A “Feed”-Back on EEG Monitoring Artifacts

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TEXT

A 33-year-old patient was admitted to our ICU for super-refractory status epilepticus secondary to anti-NMDA receptor encephalitis. Upon sedation withdrawal, continuous EEG monitoring showed repeated 90-second bilateral rhythmic activities, initially assessed as potential epileptic discharges (Figure panel A). Though the rhythmic nature and duration suggested epilepsy, the lack of spatio-temporal organization and post-ictal slowing did not (Figure panel A-B). The patient exhibited no clinical symptoms. A faint noise, starting at the same time as the rhythmic activity, revealed it was actually an artifact caused by the initiation of the nearby feeding pump's rinse cycle (Figure panel C & supplemental video). Such an artifact could easily be missed by remote EEG analysis. Mistaking such rhythmic activity for an epileptic event could result in unnecessary escalation of anti-epileptic or sedative medications. In recent years, continuous EEG monitoring has gained increasing importance in ICU settings, solidifying its role as a standard tool for neurological monitoring. One of its primary indications in the ICU is the monitoring of refractory or super refractory status epilepticus, where it has demonstrated superiority over intermittent EEG. Basic EEG interpretation skills are now essential for ICU physicians and nurses. However, one must remain vigilant about potential technical artifacts in the ICU environment. In the process of distinguishing epileptic activity from artifacts, it is crucial to consider the following parameters:

- Ensuring all non-essential devices, such as air mattresses and warming blankets, are turned off.
- Keeping the EEG headbox at a distance from mechanical ventilators, feeding pump and electric syringes.

- Applying the 50 Hz (or 60 Hz in North America) Notch filter to mitigate electrical current interferences.
- Verify whether the same electrode exhibits artifacts at other points during the recording, which could indicate defective features or low impedance.
- Evaluating for clinical correlates of EEG activity, which may be subtle, like perioral or limb myoclonus in favor of an epileptic phenomenon or other movements obviously of non-epileptic origin. Whenever there is no clinical correlation with the EEG recording, it is essential to consult with an electrophysiologist systematically.
- Assessing the spatio-temporal organization of EEG activity, looking for evolution over time in terms of frequency and topography, indicative of an epileptic phenomenon.
- Identifying post-discharge slowing, which can suggest an epileptic phenomenon.
- If interpretation remains conflicting after analyzing a spot EEG, consider implementing continuous video-EEG monitoring with sound recording. Our experience has shown that observing the evolution of the EEG recording often allows for distinguishing artifacts from epileptic activity (i.e. activities that is excessively identical and occurs at exact intervals of time in this case report)

Our case also highlights the importance of a combined video-EEG recording including a soundtrack, to allow a better detection of electrical devices. This example highlights the need to be aware of clinical correlates and the potential variability and misleading nature of electrical device artifacts when analyzing EEGs in the ICU.

FIGURE LEGEND

Figure 1. Sudden bilateral rhythmic EEG activity during the feeding pump's rinsing cycle.

A: Onset and **B:** Offset of a sudden rhythmic activity appearing on the bilateral fronto-central regions, lasting approximately 90 seconds. The EEG was recorded using the ProFusion software and is presented in a bipolar longitudinal montage. **C:** Placement of the EEG headbox adjacent to the enteral feeding pump. The rhythmic movement of the water line during the feeding pump's rinsing cycle aligned precisely with the start of the EEG rhythmic discharge (see video presented as a Supplemental Figure).

SUPPLEMENTAL MOVIE LEGEND

Supplemental movie. Bilateral rhythmic EEG activity synchronized with the onset of the feeding pump's rinsing cycle.

The movie shows the onset of the feeding pump's rinsing cycle and the subsequent movement of the water line, perfectly synchronized with the onset of the EEG bilateral rhythmic activity. The rinse cycle lasted for 90 seconds, after which the EEG rhythmic activity ceased abruptly.