

Original Article: Applications of Brain MRI



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ABSTRACT

This type of MRI is used to evaluate the brain and is very accurate and practical, and is a common method for examining brain structures and functions. For the clarity of the images and more accurate diagnosis, a substance called contrast is used in MRI, the contrast substance causes more differentiation between different brain tissues. This test can be used to check brain function and diagnose brain diseases and disorders, check cerebral vessels, birth defects and any inflammation and swelling, infection, injury or brain trauma, structural problems, abnormal masses and bleeding inside the brain. In general, if you have any metal parts in your body, especially in the head area or inside the eyeball, you must inform the expert, because the MRI machine has a strong magnet, and you are also usually asked to remove any metal objects that may be on your body. Do not carry them with you if they are affected by the magnetic field. Some of these items include: pens, pocket knives and glasses, jewelry, watches, credit cards and hearing aids, pins, hairpins, metal zippers, body piercings, artificial teeth, screws and plates or platinum or metal clips. Keep the doctor informed about your health status, history of surgery, drug use, and drug sensitivity. If you have claustrophobia (fear of closed or narrow spaces), be sure to let us know before imaging because your doctor may recommend an open MRI.

Introduction

The doctor may also use Brain MRI to check for the following: investigating the causes of deafness, muscle weakness, numbness or tingling, excessive fatigue, changes in behavior, difficulty speaking, vision problems, mental decline, migraine or chronic headaches and dizziness, and also seizures [1-3]. Take your medications as usual unless your doctor prescribes a different one. If you are pregnant, be sure to inform the MRI technician [5-9]. The important point is that if the patient has any allergy to contrast agents or kidney problems, he

should inform the doctor because the contrast agent is contraindicated in acute kidney patients [10-13]. Also, if the doctor requests a brain MRI with injection, a keratin test should be done before the imaging to check whether the person can do the test with injection or not [14-16].

- Cerebral hemorrhage;
- Examination of blood vessels in those who have a history of blood clots;
- Infection such as brain abscess;
- Hormonal disorders: Such as acromegaly, galactorrhea, Cushing's syndrome;

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- Stroke (an MRI can determine if you have brain damage from a stroke or injury);
- Pituitary gland disorders;
- Identifying Alzheimer's disease;
- Accumulation of blood clots in the brain [17-19];
- Brain aneurysm;
- Hydrocephalus;
- Cancer;
- Eye and inner ear disorders;
- (Multiple sclerosis) MS.
- Before performing this imaging, be sure to inform the MRI expert if you have the following:
 - Blood artery stent;
 - Cochlear metal implants;
 - Kidney disease;
 - Artificial heart valve;
 - Defibrillator or pace maker or heart pacemaker [20-22].

Way to do

To perform this test, the patient is asked to wear a special imaging suit [23-29]. Also, there is no need to fast, but if you need to inject contrast material, you should not eat anything for about 3 hours before. If it is the first time a person has to do an MRI, he probably does not know what is in front of him [30].

At this stage, after the patient lies down on the imaging bed, the operator places the special coil for brain MRI around the patient's head and the imaging begins [31-38]. The sound of the MRI machine is very loud and may be annoying for the patient. To prevent it, the preparer gives the patient headphones to reduce the sound and the bed enters the tunnel. The technician then leaves the room and the scan begins. In case of any problem, the person can communicate with the technician through the intercom system. During the imaging, the patient must remain motionless so that the images do not suffer from motion noise, and sometimes the patient is asked to hold

his breath and release it after 30 seconds [39-43]. If the requested type of test is injectable, the gadolinium material enters the bloodstream through a vein injection and then imaging is performed [44].

Care after brain MRI

If the MRI is done by injection, the patient may experience swelling or reddening of the skin, which should be reported to the doctor immediately [45-49]. In some cases, the patient has a slight feeling of nausea and headache, which is a completely normal symptom and drinking fluids can be very helpful because it causes the color substance to leave the body. After the symptoms are normal, the patient can continue his daily activities [50].

Complications and risks of brain MRI

In general, MRI is not dangerous except in special cases such as:

Sometimes the magnetic effect causes pacemakers and implants to not work properly and can even lead to the metal piece moving inside your body. Sometimes the patient shows sensitivity to the contrast material, which is harmful for people who have kidney problems and undergo dialysis [51-59]. Because you stay inside the device for a long time without moving, you may feel dizzy. Be careful when you get out of the device. When the contrast material is injected, heat is felt at the injection site or, rarely, there is a possibility of infection in the area where the contrast material is injected [60].

