



# EEG in the ICU

## Quiz

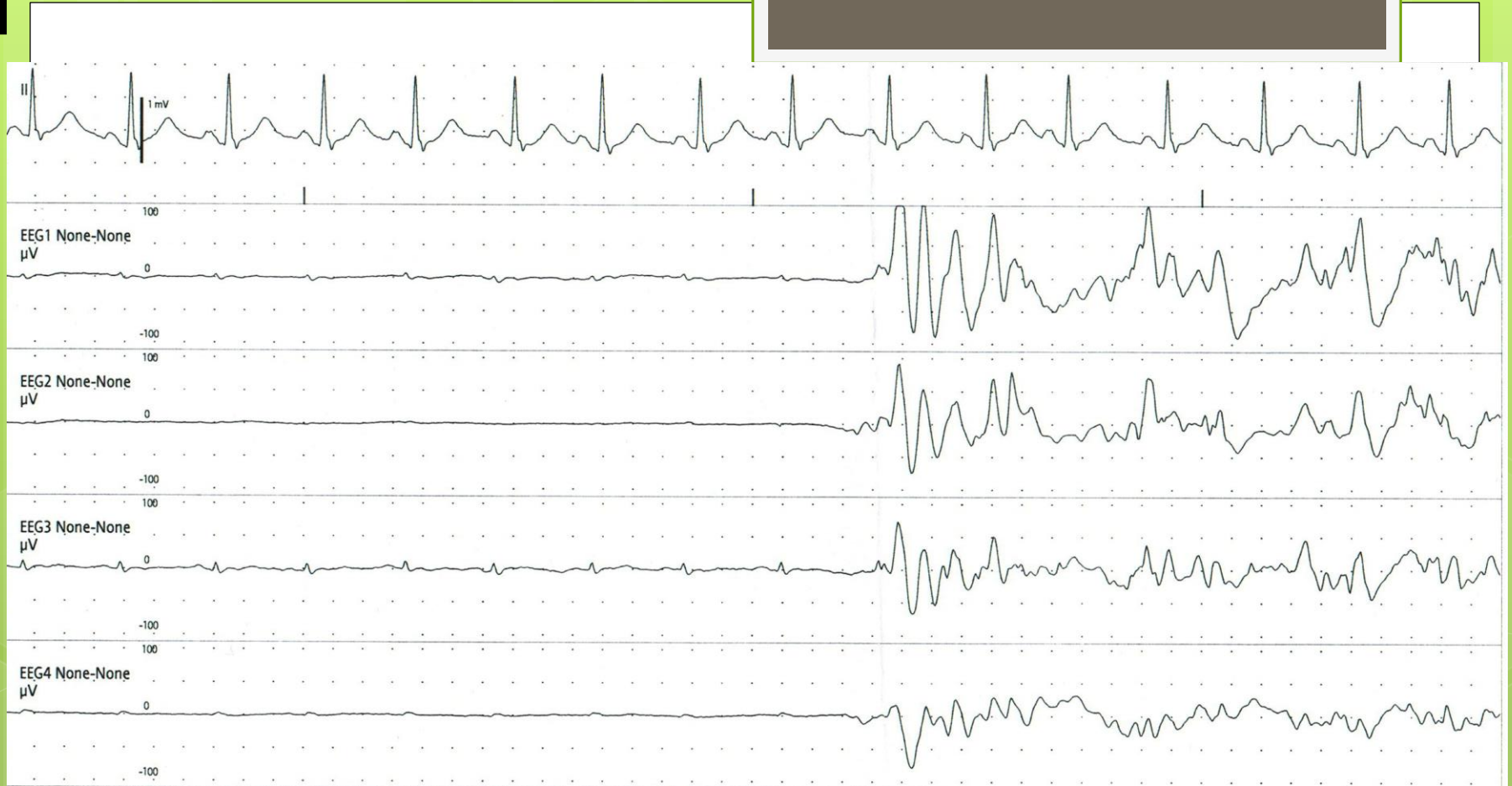
March 2012

Teneille E. Gofton

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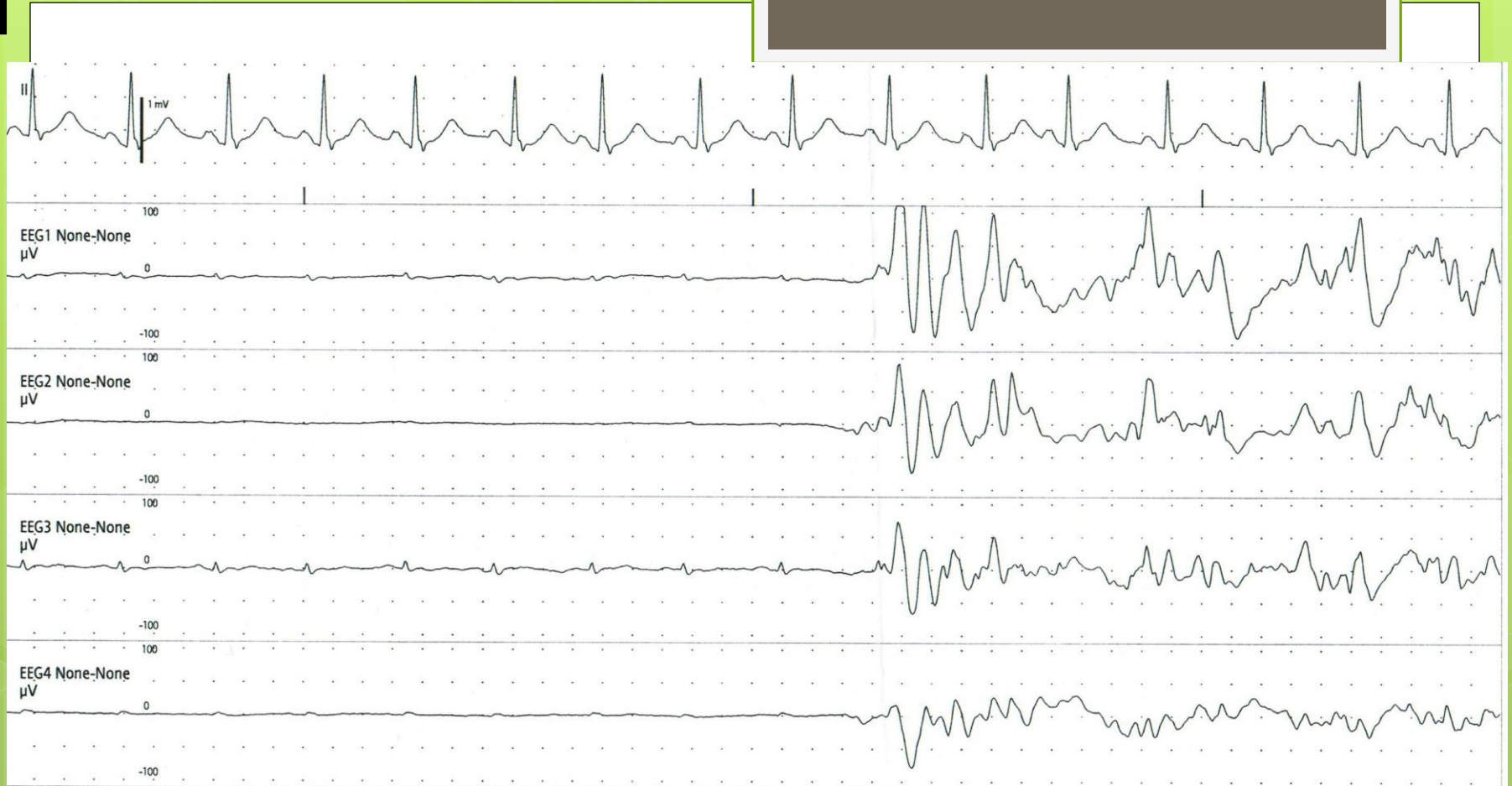
# Quiz

- The next several slides will show 15 subhairline EEGs. Choose the best possible answer in each scenario. Your score and solutions will be provided at the conclusion of the quiz.



The following subhairline EEG represents:

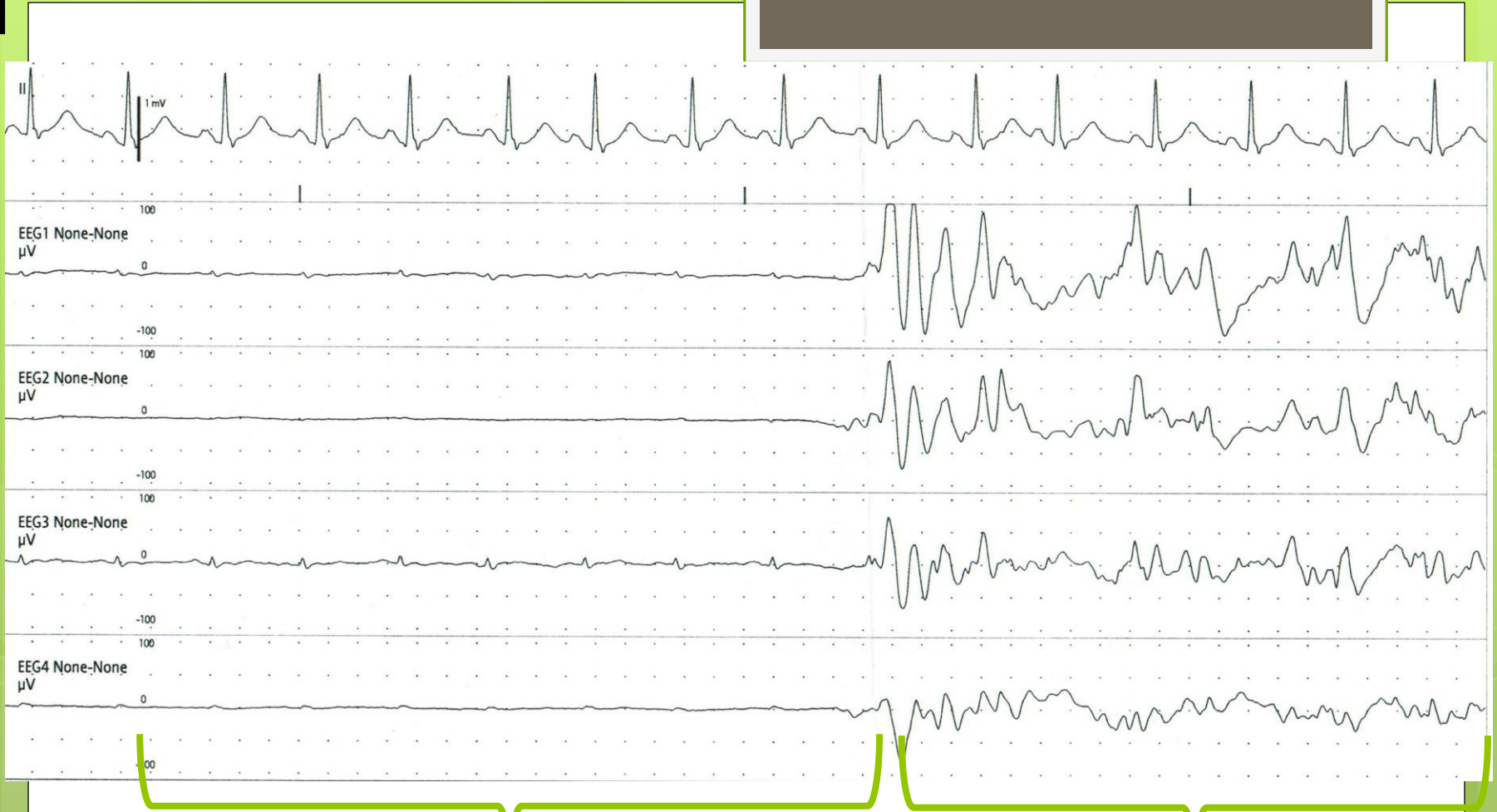
- a) Suppression-burst pattern
- b) Seizure
- c) Movement artifact
- d) Chest physiotherapy artifact



The following subhairline EEG represents:

- a) **Suppression-burst pattern**
- b) Seizure
- c) Movement artifact
- d) Chest physiotherapy artifact

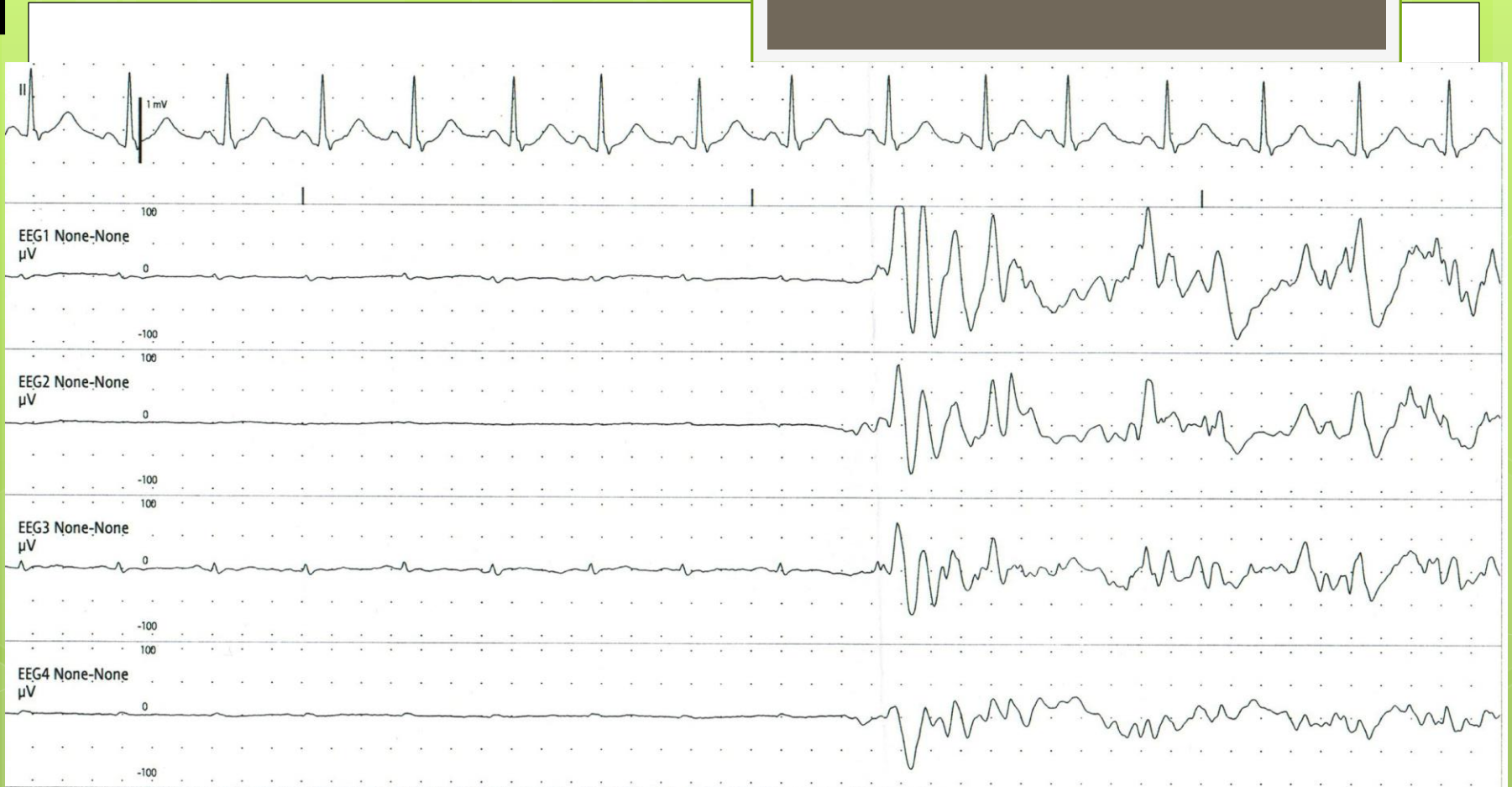
1



Period of suppression

Burst of cerebral activity

1



This is not a seizure because there is no repetitive pattern or evolution (progressive change in voltage/amplitude and frequency) of the EEG activity.

This is not movement artifact because it is not intermittent and because there is not a accompanying change in the EKG.





The following subhairline EEG represents:

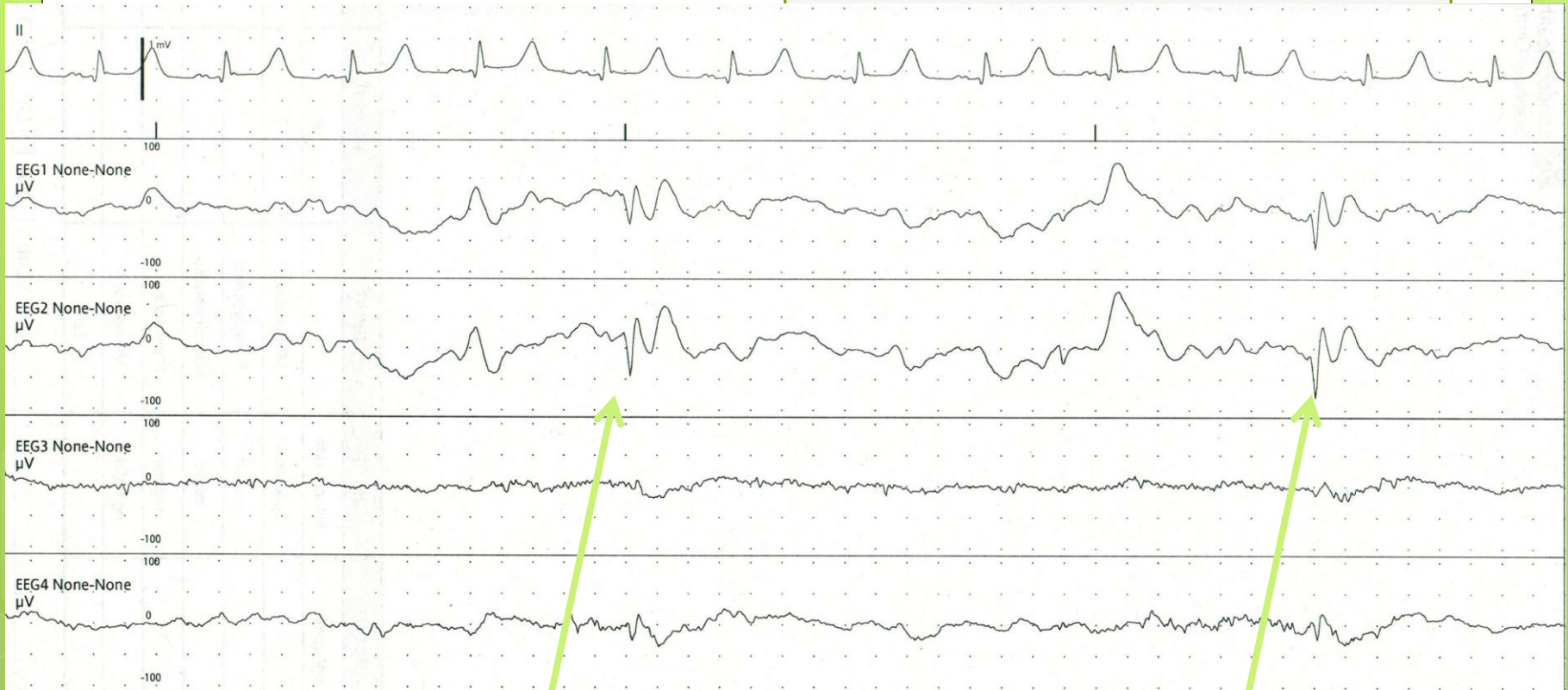
- a) Periodic lateralised epileptiform discharges (PLEDs)
- b) EKG artifact
- c) Epileptic spike
- d) Delta wave with EKG artifact



The following subhairline EEG represents:

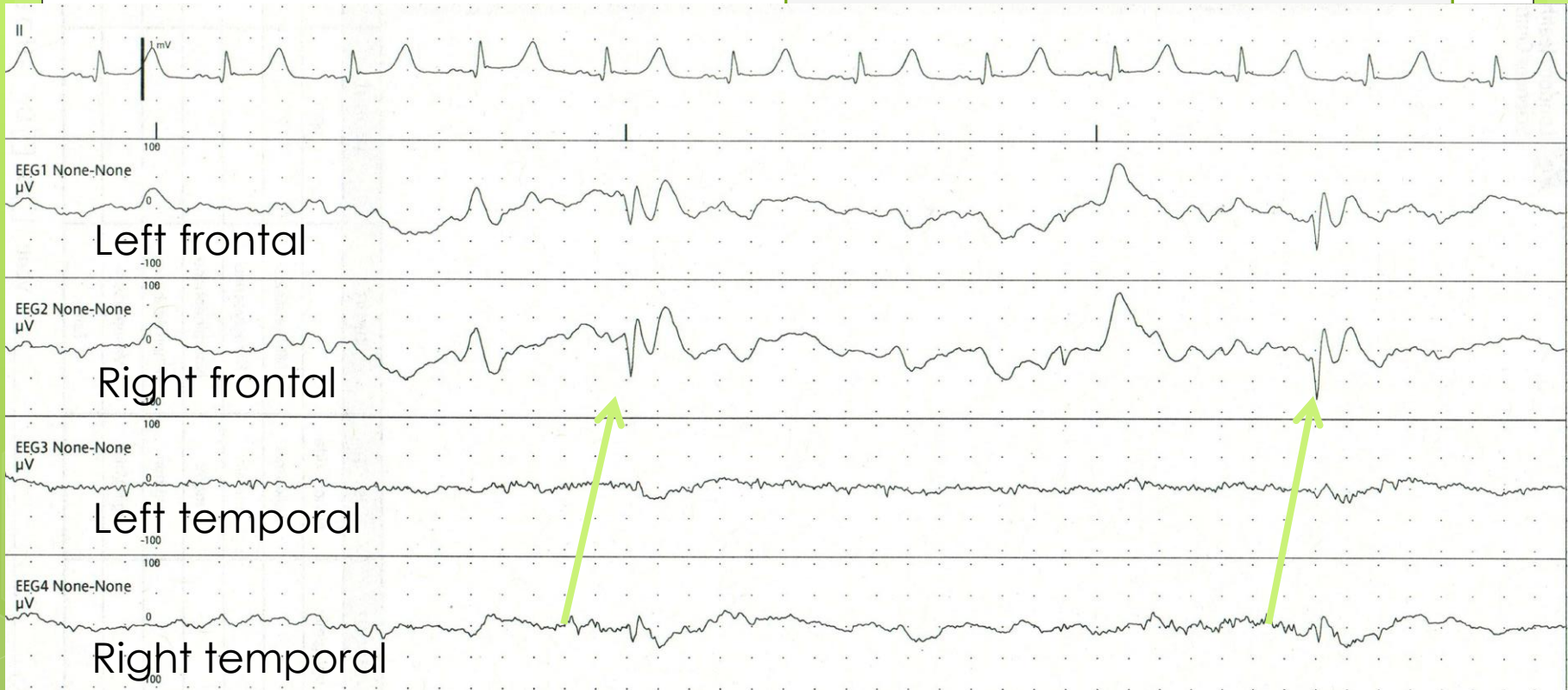
- a) Periodic lateralised epileptiform discharges (PLEDs)
- b) EKG artifact
- c) Epileptic spike**
- d) Delta wave with EKG artifact





These are the discharges of interest in this epoch.

