Device Implantation: Which Device, and How?

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SickKids

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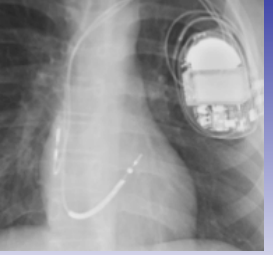
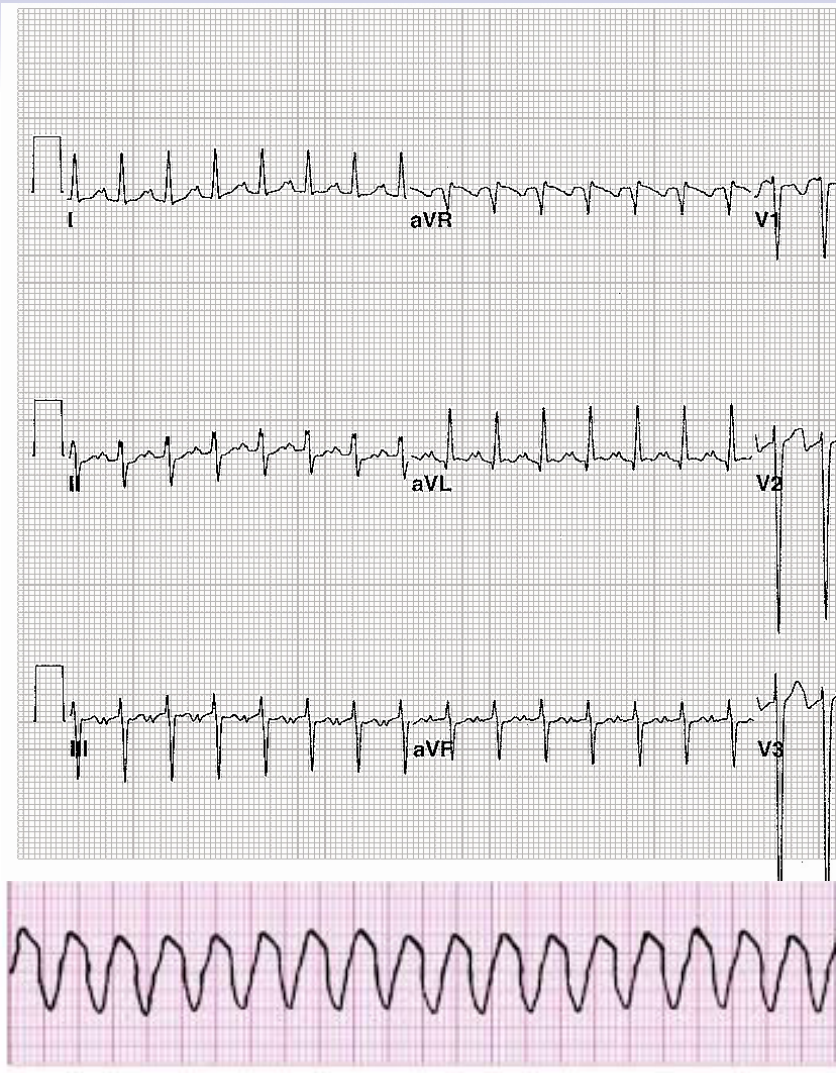
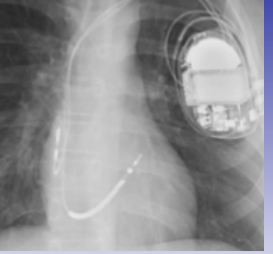
No Disclosures



Arrhythmia Management

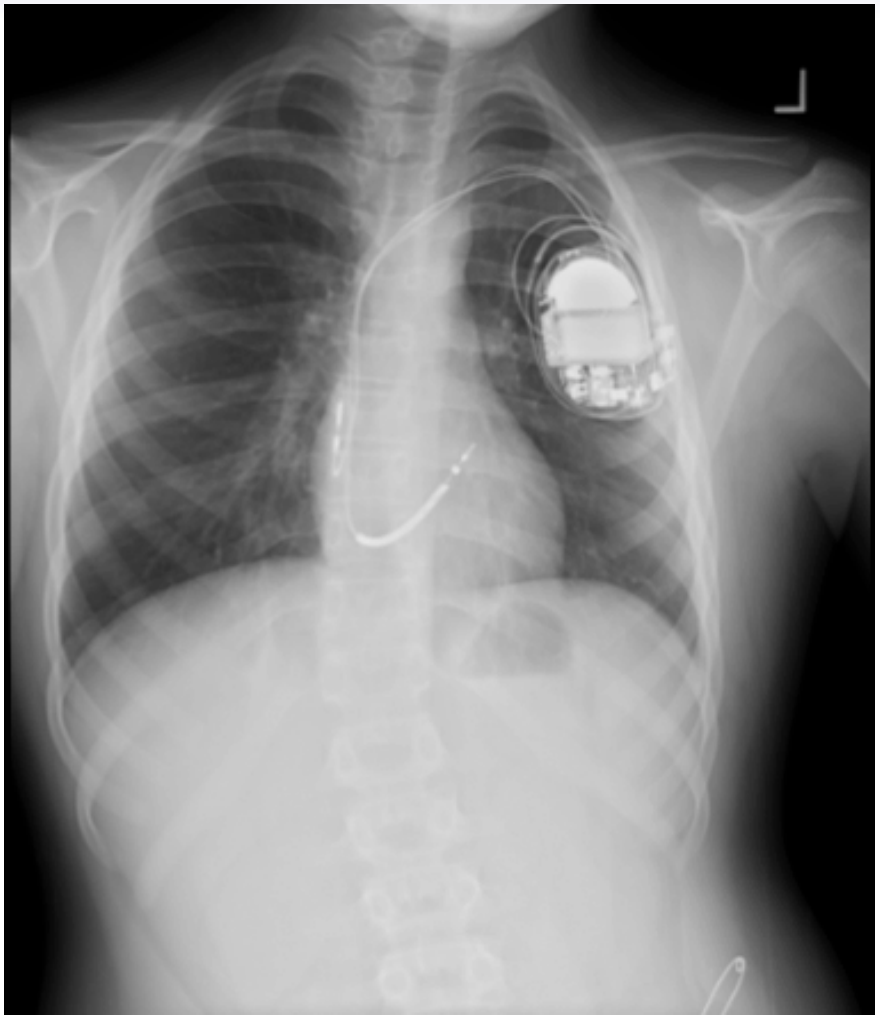
- Both atrial and ventricular arrhythmias seen in CHD
  - Myocardial scarring and stretching secondary to volume and pressure loads
  - Incisional scars allow macro-reentrant circuits

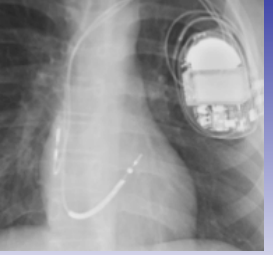




Typical Transvenous ICD

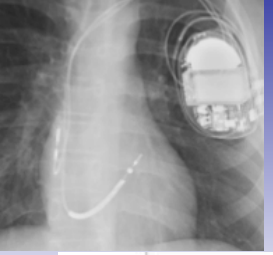
- Extensive experience in implantation technique
- Reliable



