

[Print This Page](#)

(Requires [Adobe Acrobat Reader](#))

Implantable Cardiac Defibrillator Tutorial for the Patient

Westby G. Fisher, MD, FACC

Director, Cardiac Electrophysiology

Evanston Northwestern Healthcare

Evanston, IL 60201 U.S.A

(Late update: 30 Nov 2005)

The Top 15 Frequently-Asked Defibrillator Questions

1. **What is a defibrillator?** A defibrillator is a mechanical device that can shock the heart to restore a rapid heart rhythm to a normal heart rhythm. Automatic External Defibrillators (or **AEDs**) are devices that are applied to the exterior of the chest, usually during sudden cardiac arrest, that automatically detect and, if needed, shock the person's abnormal heart rhythm back to normal. This tutorial does *not* cover AEDs. Rather, the remainder of this tutorial discusses issues related to Implantable Cardiac Defibrillators (or **ICDs**).

ICDs are surgically-implanted devices that always contain a *pacemaker* (to support slow heart rhythms) *but also contain a computer that automatically detects rapid heart rates (usually above levels the heart should achieve normally) and can either pace or shock the heart back to normal rhythm.* To do this, all internal (or implantable) defibrillators are made of several pieces. First, there are wires that are installed into the heart through veins that lead from the arms to the heart. Secondly, these wires are then connected to the defibrillator pulse generator that contains the battery, charging circuitry and computer portion of the device. The pulse generator is usually implanted beneath the skin, just above the breast muscle (called the pectoralis muscle) at a location just below the collar bone (clavicle). In very thin individuals, the doctor can implant the device beneath the breast muscle (called a subpectoral implant) to assure plenty of tissue is over the device.

2. **Why Do I Need a Defibrillator?** There are a number of reasons doctors recommend to patients that they receive a defibrillator. The most common is because the person has already HAD a rapid heart rhythm that can be potentially life-threatening and it requires treatment. What is clear is that there are no drugs as effective at preventing sudden cardiac arrest that are as effective as ICD's in this situation. In other cases, the device is implanted as "primary prevention." Over the years it has become very evident that patients with very weak heart muscles are at much higher risk of suffering a sudden onset of a rapid heart rhythm that can be potentially fatal. Unfortunately, it was also discovered that patient's first abnormal rhythm was their last. As such, there has been a push in the medical community to implant these devices early in the course of a person's heart disease history to prevent sudden cardiac arrest. With this more aggressive approach in patients with weak heart muscles, there has been about a 23% reduction in cardiac deaths over patients that have been treated without such devices and only medications.
3. **How Do these Rapid Rhythms Occur?** These abnormal rapid rhythms can occur when skipped beats occur in succession in diseased heart cells and then circulate around an area of scar or abnormal heart muscle. When the heart races, there is not enough time for the heart chamber to fill with blood, and therefore there is not enough blood to pump out of the chamber to supply the needs of the brain. This can deprive the brain of oxygen rapidly and unexpectedly, resulting in loss of consciousness, and if sustained, even death. By implanting an ICD, the device can detect the abnormal racing rhythm, charge its shocking

circuitry, and deliver a sudden shock between the wire in the heart chamber, and the outside can of the pulse generator. This shock "resets" the heart back to its normal beating pattern.

