Managing Ventricular Arrhythmias: Mapping, Ablation and Devices

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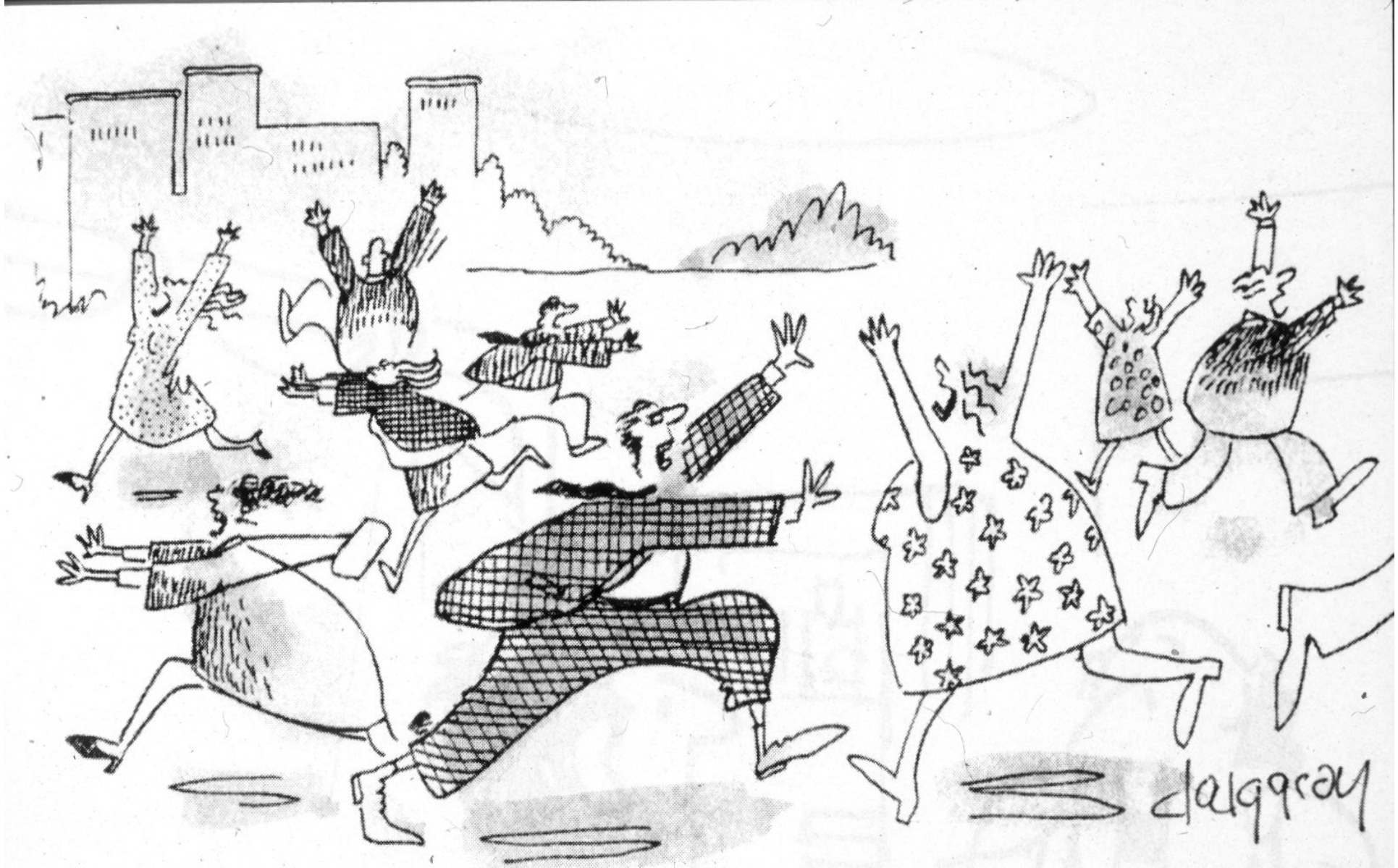
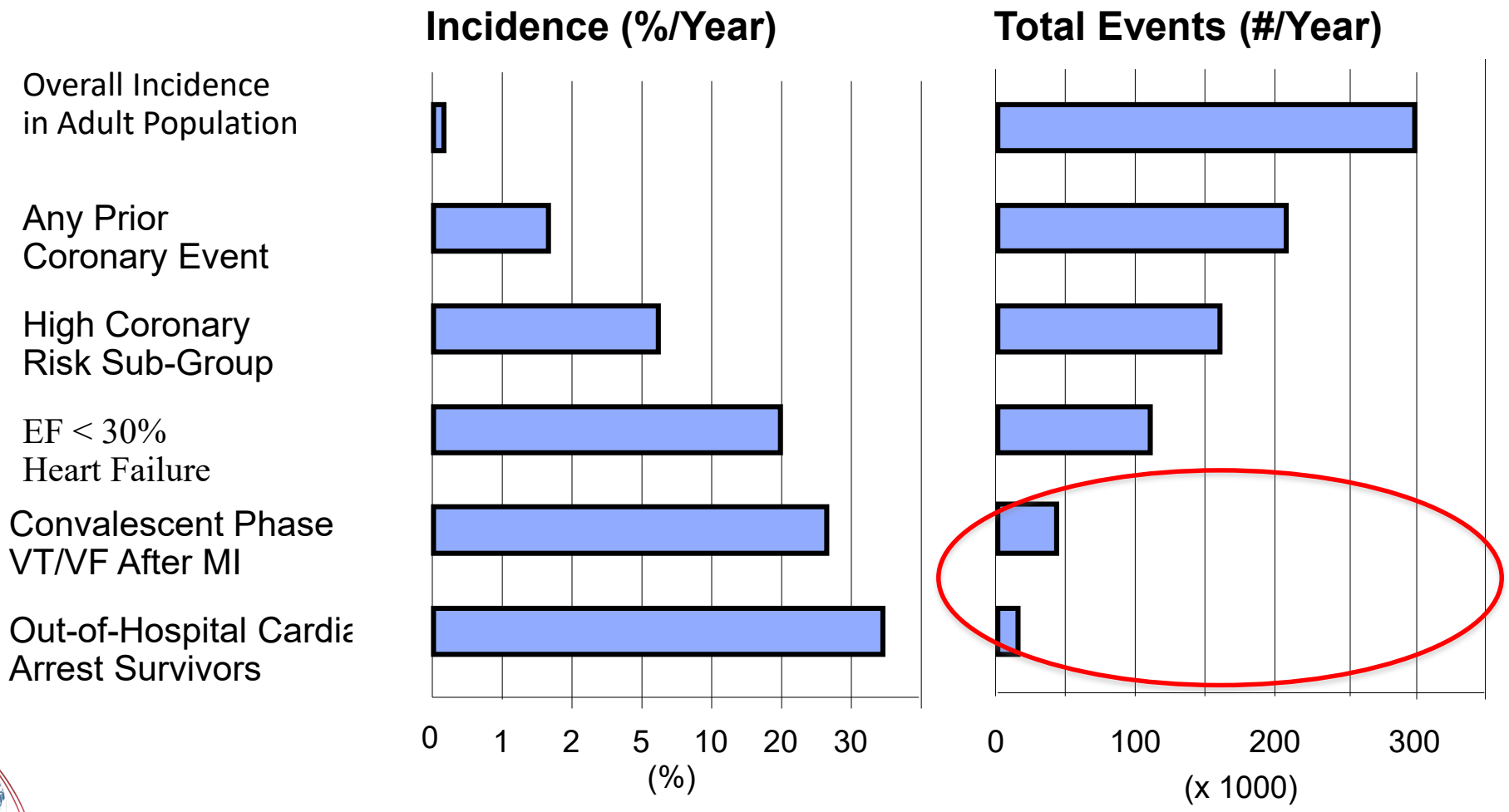
COI DISCLOSURES

- I have received lecture and proctoring honoraria from Spectranetics.
- I have been funded by and NIH/SBIR grant to AJ Medical Devices, Inc. (AJMD) and research grants from Boston Scientific, Medtronic, St. Jude Medical, Guidant, Inc. and Cameron Health, Inc.
- I am or have been a consultant to AJMD, Boston Scientific and Cameron Health.
- I have an equity stake in AtaCor Medical, Inc. and am Chief Medical Officer.



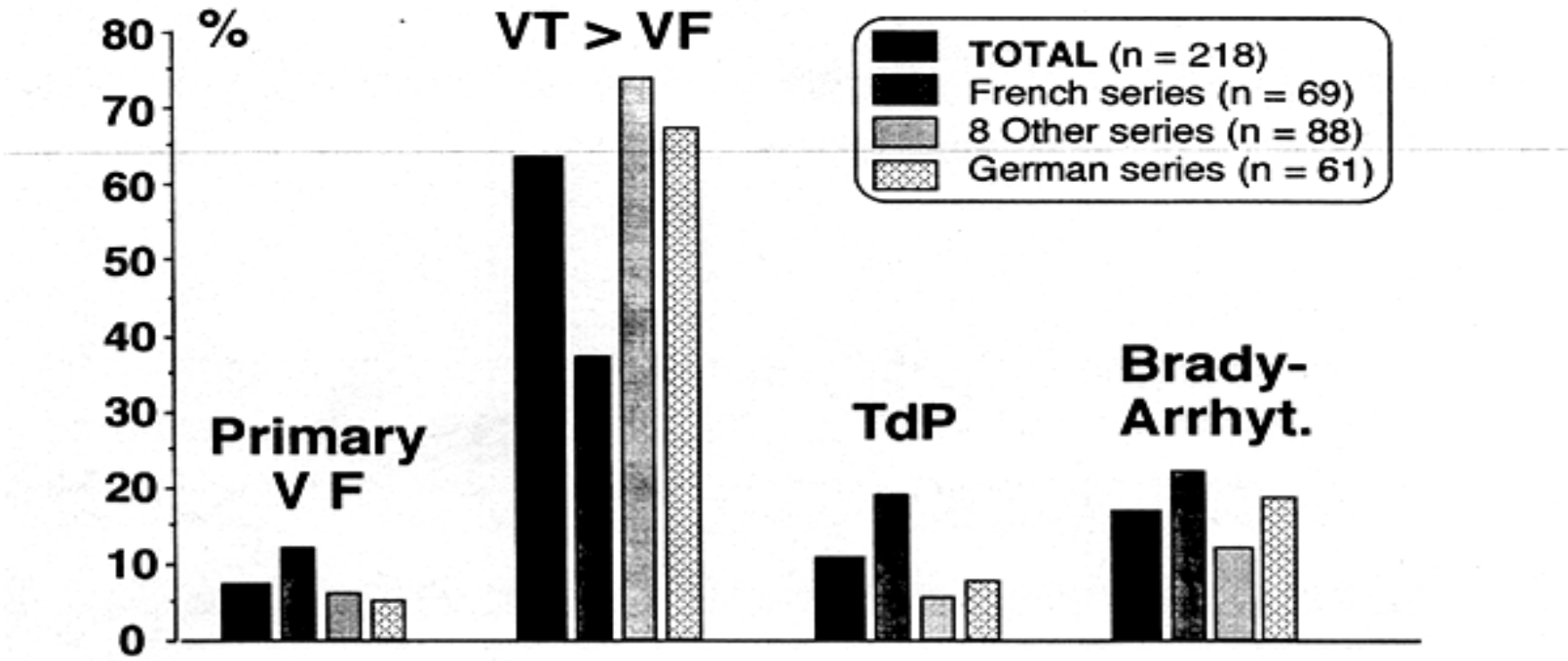
Annual meeting of the Hysterical Society

Sudden Cardiac Death
Incidence and Total Events



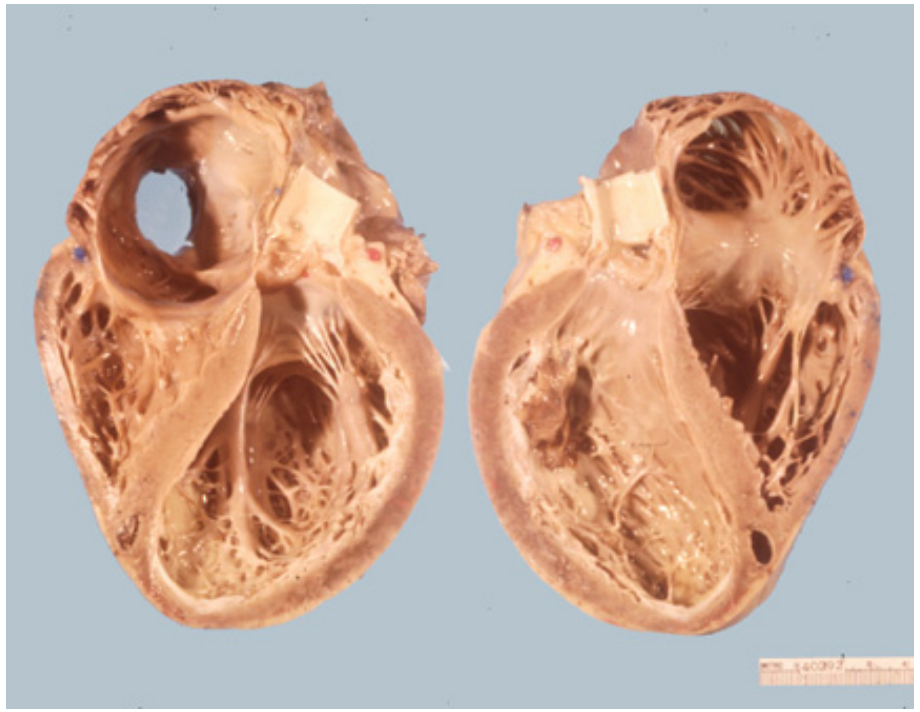
Source: Myerburg RJ. *Circulation* 1992;85(suppl I):I-2 – I-10.

