Objectives

- Learn the function of an implanted cardioverter defibrillator (ICD)
- Describe how the ICD function fits into a discussion on resuscitation
- Develop skills and understand the process needed to deactivate an ICD

Trivia Questions

- What are the 3 interventions an ICD can provide?
- What can you deduce if someone has an ICD over their right chest?
- What pacing issue may be associated with hiccups?
- If a terminal patient is having frequent discharges of their ICD and wants immediate deactivation what could you do?
- Why would a magnet be used to assess a pacemaker?
- When should you discuss ICD deactivation with a hospice patient?
- Does a patient with a DNR have to have their ICD deactivated?
Indications for an ICD
- Secondary prevention in patients with sustained ventricular tachycardia (VT) or ventricular fibrillation (VF) or resuscitated cardiac arrest thought to be due to VT/VF
- Primary prevention in patients at increased risk of VT/VF

Primary Prevention Class I Recommendations with Level of Evidence A
- LVEF < 35% due to a prior MI who are 40 days post-MI and are NYHA functional class II or III
- LVEF < 30% due to prior MI who are 40 days post-MI and are NYHA functional class I

Alternatives
- Antiarrhythmic medications
- Ablative surgery
- Transcatheter Ablation
- Cardiac Transplantation
ICD/AICD
- Automatic Implantable Cardioverter Defibrillator
- 1st placed at Johns Hopkins Hospital 1980
- Indicated primary and secondary prophylaxis of tachyarrhythmias
- More than 3 million North Americans are eligible for an ICD
- Larger than a pacemaker

ICD
- Small electric generator with a capacitor
- Pacing/sensing electrodes
- Defibrillation electrodes
- Has a sensing and a shocking function
- Most ICDs have a pacing function
- Most ICDs have a maximum delivery of 30-35 J
- Typical external defibrillator can deliver 360 J

Dysrhythmia may trigger:
- Pacing
- Cardioversion with a low energy synchronized shock
- Defibrillate with a higher energy shock
• 10% of hospices had a policy addressing ICD deactivation

• 42% of hospice patients had the shocking function deactivated

• 58% of hospices had a patient shocked in the last year

• 27% of patients receive a shock within the last month of life

• 8% of patients received a shock within minutes of death

Center to Advance Palliative Care
Fast Fact #112

- Indications for deactivation of ICD therapy
- Continued use of an ICD is inconsistent with patient goals
- Withdrawal of anti-arrhythmic medications: if anti-arrhythmic medications are withdrawn consider turning off the ICD to avoid frequent shocks
- Imminent death
- The patient has a DNR order. The functioning of an ICD is generally inconsistent with a 'Do-Not-Resuscitate' order since ICDs attempt to resuscitate the patient by shocking their hearts back into a life-sustaining rhythm

Issues to Consider

- ICD discussion should begin at admission.
- Consult the clinician who manages the ICD (usually a cardiologist or associated clinician): that individual is often the person to assume responsibility for deactivation. Patients are usually followed in a device clinic and probably have an established relationship with the physician and staff. The involvement of these professionals can provide a sense of comfort and closure for the patient and family.
- Discuss expectations of “turning off” the ICD. The following should be made clear:
  - Turning off the ICD means that the device will no longer provide life-saving therapy in the event of a ventricular tachyarrhythmia.
  - Turning off the ICD will not cause death.
  - Turning off the ICD will not be painful, nor will its failure to function cause pain.
- Establish a plan of care that will ensure availability for addressing new questions or concerns that might arise (patient/family should not feel abandoned once the device is turned off).
- If there are conflicts among providers or family members, consultation with a palliative care expert or ethics team can be helpful.

Heart Rhythm Society

- A patient with decision-making capacity has the legal right to refuse or request the withdrawal of any medical treatment or intervention, regardless of whether he or she is terminally ill, and regardless of whether the treatment prolongs life and its withdrawal results in death.
- The right to refuse or request the withdrawal of a treatment is a personal right of the patient and does not depend on the characteristics of the particular treatment involved.
A clinician cannot be compelled to carry out an ethically- and legally-permissible procedure (i.e. CIED deactivation) that he or she personally views as in conflict with his/her personal values. In these circumstances, the clinician cannot abandon the patient but should involve a colleague who is willing to carry out the procedure.

