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Medical Education

Fundamentals of ICD Therapy

Evolution of ICD Therapy

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History of ICD Therapy

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- 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

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Questions

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

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Questions

Michel Mirowski, M.D.
1924-1990



History of ICD Therapy

First Working Model Electronics

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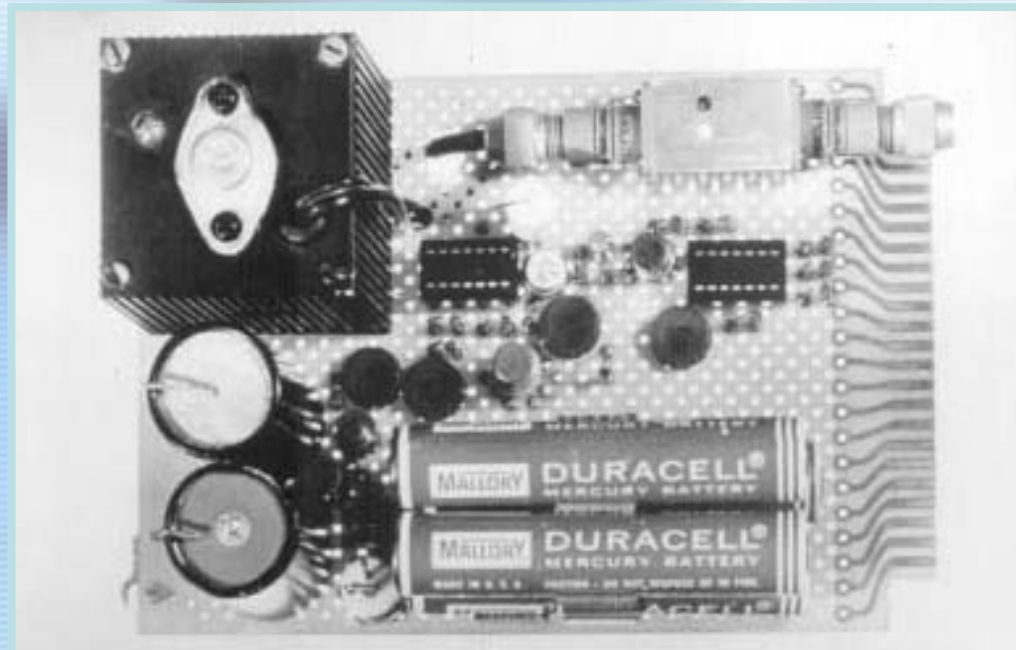
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Built from over-the-counter electronics

History of ICD Therapy Evolution

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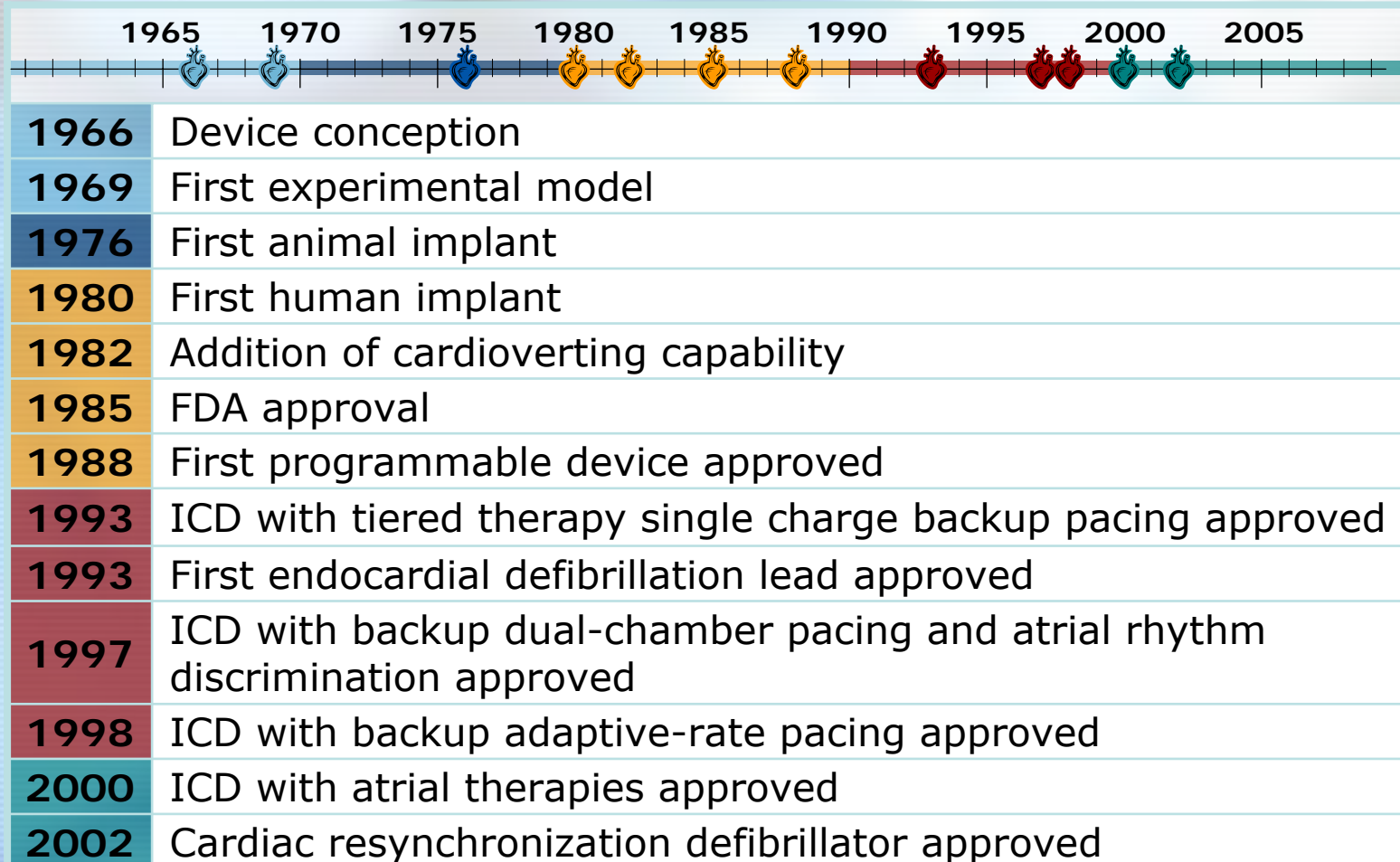
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First Clinical Model

