

TTM2-trial, 2017-

Recommendations for routine EEG 48-96 hours after cardiac arrest

According to the TTM2-trial main protocol and a decision in the steering group, **a routine EEG should be performed 48-96 hours after cardiac arrest in all patients, regardless if they are awake or not.** The EEG could be performed on weekends if there is a clinical indication and available EEG service, otherwise it should be performed on the following workday. The routine EEG will be initiated by the ICU physician according to local routines.

The reason for the recommendation to perform EEG also in awake patients is that we noticed in the TTM1-trial that a large proportion of patients woke up before the time-window of EEG but still had major long-term neurological sequelae.

The sedation is most often tapered at the time point of the routine EEG. The sedation is recommended to be stopped or kept as low as possible during the routine EEG. However, if significant sedation is ongoing due to intensive care reasons or treatment of seizures we still recommend that a routine EEG is performed during the recommended time-window, but emphasize that it cannot be used for decisions on withdrawal of care in the trial.

Additional EEG-registrations may be performed before or after the recommended time-window if there is a clinical indication, but these will not be registered in the eCRF. If full-montage continuous EEG-monitoring is used perform stimulations and fill in the EEG-data of a 20-minute period within the recommended time-window in the eCRF.

Blinding

The EEG-report will be available to the attending physician. The local EEG-specialist is blinded to the two intervention arms (temperature level) but not to other clinical data, which should be included in the EEG-referral.

Recommendations routine EEG

Minimum 16 electrodes + reference + ground. Video registration if possible.
A registration time of at least 20 minutes.

EEG-reactivity is tested in all patients (no pain stimulations in awake patients):

1. Sound stimulations – repeat at least 2 times with interval >20 sec.

(For instance: Call patient's name, clapping hands during a few seconds)

2. Pain stimulations – repeat at least 2 times with interval >20 sec.

(Include at least one proximal stimulation for instance sternal rubbing, jaw compression or squeezing of trapezius/deltoid/nipples.)

3. Additional testing is optional for instance, passive eye opening, nostril tickling or shaking the patient.

Make annotations in the EEG exactly when stimulations are performed. With abundant muscle artefacts, consider muscle relaxation.

It is recommended that the EEG-technician with assistance from the bedside physician notes ongoing sedation (YES/NO) and antiepileptic medication (YES/NO) and ongoing clinical seizures (YES/NO, if YES specify myoclonic, clonic, tonic-clonic) during registration so this

can be included in the EEG-report to make it easier for the ICU physician to fill out the e-CRF/TTM-database. The time point (date and time of day) of EEG registration, ongoing sedation/antiepileptic medication/clinical seizures and the result of the local EEG-report should be documented in the e-CRF/TTM-database.

EEG categorization:

The EEG findings should be categorized into the following categories:

- **Highly malignant EEG pattern is present (Yes / No)**
- **EEG background is reactive to stimuli (Yes / No / SIRPIDs only / Unclear / Stimulations not performed due to...)**

Definitions for EEG categorization:

The EEG description is based on the American Clinical Neurophysiology Society's (ACNS) Standardized Critical Care EEG terminology [ref Hirsch 2013]:

EEG-reactivity: Change in cerebral EEG activity to stimulation. This may include change in amplitude or frequency, including attenuation of activity. Appearance of muscle activity or eye blink artefacts does not qualify as reactive. If the only form of reactivity is SIRPIDs (Stimuli Induced Rhythmic, Periodic or Ictal Discharges) categorize as "SIRPIDs only".

Highly malignant EEG:

Definitions of the highly malignant patterns [ref Westhall 2015]:

- **Suppressed background (<10 μ V the entirety of the record) without Discharges.**
- **Suppressed background with continuously appearing Periodic Discharges.**
- **Burst-suppression background (with or without superimposed Discharges) with suppression periods (<10 μ V) constituting >50% of the recording.**

Storage

All EEG-data should be digitally stored and kept in full length and if possible the video should be kept. After patient inclusion is stopped each center will be asked to export the EEG data (EDF/EDF+ format, bipolar montage, without video), which will be centrally analysed retrospectively according to standardized criteria by neurophysiologists blinded to clinical data. Each centre appoints contact-persons (EEG-specialist, EEG-technician, engineer).

References

Hirsch LJ, LaRoche SM, Gaspard N, et al: American Clinical Neurophysiology Society's Standardized Critical Care EEG Terminology. J Clin Neurophys 2013, 30(1):1-27.

