ICD, Pacemaker Users: Beware of Interference

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SNOWMASS, COLO. — Magnetic resonance imaging is by far the most problematic medical source of electromagnetic interference with implanted cardiac device function, according to Dr. William H. Spencer III.

Other potential sources of interference include radiotherapy, neurostimulators, electrosurgery, radiofrequency catheter ablation of arrhythmias, and lithotripsy. On the other hand, here are some things device wearers often fret about but needn't: diagnostic x-rays, CT scanning, mammograms, ultrasound, and most forms of laser surgery, Dr. Spencer said at a conference sponsored by the Society for Cardiovascular Angiography and Interventions.

He shed light on sources of interference that may affect implanted cardiac devices:

► **Radiotherapy.** The damage to pacemakers and implantable cardioverter defibrillators (ICDs) by radiotherapy is dose dependent, cumulative, and permanent. "You can fry the system circuitry," said Dr. Spencer, professor of medicine at the Medical University of South Carolina, Charleston. The radiation oncology center should have protocols for avoiding direct irradiation of the device, creating the greatest possible distance between device and radiation beam, and maximum shielding.

"If you have a woman with breast cancer and positive nodes in the left axilla [who needs] radiotherapy, you may need to move the device over to the other side," he said.

► **Neurostimulators.** Transcutaneous electric nerve stimulation, and the peripheral and spinal nerve stimulators used to treat neuropathic and orthopedic pain, can often be used safely in patients with modern bipolar pacemakers. But the patient should first undergo testing at the stimulator's maximum output to ensure that it doesn't trigger or deactivate the pacemaker. There has been very little experience to date with ICDs, considered a relative contraindication to neurostimulator therapy.

► **Electrosurgery.** This creates one of the most powerful and dangerous electromagnetic fields found in the medical environment. The best option is to find an alternative form of surgery. Next best is to place the pacemaker in asynchronous mode, disable its antitachycardia and rate-responsive therapies, and employ true bipolar electrosurgery using short, irregular bursts of energy. Afterward, confirm that the device is working properly.

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DR. SPENCER

► **Radiofrequency ablation.** This interacts unpredictably with cardiac devices. Turn off rate-responsive and antitachycardia features and program the device to asynchronous mode for the procedure duration. If the goal is to create complete heart block, a temporary pacemaker must be inserted to ensure ventricular capture.

► **Shock wave lithotripsy.** This method of breaking up kidney and other stones is not nearly the problem it once was. Only patients with an abdominally implanted device generator are at high risk, and those are now uncommon. So long as the lithotripsy target and cardiac device are at least 6 cm apart, this therapy appears to be safe.

► **MRI.** The Food and Drug Administration and cardiac device manufacturers list MRI as absolutely contraindicated. Deaths have occurred. It has been estimated that if not for the contraindication, an MRI would be recommended for various indications in up to 75% of U.S. pacemaker and ICD users during the course of the device's service life. Device manufacturers have made development of MRI-safe pacemakers and ICDs a priority, but none exist yet.

Meantime, there are situations in which only the data obtainable from MRI will do. And there are many anecdotal reports of MRI being done safely in pacemaker-dependent as well as nondependent patients. But proper precautions are essential.

The pacemaker should be reprogrammed to VOO or some other uninhibited mode of pacing. Only head and neck or extremity MRI should be done—no chest or abdominal imaging. A cardiologist should be on hand to monitor the ECG and pulse oximeter. And the device must be checked and reprogrammed immediately afterward, Dr. Spencer said. ■

Wireless Communication Devices Pose a Hazard to Pacemakers

SNOWMASS, COLO. — The everyday, 21st century electronic communications environment poses unprecedented electromagnetic interference hazards for patients with pacemakers or implantable cardioverter defibrillators, Dr. William H. Spencer III cautioned at a conference sponsored by the Society for Cardiovascular Angiography and Interventions.

"What are you going to tell your patients in 2006 regarding smart phones and other wireless communication devices such as PDAs, wireless computers, and iPods?" asked Dr. Spencer, professor of medicine at the Medical University of South Carolina, Charleston.

And those are just the out-of-hospital exposure issues. Many other electromagnetic interference (EMI) hazards confront implanted cardiac device wearers in the medical environment. (See story above.)

Pacemakers can respond to EMI in unwelcome ways: complete inhibition of pacing, asynchronous pacing, rapid pacing, mode reset to a very safe pacing mode, or physical damage to the generator and/or pacing leads.

