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Sarah P. Loughran

University of Wollongong, loughran@uow.edu.au

Sabine Regel

University of Zurich

Lilith Buetler

Helios Clinic

Martin Wieser

University of Zurich

Robert Riener

University of Zurich

See next page for additional authors

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Abstract

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Authors

Sarah P. Loughran, Sabine Regel, Lilith Buetler, Martin Wieser, Robert Riener, and Peter Achermann

Sleep-wake behaviour and the EEG in altered states of consciousness

Sarah Loughran^{1,2*}, Sabine Regel², Lilith Buetler³, Martin Wieser⁴, Robert Riener⁴ and Peter Achermann^{2,5,6}

¹Illawarra Health & Medical Research Institute, School of Psychology, University of Wollongong, Australia

²Institute for Pharmacology and Toxicology, University of Zurich, Switzerland

³Helios Clinic, Switzerland

⁴Sensory-Motor Systems Lab, Institute of Robotics and Intelligent Systems, ETH Zurich and University of Zurich, Switzerland

⁵Neuroscience Center, ETH Zurich and University of Zurich, Switzerland

⁶Zurich Center for Integrative Human Physiology, University of Zurich, Switzerland

Aims: Sleep-wake behaviour in patients with severe brain damage remains poorly understood. The severe brain damage seen in vegetative and minimal conscious state patients is generally accompanied by alterations in electrical brain activity. Despite this, only few studies have addressed this and generally reported large discrepancies in observations, while also suffering from methodological weaknesses. One important consideration is whether scoring sleep based on standard criteria is appropriate due to the large changes in brain activity. Therefore, in view of these shortcomings and to improve our understanding, there is an urgent need for systematic sleep-wake assessment in these patients, which was the aim of the current study. **Methods:** Three ~24h polysomnographic recordings were collected as part of a collaborative project assessing the effectiveness of verticalisation treatment on various physiological parameters in vegetative and minimal conscious state patients. Nine patients (4 males, 5 females) between 18 and 63 years of age (mean \pm SEM: 43.9 ± 4.5 y) were evaluated at three-week intervals. Data was visually scored, however, as predicted, scoring according to standard criteria was not appropriate and therefore scoring criteria were developed based on common physiological signals seen across patients as well as spectral analysis techniques. **Results:** Overall, patients exhibited similar physiological patterns across all three of their recordings, whereas a high variability between patients was observed. A combination of physiological signals and video recordings were required to score sleep and wake-like states. All patients showed signs of sleep and wake-like states, however none showed a clear or typical sleep-wake rhythm. **Conclusions:** Sleep and waking in altered states of consciousness disorders does not show a common pattern and is different to that seen in healthy populations. Accordingly, scoring based on standard criteria seems to be inappropriate and quantitative EEG analysis provides additional important information. These aspects should be taken into account for more accurate diagnosis and prognosis, and our understanding of these conditions in the future.

Keywords: EEG, vegetative state, Consciousness Disorders, Sleep Stages, brain damage

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* Correspondence: Dr. Sarah Loughran, Illawarra Health & Medical Research Institute, School of Psychology, University of Wollongong, Wollongong, Australia, loughran@uow.edu.au