

# What You Should Know About Subcutaneous and Transvenous ICD

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HCM Summit

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# ICD in HCM

Class I

ICD should be placed

Prior cardiac arrest  
Sustained VT

Class II

IIA

Family history SD-first-degree relative  
LV wall thickness  $\geq 30$  mm  
Recent unexplained syncope

IIB

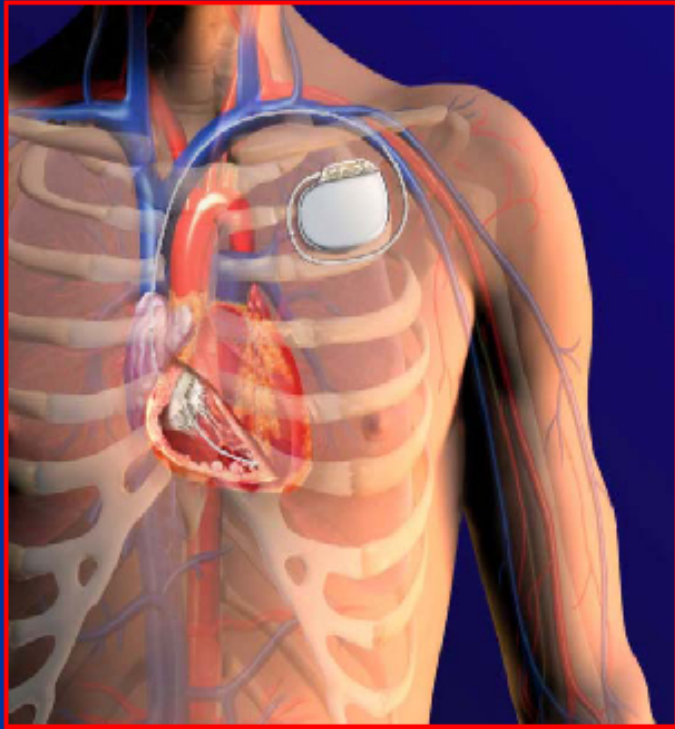
NSVT  
or  
↓BP ETT  
With other risk modifiers

Class III

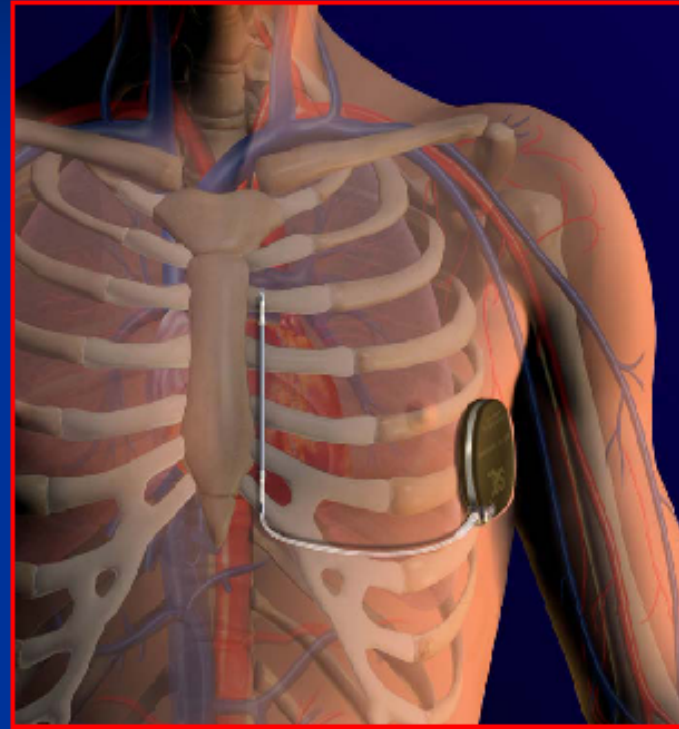
ICD not recommended

No prior cardiac arrest or sustained VT  
No risk factors

# Defibrillator Options



Transvenous

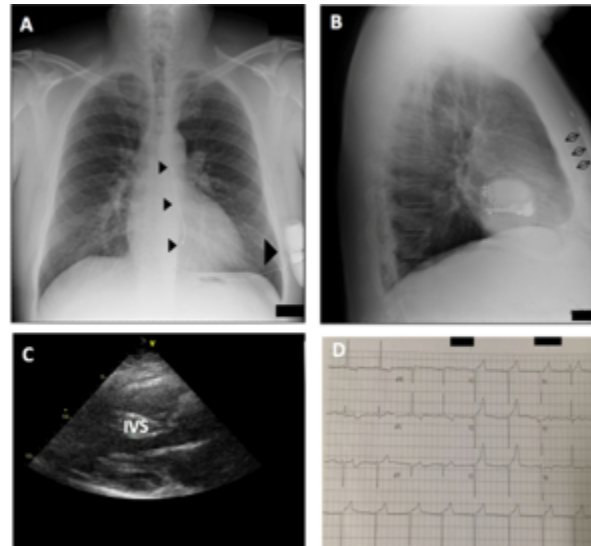
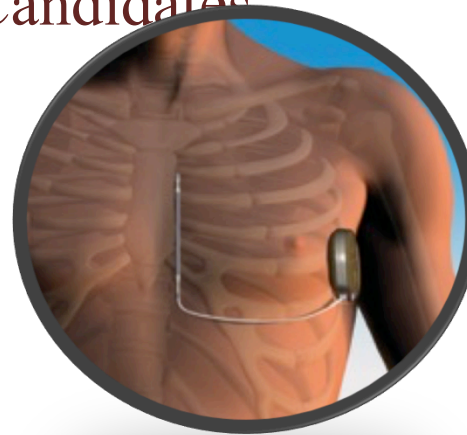


