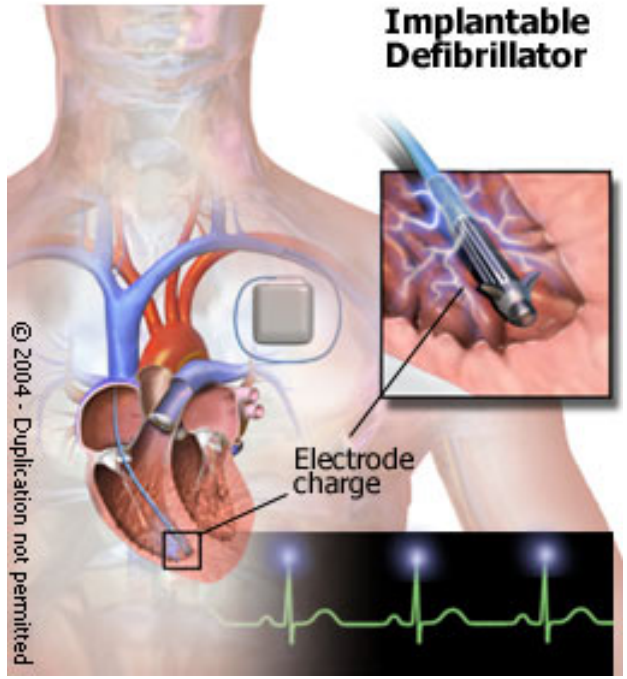
Pacing & ICD Overview

Lauren Butler



- Indications for pacing
- Pacing systems & ECG recognition
- History ICD
- Indications for ICD
- ICD Overview
- Detection & Treatment of arrhythmias
- Interference
- Indications for Rehab

Indications for Pacing

- ACC/AHA/NASPE Guideline for implantation of cardiac pacemakers & anti-arrhythmic devices – 2002

• Sinus Node disease	25 %
• AV block	42 %
• SND & AVB	10 %
• AF & AVB	13 %
• Carotid & Vasovagal syndromes	10 %

Pacing – The USCI code

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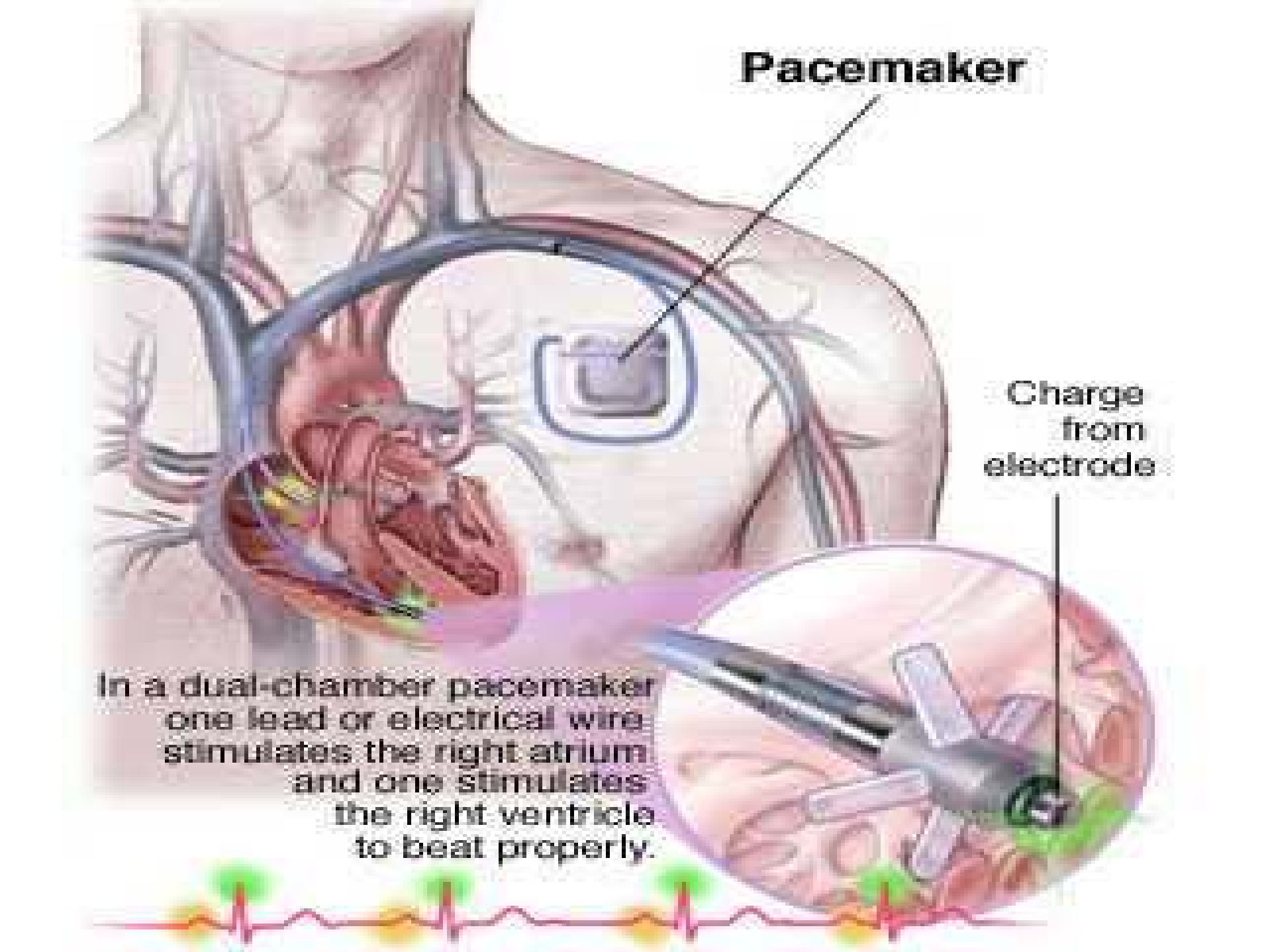
- The USCI code is the standard code for labelling the mode of pacing

