

A Note on Magnetic Resonance Imaging

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Abstract— Medical image processing goes beyond the limitations. Imaging information considers anatomical, functional and quantitative it produce images of the internal aspect of the body. Recent advances in imaging techniques have made it possible to acquire images in real time during an interventional procedure. In such procedure, usually the real-time images themselves may be sufficient to provide the necessary guidance information needed for the procedure. There are many types of imaging like Magnetic resonance imaging (MRI), Computer Tomography (CT), positron emission tomography (PET) and X-ray. In the above images, MRI is a wide variety of applications in medical diagnosis. MRI can be used to find exact method to find and analysis throughout the body compared to the other imaging Techniques. MRI is used to locate problems such as bleeding, tumours, blood vessel diseases, injury and also it shows the abnormal tissues more clearly.

Index Terms— Medical Image, MRI.

I. INTRODUCTION

Medical image processing is the most general and suitable means of transmitting the information. It allows much more complex problems for processing the images. It is an important tool for medical process, various types of scanning like Computer tomography (CT), Positron emission tomography (PET) and Magnetic resonance imaging (MRI). In this CT and PET are dissimilar but related imaging method. PET is to identify the differences in metabolic movement in the body, CT show the precise location in the body. MRI is used to find the variety of medical conditions. In several tissues, the images and features are clearer with an MRI than a CT and PET scan. MRI medical imaging techniques, is relatively new technology. The foundations begin during the year of 1946. Felix Bloch and Edward Purcell independently discovered the magnetic resonance phenomena during this year, until 1970s MRI was being used for chemical and physical analysis. In 1971 Raymond Damadian showed that nuclear magnetic relaxation times of tissues and tumors differed motivating scientists to use MRI to study disease [1]. MRI images the details obtained by using various computer techniques [2]. Hounsfield in 1973 Computed Tomography, and Mansfield in 1977 echo-planar imaging, many scientists over the next 20 years introduced MRI into the technology. The most significant advancement in MRIs occurred in 2003, when the Nobel Prize was won by Paul C. Lautenberg and Peter Mansfield for their discoveries by using MRIs as a diagnostic tool [1].

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An MRI Scan is a painless technique that allows doctors to look at organs, tissues and structures inside your body. It is used to collect important information about your head, chest, spine, brain, bone and joints and other internal organs. It helps to evaluate the problems in these areas [3]. In Head MRI can be used to find brain tumors, bleeding in the brain, an aneurysm, nerve injury, and also to find problems in eyes, ears and optic nerves. In Chest MRI can be used to find heart valves, lungs, coronary blood vessels and breasts. In Bone and joint MRI can be used to find problems with temporomandibular joint, bone marrow problems, bone tumors, cartilage problems, torn ligaments or infection. In Spine MRI can be used to find discs and nerves of the spine, disc bulges, and spinal tumors [1]. The reasons for using MRI: It has no ionizing radiation (X-rays). It has a strong magnetic field and pulses of radio waves to make images of structures inside the body, MRI scan prevents a person from any exposure to X-Rays or any other damaging forms of radiation. It is possible to take pictures from almost every angle, whereas a CT scan only shows pictures horizontally. MRI scans are generally more detailed, MRI scans give a 360 degree view whereas CT scans are more like very thin slices of bread. Normal and abnormal tissue is often clearer on the MRI scan than on the CT scan [2]. From a clinical perspective, they are useful because different tissues appear differently in T1 and T2 weighted MRI scans. T1 images cause fat to appear bright, fat like the myelin in the white matter. T2 weighted images cause water to appear bright like cerebro-spinal fluid and fat is dark [1]. MRI is a painless radiology technique the advantage is to prevent a person from any exposure to X-Rays and other damaging forms of radiation. It is also used to find the exact method of disease discover throughout the body. This paper is organized as follows. Section II discusses about the MRI of the brain. Section III describe about the MRI of the Spinal. Section IV summarizes MRI of the Heart and Blood Vessels. Section V focuses on MRI of the Bones and Joints. Section VI explains MRI of the Breast. Section VII clarifies MRI of the Abdomen and pelvis. Section VIII reviews about the MRI of the Teeth. Section IX discuss about the MRI of the Eye. Finally, Section X presents the conclusion.

II. MRI OF THE BRAIN

Head plays an important role in the body; it surrounds core elements like brain, bones, muscles, blood vessels, nerves. Fig.1 shows the various parts. MRI creates detail pictures of the brain and is useful in evaluating problems such as persistent tumors, headaches, weakness, dizziness, and blurred vision or seizures, and it can show the living tissues and it helps to detect certain chronic diseases of the nervous system [2] its shown in Fig.2.