2010/05/Expert-Consensus-Statement

The American Medical Association strongly supports patient autonomy and patients’ rights to refuse treatment with the support of the treating physician. A patient’s right to request withdrawal of life sustaining medical interventions, including deactivation of an ICD, is both legal and ethical. Withdrawal of a life sustaining medical intervention with the informed consent of a patient or legal surrogate is not physician-assisted suicide or euthanasia. (Ballentine, JM: Pacemaker and defibrillator deactivation in competent hospice patients: An ethical consideration. Am J Hosp Palliat Care. 2005;22; 14.)

Indications for deactivation of ICD therapy

- Continued use of an ICD is inconsistent with patient goals.
- Withdrawal of anti-arrhythmic medications: if anti-arrhythmic medications are withdrawn consider turning off the ICD to avoid frequent shocks.
- Imminent death.
- The patient has a DNR order. The functioning of an ICD is generally inconsistent with a ‘Do-Not-Resuscitate’ order since ICDs attempt to resuscitate the patient by shocking the heart back into a life-sustaining rhythm.
Considerations

- Every patient or the designated patient health agent will be given the information needed to ensure they understand the purpose for the deactivation of a defibrillator or pacemaker.
- The physician, nurse, and/or members of the IDT should educate the patient, family, and/or caregivers about patient’s condition, the actions of the device, and the likely results of its deactivation to confirm true informed consent.
- Whether the device is intended to treat the primary terminal illness or a different condition should not interfere with the patient’s right to request its deactivation.
- The benefit of deactivation of implantable devices should outweigh the burden of patient and family suffering.

Procedure

- At admission, all patients and their designated caregivers should be asked specifically about the presence of any implanted medical devices. Admission nurses should conduct a thorough physical exam, medical record review, and interview of the patient or health care surrogate to identify the possible presence of such devices. Documentation of the device type, manufacturer, and model is recommended (check for an identification card). Also document the name of the clinician who manages the ICD (usually a cardiologist).
- The nurse will document discussion of the deactivation procedure with the patient and family in the nursing note and will consult with the patient’s physician and/or cardiologist to obtain a physician’s order to deactivate the device, if deactivation is desired. If the patient chooses not to deactivate the device upon admission, the discussion of deactivation should be revisited periodically, as patient declines.
- Informed consent for the deactivation of the defibrillator must be signed by the patient or designated - patient health agent and witnessed by an impartial non-family member.

Temporary Magnet Deactivation

- The ICD can be emergently and temporarily disabled by holding a suitable magnet on the skin over the implanted ICD, if this is the desire of the patient or designated caregiver. The device will reactivate if the magnet is removed or displaced, and magnet placement should not be considered a substitute for deactivation by a trained professional. If emergency deactivation is performed and the patient’s life expectancy is 48 hours or less, the taped magnet can be left in place until death occurs and then removed. If life expectancy is greater than 48 hours, the cardiologist or manufacturer should be contacted.
Deactivation (Turning Off) an Implanted Cardiac Defibrillator

- An Implanted Cardiac Defibrillator (ICD) is somewhat larger than a pacemaker and smaller than an iPod, and is usually inserted just under the skin in the upper chest underneath the collar bone. The ICD consists of a small, thin, battery-driven "generator" and two or three "leads" (wires) that are attached to the generator, passed through nearby blood vessels and positioned to specific locations within the heart. The leads transmit the heart's tiny electrical signals (the signals that control the heart rhythm) back to the generator where they are continuously analyzed. If a dangerous arrhythmia is detected, the ICD immediately treats it by automatically delivering a large electrical discharge (that is, a shock) to the heart, which stops the arrhythmia and allows the normal heart rhythm to return.

- An arrhythmia is any change in the normal electrical impulses in the heart that can result in a heart beat or rhythm that is abnormal (too fast, too slow, quivering, fluttering, etc.) which can result in the heart not being able to pump blood or to the heart stopping.

- Terminally ill patients may experience shocks or discharges from the Implanted Cardiac Defibrillator which can be painful (may range from a mild shock to a jolting feeling or a painful, intense shock). These discharges may not be consistent with patients' goals of care, and can be the source of significant and preventable pain and distress to both patients and caregivers. Turning off an implantable defibrillator allows the natural disease process to conclude in the death of the patient. Death is caused by the diseased heart, not by the lack of electrical stimulation.

