

Reply: A proposed role for routine EEG evaluations in patients with disorders of consciousness

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In their Letter to the Editor, Bagnato et al. note the utility of standard EEG in diagnosis and prognostication of patients with disorders of consciousness (DOC) in early phases of recovery. These findings are consistent with our results that chronic DOC patients with imaging-based evidence of covert command following demonstrate preservation of EEG organization as a canonical finding<sup>1</sup>. Thus, we agree that the use of EEG in assessments of DOC patients is likely to be useful particularly in identifying immediate evidence of dissociation of motor behavior and large-scale network activity potentially supporting cognition<sup>1,2</sup>.

**Because of the growing consensus we would like to take this opportunity to propose** that short EEG recordings should be included as standard in routine clinical evaluation and in design of research studies involving patients with DOC in addition to quantitative behavioral assessments (such as the Coma Recovery Scale-Revised (CRS-R)<sup>3</sup>). The limitations are negligible as standard EEG is cheap, widely available, easily obtainable and has well-defined standards for interpretation.

This is important as currently the accuracy of the clinical EEG categorization in separating behaviorally conscious from behaviorally unconscious patients is comparable<sup>1</sup> to highly sophisticated quantitative analysis of high-density EEG recordings performed only in a few highly-specialized research laboratories<sup>4</sup>. Nevertheless, the question remains open whether a standard visual inspection of EEG recordings may actually be as useful in assessment of patients with DOC as more technically demanding analyses.

In addition, there are clear theoretical advantages of using long-term EEG recordings including adequate sampling of wakeful and sleep stages: 1) significant fluctuations in clinical status are typical in this patient population and the 'best' behavioral state may be missed in a short recording, 2) certain sleep features (i.e. sleep spindles) are known markers of functional integrity of cortico-thalamic circuitry, which is also thought to be important in maintaining consciousness<sup>5</sup>. Additionally, presence of sleep spindles is clearly linked to prognosis of recovery after brain injury<sup>6</sup>. In our opinion, current efforts should further aim to include long-term EEG recordings in evaluation of patients who demonstrate evidence of preserved wakeful architecture if it is feasible.

However, large-scale multi-center studies will be likely needed to answer the questions about the utility of visual analysis of EEG in diagnosis and prognostication of patients with DOC.

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