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Cerebral plasticity of the sensorimotor functions in patients with different brain tumor types - the preliminary, functional MRI study

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Purpose/Introduction: In the pathological states of the brain, complex mechanisms are initiated to preserve relevant neurological functions. The activation of the secondary and supplementary areas as well as the involvement of centers belonging to other systems takes place. Information of possible cerebral reorganization in patients with brain tumors is of the highest value for chirurgical treatment to minimize risk of postoperative, permanent deficits. The aim of the study was to evaluate the motor reorganization in patients with tumors in the sensorimotor areas of the brain and to determine if there is an influence of pathological type of the tumor and its size for mechanisms of cerebral plasticity.

Subjects and Methods: 31 patients with supratentorial brain tumors were included. All of them underwent conventional and functional MRI. All patients were asked to perform simple, repetitive movements of the hand opposite to the affected hemisphere. Ten series of eight images on 64x128 matrix were obtained and data were analyzed by SPM 99. After surgical treatment pathological types of the lesions were determined.

Results: The patient’s group was analyzed taking into the account size and malignancy criteria of the tumors. The activations in primary, supplementary motor and premotor areas of contralateral and ipsilateral hemispheres were noted. The widest and most expressed recruitment of supportive sensorimotor areas in the situation of primary motor cortex invasion was observed in the group of tumors small in size and of the lesser malignancy. According to the diameters as well as malignancy increase the number of activated regions became smaller. Big in size but of a lesser malignancy lesions induced reorganization in centers of the affected hemisphere rather than between hemispheres. Small tumors of a greater malignancy often elicited the activation in the SupplMCx. Relatively rare regions of activation were found in supportive motor brain areas in the presence of malignant, big pathological masses, mainly in SupplMCx and preMCx of both hemispheres.

Discussion/Conclusion:
1. The presence of the tumor in motor functional areas induces cerebral reorganization
2. It seems that the degree of tumor malignancy and tumor size is tighten with activation of brain plasticity of different patterns to preserve motor functions what constitutes an important factor for surgical decisions

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MR coincidence maps between fMRI and structural MR applied to schizophrenia disease

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Purpose: Functional Magnetic Resonance Imaging by means of BOLD contrast (fMRI) is able to detect functional abnormalities associated with auditory emotional stimuli in schizophrenia. In this study we tested whether functional abnormalities coexist with focal brain density reductions in schizophrenic patients with chronic auditory hallucinations.

Materials and Methods: 21 right handed male patients with DSM-IV schizophrenia and persistent hallucinations and 10 right handed male healthy paired subjects were studied. fMRI activation maps and morphometric MR images were analyzed (SPM2) independently. Afterwards, contrast subtracted images between emotional and non-emotional words were extracted, and anatomical gray matter differences in density among patients and control subjects were explored by means of the optimized voxel-based morphometry. Activation clusters from fMRI (p<0.005 uncorrected; k 5 or greater) and differences in morphometric images (p<0.005 corrected for multiple comparisons; k 200 or greater) were overlaid (voxelwise multiplying of both registered maps). The coincidence map was then generated by multiplying the emotional subtracted fMRI contrast representing the activation maps and the density decrement morphometric maps.

Results: Clusters were found where greater auditory emotional activation coexisted with lower density in schizophrenia. Those clusters were left and right middle temporal gyri, superior temporal gyri, left posterior and right anterior cingular gyri, left inferior frontal gyrus and middle occipital gyrus. Coincident clusters can be seen in figure 1.

Conclusion: By using MR coincidence maps, we hypothesized that individual variability would be lower and that these parametric maps could be used to objectively identify the disease and maybe the follow-up after treatment. The middle and superior temporal and the cingular gyri are closely related to the abnormal neural network involved in the auditory emotional dysfunction seen in these patients.

Figure 1. Color clusters show areas where there is a high emotional activation in schizophrenics and lower gray matter density.