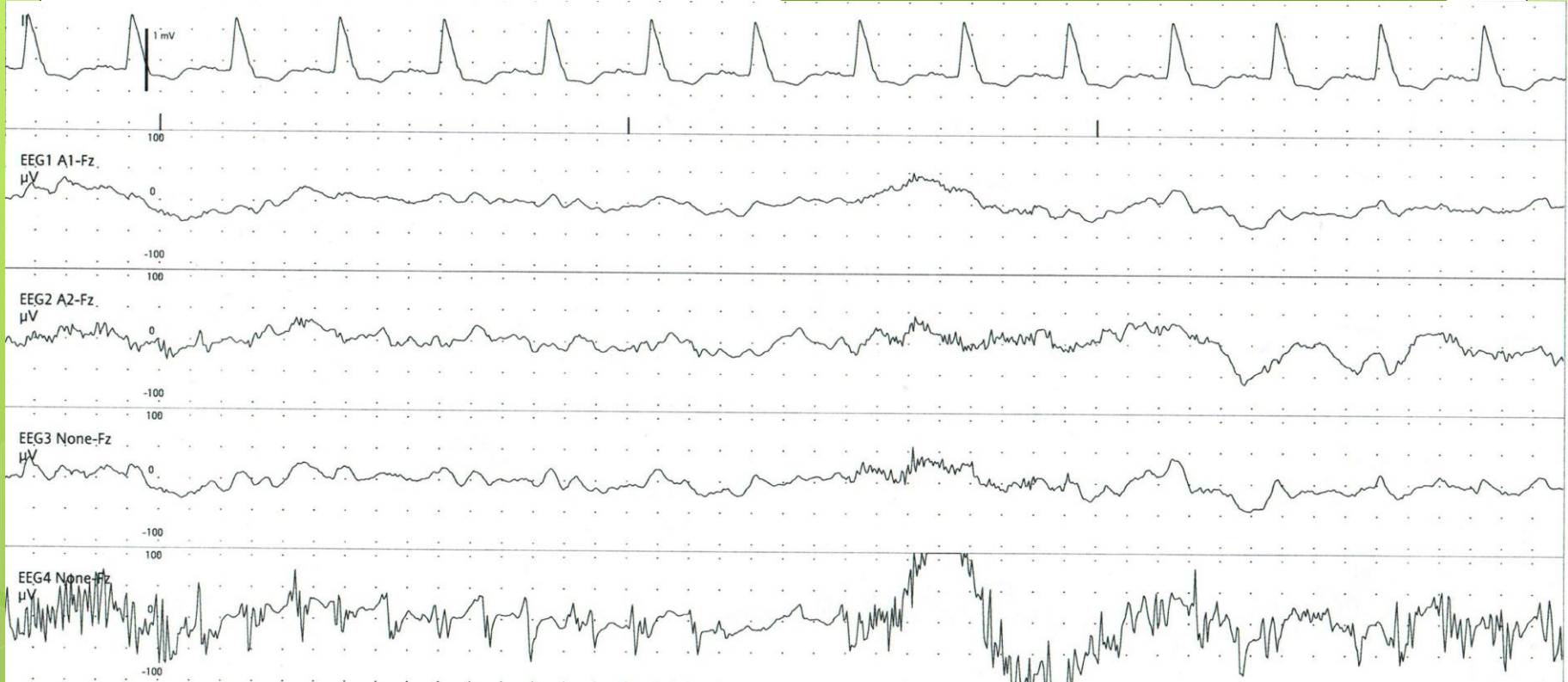
This discharge consists of a narrow electronegative spike followed by a longer lasting aftercoming slow wave. This is a spike-and-wave complex, an epileptiform discharge.



This discharge of interest occurs in both hemispheres. Therefore, it is not a lateralised (unilaterally occurring) discharge.

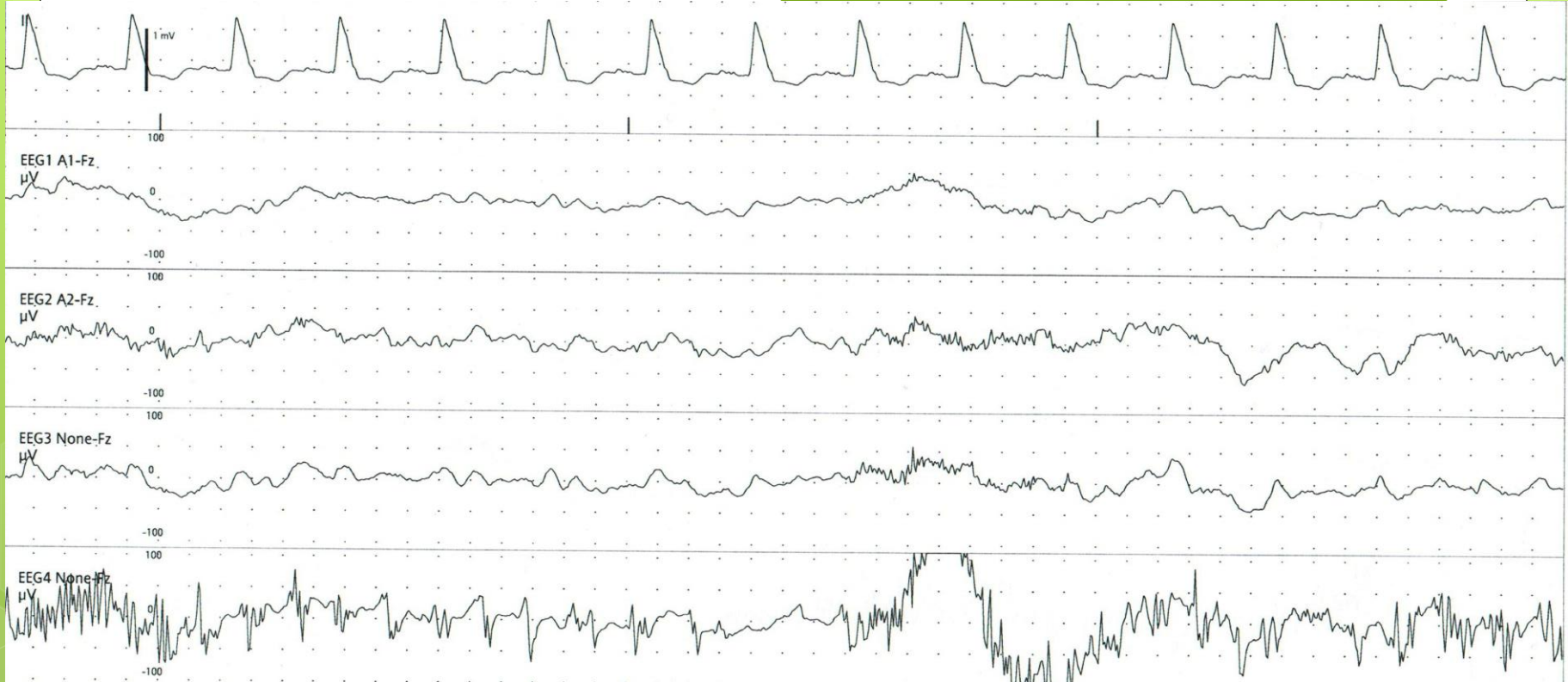
The discharge does not occur at the same intervals as the EKG.

While the discharge contains a delta wave, the preceding spike occurs prior to each delta.



The following subhairline EEG represents:

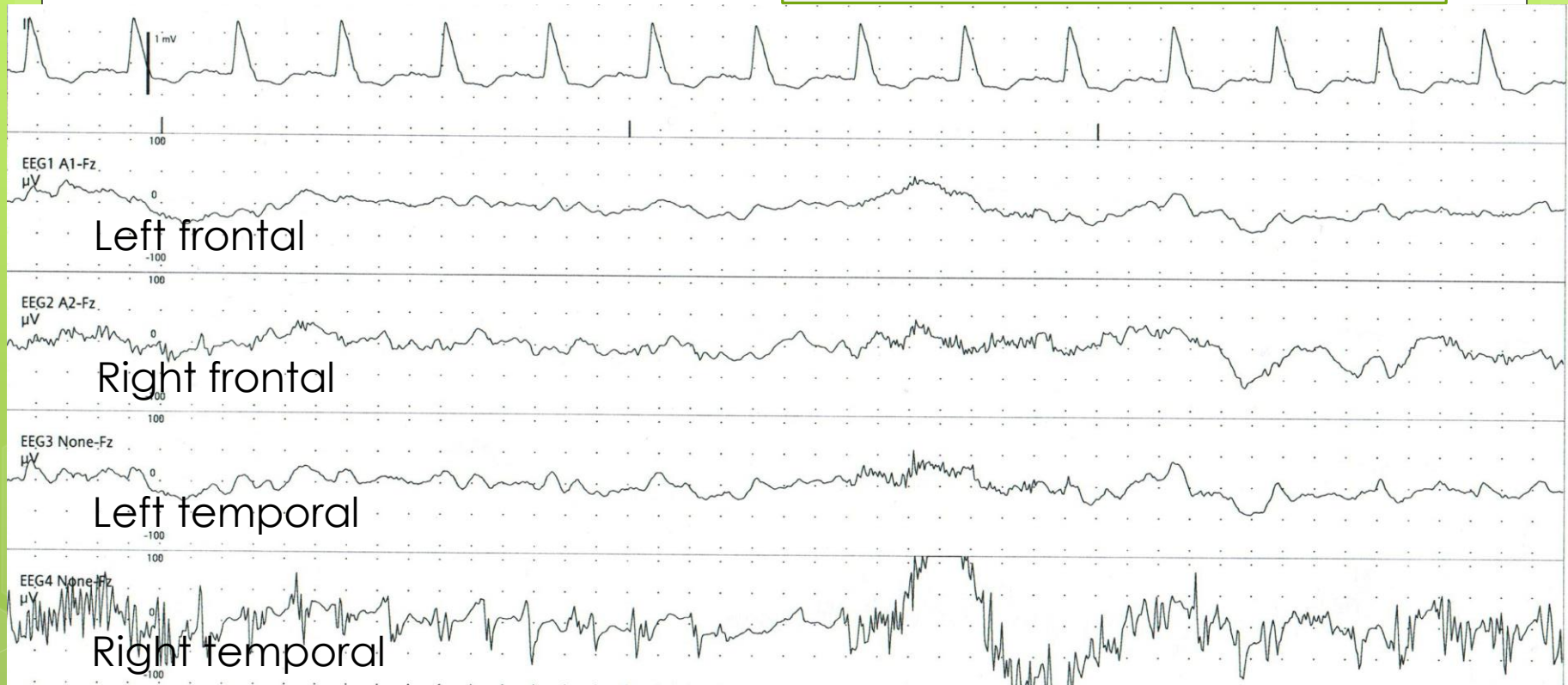
- a) Epileptiform spikes
- b) Right sided periodic lateralised discharges (PLEDs)
- c) Epileptic seizure
- d) Electrode artifact



The following subhairline EEG represents:

- a) Epileptiform spikes
- b) Right sided periodic lateralised discharges (PLEDs)
- c) Epileptic seizure
- d) Electrode artifact**