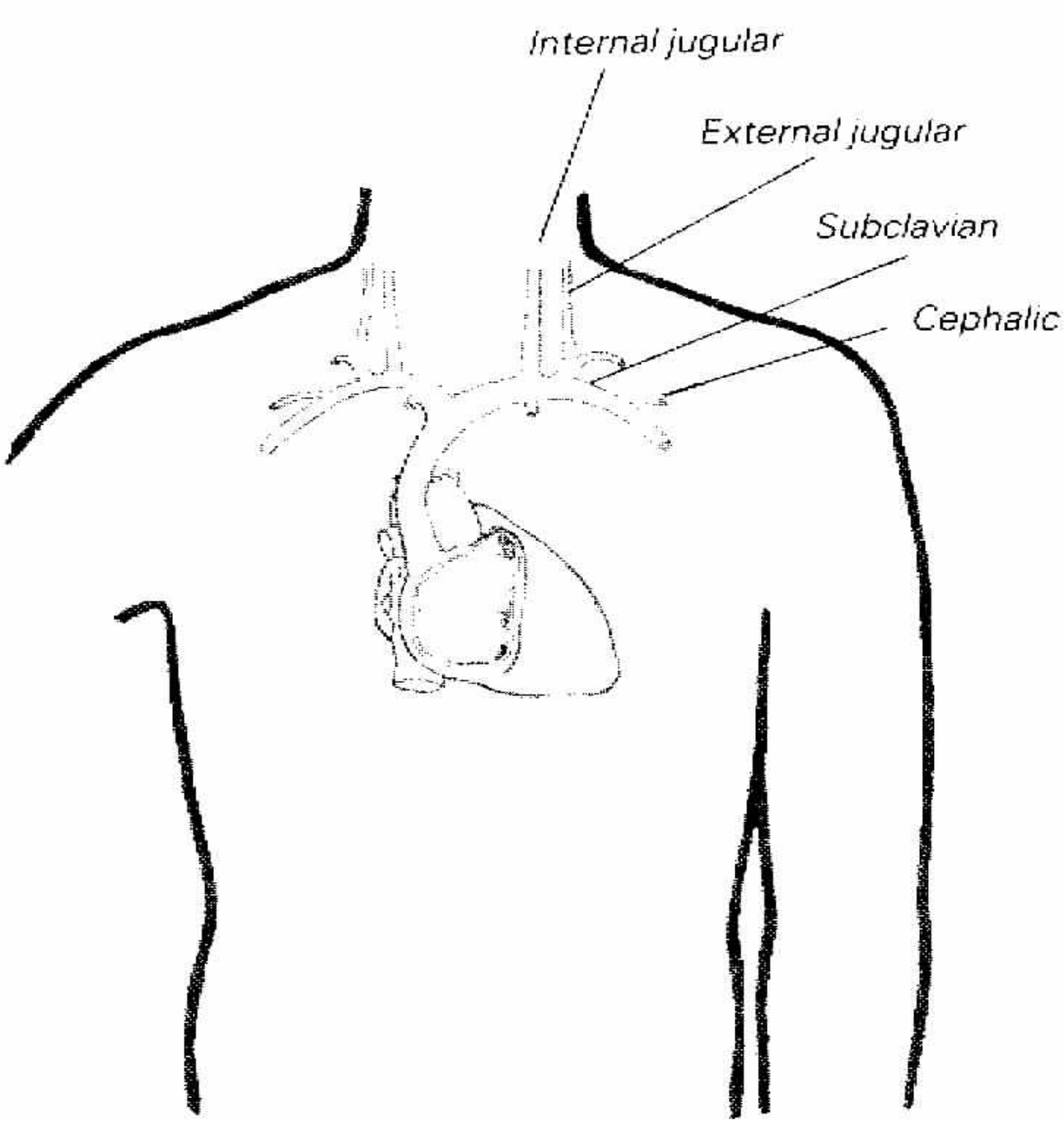
- 1ST letter – chamber(s) paced

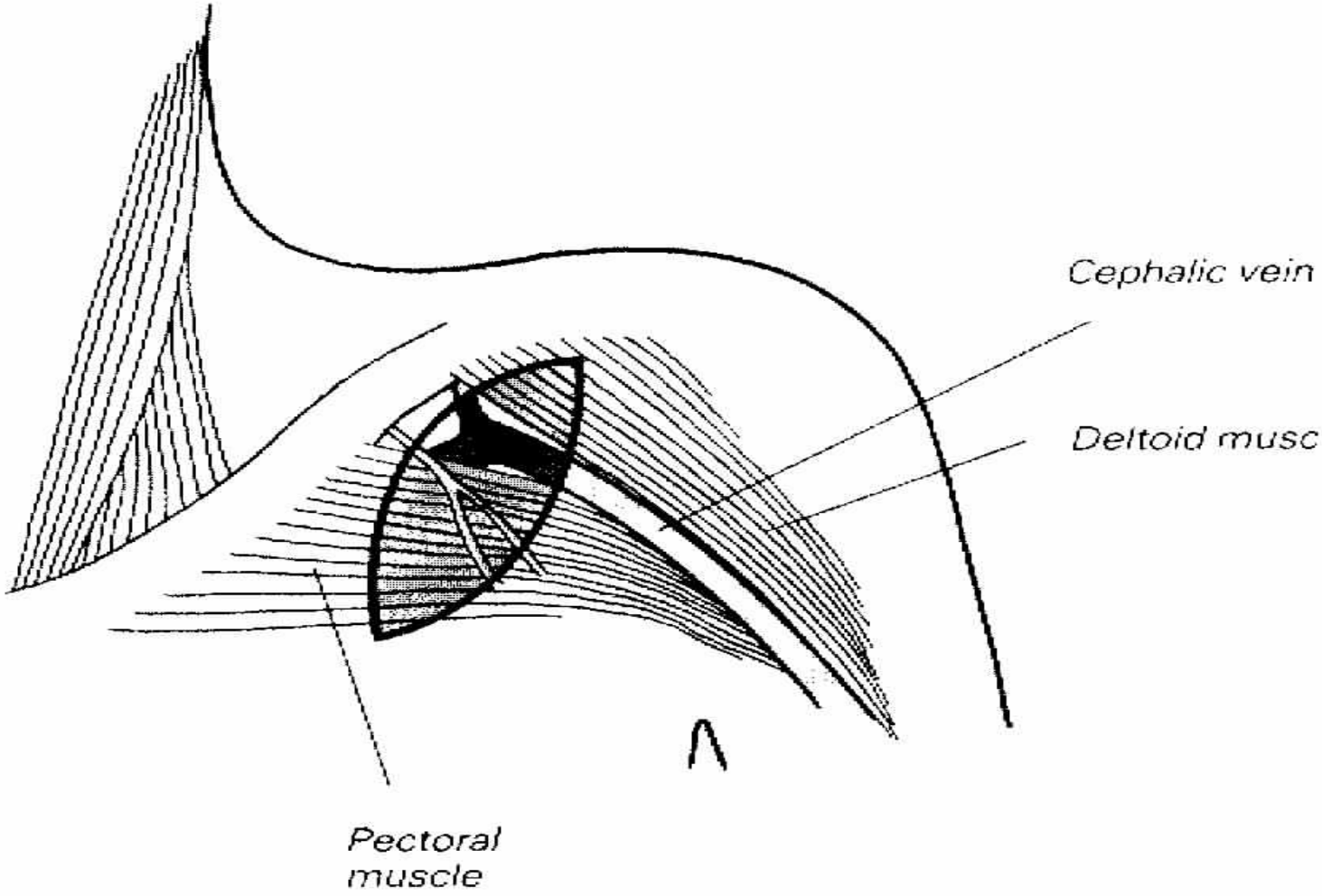
  2nd letter – chamber(s) sensed

  3rd letter – Mode of action

  4th letter – Rate Response

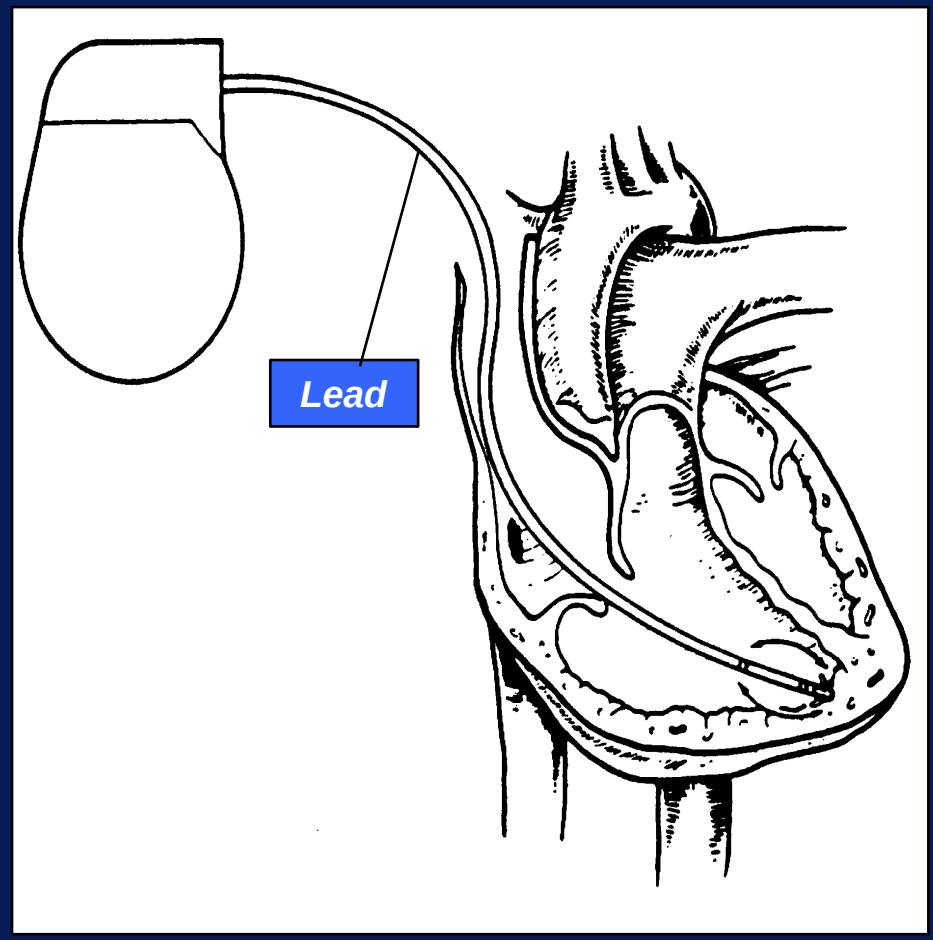

Pacemaker
Charge from electrode
In a dual-chamber pacemaker one lead or electrical wire stimulates the right atrium and one stimulates the right ventricle to beat properly.