Subcutaneous

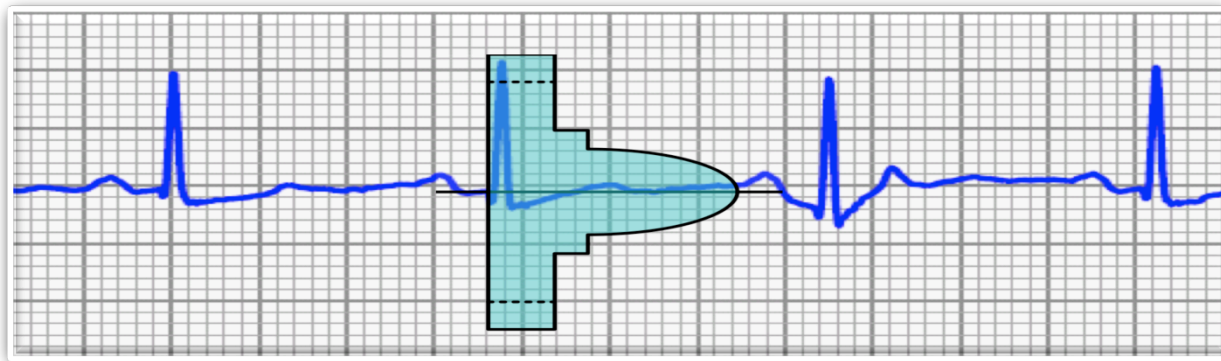
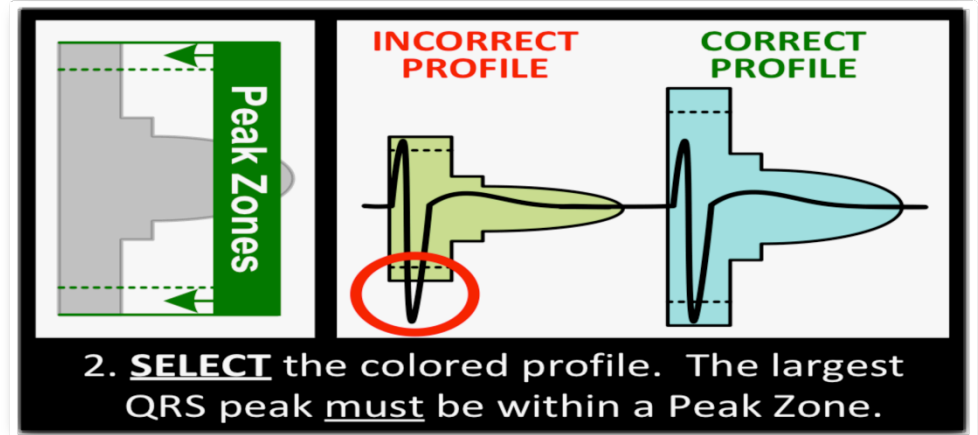
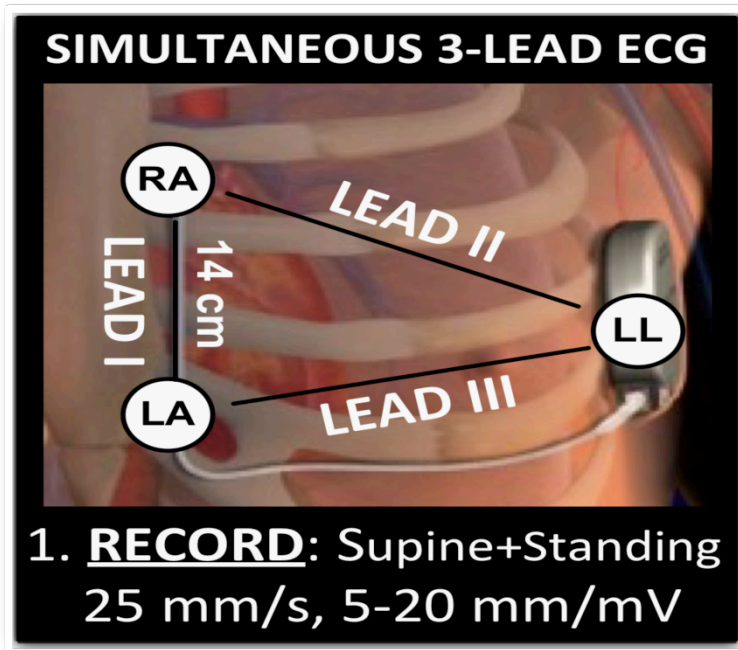


## S-ICD Candidates

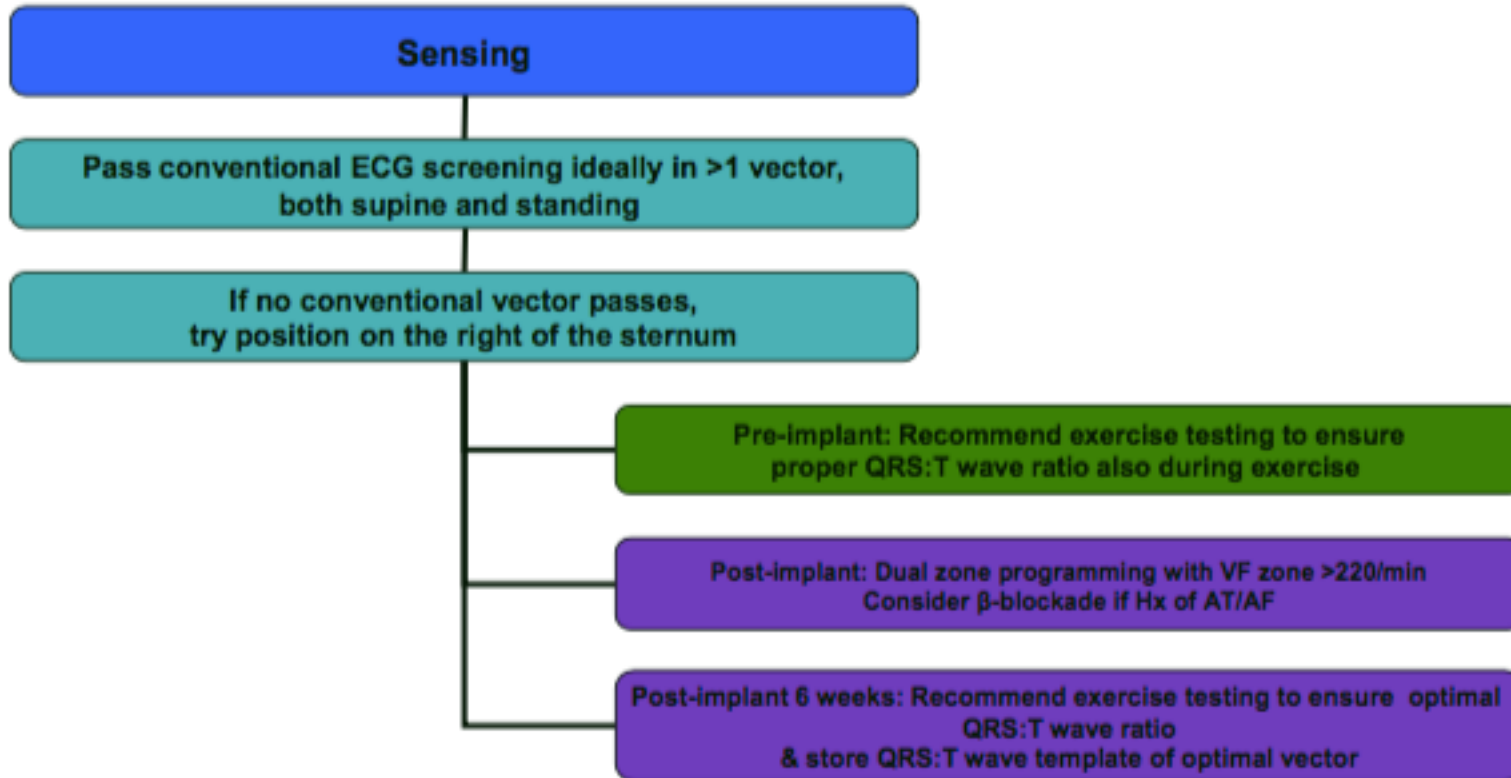
- High risk genetic disorders
- **HCM**
- LQTS
- Brugada
- High risk for lead complications
  - Young and active
  - Previous device infections
  - Diabetic and immunocomprised
- No venous access
  - Occluded veins
  - Congenital Heart Disease
- Transvenous leads undesirable
  - Hemodialysis patients
  - Younger Patients
- H/O Endocarditis or bacteremia



