

Advance Cardiology Programs

Cardiac Magnetic Resonance Imaging (CMRI)



Cardiac MRI is one of the most exciting and rapidly advancing imaging fields, and Cook Children's is one of a few select pediatric health care systems in the nation to offer this amazing technology to children and adults with congenital heart disease.

A cardiac MRI is a very safe advanced imaging technique that uses no radiation and is completely noninvasive, so it reduces stress on our patients. Yet, the powerful magnet and highly optimized software of cMRI enable us to capture images in great detail, even in teeny tiny hearts.

The cMRI program at Cook Children's is especially unique because we combine the very latest in this leading-edge technology with the expertise of a team led by pediatric cardiologist Steve Muyskens, M.D., who specializes in the field of pediatric cMRI. This gives the added advantage of having a highly skilled and trained team that not only know how to capture the heart in sharp detail, they know what to look for when meeting your doctor's request, assuring that your doctor receives the highest degree of accuracy available when making a diagnosis and—more importantly—better outcomes for your child.

Dr. Muyskens was honored as a Cook Children's Endowed Chair in 2015. This award is allowing him to create advanced cardiac imaging protocols and techniques using a 3 Tesla magnet. He has also created a 3D aPPROach lab that uses 3D virtual viewing software and 3D printing technology for the treatment of patients with complex heart conditions. The images and the model offer superior detail to those previously available and will help our cardiologists and surgeons visualize complex anatomy in order to determine the best treatment plan.

What is a cMRI?

Cardiac magnetic resonance imaging (cMRI) is performed to evaluate the structure and function of the heart and blood vessels and may provide cardiologists with information that cannot be obtained by other tests.

cMRI is noninvasive and takes pictures of the heart and surrounding structures using a large magnet, radio waves and a computer. The cMRI machine is a large, tunnel-shaped machine with a table attached. The patient lies on the table and slides into the tunnel. The machine then creates a magnetic field that surrounds the patient. Radiofrequency combines with the magnetic field to move certain molecules in the body.

The powerful 3-Tesla, or 3-T, cMRI technology at Cook Children's enables us to create images of the heart with details so sharp, we are able to see very small lesions, tumors and abnormalities in the structure of the heart. We can also see the functions of the heart, how it beats and pumps blood and how the valves are working.

Computers then use the images to provide 3-dimensional, or 3-D, image that is kind of like a map of the heart. We can even create 3-D movies of the heart which can be rotated so that we can see the how the heart works from every angle, revealing in detail any defects or disease. These images also provide cardiac surgeons with the kind of detail that can make surgery more accurate and less stressful on the patient.

Did you know that our cMRI team can make a 3-D movie of the inside of your heart? This detail helps doctors to find even the tiniest lesions, and it helps to make complicated surgeries much easier to perform because the surgeon can pinpoint the area to be treated with increased accuracy.

A cMRI does not use any radiation and it is noninvasive. The only risks are if the patient has any metal devices implanted in the body. Most devices are MRI compatible, but we still need to be informed. Devices include, but are not limited to:

- Pacemaker
- Insulin pump or other medication device
- Metal clips, pins or other metal objects
- Bullet or bullet fragments
- Heart valve replacements
- Joint replacements
- Any implant that you think may have metal in it, or any implant about which you are unsure

Our medical team will discuss this with you prior to the day of your appointment, but it helps if you can make a list ahead of time. Also, if you forgot something when going over the details with our team, please be sure to call us with that information, we're here to make this process as easy as possible for you and your child.

If your child's doctor requests the use of contrast dye to enhance the images, your child may be required to fast for several hours prior to the exam. At Cook Children's we use a non-iodinated contrast (it doesn't contain iodine) called gadolinium. Compared to other contrasts, it has very minimal side effects and is not toxic to the kidneys or liver.

Who gets a cMRI?

cMRIs are especially useful in diagnosing kids, teens and young adults with complex congenital or acquired heart disorders, in preparation for surgery and follow-up after surgery.

