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Original article

Characteristics of the synchronous occipital and frontopolar spike phenomenon in Panayiotopoulos syndrome

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Abstract

Purpose: The synchronous appearance of an occipital and frontopolar spike (the Fp-O spike) is characteristic of Panayiotopoulos syndrome (PS). This phenomenon is also seen in various other types of epilepsy, particularly those that occur in childhood. Using dipole analysis and sequential mapping, we investigated the characteristics of the Fp-O spike observed in seven patients with PS and six patients with symptomatic localization-related epilepsy in childhood (SLE). *Methods:* We analyzed both one averaged spike and 20 manually selected successive individual Fp-O spikes for each patient through sequential topographical mapping with steps of 10 ms from 40 ms before to 40 ms after the negative maximum peak of each spike. For dipole analysis, a period of 40 ms before the maximum negative peak of the averaged spike in each patient was examined using equivalent current dipole localization software. *Results:* Sequential mapping revealed that occipital negative peaks preceded frontal negative peaks in all of the PS patients, as well as in two of the six SLE patients. The four remaining SLE patients did not exhibit preceding occipital peaks. In all of the patients with PS, representative dipole locations were in the posterior area, whereas in SLE patients they were scattered over more anterior areas. The estimated sources of the Fp-O and O spikes appeared to have the same position and orientation in the two PS patients. *Conclusion:* We conclude that Fp-O spikes in PS occur as the result of a rapid spread of epileptic activity from the posterior areas to the anterior areas of the brain. Fp-O spikes in PS patients show a uniform topographical pattern and dipole location, whereas those in other patients show more heterogeneity in these features. These findings support the homogeneity of PS and thus its designation as a syndrome.

Keywords: Occipital and frontopolar spike; Panayiotopoulos syndrome; Sequential mapping; Dipole analysis; Spike analysis

1. Introduction

Panayiotopoulos syndrome (PS) is a common type of benign localization-related epilepsy in childhood similar to benign childhood epilepsy with centro-temporal spikes (BECTS) [1,2]. One of the most important characteristics of this syndrome is the existence of multifocal extra-occipital spikes in addition to the usually predominant occipital interictal spikes [1–3]. In a previous study, we observed dense dipole locations in the mesial occipital area and high intraindividual and interindividual dipole stability in PS, characteristics that are similar to those seen in BECTS [4–7].

The synchronous occipital and frontopolar spike phenomenon (the Fp-O spike) is a characteristic of PS. This type of spike discharge is also seen in various other types of epilepsy, particularly those that occur in childhood. In contrast to bilateral synchronous discharges, the synchronous occipital and frontopolar spike phenomenon, which involves intrahemispheric synchrony, has not yet been fully investigated [8].

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Sequential mapping and dipole localization analysis are well known to be useful tools for objectively investigating spike morphology and location [4,9]. In this study, we investigated the characteristics of Fp-O spikes both in patients with PS and in patients with other types of localization-related childhood epilepsy using dipole analysis and a sequential mapping technique.

2. Subjects and methods

From the pool of outpatients who had electroencephalograms (EEGs) recorded between 2004 and 2006, we selected patients who had both Fp-O spikes (synchronous occipital and frontopolar spike) and independent occipital spikes appearing either in the same EEG

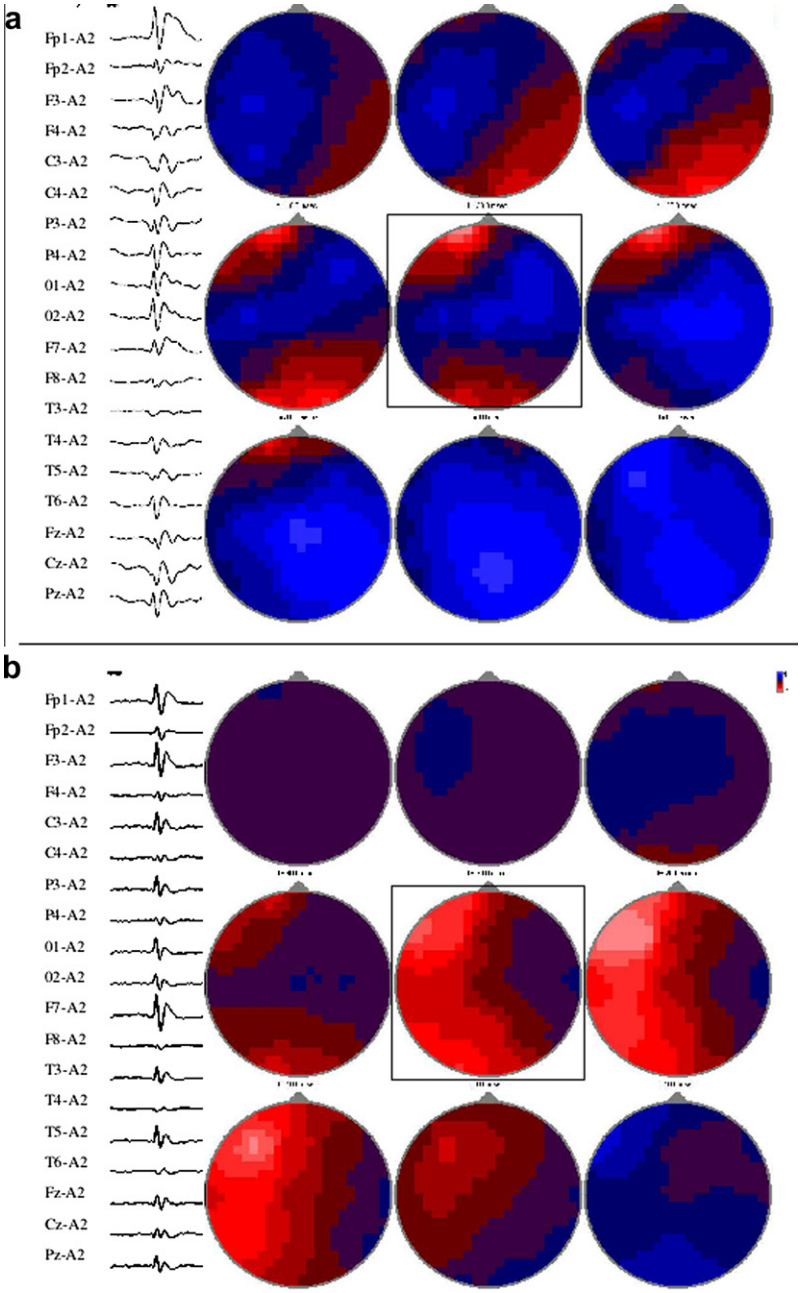

Fig. 1. Maps illustrating type O and non-O type spike sequences. (a) Sequential mapping of a patient with PS (case 1): an example of a type O map. The center map enclosed by the square is the main negative peak of the frontal spike. Nine sequential maps of the ascending and descending phases of the spikes are displayed with steps of 10 ms. The negative extreme is pink, the positive extreme is light blue, and zero is purple. Note that the first map already shows the right occipital negative peak and that this pattern continues in the three maps in the upper row. (b) Sequential mapping of a patient with SLE (case 8): an example of a non-O type map. The patient had a left frontal infarction during an operation to correct a congenital heart defect. The first two maps have no clear peak in any area. The third map shows a small negative peak in the occipital area associated with a smaller frontal negative peak. The fourth map has two negative peaks in the frontal and occipital areas. The preceding negative peak in the posterior area is not obvious in this map sequence.