ICD, Pacemaker Users: Beware of Interference

**Wireless Communication Devices Pose a Hazard to Pacemakers**

**SnoMASS, 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.

- **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 electrodes. But the patient should undergo testing at the stimulator’s maximum output to ensure that it doesn’t trigger or deactivate the pacemaker. There has been surprisingly 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.

- **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 a nonconductive pathway to the heart block, a temporary pacemaker must be inserted to ensure ventricular capture.

- **Shock wave lithotripsy.** This method of breaking up stone and other anomalies in the urinary tract tends to be effective at distances of nearly 10 cm. Patients also should hold the device over to the side for this purpose. The radiation oncology center should be instructed to walk rapidly and/or off, under no circumstances of magnetic interference hazards for patients with modern bipolar electrodes. Dr. William H. Spencer III cautioned at a conference sponsored by the Society for Cardiovascular Angiography and Interventions.

“When 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 wireless Telephones. They tend to have higher power at the antenna, according to Dr. Spencer.

Walk-through metal detectors now incorporate internal filters. 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 preoperative workplace 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 antiarhythmic drug azimilide reduces their incidence by up to 75%.

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 antiarhythmic agent, azimilide, at 75 mg/day 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 endpoint of total and nonshock shocks and symptomatic ventricular tachycardia terminated by antitachycardia pacing (Circulation 2004;110:3646-54).

The new prespecified subgroup analysis focused on electrical storm, which is defined as the occurrence of three or more separate episodes of 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 53%.

He added that the precipitating cause could be identified in 87% of electrical storm episodes. The remainder was attributed mainly to worsened heart failure or electrolyte disturbances.

In patients who experienced an electrical storm, 80% were rehospitalized within 1 year of receiving ICDs. The absolute risk rate was 2.2-fold greater than in patients with isolated ventricular tachycardia/ventricular fibrillation and 2.5-fold greater than in individuals who never experienced ventricular tachycardia/ventricular fibrillation.