

Standard MRI pulse sequences

Overview of pulse sequences used in clinical MRI, including fast spin-echo, echo-planar, parallel imaging

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In Magnetic Resonance Imaging (MRI) the signal received by the Radio Frequency (RF) coil, and so the image, is determined not just by the properties of the tissues but also by a large number of magnetic field combinations, grouped in the so called sequences. One of the peculiar features of magnetic resonance imaging is to be a multiparametric technique. In fact, it does not produce a unique picture of the sample but, depending on the sequence used to acquire the signal, it creates different images, each one typical of some parameter, for example proton density or relaxation times T1, T2, T2*. Each sequence is a combination of i) RF pulses, required to induce magnetic resonance or to create a perturbation of the magnetization behaviours; ii) gradients for spatial encoding whose arrangement determines the trajectory in k-space; and iii) readout gradients. This combination of magnetic fields has to be repeated with a Repetition Time (TR) until enough samples in k-space are acquired. Repetition Time, together with the Echo Time (TE) that is the time in which the signal is revealed, can be appropriately tuned to obtain different types of contrast.

Nowadays, a lot of different and complex sequences are employed. The basic sequences, including different strategies of k-space sampling, will be describe in order to give an overview of the possibilities and methods in generating contrast in MRI.