

T1 sensitive Images with the aid of new Blood-Pool Contrast Agent in mapping cortical centers in neurosurgical patients

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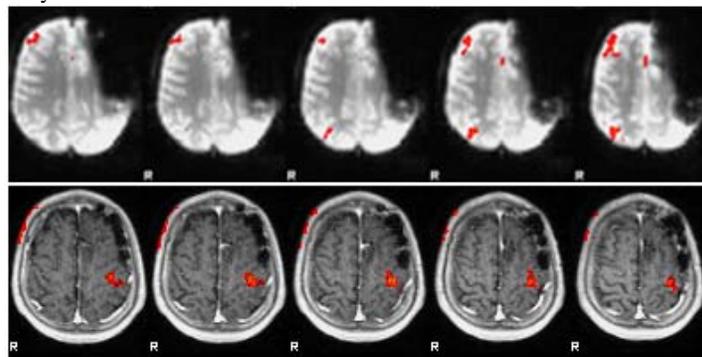
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In order to detect the BOLD effect, T2* dependant sequences are used. These sequences are characterized by high sensitivity to non-uniformities in the magnetic field. This enables the acquisition of a good BOLD signal in functional MRI experiments but is also a source of serious artifacts. Differences in magnetic susceptibility of air, bone, different types of tissues, as well as surgical implants create geometric artifacts, which ultimately decrease image quality not allowing for the evaluation of brain regions that border with these anatomical structures, e.g., at the base of the frontal lobes, near the collateral sinuses; or post-trepanation cavities, which are of high clinical importance if located near the key cortical regions, especially those pertaining to motor or language functions.

The relaxation value of a chelate of gadolinium diethylenetriaminepentaacetato with a phosphono-oxymethyl substituent (Gadofosveset Trisodium) thanks to the long duration of its binding with albumin, is greater in the T1 sequence even ten times that of gadolinium chelates which are not bound to protein. Both these characteristics delineate its value for fMRI with T1 dependent sequences. What is more, the increase in signal intensity recorded in T1 with a blood pool contrast agent (BPCA) sequences depends only on changes in blood volume in the area of interest, while at the same time it does not suffer from artifacts related to blood flow. This appears to be an important advantage of the described technique, which allows for a more precise localization of the activation.

The aim of our study was to determine the possibility to use a new functional technique - a T1 dependent sequence with the administration of a BPCA in patients with brain tumors before and after surgical treatment

Methods and Materials: 14 patients with supratentorial brain tumors: 6 before and 8 after neurosurgery operation were included. They underwent conventional and functional MRI using the standard head coil in the 1,5 T scanner /Simens, Avanto/. For each of them reference run was acquired with typical T2* sensitive EPI sequence (TR=3s/TE=40ms/FA=90deg) with 22 slices as well as T1 sensitive 3D GRE sequence (TR=8.5ms/TE=3.14ms/FA=10deg) with sixteen 5 mm thick slices and 0.78 mm in plane resolution, immediately after intravenous administration (0.03mmol/kg) of BPCA - VASOVIST (Schering). During scanning protocols subjects were asked to perform block type challenging paradigms in 30s length 'on' periods followed with the same length 'off' resting periods. Five repetitions of above conditions took 300 second giving as a result 30 volumes. Movement or language tasks were carried out depending on the localization of the tumor. SPM5 software was used for statistical analysis.



Time series plots

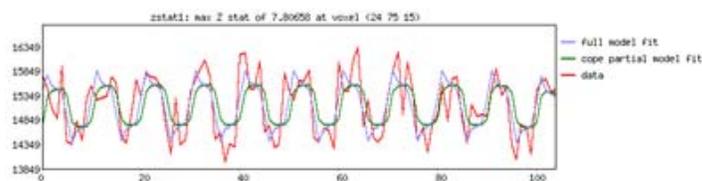


Fig1. Patient (AC) after a partial resection of a tumor of the left frontal lobe. Motor task: EPI run, T1 BPCA run, time plot of the signal in T1 BPCA run

Results: For both runs in patients before surgical treatment maximum activations were localized in the same areas. Visual inspection of respective signal amplitudes already suggests the T1 contrast to be substantially smaller than EPI (0.5 % vs 1%). In patients after the operation, surgical implants created strong artifacts in T2* sequences which make the correct interpretation of fMRI experiments impossible. The activated centers were detected in T1 sensitive sequence where these artifacts became significantly weaker.

Conclusions: 1. A new functional imaging method can be used in patients with brain tumors before and especially after surgical operations 2. The blood-pool agent with high spatial resolution T1 sequences is a promising perspective for fMRI examinations in areas suffering from susceptibility artifacts