Sudden Cardiac Death
Arrhythmic Etiology

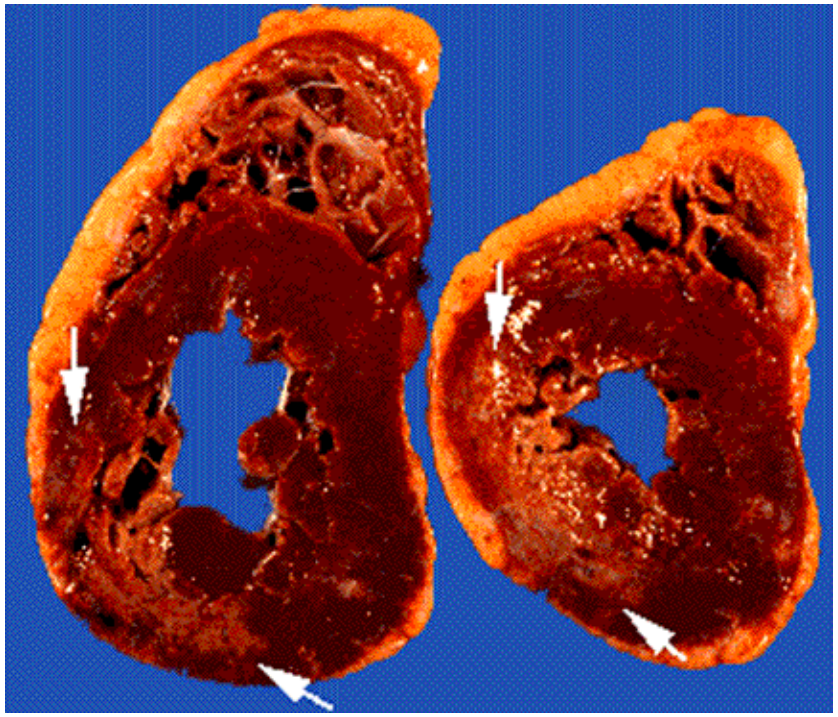


Eur Ht J.

Dilated Non-ischemic Cardiomyopathy



Large Myocardial Infarction



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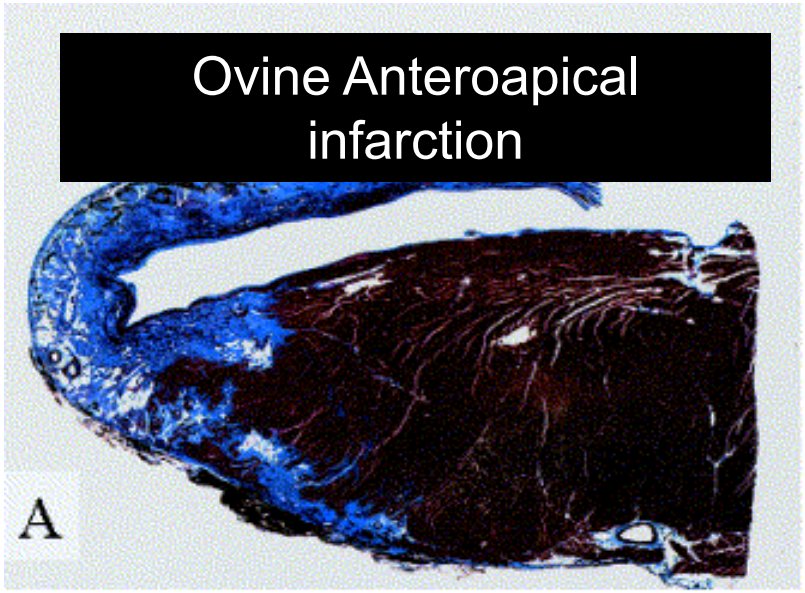
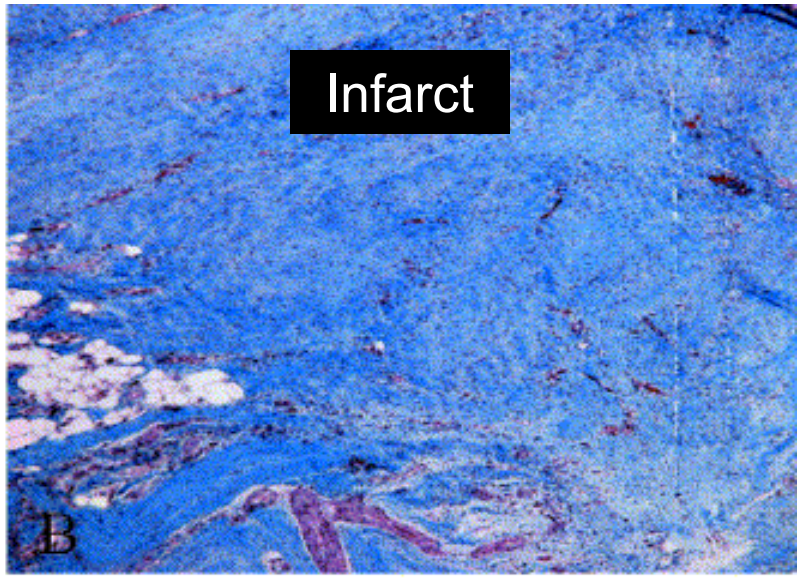
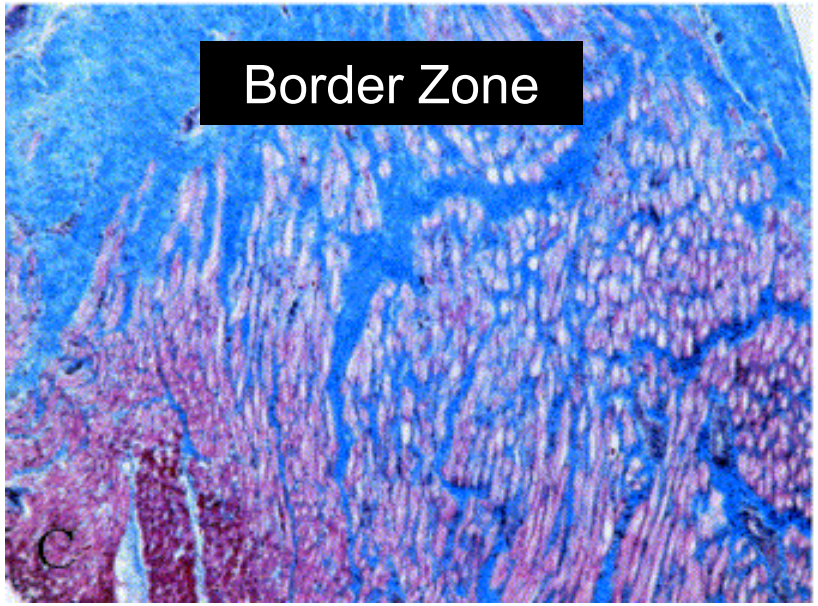
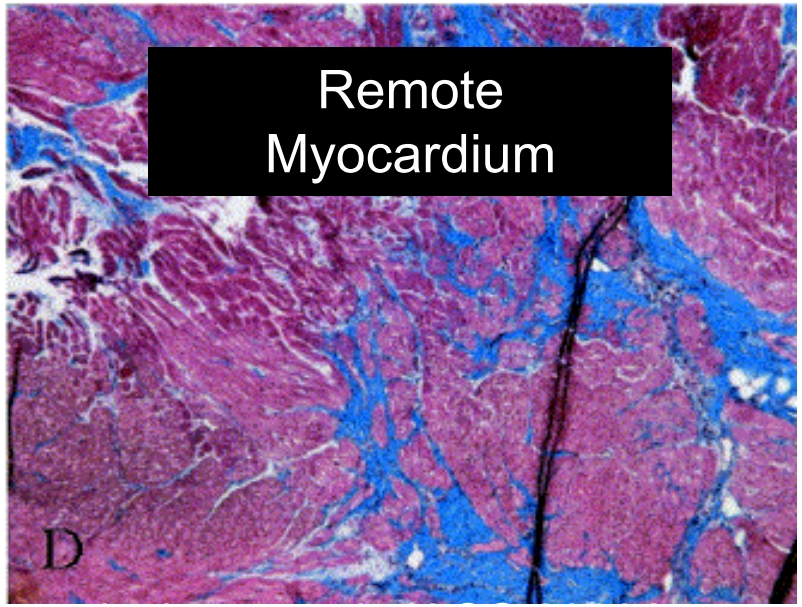
Ventricular Remodeling Post-MI









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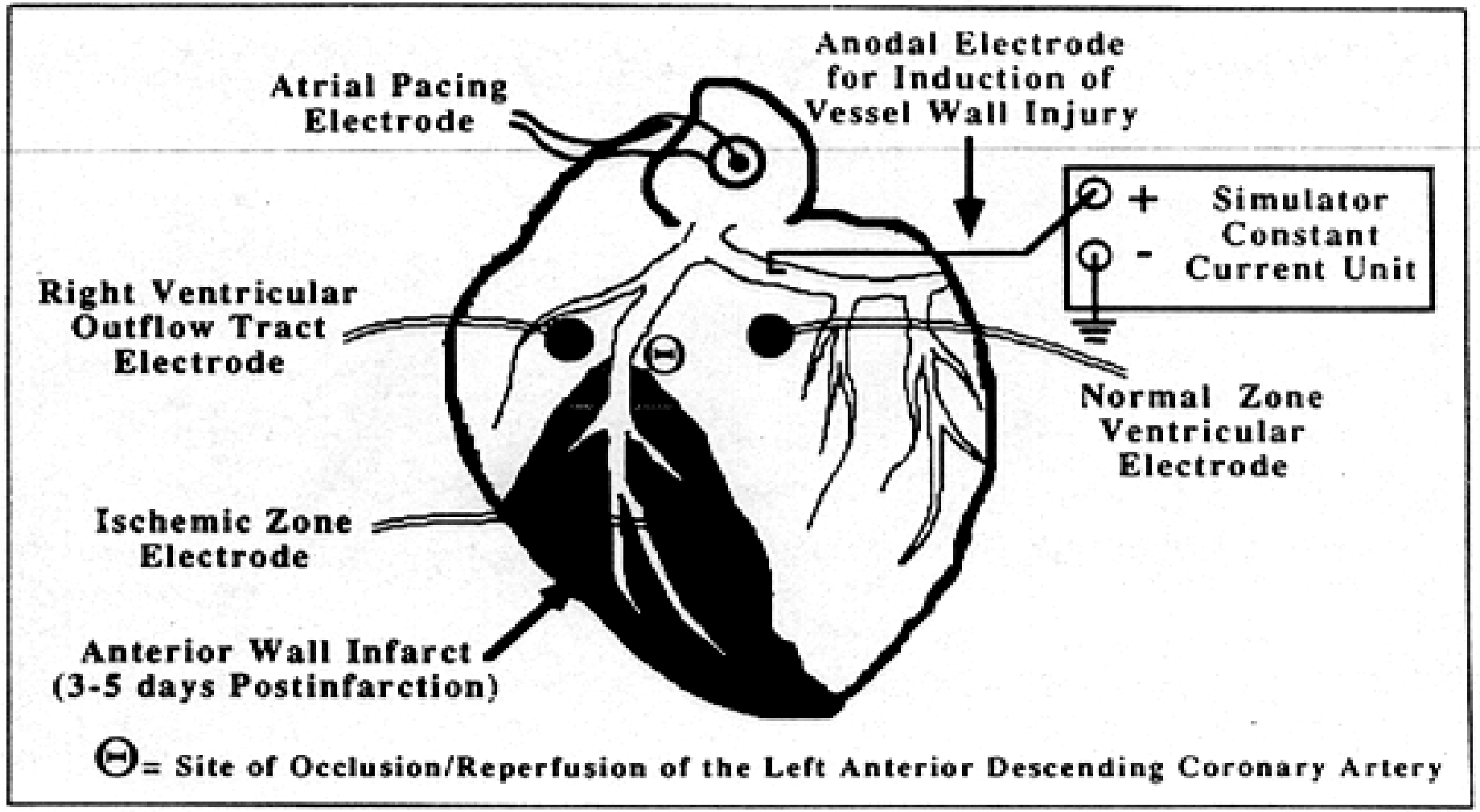
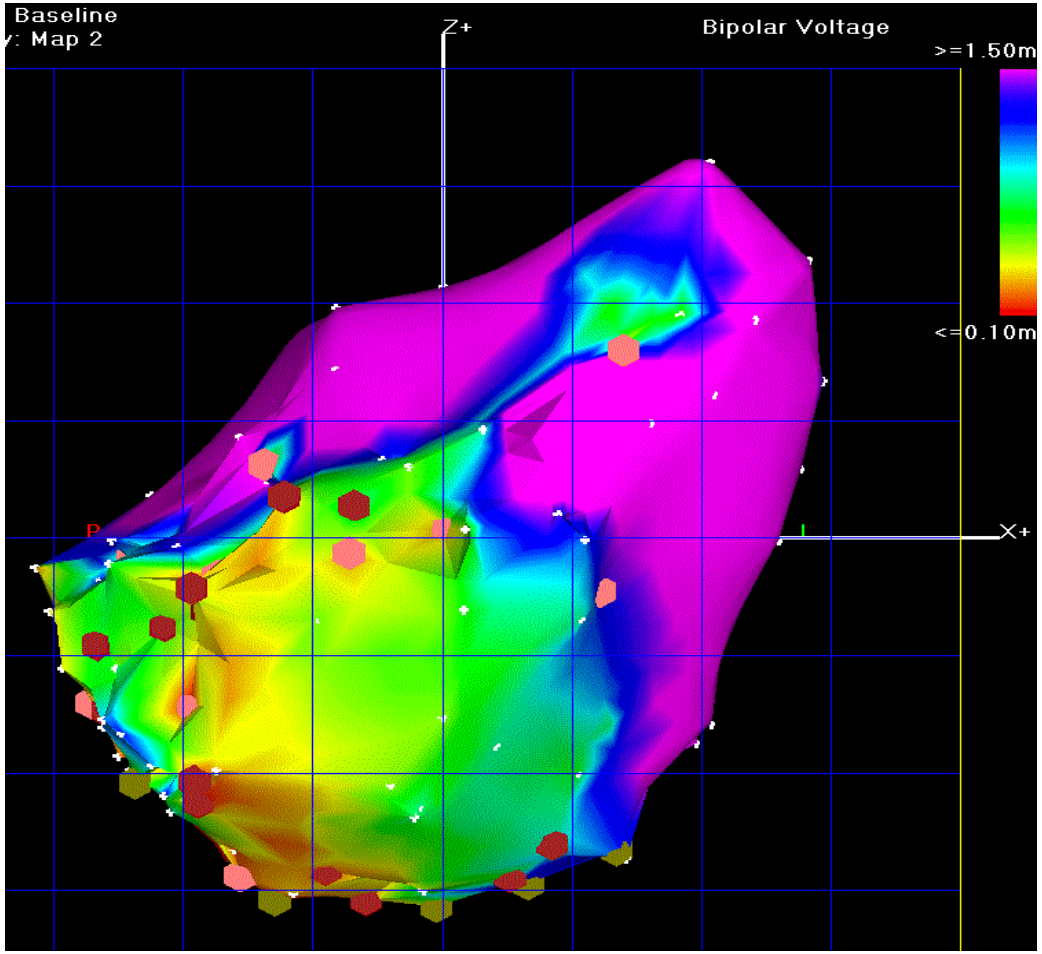
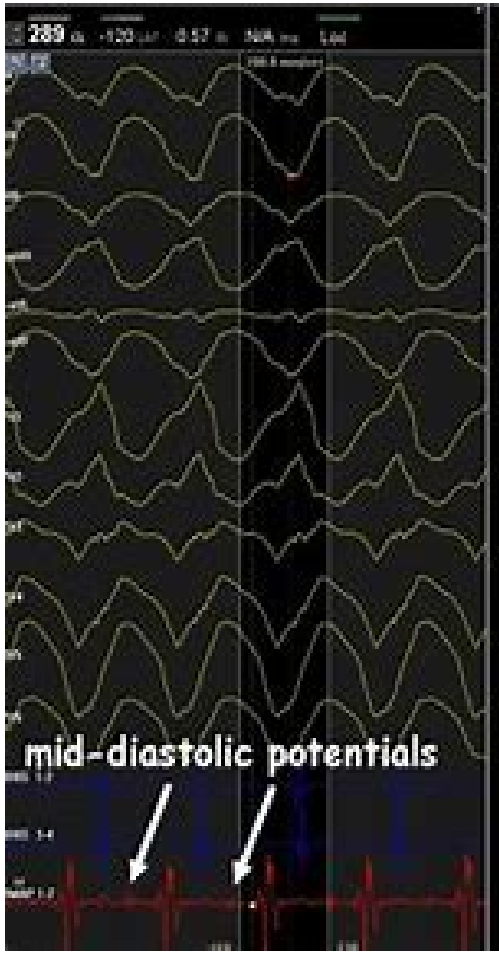
Lucchesi Model

