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Short communication

Ventricle size and P300 in schizophrenia

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Summary. Both ventricular enlargement and reduced P3 amplitudes are consistent findings in schizophrenic patients, suggesting that the two measures reflect a common underlying pathophysiological process in schizophrenia. Investigating 14 stabilized schizophrenic outpatients, a relationship between the size of the lateral ventricles as well as of the third ventricle on CT scans and the auditory event-related P3 amplitude was, however, not found. This negative result suggests that ventricular enlargement and reduced P3 amplitudes in schizophrenics reflect different pathophysiological processes. It is assumed that the P3 amplitude is related rather to abnormalities in the temporal lobe of schizophrenic patients.

Key words: Ventricle brain ratio – Cranial computed tomography – Auditory event-related potentials – P300 – Schizophrenia

Introduction

Ventricular enlargement assessed in CT and MRI scans (Gattaz et al. 1990; Nasrallah 1990; Raz and Raz 1990; Van Horn and McManus 1992) as well as reduction of the auditory event-related P3 amplitude (Cohen 1990; Pritchard 1986) are consistent findings in schizophrenic patients. Possibly, these two findings reflect a common underlying process in the pathophysiology of schizophrenia. Perinatal and/or genetic factors could result in early neurodevelopmental abnormalities leading to enlarged ventricles (Cannon et al. 1989; DeLisi et al. 1986; Lewis 1990; Roberts 1991) as well as to neuronal malformations in neo- and allocortical structures (Akbarian et al. 1993; Arnold et al. 1991; Conrad et al. 1991). This cortical disorganization should be associated with a reduced P3 amplitude because intact arrangement of cortical neurons is necessary for the electrogenesis of the P300 (Halgren et al. 1986; Johnson 1993; Knight 1990).

In the present study, we investigated the relationship between the ventricle size measured by CT scans and the auditory event-related P3 amplitude in stabilized schizophrenic outpatients.

Materials and methods

Event-related potentials (ERP) and CT scans were obtained in 14 stabilized schizophrenic outpatients diagnosed according to ICD-9 (mainly 295.3) and RDC criteria (Table 1). They were investigated during a follow-up study on long-term neuroleptic treatment (Pietzcker 1985). Patients were included in the study after a 3-month stabilization period following clinical discharge. ERP were recorded

Table 1. Description of the 14 schizophrenic outpatients (*BPRS* brief psychiatric rating scale; *CPZ* chlorpromazine equivalents; *ERP* event-related potentials; *GAS* global assessment scale; *VBR* ventricle brain ratio)

Age	31.4 ± 8.1 years
Gender	4 females, 10 males
Age at first schizophrenic episode	26.6 ± 6.9 years
Patients with	
– perinatal complications	2
– positive family history (schizophrenia; first-degree relatives)	1
Duration of illness	4.9 ± 5.8 years
Number of prior hospitalizations	3.1 (1–10)
Neuroleptic medication at ERP recording day	199.2 ± 177.4 mg CPZ/day
Psychopathological state at ERP recording day	
– BPRS sum score	25.1 ± 4.6
– GAS	62.7 ± 11.3
VBR1/2	5.5 ± 3.7
VBR3	0.5 ± 0.3
P3 amplitude	5.9 ± 3.5 μV

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in an auditory oddball paradigm: binaural tones (80% 800 Hz; 20% 1600 Hz; ISI 1.1 s; 65 dB SPL) were presented in random order by headphones. The patients were asked to close their eyes and to count the rare tones silently. In every run the responses to 240 frequent and to 60 rare tones were averaged. In the first run we recorded from Cz to linked mastoids, and in the second and third run bilaterally from C3 and C4 to linked mastoids. Bandpass filters (two-pole Butterworth filters with 12 dB/octave roll-off) were set to 1 and 30 Hz. All trials with voltages exceeding ± 50 μV were excluded from averaging. Sampling was done with a rate of 683 Hz from 150 ms prestimulus to 500 ms poststimulus (Pathfinder II, Nicolet). The P3 amplitude was determined as the most positive value within the latency window from 240 to 390 ms in relation to the prestimulus baseline for the rare tones.

The ventricle sizes were assessed planimetrically in CT scans using automatic detection of cerebrospinal fluid (CSF; Hounds-field units). The two slices of the cranial CT assessing the maximal extension of the lateral and third ventricles were chosen for automatic analysis. The number of pixels with values above the density of the CSF was counted for the intracranial space (to measure the external and internal CSF space) and again solely for the lateral and third ventricles. The area of the lateral ventricles and the third ventricle was then divided by the area of the brain for the measured slice to obtain the ventricle brain ratio. Ventricle brain ratios were calculated for the third ventricle (VBR3) and collectively for the lateral ventricles together (VBR1/2).

Results

In the 14 schizophrenic outpatients reported here, the ventricle sizes (VBR1/2 and VBR3) were not significantly correlated to the auditory event-related P3 amplitude in any of the three runs (Table 2).

Since residual symptomatology was found to be negatively correlated to the P3 amplitude, as revealed in 88 schizophrenic outpatients (Juckel et al. 1992), P3 amplitude values were corrected by partialling out the present psychopathological state (BPRS sum scores). Again, no relationship between VBR1/2 or VBR3 and the P3 amplitude could be observed.

Ventricle sizes were not related to age of onset, duration of illness, BPRS scores, medication level or number of prior hospitalizations.

Discussion

Neither the size of the lateral ventricles nor that of the third ventricle were related to the auditory event-related P3 amplitude. This finding confirms the few reports in the literature. No relationship between the size of lateral and third ventricles in CT scans and the auditory event-related P3 amplitude was found in chronic schizophrenic patients (Romani et al. 1987). This is supported by a recent MRI study concerning the lateral ventricles (Blackwood et al. 1991). It can, therefore, be concluded that a reduced P3 amplitude and ventricular enlargement reflect different processes in the pathophysiology of schizophrenia.

In this context it is of interest that a reduced auditory event-related P3 amplitude was found to be related to both left sylvian fissure enlargement and gray matter volume reduction of the left superior temporal gyrus (McCarley et al. 1989, 1993). This suggests that a reduced P3 amplitude in schizophrenics indicates certain abnormalities in the temporal lobe unrelated to ventricular enlargement. Findings showing that ventricular enlargement is not correlated to various measures of the temporal lobe, including gray matter reduction, in MRI studies of schizophrenic patients (DeLisi et al. 1992; Kelsoe et al. 1988; Suddath et al. 1989) support this view.

Table 2. Spearman correlation coefficients for the relationship between the size of the lateral ventricles (VBR1/2) as well as of the third ventricle (VBR3) and the P3 amplitude in 14 schizophrenic outpatients

	Auditory event-related P3 amplitude				
	Run 1	Run 2		Run 3	
	Cz	C3	C4	C3	C4
VBR1/2	0.16	−0.05	−0.16	−0.16	−0.11
VBR3	0.06	−0.09	−0.20	−0.16	−0.18

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