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Editorial

Brain wave recovery predicts outcome after cardiac arrest

Therapeutic hypothermia (TH) became widely recognized as the standard of care for cardiac arrest (CA) patients, increasing the likelihood of survival and favorable neurological outcome.[1] However, the spectrum of neurological outcomes is wide and prognostication remains a challenge. Introduction of TH in treatment of patients in postanoxic coma adds to complexity and alters the predictive value of certain markers for neurological outcome compared to the pre-TH era.[2] Good predictors of outcome are critical when treating cardiac arrest patients after return of spontaneous circulation (ROSC) as they aid reasoning on potential redirecting care if a patient can not be brought back to a meaningful life.[3]

Electrophysiological studies are commonly used for evaluation of brain function and prognostication of neurological outcome. Among these, amplitude-integrated electroencephalography (aEEG) has gained acceptance, as it provides a simplified and therefore a more readily available brain function monitoring tool for the critically ill patients. In fact, Maynard et al. in the 1960s developed aEEG as a device for monitoring cerebral activity in resuscitated adult patients after cardiorespiratory arrest.[4] In the following decades aEEG has been increasingly used for monitoring and predicting outcome in infants with severe perinatal asphyctic encephalopathy being managed either normothermic[5–7] or with TH.[7] In neonates, the time it took after birth for the aEEG to recover to normal background pattern was the best predictor of poor outcome and all infants either died or survived with severe disability if normal background had not recovered by 48 h.[7]

In this issue of the *Journal*, Oh et al.[8] elegantly addressed the benefits of aEEG monitoring in adult CA patients. In a prospective study in the emergency department environment they evaluated the prognostic value of aEEG applied immediately after ROSC in TH-treated CA patients. The patients' brain function was monitored until recovery of consciousness, death, or 72 h after ROSC. Neurological outcome was assessed with the cerebral performance category (CPC) scale at hospital discharge. Good outcome was defined as CPC score of 1 or 2.

The straightforward conclusion from the primary analyses of the study of Oh et al. is that the aEEG background patterns correlate with outcome in CA patients. In a previous study, Rungren et al.[9] evaluated the aEEG background patterns late, after rewarming from TH and found them to be predictive of neurological outcome at 6 months in all patients. In the study of Oh et al., a normal background pattern at the start of monitoring strongly correlated with a good outcome. Predictors for poor neurological outcome are more readily available than predictors of good outcome.[2,10,11] In the study of Oh et al., an even more accurate prediction of outcome was possible when a normal pattern did not develop throughout the recording period, as all of these patients ended with a poor outcome. Good outcome predictors in the first hours after CA, such as continuous normal voltage background pattern at the start of the recording in the study of Oh et al., are important as they can also be combined with other predictors and help diminish the chance of false-positive prediction of poor outcome directing clinical decision-making.

The time one needs to monitor adult CA patients with aEEG before a reliable prediction of outcome is possible remains to be established. However, it seems to be important to monitor the patients at least until they are rewarmed from TH, which in a clinical setting usually means at least 24 h of recording (or until about 36 h after ROSC)[9] to obtain both the early and later predictors of outcome.

In their study, Oh et al. did not attempt to evaluate the prognostic value of the presence of seizures on aEEG, although this might be another important aspect in prognostication of outcome. Epileptiform discharges are common in adult patients with brain injury after CA, they may contribute to brain damage, and patients in status epilepticus may benefit from treatment.[12] In the study of Rossetti et al.,[10] monitoring of patients treated with TH after CA with continuous EEG revealed that seizures with absent background reactivity were seen in 47% of nonsurvivors, which was significantly more often than in survivors.

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