# Pre-implant evaluation



# Proposed strategy to avoid inappropriate shocks in hypertrophic cardiomyopathy (HCM) patients.



**Device Settings**

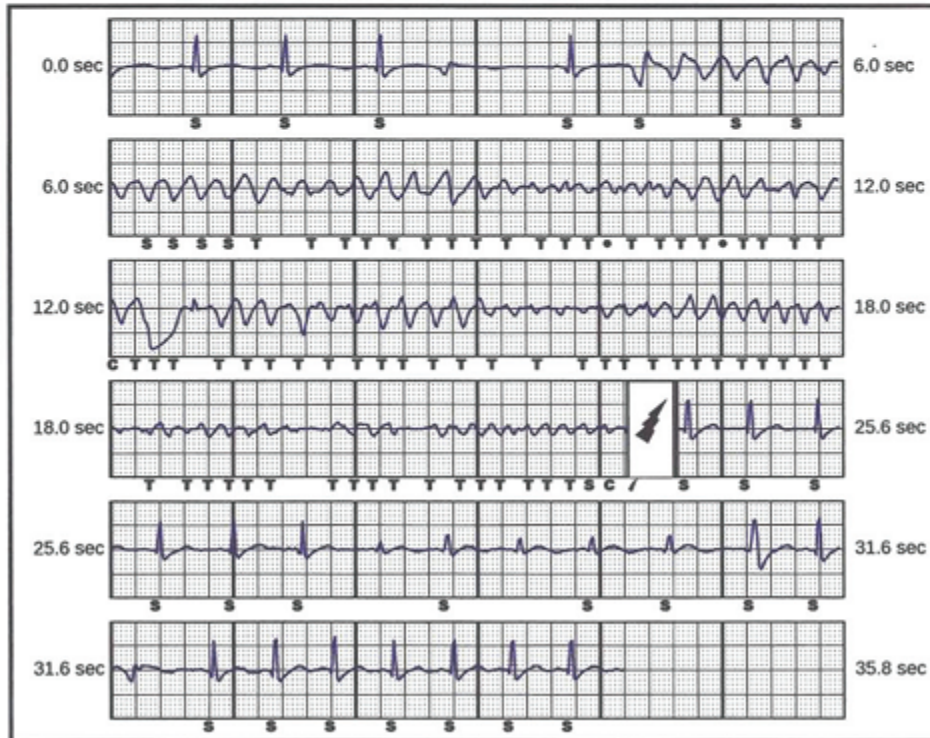
Therapy: ON  
Shock Zone: 220 bpm  
Conditional Shock Zone: 200 bpm  
Post Shock Pacing: ON

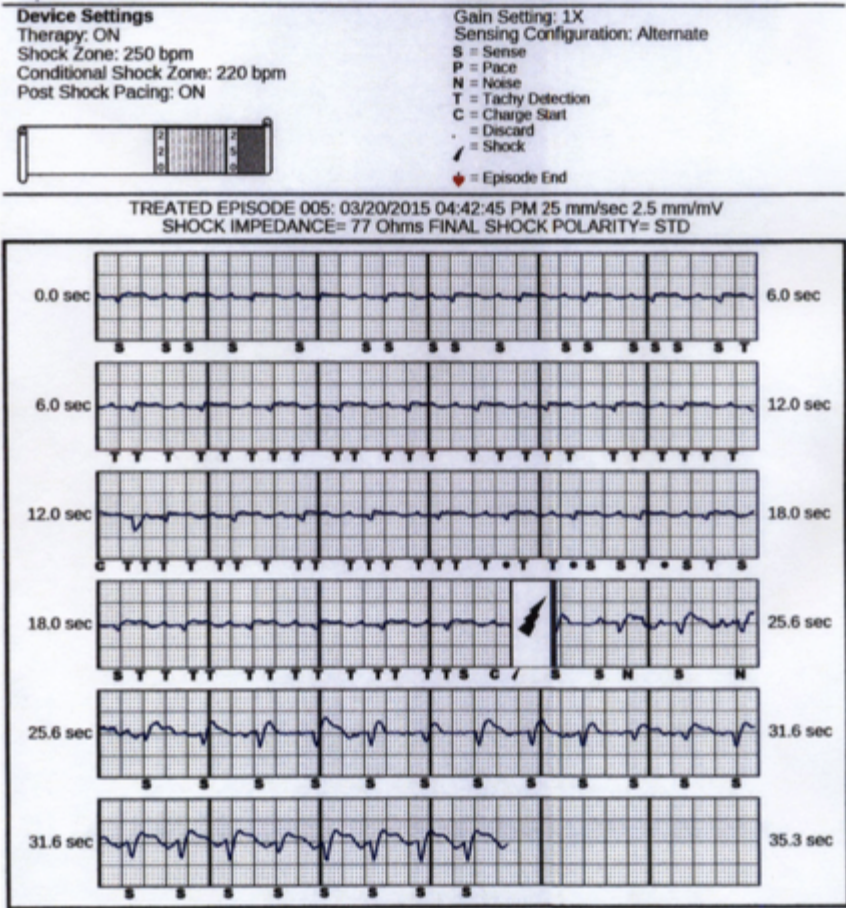


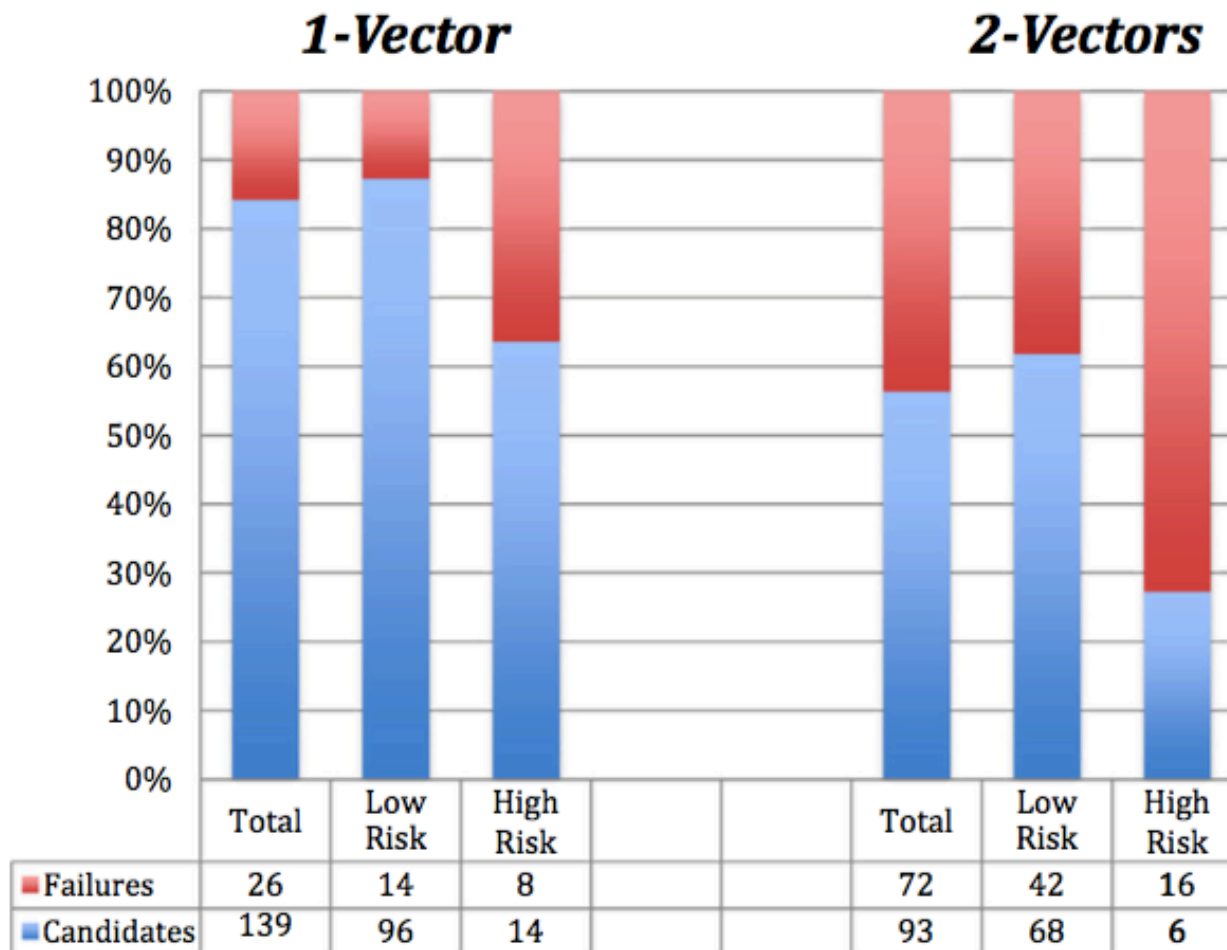
Gain Setting: 1X  
Sensing Configuration: Secondary