Internal jugular
External jugular
Subclavian
Cephalic


Cephalic vein
Deltoid musc
Pectoral
muscle

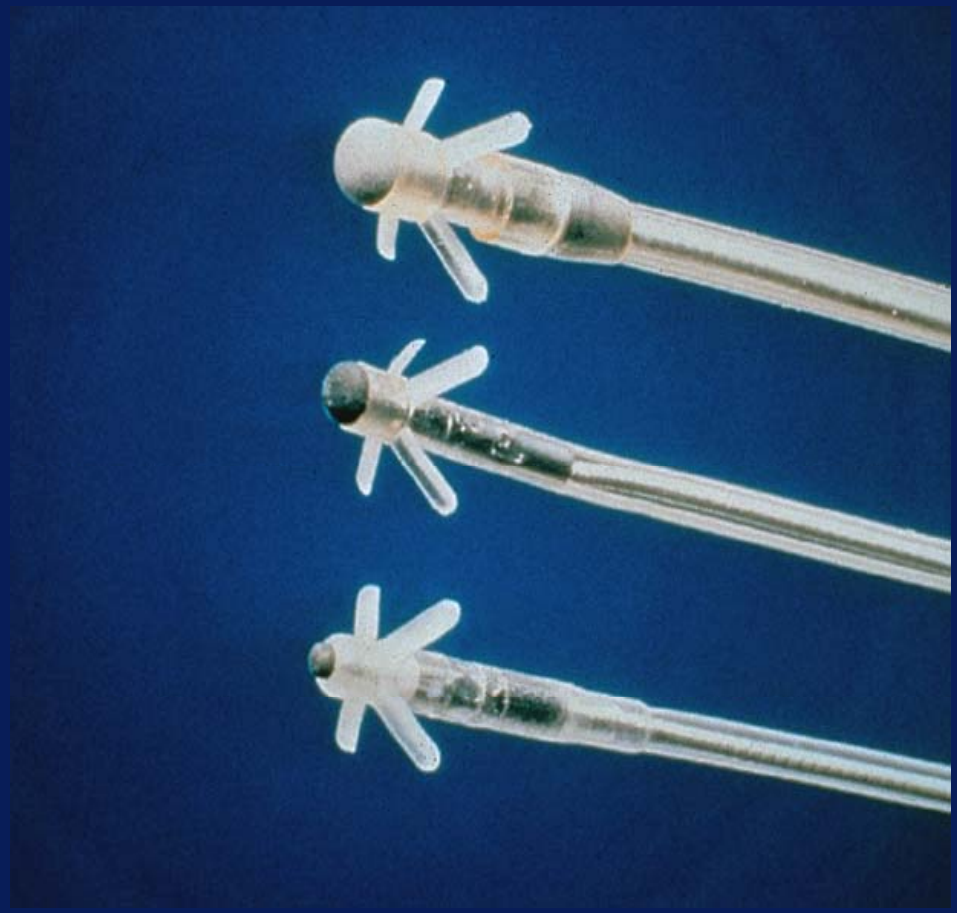
Leads Are Insulated Wires That:

- Deliver electrical impulses from the pulse generator to the heart
- Sense cardiac depolarization



Transvenous Leads Have Different "Fixation" Mechanisms

- Passive fixation
  - The tines become lodged in the trabeculae (fibrous meshwork) of the heart

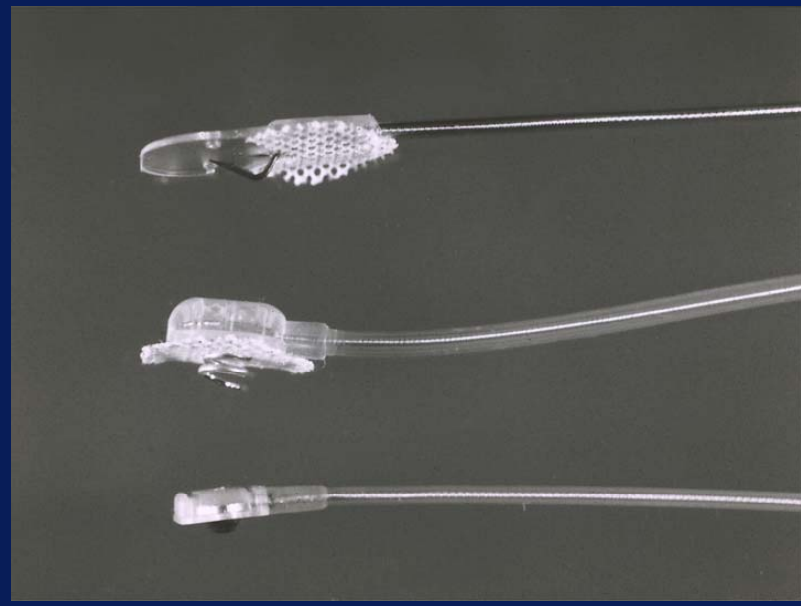


Transvenous Leads

- Active Fixation
  - The helix (or screw) extends into the endocardial tissue
  - Allows for lead positioning anywhere in the heart's chamber

Myocardial and Epicardial Leads

- Leads applied directly to the heart
  - Fixation mechanisms include:
    - Epicardial stab-in
    - Myocardial screw-in
    - Suture-on



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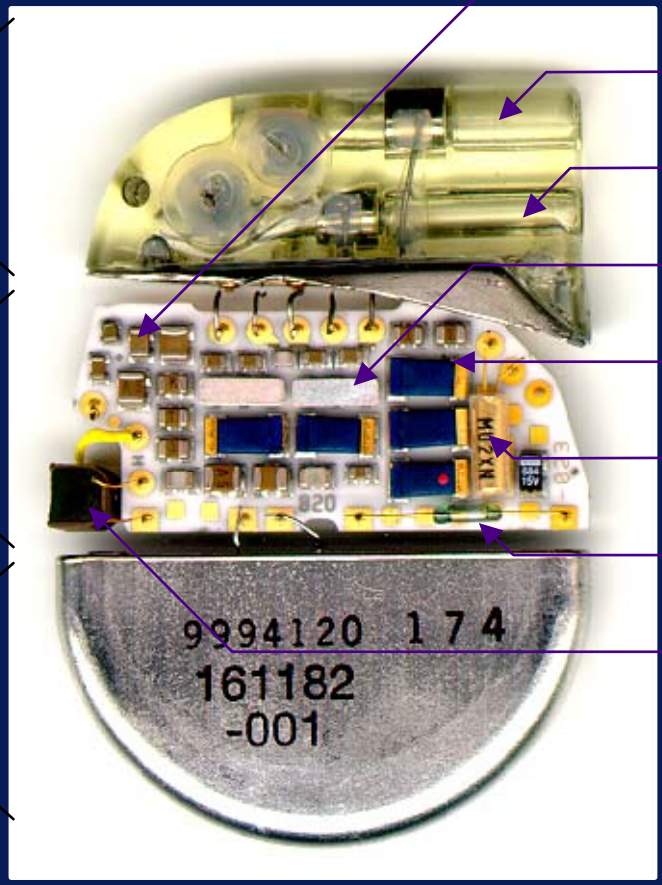
Anatomy of a Pacemaker