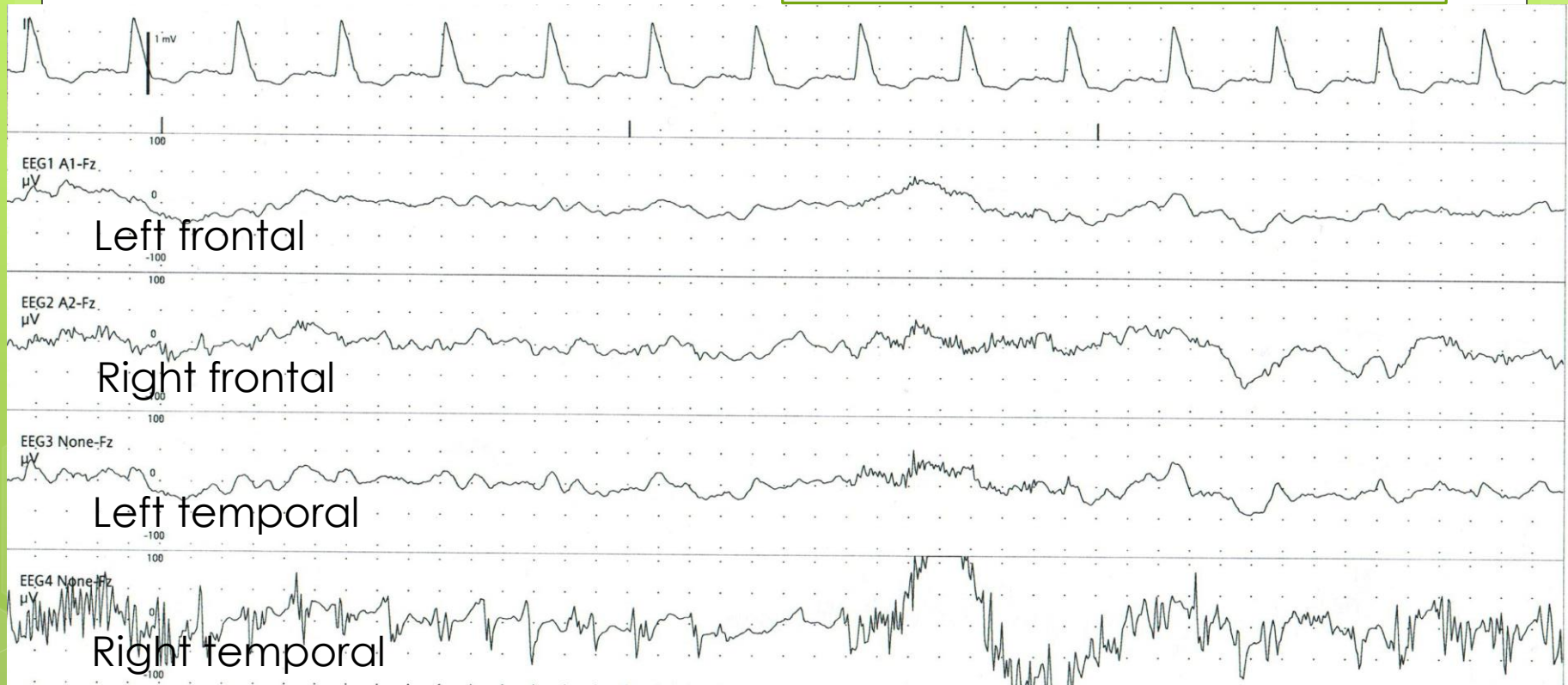




These are not epileptiform spike-and-wave discharges because they are too narrow and there is no aftercoming slow wave.

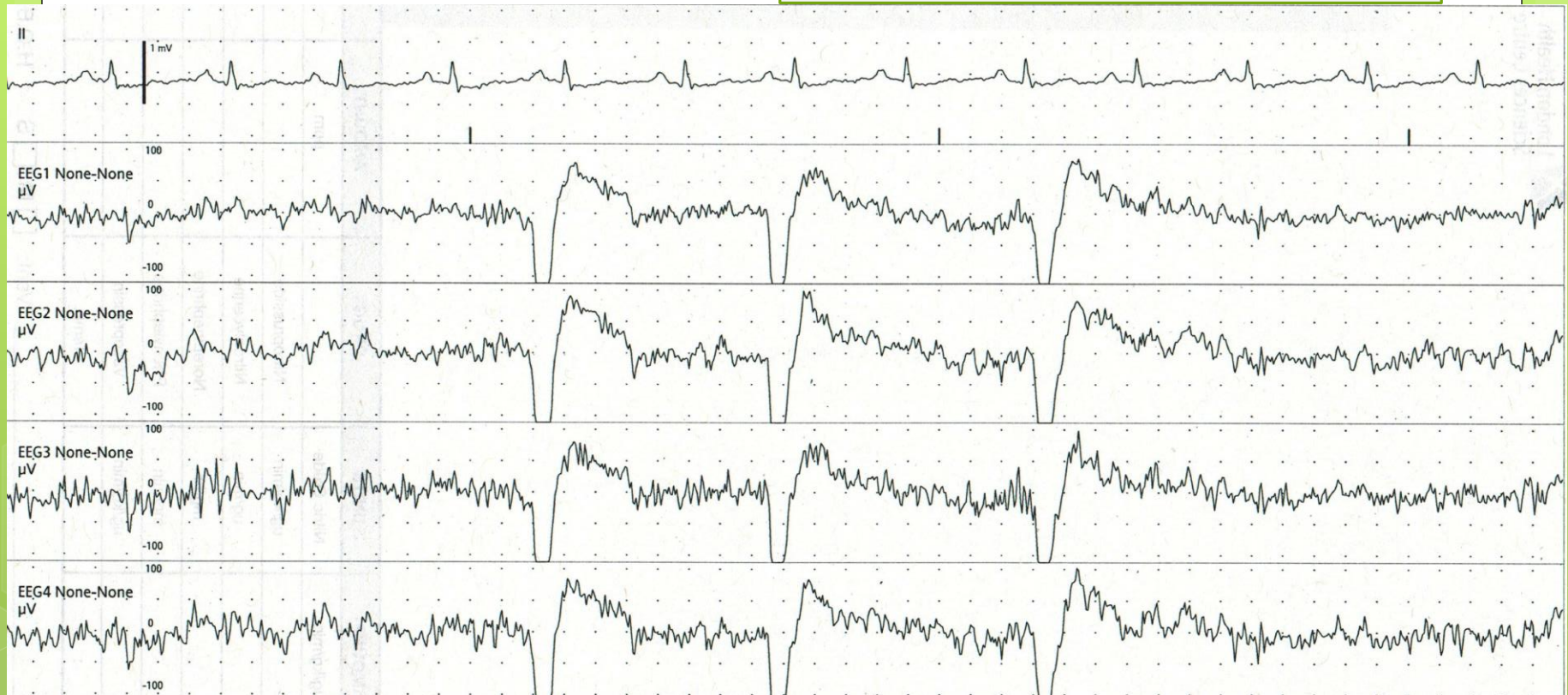
These are not periodic lateralised epileptiform discharges because they only occur in one of the two right-sided electrode derivations.





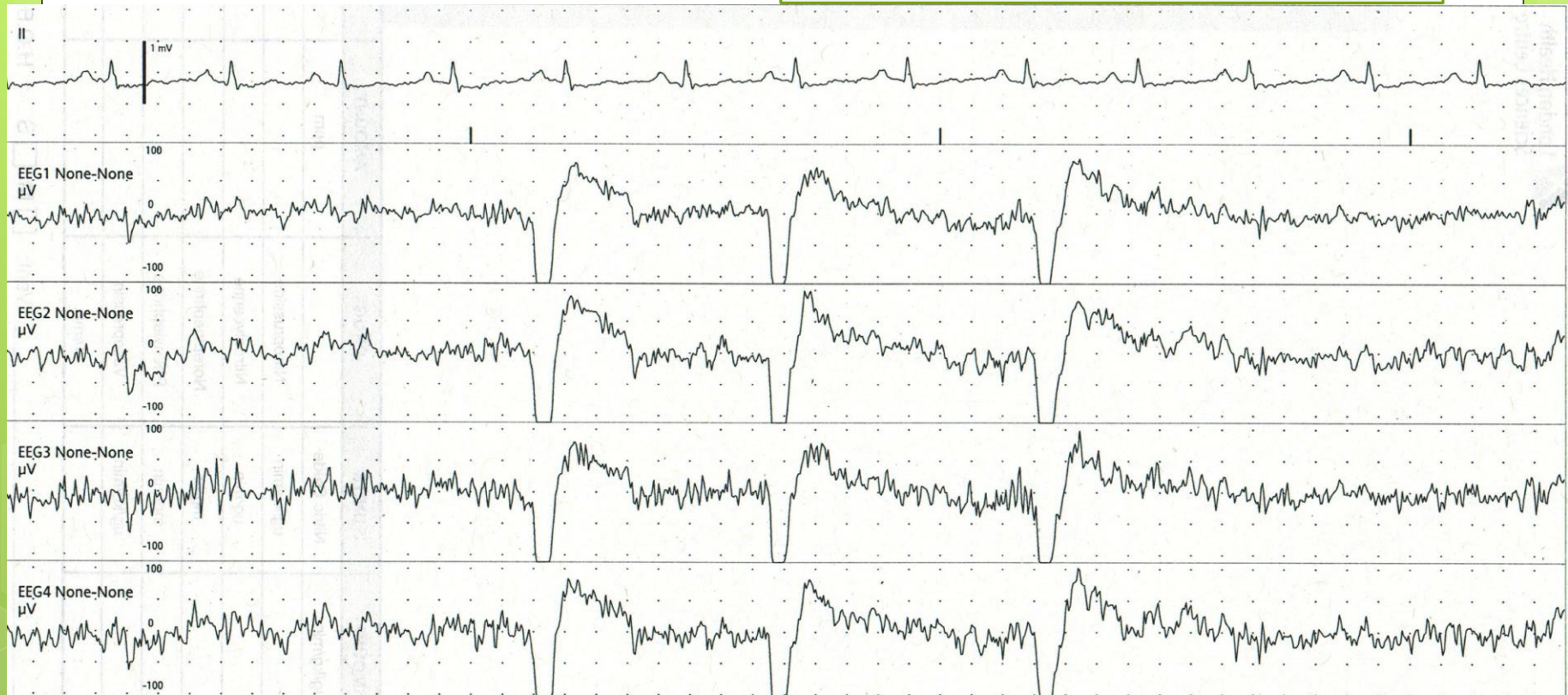
This is not a seizure because it only occurs in one single electrode derivation and there is not evolution (changing amplitude/voltage or frequency).

This is artifact because it is only seen in a single electrode derivation and in a single right sided lead.



The following subhairline EEG represents:

- a) Generalised periodic epileptiform discharges (GPEDs)
- b) Eye blink artifact
- c) Epileptic spike-and-wave
- d) Triphasic waves



The following subhairline EEG represents:

a) Generalised periodic epileptiform discharges (GPEDs)

**b) Eye blink artifact**

c) Epileptic spike-and-wave

d) Triphasic waves





These are electropositive stereotyped artifacts seen with eye blinking.

This is not a spike-and-wave complex because the electropositive component is too broad and there is no aftercoming slow wave.

This is not a triphasic wave because there are not three clear phases within the waveform.

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True or false?

Triphasic waves are only associated with hepatic encephalopathy.



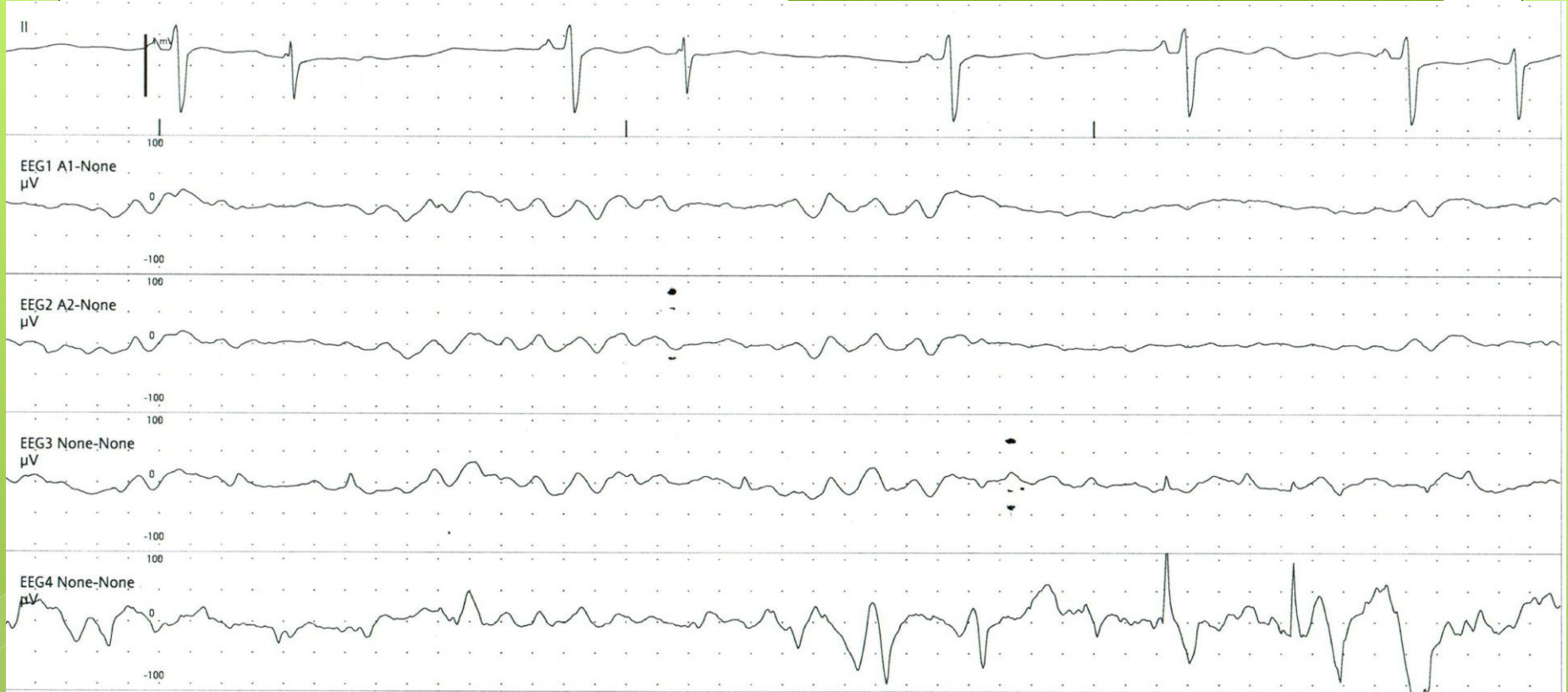
True or false?