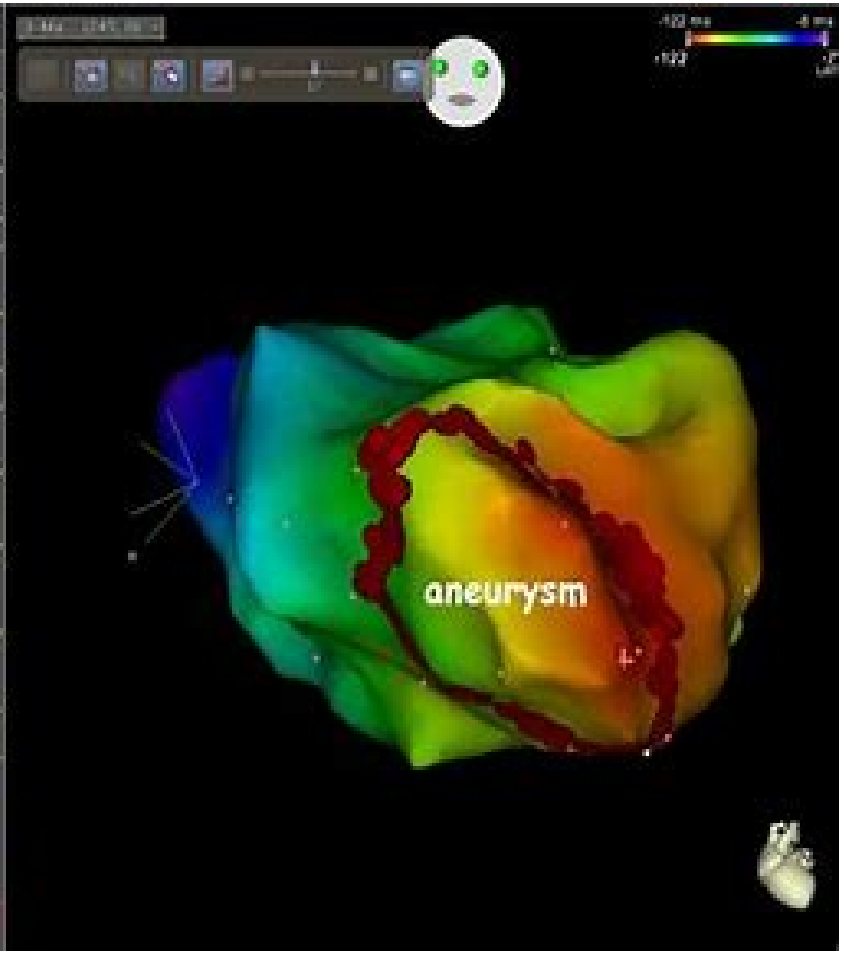


Eur J Pharmacol. 1983 Mar 4;87(4):407-13

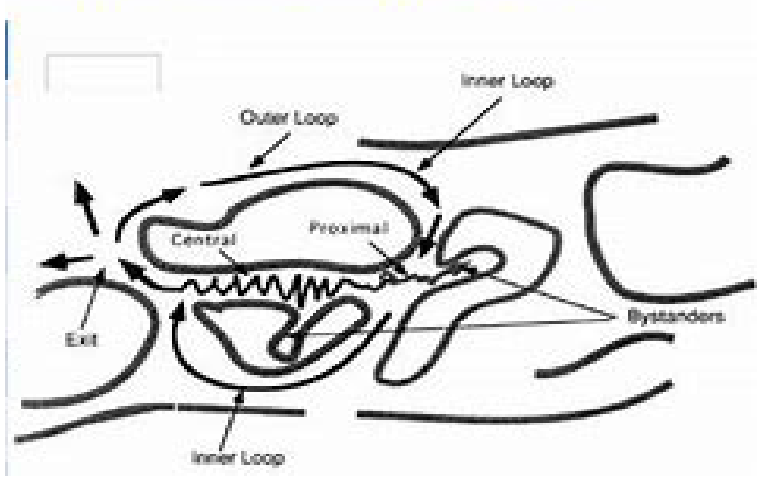
Infero-posterior scar-Bottom

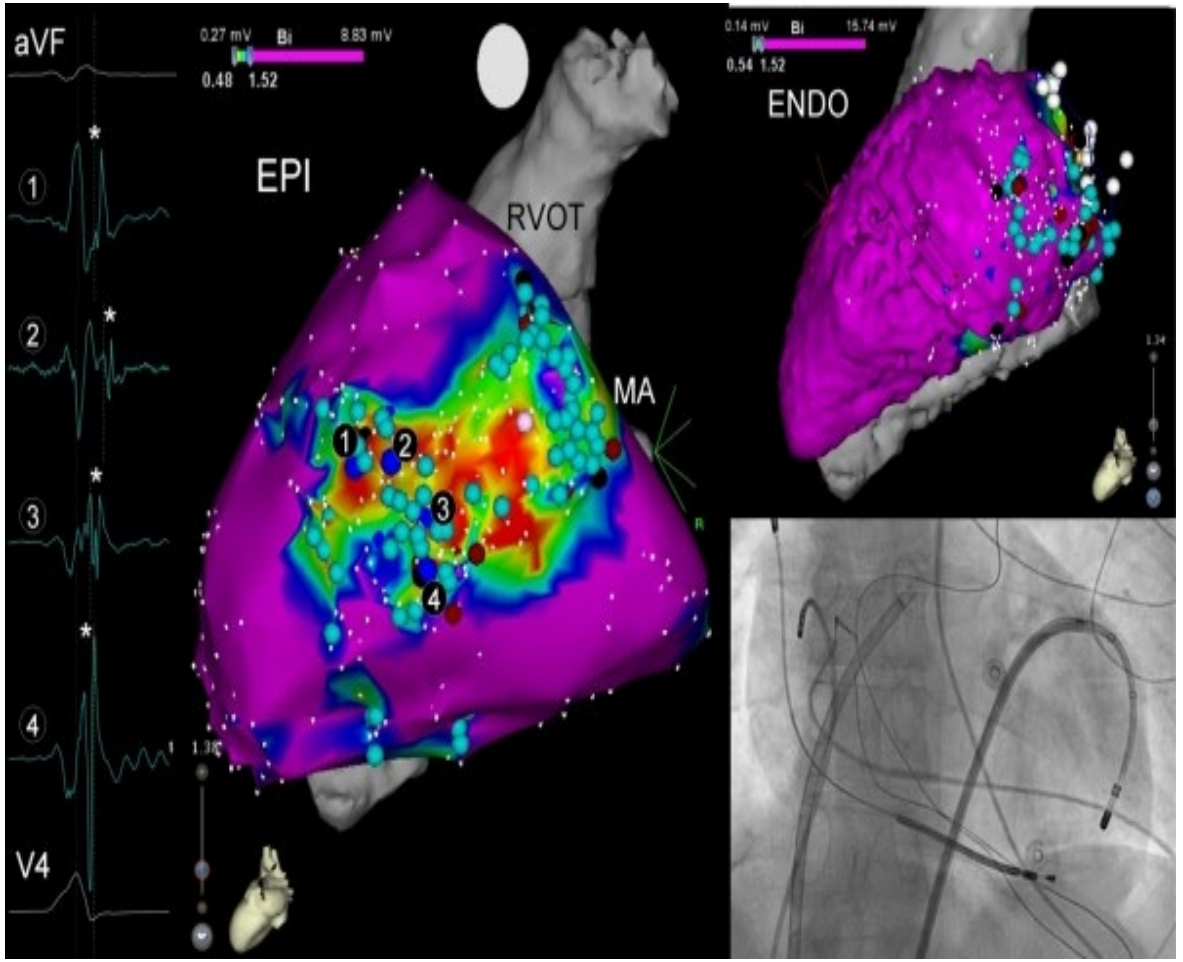




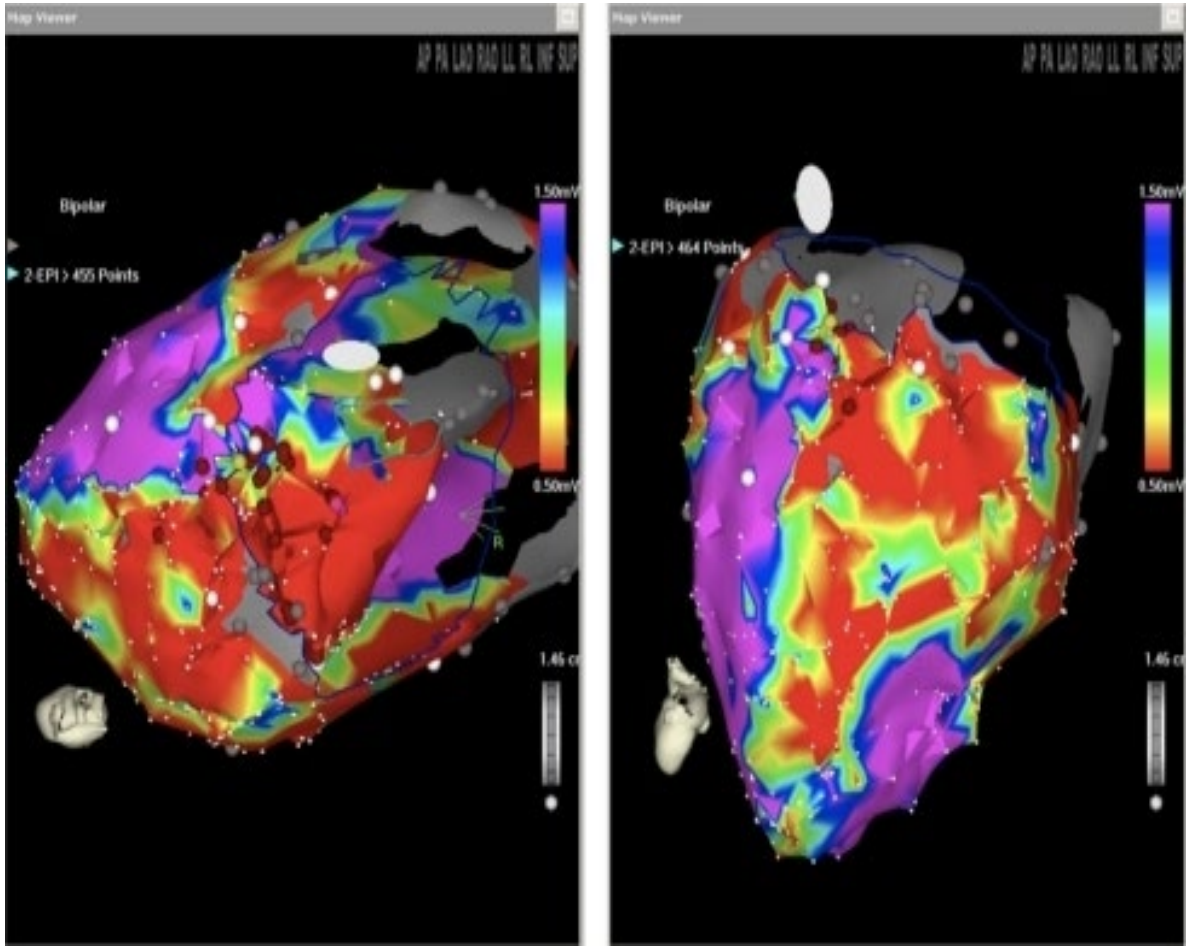


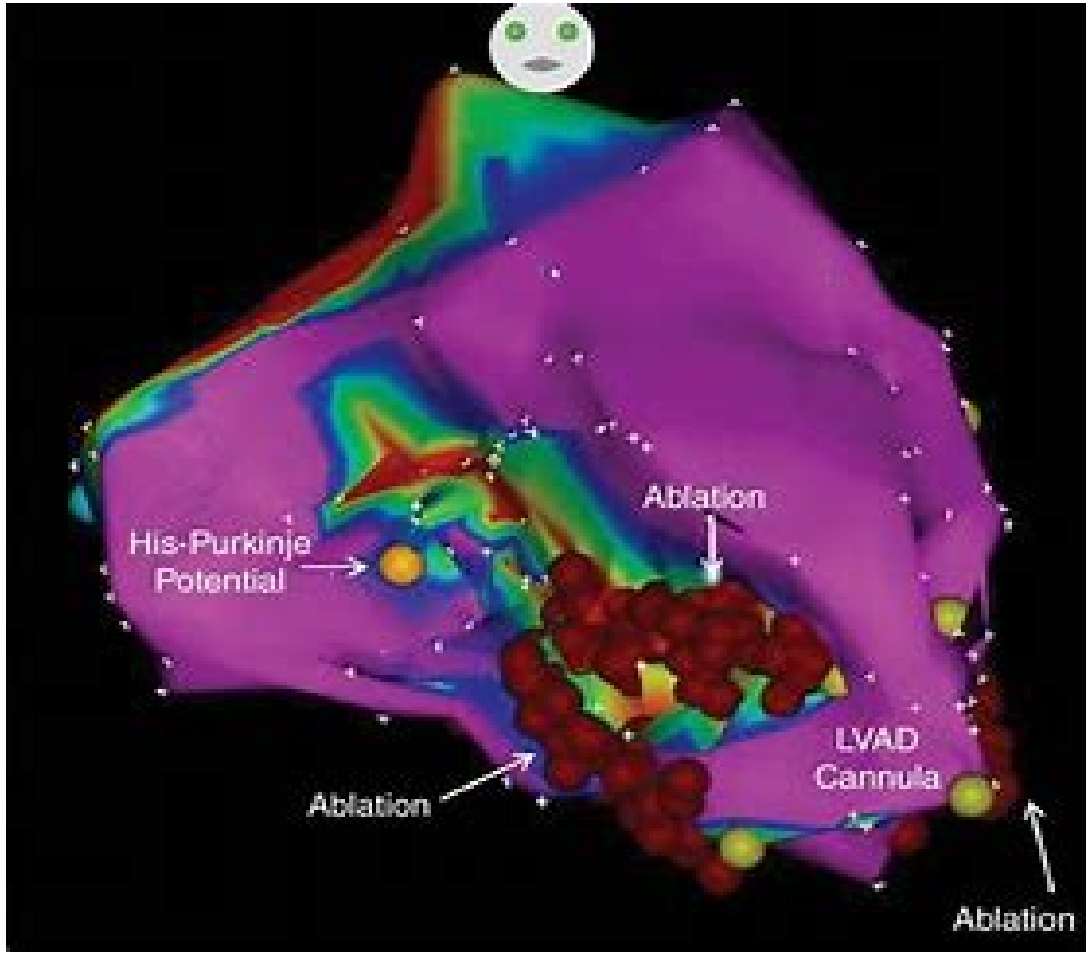
Complex Fibrotic Substrate-4 Dimensional





