




# “Parenthesis sign” in Eastern equine encephalitis

## “Sinal de parênteses” na encefalite equina do leste

María Belén Solís<sup>1</sup>  Ana Cristina Albuja<sup>2,3</sup>  Mauricio Fernando Villamar<sup>3,4</sup> 

<sup>1</sup>Pontificia Universidad Católica del Ecuador, Quito, Ecuador.

<sup>2</sup>Brown University, The Warren Alpert Medical School, Department of Pediatrics, Providence, United States.

<sup>3</sup>Brown University, The Warren Alpert Medical School, Department of Neurology, Providence, United States.

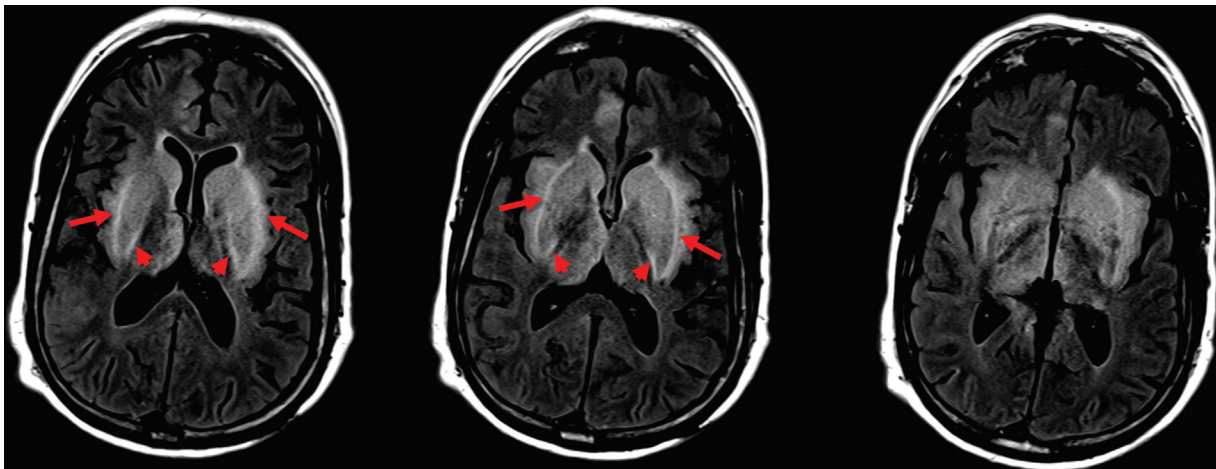
<sup>4</sup>Kent Hospital, Department of Medicine, Warwick, United States.

Address for correspondence Mauricio Villamar  
(e-mail: mauricio\_villamar@brown.edu).

Arq. Neuropsiquiatr. 2022;80(9):975–976.

A 65-year-old man from the Northeastern United States presented in the summer with headaches, fever, and severe encephalopathy. Cerebrospinal fluid (CSF) demonstrated lymphocytic pleocytosis and hyperproteinorachia. Neuroimaging is shown in ►**Figures 1** and **2**. Serum and CSF showed positive immunoglobulin M (IgM) antibodies to Eastern equine encephalitis virus (EEEV).

EEEV is a mosquito-borne alphavirus. Although rare, it can cause severe arboviral encephalitis, with mortality >33%.<sup>1</sup> Magnetic resonance imaging features such as the “parenthesis sign” (►**Figure 1**) can help distinguish between Eastern equine encephalitis and other encephalitides.<sup>2</sup> Although most publications on EEEV originate from North America, EEEV and other related alphaviruses also circulate in the Caribbean, Central America, and South America.<sup>3–5</sup>

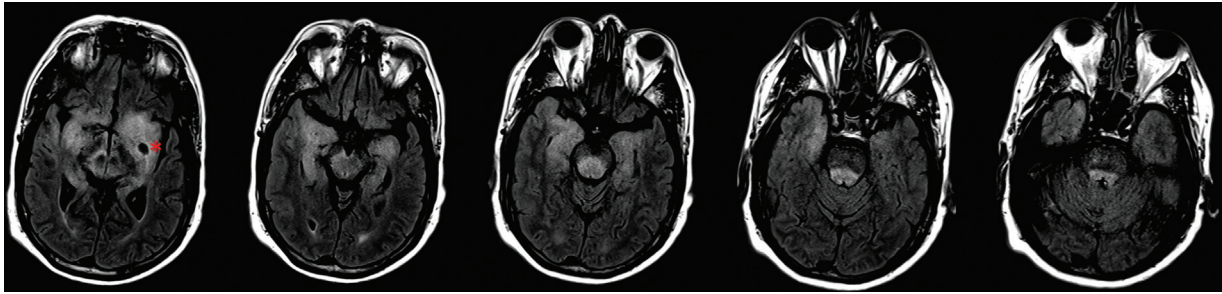


**Figure 1** T2/fluid-attenuated inversion recovery (FLAIR) axial MRI shows bilateral, relatively symmetric hyperintensities within the basal ganglia, insulae, subcortical white matter, and thalami, as well as in the inferior right frontal lobe. Marked linear hyperintensities are present in the external capsules (arrows), and parts of the internal capsules (arrowheads) bilaterally. This finding, known as the “parenthesis sign”, may help differentiate between Eastern equine encephalitis and other encephalitides.

received  
February 6, 2022  
accepted  
March 20, 2022

DOI <https://doi.org/10.1055/s-0042-1755216>.  
ISSN 0004-282X.

© 2022. Academia Brasileira de Neurologia. All rights reserved.  
This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)  
Thieme Revinter Publicações Ltda., Rua do Matoso 170, Rio de Janeiro, RJ, CEP 20270-135, Brazil



**Figure 2** T2/FLAIR hyperintensities extend into the mesial temporal lobes, midbrain, periaqueductal gray, and dorsal pons. Additionally, a dilated perivascular space is noted (asterisk).

#### Authors' Contributions

MBS: case concept and design, literature review, manuscript writing; ACA: interpretation of data, manuscript revision for intellectual content; MV: case concept and design, acquisition of data, figure editing, manuscript revision for intellectual content.

#### Conflict of Interest

The authors have no conflict of interests to declare.

#### References

- 1 Morens DM, Folkers GK, Fauci AS. Eastern Equine Encephalitis Virus - Another Emergent Arbovirus in the United States. *N Engl J Med* 2019;381(21):1989–1992
- 2 Nickerson JP, Kannabiran S, Burbank HN. MRI findings in eastern equine encephalitis: the “parenthesis” sign. *Clin Imaging* 2016;40(02):222–223
- 3 Corrin T, Ackford R, Mascarenhas M, Greig J, Waddell LA. Eastern Equine Encephalitis Virus: A Scoping Review of the Global Evidence. *Vector Borne Zoonotic Dis* 2021;21(05):305–320
- 4 Silva ML, Galiza GJ, Dantas AF, et al. Outbreaks of Eastern equine encephalitis in northeastern Brazil. *J Vet Diagn Invest* 2011;23(03):570–575
- 5 Gil LHV, Magalhaes T, Santos BSAS, et al. Active Circulation of Madariaga Virus, a Member of the Eastern Equine Encephalitis Virus Complex, in Northeast Brazil. *Pathogens* 2021;10(08):10