It can be used to diagnosis and monitoring of many diseases and disorders that affect the brain, such as bleeding in the brain [3].

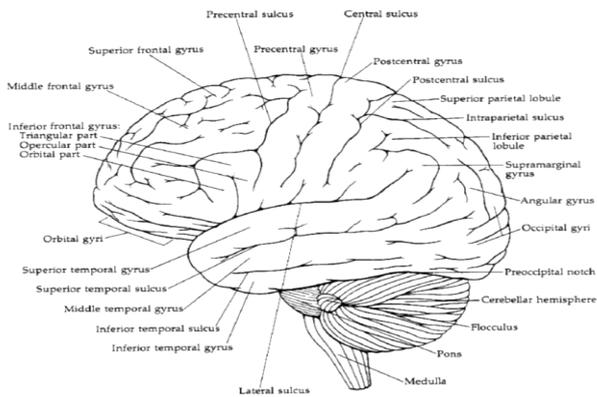


Fig. 1. Brain Image

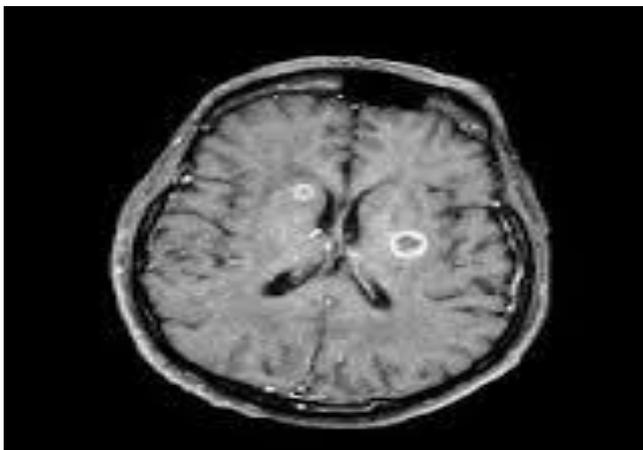


Fig. 2. MRI Brain Image

III. MRI OF THE SPINAL

MRI is performed to evaluate the anatomy of the lumbar spine, to help plan surgery on the spine, or to monitor changes in the spine after an operation, it's shown in Fig.3. The lumbar spine is useful in evaluating symptoms such as lower back pain, numbness, leg pain, tingling or weakness, or problems with bladder and bowel control [7]. MRI finds problems of the spinal discs Fig.4, such as a ruptured disc, and where the canal is abnormally narrowed (spinal stenosis) and may need surgery, and also finds tumors affecting the bones or nerves of the spine, and checks the spine that is having good blood supply, finds the infection, nerve damage caused by injury [7].

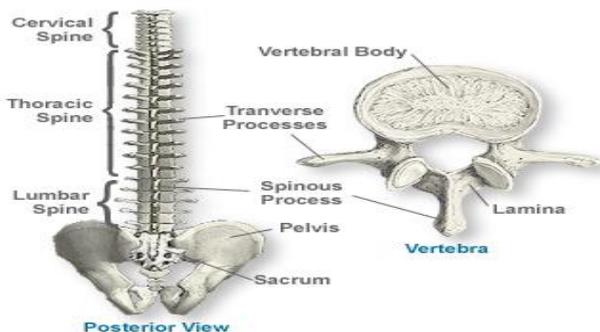


Fig. 3. Spinal Image



Fig. 4. MRI Spinal Image

IV. MRI OF THE HEART AND BLOOD VESSELS

MRI can help your doctor diagnose many different heart conditions, like Tissue damage from a heart attack, Reduced blood flow in the heart muscle to help determine whether heart artery blockages are the cause of your chest pain, Problems in the aorta, heart's main artery, aneurysm (bulge), or narrowing, Heart muscle diseases, enlargement of the heart, and abnormal growths such as cancerous tumors, Heart valve disorders [6] Fig.5. The heart is a muscular pump that pushes blood through blood vessels around the body, it's shown in Fig.6. Essential to life, the heart beats continuously, pumping an average of more than 14,000 liters of blood every day. All cells in the body need oxygen and the vital nutrients found in blood. Without oxygen and these nutrients, the cells will die. Heart helps in providing oxygen and nutrients to the body's tissues and organs by ensuring a rich supply of blood [6].