Variable Scar Characteristics





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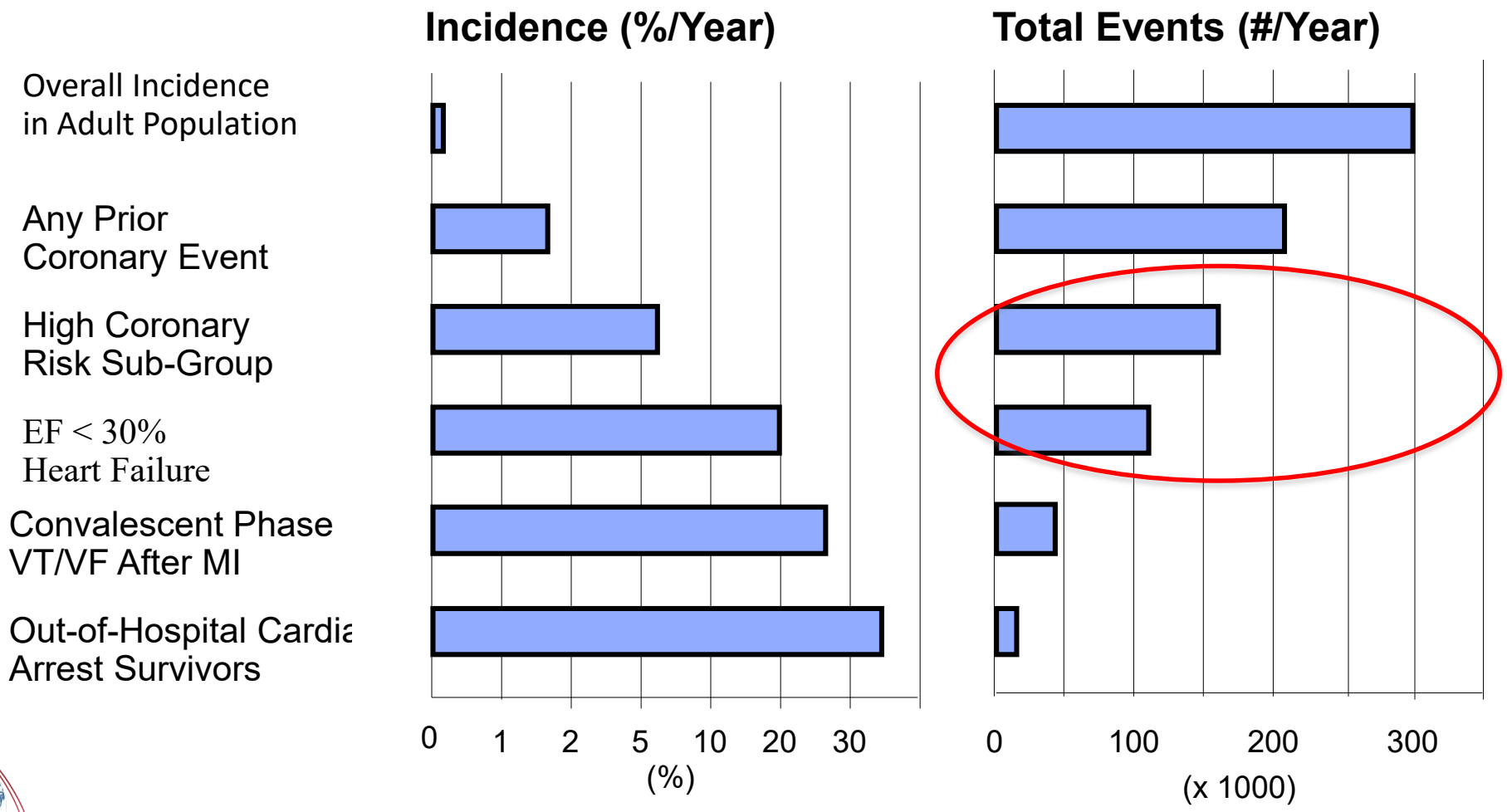
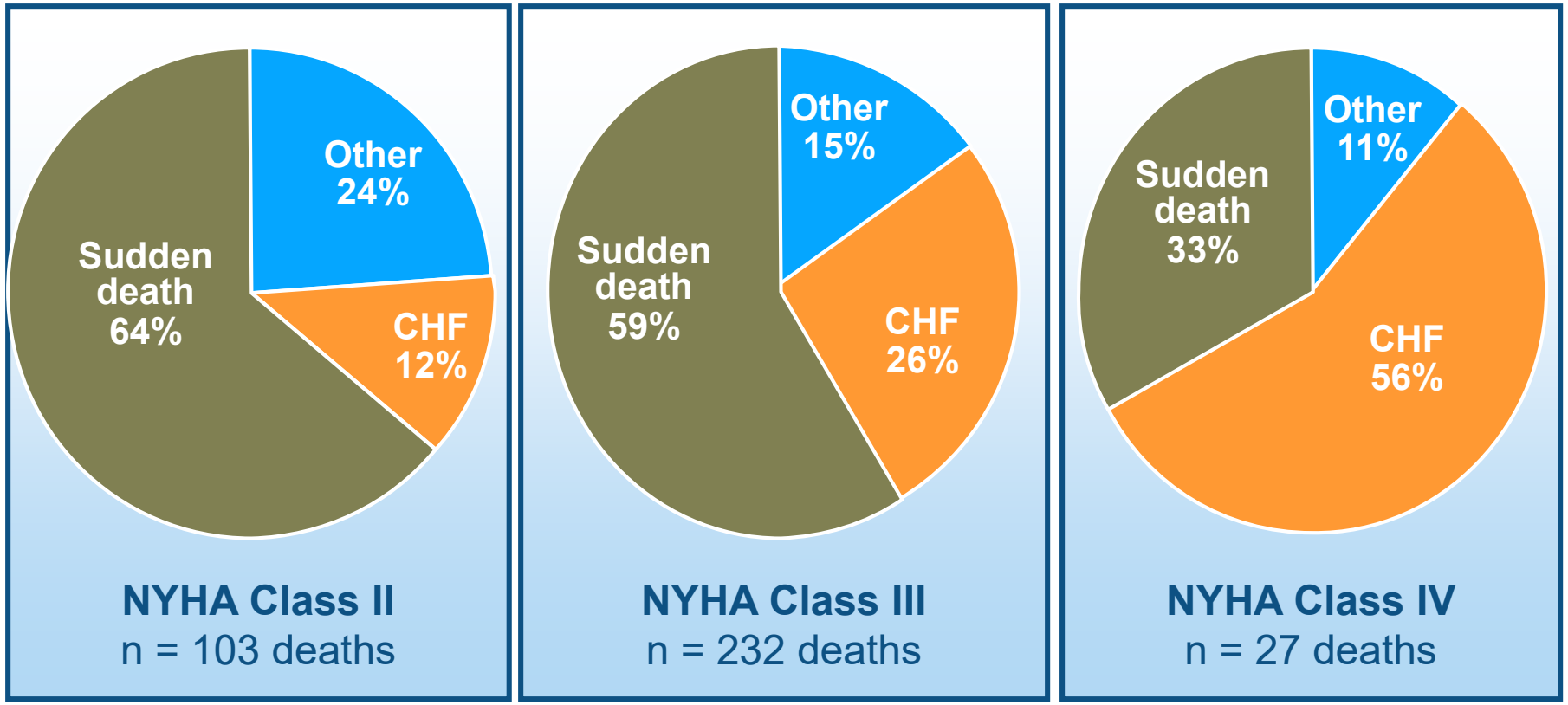
Sudden Cardiac Death
Incidence and Total Events



Source: Myerburg RJ. *Circulation* 1992;85(suppl I):I-2 – I-10.

Heart Failure Mortality



The likely mechanism of death moves from sudden death to pump failure as the heart failure progresses[1]

[1]MERIT-HF Study Group. Effect of metoprolol CR/XL in chronic heart failure: metoprolol CR/XL randomised intervention trial in congestive heart failure (MERIT-HF) *Lancet* 1999;353:2001-2007

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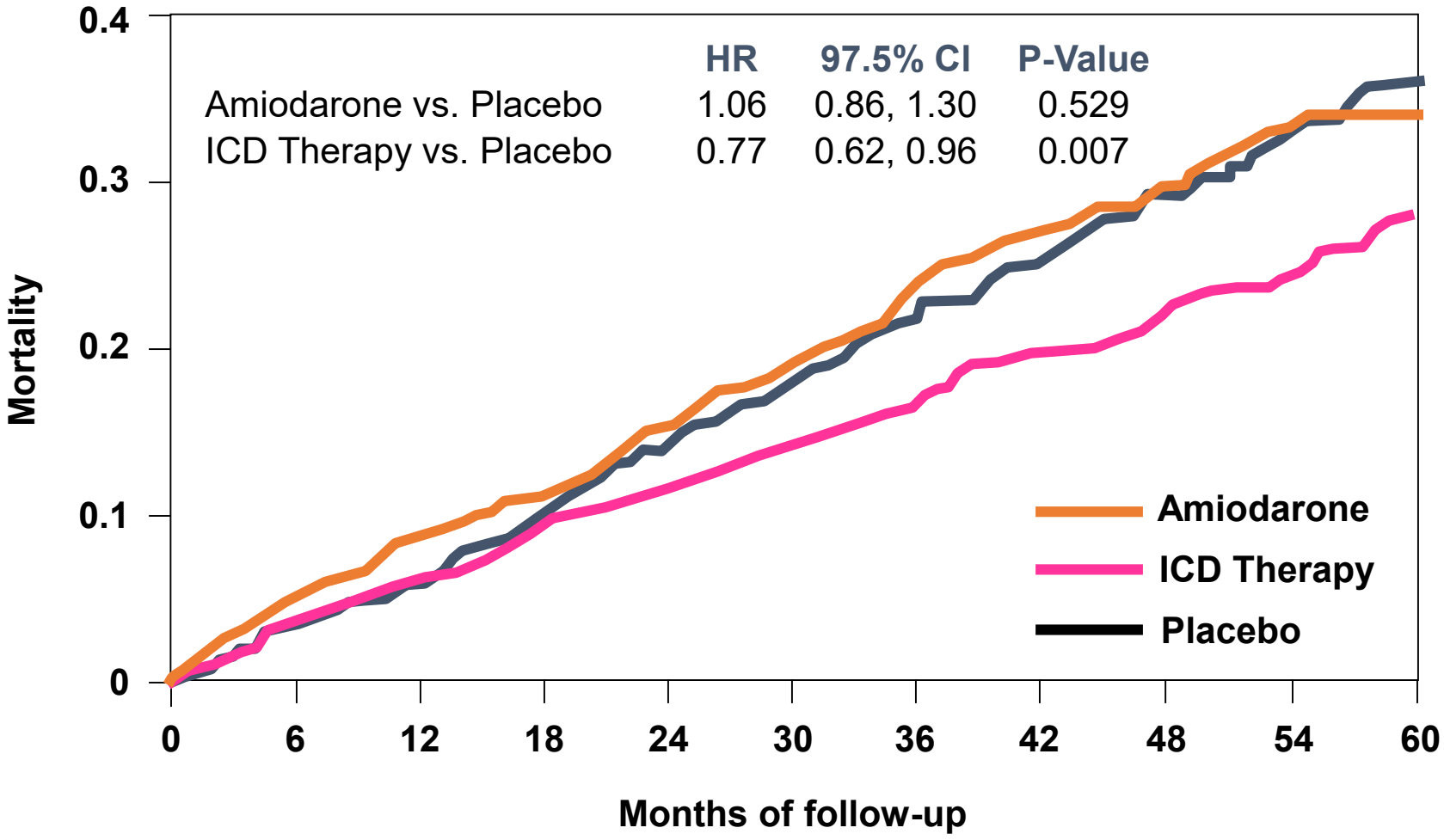
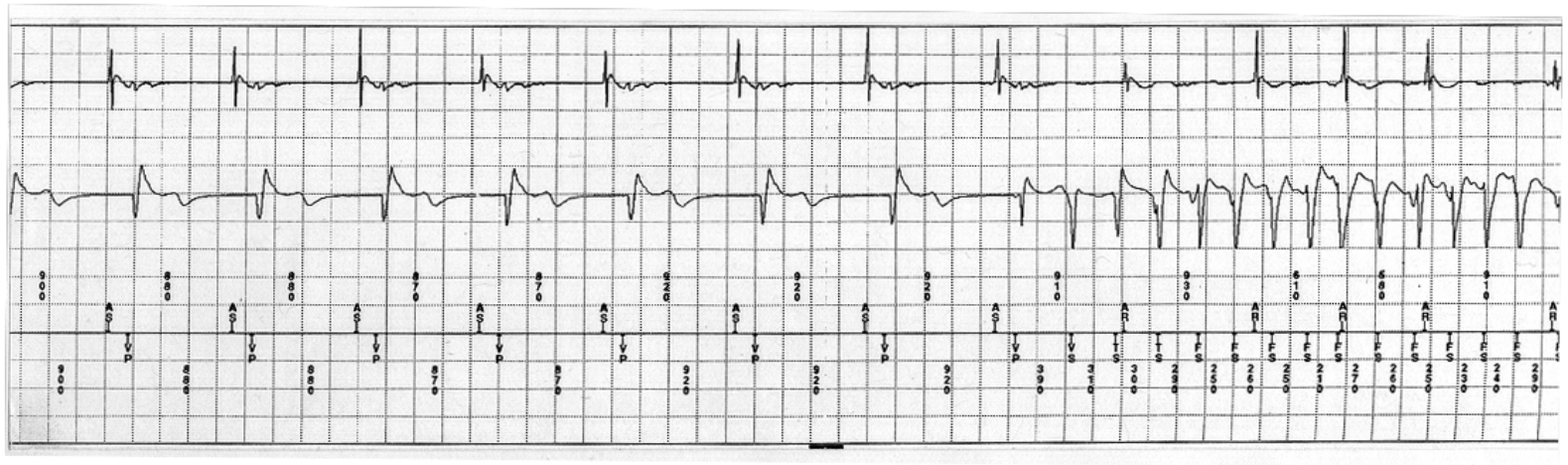
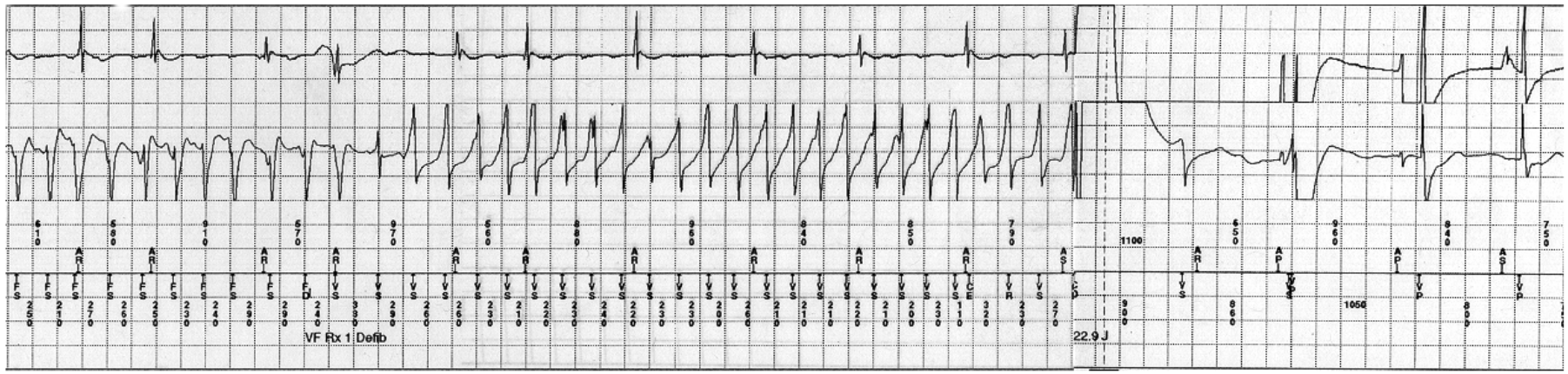
SCD-HeFT
Mortality by Intention-to-Treat



