

**Heart Rhythm Trainees, HRUK 4<sup>th</sup> October 2010**

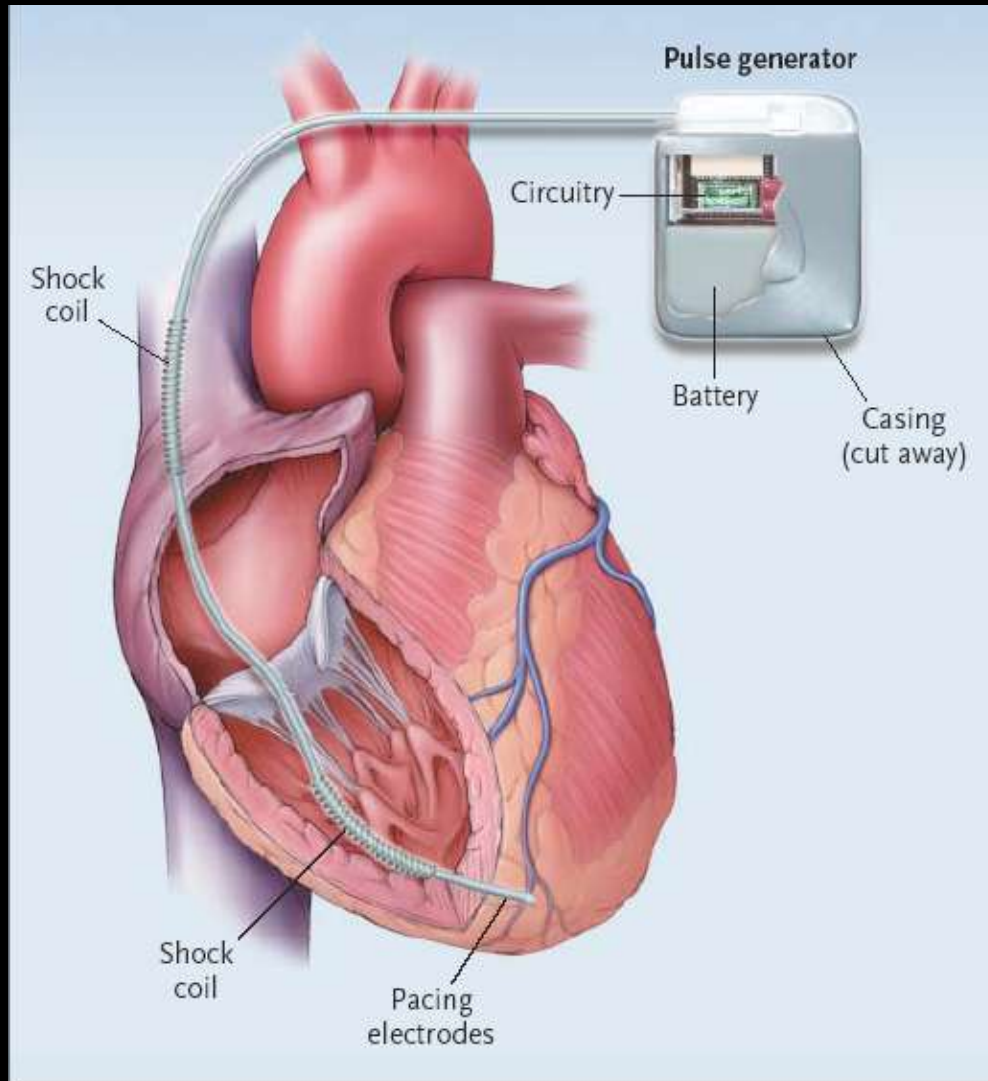
# **The Subcutaneous ICD**

**Andrew Grace**

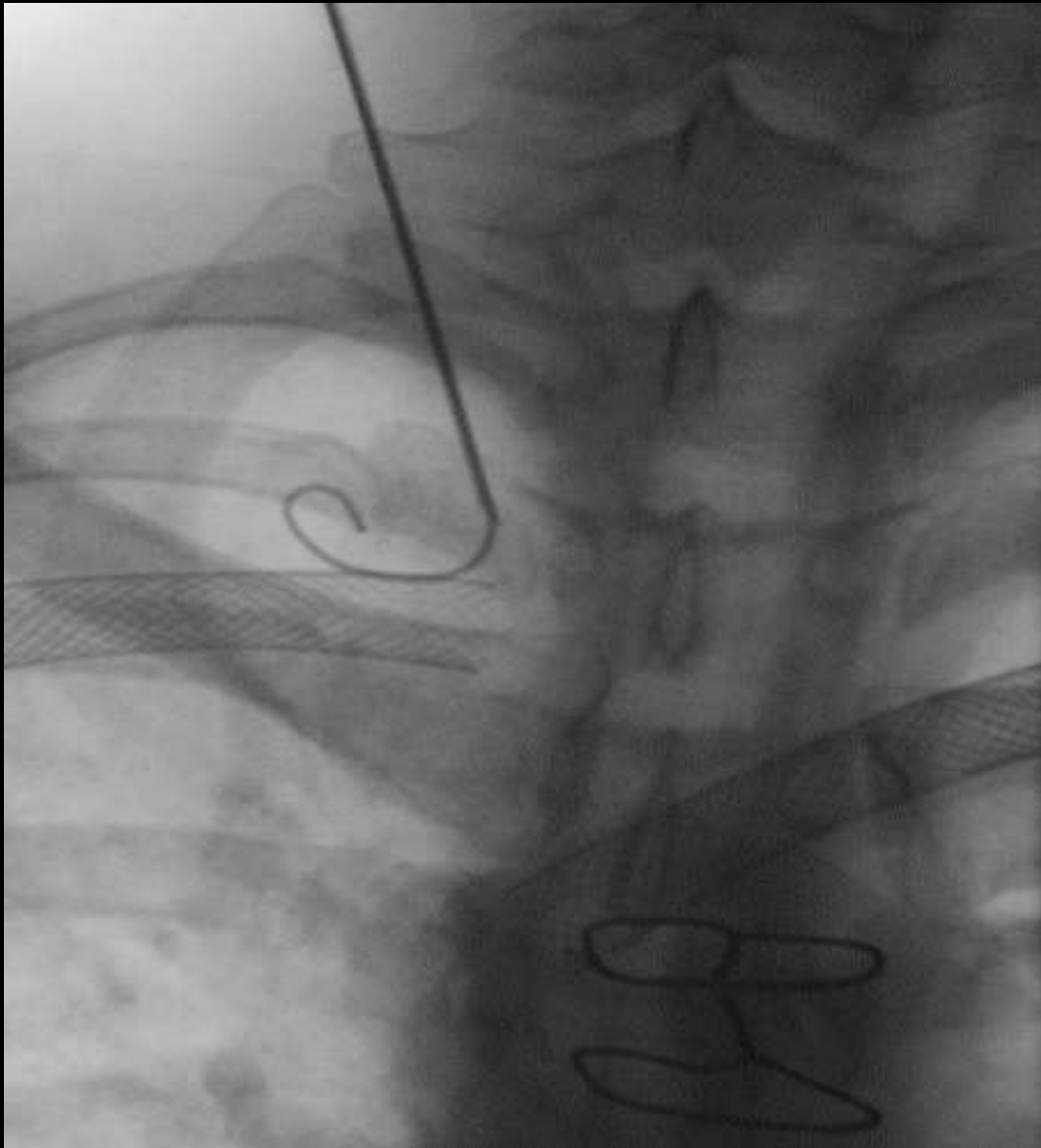
**Papworth Hospital and Cambridge University**