Triphasic waves are only associated with hepatic encephalopathy.

False.

Triphasic waves are seen in many forms of metabolic encephalopathy. They were first described in the setting of hepatic encephalopathy, but can also be seen in conditions such as renal failure and sepsis.

In severe encephalopathy triphasic waves may not be seen because of the degree of suppression of cerebral activity.



The following subhairline EEG demonstrates:

- a) A normal subhairline EEG
- b) A focal seizure
- c) A normal subhairline EEG with artifact
- d) Burst suppression

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The following subhairline EEG demonstrates:

- a) A normal subhairline EEG
- b) A focal seizure
- c) A normal subhairline EEG with artifact**
- d) Burst suppression



The entire tracing is artifactual in the 4<sup>th</sup> channel. The information from this tracing is not reliable. Abnormal activity seen in one right sided channel should be at least partially reflected in the other right sided channel. The artifact is most likely secondary to poor electrode contact with the skin.

The first three electrode derivations demonstrate a relatively normal subhairline EEG.



The following subhairline EEG shows:

- Triphasic waves
- A generalised seizure
- Diffuse delta
- Burst suppression



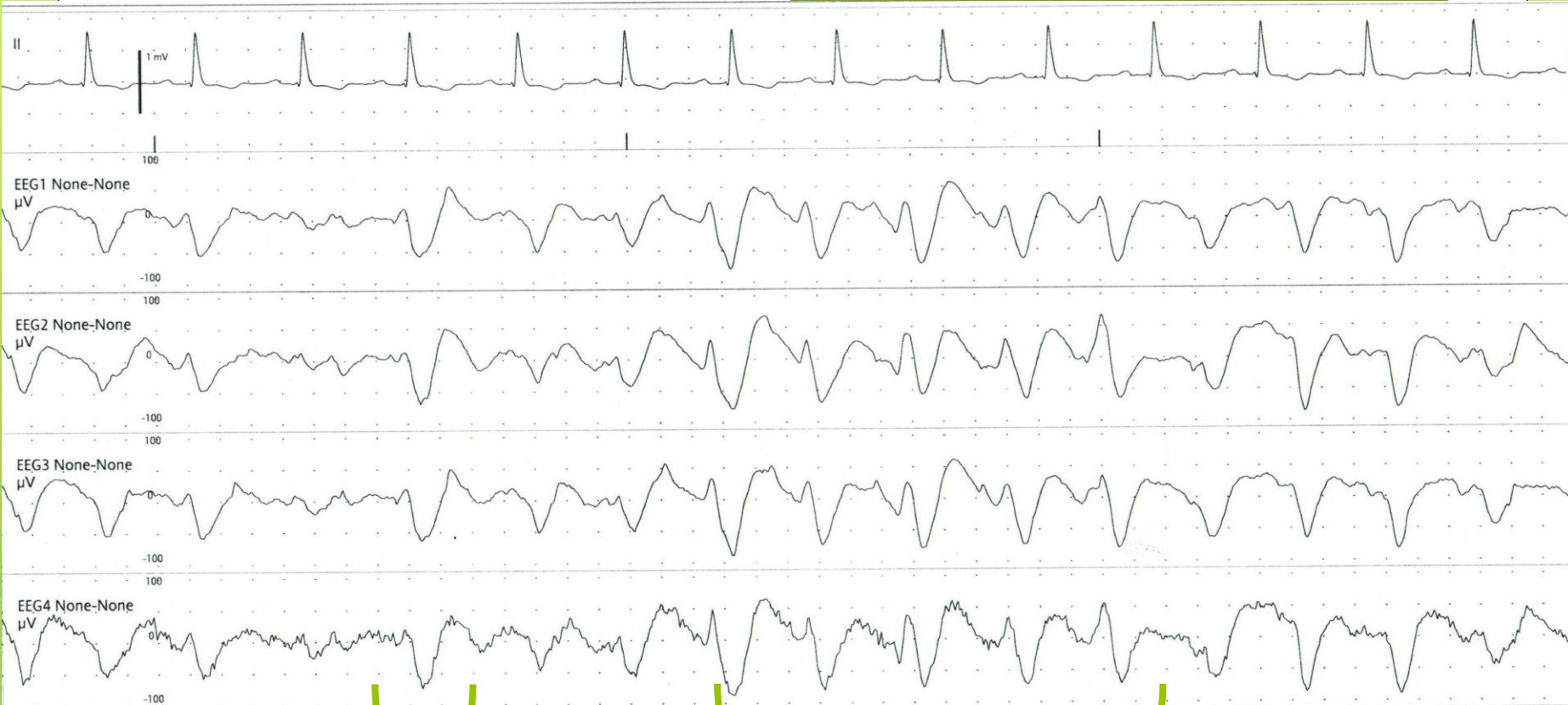


The following subairline EEG shows:

- a) **Triphasic waves**
- b) A generalised seizure
- c) Diffuse delta
- d) Burst suppression



Triphasic waves have three main components: 1) a small negative component; 2) a large positive component; and 3) a last negative component returning to the baseline. They may appear as a single wave or as a cluster of triphasic waves.



Single triphasic wave

Cluster of triphasic waves

Choose the best answer:

Continuous subhairline EEG (using the 9 electrode set-up) is able to detect what percentage of seizures?

- a) 58%
- b) 68%
- c) 78%
- d) 88%

Choose the best answer:

Continuous subhairline EEG (using the 4-channel module) is able to detect what percentage of seizures?

- a) 58%
- b) 68%**
- c) 78%
- d) 88%

The sensitivity of the bedside subhairline EEG module for seizures is 68%. The sensitivity of this system for epileptic spikes is only 39%. However, the specificity of the system for epileptic spikes or PLEDs is 92%.

Young et al. *Neurocritical Care* 2009; 11: 411-416.





The following subhairline EEG demonstrates:

- Diffuse delta
- A generalised seizure
- A cluster of triphasic waves
- Chest physiotherapy artifact



The following subhairline EEG demonstrates:

- a) Diffuse delta
- b) A generalised seizure**
- c) A cluster of triphasic waves
- d) Chest physiotherapy artifact

NB: the 4<sup>th</sup> channel is not recording.



The arrow shows the onset of the seizure. Note the evolution of the discharge over time: both the amplitude and the frequency of the activity is changing with respect to time. While the discharge is maximal in channel 3, it can be seen easily in channels 1 and 3 also.



The following subhairline EEG represents:

- a) Severe suppression with artifact
- b) The EEG leads are not properly plugged in
- c) Burst-suppression





The following subhairline EEG represents:

- a) **Severe suppression with artifact**
- b) The EEG leads are not properly plugged in
- c) Burst-suppression



There is no discernable cerebral activity in this subhairliner EEG. This is not synonymous with brain death since the recording is not compliant with the requirements for recording electrocerebral inactivity.

The EKG artifact is seen prominently since cerebral activity is so severely depressed.



The following subhairline EEG shows:

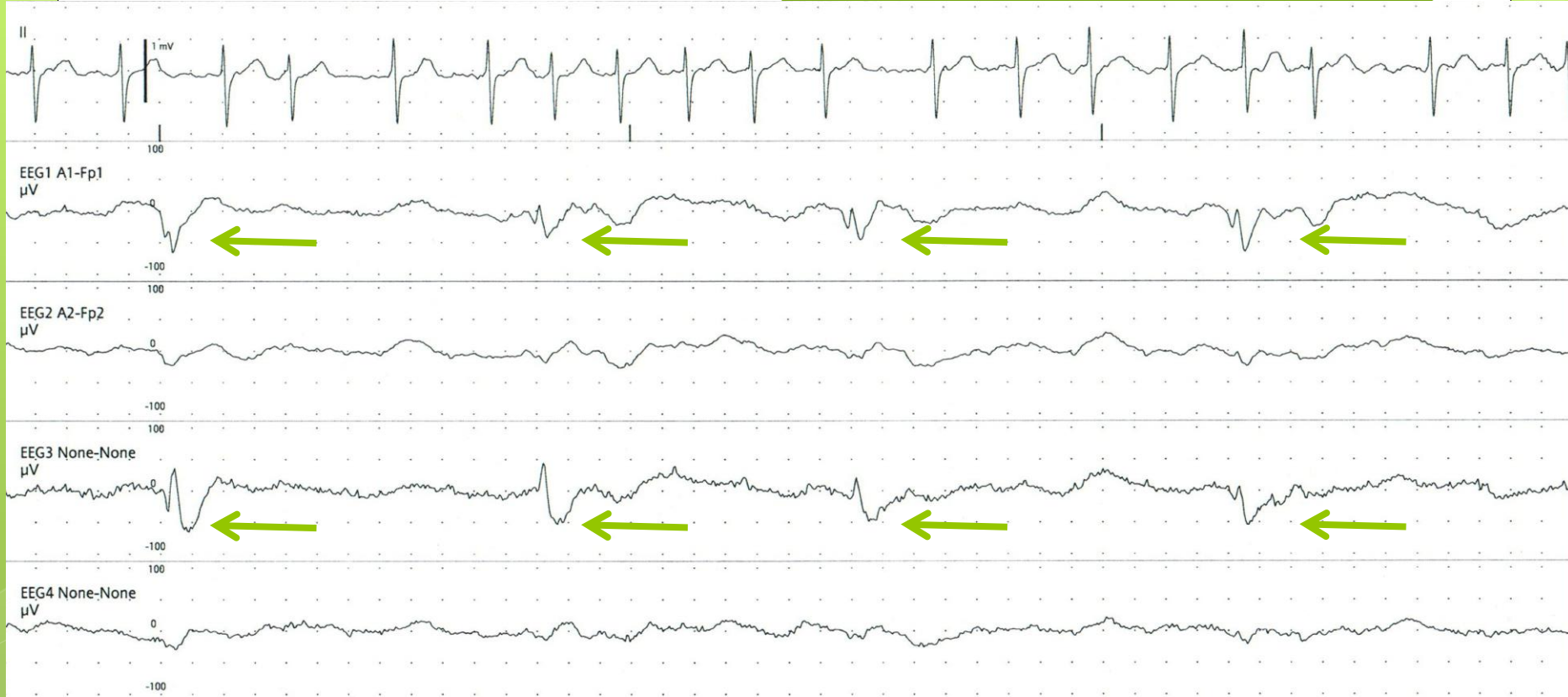
- a) Generalised epileptiform spikes
- b) Periodic lateralised epileptiform discharges
- c) Burst-suppression
- d) Delta with movement artifact



