

# Circulation

JOURNAL OF THE AMERICAN HEART ASSOCIATION



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James A. Reiffel and Jose Dizon

*Circulation* 2002;105;1022-1024

DOI: 10.1161/hc0902.105131

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ISSN: 1524-4539

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# THE CARDIOLOGY PATIENT PAGE

## The Implantable Cardioverter-Defibrillator Patient Perspective

James A. Reiffel, MD; Jose Dizon, MD

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From the patient's standpoint, the introduction of any therapeutic intervention raises quality-of-life questions, such as, "Will I live longer?" or "Will I feel better?" However, the introduction of a therapy can often raise additional questions:

- Will it have adverse effects?
- How much will it cost me?
- Is it inconvenient?
- How long will I need it?
- Will it interact with other treatments I use or things I do?
- What follow-up is needed?

These questions are valid and applicable to both drug treatments and nondrug treatments, including implantable cardioverter-defibrillators (ICDs). We will attempt to provide answers to these types of questions for patients with ICDs (Table).

ICDs have been proven to prolong survival in patients who either have suffered or are at risk of suffering serious abnormal heart rhythms that are most often the result of a damaged heart. The modern ICD is a relatively small (now 40 cm<sup>3</sup>) device (Figure 1) that is implanted under the skin, most commonly in the upper chest (Figure 2) but occasionally beneath the abdominal skin or muscles, with the use of a combination of local anesthesia and light sedation. The implantation procedure, much like implanting a permanent pacemaker, has become very safe. The ICD consists of a battery (which can last 3 to 6 years), energy delivery components, and electronic circuitry, which all are sealed in one case. The ICD is connected to the heart via one or more thin, coated wires (electrodes) that travel in the veins between the implant site and the heart. Through these electrodes, the

ICD monitors a patient's heart rhythm and delivers corrective electrical treatments appropriate for the specific types of heart rhythm disturbances that it may detect. These treatments may consist of either a single or very brief series of low-energy electrical pulses, which either stimulate the heart to beat if it has become too slow or interrupt certain types of abnormally fast heart rhythms. These low-energy pulses are not felt by the patient and are the same as those delivered by standard implantable pacemakers.

### How ICDs Work

In contrast to pacemakers, the ICD is also capable of delivering higher energy electrical pulses (shocks) to the heart to correct more serious rapid and sustained arrhythmias (ventricular fibrillation, ventricular tachycardia, and/or atrial fibrillation) that are not correctable with low-energy electrical pulses (pacing) and that can be fatal if not corrected (ie, ventricular fibrillation and tachycardia) or cause serious symptoms, such as fainting, in some patients (ie, ventricular tachycardia and atrial fibrillation). These higher energy shocks are called defibrillation shocks and are usually described as painful or significantly uncomfortable by most patients, but they provide most of the life-saving capability of the ICD. Some patients liken them to being kicked in the chest momentarily. Most often a single shock is felt, but on occasion, a series of shocks can be felt if the abnormal heart rhythm recurs or if the first shock does not work for a serious, prolonged, abnormally fast rhythm disturbance.

ICDs are implanted in patients who have survived  $\geq 1$  episode of ventricular tachycardia or fibrillation, in patients whose clinical profile indicates a high likelihood of developing sustained ventricular tachycardia or fibrillation, and in selected highly symptomatic patients with atrial fibrillation. Initially, antiarrhythmic drugs were developed to suppress abnormal electrical cardiac impulses in patients with ventricular tachycardia and ventricular fibrillation. However, in multiple clinical trials, the ICD has been shown to be superior to antiarrhythmic drugs in prolonging the life of these patients. Antiarrhythmic drugs are now a more common

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From the Division of Cardiology, Division of Medicine, Columbia University, and the New York Presbyterian Hospital, New York, NY.

Correspondence to James A. Reiffel, MD, 161 Ft Washington Ave, New York, NY 10032.

(*Circulation*. 2002;105:1022-1024.)