- S = Sense
- P = Pace
- N = Noise
- T = Tachy Detection
- C = Charge Start
- = Discard
- ⚡ = Shock
- ♦ = Episode End

TREATED EPISODE 001: 11/12/2015 05:43:51 PM 25 mm/sec 2.5 mm/mV  
SHOCK IMPEDANCE= 129 Ohms FINAL SHOCK POLARITY= STD

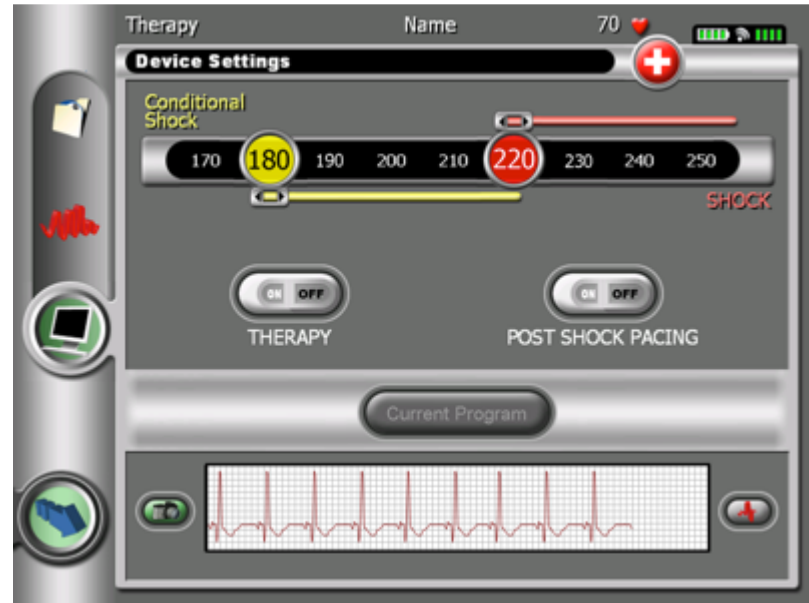
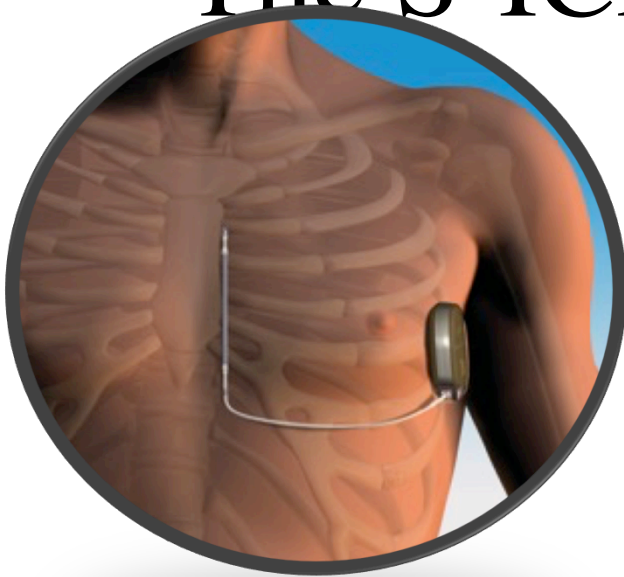






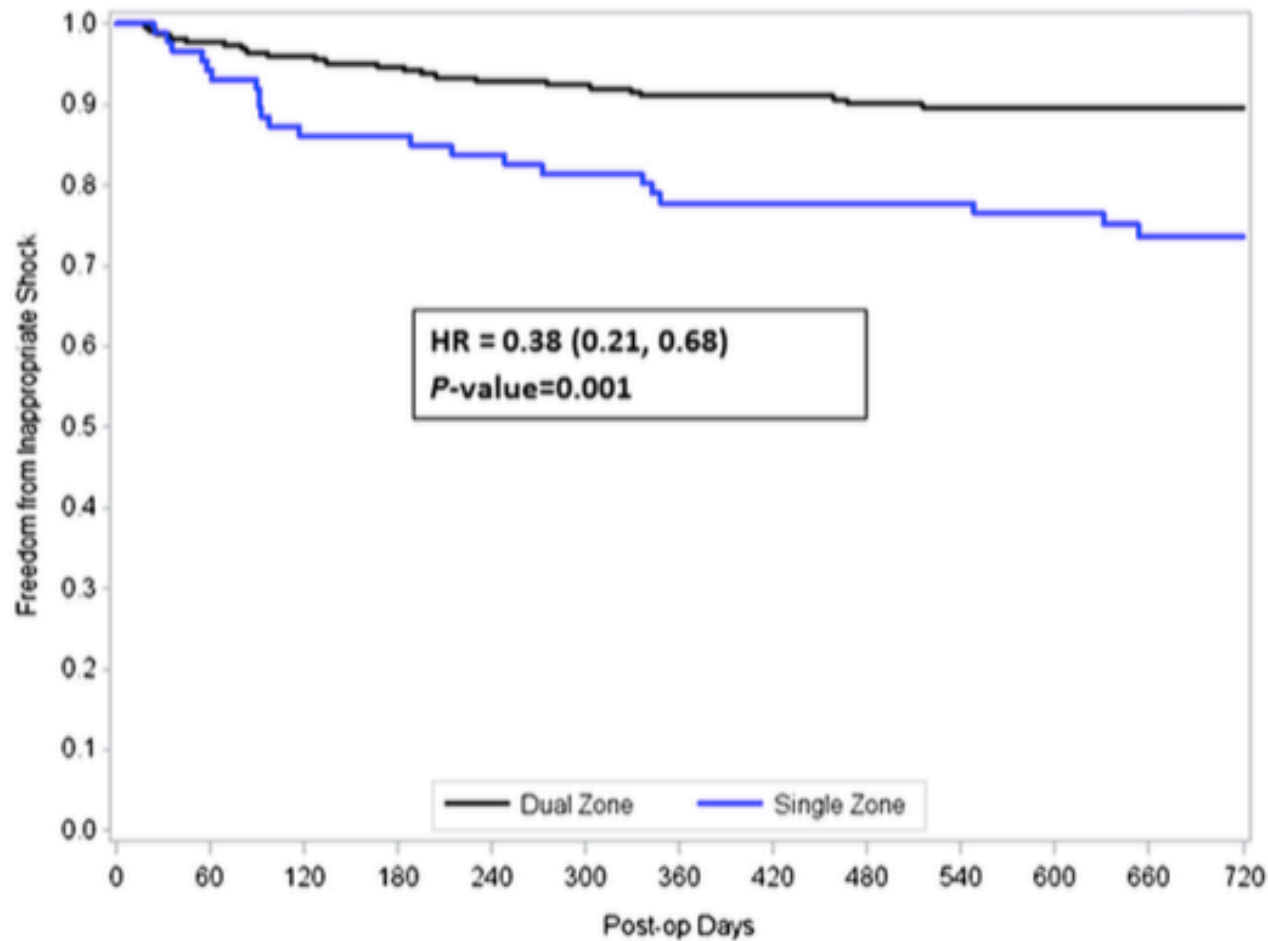
Maurizi et al Prevalence of subcutaneous implantable cardioverter- defibrillator candidacy based on template ECG screening in patients with hypertrophic cardiomyopathy Heart Rhythm 2016