Connector

Hybrid

Battery

Resistors

Atrial connector

Ventricular connector

Defibrillation protection

Output capacitors

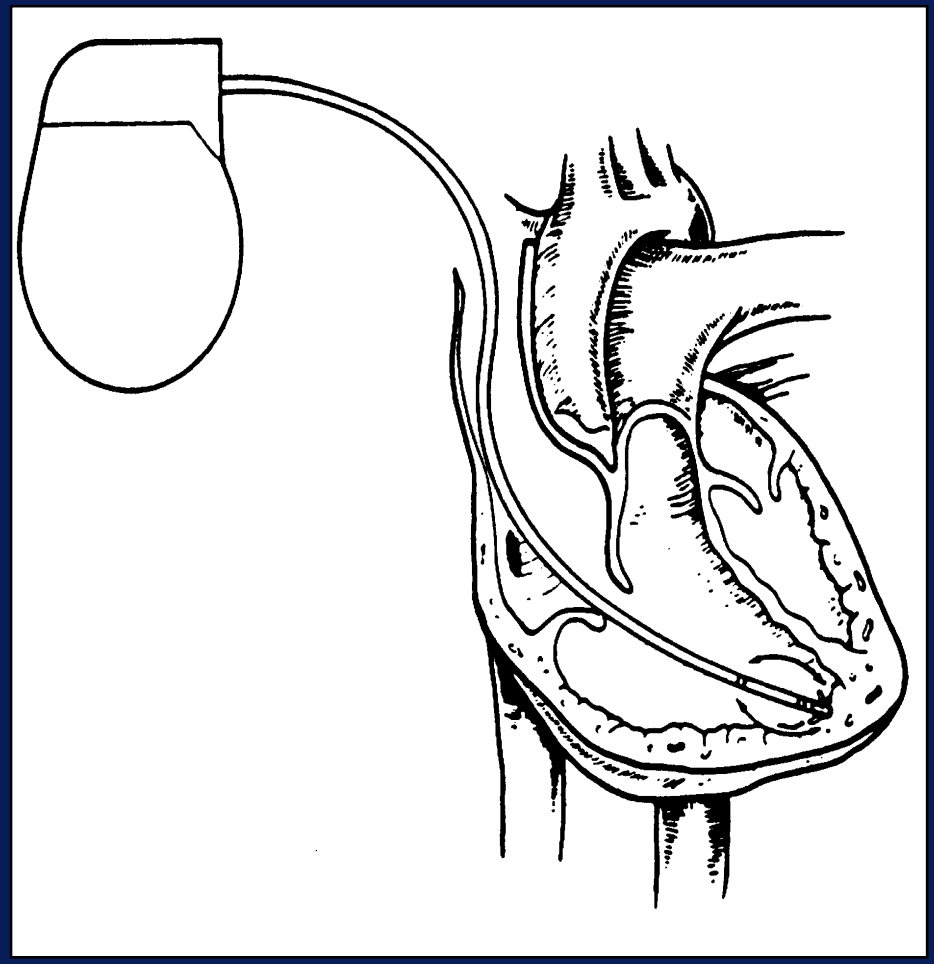
Clock

Reed (Magnet) switch

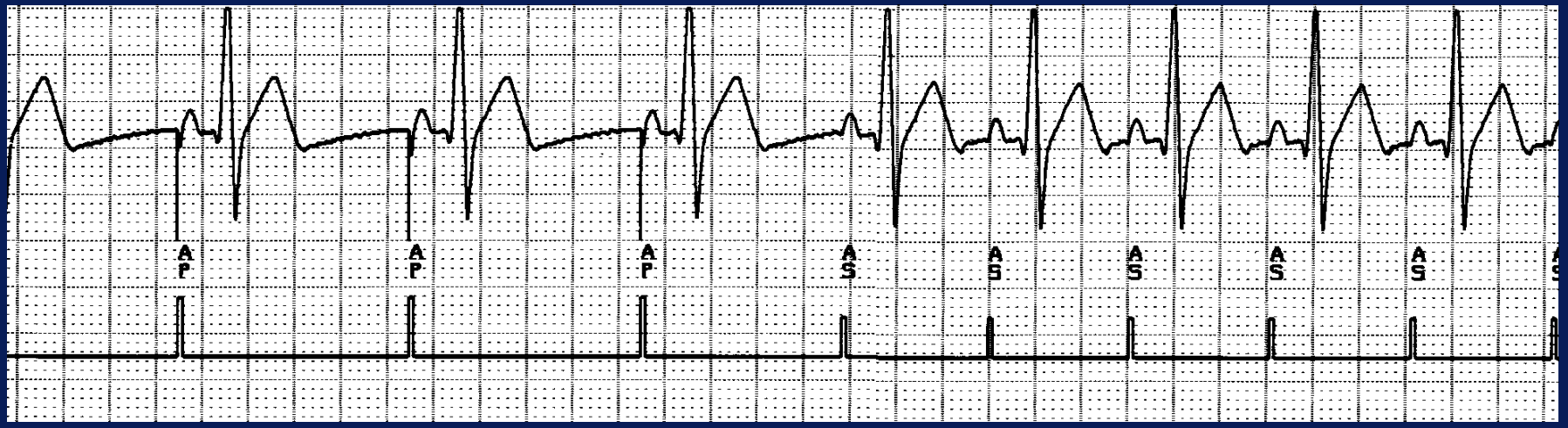
Telemetry antenna

Single-Chamber System

- The pacing lead is implanted in the atrium *or* ventricle, depending on the chamber to be paced and sensed



Paced Rhythm Recognition



AAI / 60

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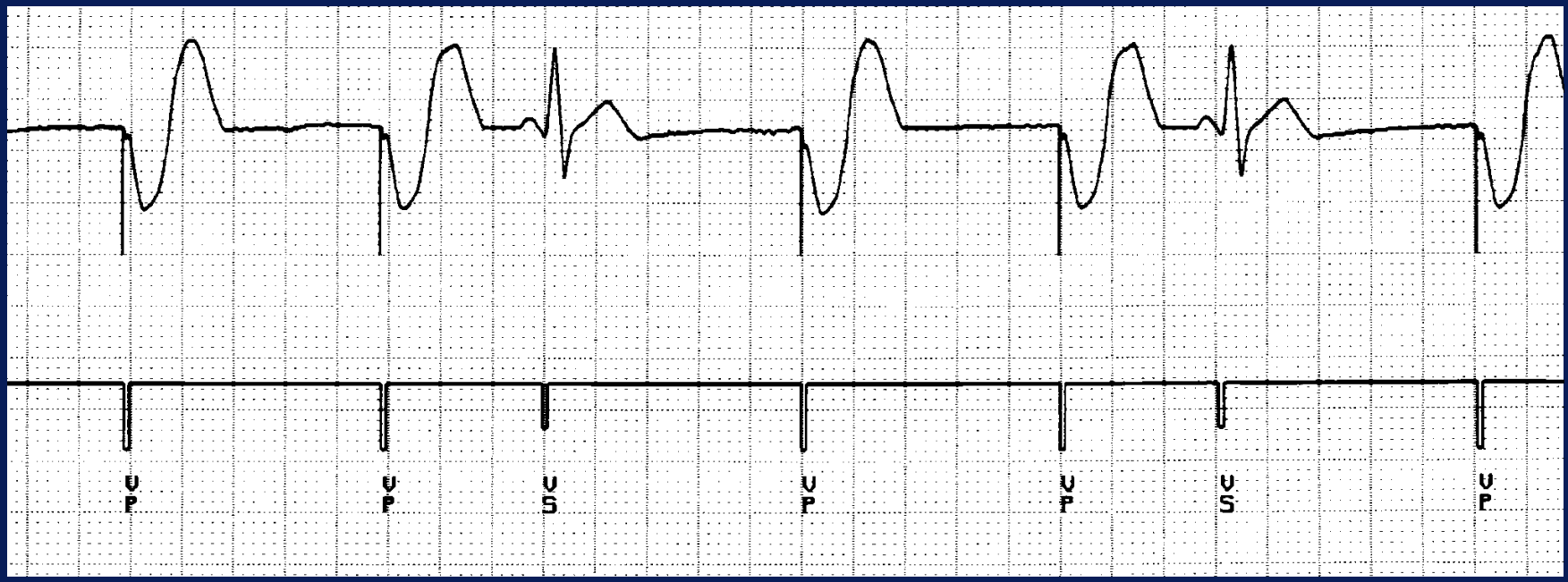
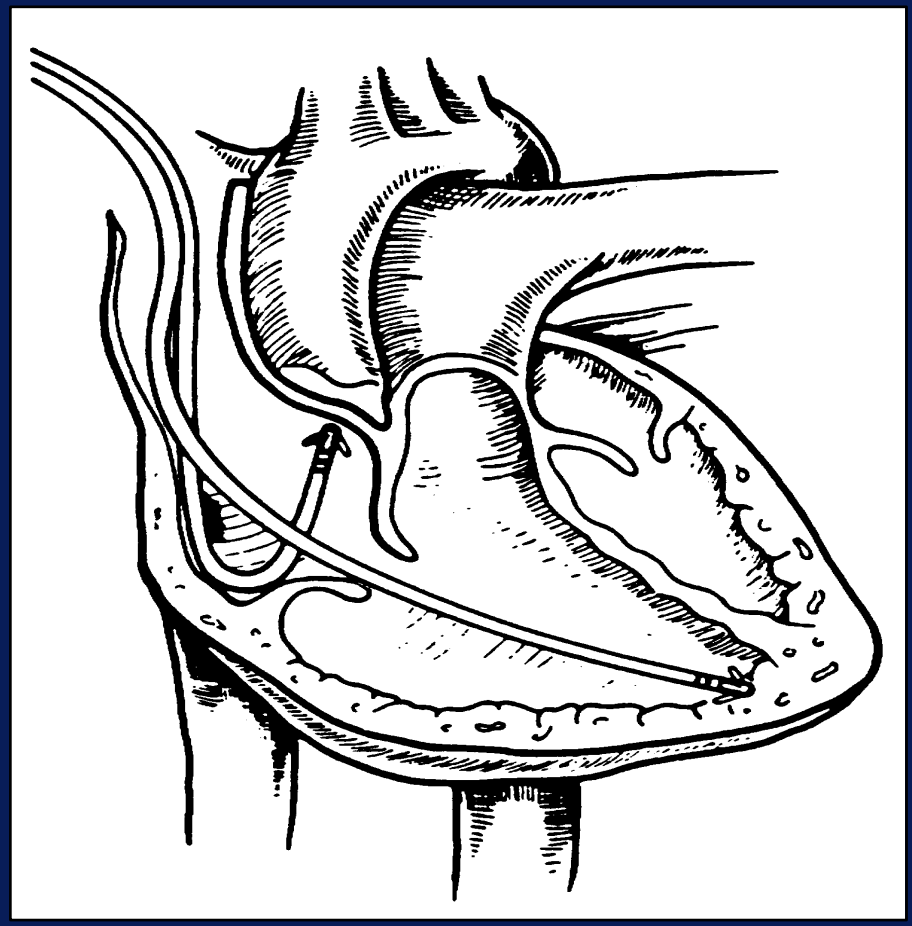
Paced Rhythm Recognition



