Neurosciences Quiz

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Notice: Authors are encouraged to submit quizzes for possible publication in the Journal. These may be in any field of Clinical Neurosciences, and should approximately follow the format used here. Please address any submissions to the Assistant Editor, Neurosciences Journal, Riyadh Military Hospital, PO Box 7897, Riyadh 11159, Kingdom of Saudi Arabia.
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Lambda waves

Case Presentation

A 42-year-old woman with a single episode of generalized tonic-clonic seizure occurring during the morning. She does not have any history of head trauma, family history of epilepsy, epilepsy risk factors, and psychiatric illness. A brain MRI was unremarkable. Low-frequency filter (time constant) 0.3 sec., high-frequency filter 50 Hz, sensitivity 7uV/mm, and paper speed 20 mm/second.

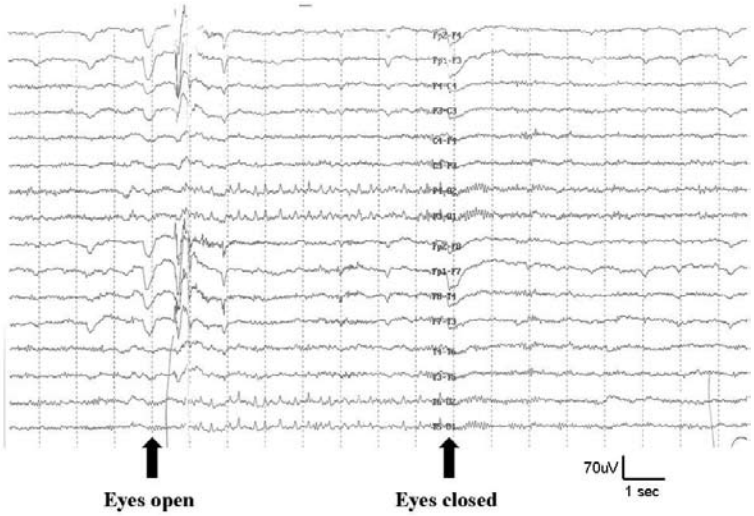

Figure 1 - Patient EEG.

Questions

1. Based on EEG alone, what is the neurological state of the subject (awake, drowsiness, sleep?).
2. What are the expected neurological deficits in this patient? How do you describe and interpret the sharp transients occurring over occipital regions bilaterally?
3. How do you differentiate these waves from positive occipital sharp transients of sleep (POSTs)?
4. How do you differentiate these waves from epileptiform discharges?
5. How would you try to eliminate them?
6. What would assist in the correct identification of these waves?
7. What is your final opinion?

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Answers & Discussion

1. The presence of eye-opening (5 sec) and eye-closing (12 sec) artefacts, together with the presence of a well-defined alpha posterior dominant rhythm indicate that the patient is awake.

2. Triangular shaped, biphasic sharp transients over occipital regions bilaterally and synchronous, occurring when eyes are opened, without after-following slow-waves. The localization and the EEG features point to lambda waves.

3. As suggested by their name, positive occipital sharp transients of sleep (POSTs) occur during sleep, whereas lambda waves, which nevertheless strongly resemble POSTs, are exclusively recorded in awake subjects.

4. Lambda waves are usually bilateral and symmetrical, although sometimes quite sharply contoured in morphology and asymmetrical, thus potentially misinterpreted as interictal epileptiform discharges. The occurrence of these waveforms exclusively during eye opening and the lack of prominent after-following slow-waves point to a physiological nature of the phenomenon.

5. Lambda waves usually disappear with blank card viewing, darkness, eye closure, drowsiness and sleep.[1]

6. In doubtful cases (exceptional) oculographic monitoring may assist proper identification.[1]

7. Lambda waves occurring during visual scanning. No epileptiform abnormalities. No correlation with the clinical picture and with the request of EEG recording.

Lambda waves are sharp transients, which may be encountered over the occipital region in awake subjects with eyes opened. These sharp transient may be biphasic or triphasic, with a most prominent positive phase; the predominant positive component is usually preceded and followed by a negative one. They are triangular or sawtooth in shape, with an amplitude usually below 20 μV, although sometimes they may exceed 50 μV, in bipolar or referential montages. The overall duration of lambda waves is roughly 100-250 msec. These waves repeat themselves, usually at intervals from 200-500 msec.[2,3] Lambda waves are almost confined to the occipital regions, and are strictly bilateral synchronous, although they may extend to parietal and posterior temporal regions. Although they strongly resemble POSTs, lambda waves are recorded in awake subjects. These waves may be quite sharply contoured in morphology and asymmetrical, thus potentially misinterpreted as interictal epileptiform discharges.

Lambda waves occur with saccadic eye movements (so called "exploratory saccades") during visual scanning, disappearing when eyes are closed and in sleep. They are best elicited when patients visually scan a complex picture, therefore exclusively during visual exploration of a brightly illuminated object or room.[2,3] Regarding this aspect, lambda waves are infrequently recorded in standard EEGs, probably because visual scanning of complex images is not a common routine recording procedure. Placing a white sheet of paper in front of the subject may eliminate the visual input, which is considered essential in their genesis.

Because of their occipital location and relationship to visual stimuli, their origin has been related to the occipital drive response. As a matter of fact, lambda waves resemble visual potentials evoked by intermittent flash stimuli, because of distribution, wave morphology, and latency between the change of visual input and the wave peak.

References

1. MacDonald DB. Normal electroencephalogram and benign variants. ***Neurosciences (Riyadh)*** 2003; 8: 110-118.
2. Niedermeyer E. The normal EEG of the waking adult. In: Niedermeyer E, Lopes da Silva F, editors. Electroencephalography: basic principles, clinical applications, and related fields. Baltimore (MD): Williams & Wilkins; 2005. p. 184-185.
3. Blume WT, Holloway GM, Kaibara M, Young GB, editors. Normal EEG. In: Atlas of Pediatric and Adult Electroencephalography. Philadelphia (PA): Lippincott Williams & Wilkins; 2011. p. 67.