Schizophrenia Research 160 (2014) 35–42

Contents lists available at ScienceDirect

Schizophrenia Research

journal homepage: www.elsevier.com/locate/schres

Association between symptoms of psychosis and reduced functional connectivity of auditory cortex

Viola Oertel-Knöchel [a,*], Christian Knöchel [a], Silke Matura [a], Michael Stäblein [a], David Prvulovic [a], Konrad Maurer [a], David E.J. Linden [c], Vincent van de Ven [b]

[a] Laboratory of Neurophysiology and Neuroimaging, Dept. of Psychiatry, Psychosomatic Medicine and Psychotherapy, Goethe Univ., Frankfurt/Main, Germany
[b] School of Psychology, University of Maastricht, Maastricht, The Netherlands
[c] MRC Centre for Neuropsychiatric Genetics & Genomics, Institute of Psychological Medicine and Clinical Neurosciences, School of Medicine, Cardiff University, United Kingdom

ARTICLE INFO

Article history:
Received 10 June 2014
Received in revised form 26 September 2014
Accepted 25 October 2014
Available online 11 November 2014

Keywords:
Resting-state fMRI
Schizophrenia
Schizophrenia spectrum
Heschl's gyrus

ABSTRACT

We have previously reported altered functional asymmetry of the primary auditory cortex (Heschl's gyrus) of patients with schizophrenia (SZ) and their relatives during auditory processing. In this study, we investigated whether schizophrenia patients have altered intrinsic functional organization of Heschl's gyrus (HG) during rest. Using functional magnetic resonance imaging (fMRI), we measured functional connectivity between bilateral HG and the whole brain in 24 SZ patients, 22 unaffected first-degree relatives and 24 matched healthy controls.

SZ patients and relatives showed altered functional asymmetry in HG and altered connectivity between temporal and limbic areas in the auditory network during resting-state in comparison with healthy controls. These changes in functional connectivity correlated with predisposition towards hallucinations in patients and relatives and with acute positive symptoms in patients.

The results are in line with the results from task-related and symptom-mapping studies that investigated the neural correlates of positive symptoms, and suggest that individual psychopathology is associated with aberrant intrinsic organization of auditory regions in schizophrenia. This might be evidence that reduced hemispheric lateralization and reduced functional connectivity of the auditory network are trait markers of schizophrenia.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

One notable human characteristic is the hemispheric laterality of language and speech processing. For example, in most healthy right-handers, the left Heschl's gyrus (HG) is larger than its right hemisphere counterpart (Chance et al., 2008).

Abnormal hemispheric asymmetry has been proposed to be a key morphological correlate of the manifestation of schizophrenia (SZ) symptoms (Stephane et al., 2001; Frith, 2005), being associated with impaired language processing and the experience of auditory verbal hallucinations (AVH) (Oertel-Knochel and Linden, 2011; Oertel-Knochel et al., 2012). Moreover, numerous neuroimaging studies showed correlations between AVHs and abnormal structure and function within the temporal lobe, including the HG (e.g. Chance et al., 2006; Dierks et al., 1999; Oertel et al., 2010; Sommer et al., 2004; van de Ven et al., 2005).

Functional neural networks, such as the language processing network, are mostly investigated using two different approaches: (1) through assessment of activity patterns during experimental tasks (Meyer-Lindenberg et al., 2001; Lawrie et al., 2002; Calhoun et al., 2004; Ford et al., 2007; Garrity et al., 2007) or (2) through resting-state functional imaging (e.g. resting-state fMRI). Resting-state fMRI measures brain activation in the absence of any active or attentional task performance. This makes the intrinsic characteristic of the neural architecture accessible while avoiding potential task-related between-group biases. In the current study, we examined resting-state functional connectivity between the HG and whole-brain in SZ patients, their first-degree relatives and matched healthy control participants. Seed regions (regions of interest — ROIs) within the HG were identified using functional activation clusters related with an auditory perceptual language task (Oertel et al., 2010).

Most previous resting-state fMRI studies in schizophrenia focused on the default mode network (DMN) (Fox and Raichle, 2007) and related regions. Comparatively, few resting-state fMRI studies investigated the intrinsic functional connectivity within the auditory network or between speech or language regions and other brain networks in schizophrenia (Gavrilescu et al., 2010; Rotarska-Jagiela et al., 2010; Vercammen et al., 2010; Hoffman et al., 2011; Wolf et al., 2011; Sommer

* Corresponding author at: Laboratory of Neurophysiology and Neuroimaging, Dept. of Psychiatry, Psychosomatic Medicine and Psychotherapy, Heinrich-Hoffmann-Str. 10, Goethe-University, 60528 Frankfurt, Germany. Tel.: +49 69 6301 7181; fax: +49 69 6301 3833.
E-mail address: Viola.Oertel@kgu.de (V. Oertel-Knöchel).

http://dx.doi.org/10.1016/j.schres.2014.10.036
0920-9964/© 2014 Elsevier B.V. All rights reserved.

et al., 2012; Oertel-Knochel et al., 2013; Shinn et al., 2013). These studies suggested abnormal interhemispheric auditory cortex connectivity. Further studies showed altered functional connectivity within motor and speech perception areas in hallucinating SZ patients (Ford et al., 2001, 2007; Shergill et al., 2005).

