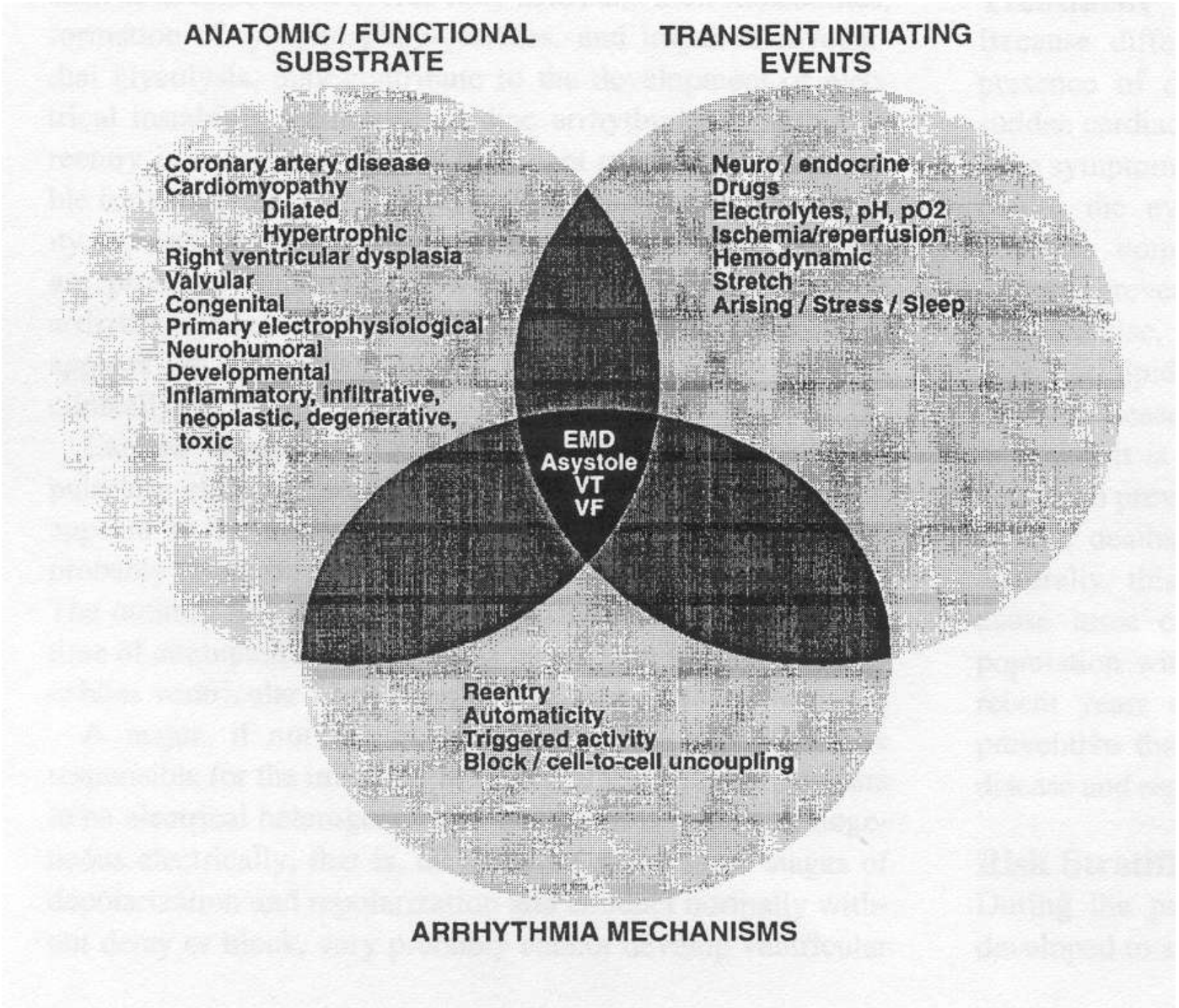
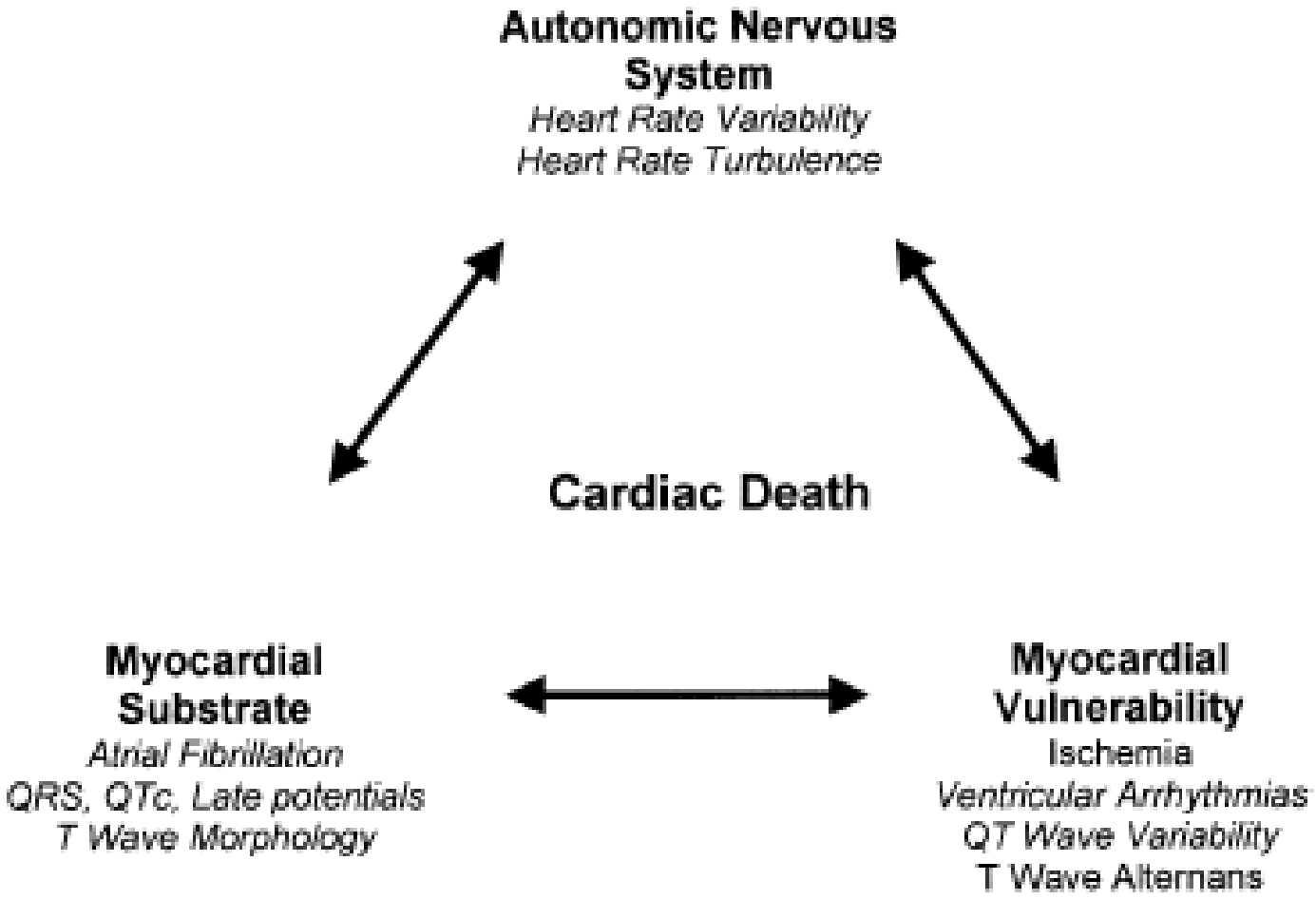
Ειναι το κλάσμα εξώθησης αρκετό για απόφαση εμφύτευσης απινιδωτή?

