NEIL CISPER

TECHNICAL FIELD ENGINEER

ICD/CRTD BASICS

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OBJECTIVES

- Discuss history of ICDs
- Review the indications for ICD and CRT therapy
- Describe basic lead and device technology
- Discuss different therapies for ICDs
- Display different fluoroscopy views of devices
- Go through patient's FAQ

ICD HISTORY

Dr. Paul Zoll (1911-1999) **Zoll, NEJM 1956**

First human transthoracic defibrillation

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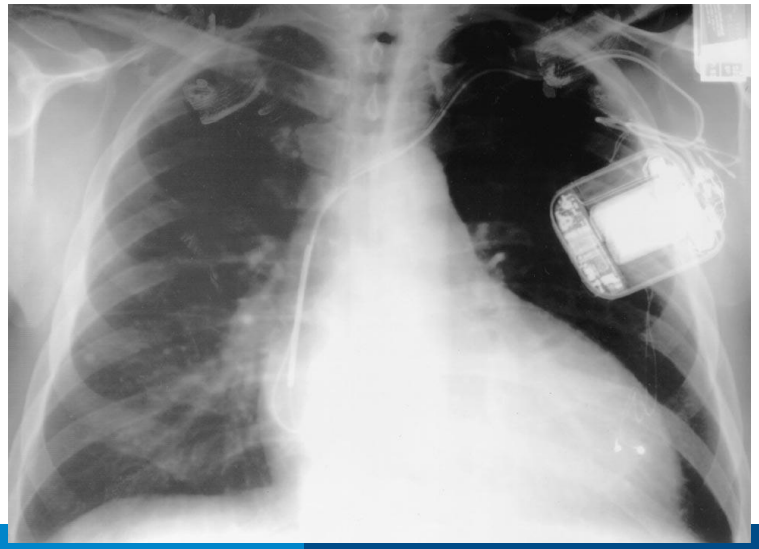
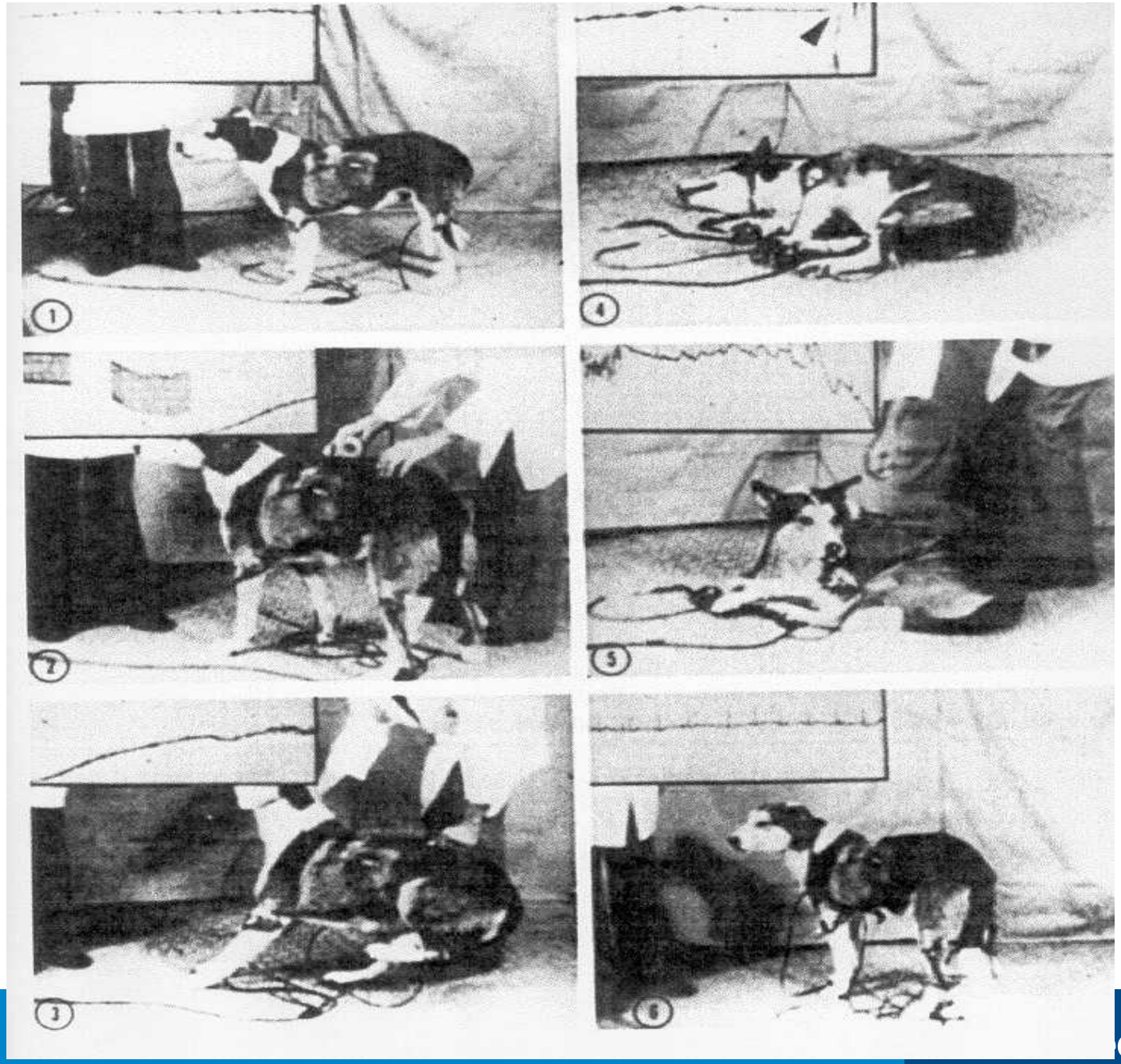
HISTORY OF ICD THERAPY

- 1966 Device conception
- 1969 First experimental model
- 1976 First animal implant
- 1980 First human implant
- 1982 Addition of cardioverting capability
- 1985 FDA approval

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HISTORY OF ICD THERAPY

- 1988 First programmable device approved
- 1991 Model with tiered therapy and single-chamber back-up pacing approved
- 1993 First endocardial defibrillation lead approved
- 1995 First pectoral implants
- 1997 Addition of atrial rhythm discrimination and backup dual-chamber pacing approved
- 2002 Model with cardiac resynchronization for CHF approved

ICD INDICATIONS

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DISEASE STATES
DEFIBRILLATORS

- Defibrillators treat **Fast** heart rates or **Tachycardia**
  - Prevent **Sudden Cardiac Death**