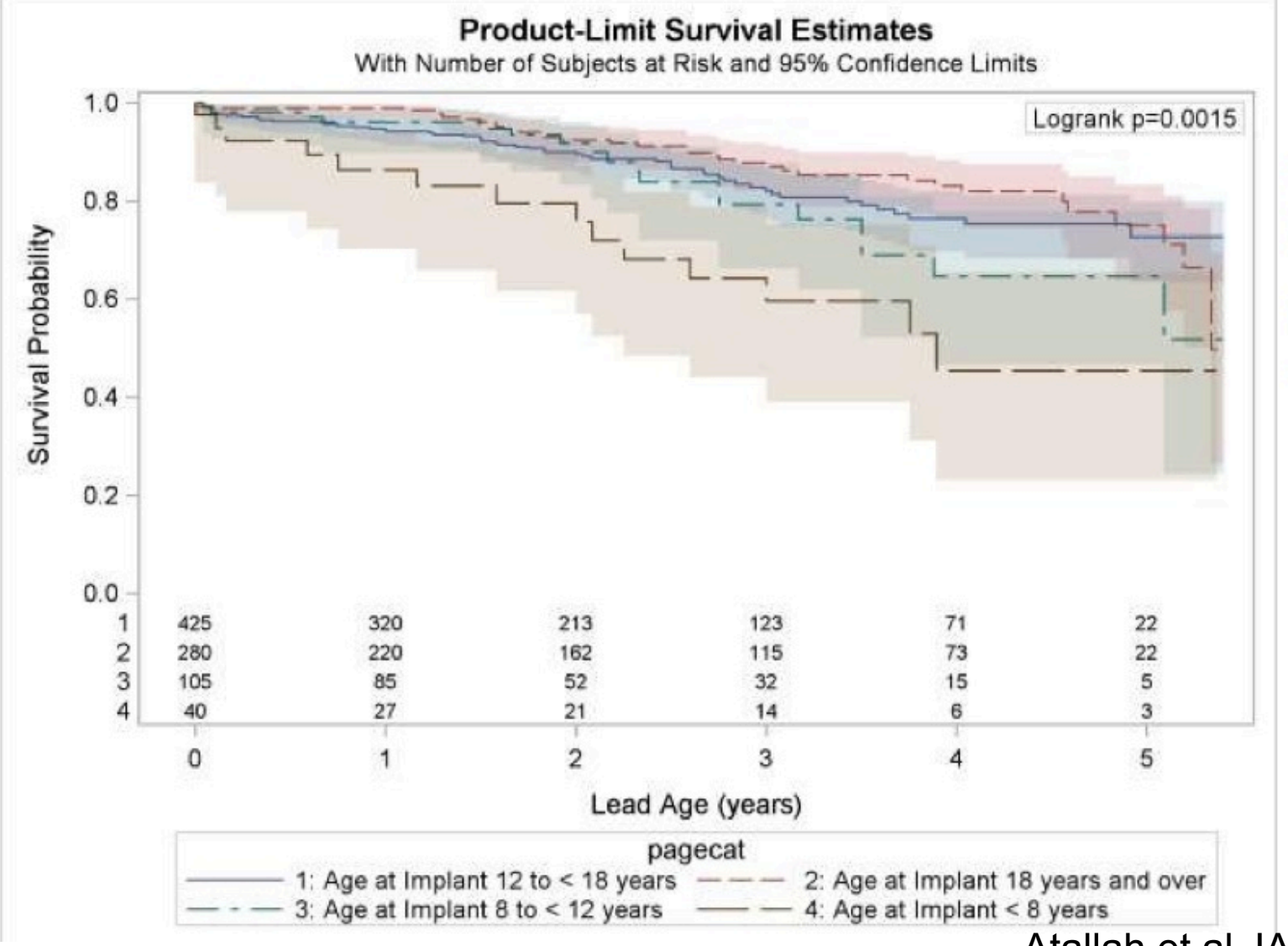


Conventional ICDs

- Transvenous Coils
  - Risk of venous occlusion
  - Risk of embolic phenomena (intracardiac shunt)
  - Lead failure
  - Infectious risk
- Use of transvenous ICD implantation may be limited secondary to:
  - Patient size
  - Venous anatomy/Venous Capacitance
  - Cardiac anatomy



Risk of Therapy



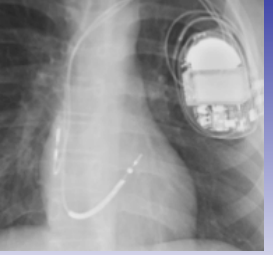
≥ 18 yrs

12-18 yrs

8-12 yrs

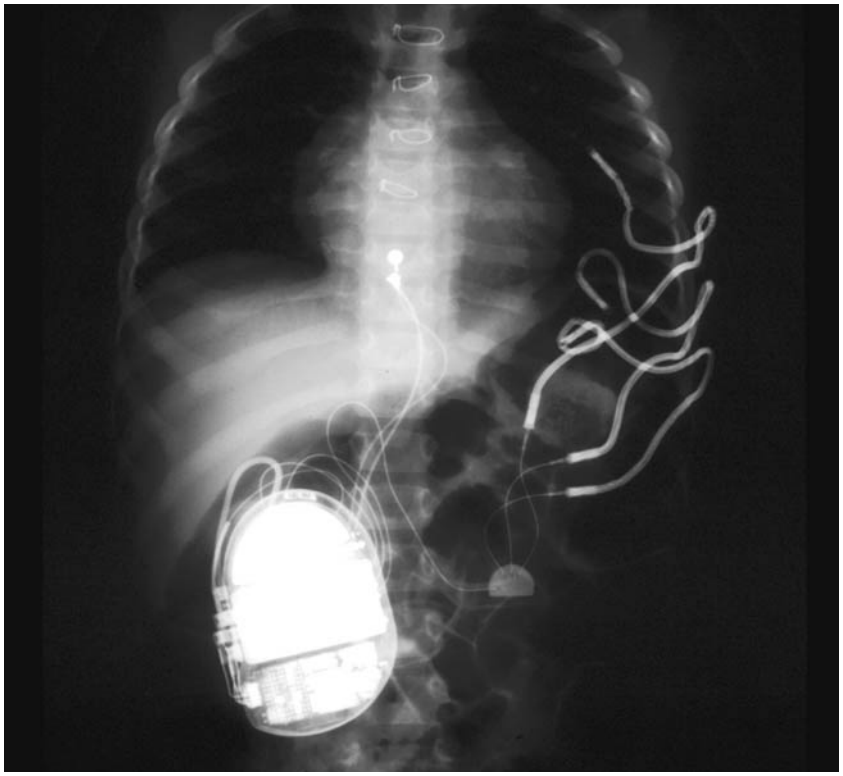
< 8 yrs

Atallah et al JACC 2013

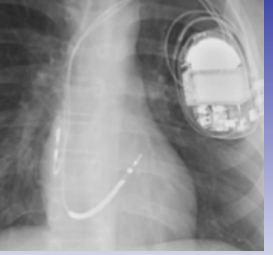


Extracardiac Configurations

- Configurations for the high voltage coil:
  - Subcutaneous array (1-3 fingers)
  - Tranvenous design ICD lead on epicardium
- Ventricular pace-sense leads:
  - Epicardial
  - Transvenous



Stephenson et al, JCE 2006

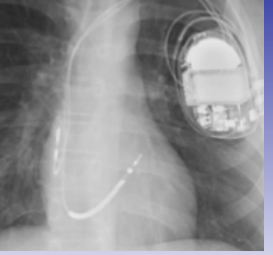


Multicenter Study of Novel ICD Configurations

- 14 pts underwent ICD implant for VT/cardiac arrest:
  - mean age of 7.7 yrs (range 4 months-27.6 yrs),
  - mean weight of 25.3 kg (7-70 kg).

- Diagnoses included:
  - **Complex CHD (6)**
  - **Intracardiac tumor (1)**
  - **Hypertrophic cardiomyopathy (1)**
  - **Dilated cardiomyopathy (1)**
  - **Idiopathic VT (4)**
  - **Long QT syndrome (1)**