**Consultant, Cameron Health Inc., San Clemente, CA 92673**

# Implantable Cardioverter Defibrillators



- **Small devices**
- **Pectoral implant**
- **Transvenous**

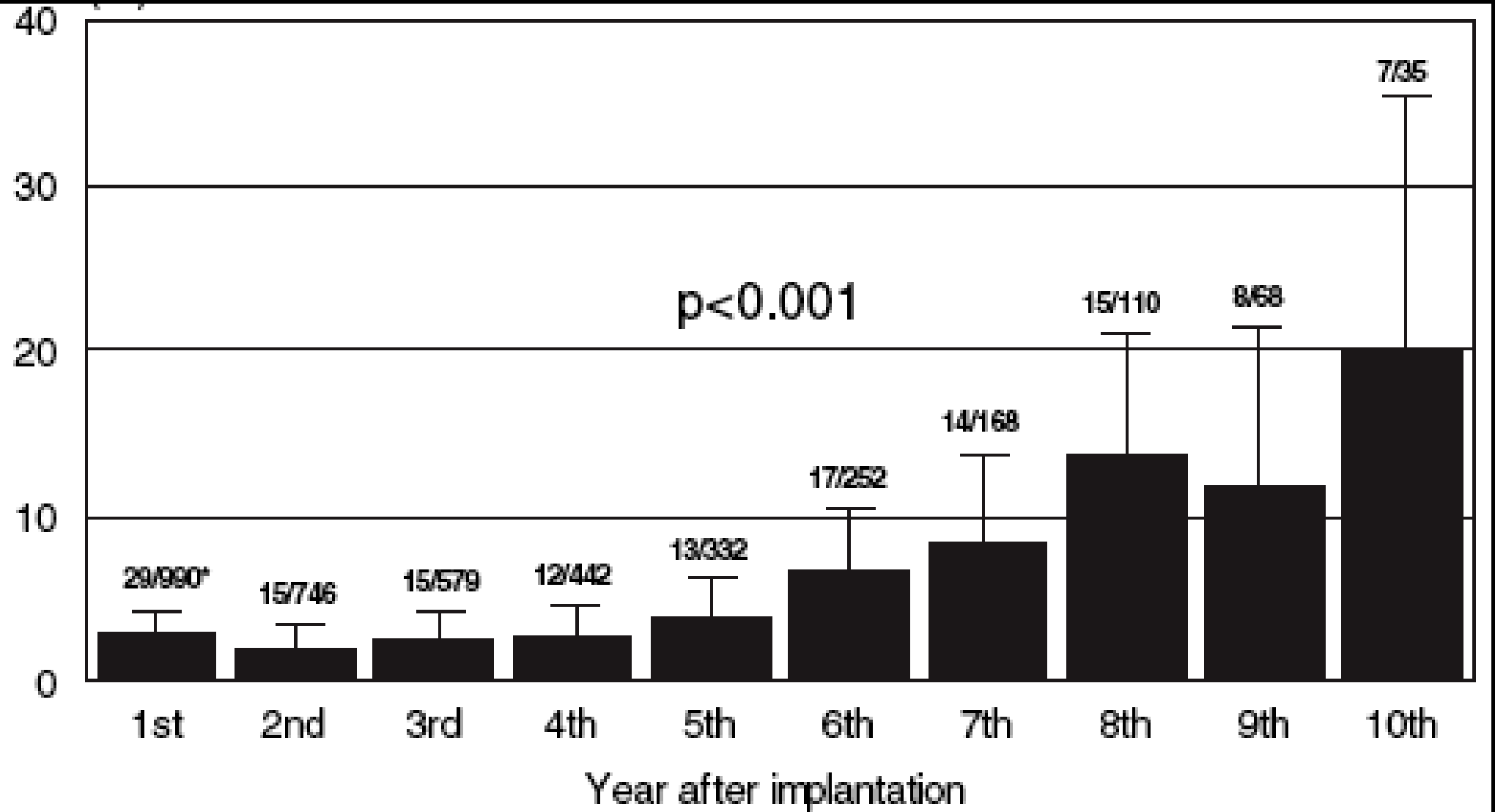


## **LEADS:**

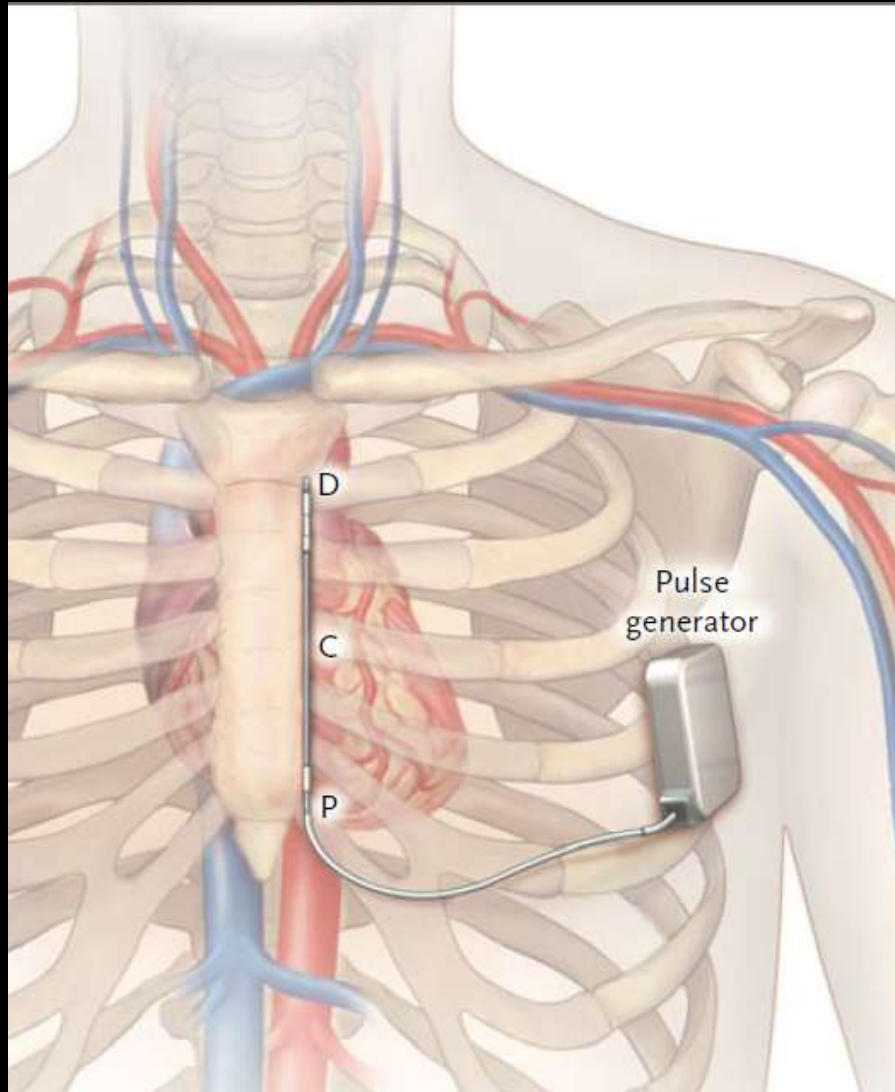
### **THE 'ACHILLES HEEL OF DEFIBRILLATOR THERAPY'**

- **Venous obstruction**
- **Thrombosis**
- **Infection**
  
- **Inappropriate shocks**
- **Lead recalls**

# Annual Rate of ICD Lead Defects (Ludwigshafen Registry)



# Simpler Systems – ‘shock boxes’

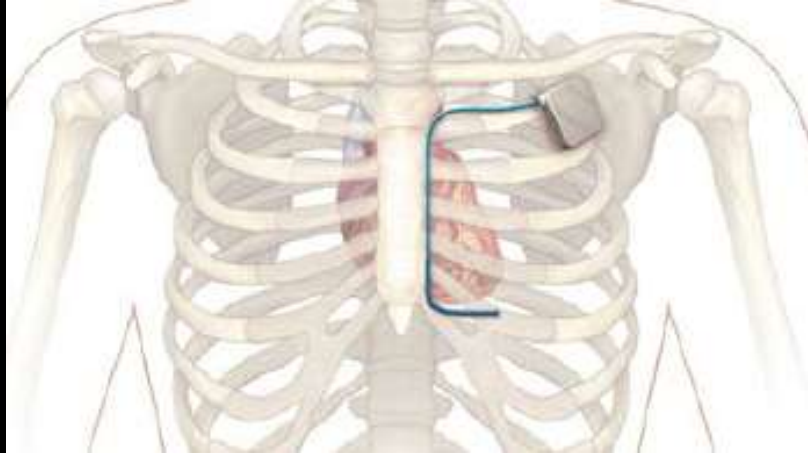