Bardy et al. NEJM 2005

VT/VF Electrogram Event





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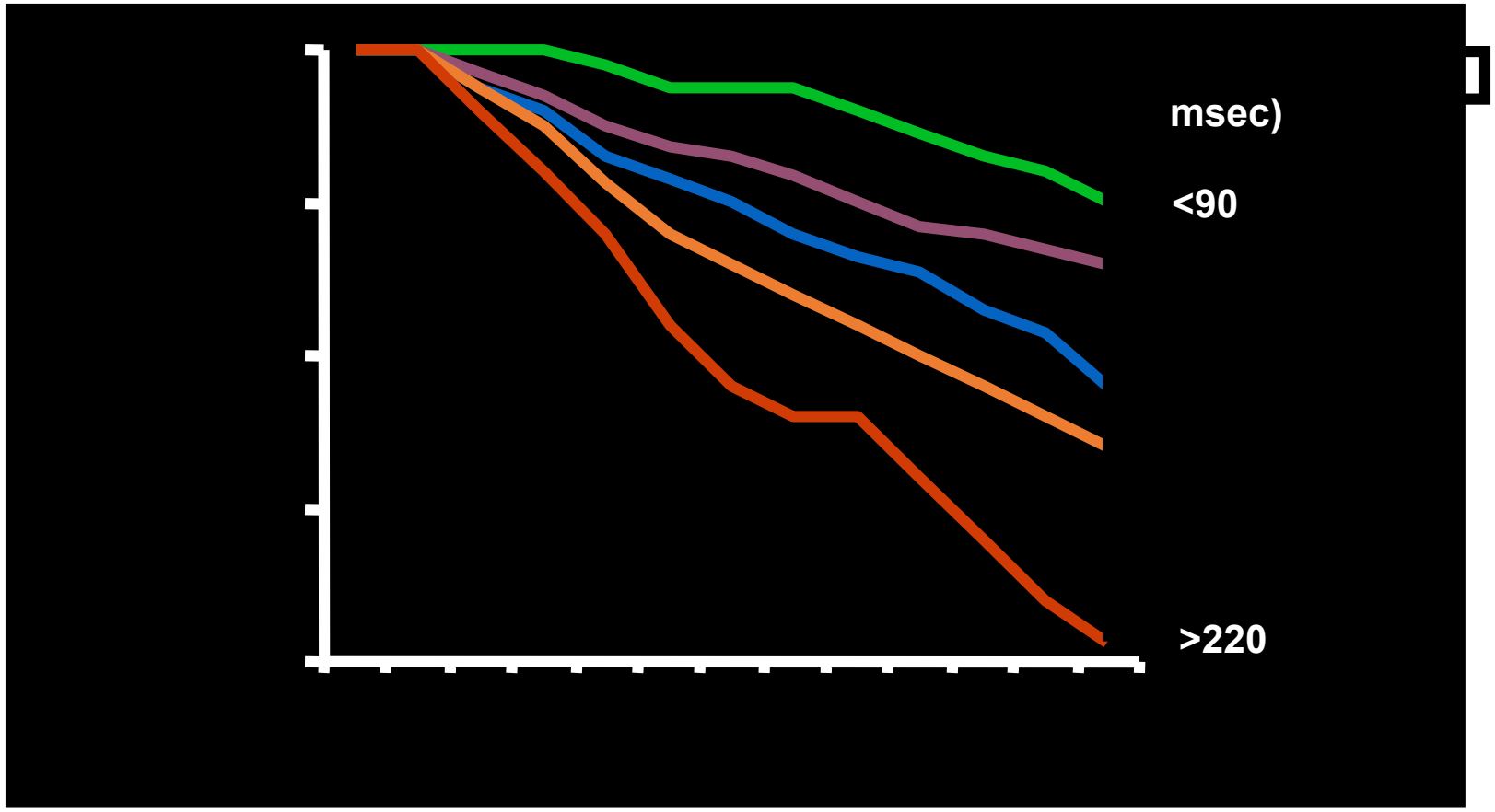
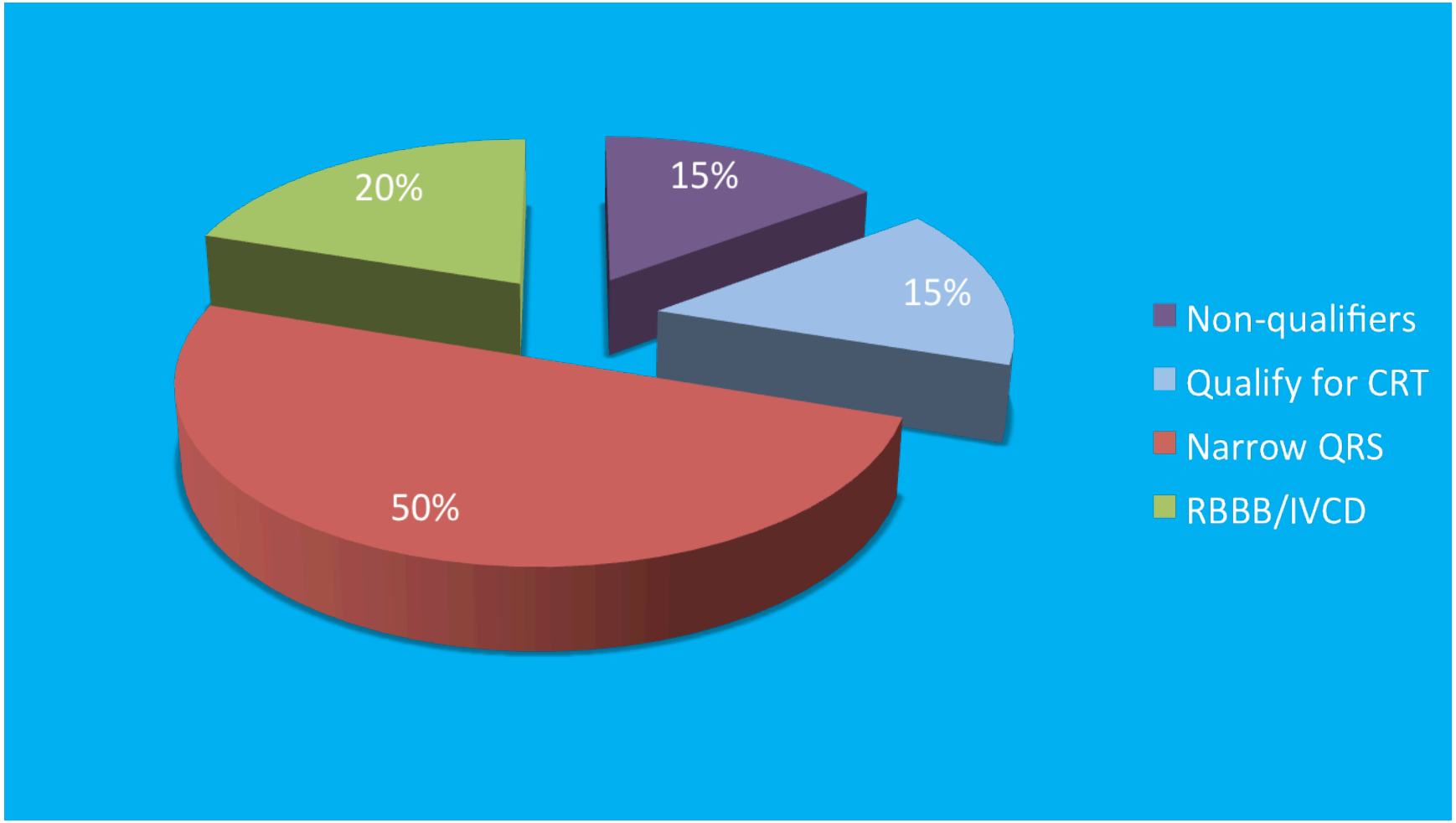
QRS Width and Heart Failure



QRS duration: an independent predictor of mortality

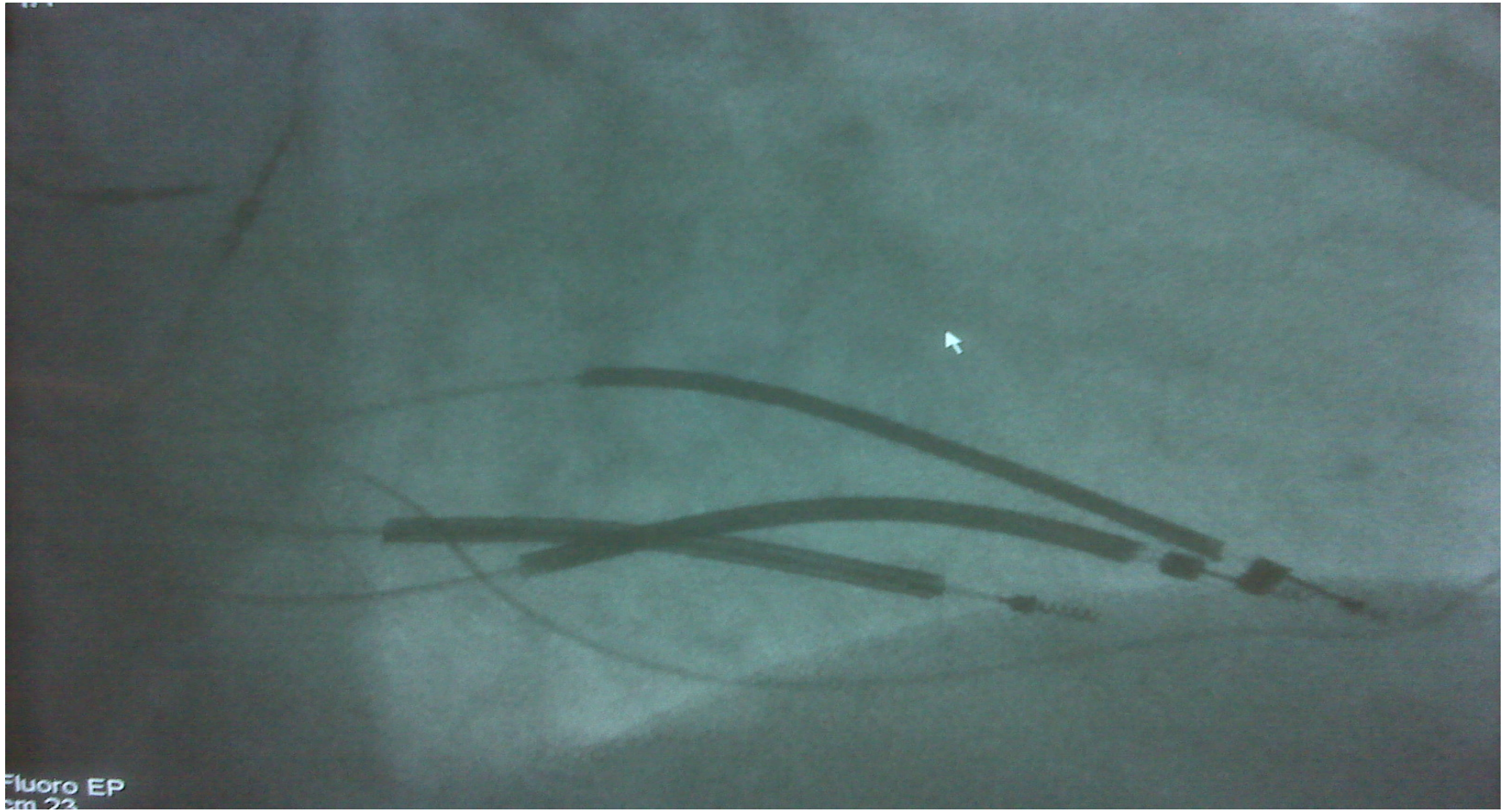
Adapted from V. Gottipaty et al. New Medicine Reports, 1997 & 1999 Heart and Stroke Statistical Update

