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EDITORIAL

EEG in patients admitted after cardiac arrest: daily clinical practice

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The role of electroencephalography (EEG) in patients admitted to your intensive care unit (ICU) after cardiac arrest has changed substantially in the last few years. In the old days, an EEG was advised in patients who did not wake up after clearance of sedative drugs following target temperature management. Then, first a median nerve somatosensory evoked potential (SSEP) test was done and if no cortical N20 response was found, an EEG could help further.[1,2] The review on EEG registrations after cardiac arrest by Jeannette Hofmeijer and Michel van Putten, in this issue of the journal, shows that the EEG is much more valuable in the first 12-24 hours after cardiac arrest.[3]

EEG registration early after cardiac arrest is easier said than done in daily clinical practice. Two factors are crucial: optimal recording and reliable assessment. For both parts, the Department of Clinical Neurophysiology is necessary as a true 'partner in crime'. Qualitatively good EEG recording on the ICU is technically more demanding than in the lab. The many electrical devices on the ICU and involuntary muscle activity of the patient can lead to significant noise in the registration. Assessment of an EEG may not be real rocket science, but when decisions about continuation of supportive care are based on the results, this has to be a careful process performed by an experienced neurologist or neurophysiologist who is aware of the pitfalls of ICU EEG registrations. So, how can you organise this in daily clinical care?

Imagine, it is Tuesday morning 10.00 hrs and you are called by the cardiologist because they are expecting a patient who had a cardiac arrest in the local supermarket. The presenting rhythm was ventricular fibrillation and cardiac ischaemia is seen on the ECG. So, after stabilisation in the emergency room, the patient is taken to the cath lab. An occlusion of the LAD is successfully treated and around noon the patient arrives on your ICU. As it took 10 minutes to achieve return of spontaneous circulation, you decide to treat this patient with target temperature management and start sedative medication to enable temperature control. Ideally, that same afternoon, continuous EEG recording will be started. However, the neurophysiology department is busy, but they manage to come to the ICU at 16.00 hrs. Applying all the electrodes takes about 30 minutes, so the registration starts about 6.5 hours after cardiac arrest. If you manage to do this, you have done very well: this is very quick! Even in centres where continuous EEG registration is well organised, it takes a mean of 11 hours to start EEG recording.[4] At 12 hours after cardiac arrest, 50% of the patients included in the study were hooked onto the EEG registration.

Only 40% of all cardiac arrests occur during office hours, so an early start to EEG registration in all cardiac arrest patients would require a neurophysiologist to be available 24/7 on the ICU.[5] In the Netherlands, this is usually not the case. And is this really necessary? Would you come to decisions on continuation or withdrawal of care within the first 24 hours after cardiac arrest? In the current Dutch guideline on prognostication of postanoxic coma, you are advised to start the prognostication process when a patient does not wake up after clearance of sedative drugs.[6] The exact moment when you expect that the sedative medication administered is no longer having an effect depends on the type of drug and dosage used, target temperature used (lower body temperatures lead to slowed metabolism) and organ failure delaying clearance. The team of treating physicians at the bedside should decide on this moment, but this is usually later than 24 hours after cardiac arrest. When a patient is then still in a coma, the EEG registration already recorded can be checked for the pattern seen at 24 hours. Use of continuous EEG recording makes it easy to look back, for example, 3AM.

Apart from this possibility of looking back, is a continuous EEG recording really needed? Not necessarily. Studies from Lausanne have shown that a standard 20-30 minute EEG registration performed at 24 hours gives you similar information.[7] If you do this registration later than 24 hours, then the specificity for poor outcome prediction remains very high but the sensitivity diminishes[4] This is caused by the recovery of the EEG to a less malign pattern in a majority of patients with a poor outcome

in the end.[8] Still, for EEG registration on the ICU early after cardiac arrest, the cooperation of the neurophysiology team is necessary. In the Amsterdam UMC, we have arranged that the technicians from the neurophysiology department start continuous EEG recording during office hours (08.00-17.00), seven days a week. This makes it possible to start registration within 24 hours in almost all patients. Registration is continued until the patient wakes up or until a maximum of 72 hours after cardiac arrest. The neurophysiology technician checks the EEG electrodes daily and applies them again if necessary. Such a continuous EEG recording for a prolonged period can help to identify epileptic activity developing over time.

Several developments that will facilitate EEG recording on the ICU are ongoing. Easy-to-use EEG electrodes, straightforward enough to allow application by the ICU nurse, are currently being developed.[9] They consist of a limited number of electrodes on the forehead and will give less information than the classical full-head EEG registration. However, brain injury after cardiac arrest is a global type of injury affecting the whole brain so a more limited recording might suffice in most cardiac arrest patients.[10]

Interpretation of the EEG recording can be supported by using basic training programs for ICU team members.[11] Furthermore, translation of the EEG recording using computer assisted analyses into scores interpretable by everyone will be the next step. Combining easy recording methods and computer-assisted analyses for assessment opens the way to continuous EEG recording on the ICU for many more neuro-ICU patients.

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