# The S-ICD System Operation



Single-zone programming allows therapy to be delivered solely on measured heart rate

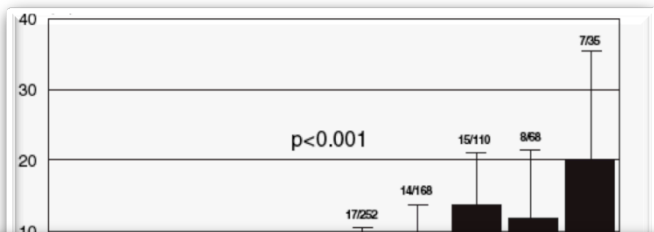
# Rhythm Discrimination with a Subcutaneous Defibrillator



Freedom from first inappropriate shock according to the number of zones programmed.

Gold et al Heart Rhythm 2014.

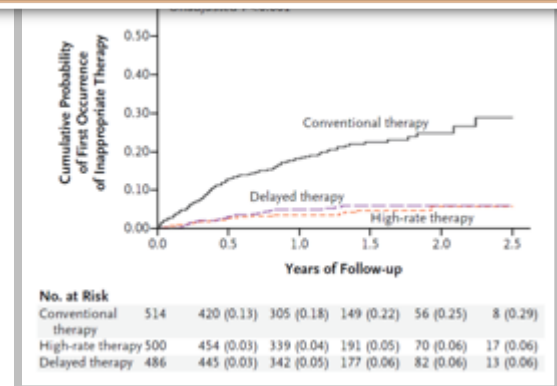
# Subcutaneous ICD



- *Transvenous leads are the weak link in current ICDs*
- *Prolonged detection/high rate detection is safe and improves outcomes*