Percentage of CRT Qualifiers



Heart Failure Society Database

Un-Intentional Exuberance



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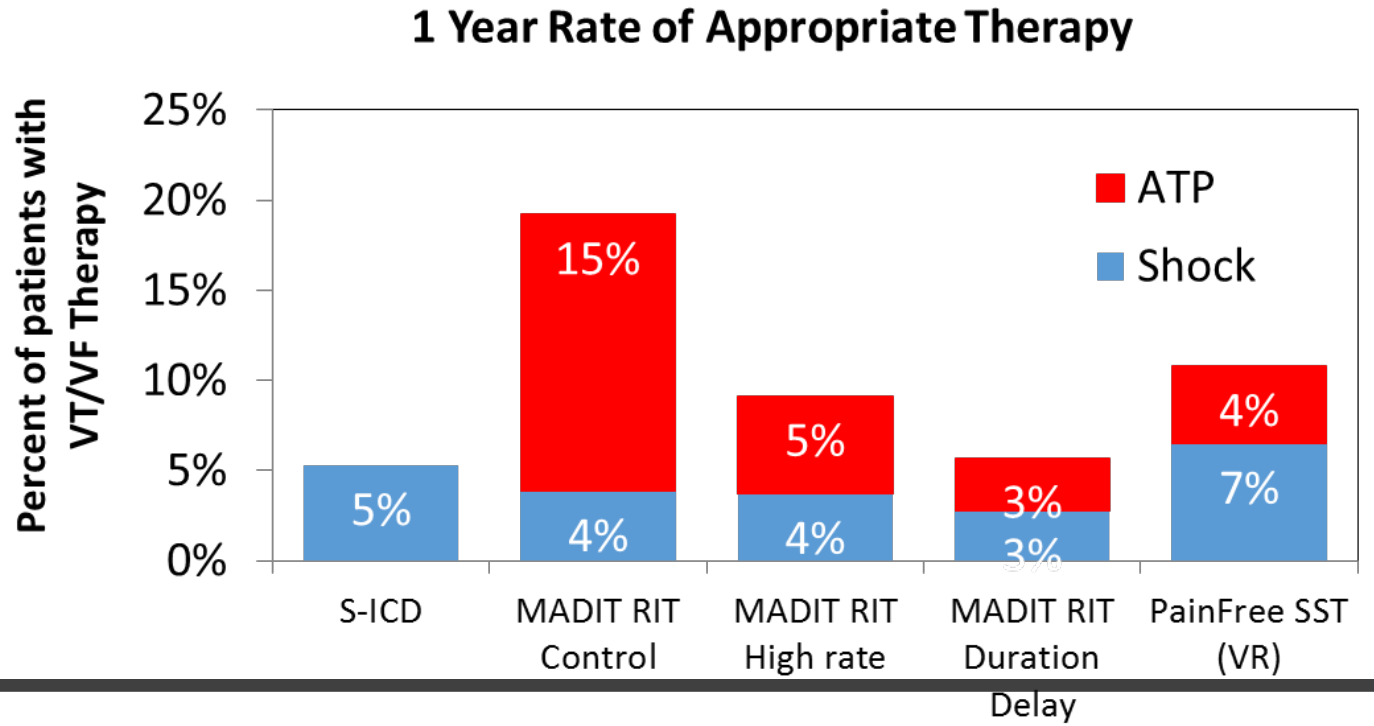
If ATP prevents unnecessary shocks, why are appropriate shock rates the same?

- Appropriate shock rates similar with or without ATP
- MADIT-RIT found no difference in rate of appropriate shocks despite large differences in ATP delivery.
- Similar rate of VT/VF shocks in S-ICD, MADIT-RIT, PainFREE SST



- MADIT-RIT* and PainFREE SST* saw a 4% incidence of appropriate ATP by programming a longer delay
- In MADIT-RIT, 80% reduction in ATP Therapy vs in Duration/Delay Arm vs Control
- Unknown how many ATP therapies were successful in avoiding shocks

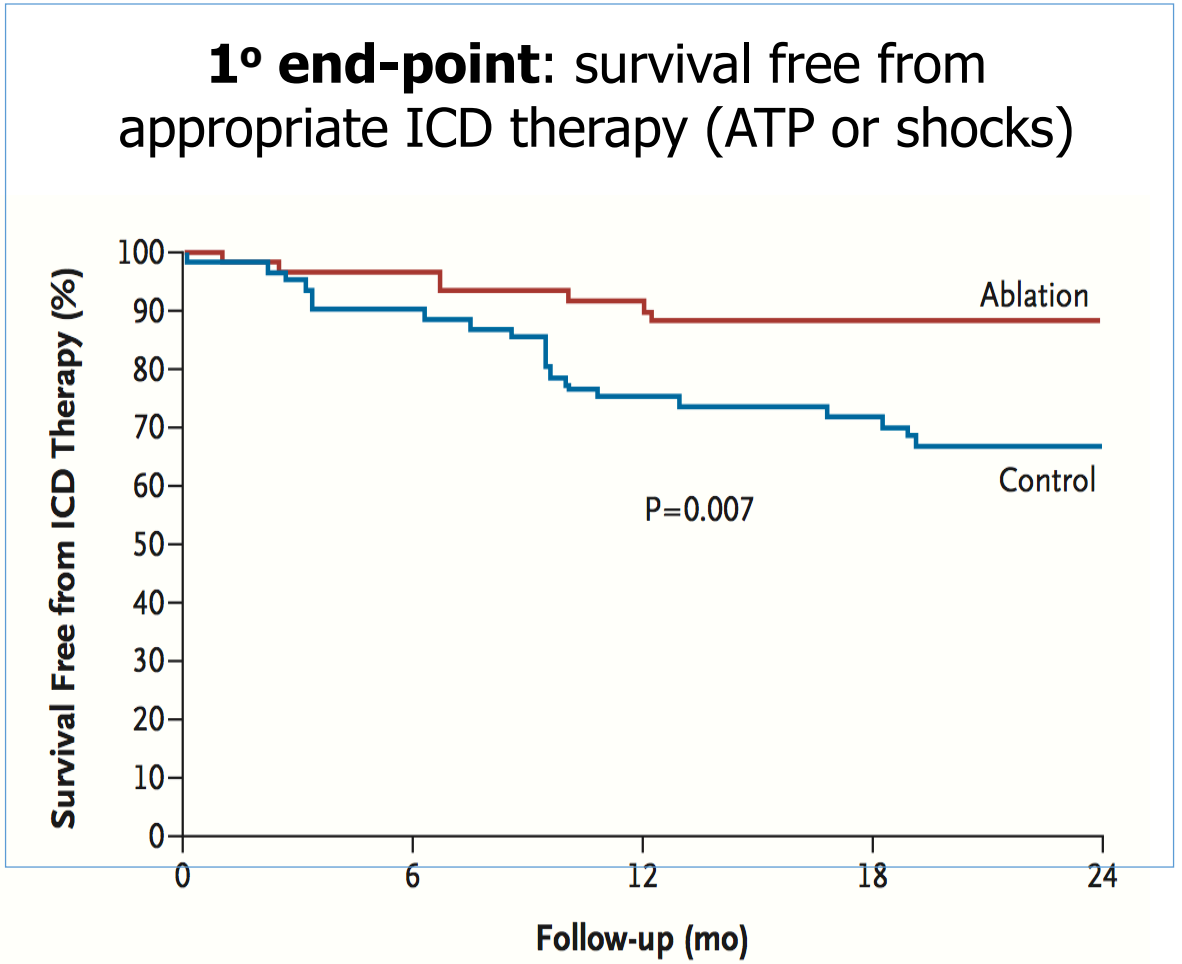
*MADIT-RIT and PainFREE SST did not include S-ICD devices.

1 year Kaplan Meier incidence shown for S-ICD and PainFREE SST
1 year rate for MADIT-RIT annualized at an average follow-up of 1.4 years

Moss, A, et al. *NEJM* 2012; 367:2275-2283
Auricchio A, et al. *Heart Rhythm*, online before print http://dx.doi.org/10.1016/j.hrthm.2015.01.017

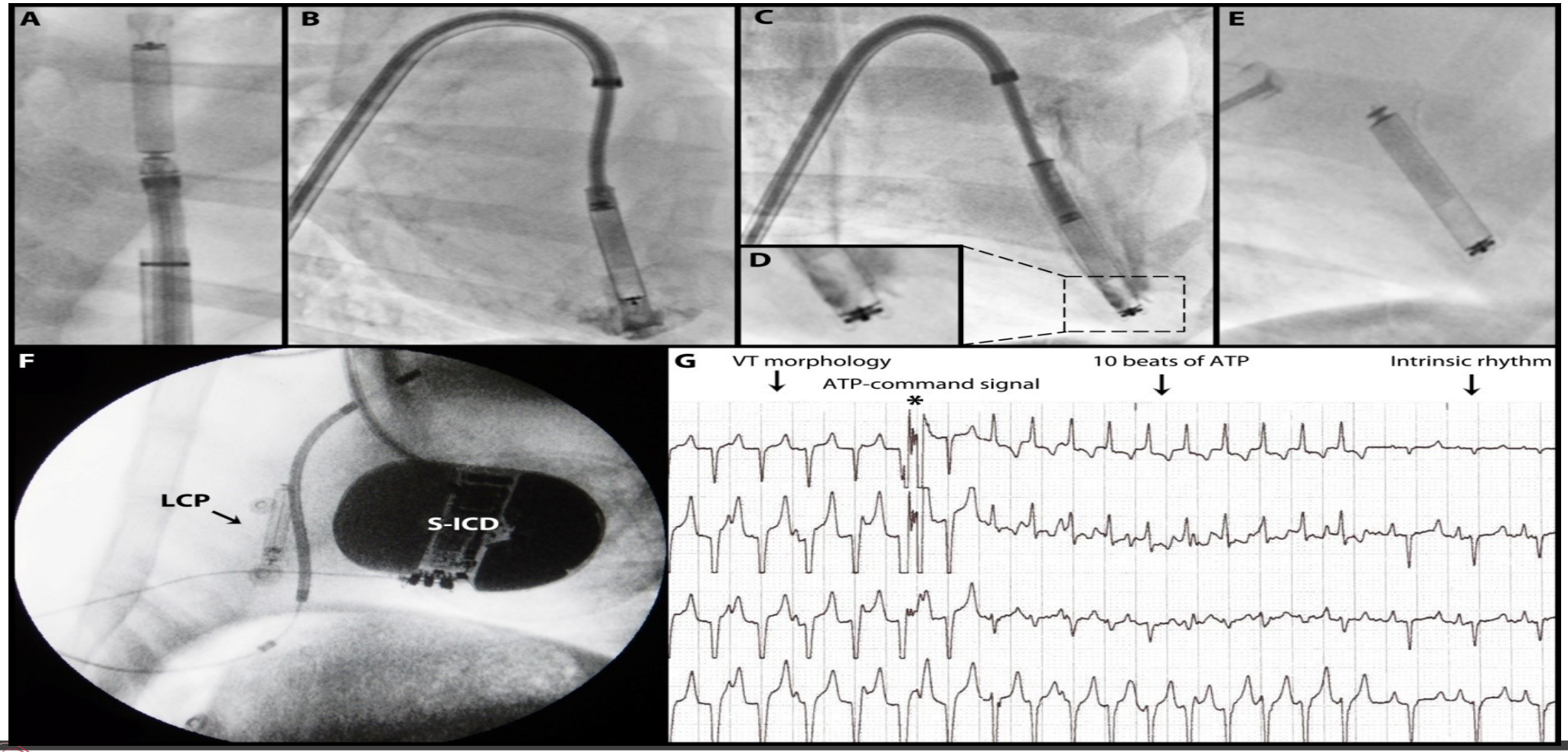
SMASH-VT

- 128 patients with prior MI, recent or planned ICD, & ventricular arrhythmia
  - VF or unstable VT
  - Syncope + inducible VT
  - First appropriate ICD therapy
- Patients on class I or III AADs excluded
- Randomized to control versus substrate-based catheter ablation (i.e. in sinus rhythm)
- Ablation-related complications in 3/64; 30-day mortality zero