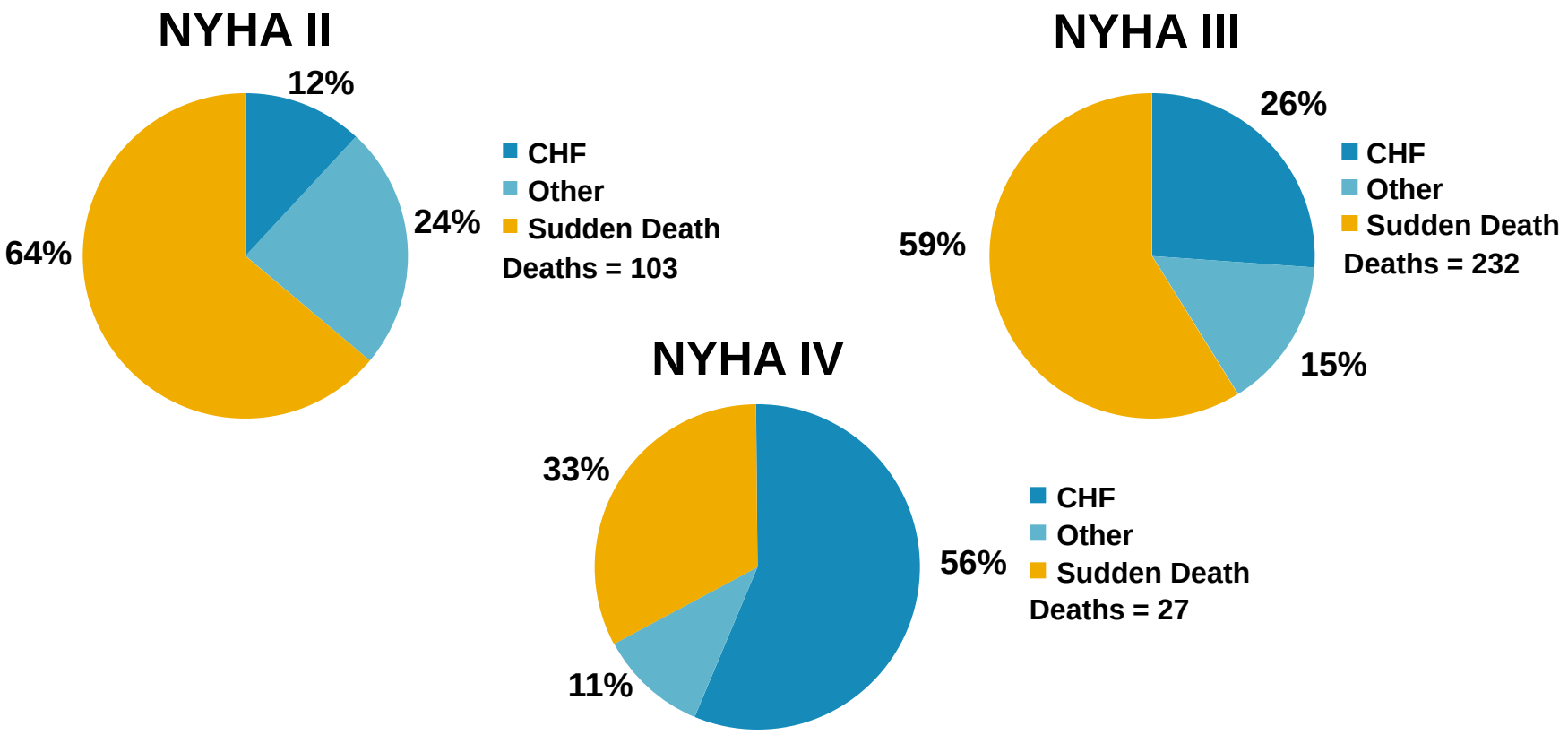
Βασίλειος Π. Βασιλικός FACC, FESC
Αναπληρωτής Καθηγητής ΑΠΘ


ANATOMIC / FUNCTIONAL SUBSTRATE
TRANSIENT INITIATING EVENTS
Coronary artery disease
Cardiomyopathy
Dilated
Hypertrophic
Right ventricular dysplasia
Valvular
Congenital
Primary electrophysiological
Neurohumoral
Developmental
Inflammatory, infiltrative, neoplastic, degenerative, toxic
Neuro / endocrine
Drugs
Electrolytes, pH, pO2
Ischemia/reperfusion
Hemodynamic
Stretch
Arising / Stress / Sleep
EMD
Asystole
VT
VF
Reentry
Automaticity
Triggered activity
Block / cell-to-cell uncoupling
ARRHYTHMIA MECHANISMS


Autonomic Nervous System
Heart Rate Variability
Heart Rate Turbulence
Cardiac Death
Myocardial Substrate
Atrial Fibrillation
QRS, QTc, Late potentials
T Wave Morphology
Myocardial Vulnerability
Ischemia
Ventricular Arrhythmias
QT Wave Variability
T Wave Alternans

SCD in Heart Failure

SCD–a prominent mode of death



MERIT-HF study group. Effect of metoprolol CR/XL in chronic heart failure: metoprolol CR/XL randomized intervention trial in congestive heart failure (MERIT-HF). *LANCET.* 1999;353:2005.

Metanalysis arrhythmic vs non-arrhythmic mortality

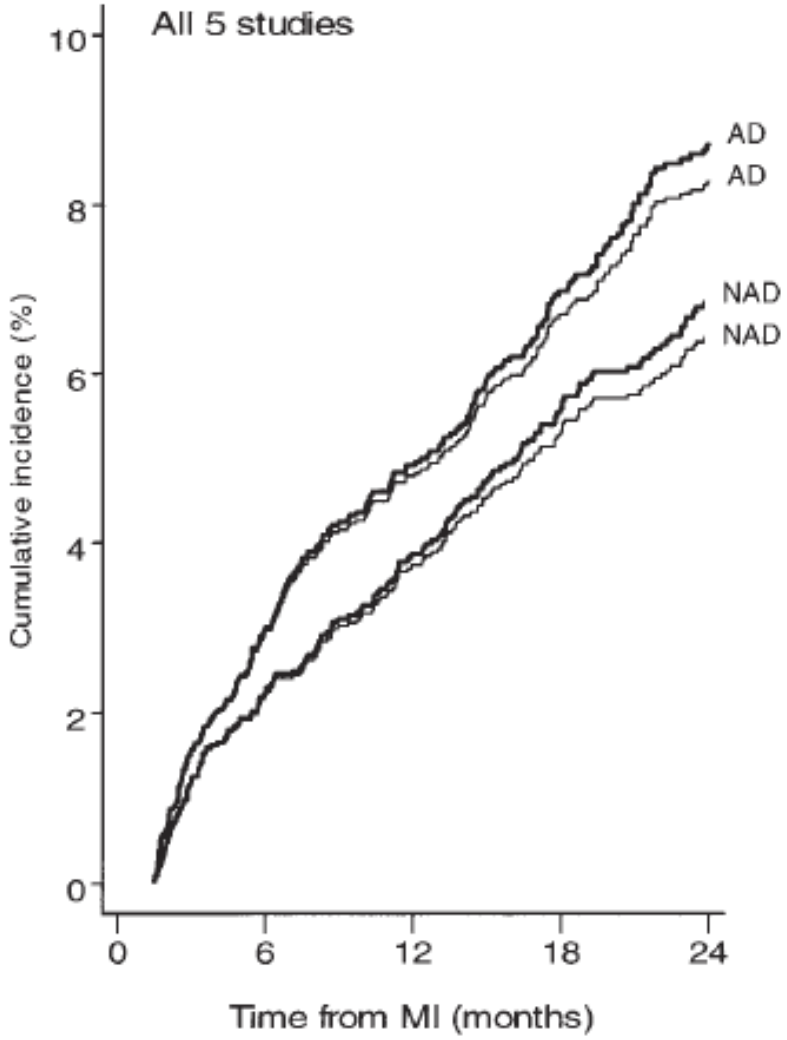
Yap et al, EHJ 2005

Table 2 Rates of arrhythmic and non-arrhythmic cardiac mortality for all patients measured from day 45 after MI and patients from TRACE and DIAMOND-MI that were measured from day of MI