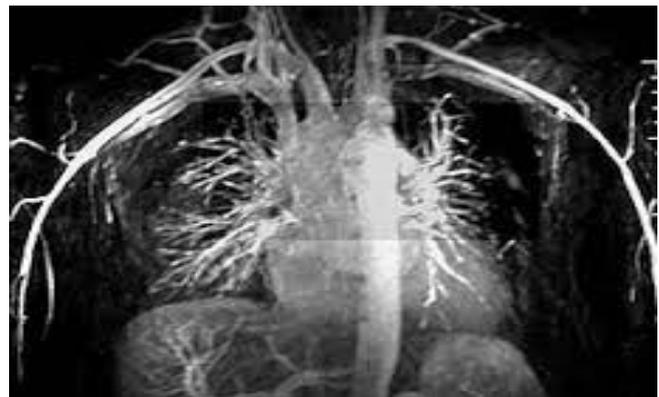


Fig. 5. MRI Blood Vessels

MRI may be performed for further evaluation of signs that may suggest: Atherosclerosis fatty materials and other substances in the blood stream, Cardiomyopathy the enlargement of the heart due to thickening or weakening of the heart muscle, congenital heart disease. Defects heart structures that occur during formation of the fetus, Congestive heart failure weakening of the heart muscle to an extent of inefficiency in pumping blood,

causing buildup (congestion) in the blood vessels, lungs, feet, ankles, and other parts of the body, Aneurysm dilation of a part of the heart muscle or the condition which may cause weakness of the tissue at the site of the aneurysm, Valvular heart disease. Malfunction of one or more of the heart valves that may cause an obstruction of the blood flow within the heart, Cardiac tumor that may occur on the outside surface of the heart, within the muscle tissue of the heart [5] Fig.7.

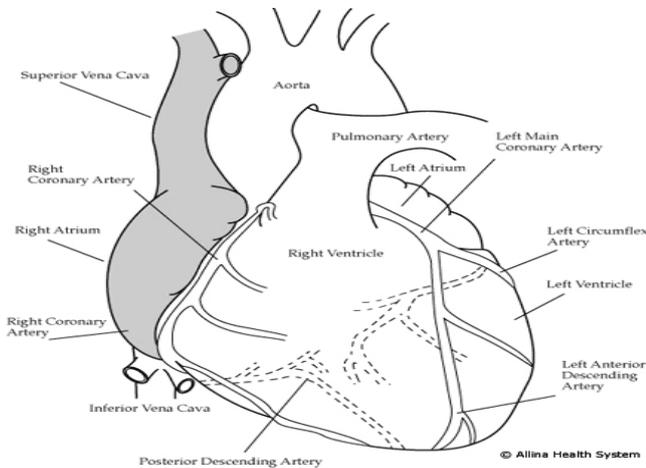


Fig. 6.Heart Image

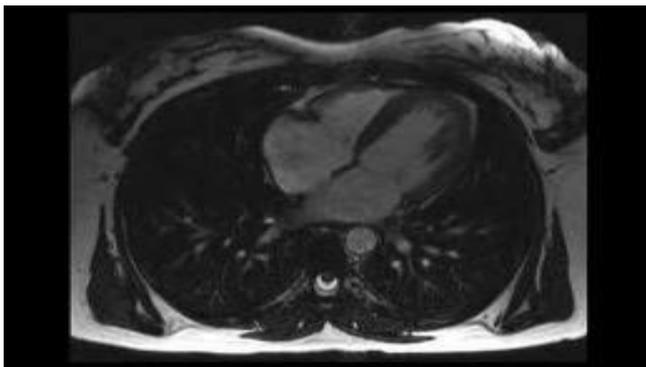


Fig. 7.MRI Heart Image

V. MRI OF THE BONES, JOINTS, AND SOFT TISSUES

MRI can check for problems of the bones and joints Fig.8, such as arthritis, problems with the temporomandibular joint, bone, marrow problems, bone tumors, cartilage problems torn ligaments or infection. MRI may also be used to detect if a bone is broken when X-ray results are not clear. MRI is done more commonly than other tests to check for some bone and joint problems [5]. MRI may be used to assess the results of corrective orthopedic procedures. Also Joint deterioration resulting from arthritis may be monitored by using magnetic resonance imaging [8].



Fig. 8.MRI Bone & Joint Image

VI. MRI OF THE BREAST

A breast MRI usually requires the use of a contrast dye that is injected into a vein in the arm before or during the procedure Fig.9. The dye may help create clearer images that outline abnormalities more easily. MRI, used with mammography and breast ultrasound, can be a useful diagnostic tool. Recent research has found that MRI can locate some small breast lesions sometimes missed by mammography. It can also help detect breast cancer in women with breast implants and in younger women who tend to have dense breast tissue. Mammography may not be as effective in these cases. Since MRIs do not use radiation, they may be used to screen women younger than 40 and to increase the number of screenings per year for women who are at high risk for breast cancer [10].