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*Circulation* is available at <http://www.Circulationaha.org>

DOI: 10.1161/hc0902.105131

## Questions and Answers About ICDs

Question	Answer
Why implant an ICD?	The ICD is the most effective method we have to prevent death from ventricular tachycardia/fibrillation.
How is an ICD implanted?	Under the skin, with local anesthesia and sedation.
How long is an ICD left in the patient?	Usually indefinitely, unless there has been a dramatic change in the patient's condition, such as a heart transplant.
Are there adverse effects?	Short-term: Infection, perforation of heart at time of implant (very rare). Long-term: Local pain, cosmetic concerns, sensation of electrical shock treatments, discomfort at implant site, psychological concerns.
What is the cost?	Usually covered by insurance if implanted for appropriate medical indication.
What are the follow-up procedures?	Outpatient visits about every 1 to 3 months; noninvasive testing.
Are there any inconveniences?	Specific lifestyle restrictions (such as driving for some patients); medications such as antiarrhythmic drugs may still be needed by some patients; reoperation for battery changes.

mainstay of the therapy of atrial fibrillation and other less severe rhythm disturbances.

### Follow-Up Procedures

After implantation, the patient with an ICD is monitored at regular intervals over time (usually every 1 to 3 months, as guided by specific factors) to evaluate what rhythm disturbances have been detected, what electrical treatments have been delivered and whether they worked, and whether the electrical treatments should be modified (ie, by altering the number and rate of pacing pulses or the energy level of a defibrillation shock). Monitoring also measures how much energy is left in the battery, the function of the electrodes, what symptoms the patient has experienced, and whether any other factors that could alter ICD treatments (eg, disease or medication changes) have appeared. Monitoring is performed noninvasively, ie, by applying a programming wand over the chest to allow communication between the ICD and an external computer via electromagnetic waves that are not detectable by or harmful to the patient. When the amount of energy stored in the battery has declined by a predetermined percentage, elective replacement of the ICD is scheduled. This avoids the very rare possibility of having inadequate energy in the battery to power the ICD when an electrical treatment is needed. As long as the electrode wires are functioning well, only the generator needs to be replaced, and this is a simple procedure.

### Problems and Solutions

Just as with medications, the ICD sometimes can have unwanted effects, akin to the side effects associated with pills. These can include the discomfort associated with

shocks, as noted above, discomfort related to the implantation, sensitivity at the ICD site (most common in very thin individuals with little muscle or fat mass over the chest bones), complications of implantation (such as infection, which is generally seen in <1% of patients), cosmetic issues (the unit is noticeable as a lump under the skin except in obese patients, and there is an incisional scar  $\approx$ 3 inches long), and psychological problems (a feeling of apprehension about the need for an ICD or fear about getting a shock). For the latter, many centers have formed support groups where experts and ICD patients can meet and discuss ICD issues. Cosmetic issues can be minimized, when important, by abdominal and/or implantation under the pectoral muscles to minimize the lump. At our center, several young women have had the ICD implanted under the lower abdominal muscles in the "bikini line" for this reason. For many patients, the psychological issues are not adverse but are beneficial, inasmuch as the high efficacy rate of the device reduces fears of serious rhythm disturbances and the risk of collapse or death and avoids the need to impose limits on their lifestyle.

With rare exception, when the ICD is implanted for an approved indication, it is covered by medical insurance and thus is not an undue expense for patients. It compares favorably with many other common procedures and costs the patient far less than common uncovered procedures, such as cosmetic surgery. Moreover, patients are usually out of the hospital the day after the implantation (same day for replace-

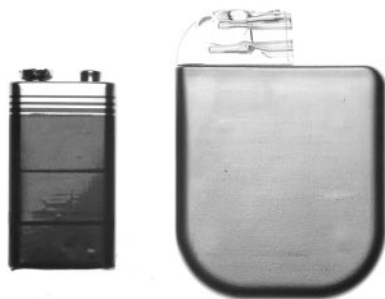


Figure 1. ICD, showing relative size vs standard 9-V battery.

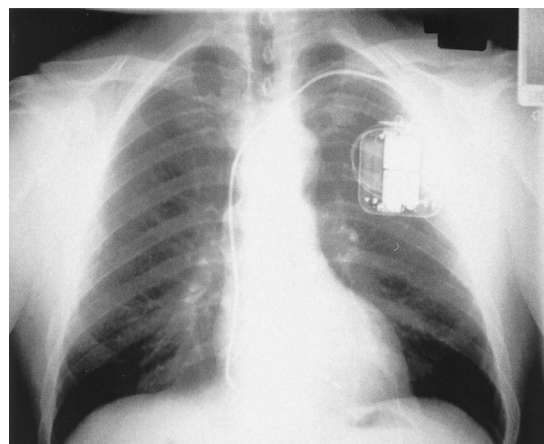


Figure 2. ICD after implantation as seen by chest x-ray.

ments), so it does not engender a lengthy, expensive hospital stay. Patients are encouraged to review costs with their specific medical providers and insurance carriers.