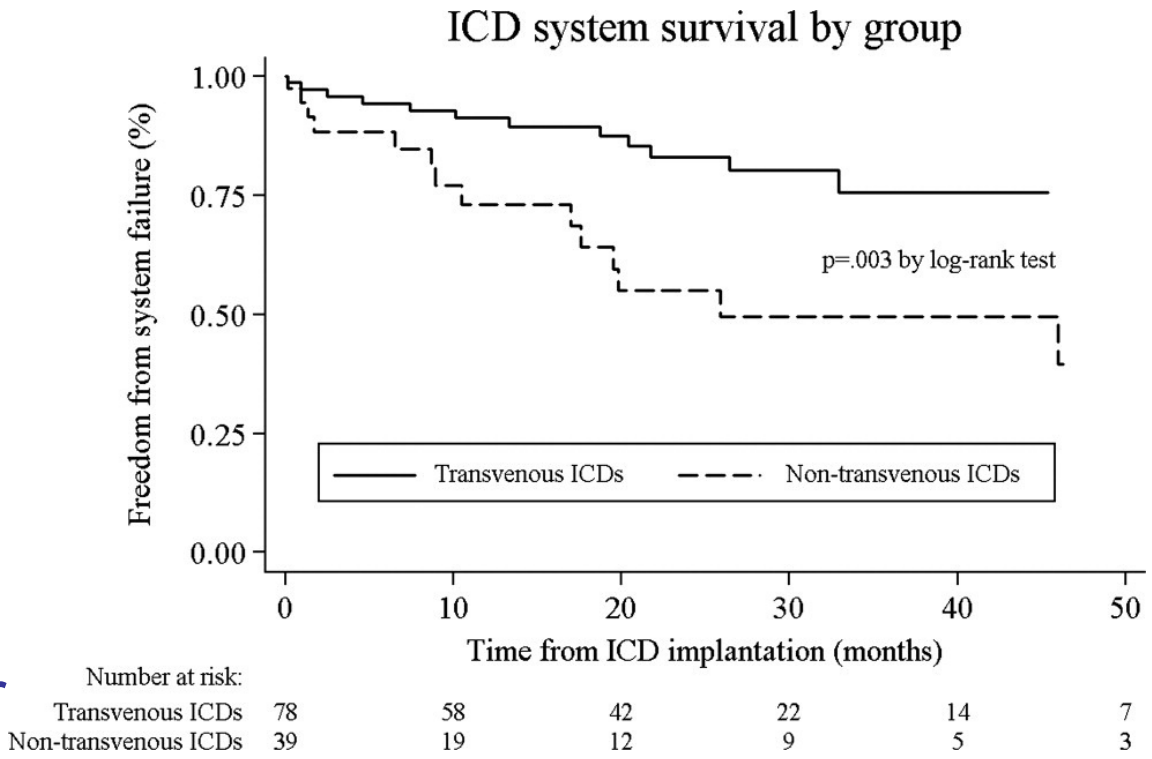
Stephenson et al, JCE 2006



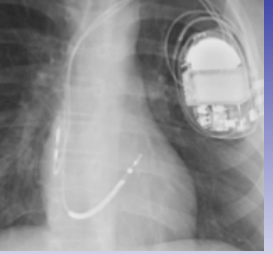
System Survival in Nontransvenous ICD Configurations

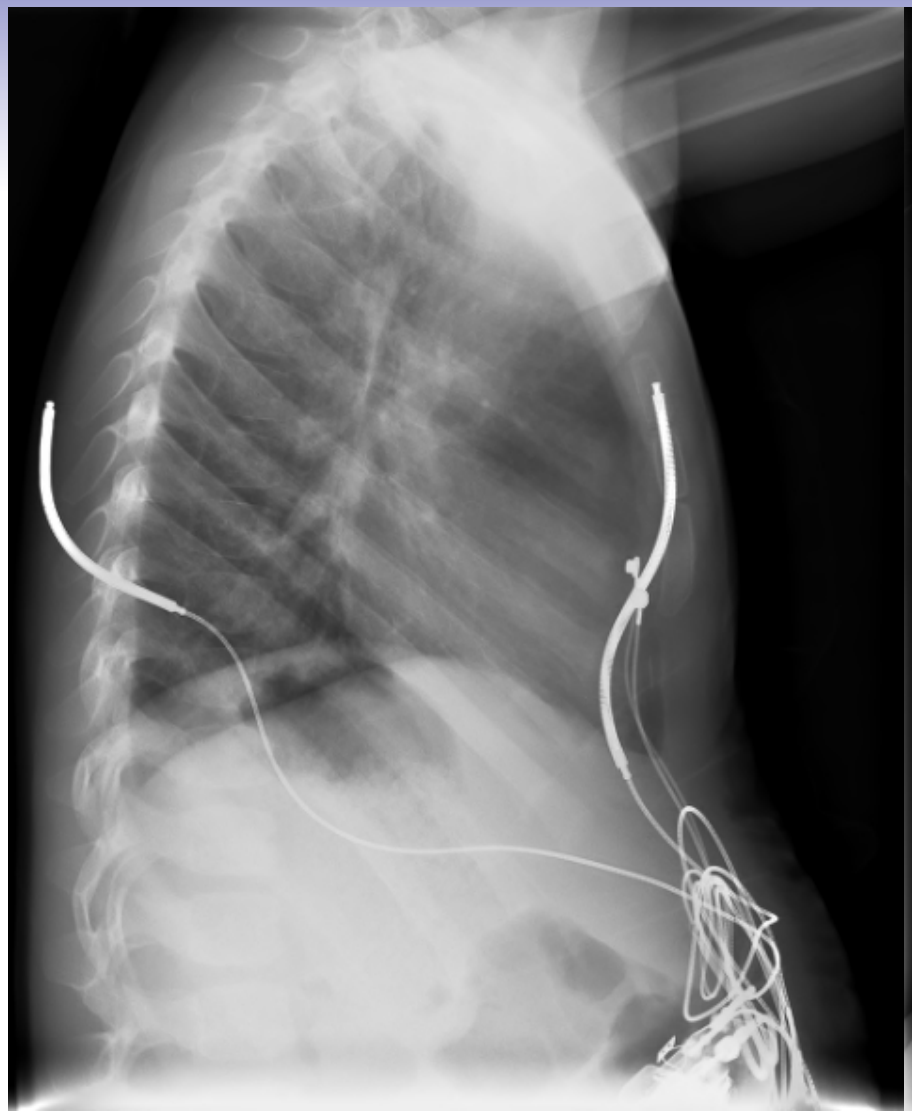
Comparison of NonTV and TV ICD implants

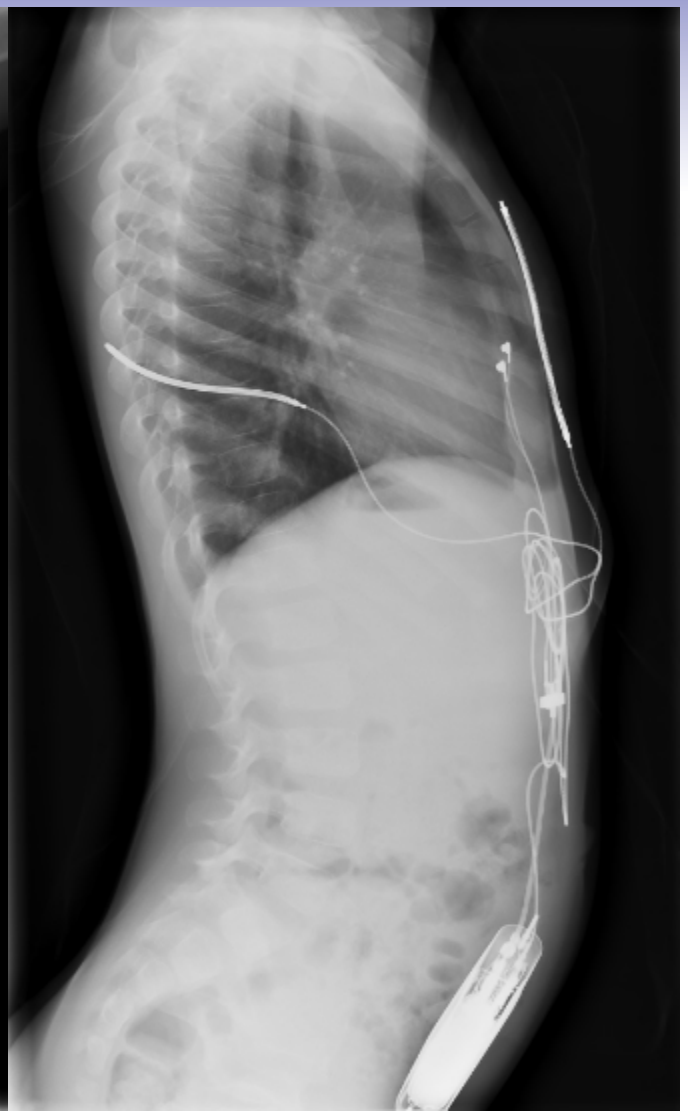
- Rate of total unanticipated interventions:
  - NTV group was 18 per 1,000 person-months
  - TV group was 6 per 1000 person-months