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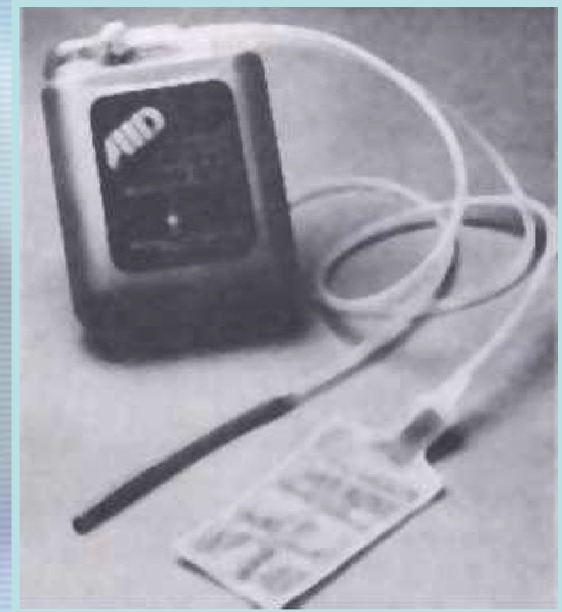
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Questions

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



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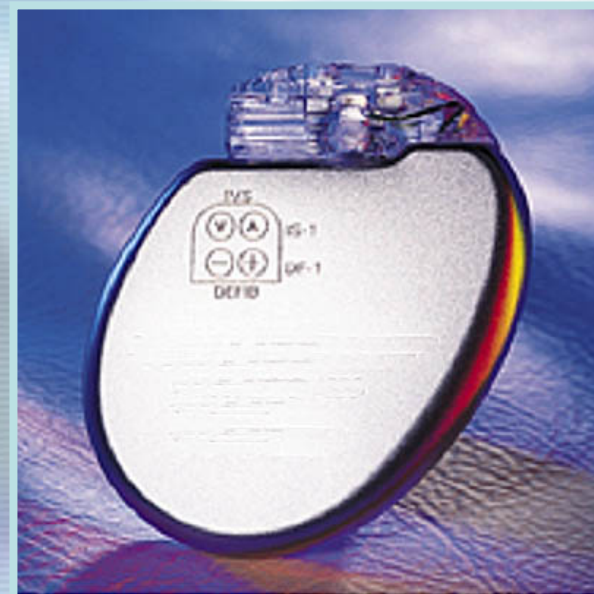
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Questions

- 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



The ICD Today

Pulse Generator Technology Focus

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Questions

- 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

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Questions

- *Reduced* implant risk
- *Increased* system longevity
- *Decreased* symptoms associated with arrhythmia recurrences
- *Increased* quality of life
- *Improved* diagnosis and management of inappropriate device therapy

Sudden Cardiac Death (SCD)

