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Visualization of pathological formations of brain with application of nonlinear processing of MR images obtained with suppression of signals from normal tissues

Topic: 213 Sequences and Techniques: Imaging

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Purpose: To improve visualization of some pathological formations of brain, it is offered to use MR images obtained with normal tissue signal suppression (NTSS). In this case one can obtain maximally refined tissue contrast picture. To realize NTSS, it is offered to use one or more scans by means of the double inversion-recovery (DIR) pulse sequence with different TI and multiplication of MR images obtained at the same FOV [1].

Subjects and methods: We realized the next DIR pulse sequence: 180° - TI_w - 180° - TI_f - 90° -FID to realize simultaneous suppression of signals from two normal tissues with different T_1 . For example, to suppress signals from fat and free water we used TI_f = 80 ms and TI_w = 1300 ms, to suppress signal from mucous - TI_w = 550 ms. If pathological forms possessed intermediate longitudinal relaxation times, they gave sufficiently big signal. As strong background signals were suppressed, the receiver sensitivity was increased. Experiments were carried out on MR-scanner TOMIKON S50 (Bruker). Some software modifications were executed. Multiplication of images was carried out on IBM PC. 3D-treatment was fulfilled on the ParaVision v.1.0.

Results: By means of DIR pulse sequence, we simplified the contrast at MR image. Multiplication of MR images gave such ones that emulated the simultaneous signal suppression from many tissues' components. It simplified the graphical treatment of images for MIP reconstructions and the volume renderings. For example, we obtained MR images which emulated simultaneous suppression of signals from tree tissue components - fat, water and mucous (Fig. 1).

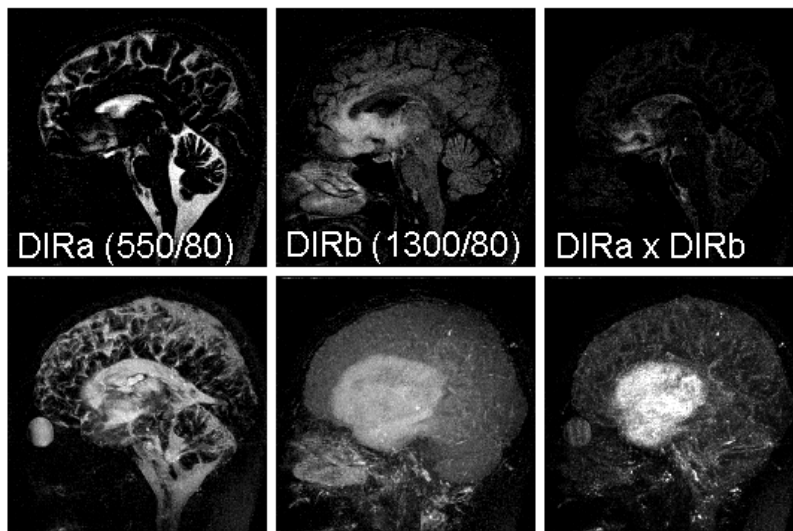


Figure 1. MR images of brain with astrocytoma. Upper set - MR images obtained with different values of (TI_w/TI_f) , lower one - their MIP-reconstructions.

We used in practice the multiplication of Gd-contrast enhanced T1WI image and one after DIR pulse sequence action for the same FOV (Fig. 2). MIP-reconstruction from image clearly revealed distribution of contrast agent on the tumor periphery. This method was used to investigate brains of 7 patients.

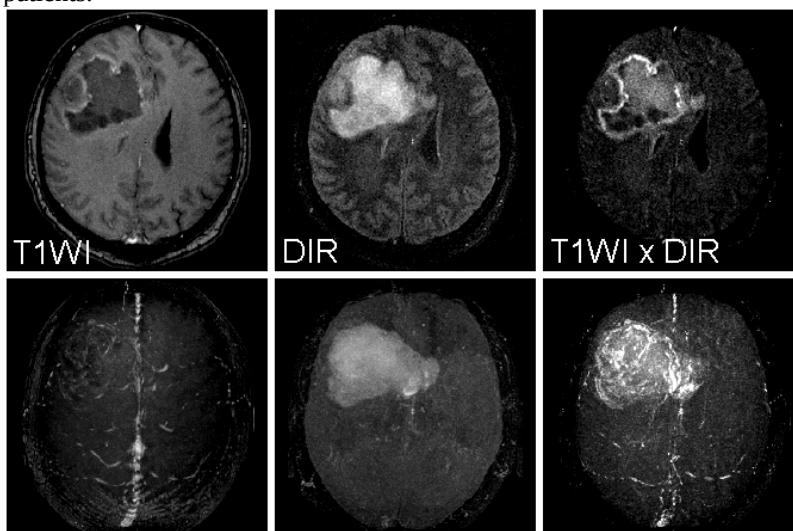


Figure 2. MR images of tumor after Gd-agent injection. Upper set - MR images, lower one - their MIP reconstructions.

Discussion: To analyze pathological forms, it is useful to simplify maximally the picture of MRI tissue contrast. It can be made by normal tissue signal suppression with DIR pulse sequence application. Multiplication of images gives additional simplification of contrast picture. It is useful for good visualization of pathological forms and 3D-treatment.

Reference:

1. Pirogov YuA, Anisimov NV, Gubskii LV, Babich PV. *Proceedings of SPIE* 2005;5744:471-480.

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