Clinical Neurophysiology 142 (2022) 275–276

Contents lists available at ScienceDirect

Clinical Neurophysiology

journal homepage: www.elsevier.com/locate/clinph

Letter to the Editor

Reply to "Continuous EEG in patients with extracorporeal membrane oxygenation support: Clinical need in multidisciplinary collaboration and standardized monitoring"

We thank Dr. Hwang and colleagues for the thoughtful discussion of our study "High incidence of epileptiform activity in adults undergoing extracorporeal membrane oxygenation" (Amorim et al., 2022) in their Letter to the Editor "Continuous EEG in patients with extracorporeal membrane oxygenation support: clinical need in multidisciplinary collaboration and standardized monitoring" (Hwang et al., 2022a). We concur with Dr. Hwang and colleagues that standardized multimodal patient monitoring in extracorporeal membrane oxygenation (ECMO) is of great value given the risk for catastrophic and long-term impact of neurological complications in this patient population. Our study highlights the spectrum and severity of encephalopathy diagnosed with EEG in patients undergoing ECMO support, as well as the high risk for neurological complications and strokes. There is an urgent need to define best practices for neuromonitoring in ECMO to prioritize access to patients most likely to benefit from interventions guided by brain monitoring.

Neuromonitoring in ECMO can be particularly helpful for patient management when there is limited opportunity for reliable clinical neurological examination given sedative or neuromuscular blockade use. Daily sedation interruption attempts are routine practice in this patient population in our institution, however coordinated structured reactivity testing by a member of the neurology team during sedation interruptions has not been fully implemented yet (Hwang et al., 2022b). This practice could be very valuable in the evaluation of recovery potential after cardiac arrest, as EEG background reactivity may be present without a clear response on clinical exam (Amorim et al., 2016). Daily sedation interruption would potentially uncover seizures or other highly epileptiform activity, which can be inadvertently exacerbated by rapid sedation weaning (Husari and Ritzl, 2022). Standardization of neuromonitoring practices and database maintenance are challenges to many medical centers, and our study aims to add to the body of literature highlighting the yield of neuromonitoring in ECMO. Additional support to these initiatives may advance our understanding of the impact of ECMO on the brain and support the development of more robust prediction models that incorporate clinical and EEG characteristics as suggested by Dr. Hwang and collaborators.

The incidence of epileptiform activity in our report is confounded by the indication of EEG monitoring (i.e., seizure screening), particularly given the high number of patients who are undergoing monitoring after extracorporeal cardiopulmonary resuscitation (ECPR, 28% in this cohort). We highlighted this important limitation in the discussion in the context of the high variability in ictal-interictal EEG findings in previous literature, with incidence of ictal-interictal continuum patterns during ECMO support ranging from 3 to 57%. This wide range of EEG findings is confirmation of the 1) lack of standardization about which patients should undergo neuromonitoring during ECMO across institutions and 2) the retrospective design of most studies in this topic. We included in our results that ECMO done for pulmonary support was associated with less epileptiform activity, however we opted not to include detailed comparisons between groups with venovenous and venoarterial ECMO due to the small sample of 16 patients in the venovenous group. Multicenter collaborations in ECMO monitoring would help us better characterize subgroups who may benefit from neuromonitoring.

We utilized the definition of ECPR from the Extracorporeal Life Support Organization, which is ECMO following conventional cardiopulmonary resuscitation. This included ECPR performed at any point since admission, including ECPR done on hospital arrival due to out-of-hospital cardiac arrest or ECPR later in their hospital following in-hospital cardiac arrest.

We are enthusiastic about the opportunity to foster collaborations in neuromonitoring to define the best practices that will help us individualize patient management and accelerate recovery for patients managed with ECMO support.

Funding

This study was supported by the American Heart Association (20CDA35310297), CURE Epilepsy Foundation (Taking Flight Award), the NIH (1K23NS090900, 1R01NS102190, 1R01NS102574, 1R01NS107291, 1K23NS119794).

Conflict of Interest Statement

Dr. Amorim reports no conflicts of interest.

Dr. Westover is a co-founder of Beacon Biosignals, and Director for Data Science for the McCance Center for Brain Health. Beacon Biosignals did not contribute funding nor played any role in the study.

https://doi.org/10.1016/j.clinph.2022.07.488

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Accepted 21 July 2022

Available online 26 July 2022