The following subhairline EEG shows:

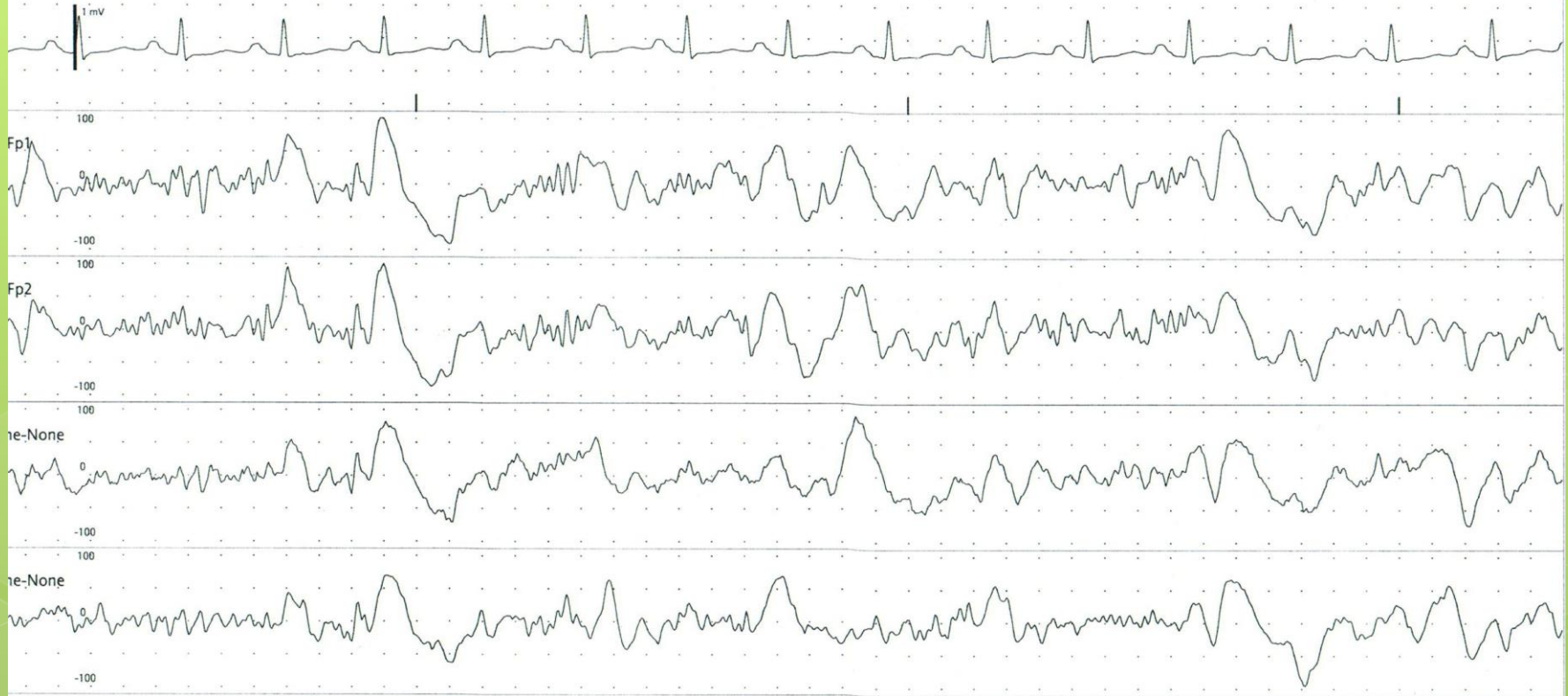
- a) Generalised epileptiform spikes
- b) Periodic lateralised epileptiform discharges**
- c) Burst-suppression
- d) Delta with movement artifact





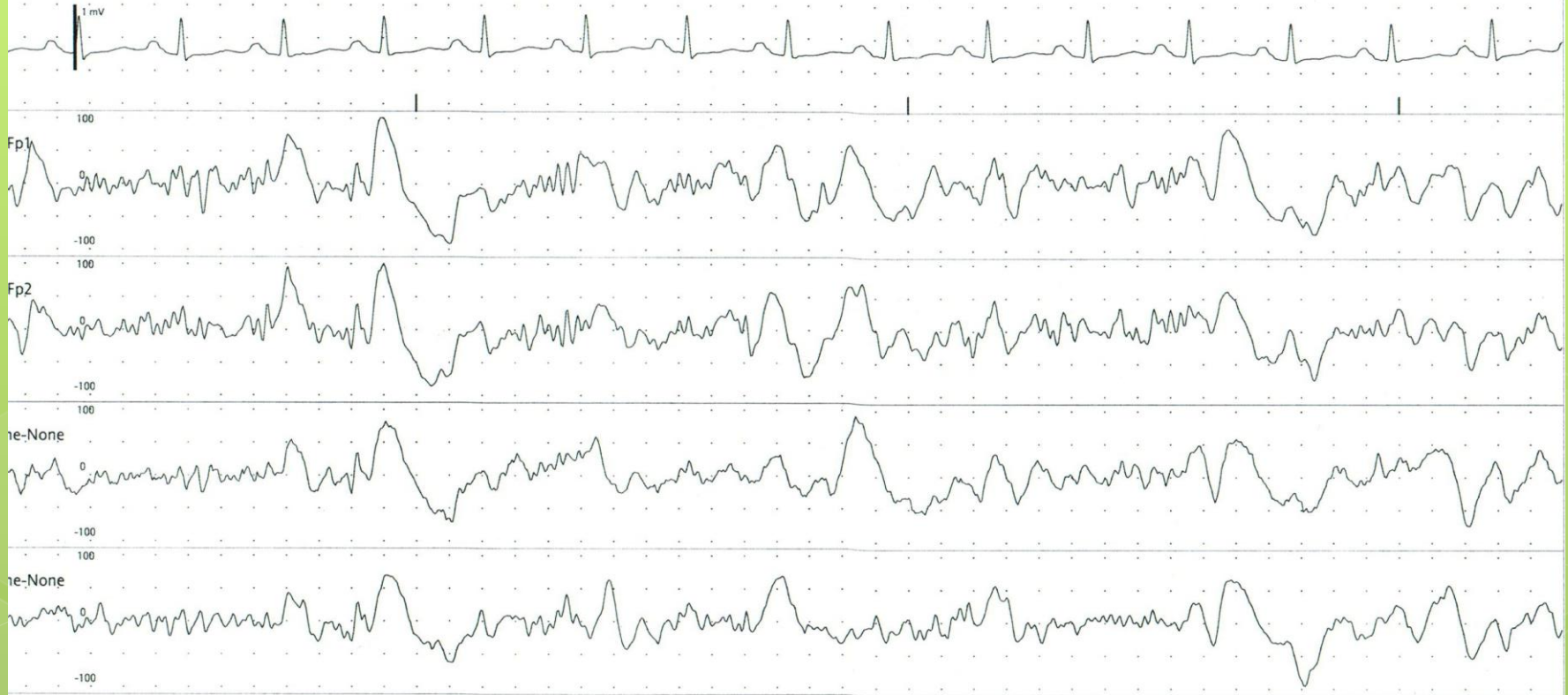
The arrows show the periodic lateralised (one hemisphere only) epileptiform discharges (PLEDs). Note that the discharges are seen only in the left hemispheric channels.

This recording is from a patient with herpes simplex encephalitis.



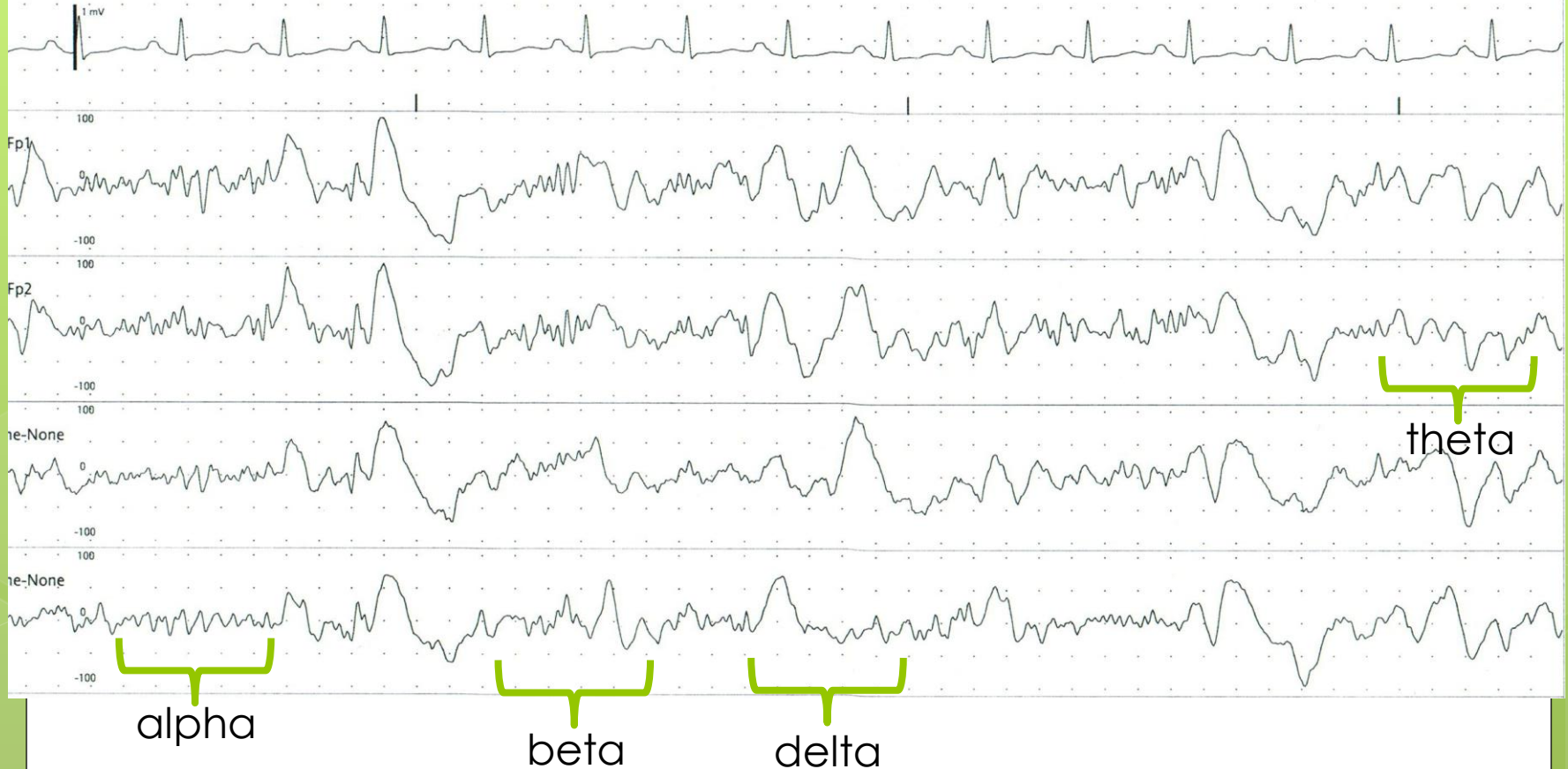
The following subhairline EEG shows:

- a) Generalised epileptiform spikes
- b) Mixed frequencies, all of cerebral origin
- c) A generalised seizure
- d) Delta with movement artifact



