Variability in P3a Index Automatic Orienting Response Dysfunction in Schizophrenic Patients Without Auditory Hallucinations

M. Rabella Figueras1, E.M. Grasa Bello1,2, S. Martínez-Horta1, R. Fernández de Bobadilla1, I. Corripio Collado1,2, A. Keymer Gausset1, M. Sierra Blasco1,2, J. Sanjuán Arias1,2, F. Artigas Pérez1,2, V. Pérez Solà1,2, J. Riba Serrano1,2

1 Department of Psychiatry, Institut d’Investigació Biomèdica Sant Pau (IB-Sant Pau). Hospital de la Santa Creu i Sant Pau. Universitat Autònoma de Barcelona (UAB). Barcelona, Spain.
2 Centro de Investigación Biomédica en Red de Salud Mental (CIBERSAM), Spain.
3 Movement Disorders Unit. Department of Neurology, IB Sant Pau. Hospital de la Santa Creu i Sant Pau. UAB. Barcelona, Spain.
4 Department of Psychiatry. Hospital Clínic Universitat. Universitat de València. Valencia, Spain.
5 Department of Neurochemistry and Neuropharmacology, Institut d’Investigacions Biomèdiques de Barcelona (IDIBAPS), CSIC: Barcelona, Spain.
6 Parc de Salut Mar. INAD. UAB: Barcelona, Spain.
7 Human Experimental Neuropsychopharmacology Institut d’Investigació Biomèdica Sant Pau (IB-Sant Pau). Hospital de la Santa Creu i Sant Pau. UAB. Barcelona, Spain.

Mrabella@santpau.cat

PURPOSE

Schizophrenia is characterized by marked disturbances of attention and information processing. Patients experience difficulty focusing on relevant cues and avoiding distraction by irrelevant stimuli. However, contradictory results have been reported in studies of event-related brain potential (ERP) responses to stimuli in attentional tasks.

Using the auditory oddball paradigm, the centro-parietal P3b component of the ERP which appears after task-relevant stimulus detection has been consistently reported to be reduced in schizophrenia [1]. However, mixed results have been observed for the novelty P3a, a fronto-central component elicited by task-irrelevant stimuli. Some studies have found novelty P3a amplitude reductions [1] suggesting a disturbed involuntary orienting response in schizophrenia. However, others have observed higher amplitudes than in healthy subjects [2] suggesting increased salience of irrelevant stimuli in certain patients.

Given the clinical heterogeneity of the schizophrenia spectrum disorders, we wished to explore if the presence/absence of persistent auditory hallucinations, an important phenotype associated with abnormal emotional processing, could account for the contradictory results reported in the literature.

METHOD

We studied the P3b and P3a components of the auditory ERP in three groups of individuals:

11 schizophrenic patients presenting chronic auditory hallucinations (AH+);
7 schizophrenic patients free of auditory hallucinations (AH-);
10 healthy controls (HC).

EEG

The electroencephalogram (EEG) was recorded from 19 standard scalp sites (Fp1/2, F3/4, C3/4, T3/4, T5/6, P3/4, O1/2, F7/8, Fz, Cz, Pz) referenced to the two mastoid leads.

Task

An auditory oddball paradigm containing frequent, infrequent (target) and novel task-irrelevant stimuli was administered. Participants were instructed to ignore the frequent and novel stimuli and to respond as quickly and accurately as possible to the target stimuli. Responses were given by button press.

RESULTS

<table>
<thead>
<tr>
<th>Sample</th>
<th>P3a Peak Value at Cz Mean±SD</th>
<th>P3b Peak Value at Pz Mean±SD</th>
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</thead>
<tbody>
<tr>
<td>AH+</td>
<td>14.4±4.9</td>
<td>5.4±4.5</td>
</tr>
<tr>
<td>AH-</td>
<td>14.4±4.9</td>
<td>5.4±4.5</td>
</tr>
<tr>
<td>HC</td>
<td>6.7±5.5</td>
<td>3.9±4.1</td>
</tr>
</tbody>
</table>

- Results showed that compared to controls, both AH- and AH+ schizophrenic patients showed reduced amplitudes of the P3b.
- No differences were found between the patient groups for this component.

Fig. 2: P3a (green) and P3b (red) means of AH+ patients, AH- patients, and healthy controls.

AH+
- Reduced P3b
- Maintained P3a

AH-
- Reduced P3b
- Reduced P3a

Healthy controls
- P3b
- P3a

Thus, whereas the P3b was similarly reduced in the two patient groups, the amplitude of the P3a was not homogeneous in the schizophrenic population and depended on the presence or absence of auditory hallucinations.

CONCLUSIONS

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