4. **How Big are Defibrillator Shocks? I Hear They're Painful.** An ICD at its maximum output applies approximately 750-800 volts in a tenth of a second between the wire in the heart and the can of the pulse generator. As such, the shock is startling and sudden. The shock causes not only a correction of the heart rhythm, but also causes contraction of chest wall muscles, vocal cords and the breathing diaphragm muscle (occasionally resulting in an involuntary brief yelp from the patient). These shocks are often perceived as "painful" or like a brief electrical shock. Realize that the shock often helps the patient feel better, (no more lightheadedness) and saves their life. Patients DO NOT always have to have their rapid heart rhythm corrected with a shock, however. Often, the abnormal rhythm can be corrected with painless and imperceptible pacing therapy. Only if the pacing therapy is ineffective is a shock required.
5. **What Are These Newer "Biventricular" Defibrillators? Do I need one?** To understand this, you first must understand that your heart works like a gas engine: that is, there has to be a "spark" to move the "piston." In other words, to make the heart muscles contract, they must be first stimulated by a small electrical impulse to cause shortening of the muscles to cause contraction of the heart chamber. Hearts that become enlarged from damage either from a heart attack or from other causes (like severe viral infections) become stretched. This stretching also effects the electrical conduction system of the heart and slows the speed of electrical activation across the heart muscle. When this happens, the amount of time to electrically activate the heart muscles is slowed, especially on the portions of the heart wall farthest from the central heart muscle walls. This causes the central heart chamber walls to contract before the side walls, resulting in discoordination of the pumping mechanism of the lower heart chambers, the ventricles. Doctors call this "**ventricular dyssynchrony**." People with enlarged, weak hearts that demonstrate such pumping "dyssynchrony" can be greatly improved by providing an extra pacing wire that stimulates the side walls of the heart chamber at the same time as the center walls. This therapy is called "**cardiac resynchronization therapy**" (or CRT) and is also known as "biventricular pacing." Patients who are candidates for CRT are patients who have had congestive heart failure that is not improved sufficiently with aggressive medical therapy. **Congestive heart failure** means the heart cannot pump blood forward enough to meet the body's needs. Often this results in fluid backing up into the lungs, causing shortness of breath especially when lying flat or with minimal exertion. Alternatively, it can also cause leg swelling and abdominal bloating. Diuretics (water pills) are medicine often used to correct the fluid build-up in conjunction with other medications cause beta-blockers (to reduce adrenaline levels) and "ACE inhibitors" that lower blood pressure and decrease the work of the heart. If these drugs have limited effectiveness, then installing a device to re-coordinate the heart muscle and improve its pumping capabilities might be recommended by your doctor.
6. **If I decide to proceed with implantation of a defibrillator, what can I expect?** You will be asked to stop certain blood thinners you might be taking approximately four days before the procedure. Please ONLY stop the drugs recommended by your doctor! Next, you'll be asked to eat nothing after midnight the evening before the procedure. This means NOTHING, not even water. If your doctor wants you to take your medicines the morning before the procedure, he or she will tell you. Typically, patients enter the same-day-surgery clinic the morning before their surgery to be registered, have last minute blood work drawn, if needed, and then an IV (intravenous line) will be placed in your arm. We usually like to have the IV started on the same side your device is to be installed, if possible. Next, you'll wait until its your turn to undergo the surgery. Then you'll be brought on a rolling bed (or "gurney") to the catheterization laboratory holding area or pre-operative holding area, where your upper chest area will be scrubbed and pre-surgical antibiotics administered to reduce the risks of infection with the surgery. Also, EKG leads and safety defibrillator patches will be applied to your chest in preparation for the surgery. Your family members can accompany you to this area. Once ready, you'll say goodbye your loved ones and the lab or operating room personnel will take you into the laboratory where you'll be connected to the EKG machine, a small monitor on your finger to measure