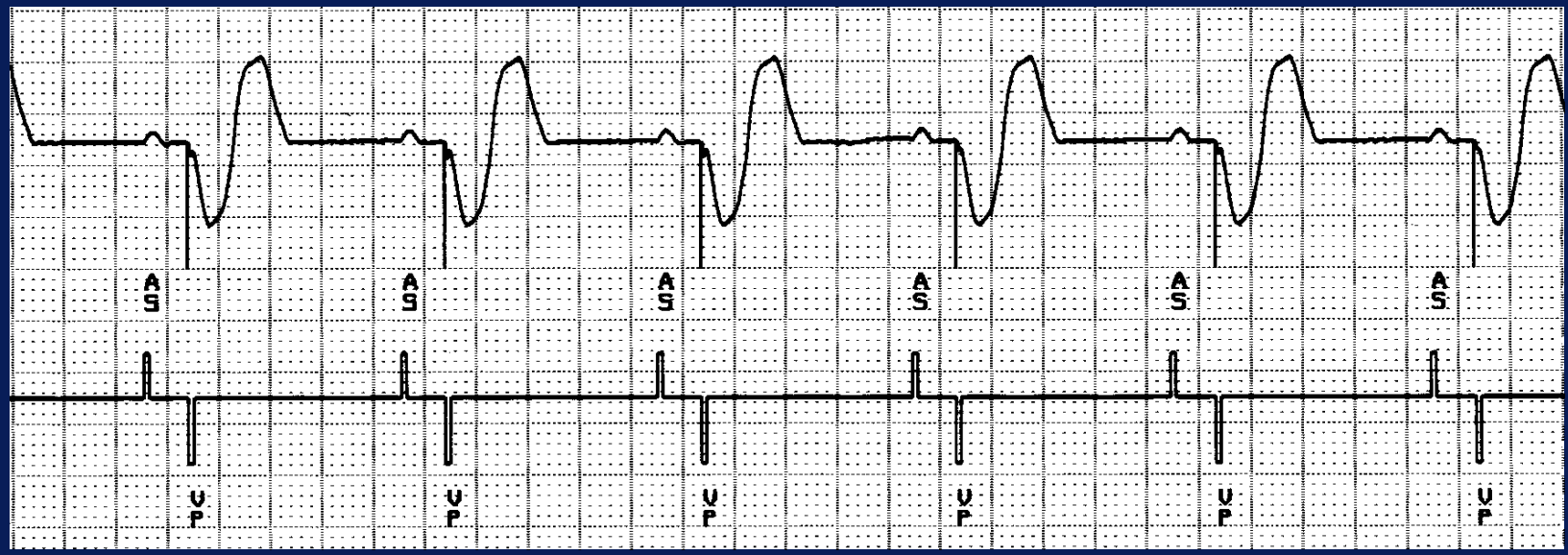
VVI / 60

Dual-Chamber Systems Have Two Leads:

- One implanted in both the atrium and the ventricle

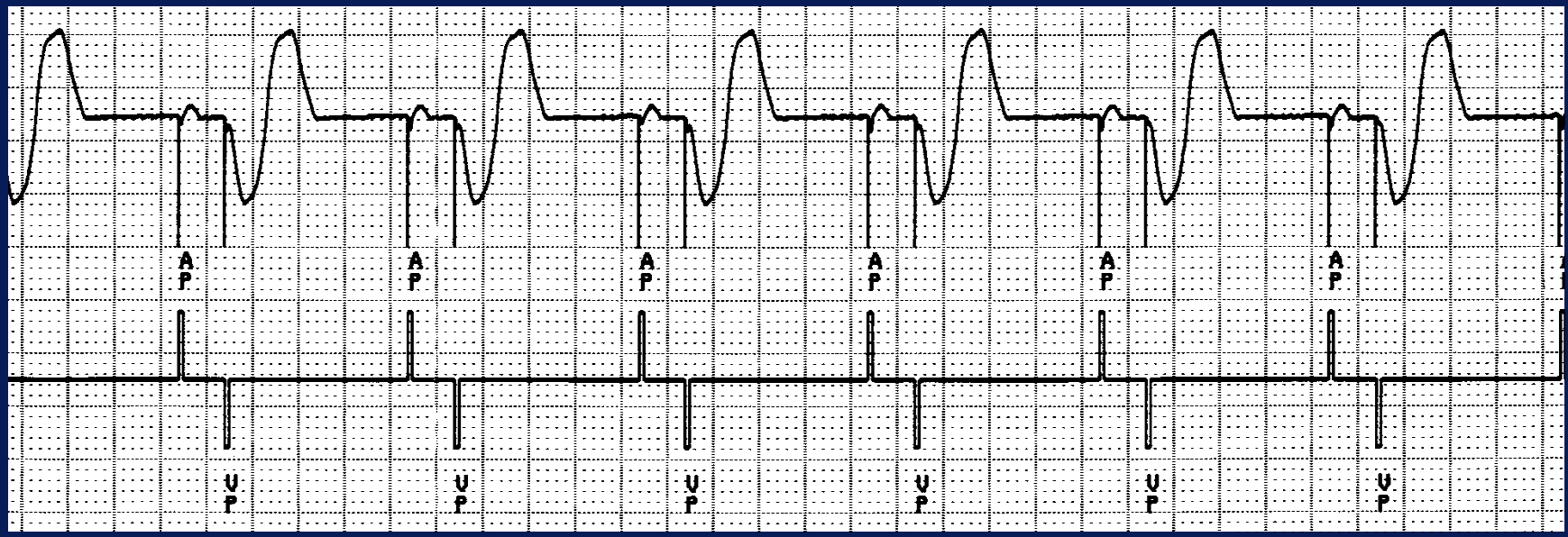


Paced Rhythm Recognition

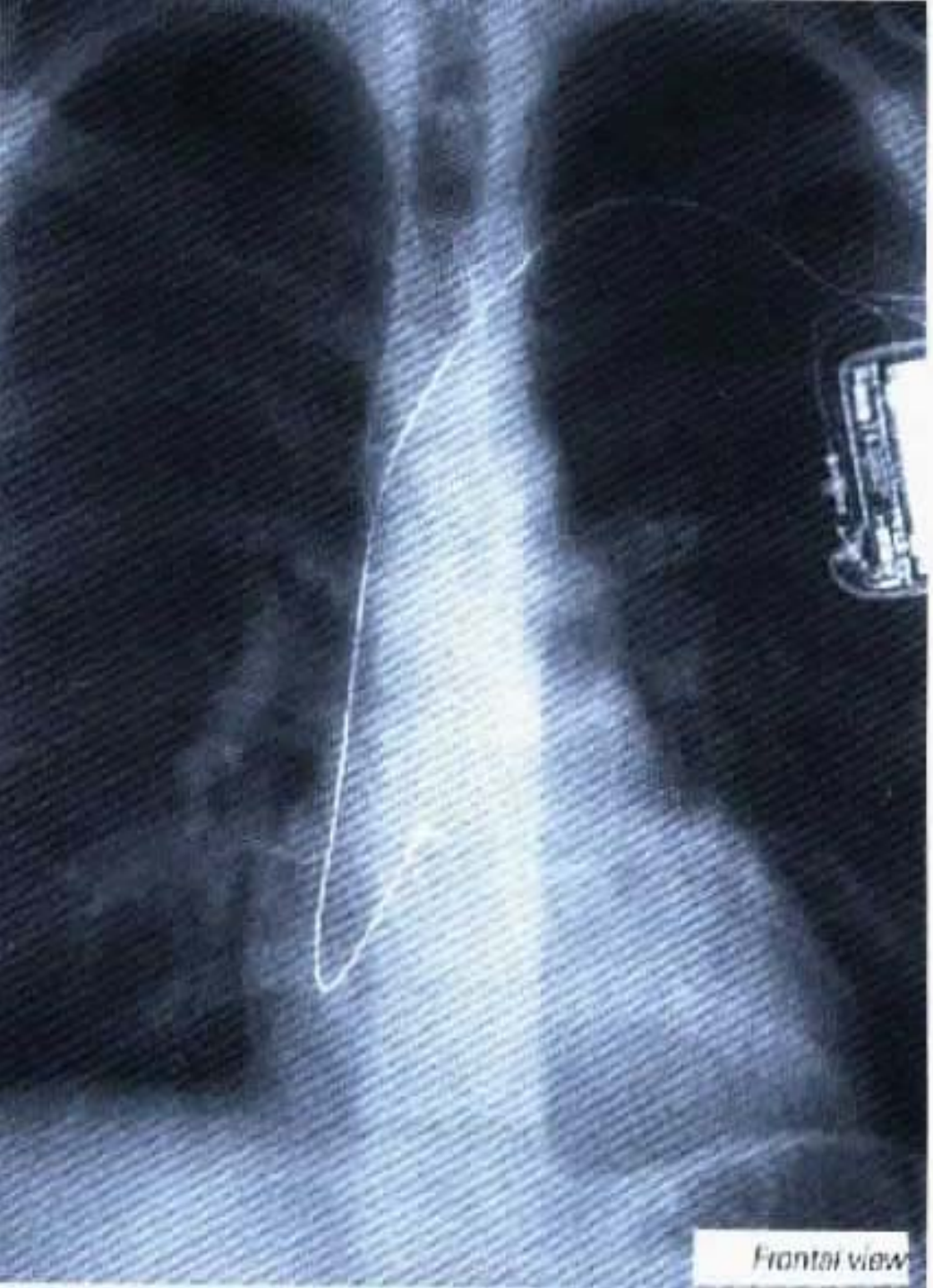


DDD / 60 / 120

Paced Rhythm Recognition



DDD / 60 / 120


Frontal view


Lateral

ICD Inventor

Michel Mirowski

1967

- First ICD - implanted in the 1980's
- Epicardial system - 2 large patches, sutured to the epicardial surface of the heart
- Patches used for pacing, cardioversion & defibrillation shocks
- 2 small sensing electrodes - also sutured to the epicardial surface
- Large unit - required abdominal placement
- Electrodes and the patches positioned at the time of open-heart surgery, mostly for CABG
- Nicknamed 'cabbage patch' patients

