systemic manifestations. Later, postinfectious sequelae due to immune-mediated reactions may also be observed.

### Aims and Objectives

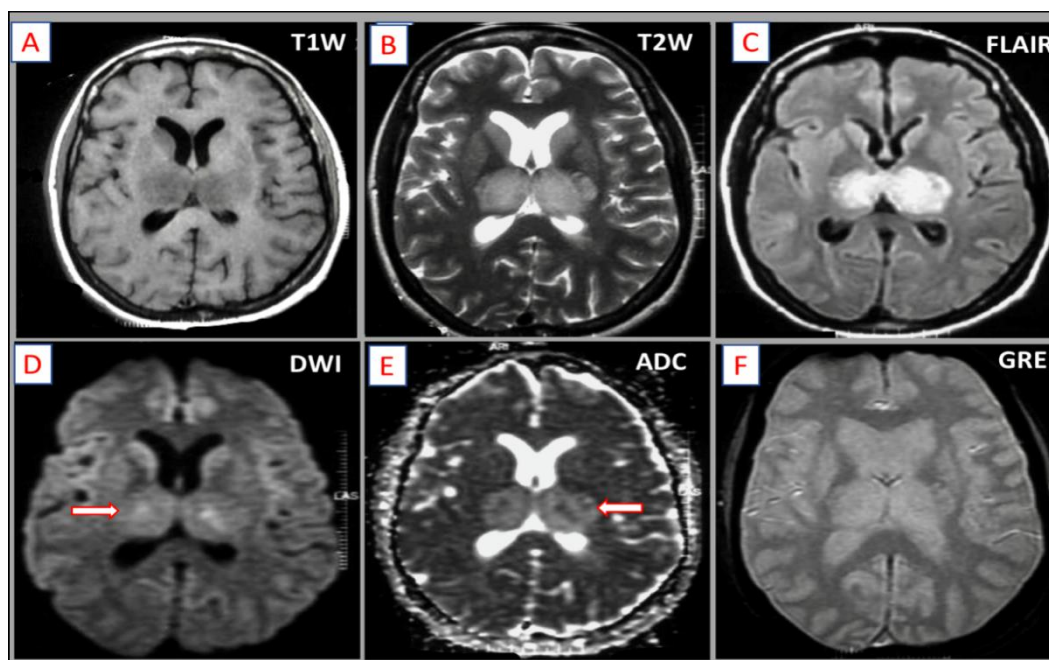
To describe the MR imaging findings in dengue encephalitis.

## 2. Materials and Methods

Review of MR imaging findings in two cases of dengue encephalitis revealed some interesting patterns and observations and the same are being highlighted here.

### Case 1:

A 36-year-old female presented to the emergency department of the hospital with high grade fever for last 5 days followed by slurring of speech and altered sensorium. A clinical diagnosis of viral encephalitis was made. Her CSF analysis showed lymphocytic pleocytosis with normal sugar and elevated proteins. NS1 antigen for dengue was positive. MRI of the brain showed symmetrical T2 and FLAIR hyperintensities involving bilateral thalami and cerebellum. The corresponding areas in both thalami showed areas of central diffusion restriction giving the appearance of “DOUBLE DOUGHNUT”. (Figure 1)