How long does a brain MRI take?

The duration of MRI imaging of the brain depends on various factors, depending on whether it is conventional or with contrast, from which area it is performed [61-66]. Normal MRI takes between 15 and 60 minutes, if contrast material is injected, more time may be needed. The patient must cooperate because it has a significant impact on the duration of the MRI.

MRI of cerebral vessels

MRA creates three-dimensional images of brain vessels using a magnetic field and radio waves and provides an accurate picture of blood flow in the vessels and in the diagnosis and investigation of vascular disorders such as narrowing of the arteries, closing of the heart vessel, blood vessels, aneurysms (enlargement and swelling) vessels and other cases are used. MRV has high accuracy and interpretability of images. This technique is able to create accurate images of brain vessels, especially veins. This imaging is used to diagnose brain diseases such as cerebral venous thrombosis (blood clot in the brain), venous structural abnormalities, intracranial blood pressure, and flow problems.

(MRS) or MR spectroscopy

This non-invasive method provides accurate information for measuring chemical changes in the brain, especially the presence of tumors. Drama R spectroscopy compares the chemical composition of normal brain tissue with abnormal and tumor tissue [67-71]. It can also be used to identify the content of internal brain lesions in the diagnosis of MS and the diagnosis of primary tumor from cancer metastases, and it is used in the diagnosis of tissue changes in stroke and epilepsy [72].

MRI of the brain in the diagnosis of the pituitary gland

MRI of the pituitary creates images of the pituitary gland and is the best and most accurate main solution to diagnose the pituitary tumor, it is used to determine the size and type of the tumor [73-45]. Most macro adenoma and micro adenoma tumors are determined by this imaging method. This method can definitively determine the disease caused by hormonal imbalance, which is caused by a pituitary tumor.

CT scan of the brain (CT scan) and MRI of the brain (MRI) are two medical imaging methods that are used to diagnose brain diseases. Both

methods are capable of diagnosing brain diseases, but there are differences in the principles of their use. Brain CT scan uses X-rays to obtain three-dimensional images of the brain and its internal structures [76]. This method is able to accurately show bone structures, blood supply and brain volume, and bone fractures. A CT scan of the brain is performed quickly and the results are usually available within a few minutes. But due to the use of X-rays, it may cause complications in some cases [77].

Brain MRI uses a strong magnetic field to obtain very detailed and high-quality images of brain structures and soft tissues. This method is able to accurately show nerve structures, brain tissue, brain disorders, tumors, inflammations and changes in blood flow in the brain. Additionally, brain MRI does not use X-rays and is safer for many patients. However, brain MRI takes more time than brain CT scan, and its results require more processing and analysis. In certain cases, depending on the type of disease, doctors may prefer one method over the other, or may even use both methods in combination to obtain more accurate and comprehensive results about the state of the brain.

Although the cost of a brain MRI is somewhat higher than a CT scan, it is a better option for people with pacemakers, nerve stimulators and cochlear implants or children who need multiple scans because babies and children are more vulnerable to X-rays.

Is it possible to perform MRI with a metallic artificial valve?

No type of metal is allowed in MRI because the magnetic field in the machine can attract metal. Heart valve prostheses are made of different materials such as polymers, metals and carbon. valves and artificial prostheses, due to the occurrence of ferromagnetic phenomena, the possibility of heating and movement of artificial prostheses, they cannot perform MRI tests.

Interpretation of brain MRI results

The attending physician examines the overall image of the MRI, but the MRI results are analyzed by the radiologist for a more detailed examination and final diagnosis. The MRI report is prepared within one day to one week. MRI is a method of examining the internal organs of the body that uses magnetic waves, radio waves and a computer to produce images of the body's organs. MRI is painless and does not require X-rays.

People with pacemakers, metal implants or chips, and metal clips in or around their eyes cannot have an MRI. Because the magnet in MRA and its magnetic field affect the result of MRA and clear images are not created. MRI is not a good option for people who are afraid of closed spaces. Magnetic resonance imaging or MRI is a radiology scanning technique. This scan uses magnetism, radio waves, and a computer to produce images of the body's organs. An MRI scanner is a tube surrounded by a large circular magnet. The patient lies on a moving bed and then goes into the magnet.