Indications for ICD

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- Secondary prevention
  - VT/VF event
  - Sustained VT with heamodynamic compromise
  - Sustained VT without heamodynamic compromise with LVEF<35%
- Primary Prevention
  - Post MI with LVEF<35% and non-sustained VT on holter and positive EPS or
  - Post MI with LVEF<30% and QRS duration ≧ 120ms

Implantation of the ICD

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- Device selection
  - Single or dual?
  - Rate response?
  - Lead selection, single or dual coil?
  - Longevity
  - Ease of follow up, data storage, ECG quality

Implantation of the ICD

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General vs local anesthesia

Surgeon vs cardiologist

Left subpectoral. Subcutaneous

Cephalic,subclavian vein

Active fixation lead

Positional measurements

VF Induction & threshold measurement

External DC for safety

Induction

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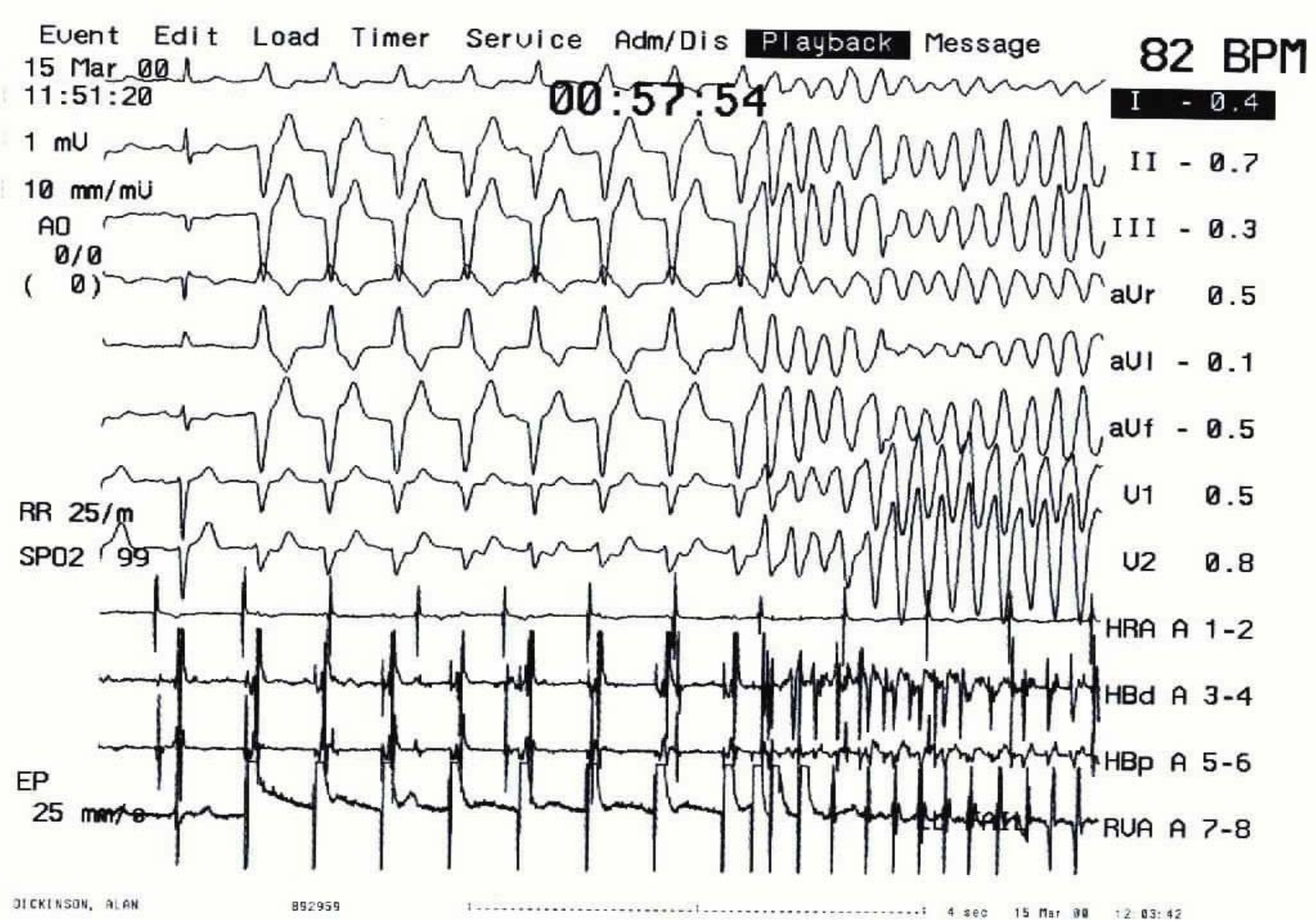

Termination

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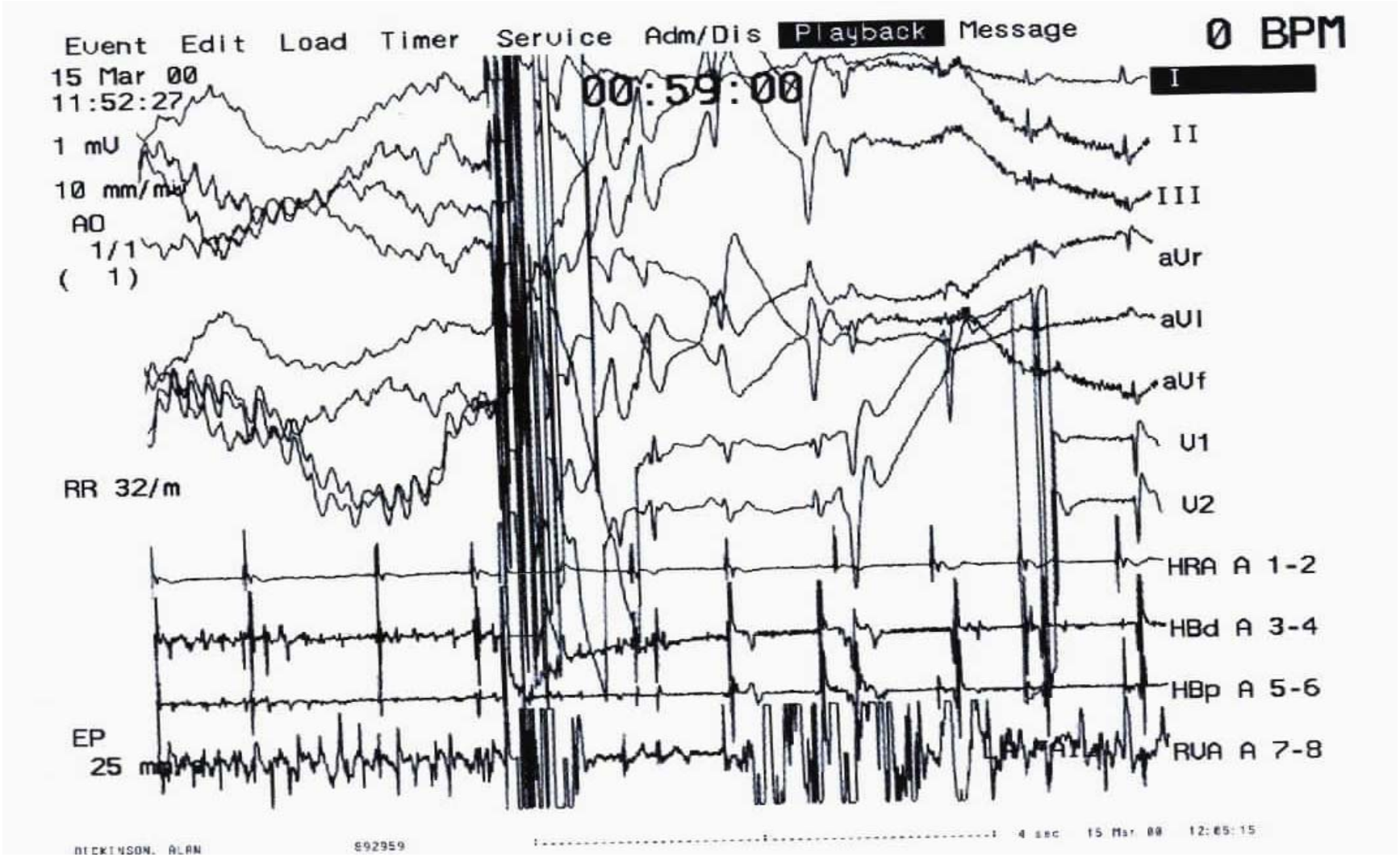
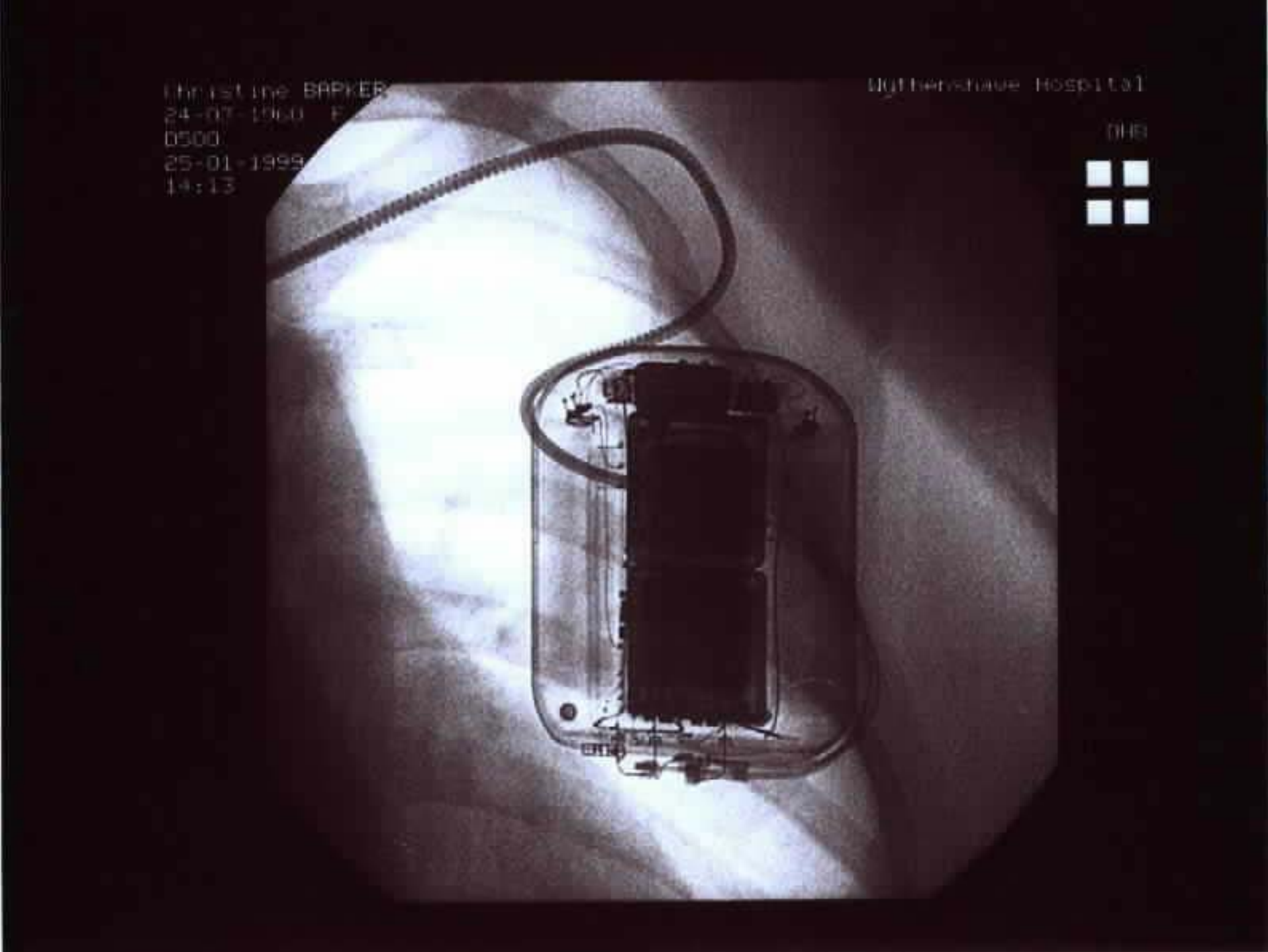
Cardiac Network