Reddy VY et al. NEJM 2007; 357: 2657-2665

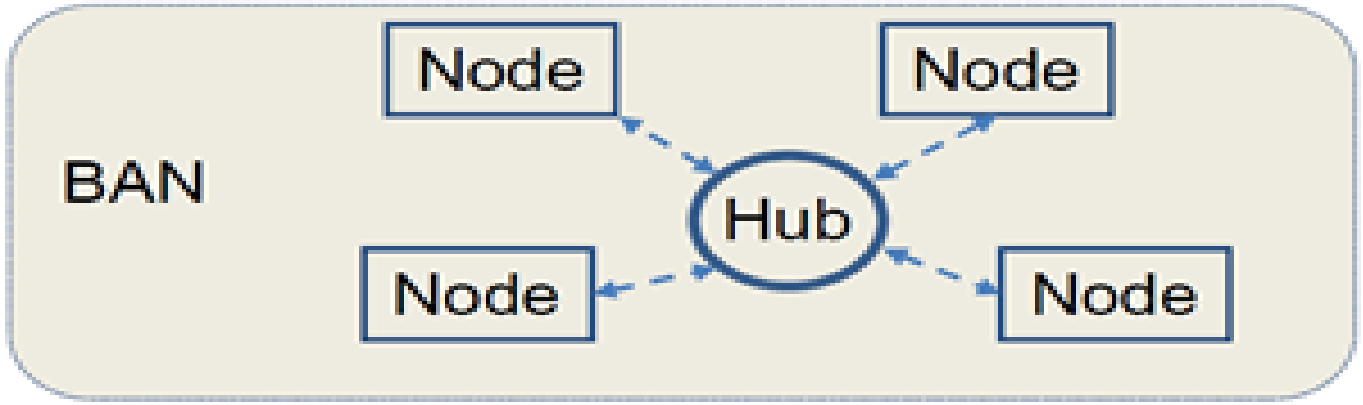
Modular Devices/Medical Body Network



Tjong FVL, Knops RE JACC 2016

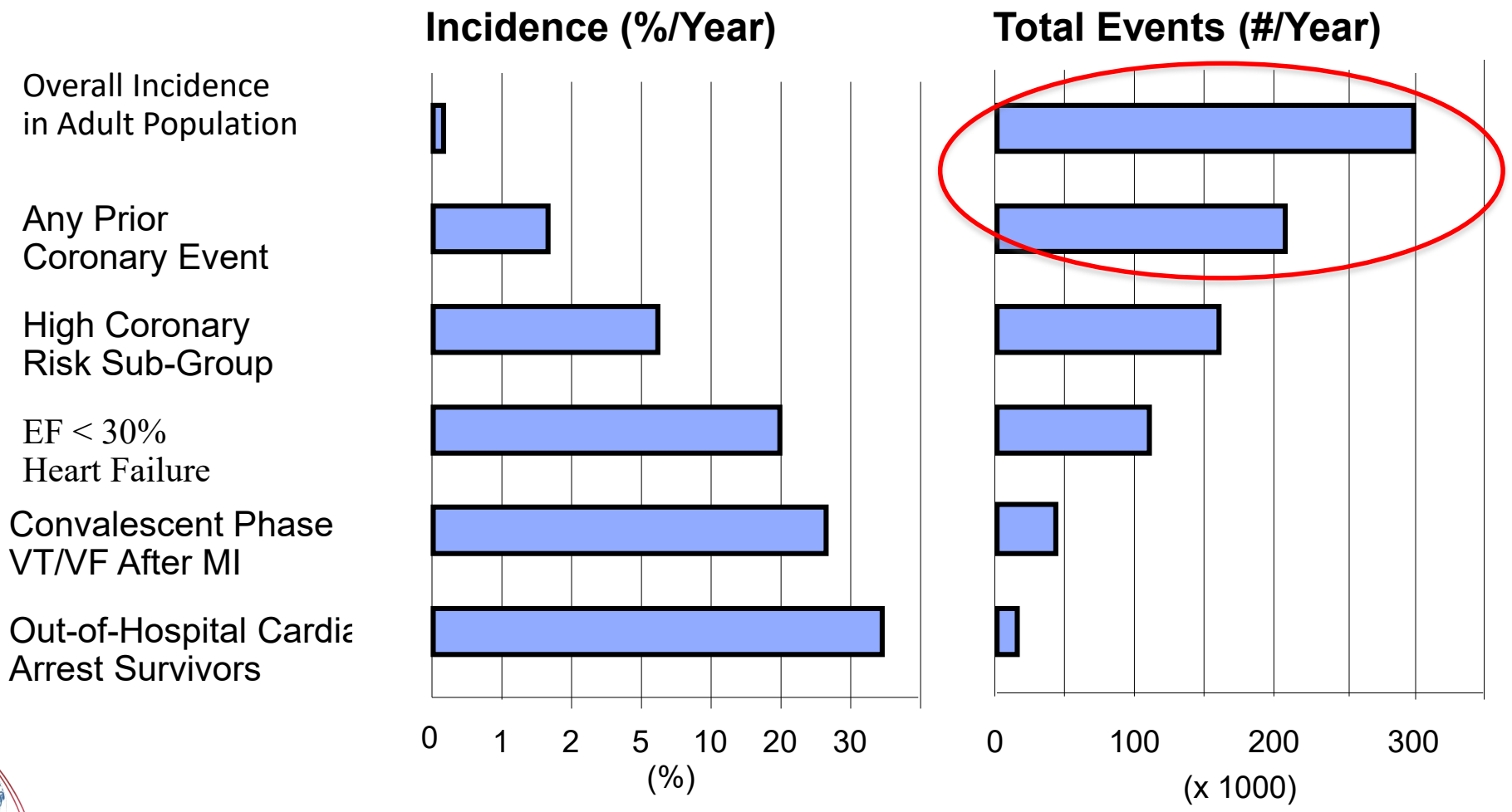
How does an MBAN system operate? We have to get Modular

- A typical MBAN consists of:
  - a master programmer/control transmitter (“hub device”),
  - one or more client transmitters (“body sensors”), which are worn on the body and only transmit while maintaining communication with the hub that controls the transmissions.
  - The hub conveys data messages to the body-worn sensors to specify, for example, the transmit frequency that should be used. The hub and sensor devices will transmit in the 2360-2400 MHz band.



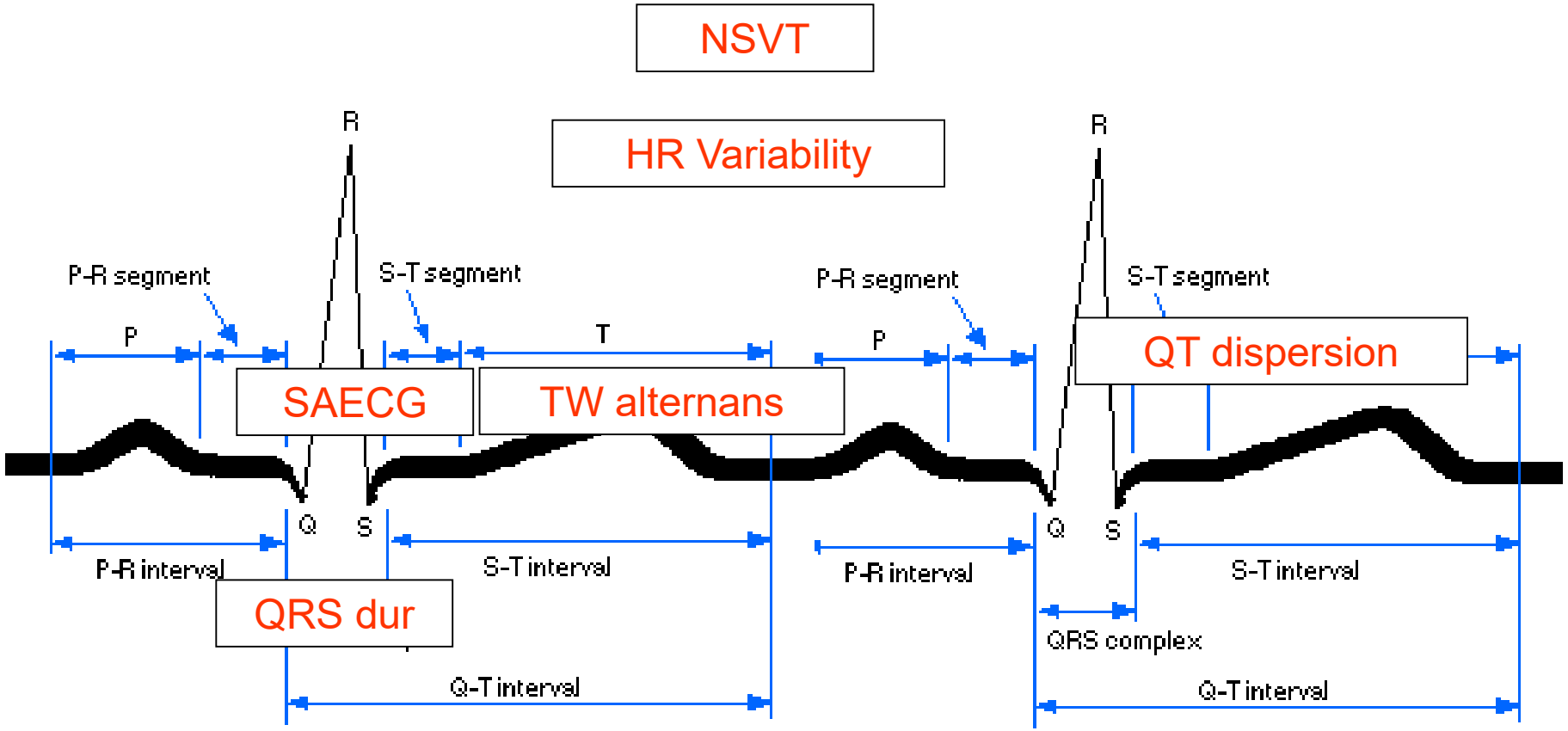
IEEE, 2008

Sudden Cardiac Death
Incidence and Total Events

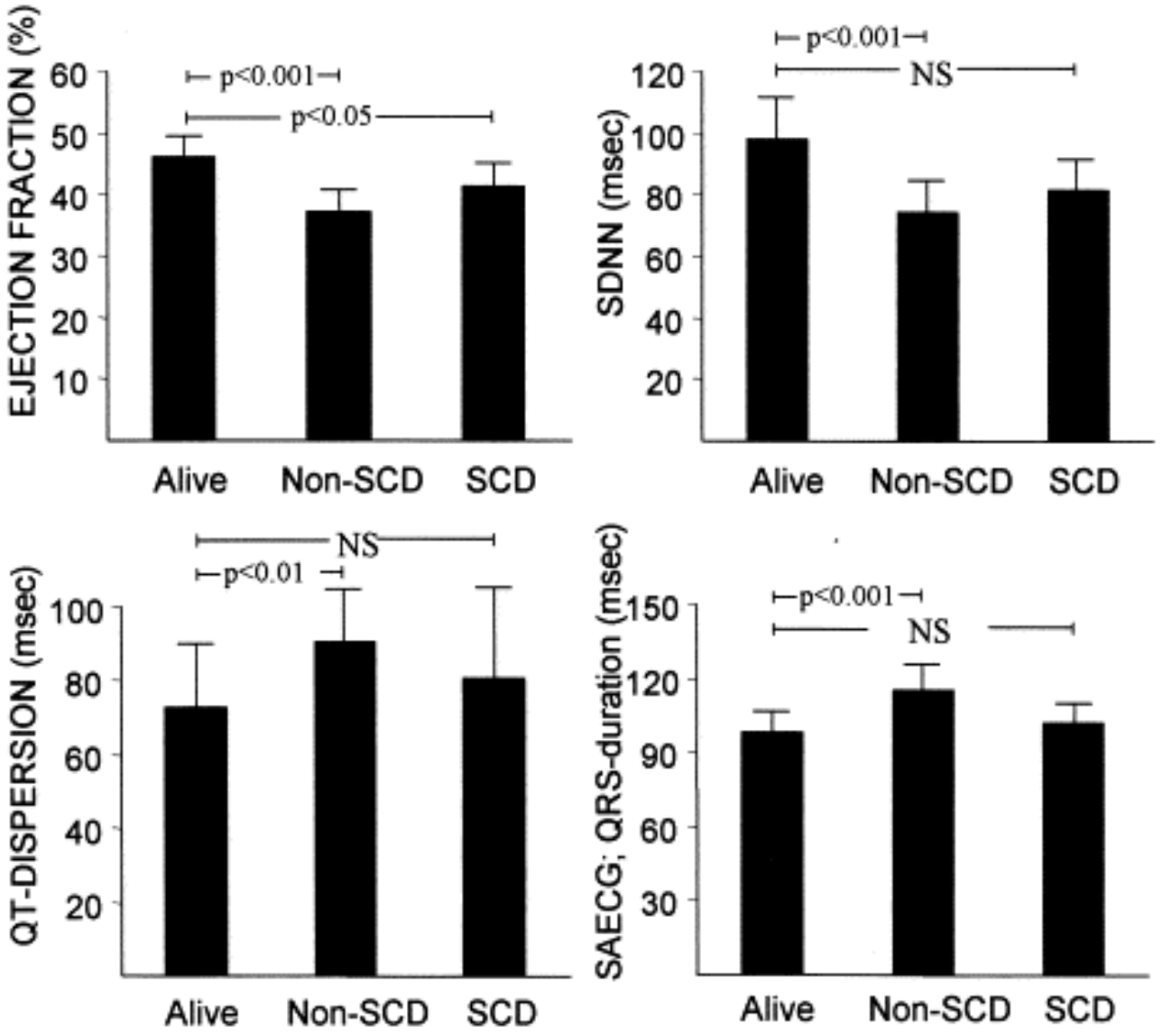


Source: Myerburg RJ. *Circulation* 1992;85(suppl I):I-2 – I-10.