Implantable cardioverter defibrillators may deliver an inappropriate shock or antitachycardia therapy or—even worse—be inhibited from delivering therapy when needed. Device memory can be corrupted, making it impossible for physicians to reconstruct what happened when the device encountered EMI.

The important thing to know about EMI due to wireless communication devices is the 10-cm rule. All implanted cardiac devices now incorporate internal filters that are highly effective in rejecting all but the strongest electromagnetic signals—those originating within about 10 cm of the device or leads. For this reason patients shouldn't carry their cell phone in a shirt or breast pocket. The power level, which fluctuates during a call, is highest immediately before and during ringing.

Patients also should hold the phone to the ear farthest from the device, which is typically the right ear. However, studies show most patients don't consistently do this, probably because they're right-handed and want to use that hand for writing or driving while talking on the phone.

The exception to the 10-cm rule involves later-generation wireless computers. They tend to have higher power at the antenna, according to Dr. Spencer.

Walk-through metal detectors used in airport screening are safe provided the patient moves briskly through. Heart devices contain very little ferromagnetic material and shouldn't trip the alarm. But if the alarm does go off, under no circumstances should the patient submit to a search using a hand-held wand over the chest; far better to be thoroughly searched by hand.

Electronic article surveillance systems used in stores to prevent shoplifting can also cause problems. "The patient should be instructed to walk rapidly through the gate and not to tarry. Vendors should not put any distractions in the area of the gate. If you tarry around one of these things, you may have an adverse event," the cardiologist continued.

EMI is really not an issue in the home provided electrical devices are properly grounded. Microwave ovens are safe.

However, arc welding—not just found in the workplace but, surprisingly, among do-it-yourselfers—creates tremendous EMI and should be avoided. Other industrial equipment needs to be approached on a case-by-case basis.

It's sometimes necessary to ask the medical device manufacturer to provide a technical consultant to conduct a comprehensive workplace EMI evaluation, said Dr. Spencer, who holds stock in Medtronic and Boston Scientific. ■

Electrical Storms Common, Unpredictable in ICD Patients

DALLAS — Electrical storms in implantable cardioverter defibrillator recipients are common, unpredictable, and debilitating—and the investigational antiarrhythmic drug azimilide reduces their incidence by up to 55%.

These were the key findings of a secondary analysis of the Shock Inhibition Evaluation With Azimilide (SHIELD) trial presented by Dr. Stefan H. Hohnloser at the annual scientific sessions of the American Heart Association.

SHIELD was a double-blind trial involving 633 patients who received an implantable cardioverter defibrillator (ICD) for secondary prevention of cardiac arrest and were randomized to the novel class III antiarrhythmic agent, azimilide, at 75 or 125 mg/day or to placebo.

The published primary results showed that treatment with azimilide resulted in relative risk reduction of 47%-57% in the combined end point of total all-cause shocks and symptomatic ventricular tachycardia terminated by antitachycardia pacing (Circulation 2004;110:3646-54).

The new prespecified substudy focused on electrical storm, which is defined as the occurrence of three or more separate episodes within a 24-hour period of ventricular tachycardia and/or ventricular fibrillation requiring ICD shock or antitachycardia pacing therapy.

"Electrical storm may, in fact, constitute a medical emergency," observed Dr. Hohnloser, who is professor of medicine at J.W. Goethe University, Frankfurt, Germany.

He added that before SHIELD, data on electrical storms were sparse and came mostly from uncontrolled clinical observations.

Of the patients in the placebo arm, 27% had at least one episode of electrical storm during the first year after ICD placement, compared with 23% of patients on 75 mg/day of azimilide and 20% of those on 125 mg/day. Low-dose azimilide reduced the overall relative risk of electrical storms by 41%, compared with placebo, while azimilide at 125 mg/day reduced the risk by 55%.

No precipitating cause could be identified in 87% of electrical storm episodes. The remainder was attributed mainly to worsening heart failure or electrolyte disturbances.

In patients who experienced an electrical storm, 80% were rehospitalized within 1 year of receiving their ICD. That rate was 2.2-fold greater than in patients with isolated ventricular tachycardia/ventricular fibrillation and 4.2-fold greater than in individuals who never experienced ventricular tachycardia/ventricular fibrillation. ■