The magnet creates a very strong magnetic field that aligns the protons of the hydrogen atom, and then these protons are exposed to a beam of radio waves. By doing this, different protons in the body start to spin and produce a weak signal that is detected by the receiver part of the MRI scanner. A computer processes this information and produces the final image. The radiologist then reviews these images and sends a report to your doctor. MRA image is very accurate and clear and can detect very small changes in body structures. Sometimes, a contrast agent such as gadolinium may be used to increase the accuracy of the images.

Purpose of doing MRI

There are several reasons why a doctor may prescribe an MRI for a patient, all of which are related to examining the health of the body's internal tissues. These tissues can include bones,

soft tissues (such as blood vessels, ligaments, and muscles), and brain. Sometimes, MRA may be used to diagnose an injury or disease, or to check a patient's progress in response to treatment.

What are the types of MRI? (What are the types of MRI with injection)

There are different types of MRI, which include:

- Functional MRI;
- Cardiac MRI;
- Breast MRI;
- MRA (Magnetic Resonance Angiography);
- MRV (magnetic resonance venography).

Each of these are used to examine and photograph different tissues of the body.

Functional MRI

Functional MRI is set to head MRI. While standard brain MRI examines the internal structures of the brain, functional MRI examines brain activity during various tasks such as speaking, recalling memories, or moving. The way functional MRI works is that the oxygen-carrying blood flow is greater in the more active parts of the brain. Functional MRI actually detects this change in oxygen levels. Functional MRI is used to help plan brain surgery and determine the effects of brain injuries and conditions such as stroke or Alzheimer's disease.

Cardiac MRI

Cardiac MRI is used to diagnose heart disease or other heart problems. The images obtained from this type of MRI can show the structure of the heart and the quality of its function. For example, the blood flow inside the heart can be checked with cardiac MRI.

Breast MRI

Breast MRI is sometimes used to screen for breast cancer in younger women after seeing signs of breast cancer in women. Also, breast

MRI is used to determine the progress of this cancer in women with breast cancer. In addition, breast MRI is also used to check the status of breast implants in people who have had breast implants.

MRA

MRA focuses on imaging blood vessels, especially arteries. To help get a clearer picture of the blood vessels, a special dye is injected into the patient before the scan. This type of MRI is used to examine the structure of blood vessels to identify problems such as narrowing or blockage of the vessels.

MRI of the heart and blood vessels

Cardiac MRI is used to diagnose heart disease, damage from heart attacks, as well as structural problems with heart valves and blood stains. A cardiac MRI is usually completed in less than 90 minutes. If you are at risk of heart failure or have heart disease, angiography of the heart can probably detect and diagnose it.

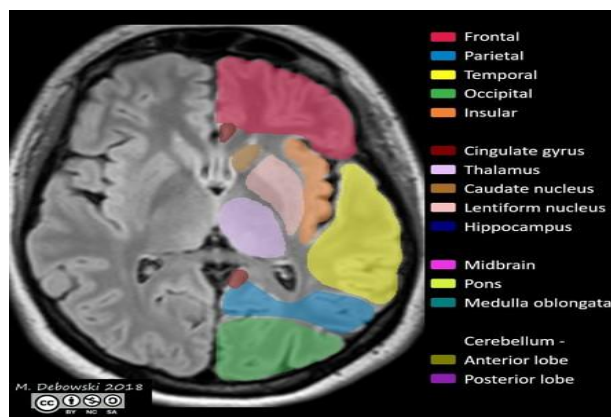


Figure 1. Brain lobes - annotated MRI

Conclusion

MRI scan is used to diagnose injuries and infections as well as bone cancer. MRI is also used to check the health of other organs in the body, including the bladder, intestines, liver, kidneys, and pancreas. This test can also help evaluate the health of the ovaries and breast in women and the prostate in men. Depending on

the purpose of the MRI, a special dye (contrast dye) may be injected to help certain tissues show up more clearly. This MRA is called MRA with injection. An MRI of the knee can be used to help identify the following problems around the knee joint:

- Weakness;
- Swelling;
- Bleeding.

This type of MRI usually takes about 30 to 60 minutes. During an MRI, small devices containing coils may be placed around the knees to help produce a clearer image.

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