Grouping of Electrophysiology Tests For Risk Stratification by ECG



Prediction of SCD after MI in the Beta-Blocking Era



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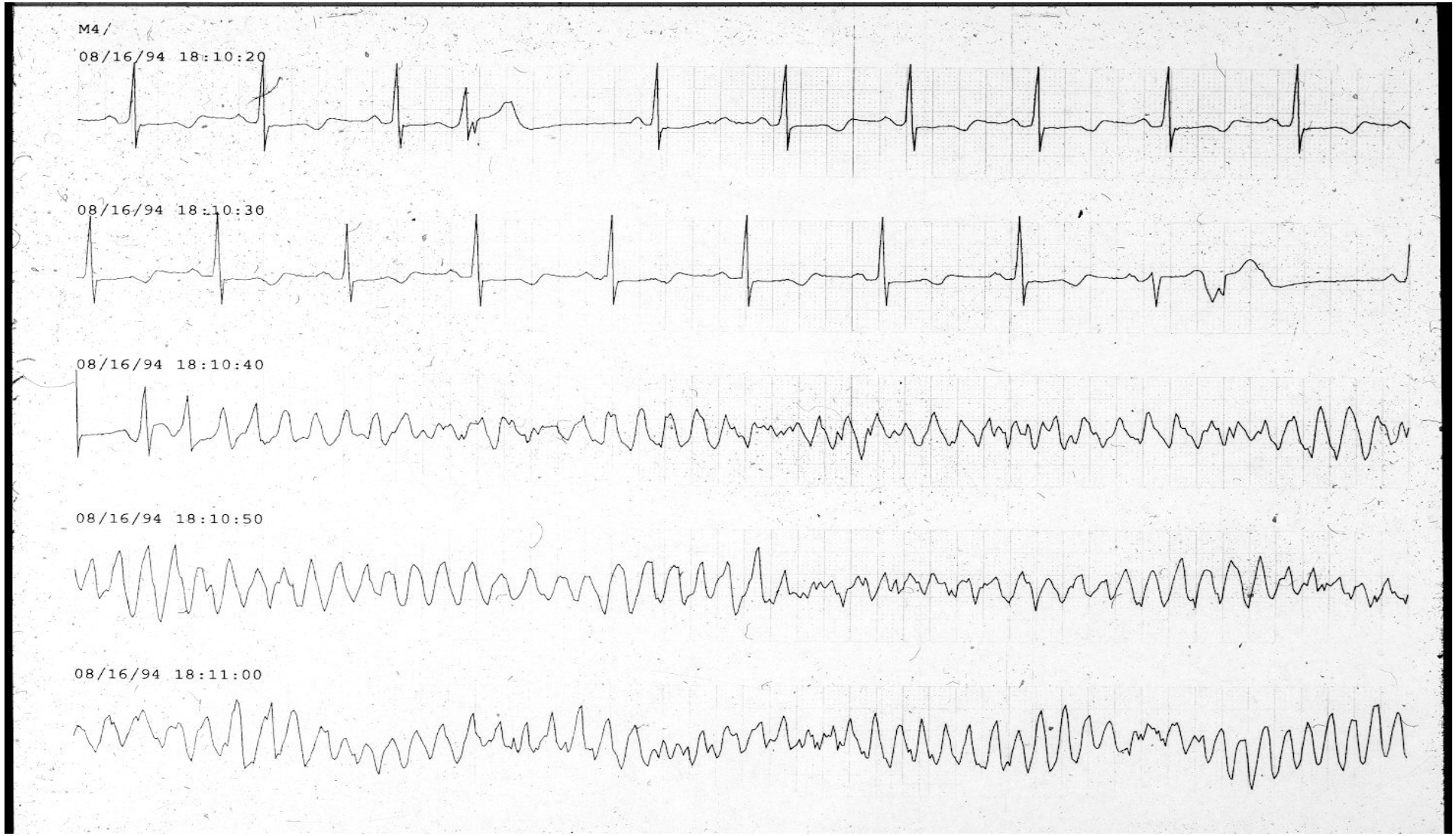

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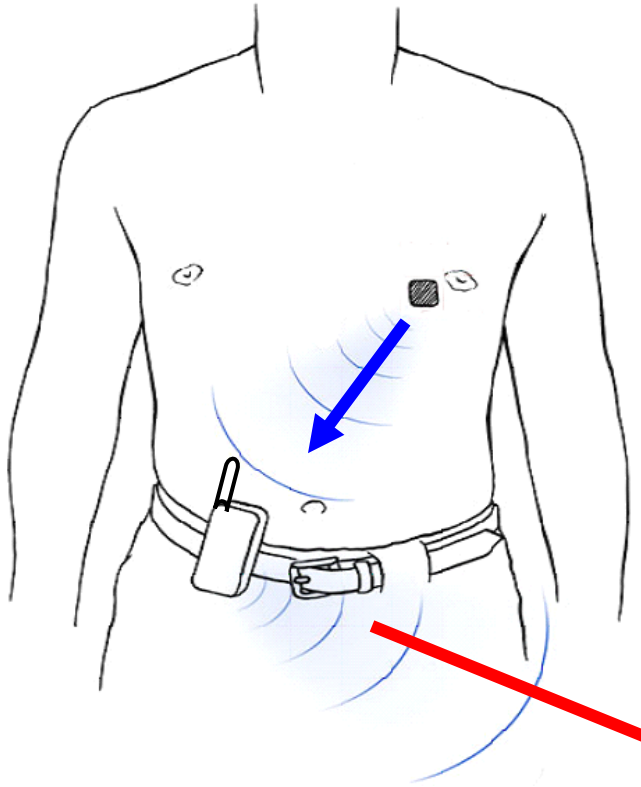
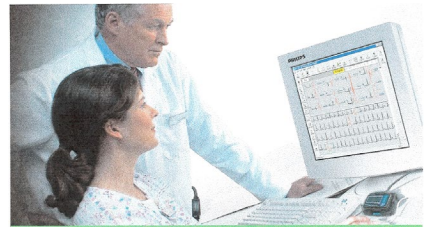
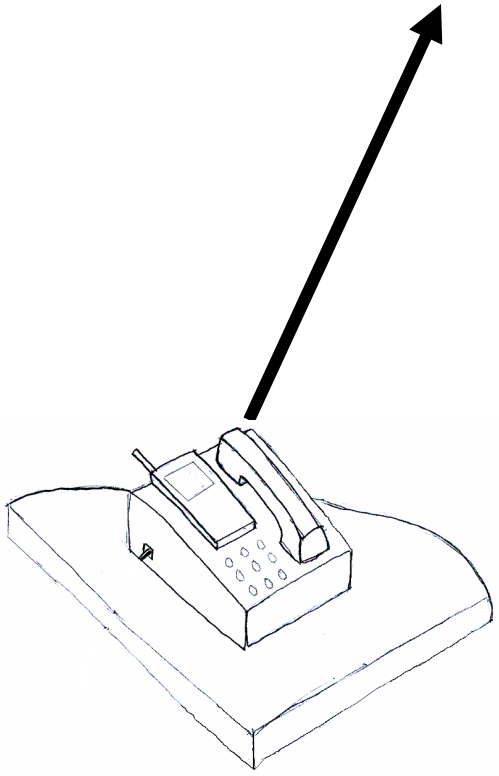
CARDIOALARM™ SYSTEM







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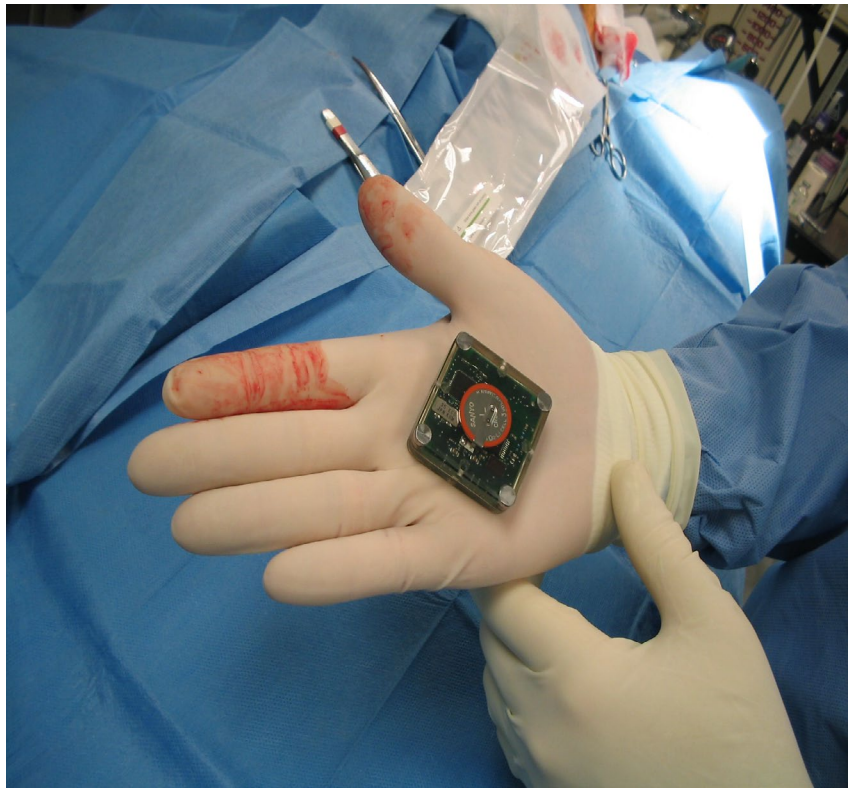
Subcutaneous cardiac arrest sensor



Sensor contains two ECG amplifiers, microprocessor, memory, transceiver, battery. Upon detection of VF, it transmits the event and ECG to an external receiver

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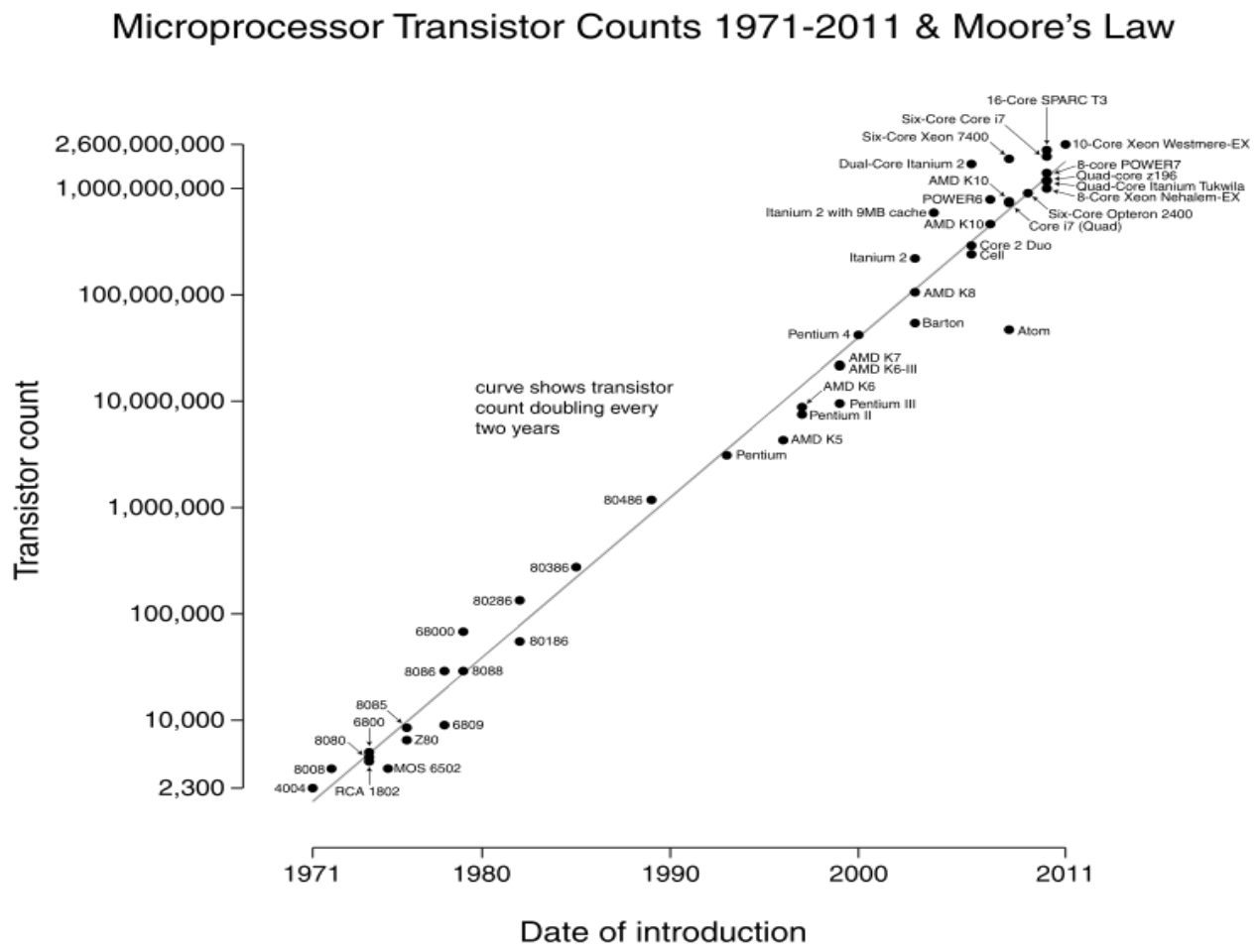
Moore's Law in healthcare



ECG Classification With Deep Learning

Joris Galema, Christopher Buch Madsen, Flavio Miceli,
Abel Oakley & Florian Schroevers

2nd July 2018

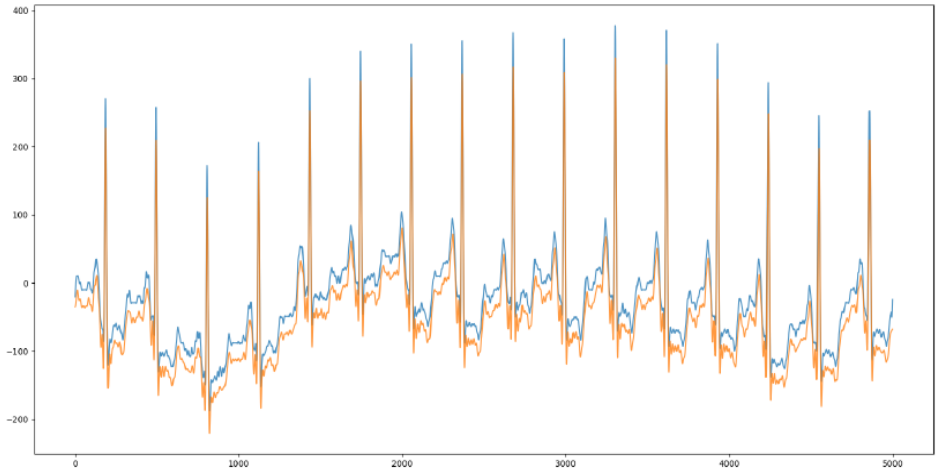


Figure 3: Fourier Approximation

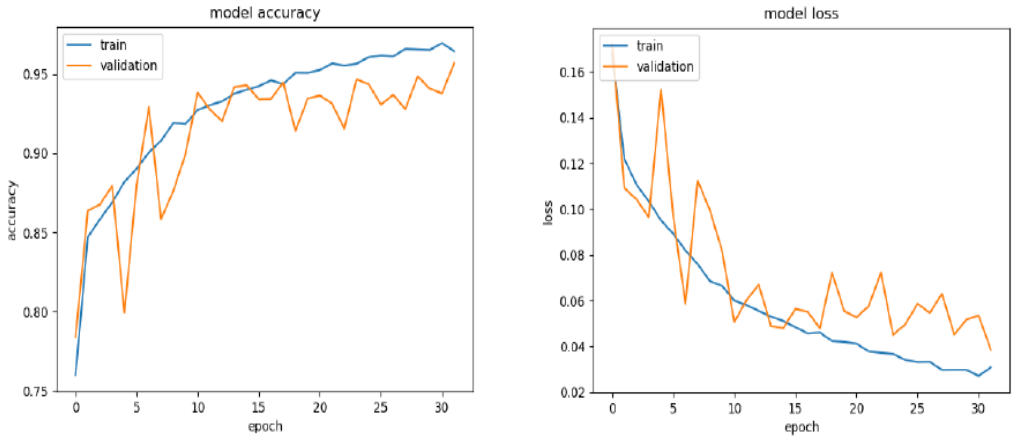


Figure 12: Accuracy and Loss per Epoch

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