

MRI SCRIPT

Narrator: *Magnetic Resonance Imaging, or MRI, is a diagnostic imaging technique used to distinguish diseased, damaged or abnormal tissue (such as a tumour) from healthy tissue. Using powerful magnets and radio frequencies, it can create very high resolution images of the inside of the body. Mike is going to go through an MRI procedure so we can see how it's done.*

Mike: They're going to run me through everything that would happen to a patient when they come for an MRI. After I had waited for a bit, I was called in and met an MRI technologist at the desk. He explained that I had to fill out some safety checklists...you can't go in the machine if you have certain metal or electrical objects in you from surgeries or procedures you've had. MRI doesn't use radiation like an X-ray or CT machine, but it does use a very powerful magnet...I was told that the magnet used in MR can be 50,000X the strength of the Earth's magnetic field, so everyone has to be super careful with any metal objects around the machine. Also, the magnet is always on, so never walk into a room with a MRI machine with anything metal in your pocket...

Once I was changed, an MRI technologist helped me get ready for the scan...sometimes you have to get an IV line inserted so they can inject something called a contrast agent...this can make blood vessels show up in the scan. He told me that patients sometimes get a sedative to calm them down and warned me that people sometimes get claustrophobic when they are in the machine, since it's really narrow and noisy. I didn't think I would have any problems, so I was ready to get into the machine.

Once I was prepped, he brought me into the scan room and got me into the machine. He got me comfortable and gave me earplugs to dampen the noise of the machine during the scan. The machine looks like a huge cylinder, which is the giant system magnet. He explained that a scan would normally get pretty noisy as magnets and coils are turned on and off, and it would last about half an hour. He said he would be in constant voice and video contact with me, and gave me a button to press if I needed anything. He also reminded me once again that this is totally safe and painless!

The next part got a little weird...they had to place coils around my head...the tech explained that these coils are like antennas that will transmit and receive radio frequencies. The radio signals made by these coils somehow work with the magnet to create an image from inside the body. He advanced me into the machine and went to his control room. It is really narrow inside the machine...I could definitely see how people feel claustrophobic in here!

N: *The technologist starts with a quick, low-res preview scan called a scout. From the scout, a block will be selected for a higher-resolution scan. Here he is selecting areas to be scanned in. Computer software allows the technologist to create a 3D 'block' to be scanned: a typical 'block' might be composed of 80 slice-like images of 0.8mm each. Put together, these slices can create a 3D image.*

The basic principle behind MR deals with how hydrogen atoms spin in a strong magnetic field. Since you are mostly made up of water, you contain plenty of hydrogen atoms. Different tissues of the body, like fat, muscle or nervous tissue all have different water content.

Picture each hydrogen atom as a magnetic spinning top. Normally, your body's hydrogen atoms would be facing different ways, but if you put them in a giant magnet...they will all line up with the magnetic field like a compass needle does in Earth's magnetic field.

Next, we have to make those hydrogen atoms generate a signal we can read and translate into an image. Here's where the radio frequency (or, RF) transceiver coils that we placed around the patient come in. If we hit the aligned hydrogen atoms with a radio frequency pulse, they absorb some energy wobble. When the pulse stops, the protons line up again and release the absorbed energy. The RF coils, which both transmit and receive signals, can detect the released energy. Tissues with more hydrogen will release more energy than tissues with less hydrogen.

To generate the actual image of a particular part of the body, a second set of magnets called gradient coils within the main magnet turn on and off to change the magnetic field in specific places. This is why we hear the loud knocking and clanking noises associated with MRI. It's like being in a car with incredibly loud, pounding bass while someone smashes a hammer against metal. You are turning powerful magnets on and off next to another powerful magnet, and they rattle around in their housings.

M: The noise was pretty loud...even though they weren't scanning me, the main magnet is still on and noisy, but it was good to know that I could talk to the tech if I had to. Basically, I just tried to relax and stay still.

N: *If they are injecting a contrast agent, the technologist can control the injection from the control room. The technologist wants to scan as soon as the contrast agent enters the heart: the agent is a paramagnetic fluid that will create 'fresh spins' as it flows through the artery. Watch as the agent flows through the heart, to the lungs, back to the heart, through the aorta and up the carotid artery to the head and neck. The scanner is activated as soon as the agent reaches this point, and the computers will generate 3D images from the data. The computer can pull different structures out... Here you can see the carotid arteries in full resolution...this might help the patient's doctor look for blockages or narrow areas that may prevent blood flow to the head and brain. These images, when paired with full scans of the head and neck, will provide doctors with the information they need to treat the patient*

M: After about a half hour, the technologist came back in to get me and that was it...it was a little bit tight and noisy in there, but it was interesting to see how it works. From here, the images would be saved and then read by a radiologist who specializes in analyzing these types of images. The radiologist would then send these to the patient's doctor.

MRI safely produces stunning images of the body and is especially well-suited to brain, spinal cord and joint imaging. Although MRI does have some limitations with respect to cost and portability, it remains one of the most powerful imaging techniques that modern medicine has to offer.