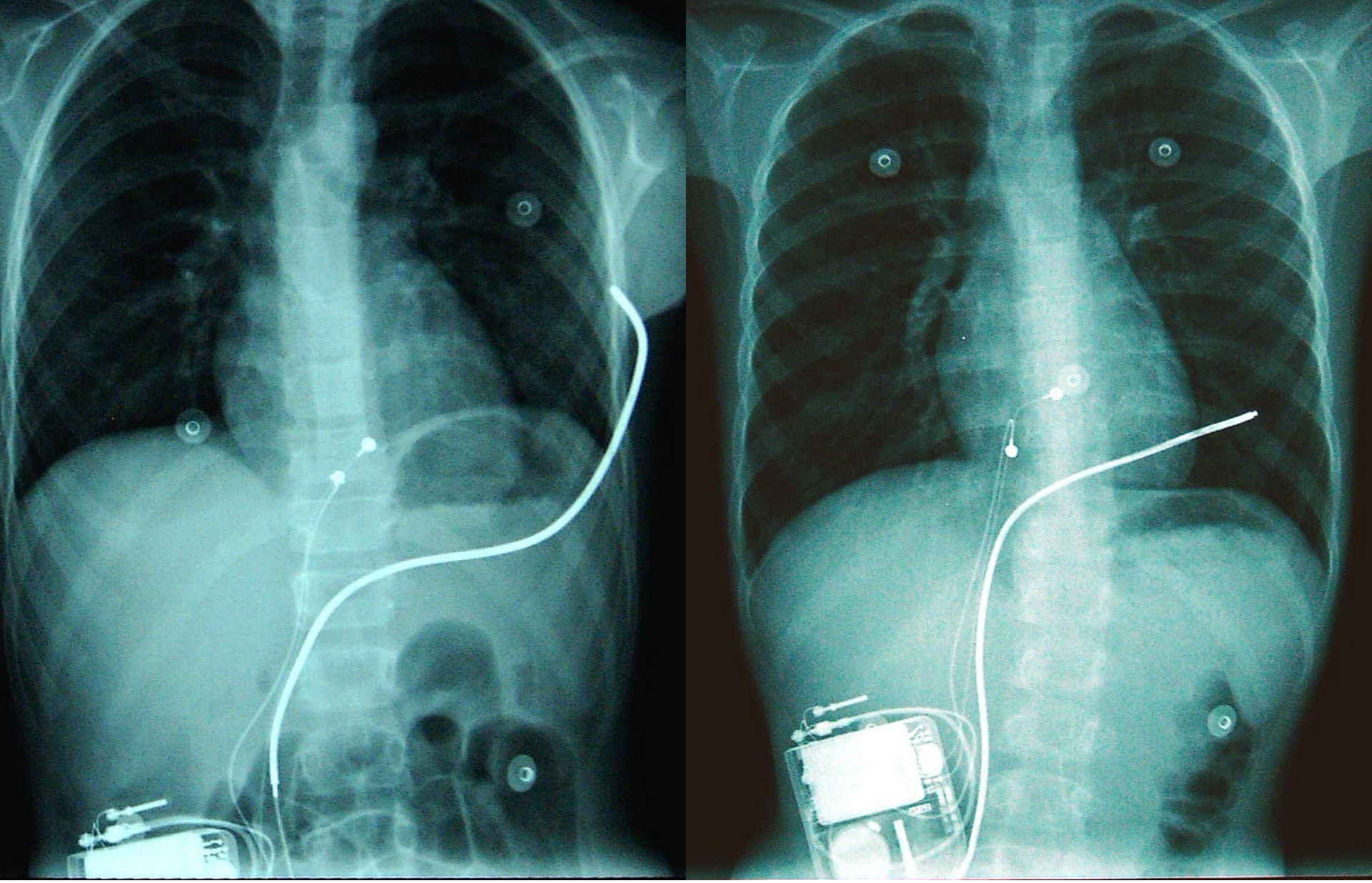


Radbill et al, Heart Rhythm 2010

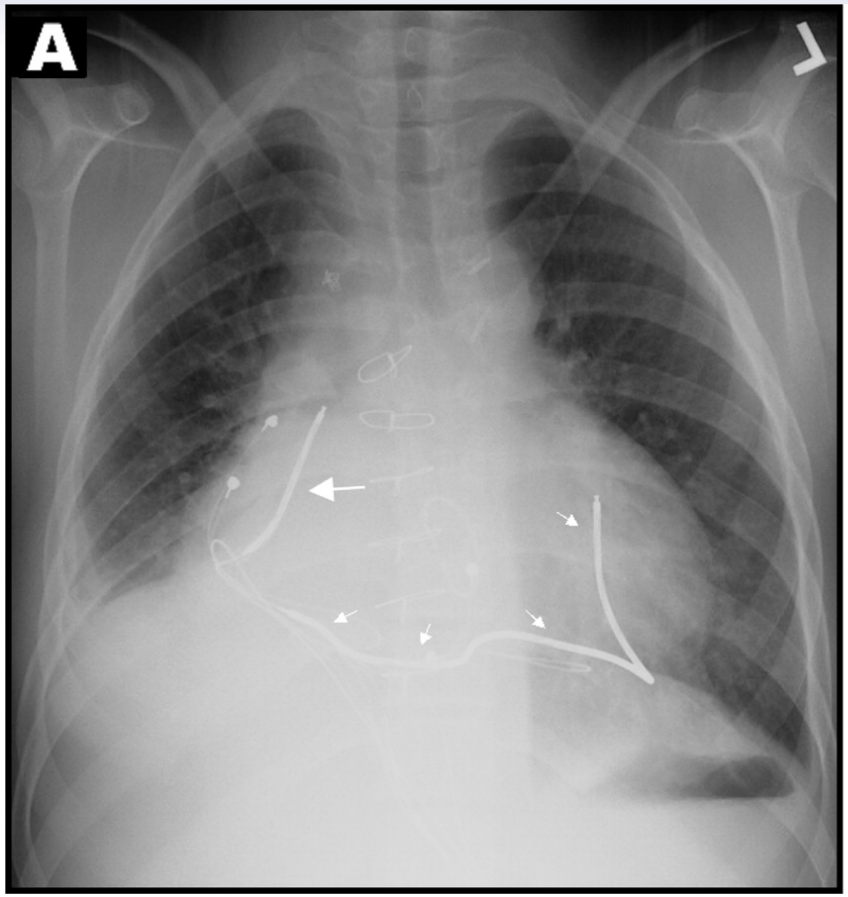


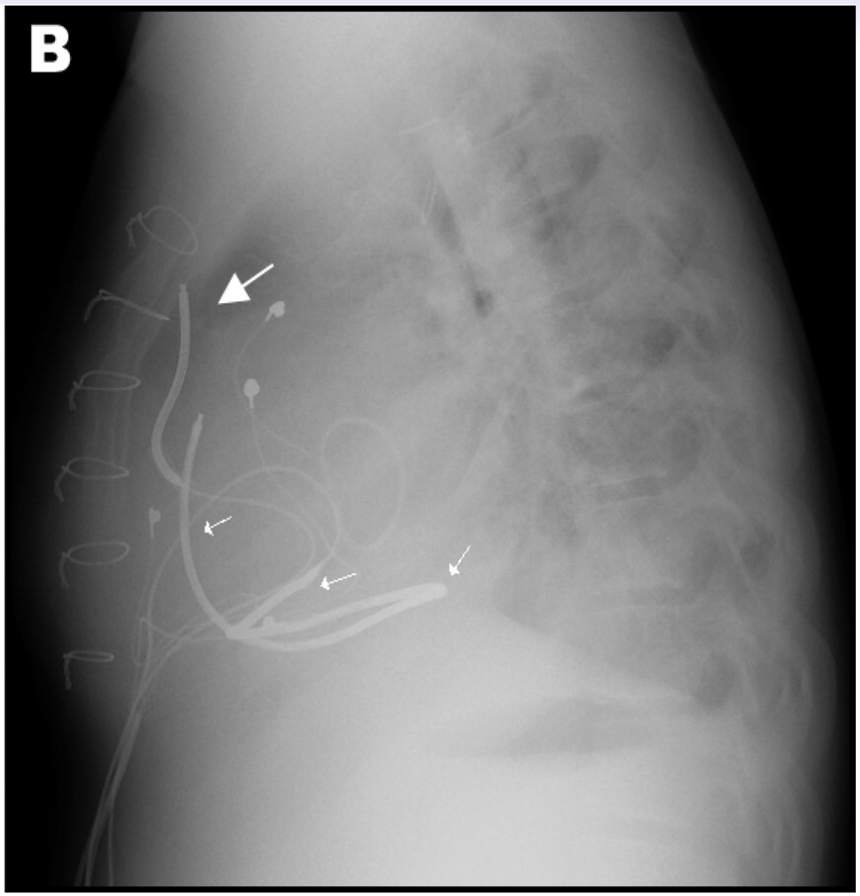




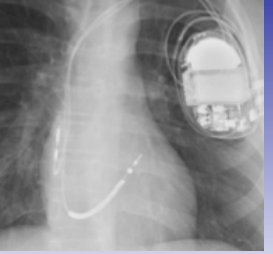


Epicardial ICD system in pt with Fontan Circulation