2008 Fidelis Lead Recall

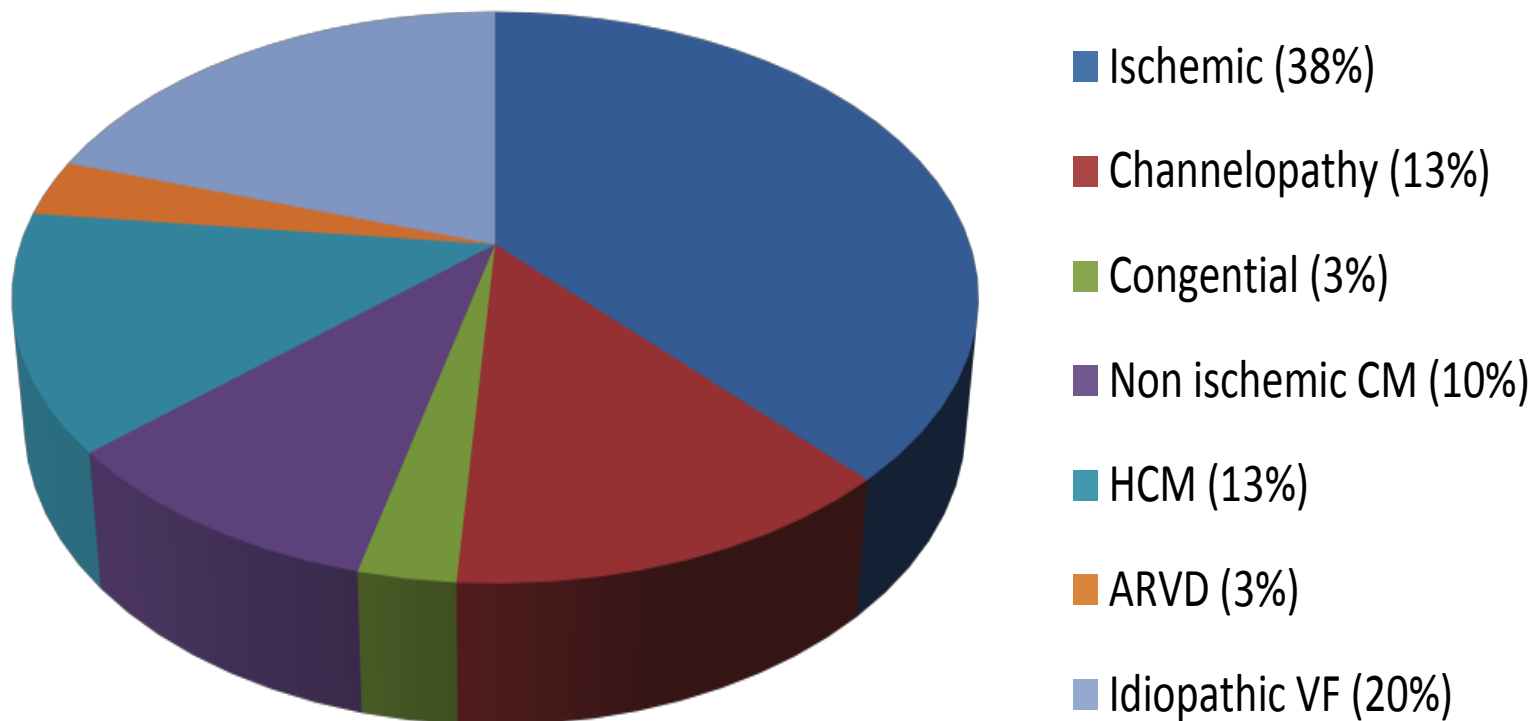
Kleemann *et al.* Circulation May 2007



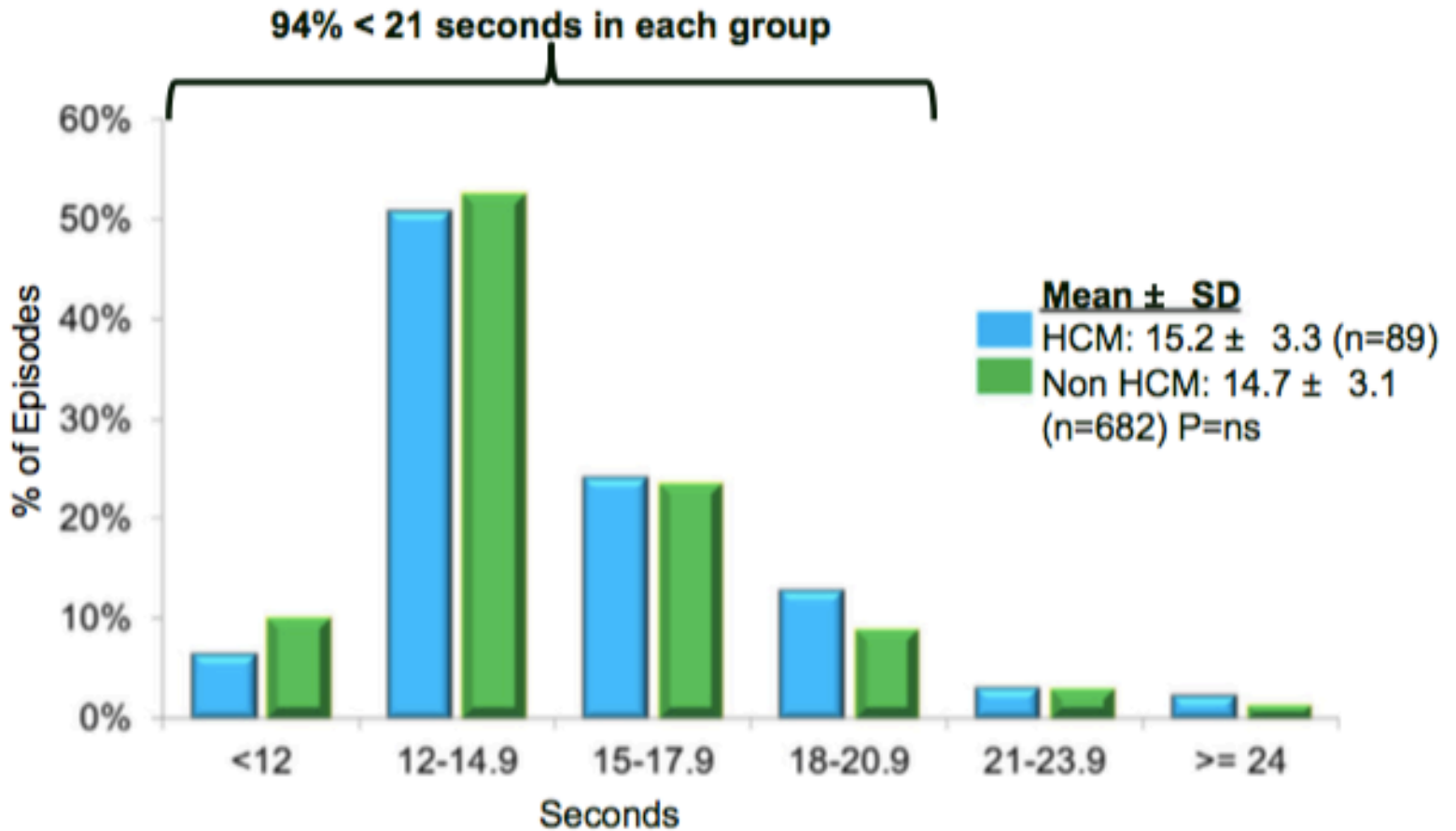
# EFFORTLESS Registry

Broad Range of ICD Indications

Patients from a broad range of indications have received the S-ICD

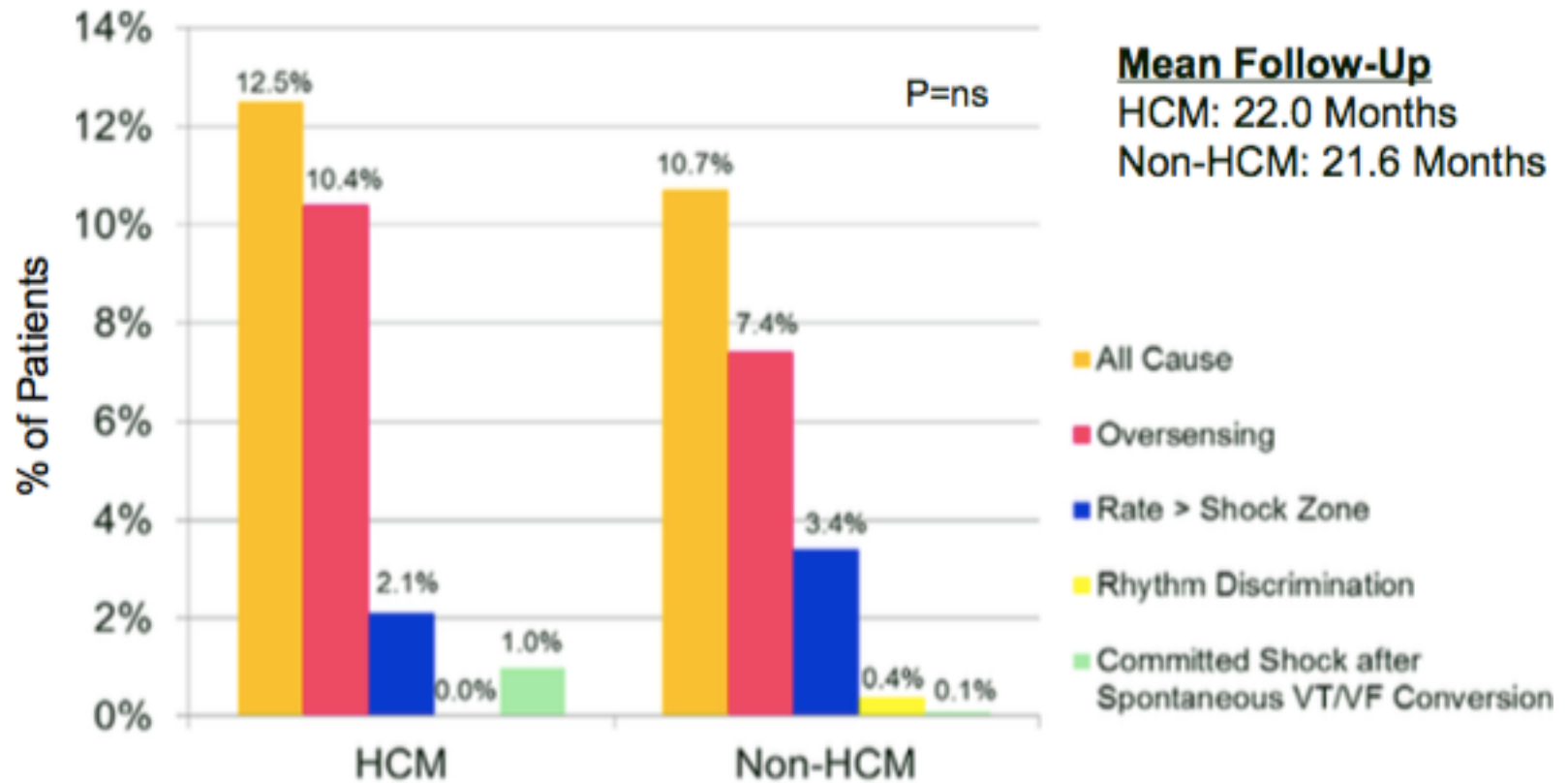


## S-ICD Conversion Testing at Implant

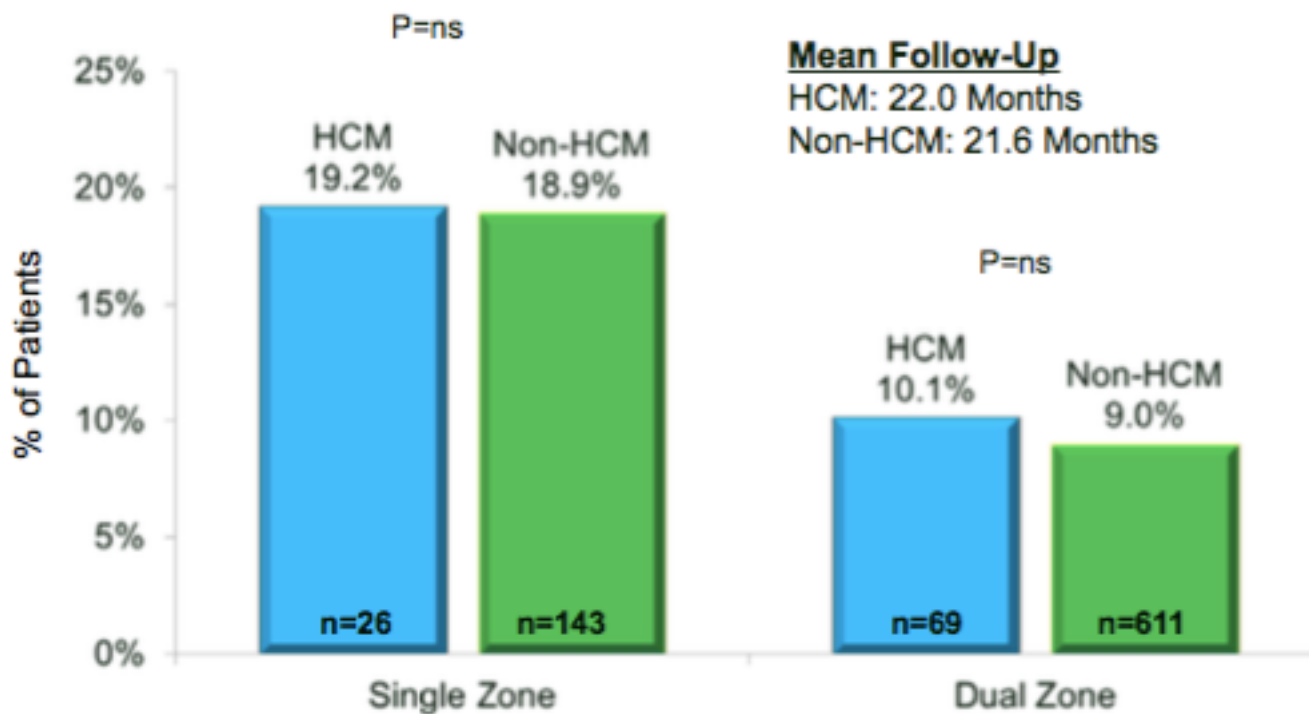


**Table 1** Detailed demographics of HCM and non-HCM populations in the pooled analysis

Category	HCM (n = 99)	Non-HCM (n = 773)	<i>P</i>
Age (y) (Range)	41.6 ± 15.8 (11–85.2)	51.3 ± 16.8 (7–88)	< .001
Male (%)	74.7	72.2	ns
