The Effects of Magnetic Resonance Imaging in the Medical Field

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Abstract: Since the late 1970s, hospitals worldwide have been using Magnetic Resonance Imaging (MRI) machines to identify various conditions that may be present within a patient's body, such as torn ligaments or more serious cases involving brain tumors. In our research, we hope to provide an understanding of how MRIs operate while also demonstrating their importance and use within the medical field. In addition, we will examine cases in which MRIs have caused serious side effects to patients. We hope to provide an explanation as to why Magnetic Resonance Imaging was and continues to be a monumental asset to the advancement of radiological technology.

Objectives

- Provide and understanding of how MRI machines function
- Identify the advantages and possible hazards of utilizing an MRI Scanner
- Introduce future possibilities of using an MRI Scanner based off of current machine knowledge

Introduction

In the 1930s, the Nuclear magnetic resonance (NMR) was created by Isidor Isaac Rabi. The medical field was not interested until the 1970s. The NMR was renamed to magnetic resonance imaging. The word “nuclear” was not appealing the the public in the 1970s. This is because of the cold war and fear of nuclear strikes.

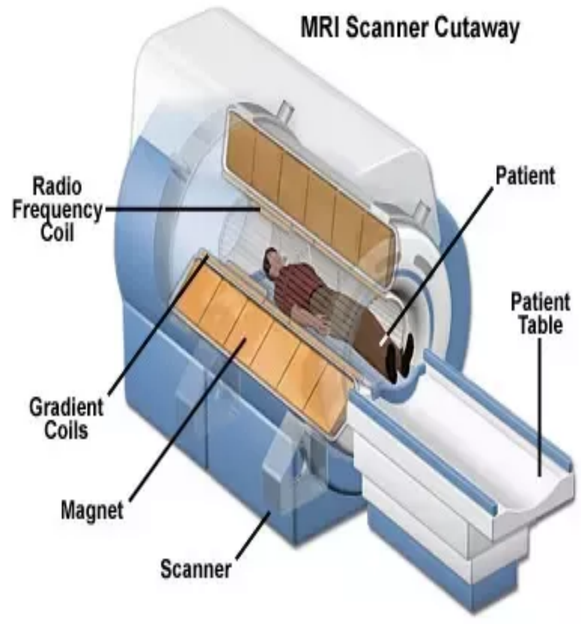
How MRI Machines Work

There is an abundant amount of protons in the human body. Each of these protons spin creating a small magnetic charge. When a person enters a MRI machine these protons then align with the magnetic field produced by the machine. A radiofrequency current is then introduced causing the protons to realign. Once this current is turned off the protons return to alignment with the magnetic field while also releasing electromagnetic energy. Sensors in the MRI machine then detect this energy and create the detailed image. While this process is occurring internally the patient does not feel anything while the scan is being completed.

Potential Hazards

While MRI machines have proven to be imperative to the medical field, the intensity of the magnetic field produced in the machines has been known to cause a few drawbacks. Some of these potential risks have included:

- **Tattoo-ed Patients:** the iron-oxide (ferromagnetic) pigments within the ink used for tattoos can be shifted while undergoing a scan, and this re-positioning has been known to cause burning and pain in the area of the tattoo. The pain usually subsides 15-20 minutes afterwards.
- **Patients with Metal Implants:** the strength of the magnetic field produced in MRI machines has been known to dislodge metal implants in patients and cause discomfort and pain. The magnetic field can also lead to ineffectiveness of the implant, and can even cause the images produced by the scan to be inaccurate.
- **Pregnant Patients:** the potentially harmful effects of MRI scans on pregnant patients is still unknown, thus, these particular patients are not advised to use such methods for their medical needs.
- **Other:** other objects that can cause complications include artificial joints, stents, cochlear implants, and pacemakers as well as an external insulin pump, a leg brace, or a wound dressing.



Conclusion & Future Advancements

Currently, MRI scanners are used to produce magnetic fields up to 3 T during clinical procedures. Keeping the field intensity at a maximum of 3 T reduces the cost of usage; this is due to the fact that need to increase the field intensity has not yet been validated. However, with recent discoveries made through research, MRI scanners have the potential to bring advancements to the medical field. If the magnetic field is increased, we would be able to scan more specific body functions, such as brain activity. This, in turn, could further studies in the area of mental health.

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