- **Subcutaneous electrode + active can**
- **Place anatomically**

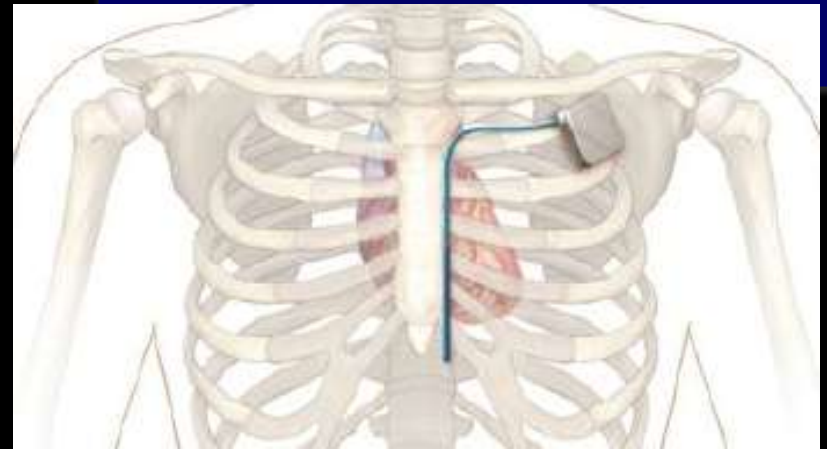
# Cambridge and the SICD

- **December 2002 – first cases**
  - lead location/DFT
- **September 2005 - Feasibility data presented (ESC)**
- **Ongoing to 2008 – sensing studies etc.**

# PECTORAL

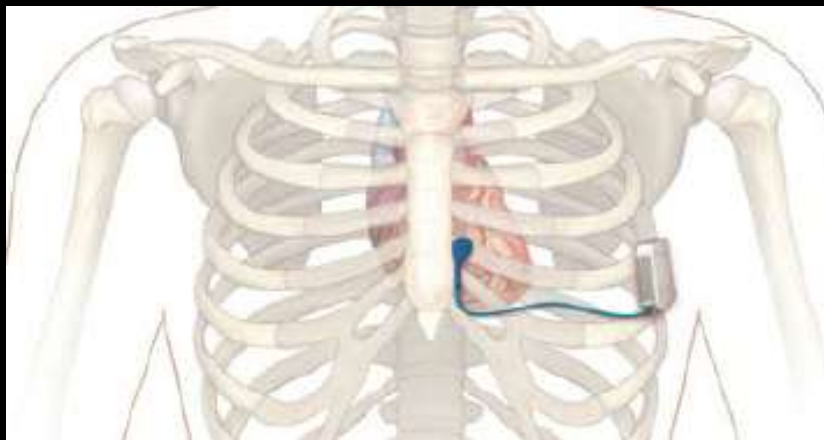


38.9J (n = 11)

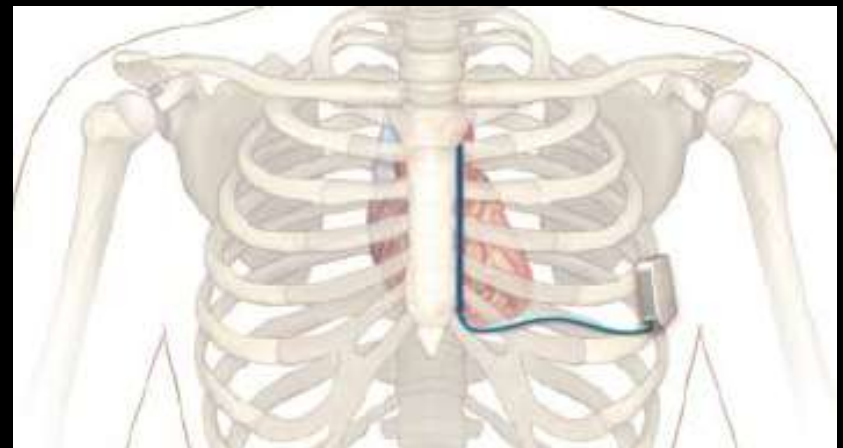


38.4J (n = 9)

# LATERAL



32.2J (n = 10)