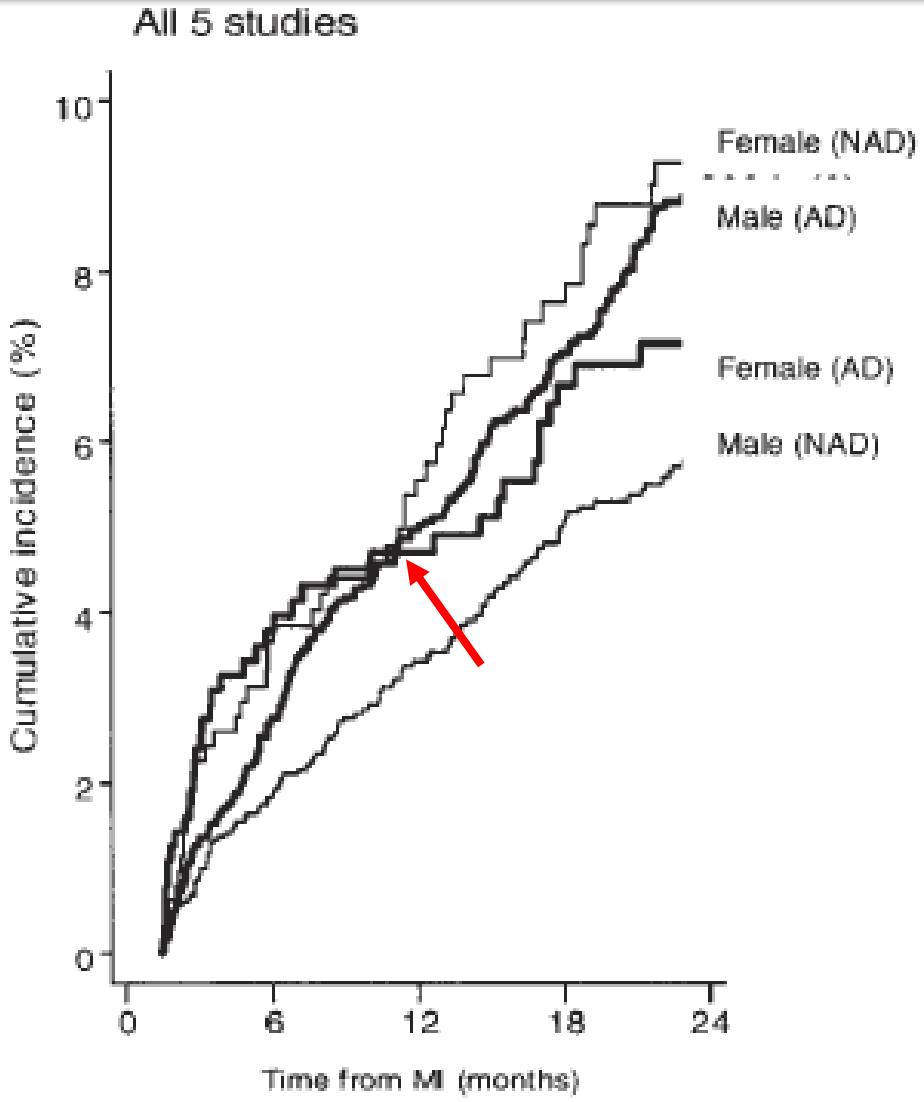
	Up to 6 month	>6–12 month	>12–18 month	>18–24 month	Overall
Rate per 100 person-year at risk					
Survival from day 45 after MI from all five studies					
AD	8.09	4.07	4.34	3.76	4.68
NAD	6.07	3.35	3.60	2.77	3.66
Survival from date of MI from TRACE and DIAMOND-MI					
AD	23.97	5.62	5.14	4.96	11.01
NAD	18.91	5.28	5.14	4.48	9.28

Overall mode of cardiac death did not appear to change over time, with the rate of arrhythmic death consistently higher than NAD.

Metanalysis arrhythmic vs non-arrhythmic mortality *Yap et al, EHJ 2005*

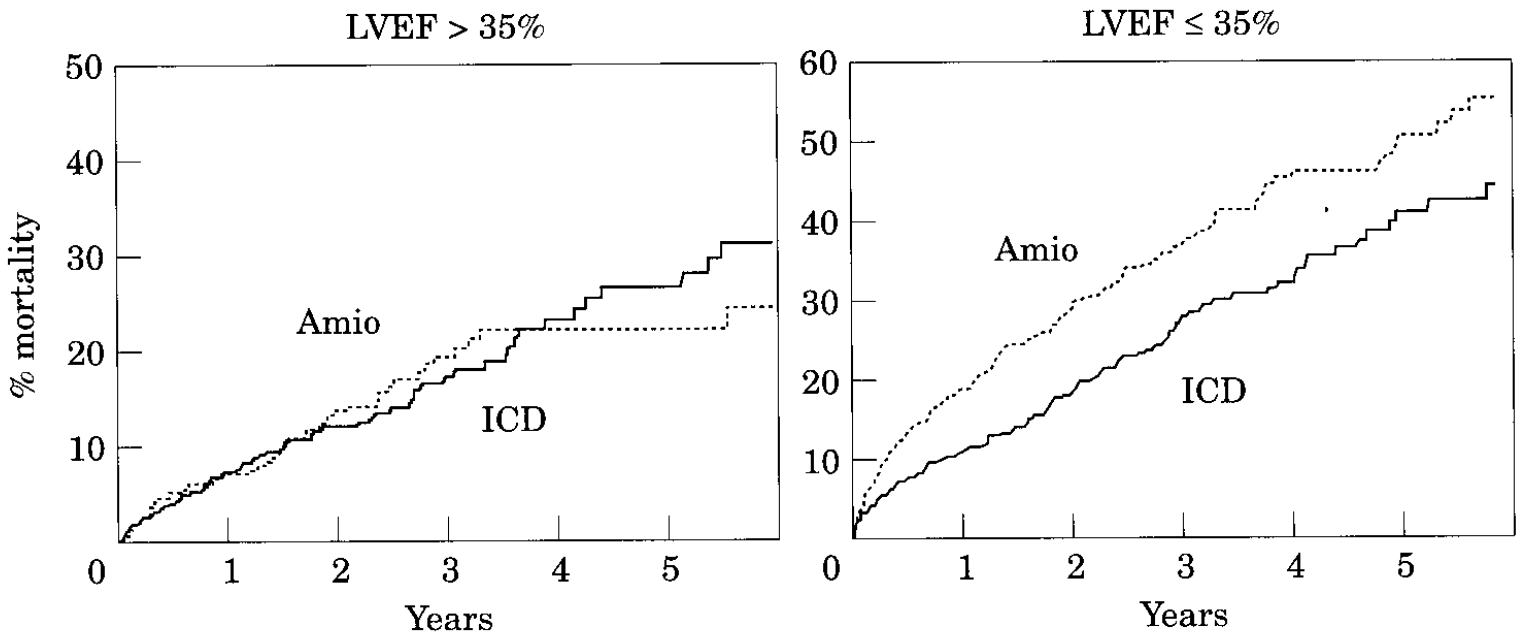


Metanalysis arrhythmic vs non-arrhythmic mortality *Yap et al, EHJ 2005*



Risk factors

- Reduced LVEF
- VPBs and NSVT documented on 24-hour ambulatory monitoring
- VT induced by EPS
- SAECG
- Reduced HRV
- T wave (repolarization) alternans (TWA)



Number at risk

ICD:	337	272	191	121	71	53	583	432	265	145	86	49
Amio:	307	233	162	97	57	40	608	417	255	145	68	40

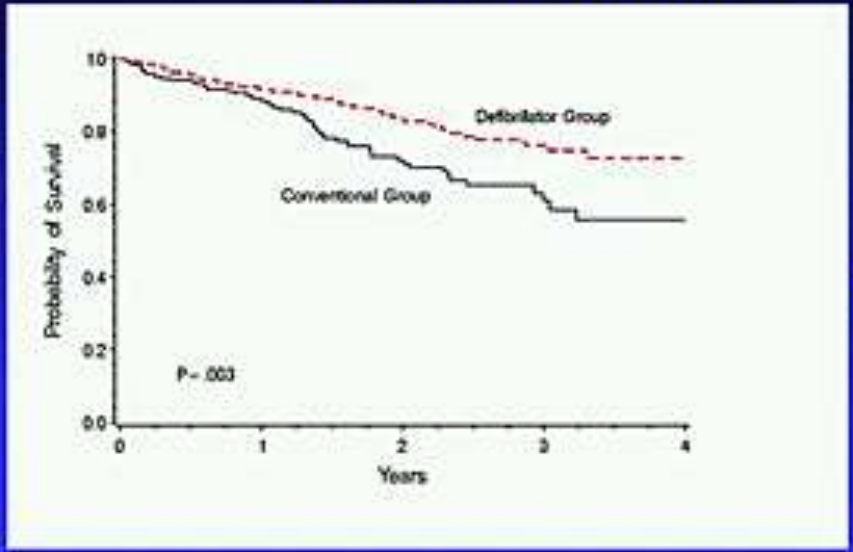
Figure 2 **Cumulative risk of death for patients with left ventricular ejection fraction (LVEF) >35% and ≤35%.**

