

Neural Correlates of Diminished Humor Comprehension in Schizophrenia: A Functional Magnetic Resonance Imaging Study

Authors : Przemysław Adamczyk, Mirosław Wyczesany, Aleksandra Domagalik, Artur Daren, Kamil Cepuch, Piotr Błądziński, Tadeusz Marek, Andrzej Cechnicki

Abstract : The present study aimed at evaluation of neural correlates of humor comprehension impairments observed in schizophrenia. To investigate the nature of this deficit in schizophrenia and to localize cortical areas involved in humor processing we used functional magnetic resonance imaging (fMRI). The study included chronic schizophrenia outpatients (SCH; n=20), and sex, age and education level matched healthy controls (n=20). The task consisted of 60 stories (setup) of which 20 had funny, 20 nonsensical and 20 neutral (not funny) punchlines. After the punchlines were presented, the participants were asked to indicate whether the story was comprehensible (yes/no) and how funny it was (1-9 Likert-type scale). fMRI was performed on a 3T scanner (Magnetom Skyra, Siemens) using 32-channel head coil. Three contrasts in accordance with the three stages of humor processing were analyzed in both groups: abstract vs neutral stories - incongruity detection; funny vs abstract - incongruity resolution; funny vs neutral - elaboration. Additionally, parametric modulation analysis was performed using both subjective ratings separately in order to further differentiate the areas involved in incongruity resolution processing. Statistical analysis for behavioral data used U Mann-Whitney test and Bonferroni's correction, fMRI data analysis utilized whole-brain voxel-wise t-tests with 10-voxel extent threshold and with Family Wise Error (FWE) correction at $\alpha = 0.05$, or uncorrected at $\alpha = 0.001$. Between group comparisons revealed that the SCH subjects had attenuated activation in: the right superior temporal gyrus in case of irresolvable incongruity processing of nonsensical puns (nonsensical > neutral); the left medial frontal gyrus in case of incongruity resolution processing of funny puns (funny > nonsensical) and the interhemispheric ACC in case of elaboration of funny puns (funny > neutral). Additionally, the SCH group revealed weaker activation during funniness ratings in the left ventro-medial prefrontal cortex, the medial frontal gyrus, the angular and the supramarginal gyrus, and the right temporal pole. In comprehension ratings the SCH group showed suppressed activity in the left superior and medial frontal gyri. Interestingly, these differences were accompanied by protraction of time in both types of rating responses in the SCH group, a lower level of comprehension for funny punchlines and a higher funniness for absurd punchlines. Presented results indicate that, in comparison to healthy controls, schizophrenia is characterized by difficulties in humor processing revealed by longer reaction times, impairments of understanding jokes and finding nonsensical punchlines more funny. This is accompanied by attenuated brain activations, especially in the left fronto-parietal and the right temporal cortices. Disturbances of the humor processing seem to be impaired at the all three stages of the humor comprehension process, from incongruity detection, through its resolution to elaboration. The neural correlates revealed diminished neural activity of the schizophrenia brain, as compared with the control group. The study was supported by the National Science Centre, Poland (grant no 2014/13/B/HS6/03091).

Keywords : communication skills, functional magnetic resonance imaging, humor, schizophrenia

Conference Title : ICNBR 2017 : International Conference on Neuropsychology and Brain Research

Conference Location : Barcelona, Spain

Conference Dates : May 26-27, 2017