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Psychiatry Research: Neuroimaging 132 (2004) 107–115

PSYCHIATRY RESEARCH NEUROIMAGING

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Temporal pole morphology and psychopathology in males with schizophrenia

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Received 16 February 2004; received in revised form 19 August 2004; accepted 12 September 2004

Abstract

A dysfunction of the paralimbic system has been implicated in the pathophysiology of schizophrenia. The temporal pole (TP) is a relevant component of the paralimbic circuit. Functional and structural imaging studies have shown circumscribed abnormalities in the TP. Subjects were 30 controls and 30 schizophrenia patients. Cortical surface size and gray matter volume of the TP were accurately measured to explore the morphology of the TP cortex and the relationship of TP measures to clinical variables in patients with schizophrenia. Correlations between structural measures and clinical dimensions, duration of illness, and cumulative neuroleptic exposure were determined. Neither macroscopic abnormalities in the TP nor differences in the pattern of asymmetry were demonstrated. The TP volume was correlated negatively to the psychotic and disorganized dimension scores. No other significant correlations were found. No morphological abnormalities in the TP were found in patients with schizophrenia. Interestingly, a reduction in the TP volume, a higher-order multimodal association cortex, was associated with the severity of disorganized and psychotic symptoms.

Keywords: Psychosis; Brain; Gray matter; Temporal pole; Neuroimaging; MRI

1. Introduction

A general dysfunction of the limbic and paralimbic systems has been hypothesized to be an underlying pathophysiological mechanism in schizophrenia (Torrey and Peterson, 1974). Most investigations on morphological characteristics of the temporal lobe in schizophrenia have focused on the study of volumetric abnormalities of temporolimbic structures (i.e., hippo-

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doi:10.1016/j.pscychresns.2004.09.002

campus, parahippocampus gyrus, and amygdala), and less attention has been paid to possible abnormalities in one of the major paralimbic (mesocortical) components of the temporal lobe, the temporopolar cortex [or temporal pole (TP)]. From our laboratory and others, previous functional studies have shown that patients with schizophrenia have circumscribed abnormalities in several limbic/paralimbic areas, including the temporal pole in schizophrenia (Andreasen et al., 1996; Ragland et al., 1998; Kim et al., 2000a).

The TP is reciprocally connected with cortical and subcortical brain regions, as well as with other medial and lateral temporal regions (Markowitsch et al., 1985; Moran et al., 1987), and is a component of the paralimbic circuit along with the orbitofrontal cortex (OFC) and the insular cortex (Mesulam and Mufson, 1982). The TP has been considered to be engaged in various cognitive functions, such as olfaction, social and emotional behavior, attentional and mnemonic processes, and auditory function, and therefore has been thought to play a role in affectional-sensory integration (Nakamura and Kubota, 1996; Gloor, 1997; Mesulam, 2000).

We have already described morphometric abnormalities of the other nodes of the paralimbic circuit (the OFC and the insular cortex) in patients with schizophrenia compared with healthy individuals (Crespo-Facorro et al., 2000a,b). It is noteworthy that these structural anomalies in paralimbic regions have been associated with the severity of psychotic symptoms (i.e., hallucinations and delusions) and social dysfunction in schizophrenia (Crespo-Facorro et al., 2000a; Chemerinski et al., 2002). Previous voxel-based morphometric studies of temporal subregions in patients with chronic schizophrenia have pinpointed a significant volume reduction of bilateral temporal pole gray matter (Wright et al., 1999; Gur et al., 2000). Nonetheless, further studies using anatomically defined (regions of interest) ROIs are needed to replicate these findings and to investigate the structure–function relationship of TP cortex. In the present study, we follow up our structural studies of paralimbic regions by exploring the morphology of the TP cortex using cortical parcellation in a group of patients with schizophrenia designed to represent a broad range of clinical variables such as duration of illness, neuroleptic exposure, and symptom severity. The relationship of TP measures to clinical variables, including symptom dimensions (negative, psychotic, and disorganized), cumulative dose of neuroleptic, and duration of illness is also investigated.

2. Methods

2.1. Subjects

One of the largest factors affecting the variance of general and regional cerebral volume is gender (Nopoulos et al., 2000).Therefore, to eliminate this confound, we limited the subject groups to one gender. Furthermore, because male patients with schizophrenia have been found to have more structural brain abnormalities than their female counterparts (Nopoulos et al., 1997), we chose first to study men. Subjects consisted of a sample of 30 patients with schizophrenia drawn from admissions to the inpatient unit of the University of Iowa Mental Health Clinical Research Center and 30 healthy volunteers recruited from the community through newspaper advertisements.

The patient group (n=30) was designed to represent a wide variety of phenomenologic profiles to provide sufficient variance in multiple measures, including severity of illness, duration of illness, and exposure to neuroleptics. In addition, to minimize confounding factors in brain morphology such as gender and handedness, the sample was restricted to right-handed males. Inasmuch as atypical neuroleptics have been shown to have a different effect on the morphology of brain tissue than that of typical neuroleptics (Corson et al., 1999; Lang et al., 2001), subjects who had been treated with typical neuroleptics only were included. That is, none of the patients had ever received atypical neuroleptics such as clozapine, risperidone, olanzapine, or seroquel. Of the 30 patients, 6 were “first episode” (defined as first psychiatric hospitalization), 11 were “recent onset” (within 5 years), and the remaining 13 were “chronic.”

All patients met DSM-IV criteria for schizophrenia and were evaluated with the Comprehensive Assessment of Symptoms and History (CASH; Andreasen et al., 1992a,b). Clinical symptoms were rated using the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983a) and the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1983b). Summary scores for three dimensions of