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REVIEW ARTICLE

Implantable Cardioverted Defibrillator: The Lifesaving Device

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Abstract

An implantable cardioverted defibrillator or automated implantable cardioverted defibrillator is a device implantable inside the body, able to perform cardioversion, defibrillation and pacing of the heart. The device is therefore capable of correcting most life threatening cardiac arrhythmias. The ICD is the first line treatment and prophylactic therapy for patients at risk for sudden cardiac death due to ventricularfibrillation and ventricular tachycardia. Current devices can be programmed to detect abnormal heart rhythms and deliver therapy via programmable antitachycardia pacing in addition to low-energy and high-energy shocks.

Keywords: Implantable Cardioverted Defibrillator; Ventricular Fibrillation; Ventricular Tachycardia.

Introduction

- ICD was invented by Michael Mirowski. It was prompted by the sudden death of a colleague. After building a prototype device, it was tested and refined in animals.
- Initially introduced to humans in 1980 despite skepticism and criticism.
- Early batteries only lasted for two years or less.
- Approved by the FDA in 1985
- Initial ICD devices were large and bulky.
- Early devices were known as "shock boxes".
- Technological advances have made ICD more convenient and safe.
- Initially, was used as a last resort treatment.
- February 2008, the smallest patient ever received the ICD procedure. The patient was a five week old infant weighing in at 4.9 kg.
- Today however several devices are available and many are programmed for multiple treatments. Each devices offers a different delivery sequence but all are capable of delivering high energy. [High Frequency] defibrillation to treat a tachycardia. [Atrial or ventricular]

Definition

- The implantable cardioverted defibrillator is a device, that detects and terminates life threatening episodes of VT or ventricular fibrillation in high risk patients.
- An implantable cardioverter-defibrillator or ICD refers to a device that helps to regulate the heart.

Indication of ICD

- Patients who have survived sudden cardiac death syndrome, usually caused by ventricular fibrillation and ventricular tachycardia
- Patients who have experienced symptomatic VT [syncope secondary to VT]
- Patients who has survived MI, but are at high risk for cardiac arrest
- Used to treat arrhythmias- atrial flutter, atrial

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fibrillation.

- Brugada Syndrome
- Bradycardia
- Long Q T Syndrome
- Sick sinus syndrome

Contraindications of ICD

- Reversible triggering factor for VT/VF
- CAD patients without inducible or spontaneous VT undergoing bypass surgery
- NYHA class IV drug refractory congestive heart failure, not candidates for transplant
- Life expectancy not exceeds 6 months
- Significant behavioral disorders or psychiatric disorders

ICD System

An ICD consist of a generator and at least one lead that can sense intrinsic electrical activity and deliver an electrical impulse. The device is usually implanted much like a pacemaker.

ICD'S are Designed to Respond to Two Criteria

- A rate that exceeds a predetermined level.
- And a change in the isoelectric line segments.

When a dysrhythmia occur, rate sensors take 5 to 10 seconds to sense dysrhythmia. Then the device takes several seconds to charge through the level to the heart. Battery life is about 5 year but various depending on use of the ICD over time. The battery is checked during follow up visits. Antiarrhythmic medication usually is administered with the technology to minimize the occurrence of the tachydysrhythmia, and to reduce the frequency of ICD discharge. The device may deliver six shock if necessary. Some ICD'S can respond with antitachycardia pacing in which the device delivers electrical impulses at a fast rate in an attempt to disrupt the tachycardia, by low energy, [low intensity] by cardioversion, by defibrillation or all three. Some also have pacemaker capability, if the patient develops bradycardia which sometimes occur after treatment of the tachycardia. Usually the mode is VVI, V, paces the ventricle, V, senses ventricular activity, I, paces only if the ventricles do not depolarize.

Some ICD's also deliver low energy cardioversion and some also treat atrial fibrillation which devices is used and how its programmed depends on the patients dysrhythmia.

Complication of ICD

- ICD surgery related infection.
- Technical aspects of the equipment such as, Premature battery depletion and dislodged or fractured leads
- Broken leads sensing of supraventricular tachydysrhythmias resulting in unneeded discharge.

Medical Management

- Patients identified as being at risk for sudden cardiac death undergo an EPS to determine the origin of the dysrhythmia and the effect of antidysrthmic agents in suppressing or altering the rate of the dysrhythmia
- Further assessment of cardiac status is made to determine whether additional interventions, cardiac surgery or angioplasty are indicated to improve cardiac function. This part of the workshop may include cardiac catherization, stress testing and echocardiography.
- Based on the evaluation decisions are made regarding the implantation approach. [e.g. thoracotomy at the time of surgery, non thoracotomy] and the type of therapy required [e.g. antitachycardia pacing, cardioversion, defibrillation].
- An electrophysiologist performs the initial programming of the device at the time of implantation. During implantation, defibrillation threshold measurements are obtained. This involves inducing the dysrthythmia and then evaluating the devices ability to terminate it. After it has been determined that the ICD functions appropriately further follow up is conducted on an outpatient basis to monitoring the number of discharges and the battery life of the device.