Height (cm) (Range)	175.4 ± 9.3 (152–202)	174.5 ± 10.4 (137–208.0)	ns
Weight (kg) (Range)	86.8 ± 19.6 (34–153.3)	86 ± 23.2 (18–230.9)	ns
BMI (Range)	28.4 ± 6.2 (19–48.7)	28.2 ± 6.7 (15.2–69)	ns
LVEF (%) Range	65.1 ± 9.9 (34–86)	36.2 ± 15.6 (10–80)	< .001
Primary prevention (%)	87.9	67.5	< .001
Medical history			

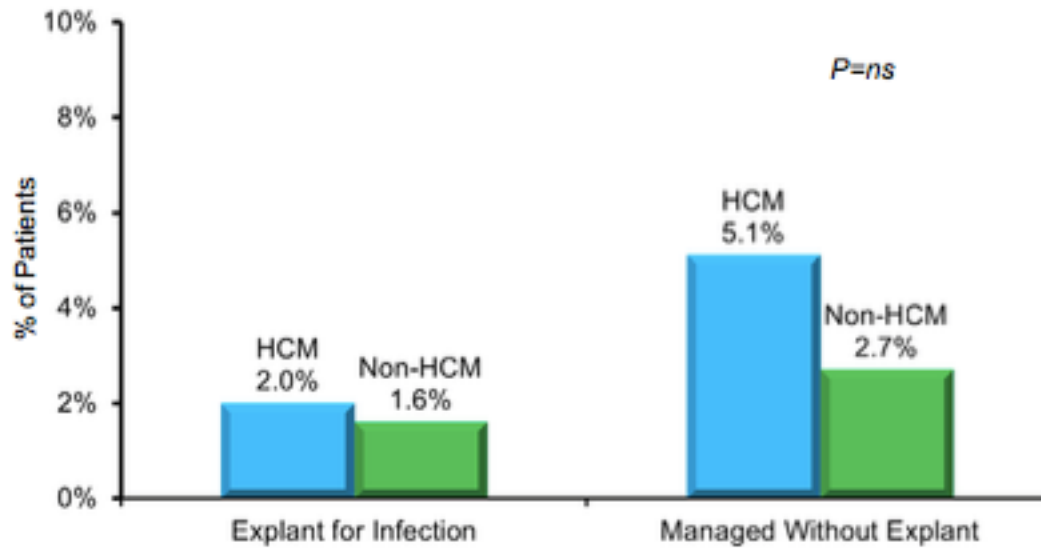


Lambiase, et al Evaluation of subcutaneous ICD early performance in hypertrophic cardiomyopathy from the pooled EFFORTLESS and IDE cohorts Heart Rhythm 2016



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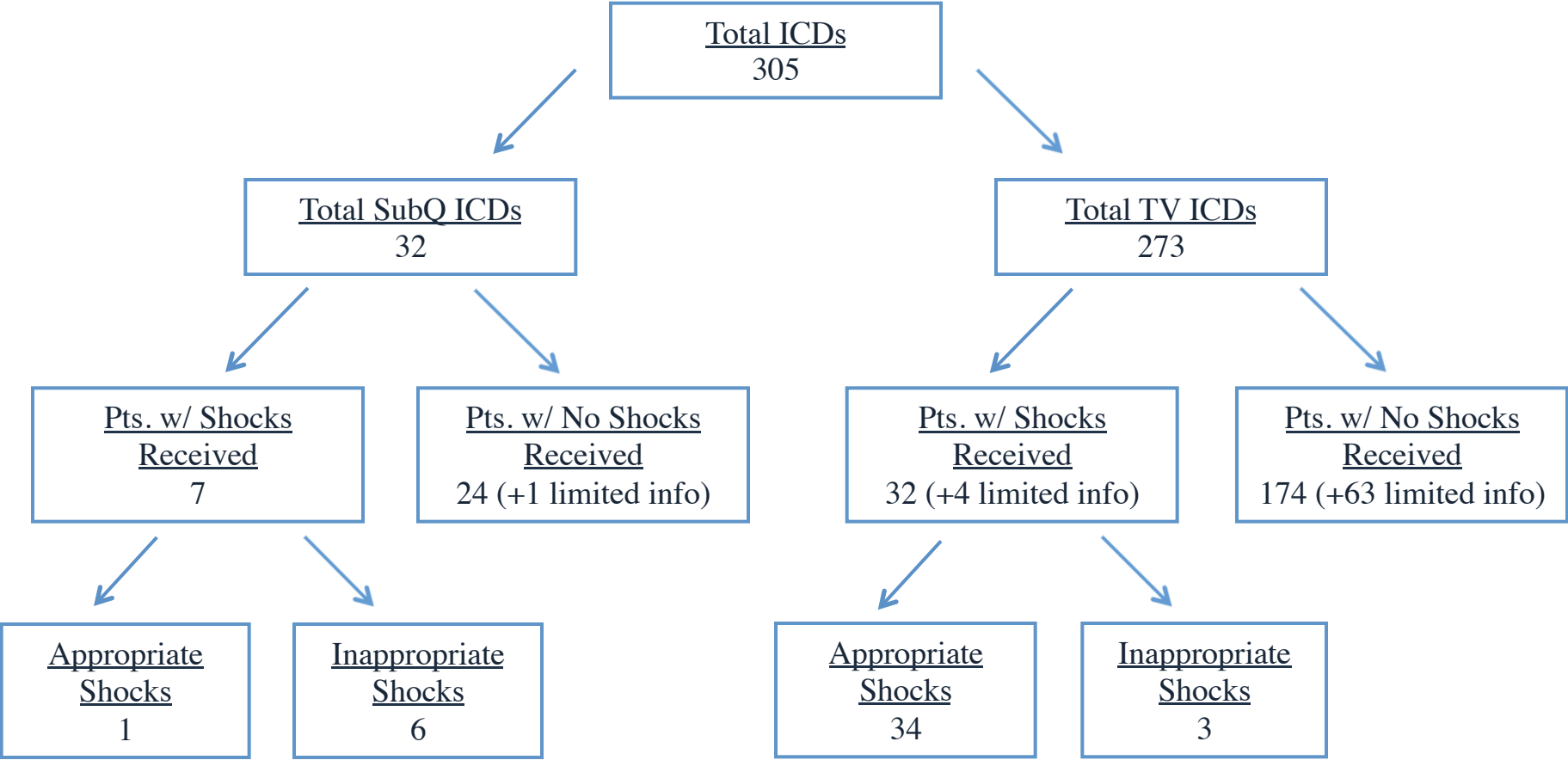
## Infections