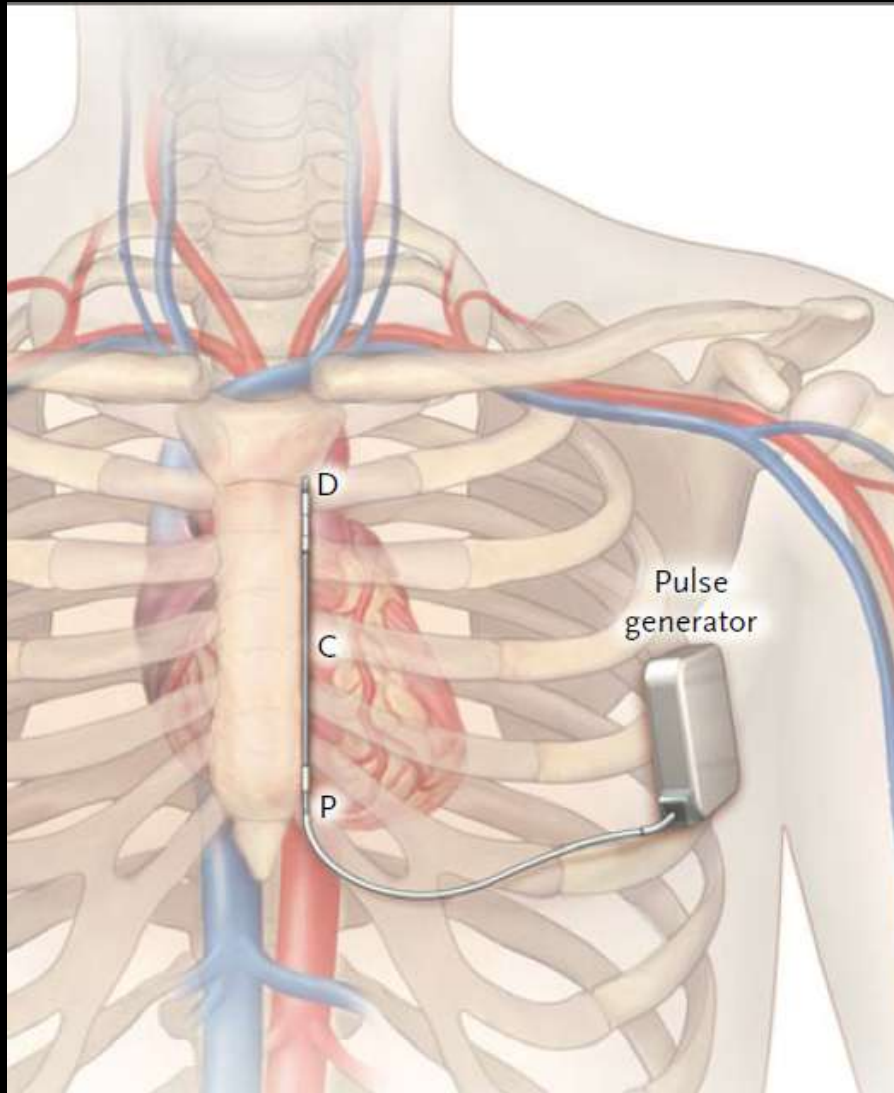


26J (n = 9)

# Cambridge and the SICD

- **December 2002 – first cases**
  - lead location/DFT
- **September 2005 - Feasibility data presented (ESC)**
- **Ongoing to 2008 – sensing studies etc.**
- **July 2008 to July 2009 – CE studies/CE mark**
- **July 2010 – First paper published (NEJM)**

# Entirely subcutaneous ICD



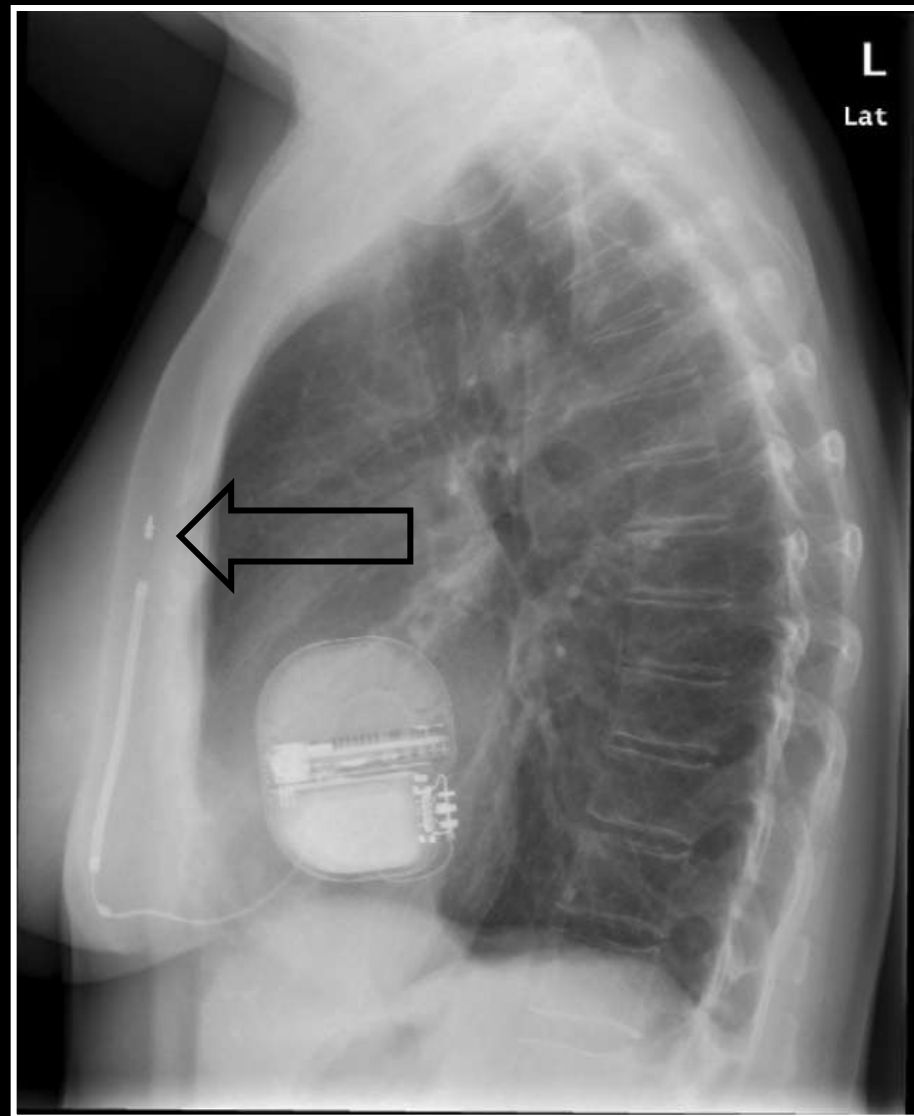
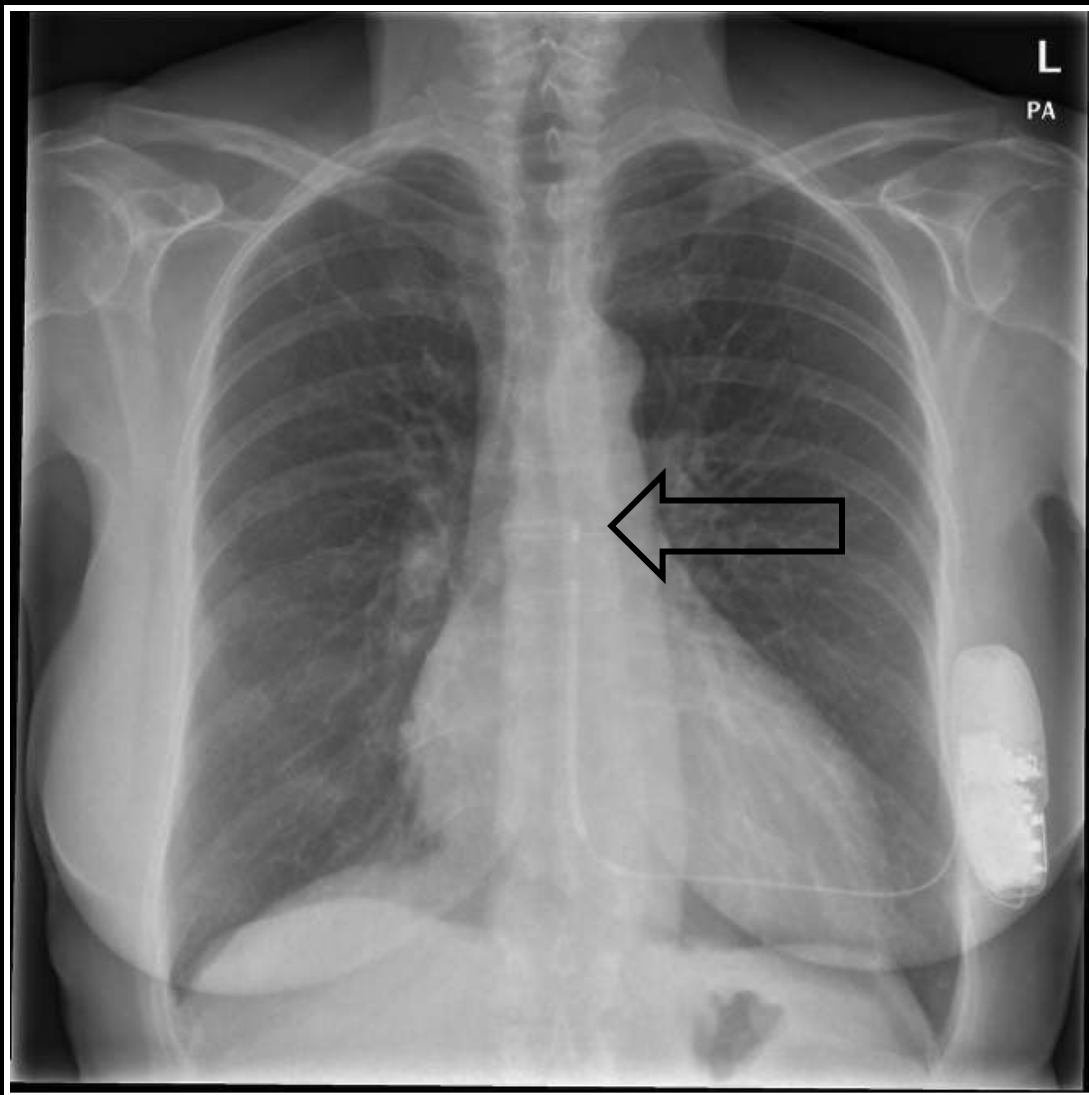
- 80 joules
- 69cc, 145 grams
- 5 year longevity
- Post-shock pacing
- 1 or 2 zones
- 170 -250 bpm
- Episode storage
- Simple to programme