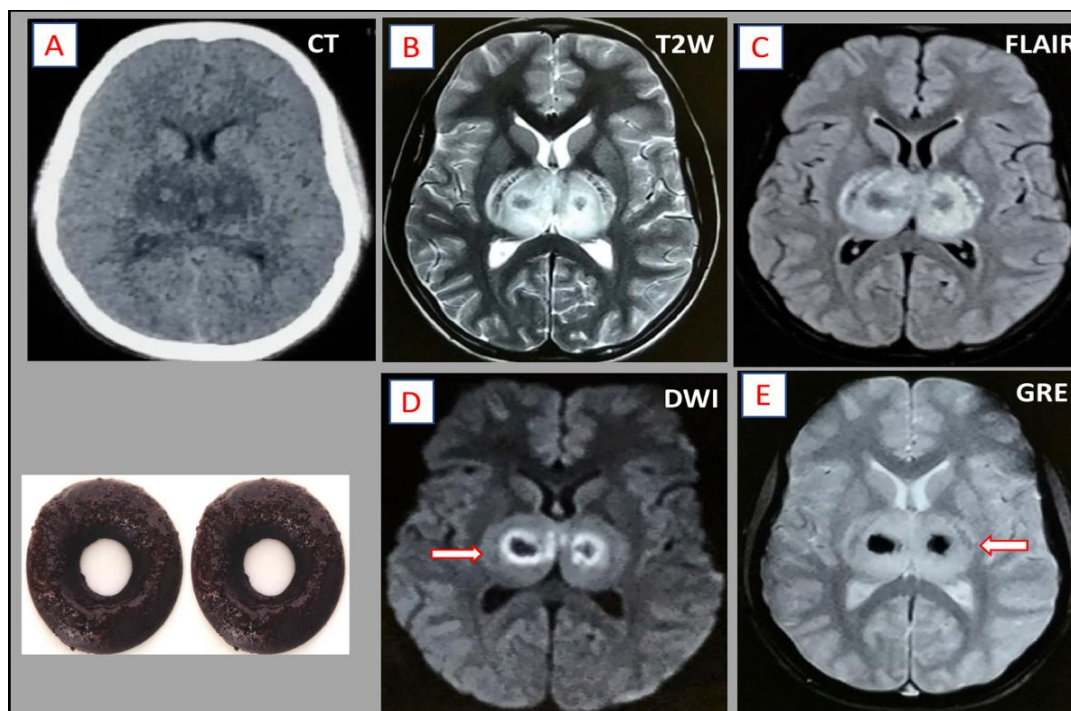


**Figure 1:** Axial MR images show T1 hypo & T2, FLAIR symmetric hyperintensities in bilateral thalami (A, B & C). DWI & ADC images show central area of diffusion restriction in bilateral thalami giving the appearance of “DOUBLE DOUGHNUT”.

### Case 2

A 15-year-old female presented to the emergency department of the hospital with fever for 4 days and seizures with altered sensorium for 2 days. On clinical examination, the patient was disoriented and not obeying commands. Her hemogram revealed thrombocytopenia. NS1 antigen for dengue was positive. MRI brain showed symmetrical T2 and FLAIR

hyperintensities with central area of differential signal intensity involving bilateral thalami. The corresponding central area showed blooming on GRE suggestive of hemorrhage and giving the appearance of “DOUBLE DOUGHNUT”. (Figure 2)



**Figure 2:** Axial CT show symmetrical hypodense areas in bilateral thalami (A). MR images show T2, FLAIR symmetric hyperintensities in bilateral thalami (B & C). GRE images (E) show central area of blooming in bilateral thalami giving the appearance of “DOUBLE DOUGHNUT”

### 3. Discussion

Dengue virus is a single-stranded RNA virus of Flaviviridae family. Neurological involvement in dengue infection was first reported in 1976 [2]. Common presentations include headache, altered sensorium, papilledema, neck rigidity, or seizures. Although diagnosis of dengue encephalitis is mainly based on clinical and laboratory investigations, MRI has a supportive role in confirming a diagnosis of dengue infection. Brain imaging adds definite information to the patients presenting with symptoms of encephalitis. MRI is the modality of choice compared to the CT and provides greater definition of brain anatomy and superior visualization of posterior fossa.

It is not uncommon to have normal MRI in early stages. The spectrum of MR findings in dengue encephalitis include cerebral edema, intracerebral hemorrhage, basal ganglia and thalamic involvement, cortical/subcortical whitematter changes. The four most commonly affected regions of brain include basal ganglia-thalamic complex, cerebral hemispheres, brainstem and cerebellum [5]. Thrombocytopenia and coagulopathy although commonly encountered in dengue infection, intracranial hemorrhage is less common than cutaneous and systemic hemorrhage

complications. Transient signal alteration in the splenium of corpus callosum on MRI Brain manifesting as “dot sign” has also been described in literature [7]. Involvement of cervical and thoracic spinal cord in dengue infection is also rarely reported [8]. In literature, focal lesions caused by dengue appear hypointense on T1 hyperintense on T2 weighted images. The diffusion weighted images show restriction of diffusion in some cases and diffusion facilitation in other cases.

In our cases the thalamic lesions appeared hypointense on T1-weighted images, hyperintense on T2-weighted images with central area of diffusion restriction was noted in both cases. We also encountered foci of blooming representing areas of hemorrhage within the lesion in one case.

The “Double doughnut” sign was first described by Kumar A S et al in a case of dengue encephalitis that presented with symmetrical thalamic hyperintensities with central areas of restricted diffusion on MR imaging [1]. We report similar findings in two cases of dengue encephalitis. “DOUBLE DOUGHNUT SIGN” is a unique MR finding in cases of dengue encephalitis and can be considered as a diagnostic feature if clinical criteria for dengue encephalitis are met. The only other infection that may present with similar

imaging findings is Japanese encephalitis that typically involves thalami and basal ganglia. CSF study and serology are usually confirmatory in these conditions.

#### 4. Conclusion

A high degree of clinical suspicion of dengue encephalitis should be kept in a patient of dengue fever with neurological symptoms. MRI features are fairly characteristic and contribute to the early diagnosis and prompt management of cases. It is therefore very important that radiologists and clinicians to be aware of these findings suggesting the possibility of dengue infection as a cause of encephalitis.

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