Connoly et al., Eur Heart J 2000

Noninvasive ECG Parameters in Multivariate Cox Model for Predicting Total Mortality in MADIT II Patients Randomized to Conventional Therapy

Variable	HR	(95% CI)	P value
Age≥65 years	1.47	(0.86-2.52)	0.164
NYHA ≥II	2.00	(1.20-3.34)	0.008
BUN>25	1.94	(1.17-3.21)	0.010
No BB use	1.57	(0.94-2.66)	0.089
A. Fib.	2.36	(1.14-4.89)	0.021
QRS>0.12 sec	1.90	(1.14-3.14)	0.013

Survival in Defibrillator Group and Conventional Treatment Group in 530 MADIT II Patients with QRS ≥ 0.12 sec (excluding paced patients).



	Mortality 2-yr	3-yr
Conv	27%	39%
ICD	17%	24%

HR=0.51 (p=0.070) → 49% reduction in mortality

VPCs

Table 2. Sensitivity and specificity of ventricular arrhythmias in the Betablocker Heart Attack Trial (BHAT) in predicting total mortality and sudden cardiac mortality

Premature ventricular beats features	Total mortality, %		Sudden death mortality, %	
	Sensitivity	Specificity	Sensitivity	Specificity
10/h	26	88	25	87
Repetitive	33	82	34	80
10/h or repetitive (either)	44	76	43	75
10/h and repetitive (both)	14	94	16	94

VPCs - EF

Table 1. Relationship between percent ejection fraction and premature ventricular beats in the Multicenter Investigation for Limitation of Infarct Size study (MILIS)

Patients		Global mortality, %	Sudden death mortality, %	Relative risk
PVB < 10	EF > 40%	5	2	1
PVB > 10	EF < 40%	19	10	6
PVB < 10	EF > 40%	20	8	5
PVB > 10	EF < 40%	40	18	11

EF, ejection fraction; PVB, premature ventricular beats.

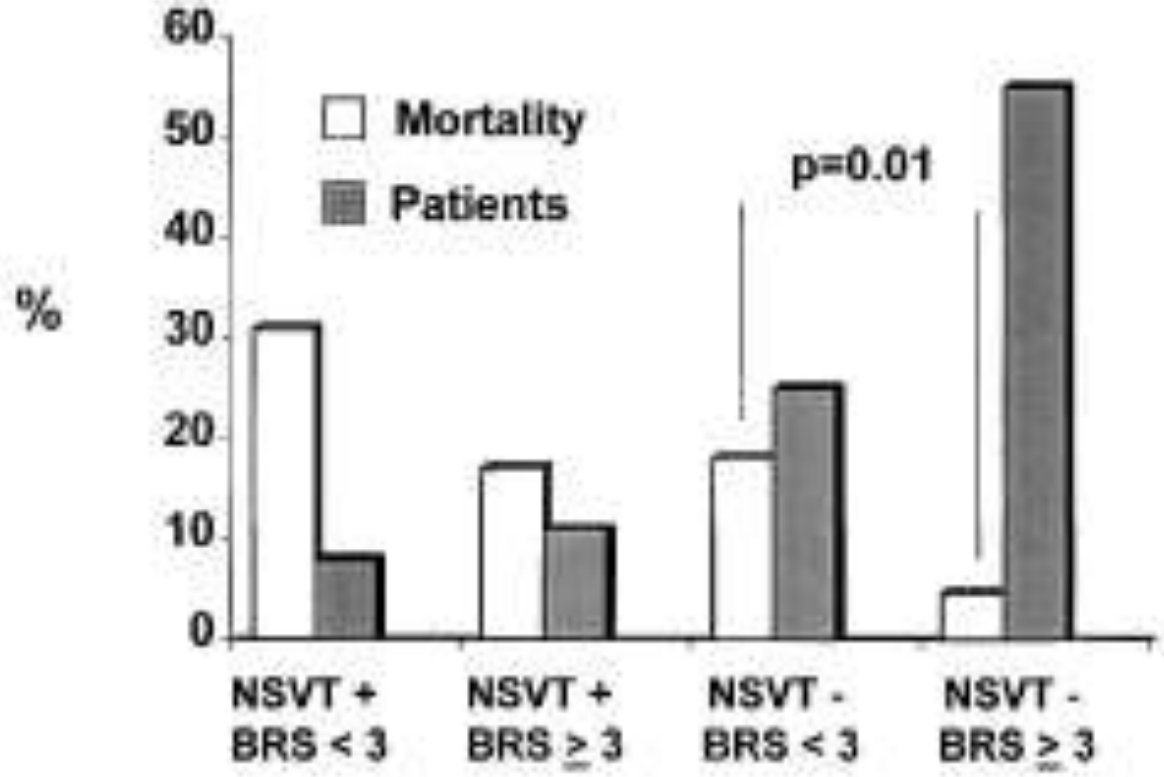
EPS

Table 3. Prognostic significance of inducible ventricular arrhythmias in post-acute myocardial infarction patients

Study	Observations	EPS VT VF, %	Arrhythmic events, %	EPS negative, %	Arrhythmic events, %
Bhandari	75	44	15	56	5
Roy	150	23	5	77	1
Santarelli	50	46	0	54	0
Richards	165	23	33	77	3
Marchlinski	46	22	17	78	9
Breithardt	132	46	16	54	4
Hamer	70	17	42	83	9
Denniss	403	34	12	66	4
Bhandari	53	33	37	66	6
Waspe	50	17	42	83	9
Naccarella	120	19	30	43	5
All patients:	1314	Mean value: 30.5	69.4	69.4	5

VF, ventricular fibrillation; VT, ventricular tachycardia; EPS, electrophysiologic study.