ORIGINAL ARTICLE

# An Entirely Subcutaneous Implantable Cardioverter–Defibrillator

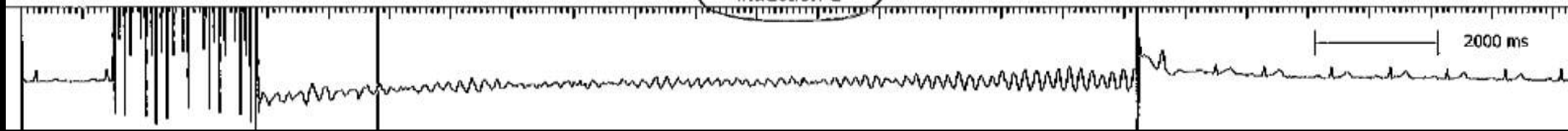
Gust H. Bardy, M.D., Warren M. Smith, M.B., Margaret A. Hood, M.B.,  
Ian G. Crozier, M.B., Iain C. Melton, M.B., Luc Jordaens, M.D., Ph.D.,  
Dominic Theuns, Ph.D., Robert E. Park, M.B., David J. Wright, M.D.,  
Derek T. Connelly, M.D., Simon P. Fynn, M.D., Francis D. Murgatroyd, M.D.,  
Johannes Sperzel, M.D., Jörg Neuzner, M.D., Stefan G. Spitzer, M.D.,  
Andrey V. Ardashev, M.D., Ph.D., Amo Oduro, M.B., B.S.,  
Lucas Boersma, M.D., Ph.D., Alexander H. Maass, M.D.,  
Isabelle C. Van Gelder, M.D., Ph.D., Arthur A. Wilde, M.D., Ph.D.,  
Pascal F. van Dessel, M.D., Reinoud E. Knops, M.D., Craig S. Barr, M.B.,  
Pierpaolo Lupo, M.D., Riccardo Cappato, M.D., and Andrew A. Grace, M.B., Ph.D.





