Neuronal Correlates of Emotion Recognition in Schizophrenia

Daniela Mier, Stefanie Lis, Karina Zygrodnik, Carina Sauer, Jens Ulferts, Bernd Gallhofer, Peter Kirsch
Centre for Psychiatry, Giessen

Background

Most of the studies testing emotion recognition have shown deficits in schizophrenia, especially in the recognition of negative emotions. While several fMRI studies investigate emotion processing in schizophrenia, only one study focussed on emotion recognition (Hempel et al., 2003). In this study the schizophrenic subjects showed hyperactivity in frontal areas and hypoactivity in the amygdala/hippocampus complex.
However, they performed worse in the emotion recognition task. This implies that at least some of the observed changes in brain activation might mirror enhanced processing demands, but not primarily a dysfunction of the involved processes.
Therefore, the aim of the present study is to analyse emotion recognition in schizophrenia with a task that ensures comparable subjective task difficulty.

Methods

Participants: 12 medicated schizophrenia outpatients and 14 healthy control subjects matched by age, education, IQ (table 1) and gender (chi-square *n.s.*).

Table 1: Demographics

	Schizophrenic participants	Control participants	Sign.
Age	31.25	33.14	*n.s.*
Education (years)	14.75	14.14	*n.s.*
IQ-fluid	117.83	120.14	*n.s.*
IQ-crystalline	110.08	114.64	*n.s.*

Study design: We applied an adaptive emotion recognition task using morphed face-stimuli showing happiness, anger, fear, disgust and no emotion (neutral). The intensity of the emotional expression was adapted individually with help of an online algorithm.

Figure 1: Study design with the example of happiness and fear

Scanning Parameters: 1,5 T GE Scanner; echo planar imaging, TR 3000 ms, TE 50 ms, 30 slices à 5 mm, interleaved acquisition

fMRI Analysis: The fMRI data were pre-processed (realigned, slice time corrected, normalised and smoothed with a 10 mm gaussian kernel) and analysed with SPM2 (www.fil.ion.ucl.ac.uk). Two models were calculated, one modelling the 5 emotions separately and one combining all emotions. Second level analysis was done with emotion specific Regions of Interest inferred from the literature: Amygdala, lateral occipital gyrus (LOC), temporal cortex and fusiform gyrus for the combined model; Inferior orbitofrontal cortex (IFC) for anger; Amygdala for fear; Insula and putamen for disgust and the nucleus accumbens (Nac) and medial frontal cortex (MFC) for happiness.

Results

Behavioral data: There were no group differences in the intensity of emotional expression required for a correct recognition of fear, anger and disgust. For the recognition of happiness the schizophrenic patients needed expressions with a higher intensity for a correct task solution.

Table 2: Adapted intensity of the emotions for both groups

	Schizophrenic participants	Control participants	Sign.
Happiness	2.36	2.01	0.008
Anger	3.40	3.26	*n.s.*
Fear	3.50	3.45	*n.s.*
Disgust	3.62	3.46	*n.s.*

Functional brain activation data:

Higher activation in the control group than in the schizophrenia group

ANGER
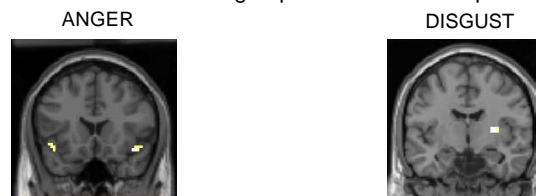
Area	k	*p*	T	x	y	z
LOFC	214	0.40	3.88	-45	15	-12
LOFC	162	0.017	4.37	42	18	-15

DISGUST

Area	k	*p*	T	x	y	z
Putamen	139	0.025	3.49	30	-9	9

Lower activation in the control group than in the schizophrenia group

HAPPINESS

Area	k	*p*	T	x	y	z
Nac	90	0.014	3.12	-6	15	-6
Nac	63	0.025	3.26	3	15	-6

EMOTIONS COMBINED

Area	k	*p*	T	x	y	z
IOC	5	0.023	3.24	42	-78	-15

Conclusions

Our data reflect a recognition problem in schizophrenia for happiness, but not for negative emotions. This contradicts results from other studies. The results could be interpreted as reflecting a reduced utilization of emotion specific areas during the processing of negative emotions in schizophrenia, which is compensated by the activation of unspecific perception areas. This hypoactivity might produce recognition deficits if the emotional intensity is not adapted. In contrast during the recognition of happiness we found compensation in emotion specific areas. This suggests that although patients need higher intensities, the brain system for positive emotions has the capability to compensate and therefore allow an adequate processing of positive emotions. This can also be interpreted as evidence for the ability of patients with schizophrenia to experience positive emotions.

References: Hempel, A., Hempel, E., Schönknecht, P., Stippich, C. und Schröder, J. (2003). Impairment in basal limbic function in schizophrenia during affect recognition. *Psychiatry Research: Neuroimaging 122,* 115-124.