Christine BARKER
24-07-1960 F
0500
25-01-1999
14:13
Ugtken-Hawe Hospital
DHB

Implantation of the ICD

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- Programming
  - VT and/or VF?
  - Detection (rate, sensitivity)
  - Therapy (burst pacing, ramp pacing, DC Cardioversion, DC Defibrillation)
  - Pacing therapy

- Post op monitoring, chest X-Ray, ECG, Echo

Follow up of the ICD

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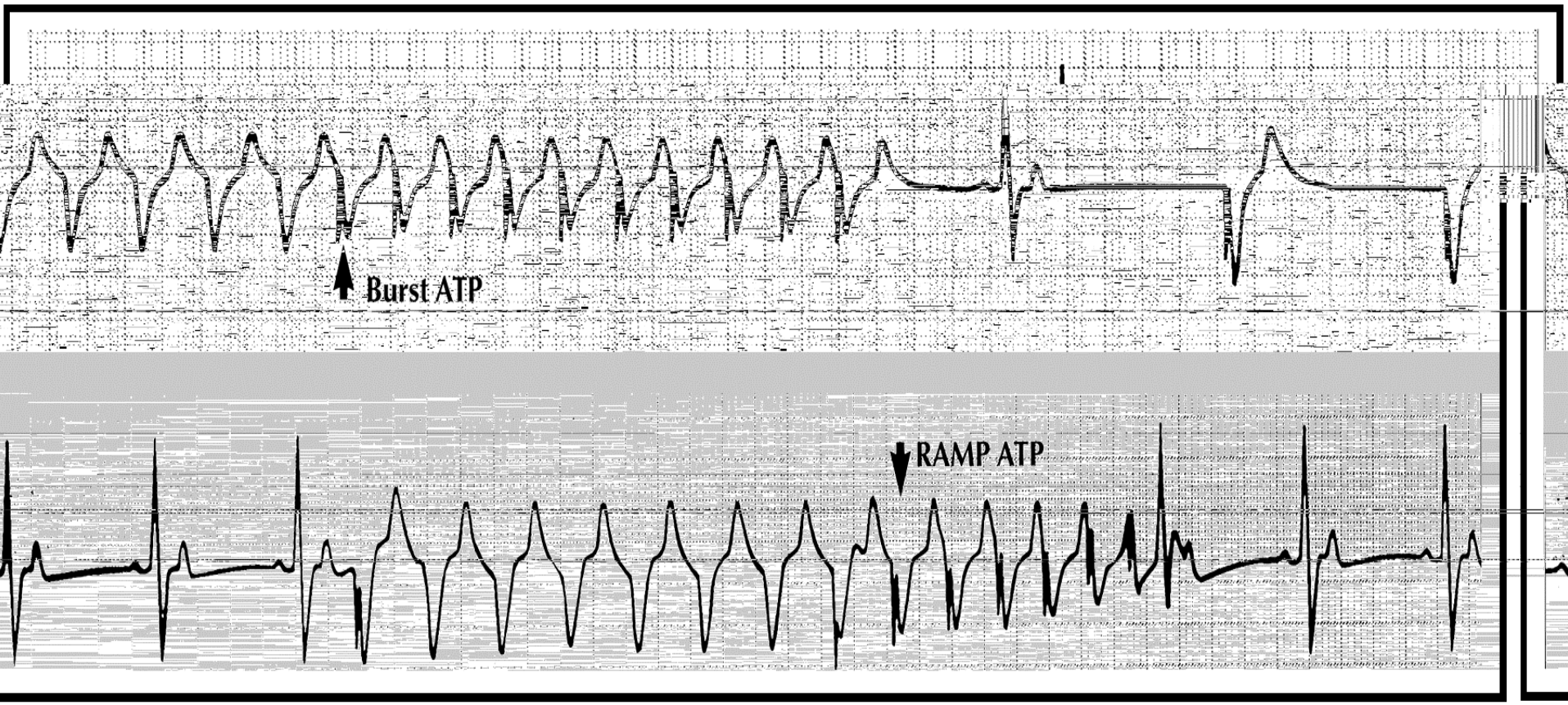
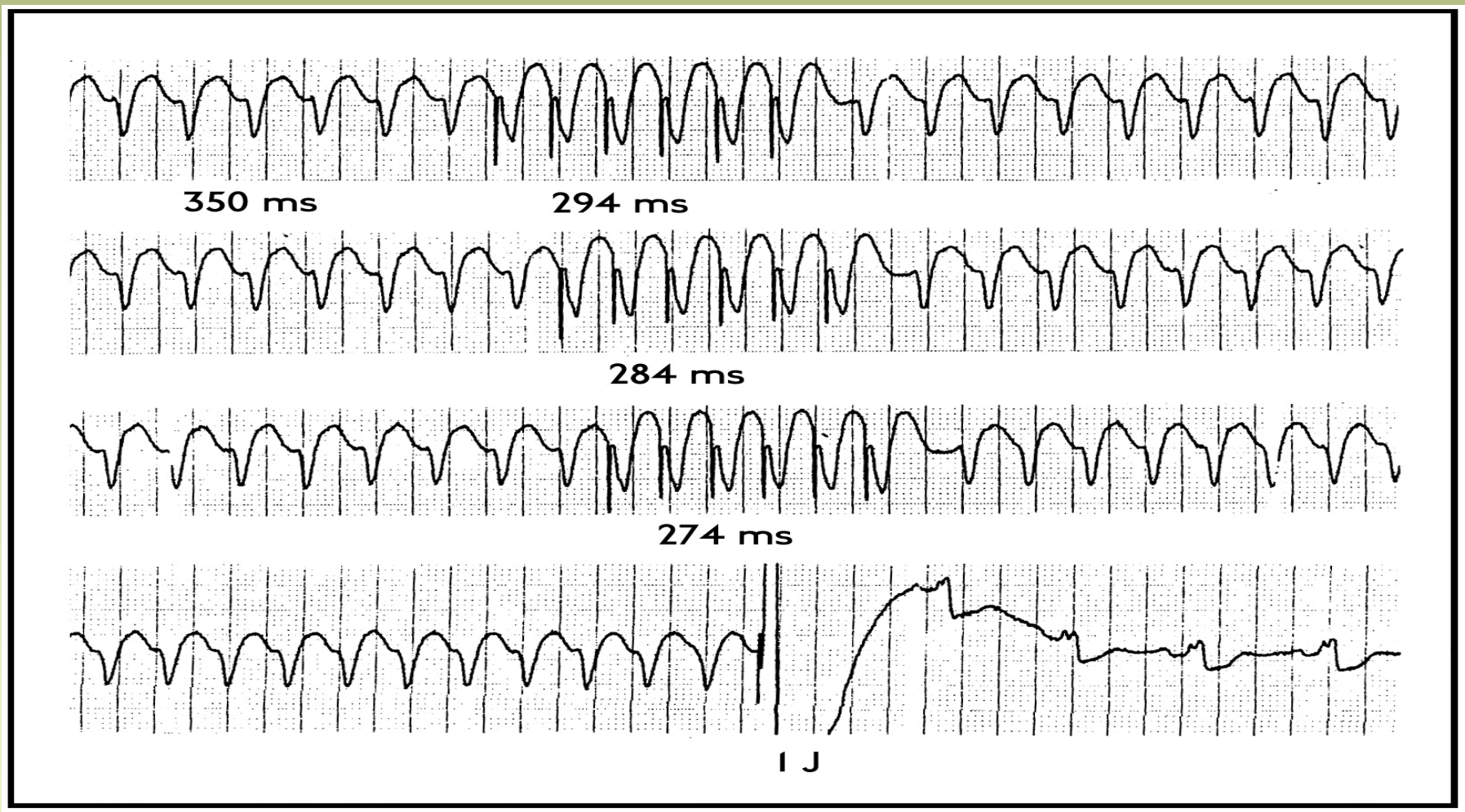
- Every 3/6 months
- Interrogation, assessment of therapy
- Routine measurements
- reprogramming
- Assessment of patient well being
- Annual clinical review