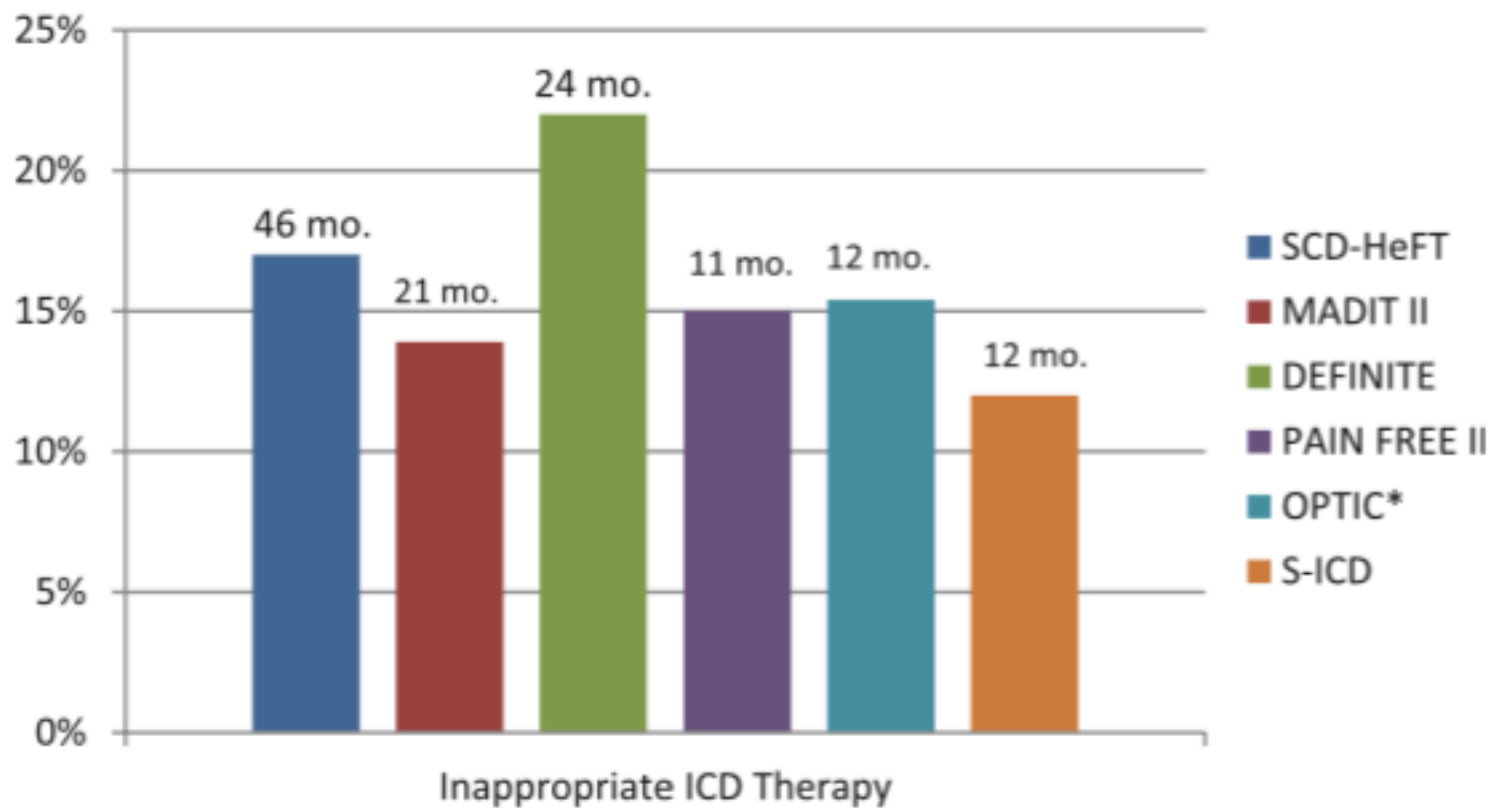


**Table 3** Comparison of S-ICD outcomes with an HCM TV-ICD meta-analysis<sup>20</sup>

Outcomes	Pooled HCM S-ICD (% pts)	Pooled non-HCM S-ICD (% pts)	HCM TV-ICD meta-analysis (% pts)	HCM S-ICD event rate (% pts/y)	HCM TV-ICD meta-analysis event rate (% pts/y)
Appropriate shocks	3	7.3	13.7 (9.9–17.5)	1.7	3.3 (2.2–4.4)
Inappropriate shocks	12.5	10.7	19 (12.6–25.4)	6.9	4.8 (2.2–6.7)
Complications					
Infection	2	1.6	3.1 (1.2–5)	1.1	0.6 (0.1–1)
Erosion	0	1.4			
Lead displacement	1	0.5	2.7 (1.6–3.9)	0.6	1.5 (0.9–1.1)
Lead displacement/malposition/ suboptimal system position	3	1.8	2.7 (1.6–3.9)	1.5	1.5 (0.9–1.1)
Lead malfunction	0	0	6.2 (4.1–8.3)	0	1 (0.5–1.4)
Conversion success rates					
Induced VT/VF	98.9	98.5			
Spontaneous VT/VF	100	98			

# ICDs in HCM Pts.





# ICD with Subcutaneous Leads

- Advantages
  - No transvenous lead complications
  - Fluoroscopy not required for implant
  - Ultra far field signals for arrhythmia discrimination
- Disadvantages
  - Post shock pacing only (No Brady, CRT, ATP)
  - No remote monitoring
  - Larger Pulse generator



## Patient Groups for S-ICD Implantation

- ***S-ICD is preferred device***
  - Channelopathies (long-QT syndrome, Brugada, hypertrophic cardiomyopathy)
  - No venous access (occluded veins or congenital anomalies)
  - High risk of complications for transvenous systems have (dialysis, pediatric, and immunocompromised)
  - Previous device infections or lead failures
  - History of endocarditis
  
- ***S-ICD should be strongly considered***
  - Young patients  
Life expectancy >10 y
  - Primary prevention indicated patients with ischemic/nonischemic heart failure
  - Prosthetic valves  
Women (preferred generator placement lateral wall)
  - Selected secondary prevention indicated patients (survivors of out-of-hospital VF, no evidence of monomorphic VT)
  
- ***S-ICD should be avoided***
  - Systolic heart failure and LBBB who are indicated for CRT
  - Symptomatic bradycardia requiring pacemaker

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