# Fundamentals of ICD Therapy

## Evolution of ICD Therapy
Disclaimer

This presentation is provided with the understanding that the slide content must not be altered in any manner as the content is subject to FDA regulations.

This presentation is to be used in conjunction with other resource material including the applicable Boston Scientific device physician’s manual and any implant accessories instructions for use.

This presentation is not intended to replace implant training.

Proper surgical procedures and techniques are the responsibilities of the medical professional.

If this presentation is not used in its entirety, the following information must be included:

- Appropriate Indications
- Contraindications
- Warnings
- Precautions and Adverse Events
Objectives

When we complete this program you will be able to:

- **Identify** two key historical milestones in the history of ICD development

- **Describe** the evolution of indications for ICD therapy

- **Identify** the diagnostic studies performed prior to ICD implantation
History of ICD Therapy
Inventor of the ICD

Michel Mirowski, M.D.
1924-1990
Built from over-the-counter electronics
## History of ICD Therapy

### Evolution

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>Device conception</td>
</tr>
<tr>
<td>1969</td>
<td>First experimental model</td>
</tr>
<tr>
<td>1976</td>
<td>First animal implant</td>
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<tr>
<td>1980</td>
<td>First human implant</td>
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<tr>
<td>1982</td>
<td>Addition of cardioverting capability</td>
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<tr>
<td>1985</td>
<td>FDA approval</td>
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<tr>
<td>1988</td>
<td>First programmable device approved</td>
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<tr>
<td>1993</td>
<td>ICD with tiered therapy single charge backup pacing approved</td>
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<tr>
<td>1993</td>
<td>First endocardial defibrillation lead approved</td>
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<tr>
<td>1997</td>
<td>ICD with backup dual-chamber pacing and atrial rhythm discrimination approved</td>
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<tr>
<td>1998</td>
<td>ICD with backup adaptive-rate pacing approved</td>
</tr>
<tr>
<td>2000</td>
<td>ICD with atrial therapies approved</td>
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<tr>
<td>2002</td>
<td>Cardiac resynchronization defibrillator approved</td>
</tr>
</tbody>
</table>
History of ICD Therapy
First Clinical Model

- Short-lived
- Shock only
- 250 g
- Nonprogrammable
- Required thoracotomy abdominal implant
The ICD Today

- Smaller, thinner
- Multiprogrammable tiered therapy
- Extended longevity (> 5 yrs)
- Endocardial lead systems
- Pectoral implant
- Advanced rhythm discrimination
- State-of-the-art pacing therapies
- Powerful diagnostics
- Atrial therapies
Maximize reliability
Decrease size
Improve shape for patient comfort
Optimize longevity
Increase ease of use
Improve diagnostics
Enhance therapy / feature options and programmability
The ICD Today
Benefits of ICD Therapy Evolution

- **Reduced** implant risk
- **Increased** system longevity
- **Decreased** symptoms associated with arrhythmia recurrences
- **Increased** quality of life
- **Improved** diagnosis and management of inappropriate device therapy
- 450,000 persons experience SCD in the U.S. annually
- Only 20-30% survive
- Most common mode of death
- 80-90% due to ventricular tachyarrhythmias
Sudden Cardiac Death (SCD)
Current Therapeutic Options

- Antiarrhythmic drug therapy
- Ablative techniques (surgical or transvenous)
- Implantation of a cardioverter defibrillator system
- A combination of drugs, ICD therapy and/or ablation
Sudden Cardiac Death (SCD)  
Typical Sequence

- Evolution of ICD Therapy
- Disclaimer
- Objectives
- History of ICD Therapy
- ICD Today
- Sudden Cardiac Death
- ICD Therapy
- Future of ICD Therapy
- Questions

Total: 9 minutes
- Ventricular fibrillation (VF) is converted successfully 98.6-98.8% of the time\(^1\)

- Ventricular tachycardia (VT) is converted with antitachycardia pacing (ATP) in 89.4-91.2% of episodes, with increased conversion success using shock therapy\(^2\)


Average procedural mortality is 0.5-0.8%* 

Among survivors of VF or nonsustained VT (NSVT) causing severe symptoms, the ICD is superior to antiarrhythmic drugs for increasing overall survival.\(^1\)

Majority have coronary artery disease (CAD)\(^1\)

>80% have no acute precipitating acute coronary occlusion\(^2\)

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ICD Therapy
High-risk Patient Profile

- Syncope
- Heart failure
- Hypertension
- Known or silent coronary artery disease (CAD)
Degree of depression of the left ventricular ejection fraction (LVEF)\(^1\)

Half of all deaths in this population are due to SCD . . .

Is this preventable?
## ICD Therapy
### Identifying the High-risk Patient

<table>
<thead>
<tr>
<th>Identify need for revascularization; evaluate cause of depressed EF, if present</th>
<th>Coronary Angiography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine EF and assess for regional wall motion abnormalities, valvular heart disease, dilated hypertrophic cardiomyopathy</td>
<td>Echocardiography</td>
</tr>
<tr>
<td>Evaluate for Brugada syndrome, congenital long QT interval and exercise-induced VT</td>
<td>Electrocardiogram (ECG)</td>
</tr>
<tr>
<td>Evaluation of syncope</td>
<td>Tilt Testing</td>
</tr>
<tr>
<td>Assess inducibility</td>
<td>Electrophysiology Study (EPS)</td>
</tr>
</tbody>
</table>
Examples of Current ICD Indications

- Survival of at least one episode of cardiac arrest (manifested by the loss of consciousness) due to a ventricular tachyarrhythmia

- Recurrent, poorly tolerated sustained VT

- Prior myocardial infarction (MI), LVEF of ≤ 35%, and a documented episode of nonsustained VT, with an inducible ventricular tachyarrhythmia
  - Patients suppressible with IV procainamide or an equivalent antiarrhythmic have not been studied

- Prior myocardial infarction (MI), LVEF of ≤ 30%

1 Indicates are specific to particular manufacturers and devices
2 MADIT indication
3 MADIT II indication
The Future of ICD Therapy

- Improved programmer/user interface
- Additional sensors for health monitoring
- Advance patient management capabilities
Questions