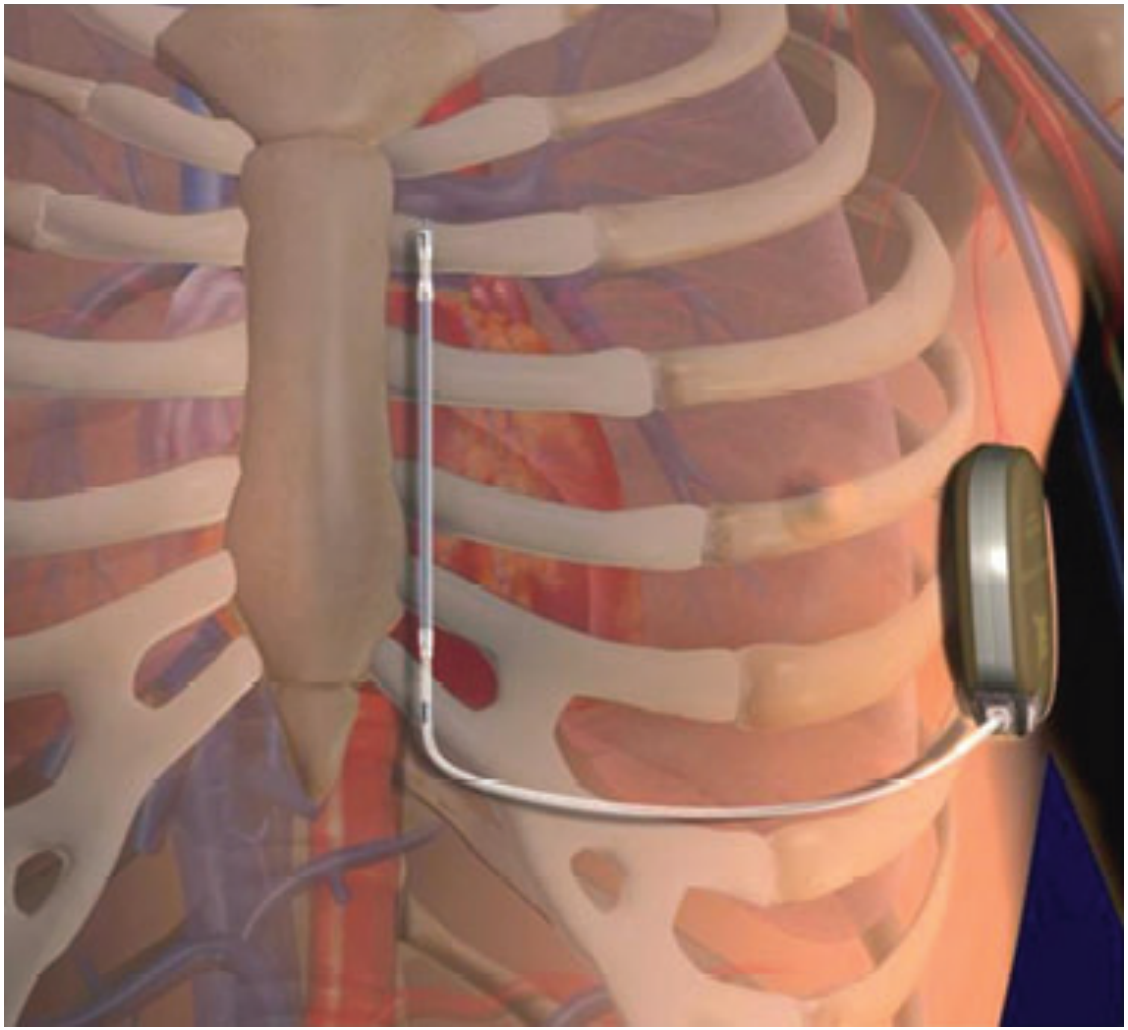


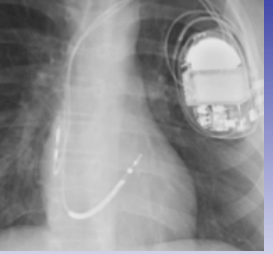


Edward P. Walsh, and Frank Cecchin Circulation. 2007;115:534-545

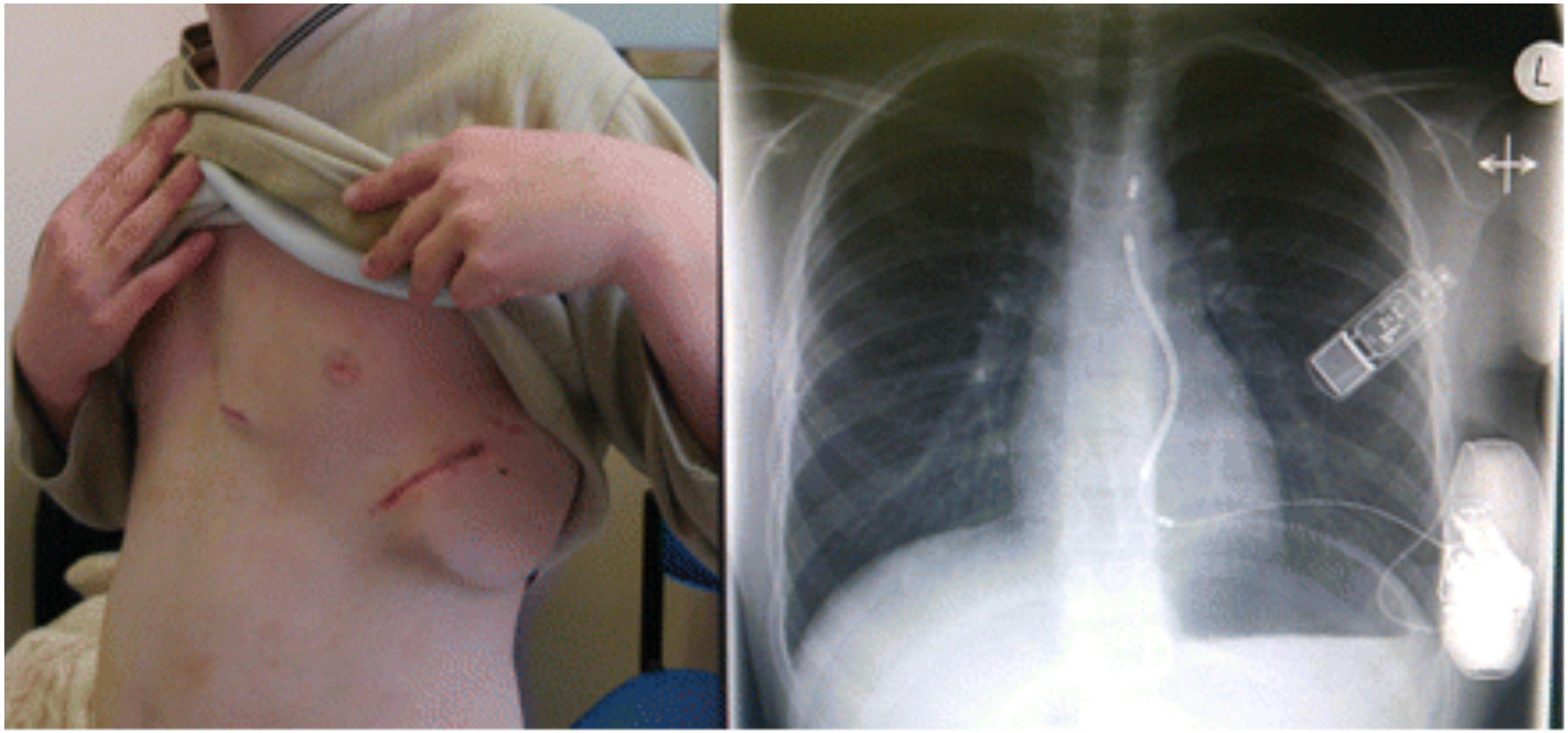


S-ICD

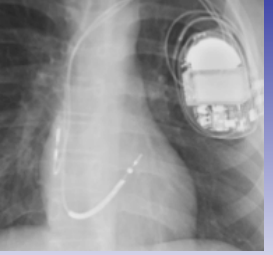




Subcutaneous ICD in Child (32 kg)

