

Hopkins study finds MRI tests safe for people with implanted cardiac devices

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Magnetic Resonance Imaging (MRI), an important diagnostic test, has traditionally been off limits to more than 2 million people in the United States who have an implanted pacemaker to regulate heart rhythms or an implanted defibrillator to prevent sudden cardiac death. Now, in a study published in the October 4 issue of *Annals of Internal Medicine*, cardiologists at Johns Hopkins report that a protocol they developed has proved effective in enabling patients with implanted cardiac devices to safely undergo an MRI scan.

"We believe this is the largest prospective study of MRI in patients with implanted devices," says lead author Saman Nazarian, a Johns Hopkins cardiac electrophysiologist and an assistant professor of medicine at the Johns Hopkins University School of Medicine.

"The guidelines we have published can be used to make MRI more available to people who could benefit from early detection of cancer and other diseases and for guiding surgeons during procedures. MRI is considered superior to CT scans in many clinical scenarios, especially for brain and spinal cord imaging," adds Nazarian. To date, more than 700 patients with implanted cardiac devices have safely undergone MRI exams at Johns Hopkins.

Their prospective study followed 438 people with implanted cardiac devices who had 555 MRI scans. Almost all of the exams, 94 percent, were conducted at The Johns Hopkins Hospital. The rest were performed at Rambam Medical Center in Haifa, Israel. The researchers found that with appropriate precautions, patients with pacemakers and defibrillators can have an [MRI scan](#) with very low risk of the device malfunctioning, moving, heating or causing [abnormal heart rhythms](#) due to the magnetic and radiofrequency energy generated by the test.

The devices implanted in three of the patients in

the study, 1.5 percent, had a power-on reset event during an MRI scan, which means that the energy emitted from the scanner caused the devices to revert to default settings. This is a rare occurrence that warrants close expert monitoring during the test, but is easily remedied after the test is completed. None of the three had device dysfunction during the long-term follow-up of between 15 and 66 weeks. One of those patients completed four repeated MRI examinations during the study without any problems.

Johns Hopkins cardiac electrophysiologist and biomedical engineer Henry Halperin began researching the issue of MRI safety with implanted devices about 15 years ago, testing a range of devices. The safety protocol he developed is now being adopted by institutions around the world.

"The newer pacemakers made after 1998 and defibrillators manufactured since 2000 come with electromagnetic interference protection," says Halperin, who is a professor of medicine at the Johns Hopkins University School of Medicine and the senior author of the study. In addition to the age of the device, the Hopkins team checks the type and configuration of the leads attached to the device. For example, if a lead is disconnected and is not part of the device's function, an MRI would not be recommended because the tip of the wire could get very hot.

"We reprogram the device to a safe mode while the patient is having the MRI scan," says Rozann Hansford, R.N., M.P.H., a study author who monitors patients at Johns Hopkins during the scans. "We carefully monitor the patient's blood pressure, electrical activity of the heart and oxygen saturation, and look for any unusual symptoms. After the test, we reprogram the device and carefully check its function." The patients' devices are checked again in 3 to 6 months.

The researchers conclude that with a protocol

based on device selection, programming and careful patient monitoring, MRI can be performed safely in many patients who have a pacemaker or a defibrillator. "With the advancing age of the population and the expanding indications for pacemakers and defibrillators, this has become an increasingly important issue, and a lifesaving one for some patients," says Nazarian. He adds that many of the patients with cardiac devices who have come to Hopkins for an MRI scan had tumors and other serious problems diagnosed and treated, whereas those problems had been missed by a previous imaging test, such as a CT or ultrasound exam.

Provided by Johns Hopkins Medical Institutions

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