- Patients who are more prone to have a cardiac arrest - **Primary** Prevention

- Patients who have had prior cardiac arrest – **Secondary** Prevention

INDICATIONS FOR ICD – CLASS 1

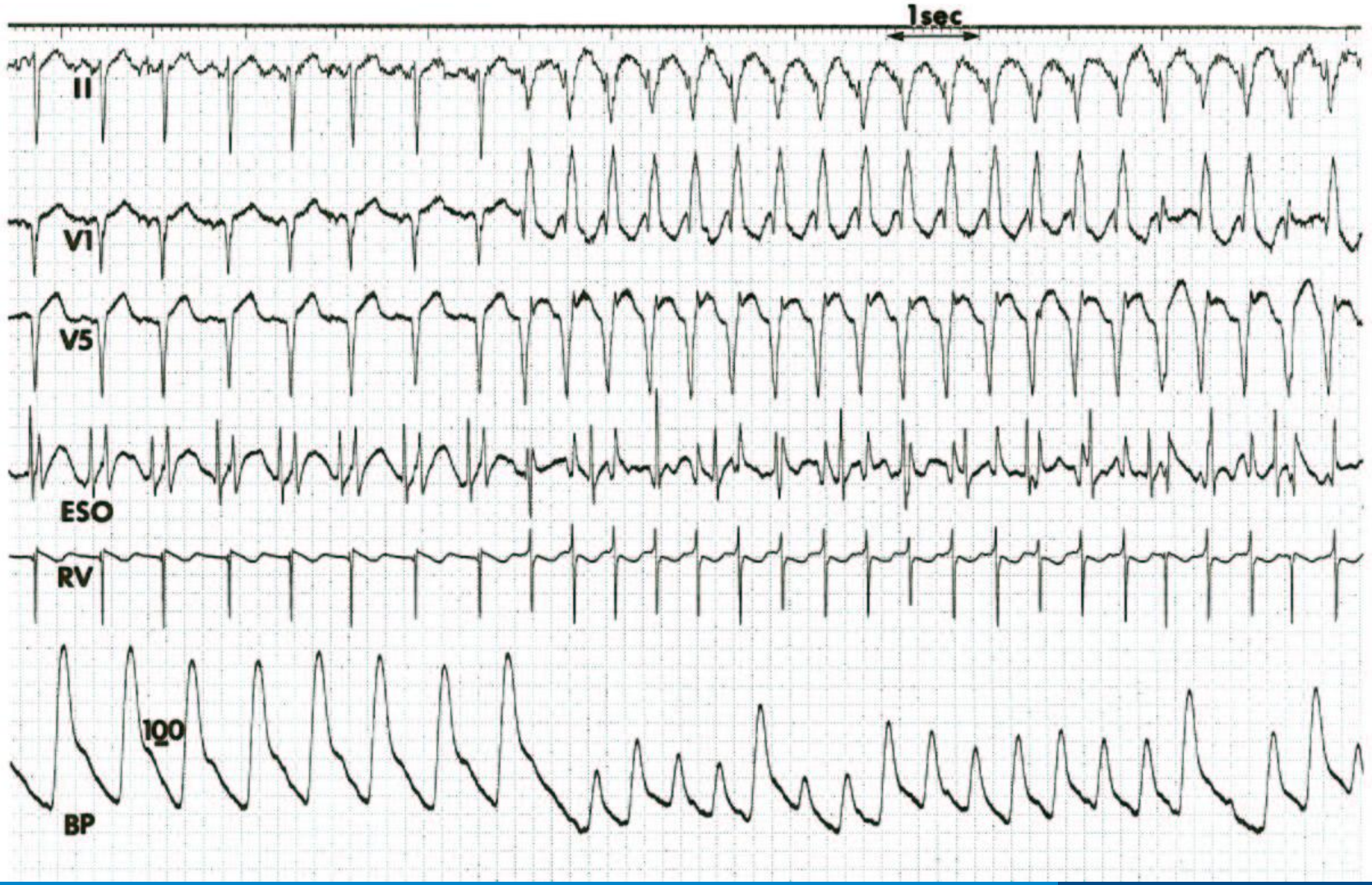
1. Cardiac Arrest
   - Due to VT or VF
   - Not due to transient or reversible cause
2. Spontaneous sustained VT
   - Structural heart disease must be present
3. Syncope of undetermined origin with:
   - Sustained VT that has clinical relevance and/or hemodynamic significance
   - VF induced during EP study when drug therapy to sustained VT is not preferred

INDICATIONS FOR ICD – CLASS 1

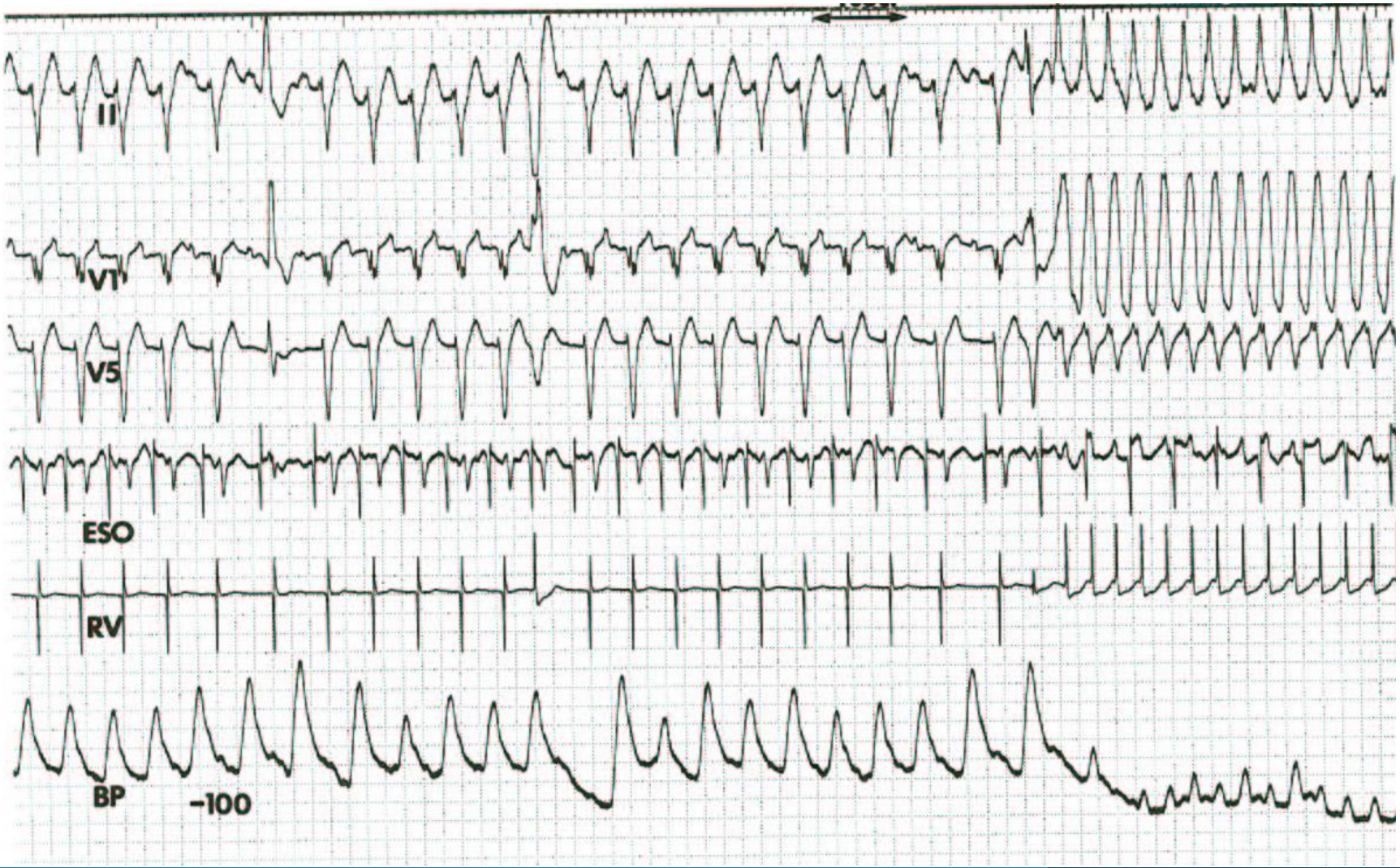
4. Non-sustained VT with:
   - Coronary disease
   - Prior MI
   - LV Dysfunction
   - Inducible VF or sustained VT
   - (Non-suppressible by antiarrhythmic drugs)
5. Spontaneous sustained VT
   - Not amenable to other treatments