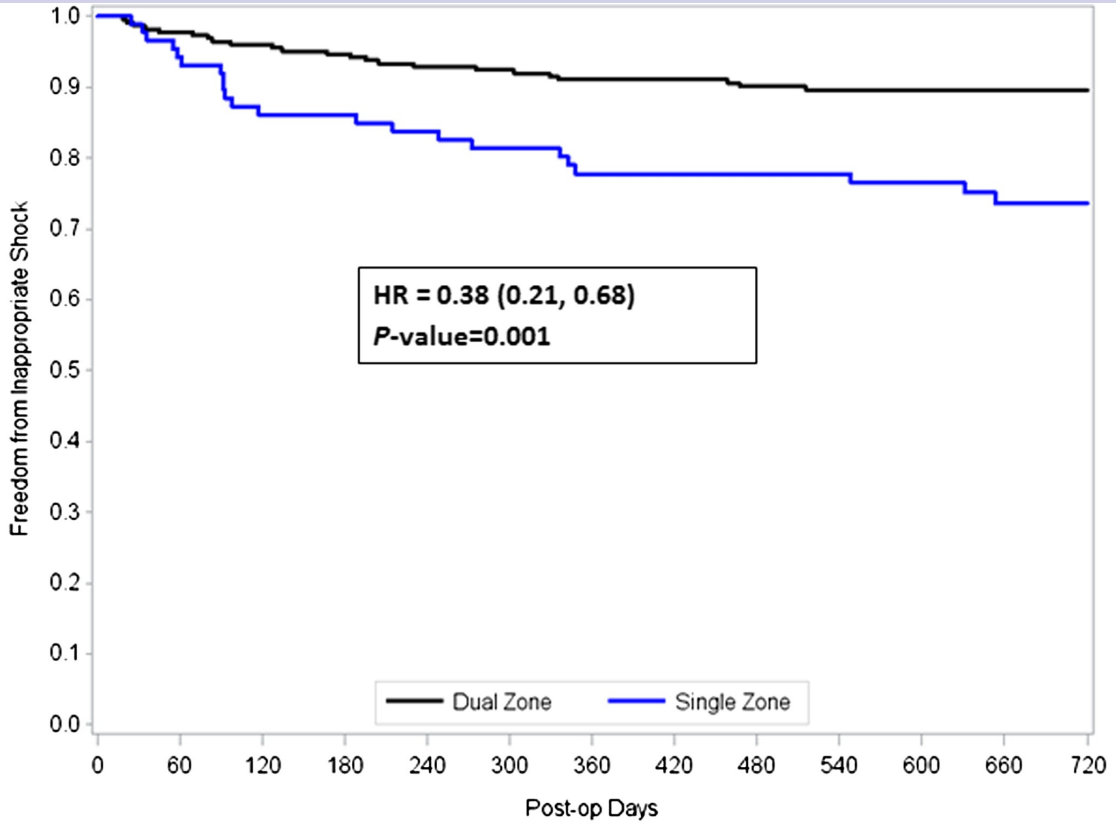


Jarman, et alEur Heart J. 2012;33(11):1351-1359



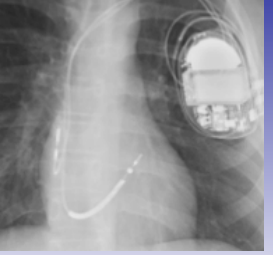
SQ ICD

- Addition of Dual Zone Discriminator improves inappropriate shock rate
- Choose appropriate patients

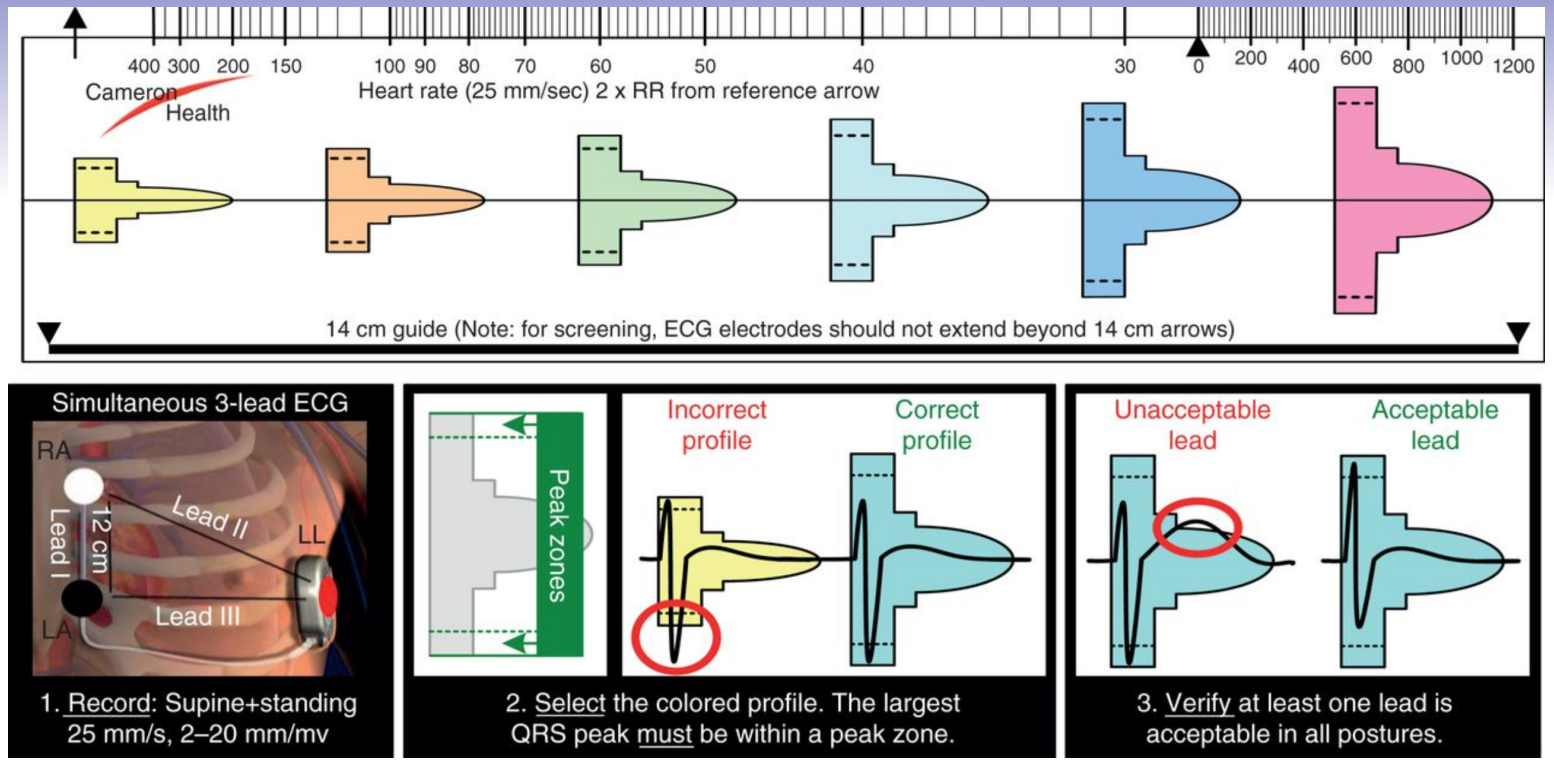


	Day 0	Day 180	Day 360	Day 540	Day 720
Single Zone					
KM Rate	100%	86.2%	77.8%	77.8%	73.6%
At risk	88	73	63	61	46
Dual Zone					
KM Rate	100%	94.7%	91.1%	89.7%	89.7%
At risk	226	211	199	173	43

Gold et al, Heart Rhythm 2014



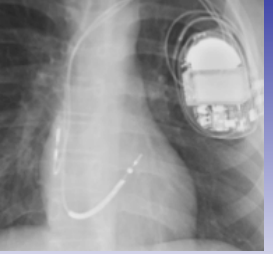
Screening in S-ICD



Sensitivity and Specificity of Screening:

- Sensitivity is worse in ACHD vs controls (84 vs 96%)
- Specificity is limited in both at 79%
- TOF particularly poor