ATRAMI STUDY, *Circulation 2001*



THE SIGNAL AVERAGED ECG AS A RISK STRATIFIER OF SCD IN MULTUCENTER CLINICAL TRIALS

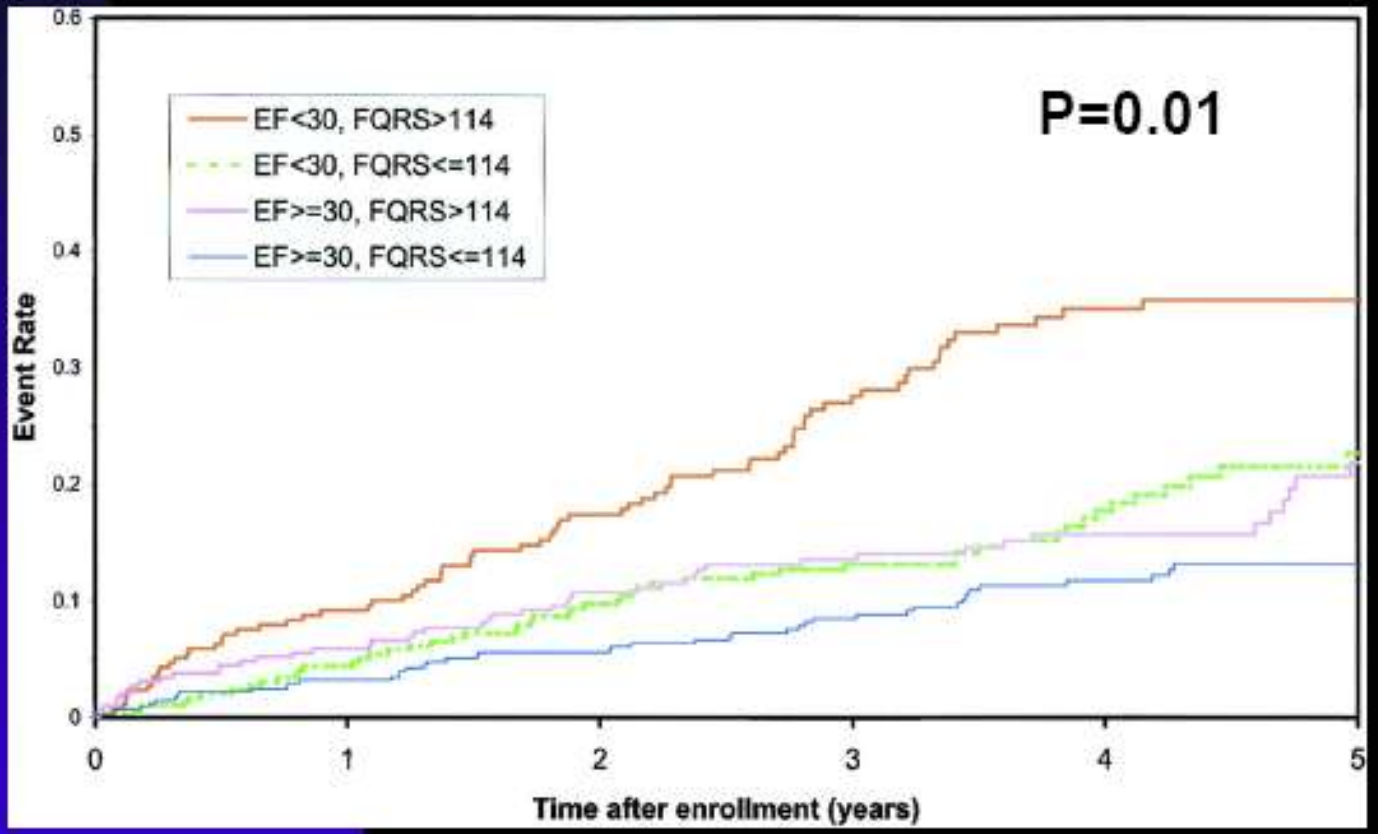
- CAST
- CABG-PATCH
- MUSTT
- MADIT-II

Prognostic value of the SAECG for arrhythmic events after MI: statistics on 22 studies and 9883 patients (mean follow-up: 22 months)

Follow-up (mos)	22
Arrhythmic events (%)	7.2
Sensitivity (%)	65
Specificity (%)	76
+ predictive accuracy (%)	18
Relative risk	6.9
Odds ratio	12.4

Bailey et al, JACC 2001

Kaplan-Meier estimates of arrhythmic death or cardiac arrest by SAECG results and ejection fraction in the Multicenter Unsustained Tachycardia Trial (MUSTT)



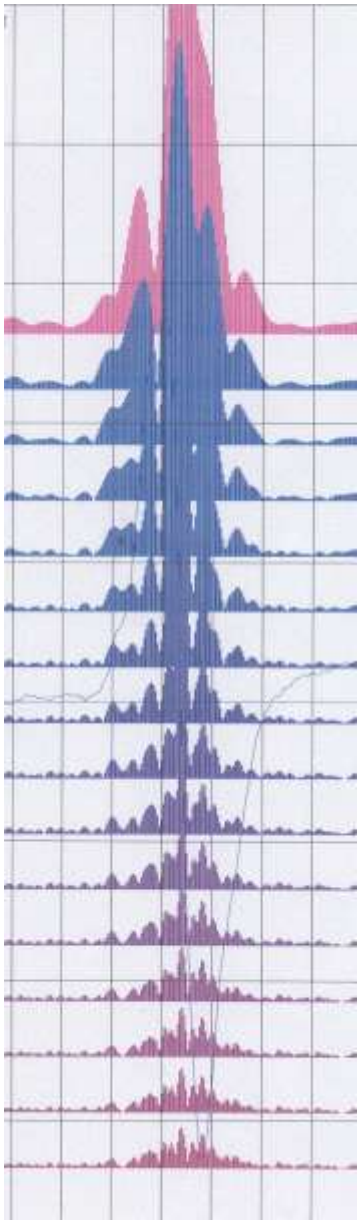
Gomes JA et al, Circulation 2001

Post Infarction Patients With and Without Ventricular Tachycardia Have Different Ventricular Conduction Characteristics: A Wavelet-based Analysis.

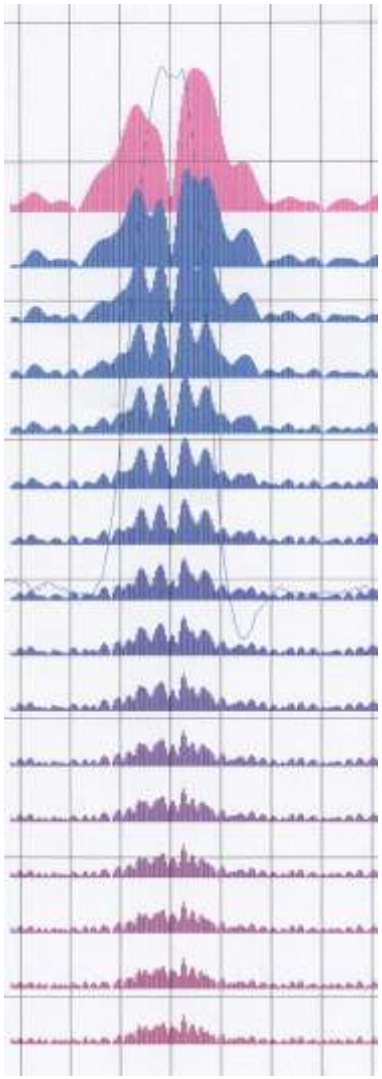
V. Vassilikos, I. Chouvarda*, G. Dakos, N. Manglaveras*, S. Mochlas, K. Pappas*, G. Louridas

1st Cardiology Division and *Medical Informatics Laboratory, Medical School, Aristotle University of Thessaloniki, Greece

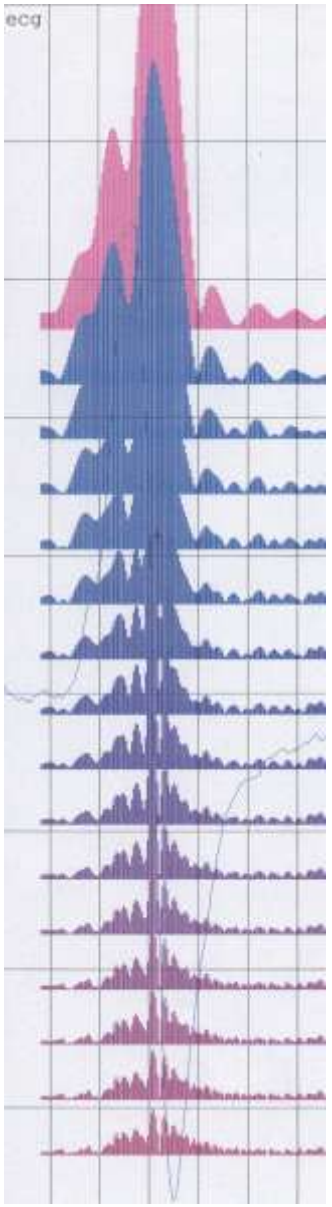
NASPE 2003



Group A (No VT)



Group B (VT)