An important factor in understanding intrinsic functional brain dynamics in schizophrenia is the investigation of neural networks in genetically-related non-clinical populations, such as prodromal patients, or non-clinical relatives of diagnosed patients. The investigation of first-degree relatives is useful for screening of inheritable or genetic effects on neuronal network function and may thus help identifying potential endophenotypes for schizophrenia (Repovs et al., 2011). A number of previous resting-state studies in schizophrenia showed functional or anatomical findings in non-clinical relatives similar to diagnosed patients (Repovs et al., 2011; Whitfield-Gabrieli et al.; Oertel et al.), which may indicate the presence of pathophysiological mechanisms or endophenotypes in populations in which symptoms or impairments are not (yet) manifested. However, investigation of HG-related connectivity in non-clinical phenotypical populations is currently missing.

In this study, we examined potential associations between HG-seeded functional connectivity and symptoms of psychosis in three groups of participants: diagnosed SZ patients, first-degree relatives and healthy controls. We hypothesized that patients and relatives show decreased functional connectivity, as well as laterality, in comparison to healthy controls. We hypothesized that the functional connectivity and asymmetry pattern of HG would predict symptoms of psychosis. We discuss our findings in light of the current literature, and suggest that aberrant HG functional connectivity may point to a clinical relevance in diagnosed patients as well as pre-clinical populations.

2. Methods

2.1. Participants

In the current study, we included 24 SZ patients, all diagnosed with paranoid schizophrenia according to DSM-IV criteria (American Psychiatric Association, 1994). All were inpatients of the Department of Psychiatry of the Goethe University, Frankfurt am Main, Germany and were treated with neuroleptic medication (all with atypical antipsychotics and four patients additionally with typical neuroleptics) at the time of testing. Table 1 lists demographic parameters, individual psychopathology and duration of disease of the patients.

We further included twenty-two first-degree relatives (REL) of patients with paranoid SZ and twenty-four healthy controls (CON) in the study (Table 1). ANOVAs of variates of age and years of (parental) education, and Chi-square test of sex showed no significant differences between the groups. Contact to the relatives was established through participating patients, from a support group for relatives of SZ patients, and through local media advertisements. The relatives were requested to provide a letter from the attending psychiatrist confirming the patients' diagnosis. In addition, an interview was conducted with each SZ patient's psychiatrist (asking for symptoms, history and medication) to confirm the diagnosis. Additionally, all relatives were asked to bring their own identification as well as of the related patient in order to prove the relationship. We further conducted a semi-structured interview with the relatives, assessing premorbid adaptation of their related SZ patients in order to back-up the diagnosis. The relative group included parents ($n = 8$) and siblings ($n = 11$) of SZ patients. The relatives and control groups were matched to the SZ patient group in age, handedness (only right-handed participants) (assessed using the Edinburgh Inventory; Oldfield, 1971), gender and education (see Table 1). None of the participants in the control group had any positive family history of schizophrenia or any other psychiatric disorders. Exclusion criteria for control and relative participants were any psychiatric disorder including Axis I and Axis II disorders according to DSM-IV, left-handedness, current drug-abuse, neurological pathology and inability to provide informed consent.

After complete description of the study to the subjects, written informed consent was obtained from all participants. Experimental procedures were approved by the ethical board of the medical department of the Goethe-University, Frankfurt/Main, Germany. Auditory analysis by an otologist revealed normal hearing. The anatomical MRI scans were reviewed by a neuroradiologist who did not find pathology in the auditory cortex or surrounding areas. All subjects were native German speakers and part of another study of the group (see Oertel-Knochel et al., 2013).

2.2. Assessment of psychopathology

The German version of the Structured Clinical Interview for DSM-IV ('Strukturiertes Klinisches Interview für DSM-IV', Wittchen et al., 1996) was carried out with the participants of all three groups. All relatives

Table 1
Demographic and illness variables of samples. Continuous variates are presented by mean (SD), nominal variates are presented as frequencies. CON = controls, REL = relatives, SZ = schizophrenia patients.

	SZ	REL	CON	F/χ^2	P	Post-hoc		
						CON > REL	CON > SZ	REL > SZ
N	24	22	24					
Age (y) M (SD)	37.9 (7.84)	39.35 (10.75)	40.84 (10.23)	3.05	ns	ns	ns	ns
Gender (m/f)	12/12	10/12	13/11	0.66	ns	ns	ns	ns
Handedness (l/r)	0/24	0/22	0/24	–	–	*		
Education (y) M (SD)	15.08 (2.51)	15.10 (4.76)	16.14 (2.98)	2.5	ns	ns	ns	ns
Parental education (y)	12.87 (2.31)	12.57 (2.18)	12.92 (2.68)	2.13	ns	ns	ns	ns
M (SD)	12.95 (2.83)	13.43 (2.98)	13.13 (2.97)	2.45	ns	ns	ns	ns
Mother								
Father								
RHS	33.0 (7.88)	25.67 (1.39)	23.01 (2.98)	28.12	***	**	***	**

Illness		Medication		PANSS			
Onset (y)	24.12 (5.58)	Atypical/typical	21/4	Total	63.29 (5.24)	Hallucinations	3.14 (1.23)
Duration of disease (y)	13.52 (6.54)	CZ equivalence (mg/day)	610.42 (387.3)	Pos.	15.45 (3.07)	General	32.65 (4.01)
				Neg.	15.19 (1.97)		

ns = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Download English Version:

https://daneshyari.com/en/article/6824449

Download Persian Version:

https://daneshyari.com/article/6824449

Daneshyari.com