Chapter 31
Evaluation of Cognitive Function in Migraine Patients: A Study Using Event–Related Potentials

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ABSTRACT
Cognitive impairments are observed in a portion of patients with migraines, but the underlying mechanisms for this impairment are not known. Event-related potentials (ERPs) have been recorded to clarify the mechanism, and the ERPs suggest that migraineurs exhibit exacerbated attention, executive dysfunction, and lack of habituation. Many factors, such as migraine phase, subtype, illness severity and duration, and preventive medicine use, are directly and indirectly involved in the cognitive function of migraine patients. Few reports have systematically considered these factors during the evaluation of cognitive function in migraine patients. In addition, the neuroanatomical basis for these cognitive dysfunctions is not clear. Recently, spatiotemporal analyses of ERPs using multichannel EEG recording have been developed, which might aid in the clarification of the relationships between cognitive dysfunction and the underlying neuropathological mechanisms. The relationships between the cortical electrical activity distribution of ERP components using standardized low-resolution brain electromagnetic tomography (sLORETA) and pathogenic factors were clarified in this study.

INTRODUCTION
Migraine is a common, chronic neurovascular disorder that affects approximately 15% of the population and entails attacks of severe, incapacitating headache (Goadsby et al., 2002). Migraine patients have altered perceptions and complain of difficulties in thinking or remembering (Drake et al., 1989). Cognitive impairments are observed in some patients with migraine. An attentional bias is an important mechanism for migraine, which is consistent with the psychobiological perspective of chronic pain. However, the factors that result
in the cognitive impairments that are identified by event-related potentials (ERPs) P3 of migraine patients have not been delineated (Drake et al., 1989; Wang et al., 1995; Evers et al., 1997; Zohsel et al., 2008) (Table 1).

### BACKGROUND

The Mini-Mental State Examination revealed no differences in cognitive function between migraine headache patients and people without headaches, which suggests the absence of general cognitive dysfunction in migraine patients (Pearson et al., 2006). A more detailed evaluation of cognitive function is necessary to determine whether migraine patients exhibit specific cognitive impairment.

### MAIN FOCUS OF THE CHAPTER

The relationships between ERPs and various behavioral data, such as performance, subtype, severity, duration, and preventive medicine use, was evaluated to clarify the neurophysiological mechanism of cognitive impairments in migraine patients. A standardized low-resolution brain electromagnetic tomography (sLORETA) (Pascual-Marqui, 2002) evaluated the relationships between the cortical electrical activity distribution of ERP components and pathogenic factors.

### Participants

Thirty-one patients with migraine were enrolled during headache-free periods, and number of these patients continued preventive treatment. Migraine diagnosis was performed using the international classification of headache disorders II (Headache Classification Subcommittee of the International Headache Society, The International Classification of Headache Disorders: 2nd edition, 2004). Clinical subtype (with/without aura), severity, duration, and preventive drug use were evaluated. Headache severity was assessed using the Headache Impact Test-6 (HIT-6) (Table 2).

### Table 1. P3 data of migraine patients in the previous reports

<table>
<thead>
<tr>
<th></th>
<th>P3 latency</th>
<th>P3 amplitude</th>
<th>Task error or reaction time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drake, 1989</td>
<td>↑</td>
<td>↓</td>
<td>?</td>
</tr>
<tr>
<td>Wang, 1995</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Evers, 1997</td>
<td>↑</td>
<td>↑</td>
<td>→</td>
</tr>
<tr>
<td>Zohsel, 2008</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
</tr>
</tbody>
</table>

### Table 2. Summary of subjects (n=31)

<table>
<thead>
<tr>
<th></th>
<th>Sex (M/F)</th>
<th>10/21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ±SD), years</td>
<td>34.8±10.7</td>
<td></td>
</tr>
<tr>
<td>Aura (with/without)</td>
<td>12/19</td>
<td></td>
</tr>
<tr>
<td>Duration of illness, years</td>
<td>15.0±11.1</td>
<td></td>
</tr>
<tr>
<td>Frequency of attack per month (mean ±SD)</td>
<td>5.1 +/- 3.3</td>
<td></td>
</tr>
<tr>
<td>Preventative drug (with/without)</td>
<td>12/19</td>
<td></td>
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</tbody>
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