Group C

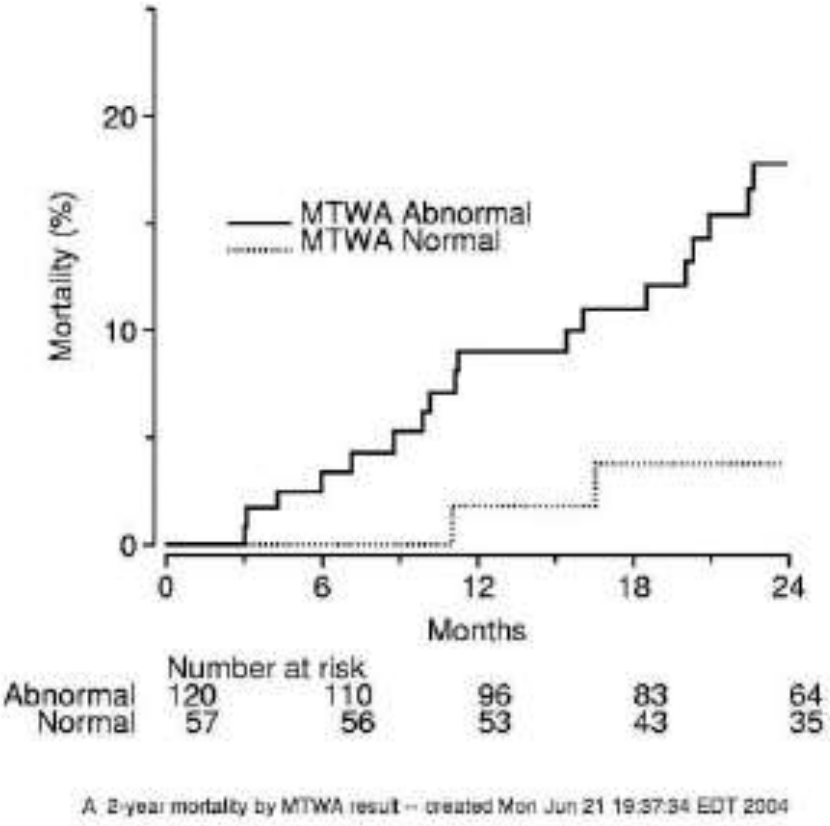
Combined assessment of TWA and LPs to predict arrhythmic events after MI Ikeda et al, JACC 2000

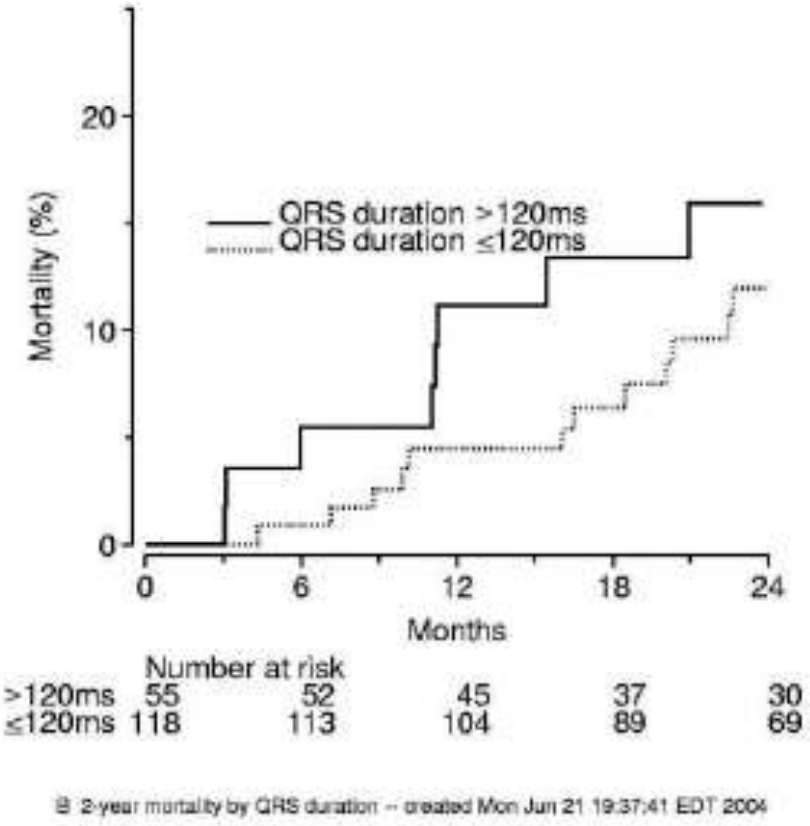
"The combination of TWA and LPs was associated with a high predictive accuracy for arrhythmic events after AMI"

	Sens	Spec	+PA	-PA	Total PA	P value
TWA	93%	59%	28%	98%	64%	0.006
LPs	53%	85%	38%	91%	80%	0.0008
EF	60%	78%	32%	92%	75%	0.004
TWA+LPs	53%	91%	50%	92%	85%	0.0001
TWA+EF	60%	84%	39%	92%	80%	0.0005
LPs+EF	40%	86%	33%	89%	79%	0.001
TWA+LPs+EF	40%	91%	43%	90%	83%	0.001

