

# Integrating Qualitative and Quantitative MRI Analysis for Optimizing DBS Candidate Selection in Patients with Disorders of Consciousness

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Marina Raguž,<sup>1,2</sup> Petar Marčinković,<sup>1</sup> Hana Chudy,<sup>3</sup> Valentina Galkowski,<sup>4</sup> Maja Majdak,<sup>3</sup> Darko Chudy.<sup>1,5</sup>

<sup>1</sup> Department of Neurosurgery, Dubrava University Hospital, Zagreb, Croatia

<sup>2</sup> Catholic University of Croatia, Zagreb, Croatia

<sup>3</sup> Department of Neurology, Dubrava University Hospital, Zagreb, Croatia

<sup>4</sup> Department of Radiology and Interventional Radiology, Dubrava University Hospital, Zagreb, Croatia

<sup>5</sup> Department of Surgery, School of Medicine, University of Zagreb, Croatia

Corresponding author: Marina Raguž. email: marinaraguž@gmail.com

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## Abstract

**Introduction:** Disorders of consciousness (DoC) encompass a range of clinical conditions with overlapping presentations, often leading to diagnostic uncertainty. While advanced neuroimaging techniques such as fMRI and PET have improved diagnostic accuracy, they are not routinely accessible. This study aimed to evaluate whether conventional structural MRI, through combined qualitative and quantitative analysis, could support more accurate diagnosis and improve the selection of patients for deep brain stimulation (DBS) as a therapeutic intervention.

**Method:** We prospectively included 50 patients with DoC who underwent standardized clinical, neurophysiological, and structural MRI evaluations. Patients were classified as DBS candidates or non-candidates based on predefined clinical and neurophysiological criteria. MRI was assessed qualitatively for features such as cortical atrophy, ventricular enlargement, leukoaraiosis, and thalamic or brainstem atrophy. Quantitative volumetric analysis was performed using the FreeSurfer pipeline.

**Results:** Qualitative indicators, such as leukoaraiosis, corpus callosum lesions, thalamic and diffuse cortical atrophy, and ventricular enlargement, were significantly correlated with DBS candidacy. Quantitative analysis revealed that ventricular volume, total gray matter, CSF, supratentorial volume, and striatal volume were predictive of DBS eligibility. A combined model integrating both qualitative and quantitative parameters showed the highest predictive value.

**Discussion:** These findings highlight the potential of widely available structural MRI to bridge the gap between complex neuroimaging and practical clinical decision-making. The integration of structural markers into routine diagnostic workflows may enhance personalized treatment strategies for patients with DoC.

**Conclusions:** Structural MRI, when analyzed using a combined qualitative and quantitative approach, provides meaningful diagnostic and prognostic information in DoC. This method may enhance the selection of appropriate candidates for DBS and improve clinical outcomes. Future multicenter research is warranted to validate these findings and establish standardized imaging-based criteria.

## References

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