your blood oxygen levels, blood pressure cuff, and oxygen in your nose. You'll get some nice medicines through your IV that will help you relax and enjoy the ride!! Next, you'll be secured to the narrow operating table with some loose restraints. Another antiseptic solution will be applied again to the operative area. Then you'll have your upper chest and even face areas draped with sterile towels, and a local anesthetic (numbing medicine) injected into the skin where the surgery is to take place. It stings a bit, but after this is done, most patients find the rest of the procedure totally or nearly completely painless. The doctor will then place the wires (or leads) into the large vein coursing from the arm back to the heart, and thread these wires to the appropriate heart chambers. One in place, the doctor will test the leads for their ability to pace the heart with small amounts of voltage and assure that the wires can "sense" your own heart beats when they occur in each chamber. Once happy with their location, the doctor will then make a small pocket beneath the skin in which to place the pulse generator of the ICD. The leads are then connected to the ICD and the ICD and lead assembly placed within the newly-formed pocket. At this point, the doctor typically requests the nurses or anesthesiologists to give more sedation to put you to sleep briefly. While asleep, your heart will be placed in the worst possible rhythm on purpose in a controlled setting to assure the device is going to work properly when you leave the hospital. Once in this rhythm, the device will shock the heart back to normal rhythm. The doctor will make final adjustments to the defibrillator settings, and the surgical pocket will be closed with absorbable sutures. A small dressing is applied over the wound, and you'll be returned to the post-operative recovery area. That's it!

7. **What does the wound look like after surgery?** Examples of post-surgical scars can be found [here](#). Typically there is a small dressing applied over a series of small tape-like strips that are applied to your wound. You will likely notice a small bump at the site of the surgery that is firm and represents the "can" or body of the ICD. It is not uncommon to have a small amount of bruising near the surgical site, and occasionally a small collection of blood beneath the skin (a "hematoma") can occur. If too large, hematomas sometimes have to be surgically drained. This occurs rarely.
8. **What can go wrong with the surgery?** First of all, for the surgeon, the most difficult portion of a device implant is gaining access to the vein that leads to the heart. If a needle penetrates the artery next to the vein, a large amount of **bleeding** can occur beneath the skin and this can put pressure on the vein, making it nearly impossible to access. On occasion, the opposite chest wall might have to be used to gain access to a vein that leads to the heart near the upper chest area. If the needle used to enter the vein passes through the vein into the chest cavity, the lung can be punctured resulting in collapse of the lung (called a "**pneumothorax**"). This requires evacuation of the air from the chest cavity and will mean that your hospital stay would be prolonged while this is resolved. By far and away the most concerning risk is that of **infection**. Every effort will be made to reduce this risk as much as possible. Infection occurs in about 1-1.5% of device implants in the United States. If your device becomes infected, then the ENTIRE system (ICD generator AND leads) must be removed to assure resolution of the infection. Reimplantation at a later date will be needed. Another risk is that of **cardiac perforation**. That is, one of the wires placed within the heart chambers can penetrate the heart causing blood to leak into the membranous lining around the heart called the pericardium. If enough blood leaks there, it often must be drained surgically, and the wires might need to be repositioned in the heart. This risk is probably on the order of 0.5-1%. If unrecognized, patients can die (albeit rarely) from such a complication. Overall, the risk of **death** with a pacemaker or ICD implantation is about 1 in 10,000. If a biventricular device is implanted, several other issues can arise. First of all, placement of the left-sided (extra) lead requires appropriate anatomy in which to place the lead. About 5% of the time, the anatomy will not accommodate the placement of the left-sided lead. Also, in biventricular pacing devices, this extra lead is placed in the veins on the OUTSIDE of the heart, and therefore this lead can pace other structures besides the heart. These structures included the diaphragm, phrenic nerve that supplies the diaphragm, or even the chest wall muscles themselves. In this case, near constant twitching of the chest wall or diaphragm with each heart beat is noticed. If this happens, efforts can be made to reprogram the device, but occasionally the lead has to be surgically moved. It is important to realize that these complications are rare,

and that by and large, this procedure remains relatively safe.