- All ICDs are "programmable," which means that with special programming equipment (called a "programmer") that wirelessly communicates with the ICD, the doctor can order a change to the way the device functions, or it can be turned off by a special magnet.

- A Pacemaker is a small device that sends electrical impulses to the heart muscle to maintain a suitable heart rate and rhythm. It is inserted under the skin with leads and a battery just like the ICD. Deactivation (turning off) of the pacemaker is not as common, and must be done in a physician's office. In many terminal patients, the heart rhythm will slow, producing signs and symptoms of worsening heart failure (fatigue, dizziness, shortness of breath). In general, pacemakers do not keep dying patients alive, as the heart muscle is usually too sick to respond to the electrical impulses produced by the pacemaker.

- Expectations of "turning off" the ICD:
  - Turning off the ICD means that the device will no longer provide life-saving therapy in the event of an arrhythmia.
  - Turning off the ICD will not cause death.
  - Turning off the ICD will not be painful, nor will its failure to function cause pain.
  - If combined with a pacemaker, the ICD can be turned off separately.
Manufacturers:

- Boston Scientific (formerly Guidant)  
  800 CARDIAC (800-227-3422)

- Medtronic  
  800 MEDTRON (800-633-8766)

- St Jude Medical  
  800-722-3774

Temporary Deactivation

- A magnet will disengage the tachycardia sensing and intervention ability so no shocks will be delivered but the bradycardia pacing function will not be affected by a magnet

- There may be a beeping when the magnet is placed, removing the magnet will enable the shocking function

- 5-12 gauss is required at the level of the device

- Doughnut magnets for deactivation produce 50 gauss at 7 cm
Can there be unintentional deactivation?

- Stereo Speakers
- Magnetic Bingo Wands
- Magnetized Screws
- Health Care Magnets
- 12 Volt Starter for a Model Airplane

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**Magnetic Field Strength of Various Devices Found in Homes**

<table>
<thead>
<tr>
<th>Device</th>
<th>Field Strength @ 5 mm</th>
<th>Field Strength @ 7.5 mm</th>
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<tbody>
<tr>
<td>Single Business Card Type Magnets</td>
<td>Less than 0.5 gauss</td>
<td>Less than 0.5 gauss</td>
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<tr>
<td>Stack of 12 Business Card Type Magnets</td>
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<td>9 gauss</td>
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<td>Motorola Bluetooth Earpiece</td>
<td>20 gauss</td>
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<td>Ear buds for Cell Phone</td>
<td>18 gauss</td>
<td>10 gauss</td>
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<td>Electronic Headset</td>
<td>31 gauss</td>
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<td>Generic Headset</td>
<td>29 gauss</td>
<td>21 gauss</td>
</tr>
<tr>
<td>Home Telephone Receiver</td>
<td>30 gauss</td>
<td>12 gauss</td>
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<tr>
<td>Blackberry Curve Cell Phone</td>
<td>31 gauss</td>
<td>21 gauss</td>
</tr>
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<td>81 gauss</td>
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<td>Ear Buds for Cell Phone</td>
<td>28 gauss</td>
<td>13 gauss</td>
</tr>
<tr>
<td>Generic Headset</td>
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<td>26 gauss</td>
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<td>Computer Speaker</td>
<td>16 gauss</td>
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<td>17 gauss</td>
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<td>Blackberry Curve Cell Phone</td>
<td>52 gauss</td>
<td>29 gauss</td>
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<tr>
<td>Ceramic clip magnet</td>
<td>&gt;80 gauss</td>
<td>&gt;80 gauss</td>
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**Effects of Various Magnetic Devices at Differing Distances on ICD Deactivation**

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<tr>
<th>Device</th>
<th>#1 @ 2mm</th>
<th>#1 @ 4mm</th>
<th>#2 @ 2mm</th>
<th>#2 @ 4mm</th>
<th>#3 @ 2mm</th>
<th>#3 @ 4mm</th>
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<td>Single Business Card Type Magnets</td>
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Legend:
- NT: ICD not deactivated
- +++: ICD effectively deactivated

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How does the technician deactivate the ICD?

- Places a wand over the ICD that reprograms it to deactivate
- Interrogates the ICD during the encounter

Trivia Questions

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Bibliography

- Ganz L: General principles of the implantable cardioverter-defibrillator. Uptodate.


Bibliography