Just as with pacemakers, which are smaller, simpler devices that contain only some of the features of an ICD, the ICD can interact with external electromagnetic or radiofrequency signals. These interactions may be beneficial, as during ICD follow-up visits, or they may be adverse. More than momentary exposure to such fields may alter the function of the device and must be avoided. Thus, patients with ICDs should not undergo MRI procedures (but x-ray scans are not prohibited), should not stand in or near the doorway of stores with electronic theft-detection devices or airport security chambers (although they may pass through them), should not hold magnetic items (including stereo speakers) near their unit, and should not hold cellular telephones against the device (use the opposite ear). In areas of electronic security, patients can undergo hand security checks, as long as the inspector's wand is not kept over the device. Patients with ICDs are given identification cards to show such security personnel. Because microwave leaks may also interact with the ICD, we suggest to patients that they may use microwave ovens but not stand by them when they are on.

A substantial issue for both the patient with an ICD and his/her physician relates to driving. In the untreated patient, ventricular tachycardia may produce loss of consciousness (syncope) even if the episode is not fatal. This may occur if the heart beats so fast that it cannot fill adequately between beats. The time interval between the onset of the rhythm disturbance and fainting can vary from a few seconds to much longer, depending on many factors. Because the ICD takes several seconds (usually 5 to 15) to detect rhythm disturbances and deliver treatments, and because the first treatment delivered may not be effective and additional treatments may be required, it is possible for some patients to experience dizziness or fainting before the delivery of an effective shock and termination of the abnormal rhythm. Patients with an ICD are usually advised to avoid circumstances in which they or someone else could be injured were fainting to occur, eg, driving, piloting, and scuba diving. Such restrictions also vary with state law, and patients are encouraged to review this

issue with their physician on a case-by-case basis. Not infrequently, patients who experience long periods without a shock (eg, 6 to 12 months) and/or demonstrate an absence of fainting even if an event occurs are allowed to return to activities such as driving. Other restrictions may include contact sports to avoid damage to the ICD and its leads (electrodes), although most other athletic activities are not restricted if the patient's overall heart function can tolerate it.

In many patients, ICDs are used in conjunction with an antiarrhythmic drug. The antiarrhythmic medication may be used to decrease the frequency of rhythm disturbances (and thus to reduce the risk of fainting, discomfort from shock, or psychological burdens). Antiarrhythmic medication may also be used to alter the nature of the rhythm disturbance such that it may be less symptomatic and/or more amenable to termination by the low-energy pacing impulses rather than high-energy shocks. In many centers, up to 70% of patients with an ICD also take  $\geq 1$  antiarrhythmic drug. The antiarrhythmic drugs, although serving a beneficial purpose, carry with them the cost of the drug, the inconvenience of taking a drug, and the potential for drug-related adverse effects. Thus, they are used selectively rather than in all ICD patients. Moreover, because many antiarrhythmic drugs can alter the characteristics of the rhythm disturbance and the ability of the ICD to terminate it, repeat testing of the ICD is usually necessary when an antiarrhythmic drug is started or the dose is changed. Such repeat testing generally is performed in the electrophysiology laboratory on an outpatient basis and requires a brief period of sedation. The features of the ICD may be adjusted on the basis of the results of the repeat testing.

For more information, including additional diagrams, see the following websites:

- American Family Physician. The Implantable Cardioverter-Defibrillator. <http://www.aafp.org/afp/980115ap/980115b.html>. Accessed January 25, 2002.
- St Jude Medical, Inc. Some Basic Facts About ICDs. Available at <http://www.sjm.com/4.0/4.3/4.3.3/4.3.3.8/4.3.3.8.3.shtm>. Accessed January 25, 2002.
- Heart Center Online for Patients. The ICD Center. [http://www.heartcenteronline.com/The\\_ICD\\_Center.html](http://www.heartcenteronline.com/The_ICD_Center.html). Accessed January 25, 2002.