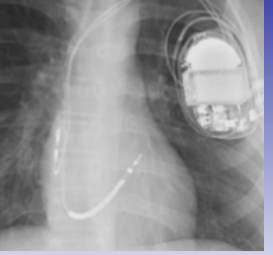
Zeb et al, IJC 2015



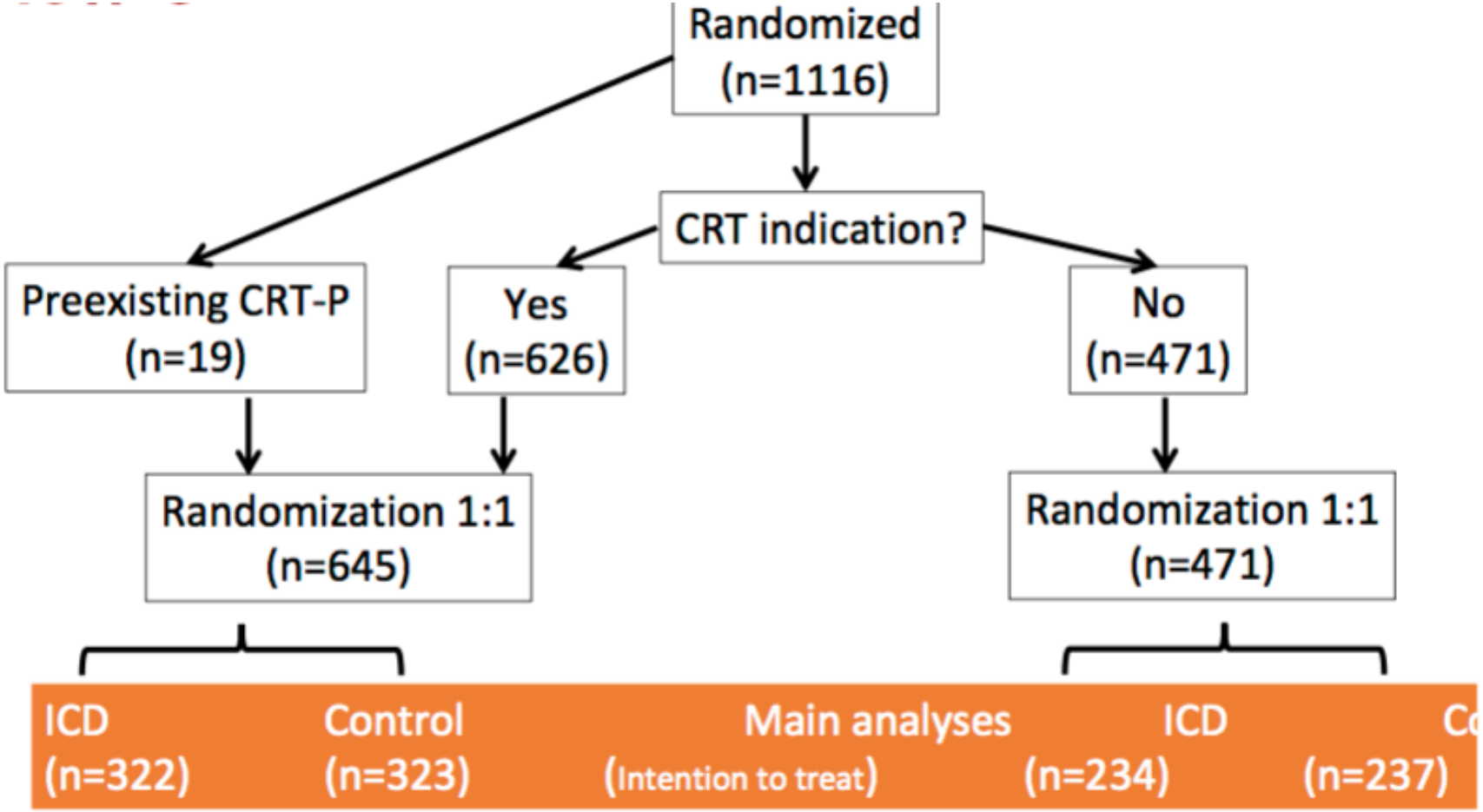
Arrhythmia Management – Sudden Death Risk

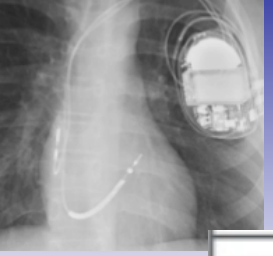
- Study which looked at risk factors for sudden cardiac death in ACHD patients
  - 19% of death was sudden
  - Multivariate analysis revealed
    - SVT OR of 3.5 (1.5-7.95) p = 0.004
    - QRS duration (per 10 ms increase) OR 1.22 (1.1-1.34) p = 0.008
    - Moderate to severely impaired systemic V function OR of 3.4 (1.1-10.43) p = 0.03