n= 102 cases; PA= predictive accuracy

MADIT II sub-analysis

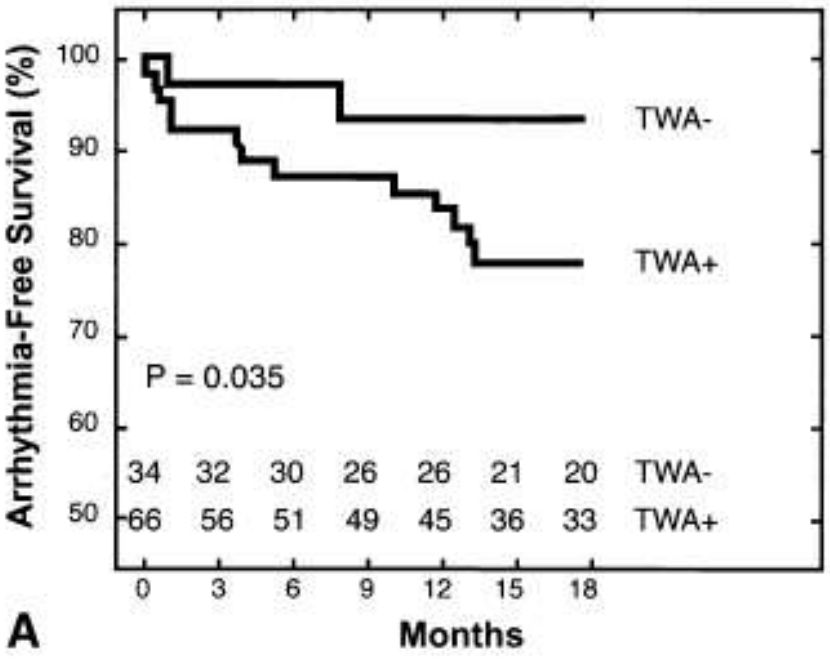




Bloomfield et al, Circulation 2004

TWA and BRS in DCM

Univariate analysis



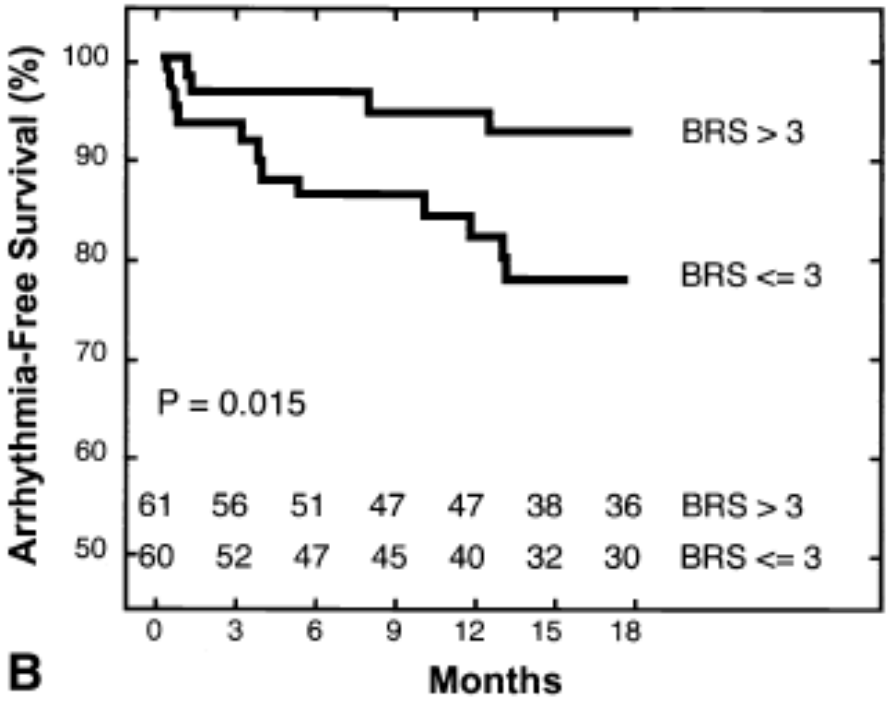
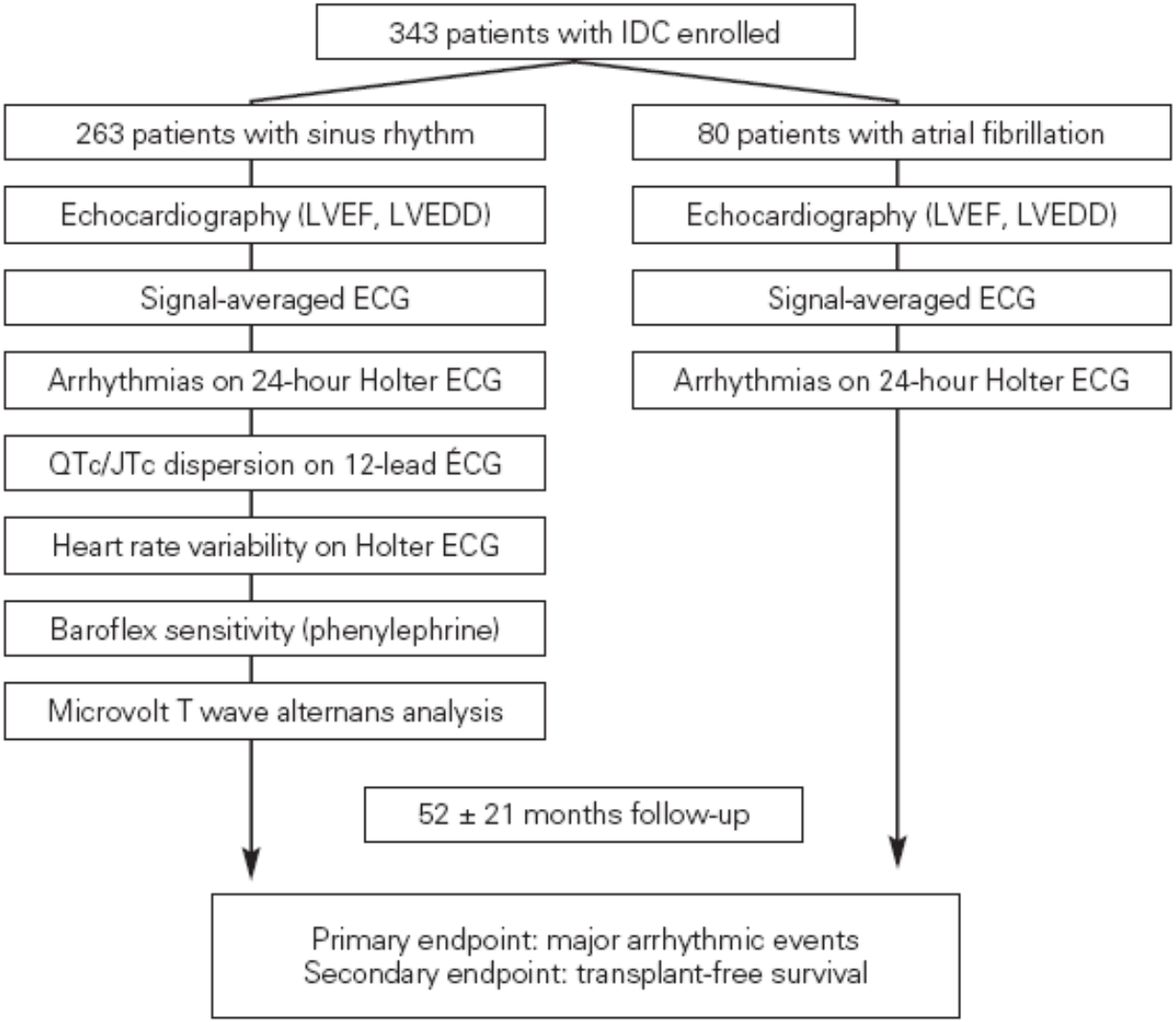


Figure 1. Kaplan-Meier event-free survival curves for microvolt-level T-wave alternans (TWA) and baroreflex sensitivity (BRS). p values relate to log-rank test.

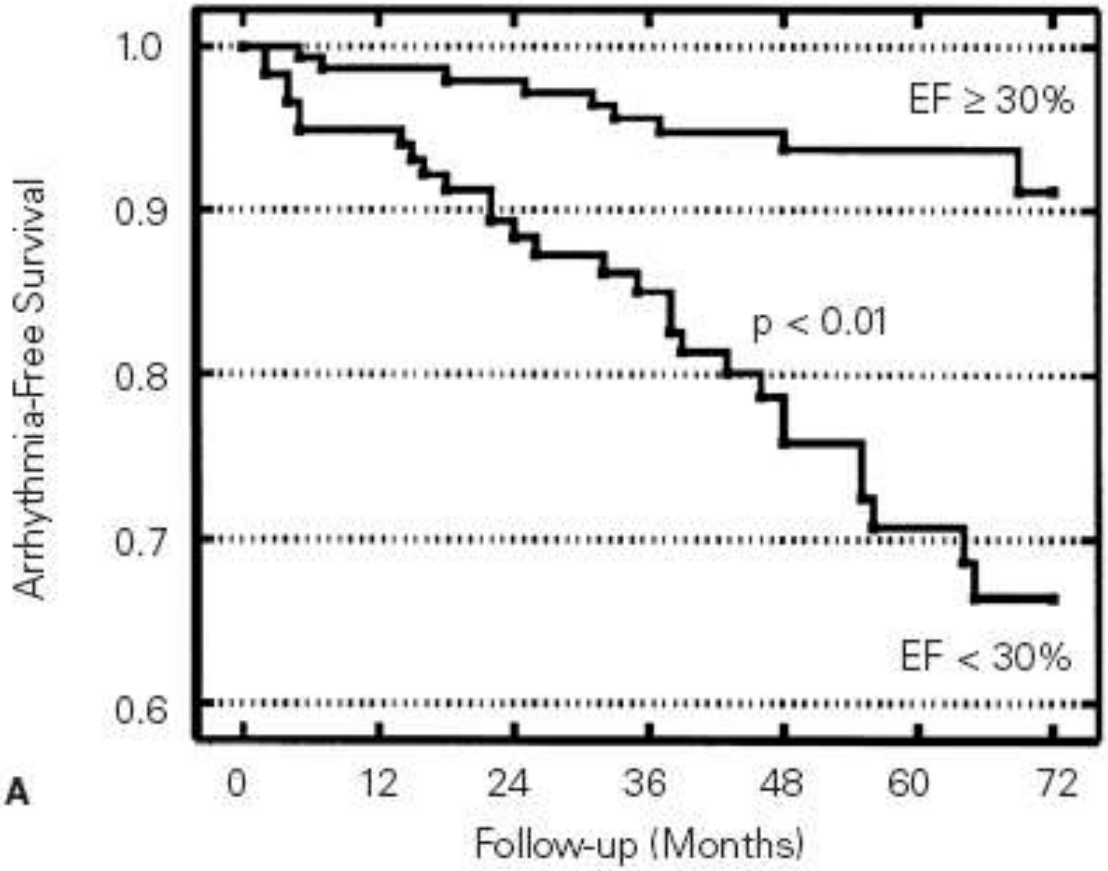
Hohnloser et al, JACC 2003

Marburg cardiomyopathy study



Grimm et al,
Circulation 2003

Marburg cardiomyopathy study



Grimm et al, Circulation 2003

REFINE Study, *JACC 2007*

n=322

Table 4 AUC for the Individual Parameters in Predicting the Primary Outcome (Cardiac Death or Resuscitated Cardiac Arrest) in the Acute and Nonacute Early Post-MI Periods