Incidence

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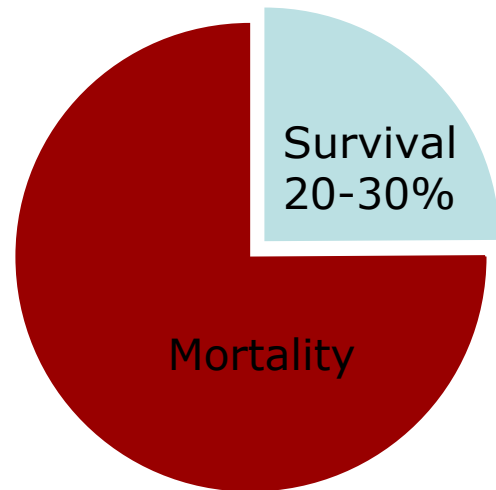
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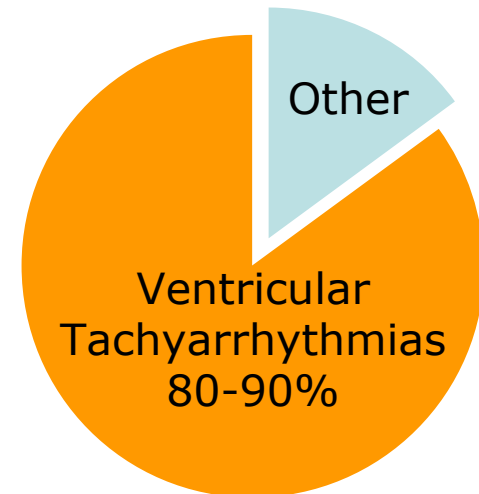
Questions

- 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

Outcome of SCD



Causes of SCD



Sudden Cardiac Death (SCD)

Current Therapeutic Options

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Questions

- 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

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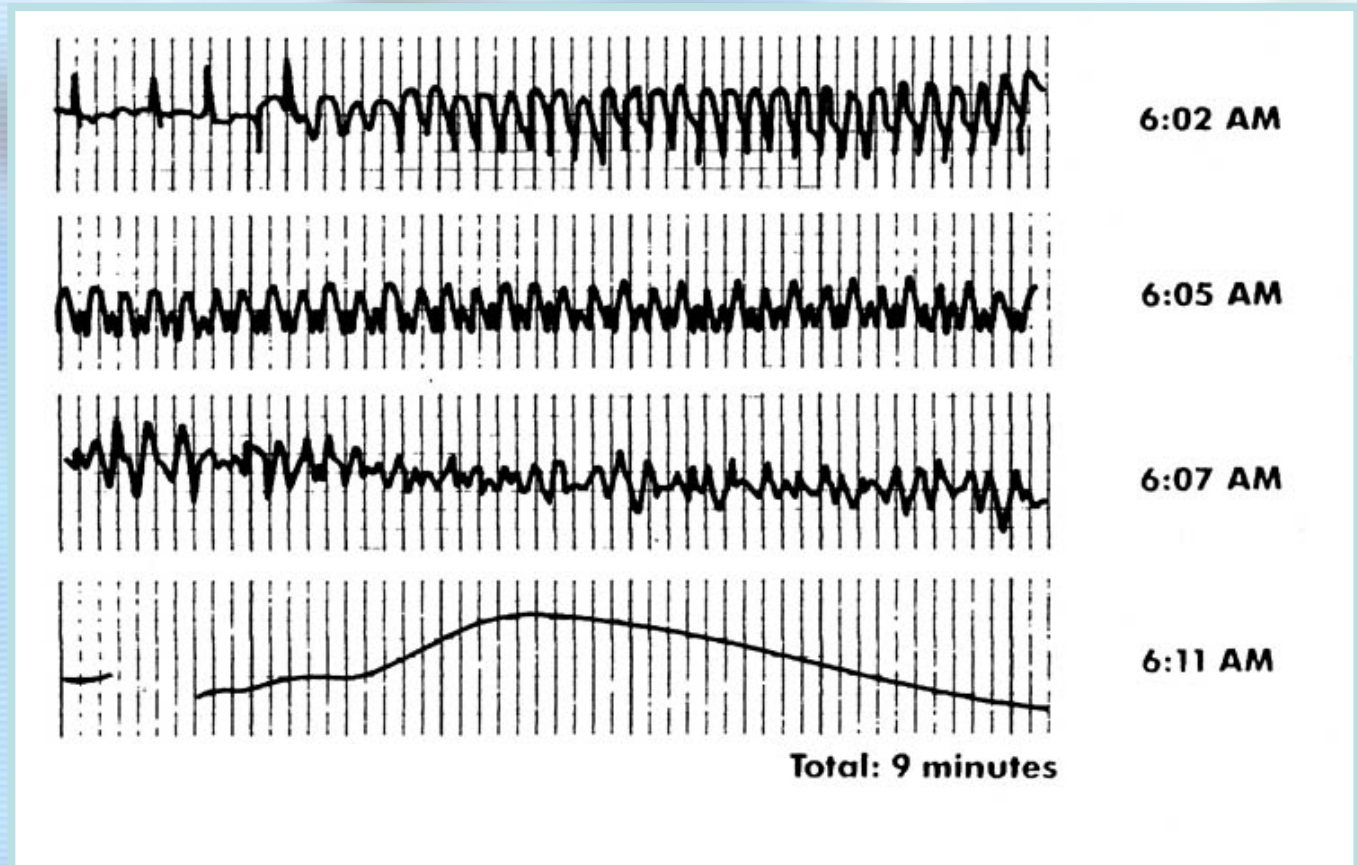
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- Ventricular fibrillation (VF) is converted successfully 98.6-98.8% of the time¹
- Ventricular tachycardia (VT) is converted with antitachycardia pacing (ATP) in 89.4-91.2% of episodes, with increased conversion success using shock therapy²

