Neurosciences Quiz

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Eyelid fluttering artifact

Case Presentation

A 34-year-old woman develops a sudden episode of dizziness with sweating and tonic posturing of the arms. She does not have any history of head trauma, family history of epilepsy, epilepsy risk factors, and psychiatric illness. She was anxious due to her infertility and was referred for EEG after developing this single sudden episode. An MRI study of the brain showed mild diffuse cerebellar atrophy, otherwise, unremarkable. An EEG study was requested to exclude a seizure disorder. The EEG was carried out using Nicolet One EEG machine. The electrodes were placed using the international 10-20% system.

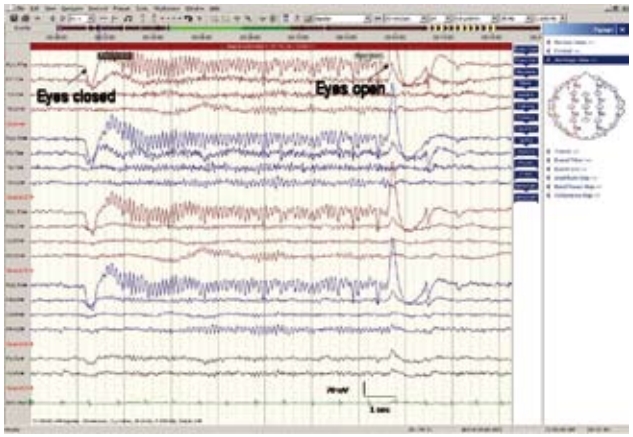

Figure 1 - Shows a bipolar double banana montage with low-frequency filter (LFF) 1.0 Hz, high-frequency filter (HFF) 35Hz, sensitivity 7uV/mm, and paper speed 30mm/second. Note the bisynchronous downward and upward potentials, which are due to movement of the ocular dipole toward and away from the fronto-polar electrodes during eye closing and eye opening.

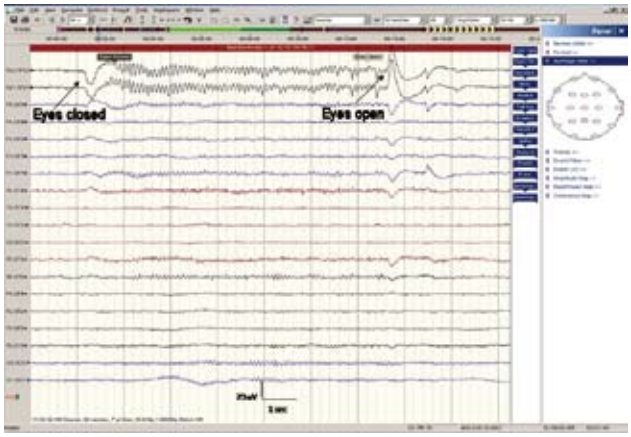

Figure 2 - Shows the 10 second EEG record after remontaging to Laplacian montage with LFF 1.0 Hz, HFF 35Hz, sensitivity 7uV/mm, and paper speed 30 mm/second. Note that the frontal activity disappeared on eye opening, namely, behaving like alpha rhythm.

Questions

1. What is the alpha frequency?
2. What are the characteristic features of alpha rhythm?
3. Identify the potentials recorded at FP1-F7 and FP2-F8 channels.
4. Could it be muscle artifact filtered out by using HFF at 35 Hz instead of 70 Hz in the fronto-polar electrodes?
5. Do you want to change your opinion after remontaging?
6. In what conditions do you see alpha in the frontal region and what are their special diagnostic features?
7. Is it an eyelid myoclonia? Give reasons in favor and against.
8. Could it be Mu rhythm?
9. What is the final opinion?

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Answers & Discussion

1. The posterior EEG background rhythm is in the range of 10Hz, which is an alpha frequency (**Figure 1**).

2. An alpha rhythm is an occipital rhythm (seen in the posterior regions of the head on both sides) in awake, relaxed state with closed eye in adult subjects. It is attenuated with eyes open or mental activity. The normal range for the frequency is from 8-13 Hz, being higher in amplitude on the non-dominant hemisphere. This activity is now referred to as "posterior basic rhythm," the "posterior dominant rhythm," or the "posterior alpha rhythm."

3. FP1-F7 and FP2-F8 channels the activity at 10Hz, which disappears on eye opening, behaving like posterior alpha rhythm (**Figures 1 & 2**).

4. No, because it is there without any change of the waveform when the HFF is changed to 70Hz. However, in case of muscle artifact, the HFF at 15Hz appears as beta wave. Therefore, routine EEG recording HFF at 70Hz is preferable.[1]

5. No, it is still a distinct 10Hz activity localized in the fronto-polar electrodes without any field distribution (**Figure 2**).

6. Conditions with alpha in frontal region with special features:
   - EEG in "alpha coma" showed diffuse alpha extending to the frontal regions in comatose patients, most frequently is seen in severe anoxic encephalopathy and is unresponsive to external stimuli.[1,2]
   - Frontal alpha asymmetry (a measure of relative difference of the alpha power between the 2 anterior hemispheres) has been associated with the trait and state reactivity of different affective styles. Results showed significant interaction of resting MEG alpha activity between hemispheric side and menstrual phases.[3]
   - Alpha response system may relate to frontal brain functioning during aging, anger in fibromyalgia syndrome, aggressive children, adolescents with mood and disruptive behavioral disorders, and music leading pleasure. This alpha activity is suppressed during cognitive tasks and accentuated in non verbal tasks with pleasant music indicating the interference between emotion and cognition.[4]

7. No, eyelid myoclonia is a generalized epileptiform ictal activity, but the frontal activity in our records is monorhythmic and does not evolve with time.[5]

8. No, Mu rhythm is a central rhythm of alpha frequency, which attenuates with contra-lateral arm movement and is not affected by eye opening or closing.

9. This is an "eyelid fluttering artifact" previously called Kappa rhythm (or Kappa waves). It is usually seen in the prefrontal leads just over the eyes. They are usually in the alpha (8-13Hz) or theta (4-7Hz) range. They are generated by rapid fluttering of the eyelids, sometimes so minute that it is difficult to see. Therefore, they are in fact noise or "artifact" in the EEG reading, and should not technically be called a rhythm or wave. Similarly, sequential eye blinking can give rise to the 5-8Hz activities that are identifiable by their location at FP1/FP2 as well as their response to eye opening.[2]

References

1. Ebersole JS, Pedley TA, editors. Current practice of clinical electroencephalography. 3rd ed. Philadelphia (PA): Lippincott Williams & Wilkins; 2003. p. 102.
2. Blume WT, Kaibara M. Atlas of adult electroencephalography. 2nd ed. New York (NY): Raven Press; 1995.
3. Hwang RJ, Chen LF, Yeh TC, Tu PC, Tu CH, Hsieh JC. The resting frontal alpha asymmetry across the menstrual cycle: a magnetoencephalographic study. ***Horm Behav*** 2008; 54: 28-33.
4. Yordanova JY, Kolev VN, Başar E. EEG theta and frontal alpha oscillations during auditory processing change with aging. ***Electroencephalogr Clin Neurophysiol*** 1998; 108: 497-505.
5. Capovilla G, Striano P, Gambardella A, Beccaria F, Hirsch E, Casellato S, et al. Eyelid fluttering, typical EEG pattern, and impaired intellectual function: a homogeneous epileptic condition among the patients presenting with eyelid myoclonia. ***Epilepsia*** 2009; 50: 1536-1541.