Epilepsy and functional MRI (fMRI)
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Hello. My name is Dr. Ruggieri. I am a neuroradiologist in the Cleveland Clinic Neurologic Institute who works closely with the Epilepsy Institute and the head of the Section of MRI in the Imaging Institute. I would like to introduce you to a specialized test that your doctors have scheduled for you or your child called a “functional MRI.”

You or your child have likely already had a conventional MRI but this is a bit different. This is a specialized test designed to find the areas that control your normal activities like your ability to speak, to understand what others say to you, the ability to move certain parts of your body like your hand, and, in some cases, your sight. While there are relatively standardized areas that control these functions, everyone’s brain is a little bit different. You and your doctors are likely considering surgery to improve or eliminate your seizures. This test helps to localize the areas responsible for controlling the functions we discussed a moment ago and to show how far away these areas are from the area causing the seizures. When you or your child perform these tasks, the blood’s oxygen content and the blood flow changes to the areas controlling those activities. We can detect those changes and pinpoint where those areas are in your brain to help your doctor plan your surgery or your child’s surgery more safely.

The MRI machine is comparable to the one that you have experienced in the past but this is may be a stronger magnet. We will also place you in a helmet-shaped head coil like this, similar to what you remember from the diagnostic MRI of your brain. As such, we must take the same precautions that we took when we performed your conventional MRI exam as far as restricting metal that may be attracted into the strong magnet. For the sake of safety, we will ask you to update the MRI screening form that you remember from your earlier exam.

In contrast to your last MRI where we asked you to rest and remain perfectly still, we are now going to ask you to perform a variety of tasks for us while you are lying in the magnet. It is still critically important for you to remain still otherwise. We will speak to
you periodically throughout the exam through specialized earphones. A computerized voice will also intermittently give you instructions when to start or stop certain tasks through these earphones. In addition, you will be able to view a computer screen through a mirror built into the head coil that will guide you through some of these tasks.

The first thing we do will be to get a detailed picture of your brain so the first few minutes will be just like the MRI that you had in the past where you just lie quietly and listen to the machine. In some cases, your doctors may request more detailed diagnostic pictures of your brain in addition to the fMRI, but we will tell you about this when you arrive.

The first “task” you will perform during the fMRI exam will be a motor task during which we ask you to alternate between periods of rest with your hands at your side and periods of movement when we ask you to touch your fingers together. During the intervals when you are moving, we will ask you to touch your thumb to each of your other fingers in a sequential fashion with both of your hands at once.

Depending on the location in your brain that is causing your seizures, we may then ask you to move other parts of your body as well but we will give you special instructions for these separate tasks when you first arrive and again while you are in the MRI machine. Although you will be moving your fingers during the conventional task, it is extremely important that you remain perfectly still otherwise so we can accurately map the areas controlling these tasks to the detailed pictures that we took at the beginning of the test.

The next task will be a rhyming task. We will again alternate between “on” and “off” periods. During the “on” periods, we will display pairs of words to you on the computer screen which you will see through the mirror that we spoke of earlier. We will also give you a two-button response box to hold in your hand with yes and no buttons. When the two words on the screen match, you will press the “yes” button and you will hit the no button when the two words do not match. You will say these words to yourself in your mind but it is important not to physically speak or mouth the words.
During the “off” periods, we will display pairs of stick figures and you will push the yes or no buttons depending on whether the two pairs of stick figures are identical or not. The red areas on the pictures of the brain on the right are the areas of activation or the areas controlling rhyming for this particular volunteer.

The next task is a covert word generation task. During the “on” periods, we will display a letter on the computer screen and we will ask you to think of as many words you can that begin with that letter. You will again do this silently without speaking or mouthing the words. We will also ask that you avoid formal names as your answers.

During the “off” periods, we will present nonsense symbols to you on the screen (such as that in the middle of the screen) so you will obviously be unable to think of any words that begin with that symbol during these “off” periods. All of the red and yellow areas on the right are activated with this task.
The last task will be a passive listening task. During the “on” periods, we will read a book to you. We ask you to pay careful attention to the passage since we will ask you a series of questions afterwards to see if you understood the passages.

During the “off” periods, you will hear the same passage read backwards so the speech will be garbled. You must realize that we will not warn you when we are switching between the “on” and “off” periods so you must pay careful attention throughout this task. We will again produce similar maps but with different areas of activation.

If you moved at all during any of the tasks, we may ask you to repeat one or more of these tasks. It may also be necessary to repeat the detailed pictures we took at the beginning if you move at all during the exam. Since it is so critical that you remain still and do your absolute best during each task, you should be well rested when you arrive for the fMRI appointment. We obviously cannot sedate you as this will also compromise the results of the exam.

After the fMRI exam is complete, we must process all the data. We will then produce a report for your doctors, which localizes these specialized functions in your brain or your child’s brain for preoperative planning purposes. Please do not be concerned about the complexity of this exam. We will review the instructions for you or your child a couple of different times before we start. We will also repeat the instructions during the course of the exam itself.