¹Sakena S, for the PCD Investigators. Clinical outcome of patients with malignant ventricular tachyarrhythmias and a multiprogrammable implantable cardioverter-defibrillator implanted with or without thoracotomy: an international multicenter study. *J Am Coll Cardio.* 1994;23:1521-30.

²Zipes DP, Roberts D. Results of the international study of the implantable cardioverter-defibrillator : a comparison of epicardial and endocardial lead systems. *Circulation.* 1995;92:59-65.

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Safety of ICD therapy implantation

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Average procedural mortality is 0.5-0.8%*

* Saksena S, for the PCD Investigators. Clinical outcome of patients with malignant ventricular tachyarrhythmias and a multiprogrammable implantable cardioverter-defibrillator implanted with or without thoracotomy: an international multicenter study. *J Am Coll Cardiol.* 1994;23:1421-30.

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Survival Benefit with ICDs

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Questions

Among survivors of VF or nonsustained VT (NSVT) causing severe symptoms, the ICD is superior to antiarrhythmic drugs for increasing overall survival¹

¹The Antiarrhythmics Versus Implantable Defibrillators (AVID) Investigators. A comparison of antiarrhythmic drug therapy with implantable defibrillators in patients resuscitated from cardiac arrest and near-fatal ventricular arrhythmias. *N Engl J Med.* 1997;337:1576-83.

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Identifying the High-risk Substrate

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Questions

- Majority have coronary artery disease (CAD)¹
- >80% have no acute precipitating acute coronary occlusion²

¹ Myerburg R J, Zaman L, Luceri R.M., et al. Clinical characteristics of sudden cardiac death: implications of survival. *Sudden Cardiac Death*. 1985;107-117.

² Panidis IP, Morganroth J. Initiating events of sudden cardiac death. *Sudden Cardiac Death*. 1985;81-92.

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High-risk Patient Profile

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Questions

- Syncope
- Heart failure
- Hypertension
- Known or silent coronary artery disease (CAD)

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Most Powerful Predictor of SCD

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Questions

- Degree of depression of the left ventricular ejection fraction (LVEF)¹

¹ Saksena S, Camm JA. Implantable defibrillators for prevention of sudden death: technology at a medical and economic crossroad. *Circulation*. 1992;85:2316-21.

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SCD in Patients with Heart Failure

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Questions

- Half of all deaths in this population are due to SCD . . .
- Is this preventable?

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Identifying the High-risk Patient

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Questions

Identify need for revascularization;
evaluate cause of depressed EF, if
present

▶ Coronary
Angiography

Determine EF and assess for regional
wall motion abnormalities, valvular
heart disease, dilated hypertrophic
cardiomyopathy

▶ Echocardiography

Evaluate for Brugada syndrome,
congenital long QT interval and
exercise-induced VT

▶ Electrocardiogram
(ECG)

Evaluation of syncope

▶ Tilt Testing

Assess inducibility

▶ Electrophysiology
Study (EPS)

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Questions

- 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 $\leq 35\%$, and a documented episode of nonsustained VT, with an inducible ventricular tachyarrhythmia²
 - Patients suppressible with IV procainamide or an equivalent antiarrhythmic have not been studied
- Prior myocardial infarction (MI), LVEF of $\leq 30\%$ ³

¹ Indications are specific to particular manufacturers and devices

² MADIT indication

³ MADIT II indication

The Future of ICD Therapy

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Questions

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

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