Nursing Management

- In case of a ventricular dysrhythmia it is important to know the type of ICD implanted to device functions and whether it is activated [i.e. on]
- If the patient experiences a shockable rhythm, the nurse should be prepared to defibrillate in the event that the device fails.
- During external defibrillation the paddles or patches, should not be placed directly on the I CD generator.
- Standard paddle placement may need to be

altered in patients with ICD to achieve successful defibrillation.

- Most patients continue to take some antidysrhythmic medications to decrease the number of shock required and to slow the rate of the tachycardia.
- Providing patient sand family with explanations regarding implantation of the ICD.
- Manage acute episode of life threatening dysrhythmias.
- Explain the lifestyle change necessitated by the dysrhythmia and resulting ICD implantation including, the eliminating of caffeine, alcohol or other substances believed to contribute to the disorders stress reduction measures are often encouraged.

Patient Education

- Teach pathophysiology of the underlying disease process including sudden cardiac death and ventiricular dysrhythmias
- Information regarding how the implantable cardioverted defibrillator is programmed to function.
- Action to take if a shock occurs
- Activity limitations related to driving and avoiding strong magnetic fields.
- Signs and symptoms of device failure.
- Follow up schedule with health care professional.
- Cardiopulmonary resuscitation training for family members.
- The nurse requires the common side effects of the antidysrhythmic agents with the patient and encourage the patient to discuss the incidence and severity of side effects with a health care professional.
- Patients should also know how to take the pulse and the type of pulse changes that need to be reported.

Home Care Checklist

Limitation for ICD

- The price of an ICD may cost from $10,000-$100,000. It depends on the maker of the device and the function.
- Some complications may occur after operation that will require medical attention.
- An ICD does not interfere with everyday life, but has a psychological impact.
- Women were more susceptible to having troubles with coping and having anxiety.
- Shocks from the ICD produce fear and anxiety.
- Children are too vulnerable to the complications of the ICD, whether internal or external.

Future of ICD

- The price of the ICD will be lowered and become more accessible.
- The size of the pulse generator will be reduced, becoming more convenient.
- The battery life will be prolonged.
- The device will become more useful in pediatrics, and become a primary option for children.

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Sr. No	Home care	Patient	Caregiver
1.	**Avoid infection at the ICD insertion site**		
a.	Observe incision site daily for redness, swelling and heat	√	√
b.	Take temperature, report any increase	√	√
c.	Avoid tight restrictive clothing that may cause friction over the insertion site	√	√
2.	**Adhere to activity restrictions**		
a.	Movement of arm may continue to be restricted, until incision heals if the ICD was implanted in pectoral region.	√	

b.	Avoid heavy lifting	√	
c.	Discuss safety of activities [e.g. driving with physician]	√	
d.	Avoid contact sports	√	
3.	**Electromagnetic inferences; understand the importance of following**		
a.	Electrical substations and so forth magnetic field may deactivate the ICD, negating any effect on a dysrhythmia, avoid large magnetic fields such as those created by magnetic resonance imaging, large motors, arc welding.	√	
b.	At security gate at airports, government buildings or other secured areas, show identification card and request a hand search.	√	
c.	Some electrical and small motor devices as well as cellular phones, may interfere with the function of the ICD, avoid if placed very close to the ICD. Avoid leaning directly over devices, or ensure contact is of brief duration; place cellular phone on appropriate side of ICD.	√	
d.	Household appliances [e.g. microwave ovens] should not promote safety.	√	√
4.	**Promote safety**		
a.	Describe what to do if symptoms occur and notify physician if any discharge seem unusual.	√	√
b.	Maintain a log that records discharges, records events that precipitate the sensation of shock. This provides important data for the physician to use in readjusting the medical regimen		
c.	Encourage family members to attend CPR class	√	√
d.	Call 911 for emergency assistance if feeling of dizziness occurs.	√	√
e.	Wear medical identification [e.g. medical alert that includes physician information.	√	
g.	Avoid frightening family or friends with unexpected shocks, which will not harm them. Inform family and friends that in the event they are in contact with the patient when a shock delivered; they may also feel the shock. It is especially important to warn sexual partners that this may occur.	√	√
5.	**Follow up care**		
a.	Discuss psychological responses to the ICD implantation, such as changes in self image, depression due to loss of mobility secondary to driving restrictions, fear of shocks, increased anxiety, concern that sexual activity may trigger the ICD and changes in partner relationship.	√	√
b.	Adhere to appointment that are scheduled to test electric performance of ICD. Remember to take log of discharges to reviews with physician.	√	√
c.	Attend an ICD support group within the area.	√	
d.	Hospitalization may be necessary periodically to change battery or replace pacemaker unit	√	√

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