SPONTANEOUS VENTRICULAR FIBRILLATION

SPONTANEOUS VENTRICULAR TACHYCARDIA



SPONTANEOUS FAST VENTRICULAR TACHYCARDIA



CRT INDICATIONS

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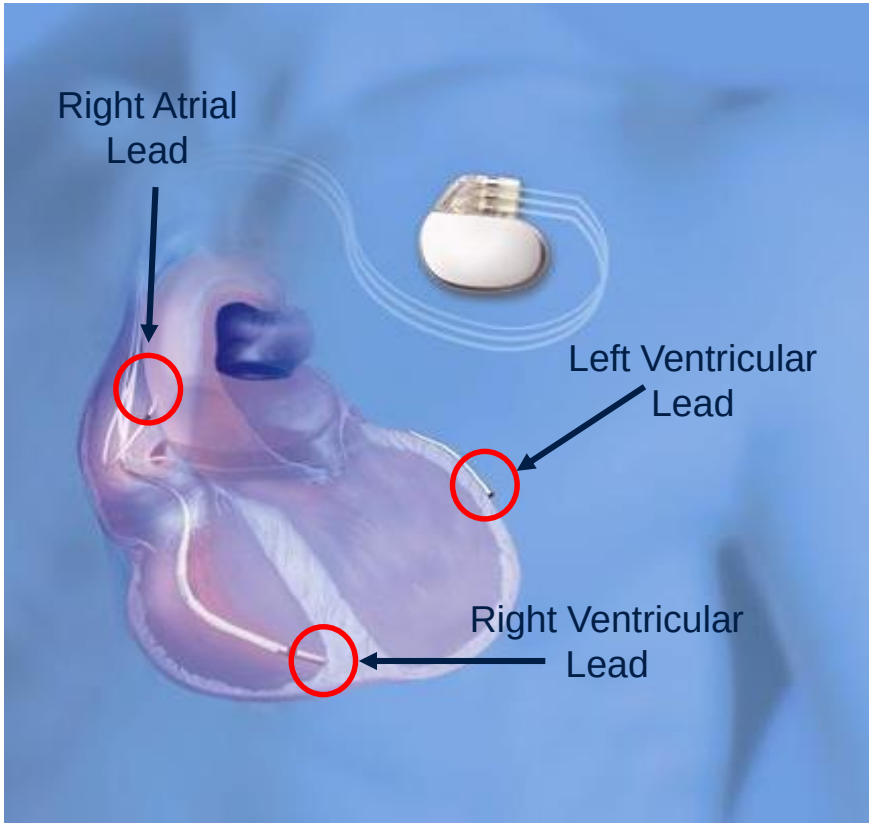
CRT = BIVENTRICULAR (BIVS)

- A CRT device sends small, undetectable electrical impulses to both lower chambers of the heart to help them beat together in a more synchronized pattern. This improves the heart's ability to pump blood and oxygen to the body.
- Indication is for patients who have Heart Failure and Ventricular Dysfunction



CRT DEFINITIONS

- What Causes Ventricular Dysynchrony?[1]
  - Disruption of myocardial collagen matrix impairing electrical conduction and mechanical efficiency
  - Intraventricular conduction delays usually manifested as left bundle branch block
  - Regional wall motion abnormalities with increased workload and stress—compromising ventricular mechanics
- What is Cardiac Resynchronization Therapy?
  - Cardiac resynchronization therapy works by sending electrical signals to the right and left ventricles of the heart so they contract together (resynchronize). By improving the pumping action of the heart, there may be an improvement in heart failure symptoms.

1. Tavazzi L. Eur Heart J 2000;21:1211-1214

DEVICE COMPONENTS

PACEMAKERS AND ICDS

All Defibrillators are Pacemakers, not all Pacemakers are Defibrillators

FUNCTIONS OF AN ICD

1. **Senses** appropriate cardiac signals
2. **Detects** dangerous rhythms
3. Provide **Therapy** for Ventricular Tachycardia and Ventricular Fibrillation
4. **Paces** if necessary