Induction 1

2000 ms

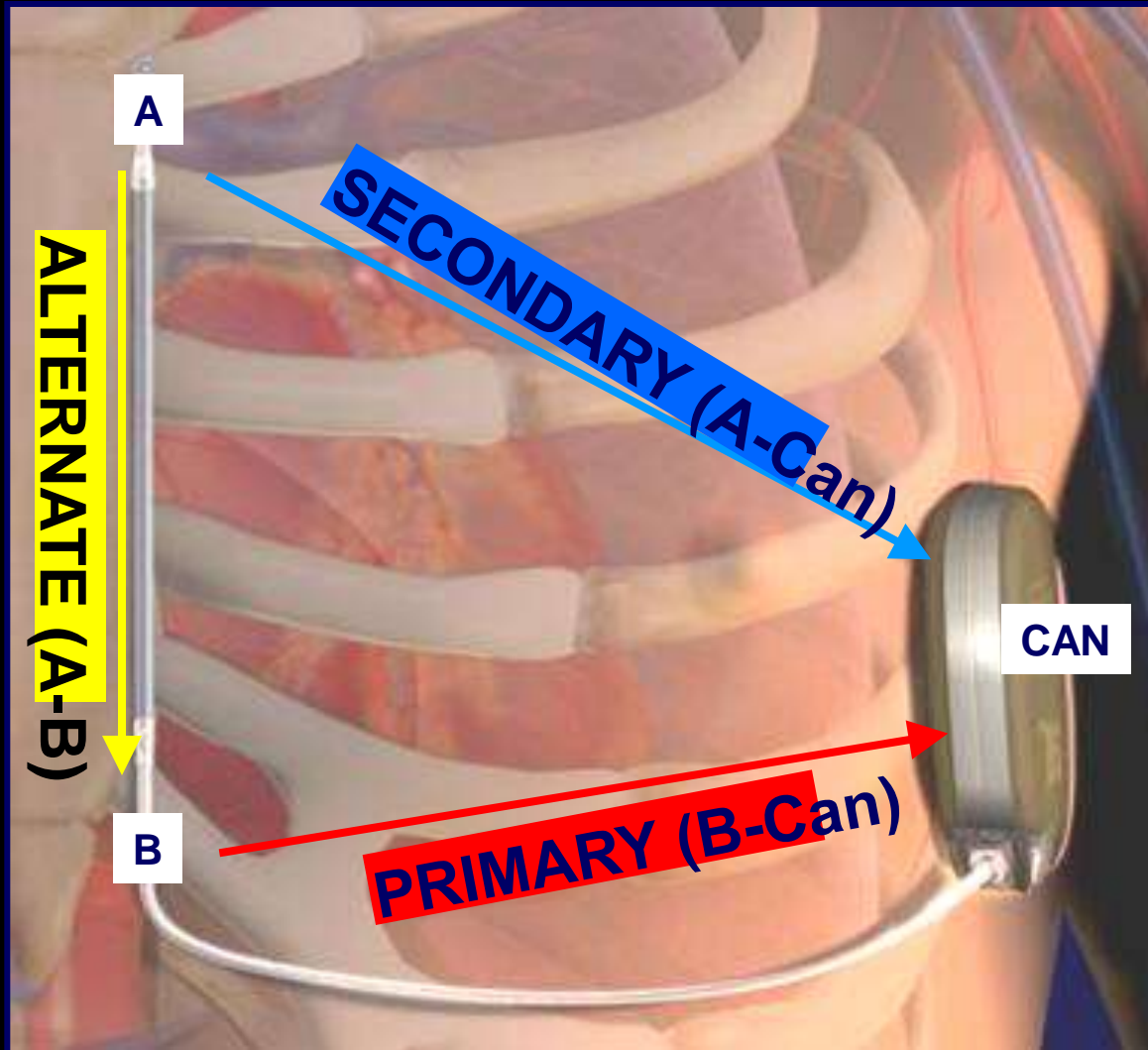


**First implanted post-approval device**  
**Papworth 25<sup>th</sup> July 2009**



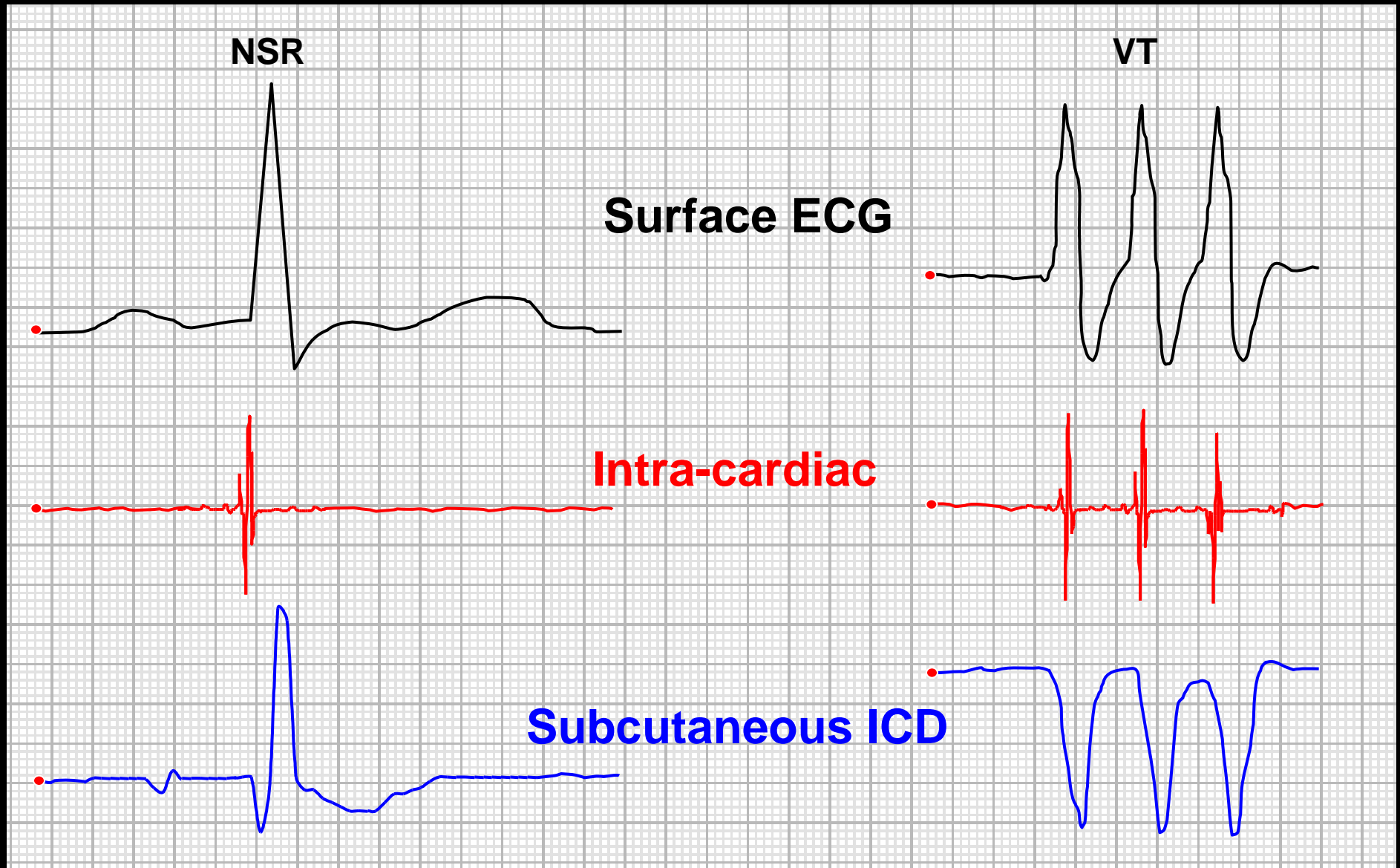
# S-ICD Therapy...

Sensing the subcutaneous signal...

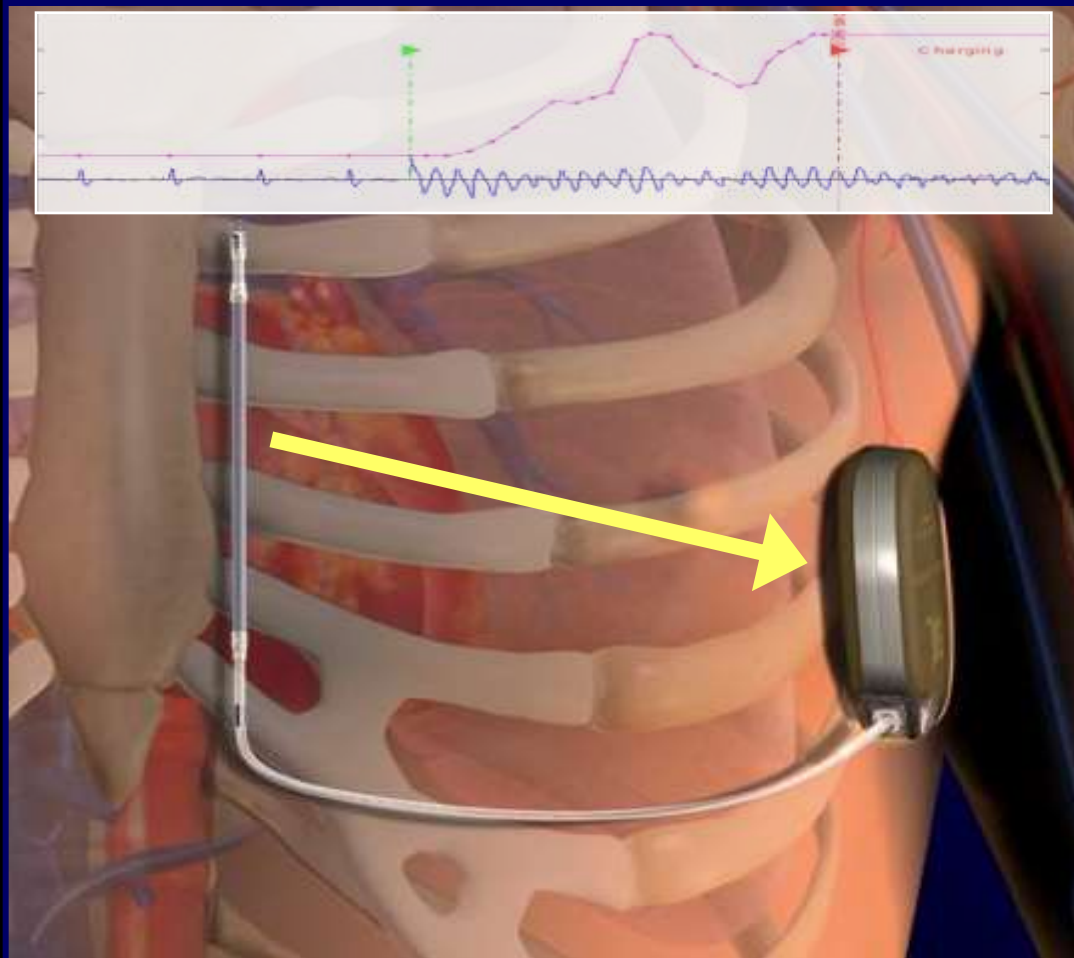


- Three possible sensing vectors
- Optimal sense vector automatically selected by the device

