A Summary of MRI presentations

Gengyao Yuan 20613016

MRI is a medical imaging technique used to generate detailed images inside of the human body (MAIOS SAS, 2018), which is used for medical diagnosis and screen for diseases, cancer, and response to treatment. It is discovered in 1947 by Felix Bloch and Edward Purcell and the First clinical image obtained in 1977.

Overall, it is a technology by using E&M field to detect the signal “reflect” by water molecules, since the water concentration is different in different part of the body, the signal strength is also different, which the differences can be shown on picture by different white -black levels. In this way, MRI can provide a functional approach to images inside of the human body.

There are two main magnetic fields used in MRI. Firstly, is the primary magnet, which is a coil of superconducting niobium-titanium whose resistance is zero. It is used to vary the magnetic field slightly. Under the earth magnetic field, protons contained by water molecules rotate randomly. After magnetic field by the primary magnet, protons align with the field parallel or antiparallel. The second one is Gradient Coil, which is used to vary the precession frequency of protons across the body so that the nuclear spinning faster.

The equation of the magnetic field provided by Gradient Coil is ω=γB=γ(B0+△B), where the B0 is a constant field, and deltaB is the changing field, by changing the strength of the field, MRI machine can increase or decrease the frequency of nuclear spinning.

When the nuclear spin system near the Larmor frequency, which in our case referred to the RF impulse (caused by the gradient coil), the external energy is injected into the system, however, the High energy phase is unstable. After gradient coil out of line, the collective effect of this drop-in energy creates the T1 & T2 effects. T1 is the total time for protons to back to the equilibrium phase. T2 is the time required for the transverse magnetization to fall to approximately 37% (1/e) of its initial value. Since the magnetization change under T1 and T2 effect induced the current in the coil to produce signal and T2 is much stronger than T1. MRI collect most of the signs and do imagining during T2.

The Gradient Coil is placed by x,y, and z-direction, and only the protons in that slice by Gradient Coil will give off signals. Thus, it will produce a PF signal with 3d position information. The computer can digital this signal by Fourier Transformation then sent it to image processor. In the end, a very detailed picture of soft tissues will be produced. The different part in a human body will be colored with black and white areas according to hydrogen concentration

This presentation given by group 7 is well designed and giving a clear explanation how the MRI work and how useful its result could be.

**References:**

MAIOS, A. (n.d.). MRI online course (Magnetic Resonance Imaging). Retrieved December 3, 2018, from <https://www.imaios.com/en/e-Courses/e-MRI>

AD, Elster. (2018). Free induction decay (FID). Retrieved December 3, 2018, from <http://mriquestions.com/free-induction-decay.html>