For patients who may be transitioning to adult care, a cMRI can help to provide detailed and valuable information to the treating physician. It is also used for monitoring adult patients with lifelong congenital conditions to assure that there have been no significant changes in the functioning of the heart. A cMRI is often used to:

- Evaluate the structure of the heart and surrounding blood vessels
- Assess blood flow to the heart muscle
- Determine the functioning of the heart's chambers and valves
- Evaluate infection
- Detect tumors

Choosing Cook Children's cMRI Program

When you choose Cook Children's Cardiac Magnetic Resonance Imaging (cMRI) program, you know that your child is in the care of one of the nation's very best medical teams, made up of people who truly understand the functioning of all pediatric hearts and those of adults with lifelong congenital conditions.

Developed and led by pediatric cardiologist Steve Muyskens, M.D., our clinical program team performs and interprets cMRI in cardiology patients of all ages and with all types of heart disease using the most advanced technology available today.

Dr. Muyskens trained in pediatrics and pediatric cardiology at Washington University School of Medicine in Saint Louis, MO. During that time he developed his interest in non-invasive imaging and pursued additional training in cardiovascular magnetic resonance imaging through the Mallinckrodt Institute of Radiology at Barnes-Jewish Hospital and Washington University. Following his graduation he spent three months at Boston Children's Hospital, Harvard School of Medicine, increasing his knowledge and experience in CMR.

Today, we offer one of the few programs where a board certified pediatric cardiologist is present and participates in our imaging to assure that all images are what the requesting doctor needs. In addition, every member of our cMRI team has been personally trained by Dr. Muyskens.

Whether it is a first diagnosis or preparing for a complex cardiac surgery, by providing a truly advanced pediatric cMRI program, we offer doctors clearer, more accurate images in 3-D and moving 3-D. This, in turn, delivers increased information and the ability see and address issues, while at the same time reducing stress on patients, and improving their outcomes, now and well into the future.

Since January 2011 when this program was introduced, more than 300 cardiovascular MRIs have been performed at Cook Children's.

Preparing for a cMRI

Prior to your visit

Even though a cMRI is noninvasive and uses no radiation, young children can sometimes feel nervous about the procedure. We recommend that you explain to your child, in an age appropriate manner, why the exam is being done and how it will help them. The cMRI machine is very large and during scans it is also loud. Some children, and even older patients, might be afraid of the size and sounds of the machine. Explaining ahead of time why the machine is so large and why it makes noise during the scan can help to ease your child's fears if he or she knows what to expect.

Let your child know that you will be nearby. You may want to bring a story book to read during the waiting. You can bring a favorite blanket or stuffed toy that your child can hold during the cMRI (be sure that the stuffed toy doesn't have any metal parts). Since patients can watch a movie or listen to music during the cMRI you are welcome to bring a music CD or a light-hearted movie DVD (Blu-ray formats CANNOT be played) from home. Also, if the patient wears glasses and contacts, and plans to bring a DVD movie, it is best to wear the contacts. Movies are watched through our movie goggles which are not compatible with all eye glasses.

Because your child will need to remain very still and hold their breath for 10-15 seconds during each scan, it will be helpful to practice this at home before the day of your appointment.

Prior to your scheduled visit, you will receive a call confirming your appointment. At that time, we will also go over the schedule, any requirements or restrictions for eating or drinking before the test and instruction if your child is to be sedated. We will also answer any questions you may have. If your child's doctor requests the use of contrast dye to enhance the images, your child may be required to fast for several hours prior to the exam. We will also go over these instructions with you.

On the day of your appointment

On the day of your appointment, dress your child in comfortable clothing that is free from zippers, snaps or other metals. If you like, you may also bring a DVD video or music CD for your child to enjoy during the test. If one parent plans to stay in the imaging suite with the child, that parent should also dress in comfortable clothing that is free from zippers, snaps or other metals. A parent who has any type of metal implant will not be able to remain in the suite for health and safety reasons.