# Sensing with a subcutaneous ICD



# S-ICD Therapy...



**80J (delivered)**

**Biphasic shock**

**Charge times comparable  
to current industry  
standards**



# Entirely Subcutaneous ICD

- **Effective in protection**
- **Higher specificity**

# Entirely Subcutaneous ICD

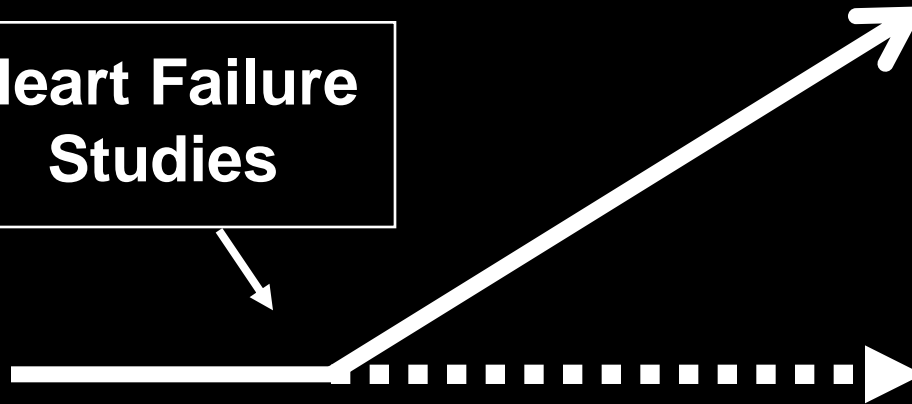
- **Effective in protection**
- **Higher specificity**
- **Lower risk: leaves venous system alone  
+ safer to remove**
- **Predictable, faster implant times**

# An Evolving Landscape - Device Selection.....



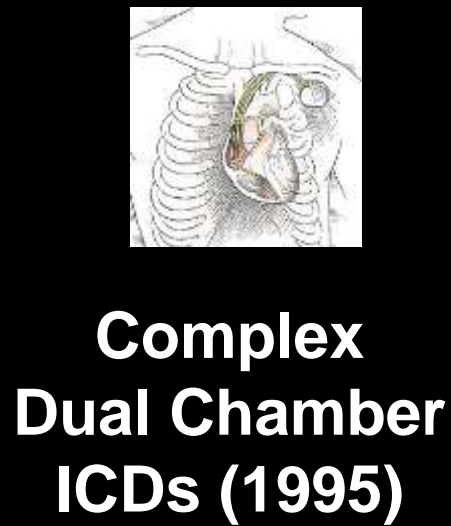
**Complex  
Dual Chamber  
ICDs (1995)**