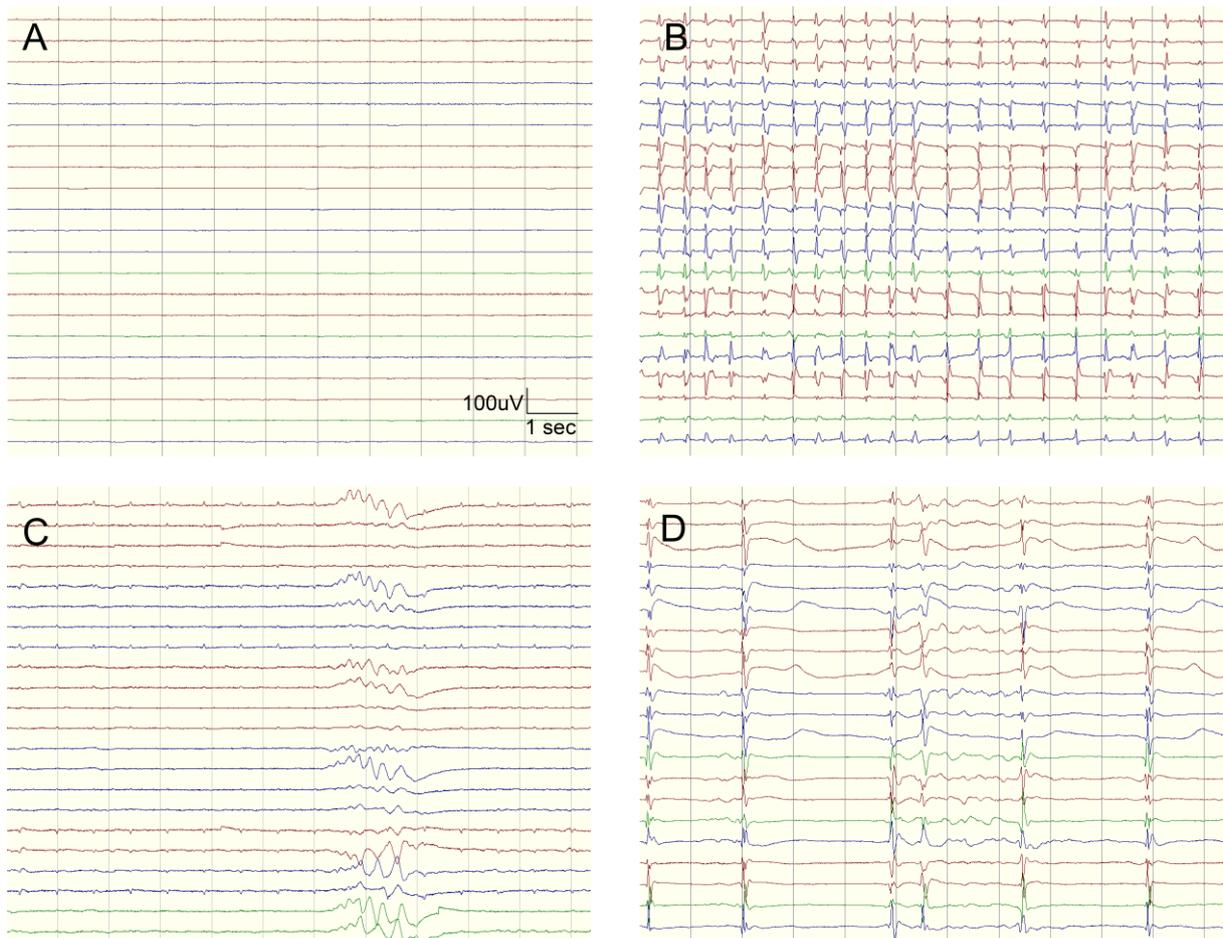
Westhall E, Rossetti AO, van Rootselaar AF, et al. Standardized EEG interpretation accurately predicts prognosis after cardiac arrest. Neurology. 2016;86:1482-90.

On behalf of the steering group,

Dr Erik Westhall, Department of Clinical Neurophysiology, Skane University Hospital, Lund, Sweden. For support send an email to: erik.westhall@med.lu.se

Version: 11th January 2017

Highly malignant EEG patterns:



Highly malignant EEG patterns defined using the standardized EEG terminology by the American Clinical Neurophysiology Society.

A: Suppressed background (amplitude $<10\mu\text{V}$, 100% of the recording) without discharges.

B: Suppressed background ($<10\mu\text{V}$) with superimposed continuous periodic discharges.

C: Burst-suppression (periods of suppression with amplitude $<10\mu\text{V}$ constituting $>50\%$ of the recording) without discharges.

D: Burst-suppression with superimposed discharges.