Please arrive at least one hour before your test is scheduled. This will allow time for registering, any additional paperwork that may be required, time to remove any metal jewelry and hair items such as barrettes, hair clasps or elastics and, if required, placement of your child's IV.

If your child requires anesthesia, you will need to arrive at least 2 hours before your appointment.

You should plan to spend 3-4 hours at the Medical Center (longer if anesthesia is required). The actual cMRI examination of the heart usually lasts from 1-1/2-2 hours, but we need to allow plenty of time to get ready. Please note that if you are late for your appointment, your cMRI may have to be rescheduled.

If you have to reschedule, please contact our office as soon as possible. We have many patients who are waiting to have a cMRI test, letting us know at least several days in advance assures that another patient can be seen in that time slot.

Will my child need sedation?

In order to ensure that we get the clearest pictures possible, it is important for your child to remain still in the cMRI scanner during the test. We have children and some teens and adults who are unable to lie still or are frightened by the machine may require sedation during the exam.

Patients sometimes experience anxiety inside the tunnel. This is called claustrophobia, and it is usually temporary, lasting only a few minutes until they get used to the tunnel. However, if you feel your child is claustrophobic, please talk with your doctor well in advance of your cMRI appointment. Your doctor may be able to prescribe medication to help relieve the anxiety.

If your child is receiving sedation

Certain eating and drinking restrictions are required for all patients receiving sedation. Eating and drinking instructions are different for each child, but in general, 6 hours before your scan is scheduled to begin, you will stop giving your child solid foods, and begin giving the following clear liquids only:

- Water
- Yellow Gatorade
- Apple juice with no pulp
- Pediatlyte

If your child is six months old or younger and you are nursing, you may give your baby breast up to 3 hours before the cMRI is scheduled.

If your child is NOT receiving anesthesia

Patients who are not receiving anesthesia should not eat or drink anything 1 hour before the cMRI is scheduled. If your child requires anesthesia, you will need to arrive at least 2 hours before your appointment.

What happens during a cMRI?

Getting ready

Before the actual exam begins, you will fill out a screening form. Next, your nurse will explain the exam, answer any questions you or your child may have. If a hospital gown is required for the exam, it will be put on at this time, then the nurse or technologist will put EKG stickers (leads) on your child's chest or back, and an IV line will be placed.

Your child will lie down on the bed, or table, of the machine. The doctor and technicians will do what we call a "practice run." The table will move into the center of a big round tunnel, which is where the images are scanned. When a scan begins, the machine makes very loud whirring and clanking noises, but nothing will touch your child, it just means pictures are being taken. The team will practice breath-holding and lying still with your child. Once the patient is comfortable, the actual exam will begin.

During the exam

You are welcome to stay with your child during the cMRI. If you're pregnant, another parent or adult can stay with your child instead. Due to space limitations, only one person can stay with your child during the exam.

During the exam, your child will be wearing headphones so the cMRI doctor can talk to him or her and give instructions, such as when to hold still, when to hold their breath and when to relax and breathe. During each scan the machine is very loud. If your child is listening to a music CD or DVD video, the headphones will help to block out the noise. The process will be repeated several times since many pictures are required in order to create an image.

After the exam

Once the images are complete, your child's IV will be removed and you and your child will be ready to leave. If your child received sedation, he or she will go to the recovery room until they are fully awake and able to drink, then they will be ready to return home.

Getting the results

Once the exam is complete, Dr. Muyskens and our cMRI team will review the images and report the results to your child's cardiologist, this usually takes 1-2 days. The cardiologist will call you with the results. Depending on the complexity of your child's condition, this may take several days.

Cancellations

We know sometimes things happen beyond your control, like your child may get ill, but if you have to cancel your cMRI appointment, please call 682-885-2140 at least 3 days prior to your appointment.

If you must cancel the night before your scheduled cMRI, please leave a message by call 682-885-2142.