**Heart Failure  
Studies**

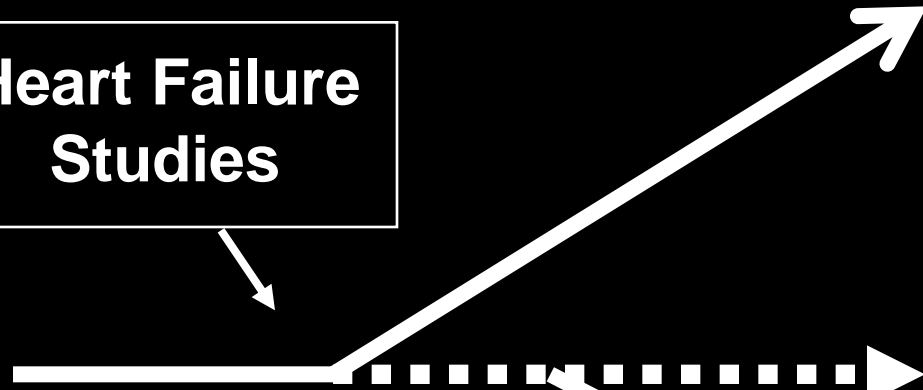


**CRT-D (2001)**

# An Evolving Landscape - Device Selection.....



**Heart Failure  
Studies**



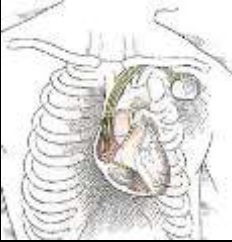
**CRT-D (2001)**

**SCD-HeFT**



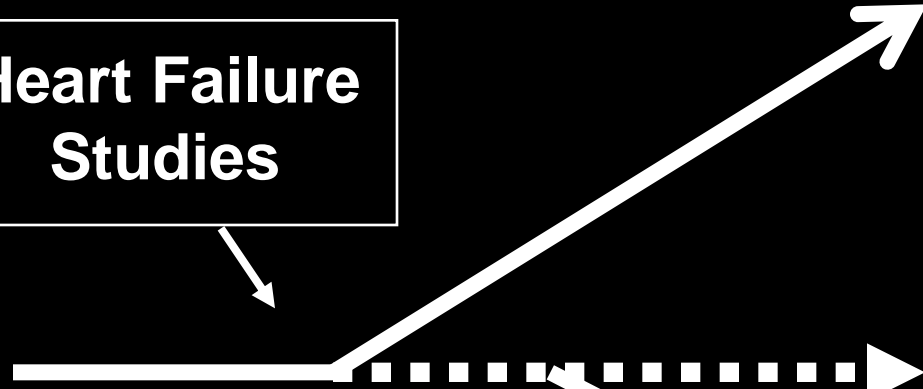
**Uncomplicated  
Devices (2009)**

# An Evolving Landscape - Device Selection.....



**Complex  
Dual Chamber  
ICDs (1995)**

**Heart Failure  
Studies**



**CRT-D (2001)**

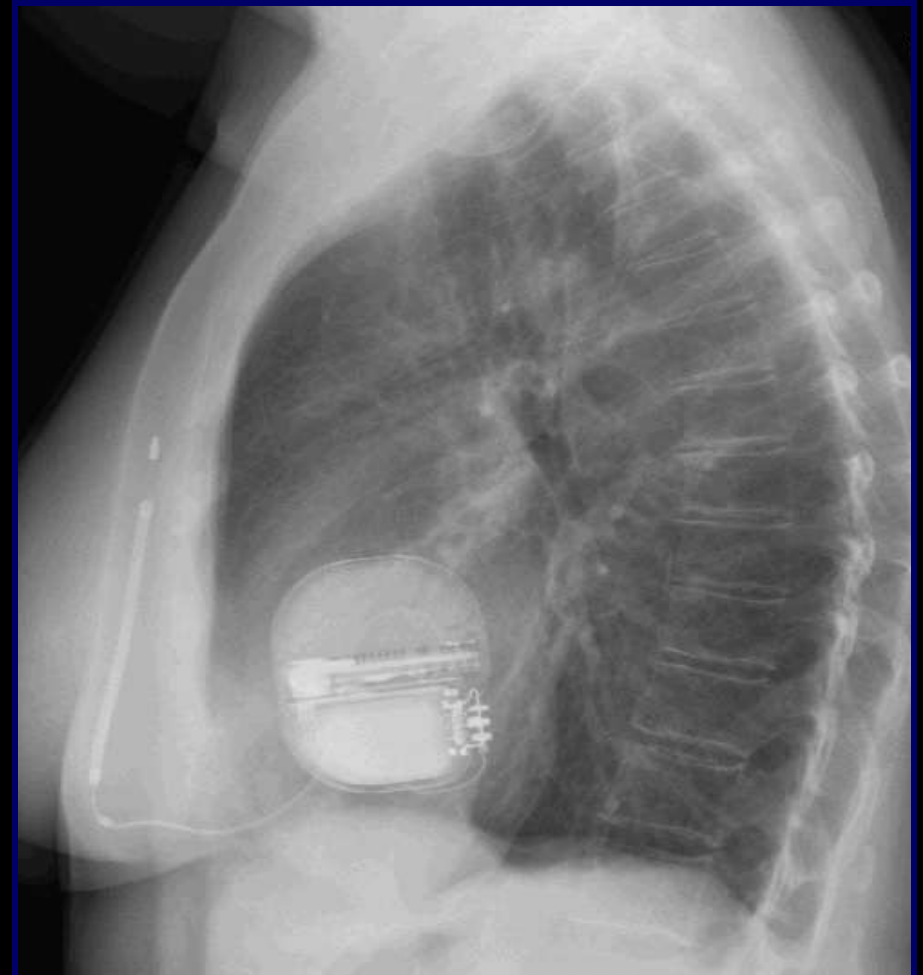
**Dwindling Utility**

**SCD-HeFT**



**Uncomplicated  
Devices (2009)**

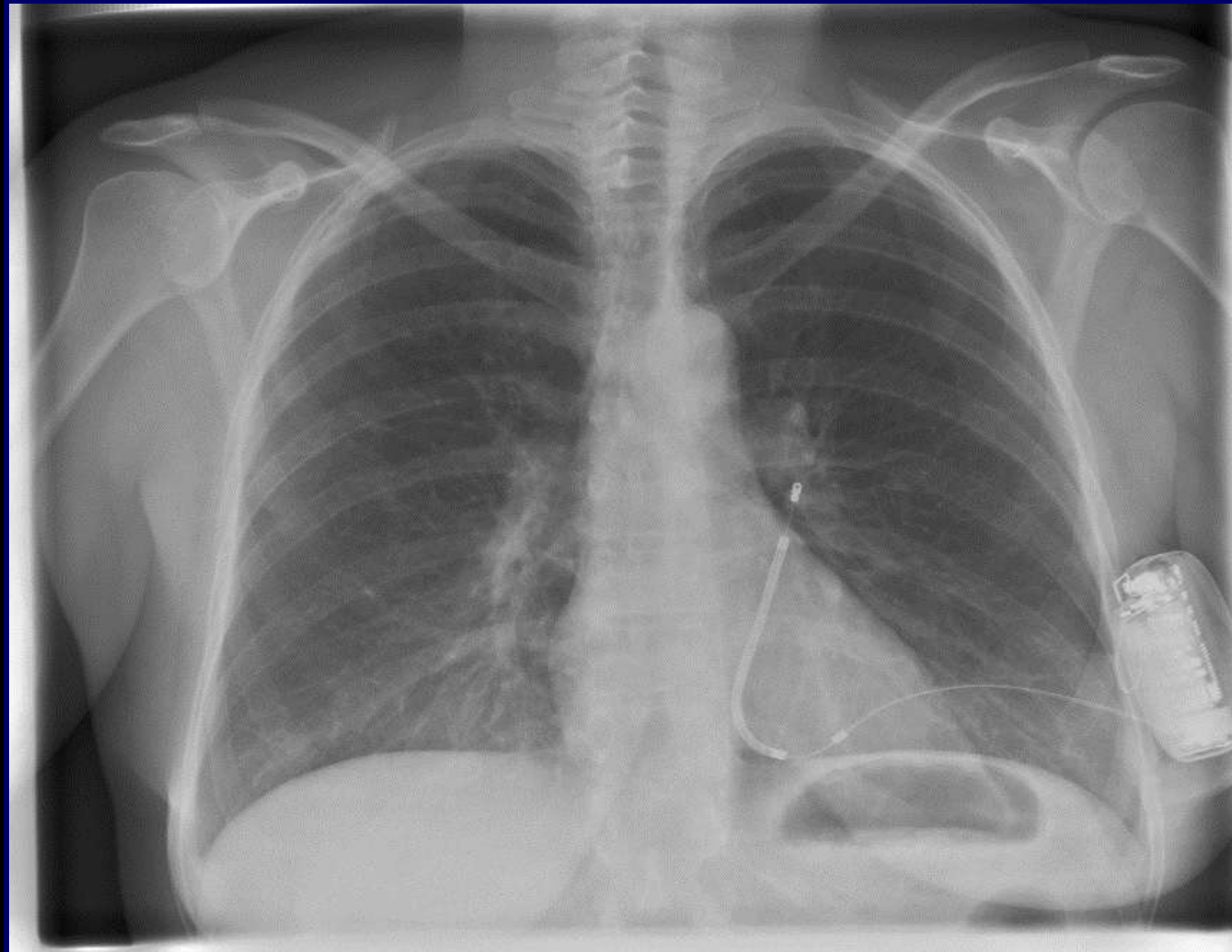
# Implant Method Good location...



# Implant Method Good location...



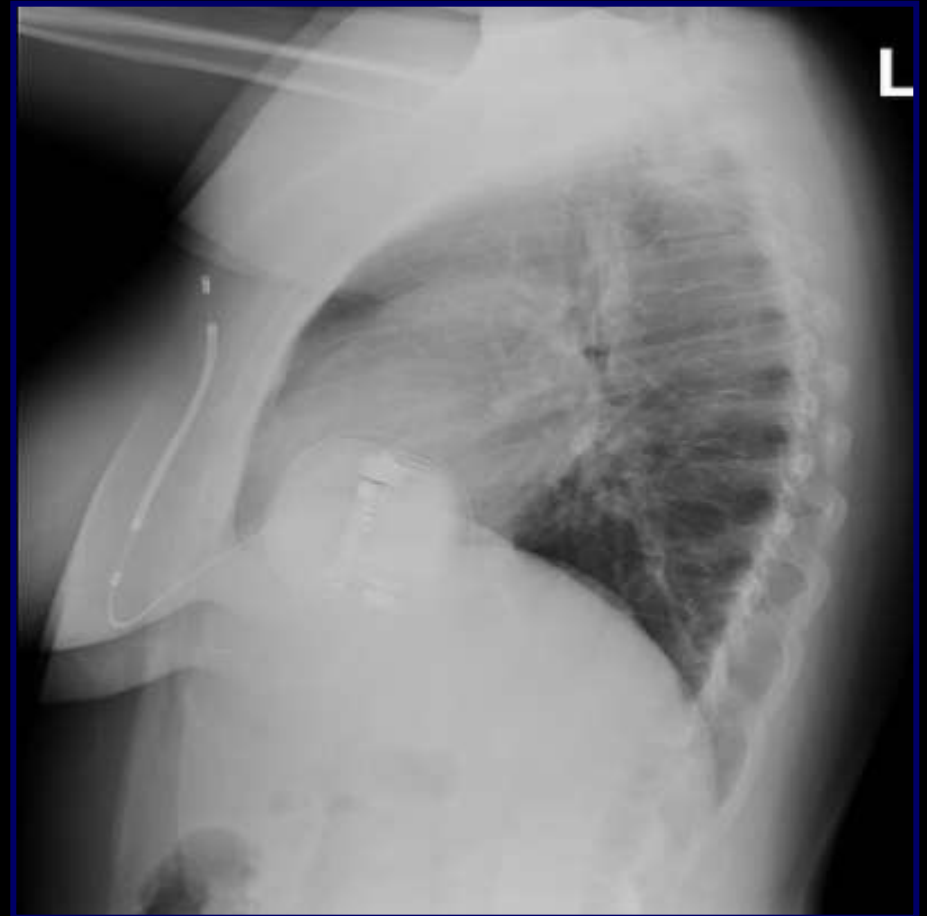
# Implant Method lateral electrode...



# Implant Method lateral electrode...



# Implant Method superficial tip ...



# Implant Method anterior can...



# S-ICD Systems Implanted (worldwide)