IMPLANTABLE CARDIAC DEVICES

Pacemakers

Heart Failure Devices

CRT-Pacemaker

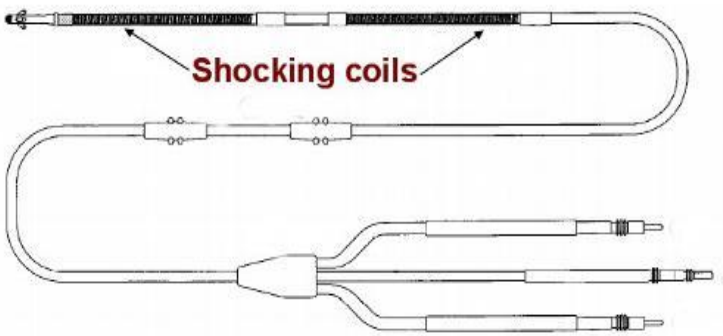
Defibrillators

CRT-Defibrillator

IMPLANTABLE LEADS

Pacemaker Leads

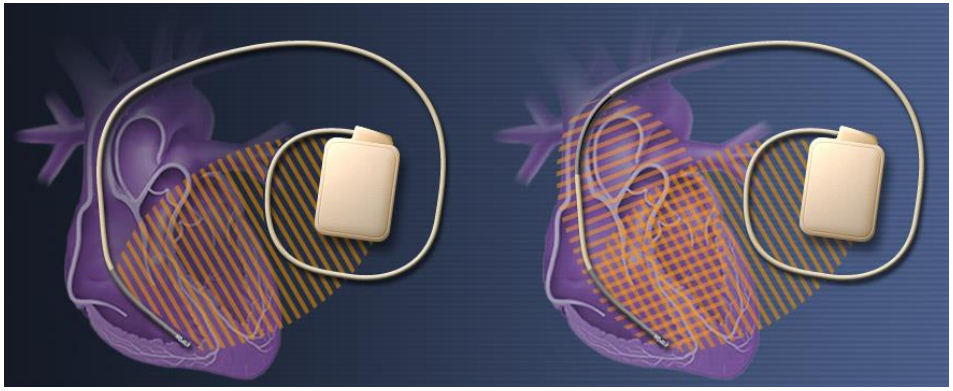
Defibrillator Leads



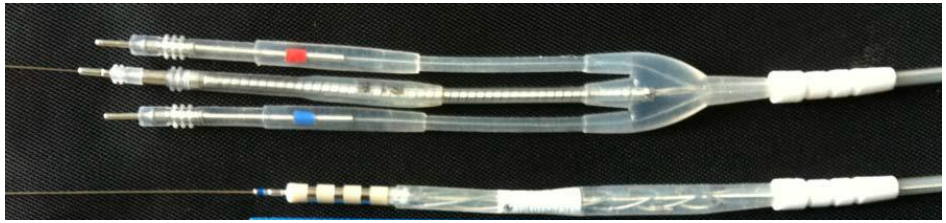
LV Leads (CRT)

DEFIBRILLATOR LEAD SELECTION

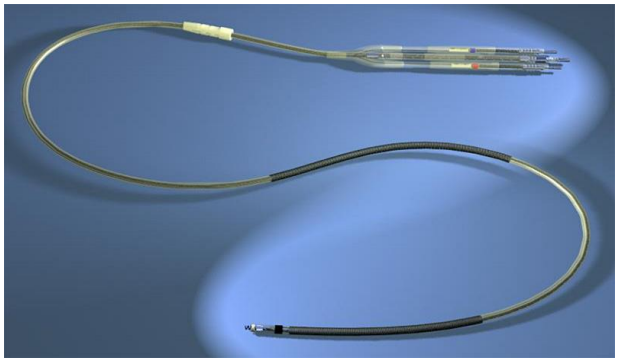
Active or Passive fixation



Single or Dual Coil



DF1/IS1 or DF4 connector



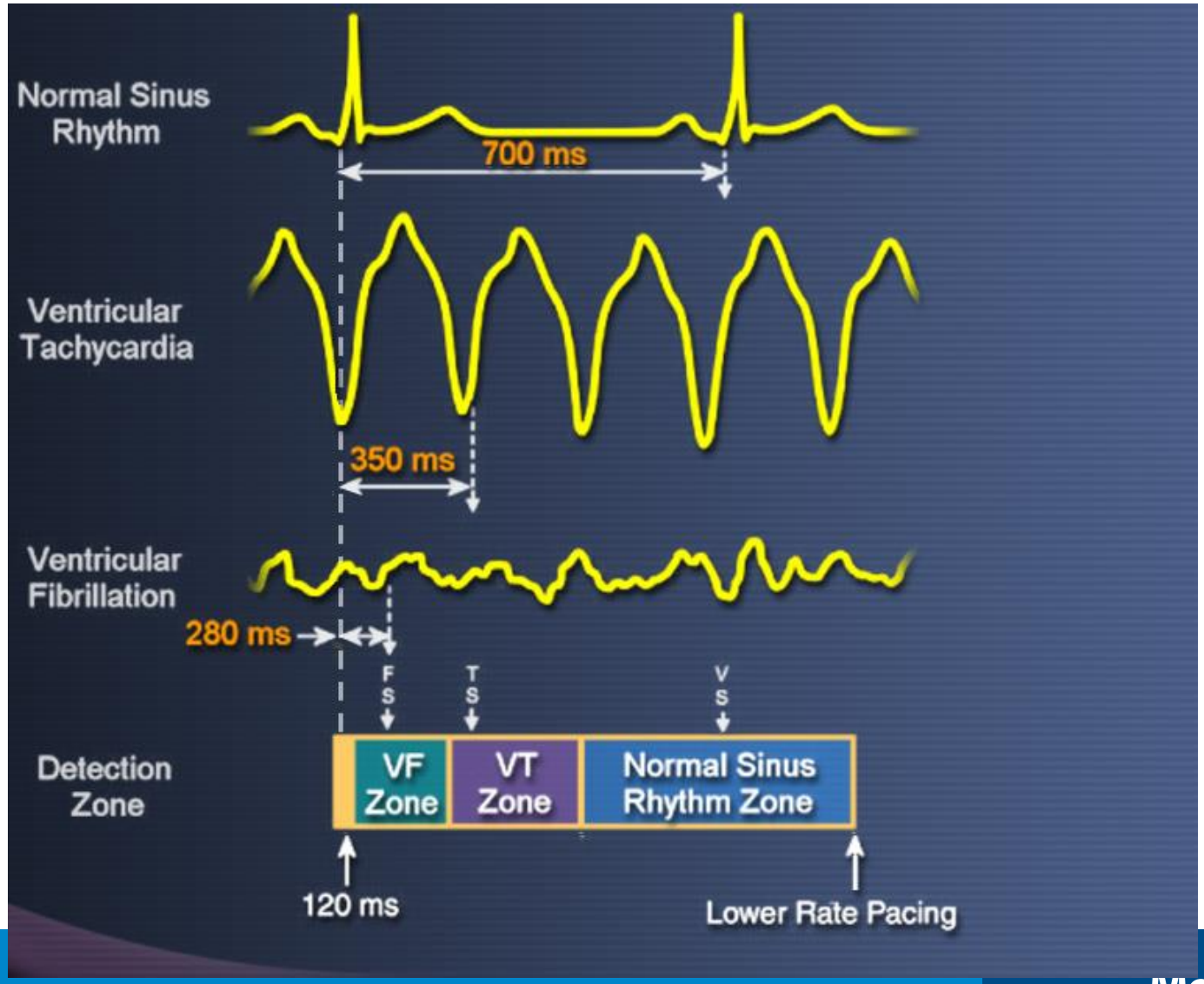
Multiple options for each patient

DETECTION

DETECTION

- **What does "Detection" mean?**
  - A device defined arrhythmia is present based on what is sensed as determined by **Rate** and **Duration** criteria.
  - Based on multiple criteria
    - **Rate**
    - **Duration**

DETECTION
RATE



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ICD THERAPY

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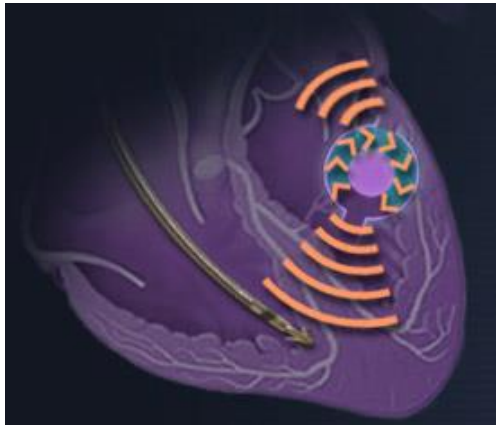
ICD Therapy

- High Power (Shock Therapies)
  - Cardioversion
  - Defibrillation
- Low Power (Pacing Therapies)
  - Anti-tachycardia Pacing (ATP)
  - Bradyarrhythmia Pacing

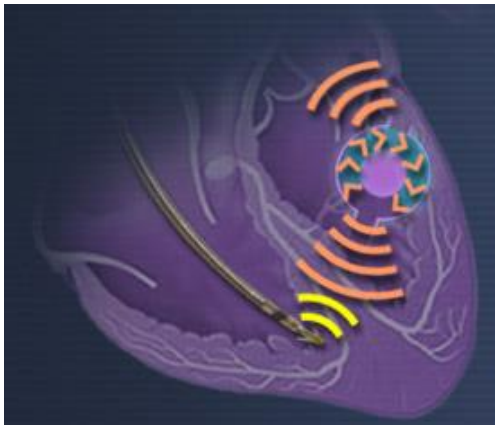
ICD THERAPIES
ANTI-TACHYCARDIA PACING (ATP)

- Pacing pulses delivered at a rate faster than the rhythm detected
  - Can successfully terminate re-entrant tachycardias
  - “Speed up the heart to slow it down”

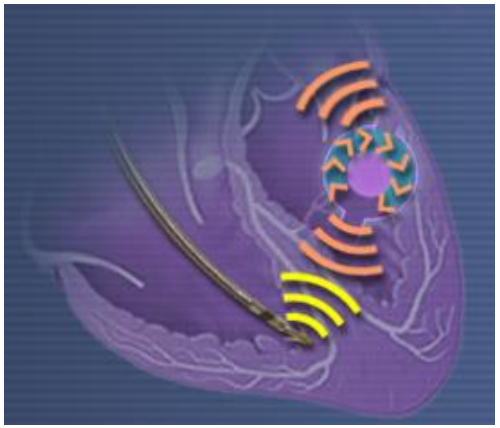
ICD THERAPIES
ATP



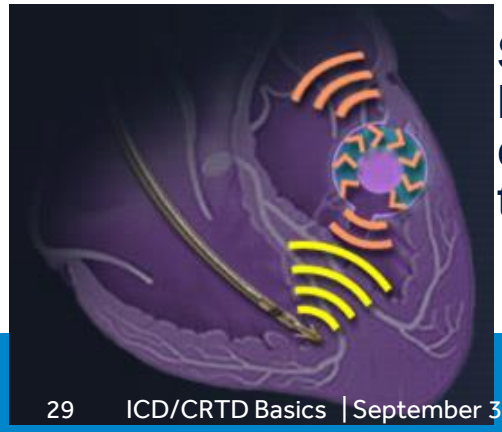
Re-entry initiated



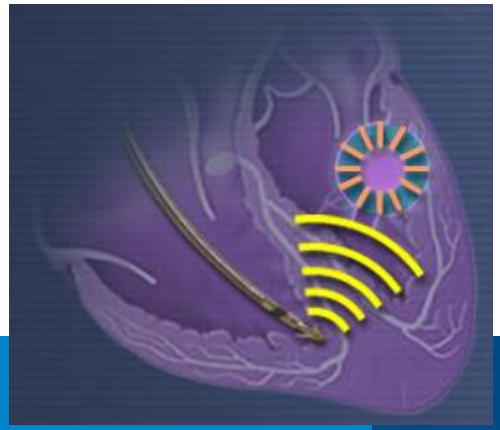
ATP delivered at a rate faster than tachyarrhythmia. Wavefronts collide.



Subsequent Pulse: Wavefronts collide closer to re-entry circuit



Subsequent Pulses: Wavefronts collide even closer to re-entry circuit



Arrhythmia terminated

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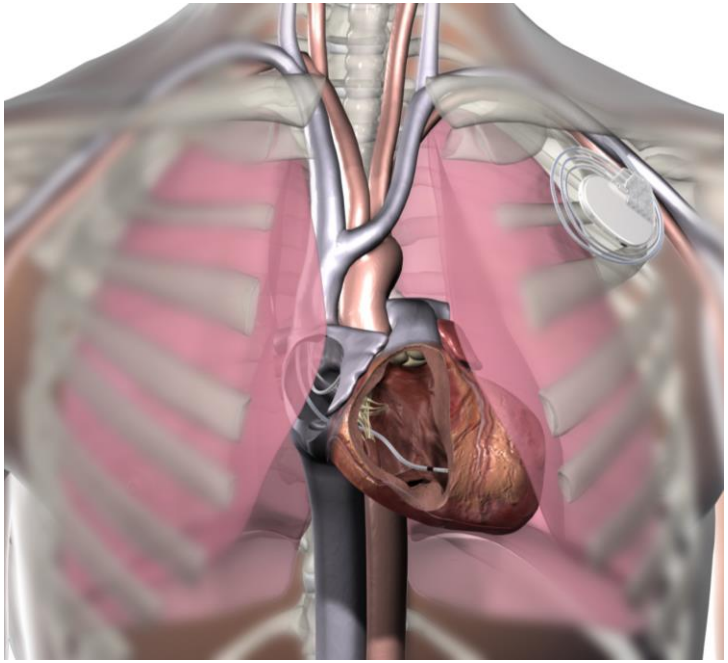
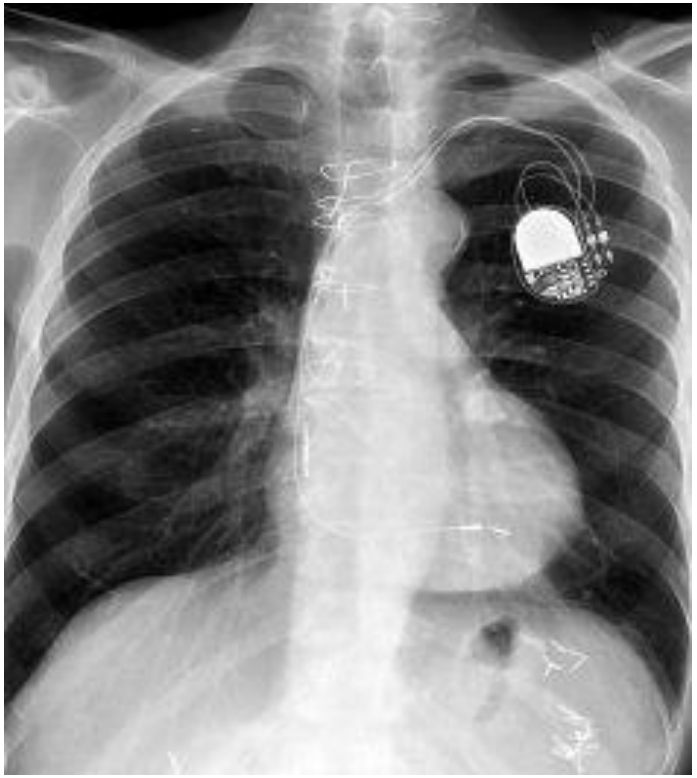
FLUOROSCOPY IMAGES

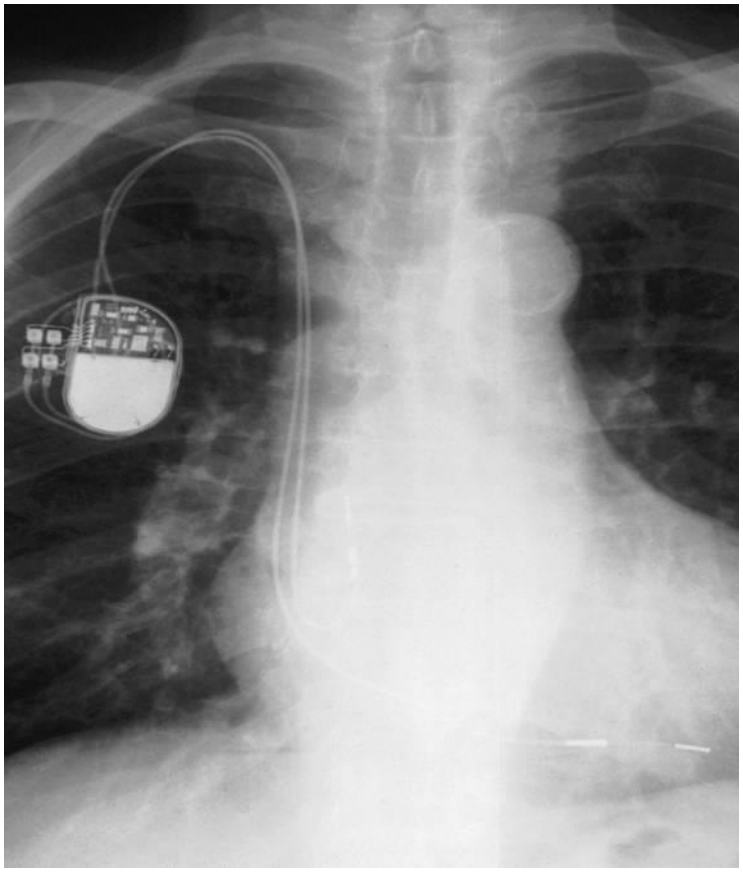
- Pacemakers

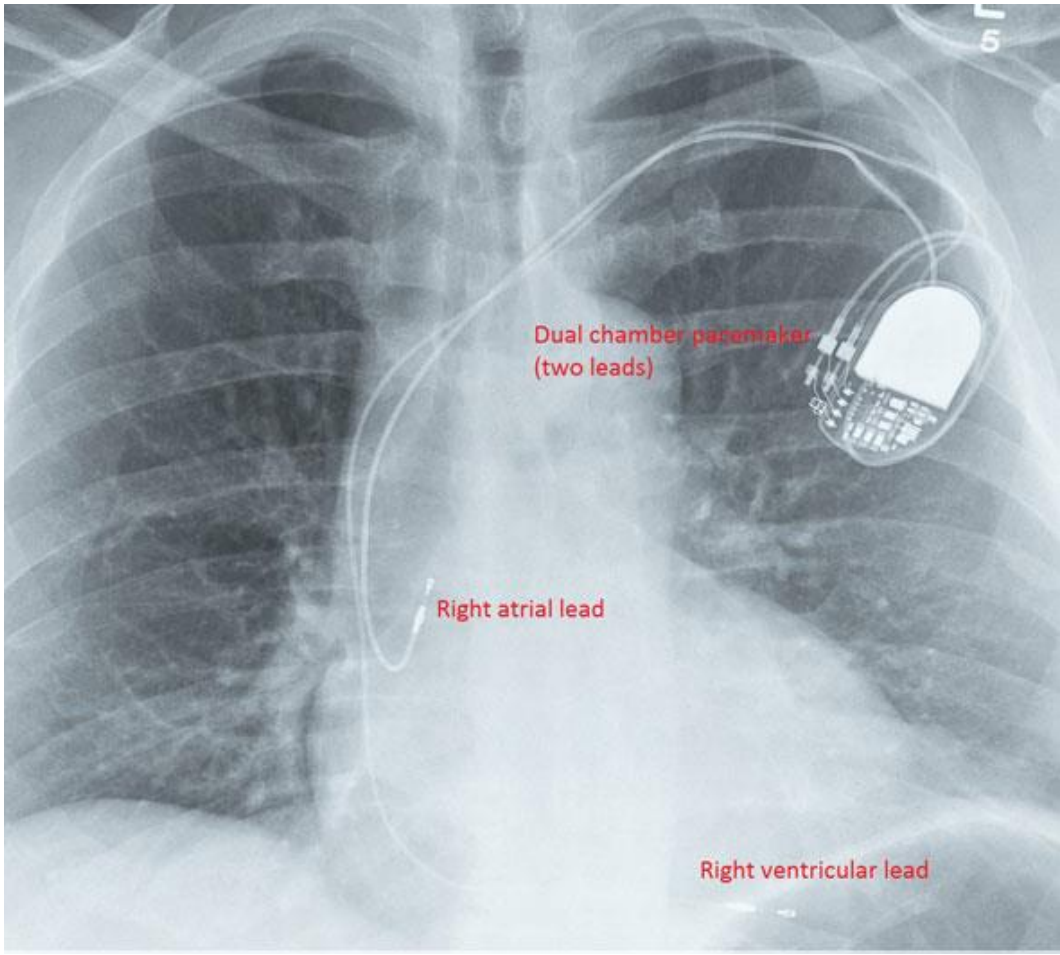




FLUOROSCOPY IMAGES

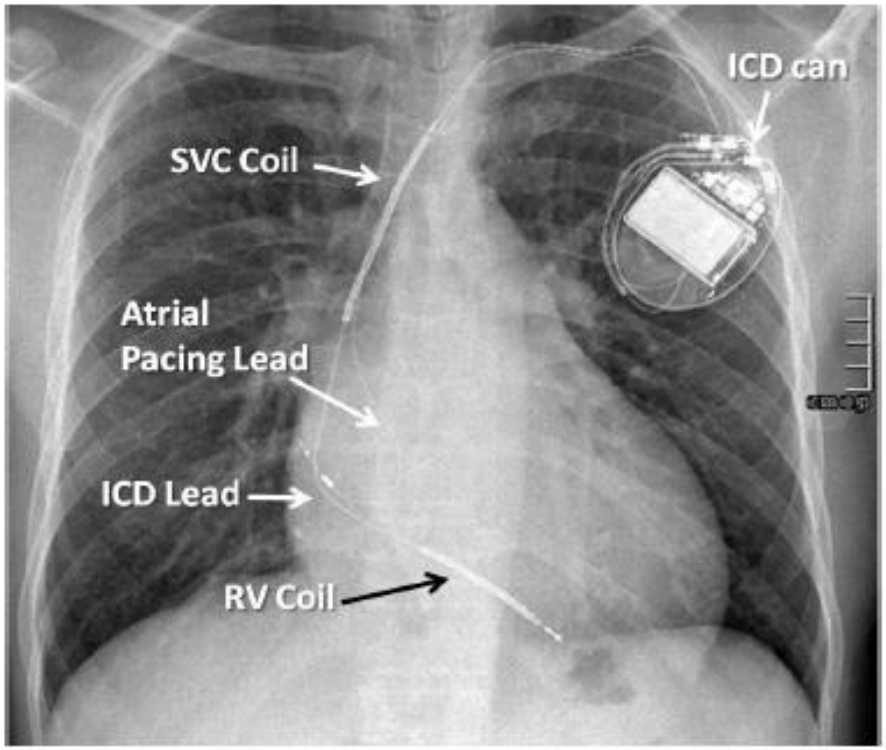
Pacemakers

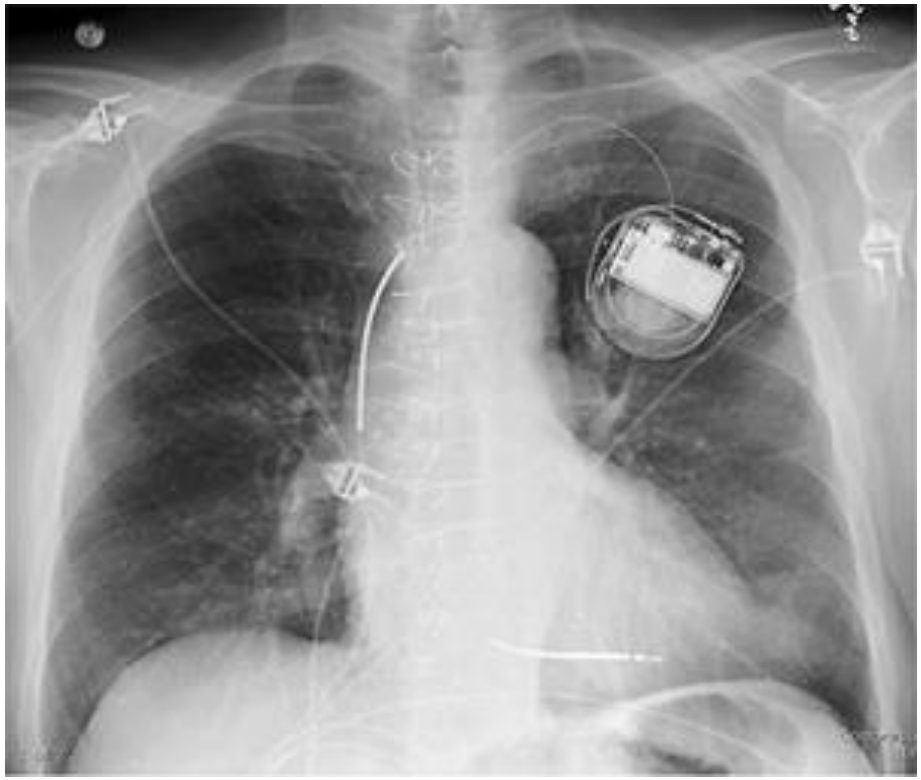




FLUOROSCOPY IMAGES

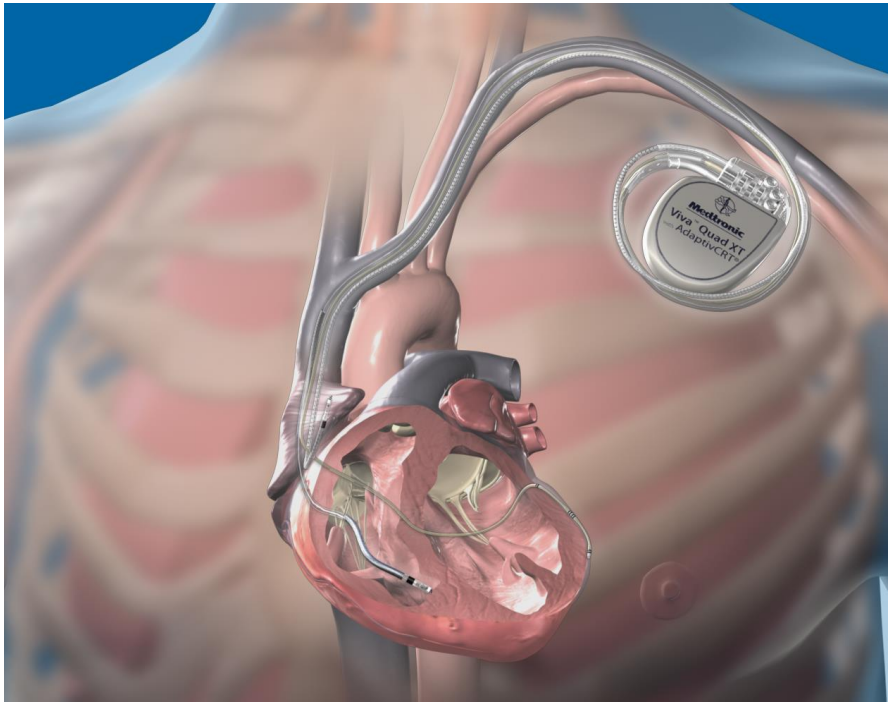
Defibrillators

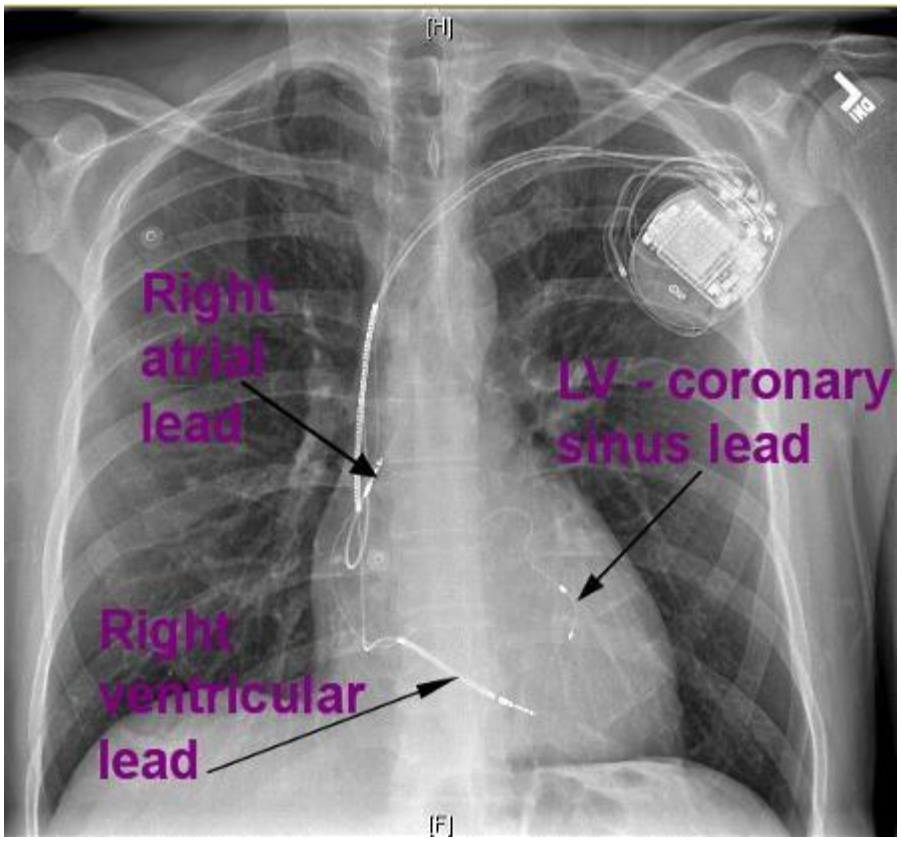




FLUOROSCOPY IMAGES

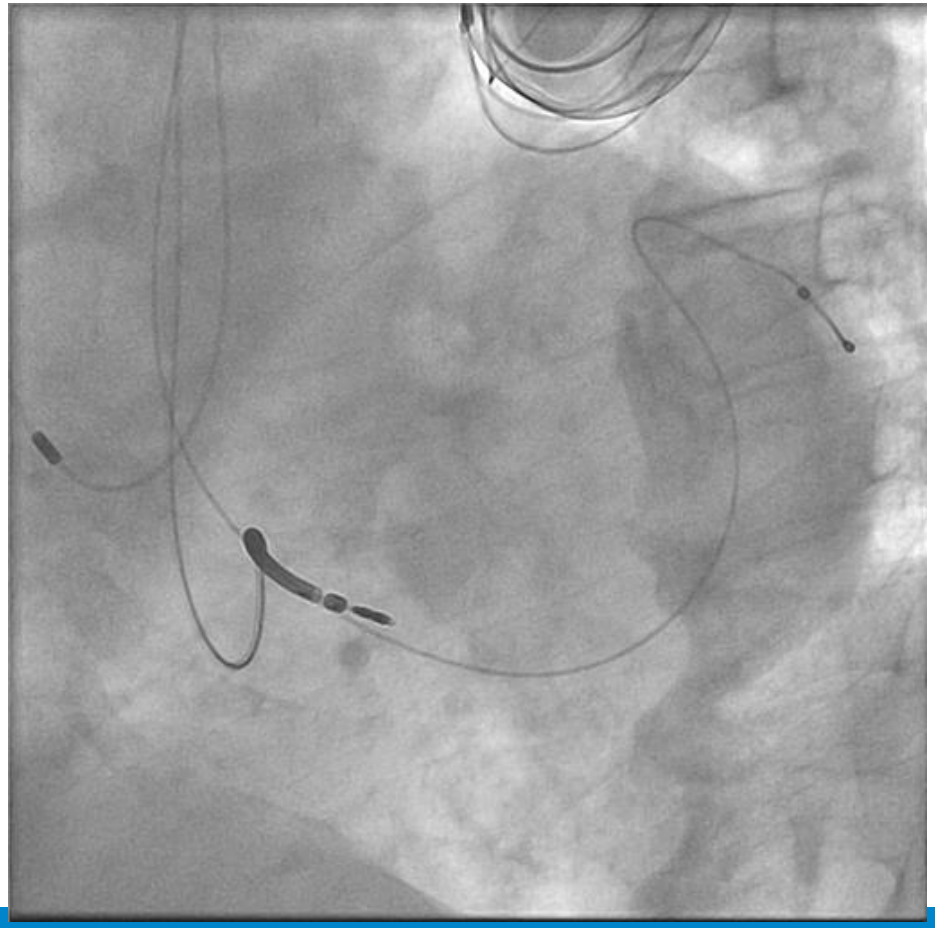
CRT – HF – BiV Devices

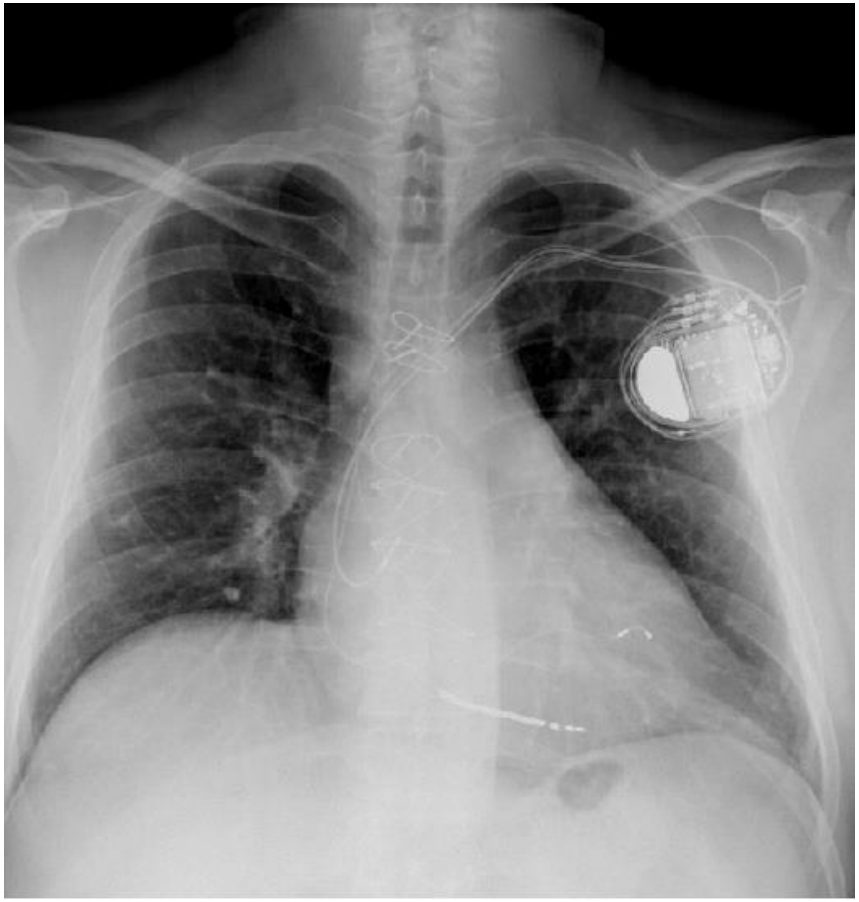




FLUOROSCOPY IMAGES

CRT – HF – BiV Devices





REMOTE FOLLOW-UP

REMOTE FOLLOW-UP

CareLink Monitor

Old Monitor

REMOTE FOLLOW-UP

MyCareLink Smart

MyCareLink

REMOTE FOLLOW-UP

Patient Instructions

- Take monitor home
- ICD/CRTD Patients
  - Plug into the wall next to wear you sleep at night
  - Each night it will monitor your device and transmit if necessary
- Pacemaker Patients
  - Store monitor
  - Clinic will schedule transmissions
  - On the day of the scheduled transmissions, plug in device and follow the screen prompts

FAQS

- Do you have any common patient questions?
- Longevity??