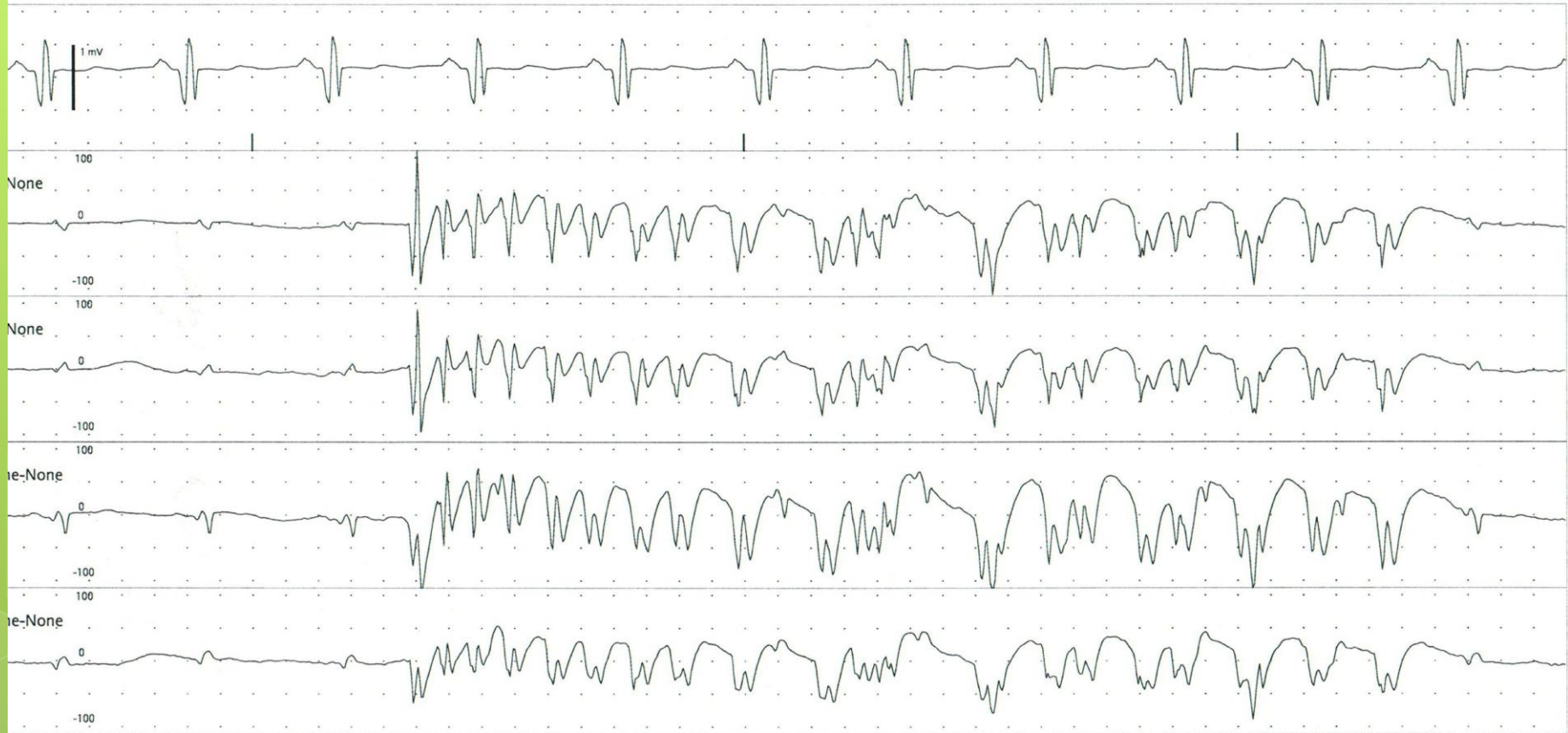
The following subhairline EEG shows:

- a) Generalised epileptiform spikes
- b) Mixed frequencies, all of cerebral origin**
- c) A generalised seizure
- d) Delta with movement artifact



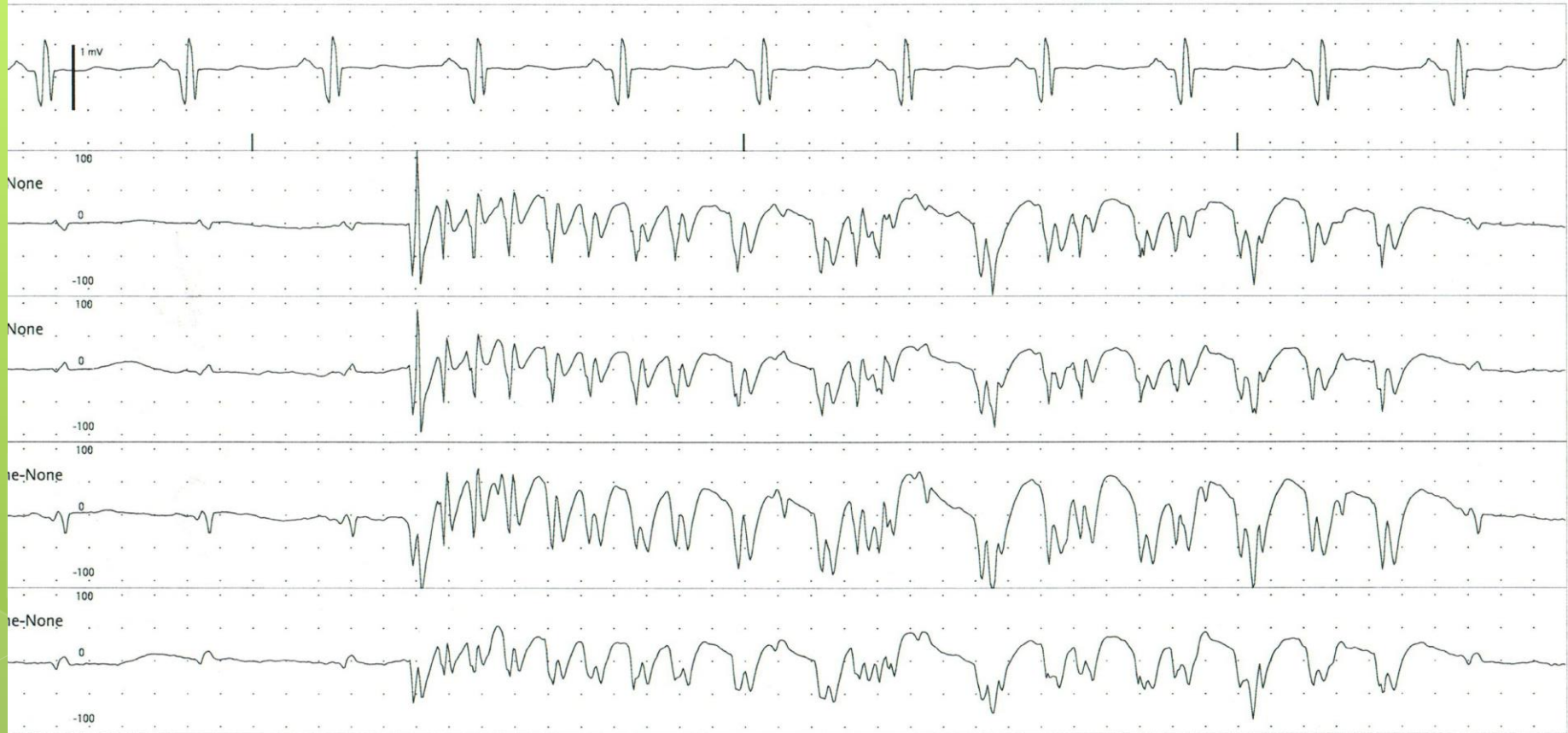
There are multiple different frequencies of waveforms seen here. None can be called a spike-and-wave complex since the small 'spike' appearing after the delta is more likely to have occurred due to a combination of preceding waveforms rather than as an epileptic phenomenon.





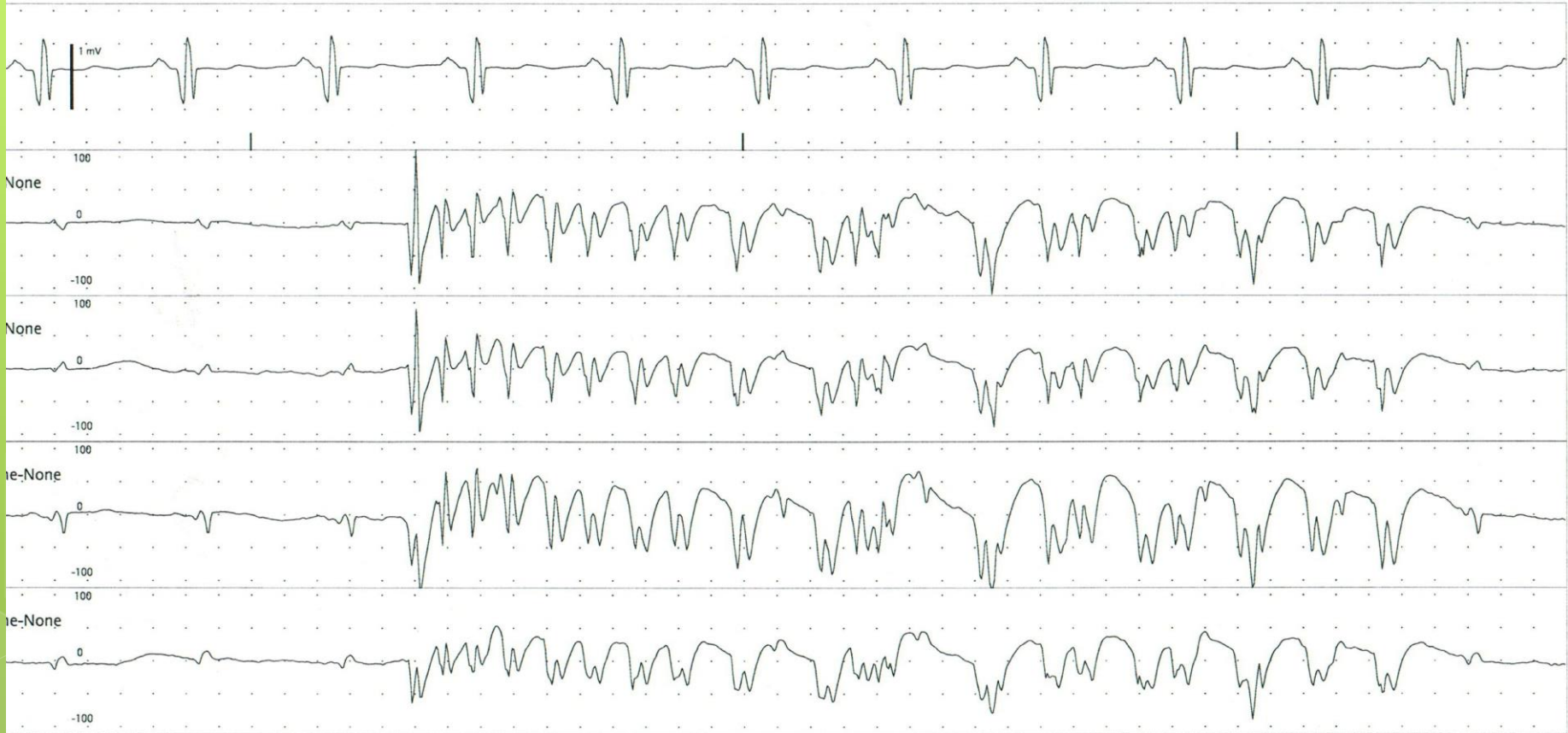
The following subhairline EEG shows:

- a) Generalised epileptiform spikes
- b) Movement artifact from myoclonus
- c) A generalised seizure
- d) Burst-suppression