Examples: VTs Terminated with Burst and Ramp Pacing



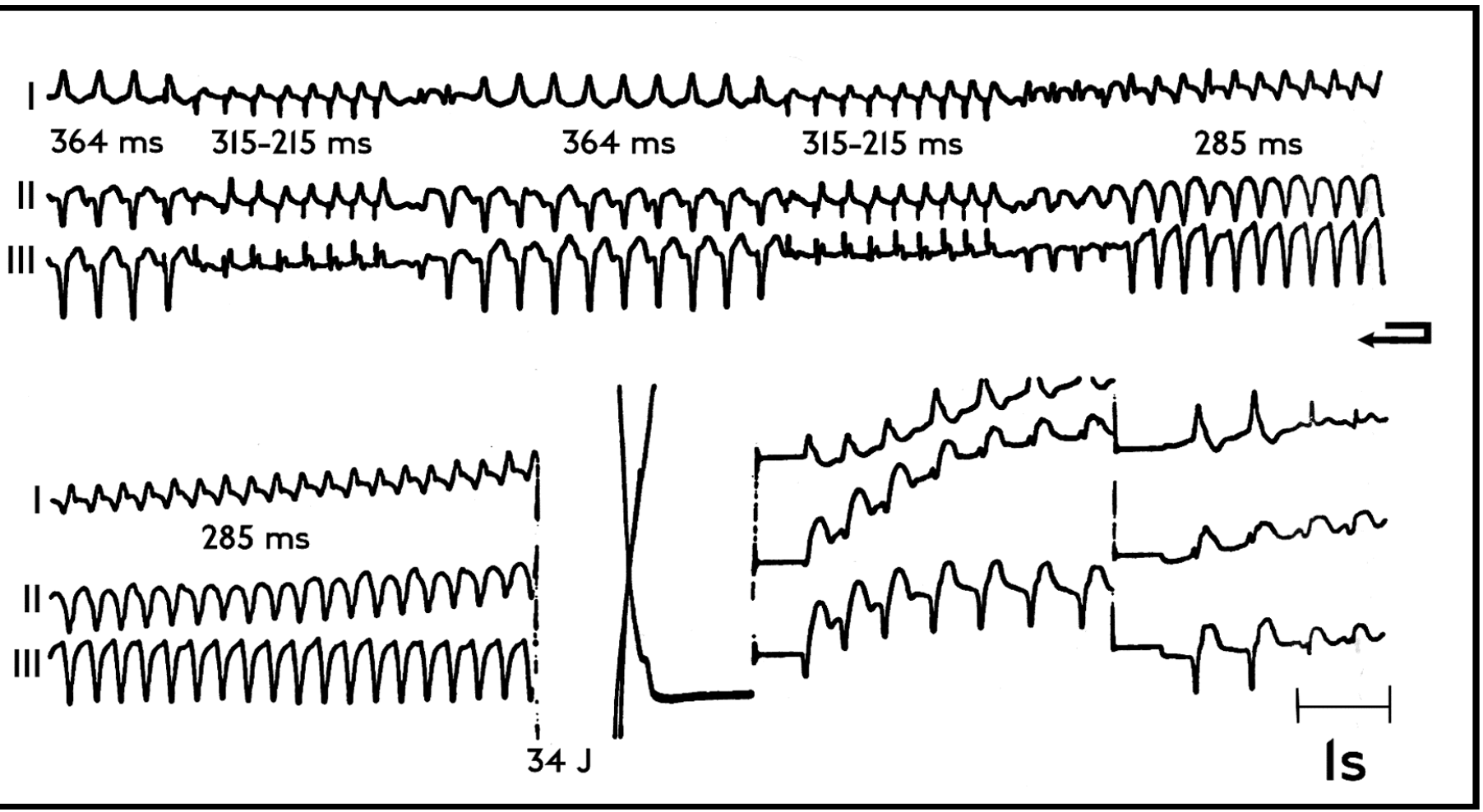
GUIDANT

Example: Attempt to Treat VT with Scan Decrement



GUIDANT

Example: VT Accelerated by ATP



Battery requirements for defibrillation and pacing are very different:

Defibrillation	750v occasionally
Pacing	3v every second

ICDs and Driving

- For secondary prevention, no driving for 6 months
- If therapy in that 6 months and pt compromised then no driving for further 6 months

ICDs and Electromagnetic Interference

- **Galvanic (direct contact with current source):**
  Cautery/defibrillation-cardioversion
- **Electromagnetic (no direct contact):**
  Arc welding/metal detectors/radio transmitter/some electrical appliances
- **Magnetic:**
  MRI/industrial video tape cleaners

Effects of Electromagnetic Interference

- **Prevent arrhythmia detection**
- **False detection**
- **Device turned off**
- **Circuit damage**

Instructions

- **No MRI (option - CT scan)**
- **No lithotripsy (hydraulic shock wave)**
- **Do not loiter near EMI sensors**
- **Avoid EMI at airports (no hand held wand over device)**
- **Avoid diathermy and turn off ICD for surgery that requires it (probe at least 20cm from device)**

Cardioversion

- **Always Cardiovert through device if possible**
- **Paddles away from generator**
- **Paddles perpendicular to lead system of device**
- **Keep energies as low as possible**
- **Interrogate device post cardioversion**

Safe to Use Appliances

- **Microwaves**
- **TVs/VCRs**
- **AM/FM radios**
- **CDs**
- **Toasters/blenders etc**
- **Electric blankets**
- **PCs**
- **Fax’s etc**

Cell/Mobile Phones

- **20cms from device**
- **Opposite ear to implant**
- **Avoid putting phone in breast pocket**

Implications for Rehab Pacing Patients

- **Exercise Capacity – may be affected due to model of pacemaker rather than functional limitation**
- **Immediate post op recovery phase – lead displacement**
- **Patient & staff confidence**
- **Knowledge model, settings & Pacing interpretation on the ECG**
- **CP support**

Implications for Rehab ICD Patients

- **Exercise Capacity – no formal ETT prior to discharge**
- **Patient & carer acceptance of device and its implications**
- **Patient & carer confidence**
- **Knowledge model, settings and therapies**
- **Complex rehabilitation**
- **Cardiac Physiologist support**
- **Lack of formal psycological support**

Summary

- 411 pacemakers per million population implanted nationally (2003 + 2004)
- 41 ICD per million population implanted nationally (2003 + 2004)
- 1.6 million – our network
- Nice guidance reduces need for EP testing and will impact on implant rates for ICD
- Chapter 8 – arrhythmias & sudden cardiac death will impact on pacing & ICD implants

Any Questions?

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