Changes in default mode network connectivity in breast cancer survivors

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Abstract

Statement of the Problem: After breast cancer treatment up to 90% of patients suffer from different neurological and psychiatric disorders such as vertebrobasilar insufficiency, chronic pain syndrome, anxiety and depression. These disorders may cause alterations in functional connectivity of the default mode network of the brain. The purpose of the study is to assess changes in functional connectivity of the default mode network in patients after breast cancer treatment using resting state functional magnetic resonance imaging (rs-fMRI).

Methodology & Theoretical Orientation: Rs-fMRI was performed on 46 patients aged 35 to 50 years after complex treatment (Patey radical mastectomy, chemo and/or radiation therapy) for breast cancer and 20 healthy female volunteers (control group). All patients were previously examined by a neurologist and had symptoms including pain in the upper limb, dizziness, headaches, impaired sensitivity and muscle strength on the side of surgical treatment.

Findings: According to the results of a comparative statistical analysis of rs-fMRI data between patients after breast cancer treatment (n=46) and the control group (n=20), a decrease in functional connectivity was revealed between the MPFC and the right fusiform gyrus (p=0.046), the cortex of the left precentral gyrus (p=0.032) in patients after breast cancer treatment in comparison with healthy female volunteers. There was an increase in functional connectivity between the MPFC and the operculum cortex of the parietal lobes on both sides (p=0.018, p=0.036) (Fig. 1, 2).

Conclusion & Significance: The use of rs-fMRI in breast cancer survivors allowed us to identify changes of functional connectivity in the brain caused by neurological disorders, which correlated with a decreased quality of life in these patients. The results indicate the necessity to improve treatment and rehabilitation methods in this group of patients.

Image

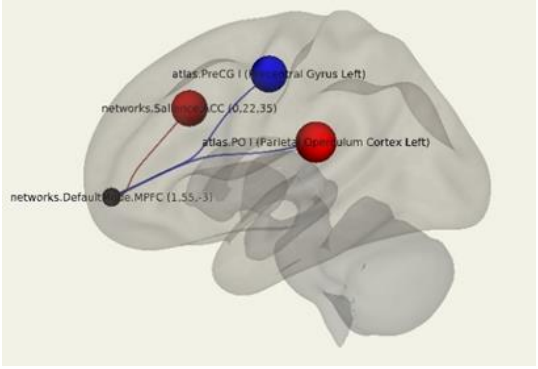


Fig. 1

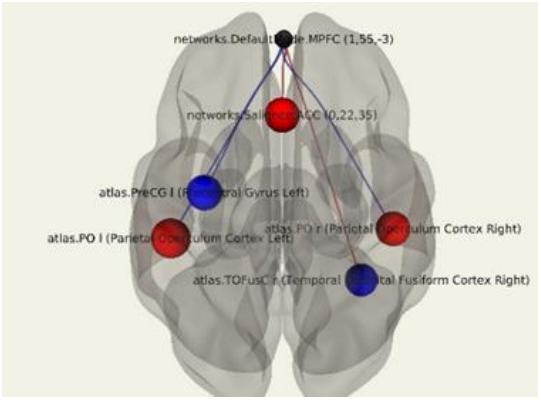


Fig. 2

Recent Publications (minimum 5)

1. Kesler SR, Rao A, Blayney DW, Oakley-Girvan IA, et al. Predicting Long-Term Cognitive Outcome Following Breast Cancer with Pre-Treatment Resting State fMRI and Random Forest Machine Learning. Front Hum Neurosci. 2017 Nov 15;11:555.
2. Feng Y, Zhang XD, Zheng G,et al. Chemotherapy-induced brain changes in breast cancer survivors: evaluation with multimodality magnetic resonance imaging. Brain Imaging Behav. 2019 Dec;13(6):1799-1814.
3. Miao H, Chen X, Yan Y, et al. Functional connectivity change of brain default mode network in breast cancer patients after chemotherapy. Neuroradiology. 2016 Sep;58(9):921-8.
4. Stouten-Kemperman M.M., de Ruiter M.B., Koppelmans V., et al. Neurotoxicity in breast cancer survivors ≥10 years post-treatment is dependent on treatment type. Brain Imaging and Behavior. – 2015. – Vol. 9 – P. 275–284
5. Delanian S. Is radiation-induced arteriopathy in long-term breast cancer survivors an underdiagnosed situation?: Critical and pragmatic review of available literature. Radiother Oncol. 2021 Apr;157:163-174.

Photograph



Biography

Tatyana Bukkieva is currently a PhD student of Almazov National Medical Research Centre and a junior researcher of Magnetic Resonance Imaging scientific laboratory. Topic of her dissertation is: «The possibilities of functional and diffusion tensor magnetic resonance imaging in the assessment of changes in functional brain networks in patients after breast cancer treatment». This work is financially supported by the Ministry of Science and Higher Education of the Russian Federation (Agreement No. 075-15-2020-901). More than 5 articles on the subject have already been prepared (ORCID 0000-0002-6779-0241), including the article in a Q1-ranking Journal of Clinical Medicine.

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Notes/Comments: