

Structural and functional connectivity of ascending reticular activating system in a patient with impaired consciousness after a cardiac arrest

A case report

Alejandra M. Parra-Morales, MD^a, Jorge Rudas, PhD^{a,b}, Jorge A. Vargas, MD^c, Francisco Gómez, PhD^d, Cesar O. Enciso-Olivera, MD, MSc^e, Diana Trujillo-Rodriguez, MSc^a, Darwin Martínez, PhD^{f,g}, José Hernandez, MD, MSc, PhD^h, Edgar G. Ordóñez-Rubiano, MDⁱ, Jorge H. Marín-Muñoz, MD^{c,*}

Abstract

Rationale: Diffusion tensor imaging (DTI), diffusion tensor tractography (DTT), as well as resting-state-functional magnetic resonance imaging (rsfMRI) are promising methods for assessing patients with disorders of consciousness (DOCs).

Patient concerns: This work describes the main findings using DTI, DTT, and rsfMRI in a patient with a DOC secondary to an anoxic encephalopathy who had a fatal outcome. She was an 85-year-old woman who presented a cardiac arrest and underwent cardiopulmonary resuscitation for 20 minutes then returning to spontaneous circulation. After sedation withdrawal, 2 days after the event, she remained with a Glasgow Coma Scale score of 3/15 and with an absence of brainstem reflexes.

Diagnoses: DOC secondary to an anoxic encephalopathy after cardiovascular resuscitation.

Interventions: A complete brain MRI scan was performed 72 hours after the initial event, including DTI, DTT, and rsfMRI. DTT demonstrated disruption of both ventral and dorsal tegmental tracts bilaterally. DTI showed a reduction of fractional anisotropic level in the mesencephalic nuclei. Moreover, changes in the number of fiber tracts were not evidenced in any portions of the ascending reticular activating system (ARAS). Finally, an increase in the anticorrelated and correlated association among the nuclei in the ARAS and the cortex was evidenced.

Outcomes: Patient deceased.

Lessons: Neuroimaging demonstrated low FA values in the ARAS, destruction of dorsal and ventral tegmental tracts, as well as hyper-connective (highly correlated or anti-correlated) association among ARAS and cortical nuclei compared with 3 healthy control subjects.

Abbreviations: AAN = Arousal Network Atlas, ADC = apparent diffusion coefficient, ARAS = ascending reticular activating system, BOLD = blood-oxygen-level dependent imaging, DIPY = Diffusion Imaging in Python, DOC = disorder of consciousness, DTI = diffusion tensor imaging, DTT = diffusion tensor tractography, DWI = diffusion weighted imaging, FA = fractional anisotropy, FC = functional connectivity, FSL = FMRIB Software Library, ODF = orientation distribution function, ROI = region of interest, rsfMRI = resting-state functional magnetic resonance imaging, TBI = traumatic brain injury.

Keywords: ascending reticular activating system, consciousness, diffusion tensor imaging, arousal, fMRI, tractography

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^a Division of Clinical Research, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital de San José, Hospital Infantil Universitario de San José, ^b Department of Biotechnology, Universidad Nacional de Colombia, ^c Department of Radiology, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital Infantil Universitario de San José, ^d Department of Mathematics, Universidad Nacional de Colombia, ^e Department of Critical Care and Intensive Care Unit, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital Infantil Universitario de San José, ^f Department of Computer Science, Universidad Nacional de Colombia, ^g Department of Computer Science, Universidad Central, ^h Department of Neurology, Hospital Infantil Universitario de San José, ⁱ Department of Neurological Surgery, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital de San José, Bogotá, Colombia.

* Correspondence: Jorge H. Marín-Muñoz, Department of Radiology, Fundación Universitaria de Ciencias de la Salud (FUCS), Hospital Infantil Universitario de San José, Bogotá, Colombia, Cra. 52 #67a-71 (e-mail: jmarin@imexhs.com).

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