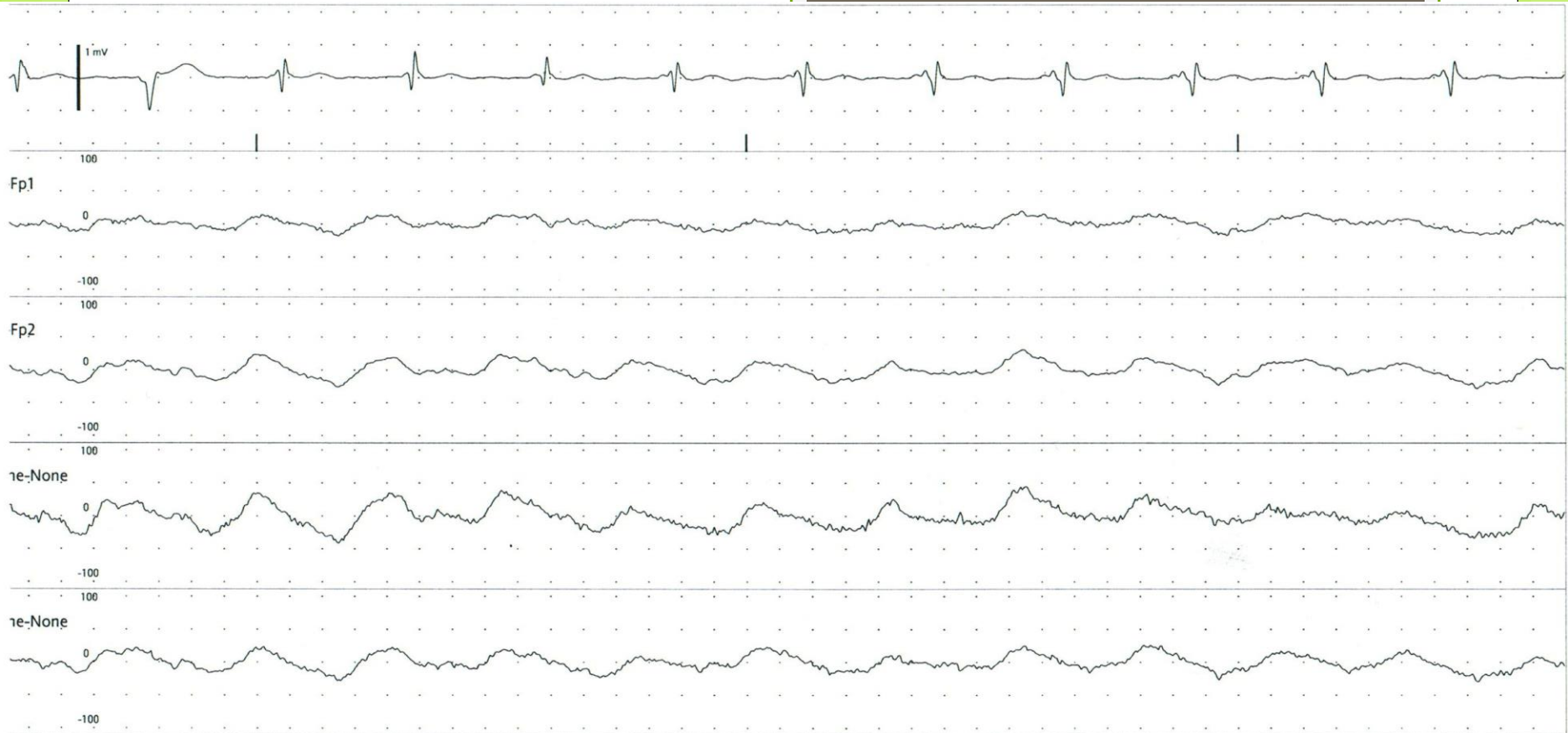


The following subhairline EEG shows:

- a) Generalised epileptiform spikes
- b) Movement artifact from myoclonus
- c) A generalised seizure**
- d) Burst-suppression



This is a very short seizure. There is a definite onset, an evolution over time (change in both amplitude and frequency of the waveforms) and a definite offset. The period of activity is longer than what is usually associated with burst-suppression and the bursts within a burst-suppression pattern do not show evolution.



The following subhairline EEG shows:

- a) Diffuse low voltage delta
- b) Pulse artifact within an otherwise suppressed EEG
- c) Triphasic waves
- d) suppression





The following subhairline EEG shows:

- a) Diffuse low voltage delta
- b) Pulse artifact within an otherwise suppressed EEG**
- c) Triphasic waves
- d) suppression





There is prominent cardioballistic (pulse) artifact seen in this EEG. It is prominent because cerebral activity is so suppressed.



This subhairline EEG demonstrates:

- a) Generalised periodic epileptiform discharges
- b) Diffuse delta
- c) Triphasic waves
- d) A generalised seizure



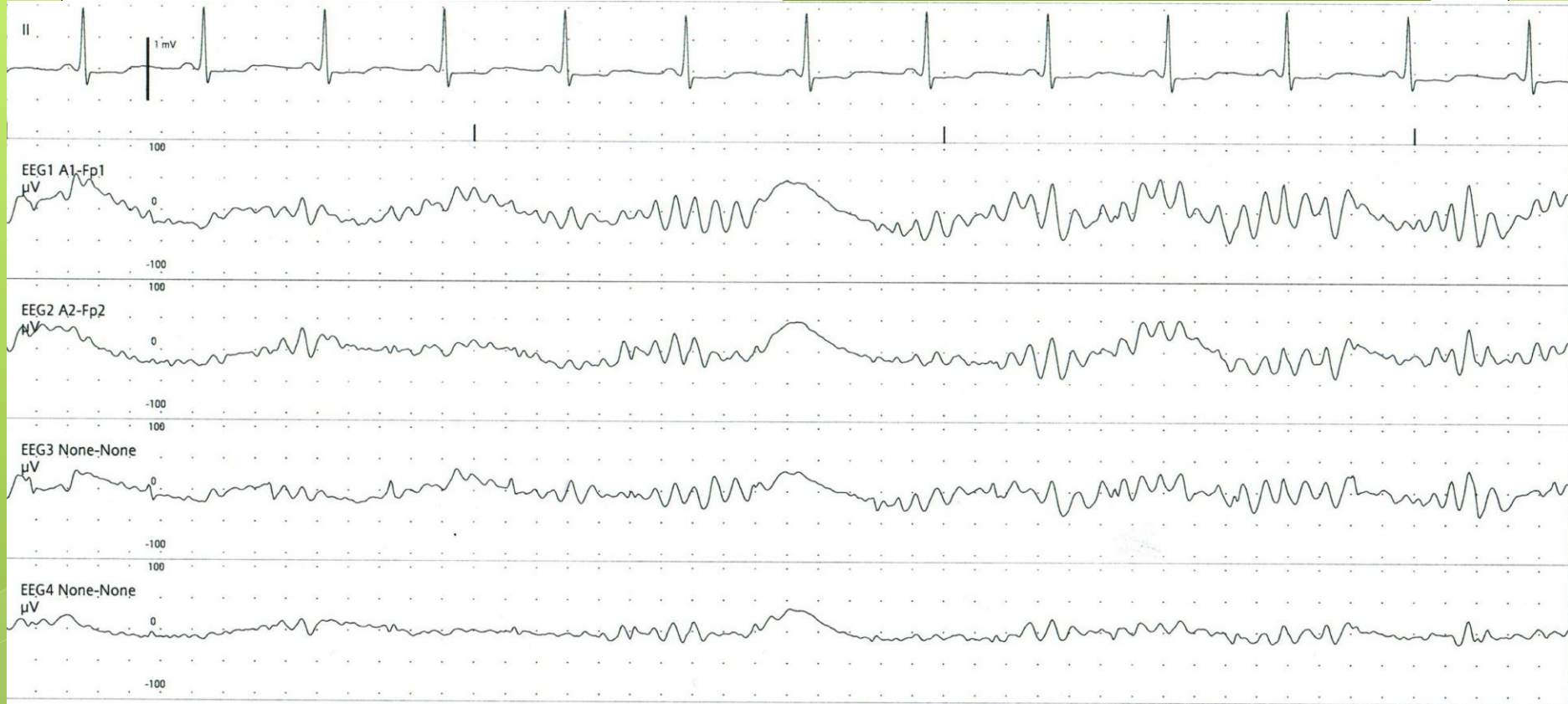
This subhairline EEG demonstrates:

- a) **Generalised periodic epileptiform discharges**
- b) Diffuse delta
- c) **Triphasic waves**
- d) A generalised seizure



It is very difficult to determine whether or not these generalised discharges are triphasic waves or generalised periodic epileptiform discharges. The patient's history and clinical data in as well as a formal EEG will assist in differentiating these waveforms.

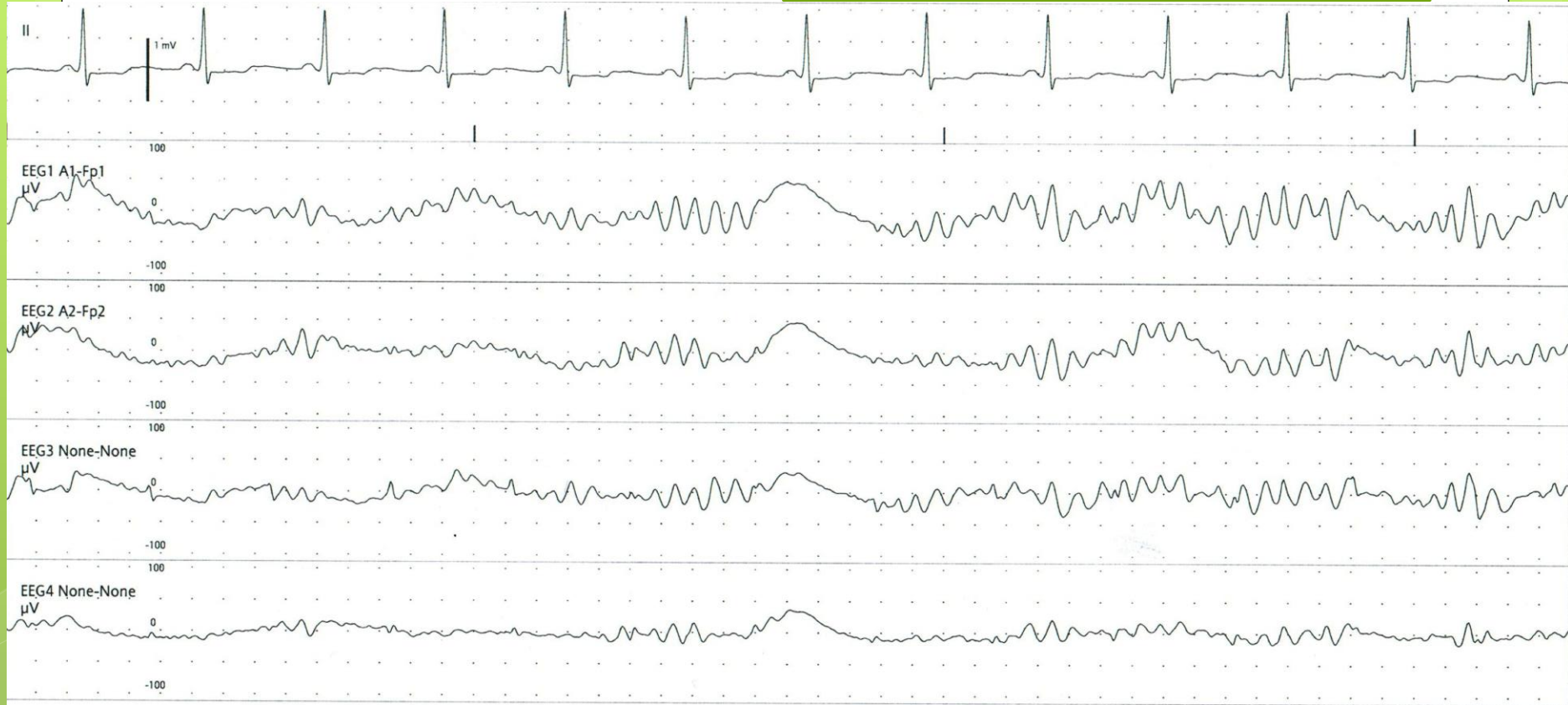




The following subhairline EEG shows:

- a) Normal sleep spindles
- b) A generalised seizure
- c) Intermittent delta waves
- d) Theta coma pattern





The following subhairline EEG shows:

- a) **Normal sleep spindles**
- b) A generalised seizure
- c) Intermittent delta waves
- d) Theta coma pattern



Sleep spindle

Rarely, patients in the ICU demonstrate normal sleep patterns. This EEG shows normal sleep spindles with occasional delta waves. This is typical of stage 2 (N2) sleep.