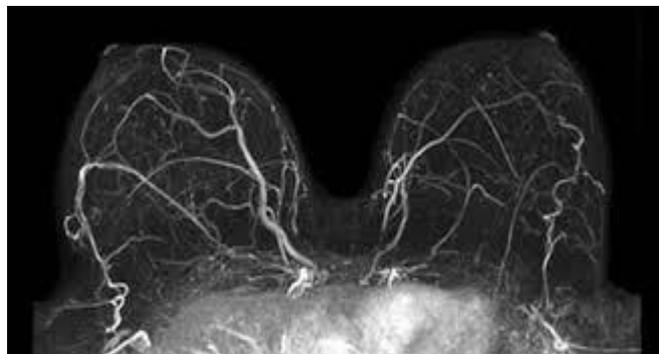


Fig. 9.MRI Breast Image

VII. MRI OF THE ABDOMEN AND PELVIS

MRI can find problems in the organs and structures in the belly, such as the liver, gallbladder, pancreas, kidneys, and bladder. It is used to find tumors, bleeding, infection, and blockage. In women, it can look at the uterus and ovaries. In men, it looks at the prostate [3][1] Fig.10.

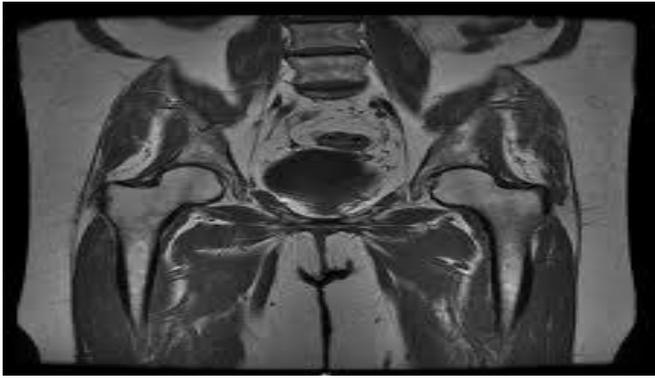


Fig. 10. Mri Image

VIII. MRI OF THE TEETH

MRI has been used in research of healthy and decayed teeth during the last decade. It is used in detecting the tooth surface, root canals, and the location of cavities. The damaged teeth is very important to find the root canals and shape dental cavities. MRI techniques are currently being used in dentistry for diagnosis of temporomandibular joint diseases leading to a degeneration of the discs Fig.11, MRI is also used to locate control points in the growth of the facial skeleton and in examining the bone before applying dental implants [9][4].



Fig. 11. Mri Teeth Image

IX. MRI OF THE EYE

MRI scans are often used to determine the extent of a tumor's growth and its spread Fig.12. They are particularly useful in looking at eye tumors. They are also helpful in finding cancer that has spread to the brain or spinal cord, as well as any spread of melanoma outside the eye orbit. MRI of the head is often done not only to see the eye better, but also to look for lymphoma in the brain that spreads this cancer [11].

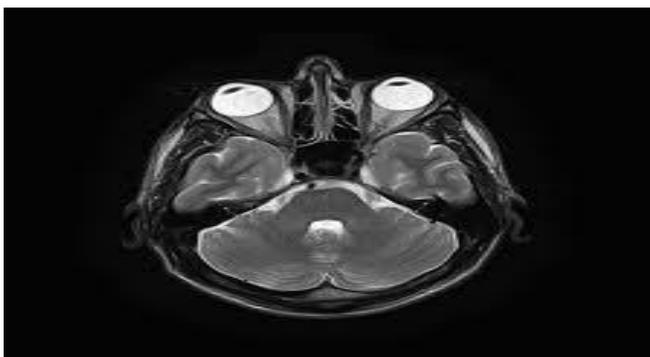


Fig. 12. Mri Eye Image

X. RESULT AND ANALYSIS

The MRI usually matches the body part where you are having symptoms. The main uses are it can be safely used in people; particularly it is useful for viewing soft tissue structures, ligaments and cartilage, and organs like the brain, heart and eyes. It also provides blood moves to organs and blood vessels to find blockages. MRI has some disadvantages like it is very noisy, takes a long time to scan. Compared to other scans like CT, X-ray it is very useful for surgical procedures. The Advantage is it is a painless and safe scan that produces clearer images of the body.

XI. CONCLUSION

MRI allows for direct visualization and verification. The Functional visualization of an image is particularly effective and the functional characteristics can be mapped onto different visual cues that facilitate the interpretation of the multidimensional information as well as the correlation of qualitative and quantitative information. We have described and compared MRI with CT, X-Ray and PET; the MRI produces better results at viewing up problems with soft tissues like muscles and most sensitive for spinal and joint problems. MRI might provide some new insights and also to find new solutions to existing problems.

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