Koyak Circ 2012

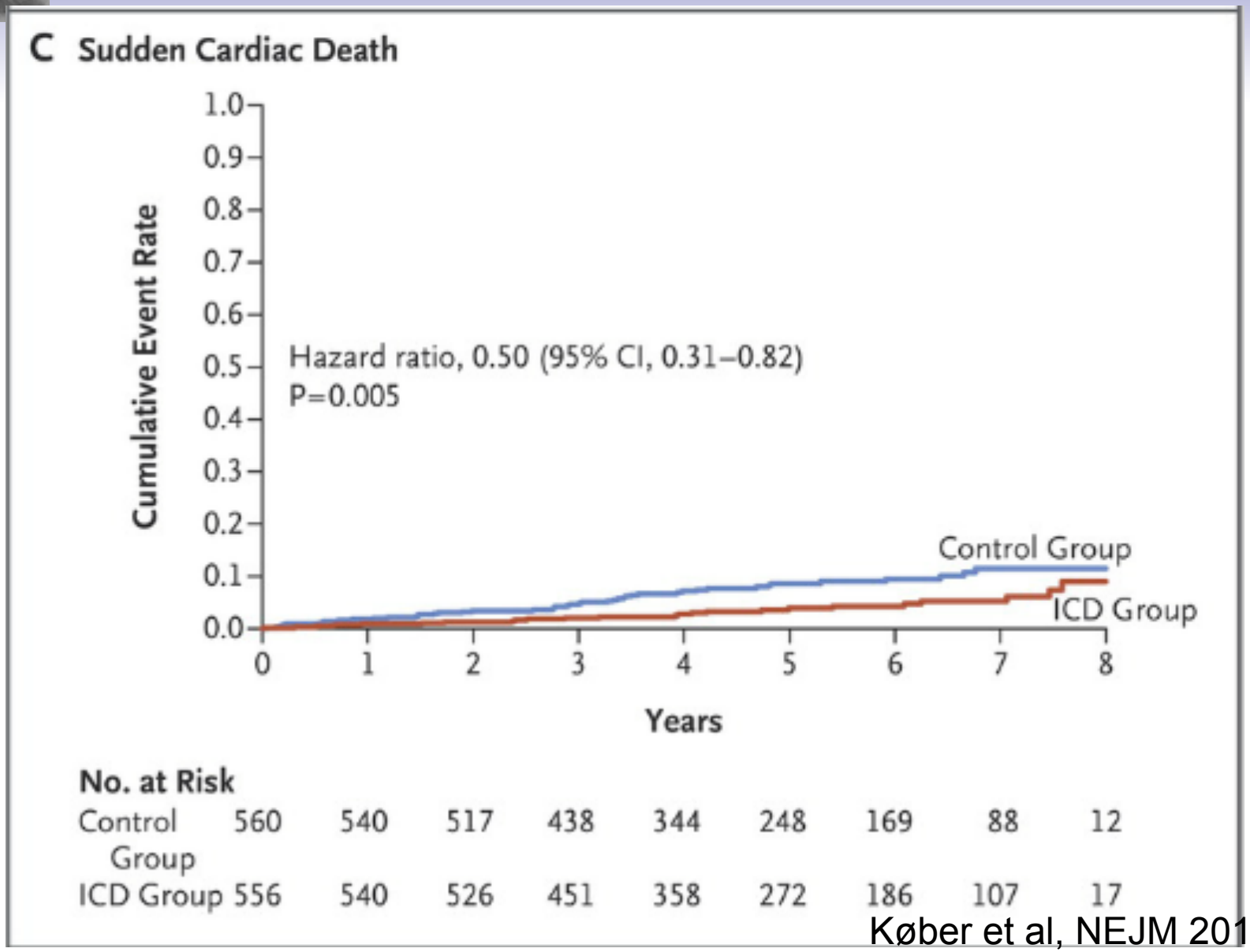


New Data - DANISH

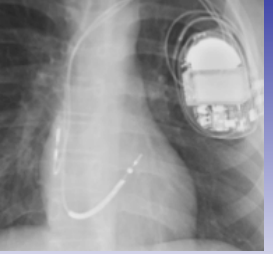




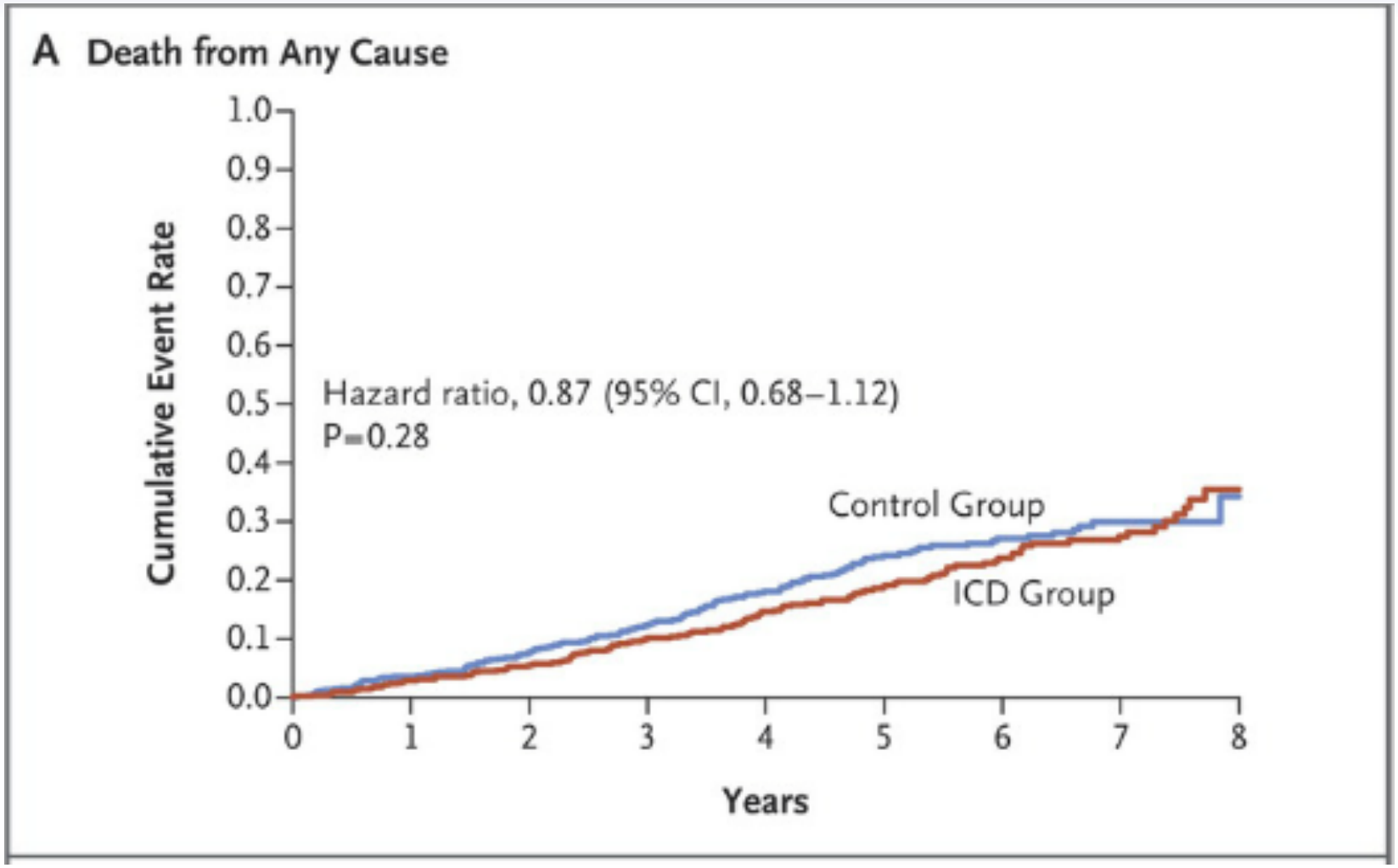
ICDs reduce SCD



Køber et al, NEJM 2016



…but not mortality



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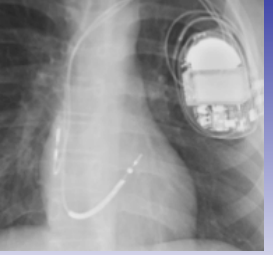
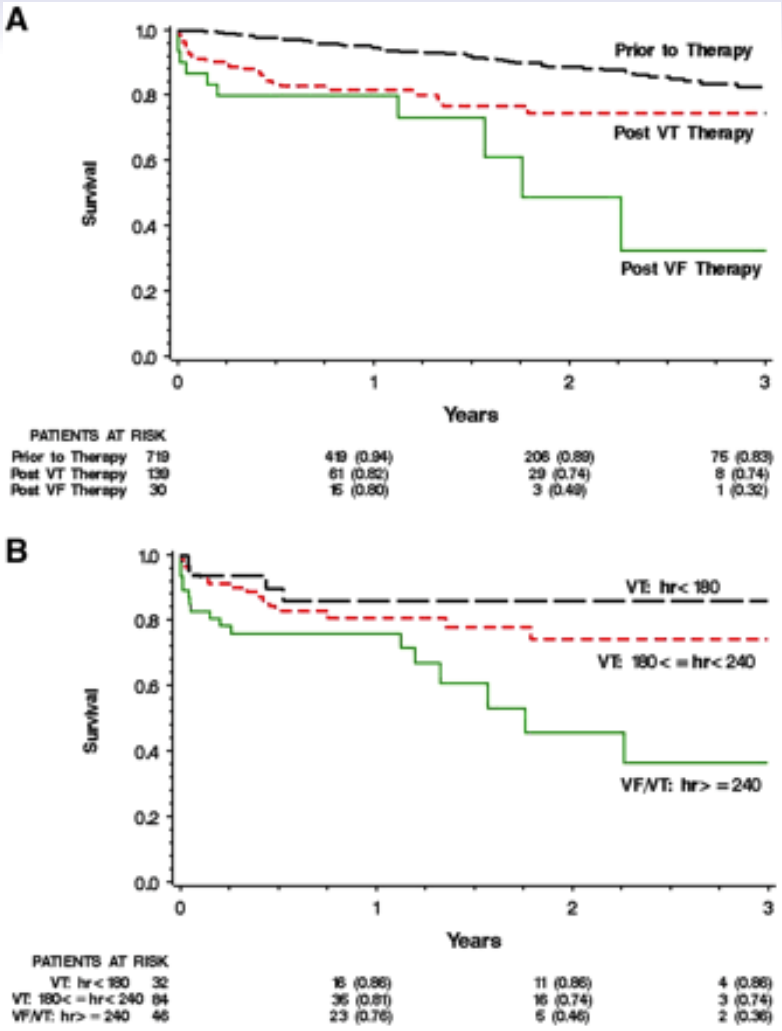
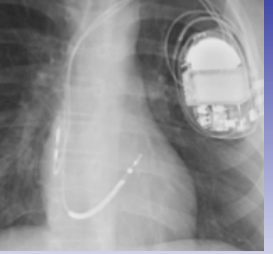


ICD Therapy- All shocks are bad

- Moss and colleagues raised the question of whether ICD shocks would increase mortality
  - Reviewed MADIT-II data of 720 patients with an ICD
  - HR of 3.4 (1.9-5.9) p < 0.001 with an appropriate shock
- Poole and colleagues looked at patients in SCD-HeFT and examined 829 patients
  - Appropriate discharges had a HR of 5.68 (3.97-8.12) p < 0.001
  - Inappropriate discharges had a HR of 1.98 (1.29-3.05)p= 0.002



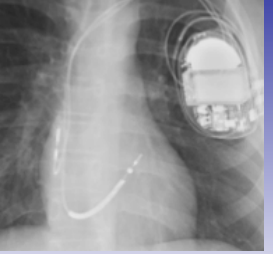
Moss Circ 2004
Poole N Eng J Med 2008



ICD therapy– All shocks are bad

- Several strategies employed to decrease ICD discharge rate
  - High-rate cute off programming
    - 365 adult patients with mean EF of 25%
    - Only 6.6% inappropriate shocks
  - Longer detection Intervals
    - Randomized study of 65 patients
    - 17.6 discharges/year vs. 2.9 discharges/year
- Important to keep in consideration when programming ICD therapies in young

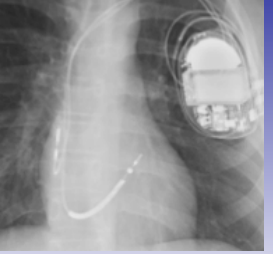
Clementy Europace 2012
Hayashi Heart Vessels 2016



Careful Risk Stratification

- ICDs are highly effective but carry a high morbidity
- Our task is to identify those who need the protection of an ICD…

- And those who are safer without one



ICDs in ACHD: Individualize!

- TV:
  - vascular access and no shunts
- Extracardiac:
  - no access or have intracardiac shunts
  - require pacing (brady or CRT) or will benefit from ATP
- SQ ICD:
  - Large enough
  - No need for brady pacing (?)
  - No need for ATP
  - No need for CRT
  - No access or have intracardiac shunts
  - Acceptable QRS and T waves

Thank You