9. **What happens after I go home?** In about a day or two, you'll be asked to remove the dressing over the surgical incision (but leave the steri-strips on until they fall off on their own in about 14 days). You can shower within 24 hours after removing your dressing. New device implant patients are usually asked to limit their arm motion on the same side as the surgery by avoiding raising the arm above the level of the shoulder for four weeks. You will be seen in 7-14 days after the surgery to assure no infection exists. Then you will be seen every three to six months in the ICD clinic by a nurse and doctor who is experienced in assuring the device is working properly. Newer internet-based follow-up systems are being implemented that might permit less frequent office visits. Ask your doctor if such a service is offered in your institution.
10. **Can I drive after the device goes in?** This depends. If you lost consciousness due to a heart rhythm abnormality, the your typically cannot drive for a period of time after the device is implanted. This time varies state-to-state and provider-to-provider. If you have had the device installed as a "primary prevention" device, then driving is likely permitted once your arm heals to permit unrestricted arm movement. Remember, it's usually NOT the presence of the device that limits your driving, it's your clinical history: patients who have blacked out before, usually must demonstrate that this is unlikely to occur again after the device is installed.
11. **Can I stand by a microwave?** Yes. Today's leads typically are resistant to outside interference and should not be effected by outside interference from microwaves. There have been rare reports of interactions between **electronic article surveillance systems** (such as passing through metal detectors or being hand-scanned in an airport), and pacemakers briefly being inhibited, but these devices tended to be older systems than those implanted today. In most cases, effects of outside electromechanical interference are intermittent or momentary. Therefore, don't stay near the electronic surveillance systems any longer than necessary (walking through them should be fine), and warn security personnel not to hold their metal detector over your device any longer than is absolutely necessary. **Cellular phones** are also less likely to effect pacemakers and defibrillators today for two reasons: (1) cell phones are now generally digital, rather than analog devices, and (2) the leads commonly used in pacemaker implantations today are more resistant to outside interference and do not serve as a good "antenna" to receive outside electrical noise. A word about **therapeutic radiation**: if you need radiation therapy, it IS possible that the radiation could damage the pacemaker or defibrillator's circuit and shielding is recommended. Perhaps more important, radiation scatter is non-uniform if the pacemaker or defibrillator is within the radiation field. In these cases, the device should be surgically moved to the opposite side away from the radiation field.
12. **When can I have sex?** Talk to your doctor. If there is no reason vigorous exertion is likely to be harmful AND the device is fully healed for four weeks, then sexual relations may resume. If you have a shock during sex, the partner rarely senses a significant jolt from the device.
13. **What about the airport? What do I do?** Immediately following your surgery, you will receive a temporary ID card with the serial number of your device and leads that have been installed. You may show this to airport personnel and they typically will hand-search you at the airport. Remember, the company will also send you a more permanent device ID card in 4-6 weeks after your implant to your home. There are no data to suggest that walking through airport security passageways will adversely effect your device.
14. **What if I get shocked at home?** You do not typically have to rush in the hospital if you are shocked by your device. All the data from a single shock is stored safely by your device and can be checked the next business day. If your feel fine after the shock, you can be seen the following day to assure things are working appropriately. Remain calm and notify your doctor IF you receive three or more shocks within twenty-four hours. If this happens, it either means you're having many abnormal heart rhythms, or your device needs to be checked to assure its functioning properly adn your should probably be seen in the closest Emergency Room.
15. **How long does the battery last? How will I know if the battery is getting old?** Each time your device is checked or "interrogated", it displays the voltage of the battery in the device and its expected longevity. Typically, ICDs last 3-7 years before the battery needs

to be replaced. Provided the leads are not damaged during the replacement surgery, then you typically go home the SAME day after the device is implanted. Your doctor (or his or her representative in the pacemaker or defibrillator clinic) should adjust the pacing output as needed to a level that will assure safe pacing but not drain the devices' battery too quickly.

16. Do you have other questions not covered here? Feel free to post them on our [Forum](#).

We hope these Frequently Asked Questions have helped your understanding of ICD's and their importance to heart patients. Another useful site for patients contemplating an implantable defibrillator includes: [The Heart Rhythm Society](#).

A Service of [Medtees.com: Empowering Patients](#)

Help, humor, community for patients with chronic or difficult illnesses.

Copyright © 2005 Westby G. Fisher, MD All rights reserved