

Do social cognitive deficits in schizophrenia affect the mentalizing network: A transcultural fMRI study

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Introduction

It is well known that patients with schizophrenia have social cognitive deficits (Penn et al., 2008). However, knowledge is needed regarding the neural basis of these deficits. The Animated Triangles test (Abell et al., 2000) is one of the most widely used social cognitive tests in functional imaging of patients with schizophrenia (Das et al., 2012a; Das et al., 2012b; Koelkebeck et al., 2013; Martin et al., 2016; Pedersen et al., 2012). However, results are complex and diverging, mostly due to differences in how the test was administered during scanning, differences in duration of illness (ranging from first-episode to chronic samples), solely male populations, or populations of different ethnic origin (Bliksted et al., 2016). Recently, the WU-Minn Human Connectome Project has developed a validated social cognitive fMRI paradigm based on the Animated Triangles test (Barch et al., 2013; Hillebrandt et al., 2014). To our knowledge, the HCP social cognitive paradigm has only been used in healthy subjects so far.

Aims

In this study we wanted to investigate the impact of social cognitive deficits on the neural mentalizing network in patients with schizophrenia.

We used the HCP Social cognition fMRI paradigm in a transcultural study in China and Denmark in order to investigate cultural similarities between Chinese and Danish patients with schizophrenia

Materials and methods

Subjects

This poster only involves data from the Danish sample. Patients with first-episode schizophrenia were recruited from OPUS, Clinic of first-episode schizophrenia, Aarhus University Hospital. Healthy controls were matched based on age, gender and years of education. Demographics etc in Table 1.

Experimental fMRI paradigm

We used the social cognition fMRI test paradigm from the Human Connectome Project (HCP) (Barch et al., 2013; Hillebrandt et al., 2014). Permission to use the paradigm was received from the WU-Minn HCP consortium (<http://www.humanconnectome.org>). This paradigm is known to induce activation in cortical regions that have previously been associated with social cognition (Barch et al., 2013; Castelli et al., 2002; Castelli et al., 2000; Hillebrandt et al., 2014; Wheatley et al., 2007).

Total duration of the paradigm was 12.54 minutes.

fMRI data acquisition

The functional images were acquired on a 3 Tesla Magnetom Trio MRI system (Siemens, Erlangen, Germany) using a 32-channel radiofrequency head coil. The T2*-weighted echo planar images (EPI) consisted of 40 slices with 3 mm thickness acquired in descending order with the following parameters: repetition time (TR) = 2 sec, echo time (TE) = 27 ms, flip angle = 90°, field of view (FOV) = 192 x 192 mm and in-plane resolution = 64 x 64. Soft foam cushions were used to minimize head movements.

Data analysis

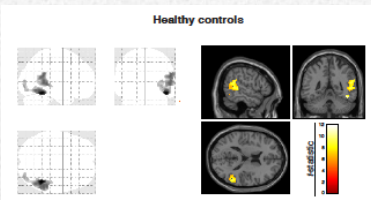
The fMRI data were analyzed using Statistical Parametric Mapping (SPM12, revision 6685). Behavioral data were analyzed using Stata IC 14 software.

Table 1 Comparison of schizophrenia patients and matched controls

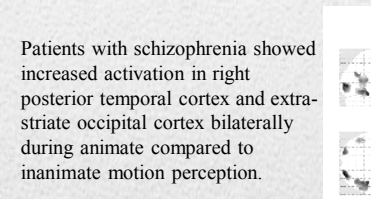
	Schizophrenia (N=24)	Healthy controls (N=25)	Statistics	P value
Age, mean(95%CI)	25.21(23.35;27.07)	24.6(22.78;26.42)	$z=0.62$	0.53 ¹
Females, N (%)	7(39)	11(61)	$\chi^2(1)=1.16$	0.28 ²
Years of education, mean (95%CI)	15.9(14.91;16.89)	14.60(13.59;15.62)	$z=1.61$	0.11 ¹
Current occupation, N (%)			$\chi^2(5)=18.0$	0.003 ²
			6	(0.001) ³
Unemployed	6(25)	1(4)		
Work	7(29)	5(20)		
Student	5(21)	19(76)		
Sick leave	3(13)	0(0)		
Pension	1(4)	0(0)		
Other	2(8)	0(0)		
SANS ^a , mean(95%CI)	8.17(7.02;9.31)	1.32(0.20;2.44)	$z=-5.55$	<0.0001 ¹
SAPS ^a , mean(95%CI)	7.08(5.97;8.20)	0.28(-0.81;1.37)	$z=-5.54$	<0.0001 ¹
PSP ^c	55.03(48.93;61.23)	86.32(83.20;89.44)	$t(34.23)=9.37$	<0.001 ⁴
GAF-F ^d	56.39(51.78;61.00)	86.56(82.14;90.98)	$z=5.56$	<0.001 ¹
WAIS-III (Est func IQ) ^e	92.96(84.49;101.43)	97.4(86.19;108.61)	$t(47)=0.65$	0.52 ⁴
Intentionality ToM ^f	14(12.67;15.33)	15.24(13.94;16.54)	$z=1.31$	0.19 ¹
Intentionality Random ^f	0.75(0.28;1.22)	1.67(0.64;2.70)	$z=-1.58$	0.11 ¹
Accuracy ToM ^f	8.04(7.26;8.82)	8.88(8.12;9.64)	$z=1.47$	0.14 ¹
Accuracy Random ^f	0.75(0.26;1.24)	2.27(0.83;3.71)	$z=-1.96$	0.05 ¹

Results

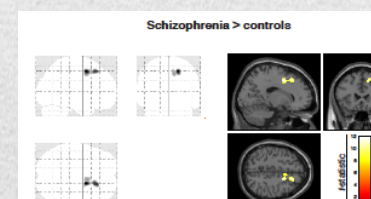
When looking at the response times as a proxy for the amount of time it took the participants to judge whether a scenario involved a social interaction, we saw that healthy controls were 112 ms slower at judging animate motion compared to inanimate motion at the group level ($t(24)=2.26$; $p=0.01$). In contrast, patients with schizophrenia showed no group difference in reaction times when judging animate or inanimate motion. When comparing patients and controls, we found no significant difference in reaction times.



Healthy controls showed increased activation in right posterior temporal cortex during animate compared to inanimate motion perception.



Patients with schizophrenia showed increased activation in right posterior temporal cortex and extra-striate occipital cortex bilaterally during animate compared to inanimate motion perception.



When perceiving an animate motion scenario, patients with schizophrenia had increased activation in the right superior frontal gyrus compared to the controls

Discussion

Behavioral data suggests that our Danish first-episode patients were high functioning compared to an “average” patient with schizophrenia were you would expect to find cognitive and social cognitive deficits 1-2 SD below healthy controls (Kern et al., 2004; Penn et al., 2008). Still, our fMRI results indicate that the patients with schizophrenia had to work harder to grasp the meaning of the animate ToM animations. More research is needed in order to differentiate between social cognitive subgroups in patients with schizophrenia. We plan to compare our current fMRI results to a Chinese sample of patients with schizophrenia in order to investigate transcultural similarities among patients and controls. Behavioral data has shown that the Chinese and Danish samples do not differ with regard to positive symptoms (SAPS), negative symptoms (SANS), social functioning (PSP, GAF-F) and age (data not shown).

As pointed out by Green et al. “social cognition can be divided into several distinct processes, which involve many different brain regions, some of which show overlap between processes” (Green et al., 2015). This indicated that overall more research is needed with well validated paradigms in order to understand the mechanisms of social cognitive deficits in different subgroups of patients with schizophrenia.

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