

Magnets in newer portable electronic devices can interfere with implanted defibrillators

March 1 2022



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Magnet technology is increasingly being used in portable electronic devices, such as the Apple AirPods Pro charging case, the Apple Pencil 2nd Generation and the Microsoft Surface Pen. However, if the devices

are carried in pockets near the chest, and the individual has an implanted cardiac device (ICD), the magnets may interfere with the ICD's ability to help regulate the heart, according to new research published today in *Circulation: Arrhythmia and Electrophysiology*, a peer-reviewed journal of the American Heart Association.

"If you carry a portable electronic device close to your chest and have a history of tachycardia (rapid heartbeat) with an ICD, strong magnets in these devices could disable your cardioverter defibrillator," said lead study author Corentin Féry, M.Sc., a research engineer at the University of Applied Sciences and Arts Northwestern Switzerland, Institute for Medical Engineering and Medical Informatics in Muttens, Switzerland. "Heart patients should be aware of these risks, and their doctor should tell them to be careful with these [electronic devices](#) with magnets."

Devices and machinery with magnets exhibit a vector field or area of magnetic influence that can inhibit pulse generators for implanted ICDs and pacemakers. In ICDs, magnets can activate a switch prohibiting the ICD from delivering lifesaving shocks. Newer [portable electronic devices](#) equipped with strong magnets can disrupt the ICD operation. Earlier research on the iPhone 12 Pro Max demonstrated that its magnetic field is strong enough to interfere with the normal operation of an implanted pacemaker or ICD when held within an inch.

In this study, researchers tested the magnetic field output of the wireless charging case of the Apple AirPods Pro, the Microsoft Surface Pen and the Apple Pencil 2nd Generation. Their magnetic field strength was measured and compared to the iPhone 12 Pro Max. Using a magnetic mapper with 64 magnetic sensors, researchers measured the magnetic field strength of these products at various distances. The portable electronic devices were also placed closer and closer to five defibrillators from two representative manufacturers until a therapy deactivation occurred. These distances then constitute the minimal safety distance at

which an interaction has actually taken place.

The maximum distance for a possible interaction between the portable electronic devices and the implantable cardiac devices was:

- around 2 cm (0.78 inches) away for all of the Apple products; and
- 2.9 cm (1.14 inches) away for the Microsoft Surface Pen.

While the tests results showed the maximum distance for a possible ICD interaction, researchers said for safety the minimal distance is between 0.8 cm (0.31 inches) for the iPhone 12 Pro Max and the Apple Pencil 2nd Generation, and 1.8 cm (0.71 inches) for the Microsoft Surface Pen and the opened charging case of the Apple AirPods Pro .

"The public needs to be aware of the potential risks of portable electronic devices in addition to the iPhone 12 Pro Max that may affect anyone with an ICD," said study co-author Sven Knecht, D.Sc., a research engineer at the Cardiovascular Research Institute Basel at University Hospital Basel, University of Basel in Switzerland. "What is most concerning is that magnets are being used in more and more portable electronic devices, and with so many magnets around us, the risk to cardiac patients is even greater."

"These devices can cause a problem when carried in your shirt or jacket pocket in front of the chest, as well as when you are lying on the couch and resting the electronic device on your chest, or if you fall asleep with the electronic device," Féry added. "The main thing to remember is that any electronic device may be a danger, especially ones with a magnet inside."

In the future, the researchers plan to focus on testing e-cigarettes, other pencils for tablets and other portable electronic devices for their

potential magnetic interaction with cardiac devices. "With so many copycat products and accessories available, there may be a problem for the public to know which products pose increased risks," Knecht said.

A major limitation of the study was that it was not conducted on ICDs implanted in patients. "In people with ICDs, the impact of the magnetic interaction will depend on the individual and their overall health," Knecht said. "This research was the first step in identifying the importance of assessing some products for safety. The next step is to confirm these interactions by testing implanted devices in volunteer patients who are at the hospital for routine tests."

The [American Heart Association recommends](#) keeping cell phones at least six inches away from ICDs or pacemakers by using it on the ear opposite from the implantation and to avoid keeping the cell phone in a front chest pocket.

"The American Heart Association and the manufacturers of pacemakers and implantable cardioverter defibrillators have long recommended that magnets be kept away from these implanted devices. A recent [Journal of the American Heart Association](#) study reported that the magnetic field induced in the receiver coil of the iPhone 12 Pro Max can result in clinically identifiable magnet interference in pacemakers and ICDs," said N.A. Mark A. Estes, M.D., professor of medicine and director of the Clinical Cardiac Electrophysiology Fellowship Program at the Heart and Vascular Institute of the University of Pittsburgh School of Medicine, and an American Heart Association volunteer. "The current study extends observations on magnetic field interactions with even more devices containing magnets. Patients with cardiac electronic implantable devices should be instructed to keep all electronic devices that can generate a [magnetic field](#) several inches from their pacemakers or ICDs."

Co-authors are Adrien Desombre, B.Sc.; Thomas Quirin, M.Sc.; Patrick Badertscher, M.D.; Christian Sticherling, M.D.; and Joris Pascal, D.Sc. Authors' disclosures are listed in the manuscript.

More information: Magnetic Field Measurements of Portable Electronic Devices: The Risk Inside Pockets for Patients With Cardiovascular Implantable Devices, *Circulation: Arrhythmia and Electrophysiology*,

www.ahajournals.org/doi/10.1161/CIRCEP.121.010646

Provided by American Heart Association

Citation: Magnets in newer portable electronic devices can interfere with implanted defibrillators (2022, March 1) retrieved 5 May 2024 from <https://medicalxpress.com/news/2022-03-magnets-portable-electronic-devices-implanted.html>

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