Impairment	AUC*	
	2 to 4 Weeks After Index MI	10 to 14 Weeks After Index MI
Autonomic tone		
Heart rate variability (SDNN <105 vs. ≥105 ms)	0.59	0.62
Baroreflex sensitivity (<6.1 vs. ≥6.1 ms/mm Hg)	0.60	0.66
Heart rate turbulence (abnormal onset or slope vs. both normal)	0.58	0.66
Electrical substrate		
Exercise repolarization alternans (non-negative vs. negative)	0.61	0.62
Holter repolarization alternans (≥5 vs. <5 μV)	0.60	0.62
QRS width (≥114 vs. <114 ms)	0.55	0.56
History of diabetes	—	—
Left ventricular ejection fraction (≤0.30 vs. >0.30)	0.62	0.62

REFINE Study, *JACC 2007*

Table 6 AUC, Test Characteristics, and Accuracy of the Noninvasive Parameters to Predict the Primary Outcome (Cardiac Death or Resuscitated Cardiac Arrest) at 10 to 14 Weeks Post-MI

Parameters (10 to 14 Weeks Post-MI)	Area Under the ROC Curve*	Characteristics (95% CI)		Predictive Accuracy (95% CI)	
		Sensitivity	Specificity	Positive	Negative
Abnormal exercise TWA + BRS (n = 52) vs. others	0.65	45 (39–49)	86 (82–90)	23 (18–28)	94 (92–96)
Abnormal Holter TWA + BRS (n = 53) vs. others	0.65	45 (39–49)	86 (82–90)	23 (18–27)	94 (92–97)
Abnormal exercise TWA + HRT (n = 91) vs. others	0.70	59 (53–64)	74 (70–79)	18 (14–23)	95 (92–97)
Abnormal Holter TWA + HRT (n = 93) vs. others	0.71	62 (57–67)	74 (70–79)	19 (15–24)	95 (93–98)

REFINE Study, *JACC 2007*

+EF

Table 7 AUC, Test Characteristics, and Accuracy of the Noninvasive Parameters Combined With LVEF to Predict the Primary Outcome (Cardiac Death or Resuscitated Cardiac Arrest) Beyond 8 Weeks Post-MI

Parameters (Beyond 8 Weeks Post-MI)	Dichotomized AUC*	Characteristics (95% CI)		Predictive Accuracy (95% CI)	
		Sensitivity	Specificity	Positive	Negative
Abnormal exercise TWA + BRS + LVEF <0.50 (n = 31) vs. others	0.71	37 (32–42)	93 (90–96)	32 (27–37)	94 (92–97)
Abnormal Holter TWA + BRS + LVEF <0.50 (n = 32) vs. others	0.71	37 (32–42)	93 (90–95)	31 (26–36)	94 (92–97)
Abnormal exercise TWA + HRT + LVEF <0.50 (n = 64) vs. others	0.72	52 (46–57)	83 (79–87)	23 (17–26)	95 (92–97)
Abnormal Holter TWA + HRT + LVEF <0.50 (n = 55) vs. others	0.74	55 (50–61)	86 (82–90)	27 (22–32)	96 (93–98)

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Risk Stratification for Primary Implantation of a Cardioverter-Defibrillator in Patients With Ischemic Left Ventricular Dysfunction

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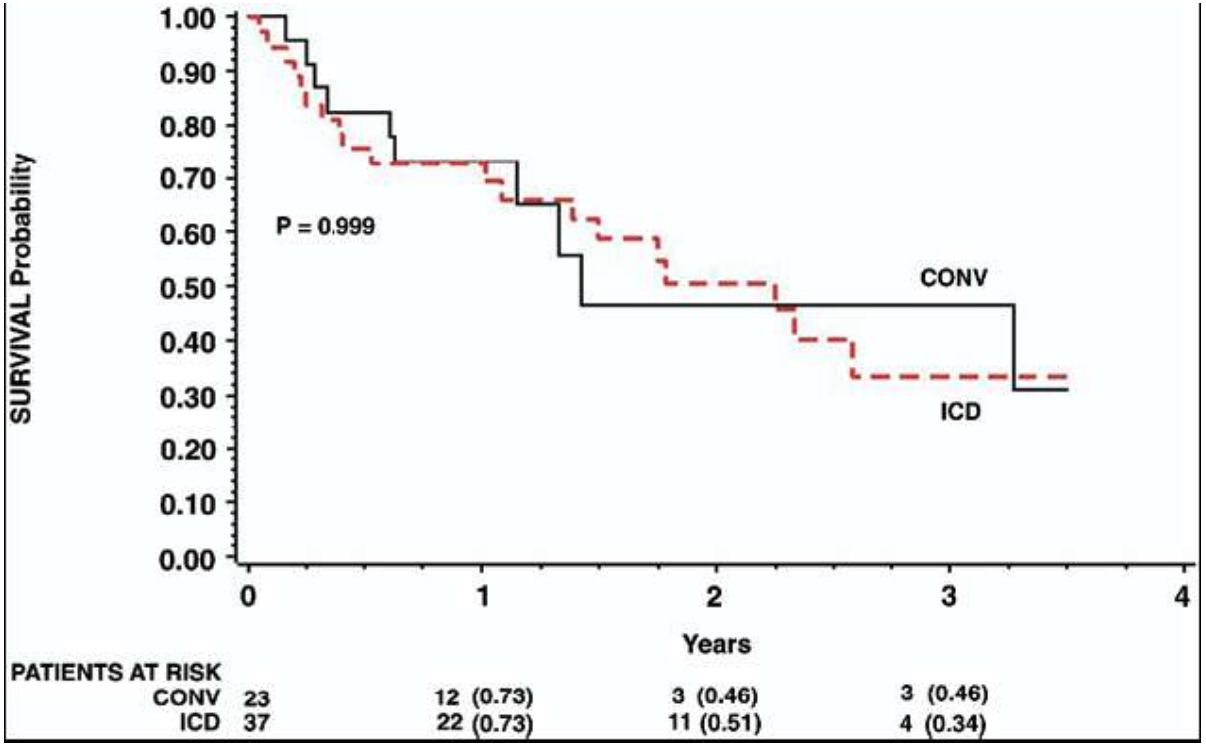
Rochester and Buffalo, New York

- NYHA functional class > II
- Age>70 years
- BUN>26 mg/dl
- QRS duration> 0.12 s
- Atrial fibrillation

Table 4 Multivariate Proportional Hazards Regression Model: Risk of All-Cause Mortality in the Conventional Therapy Group for Selected Risk Factors*†

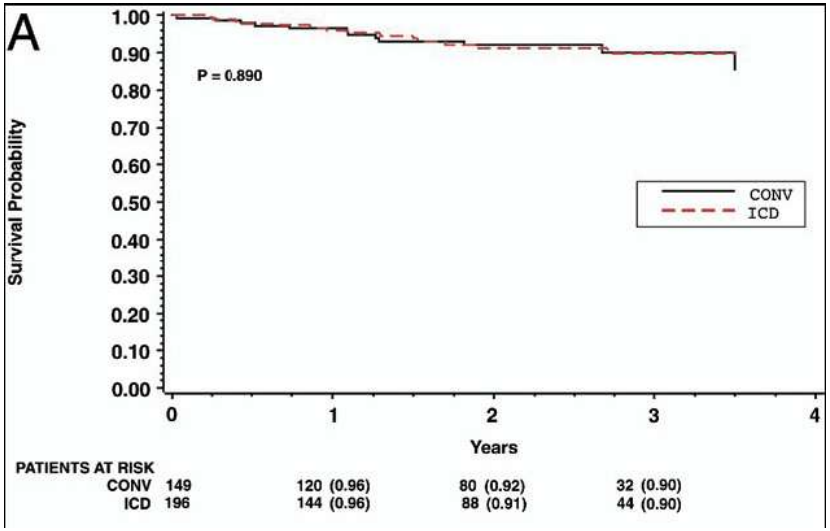
Risk Factor	HR	95% Confidence Interval	p Value
NYHA functional class >II	1.87	1.23–2.86	0.004
Atrial fibrillation‡	1.87	1.05–3.22	0.034
QRS >120 ms	1.65	1.08–2.51	0.020
Age >70 yrs	1.57	1.02–2.41	0.042
BUN >26 mg/dl (and <50 mg/dl)	1.56	1.00–2.42	0.048

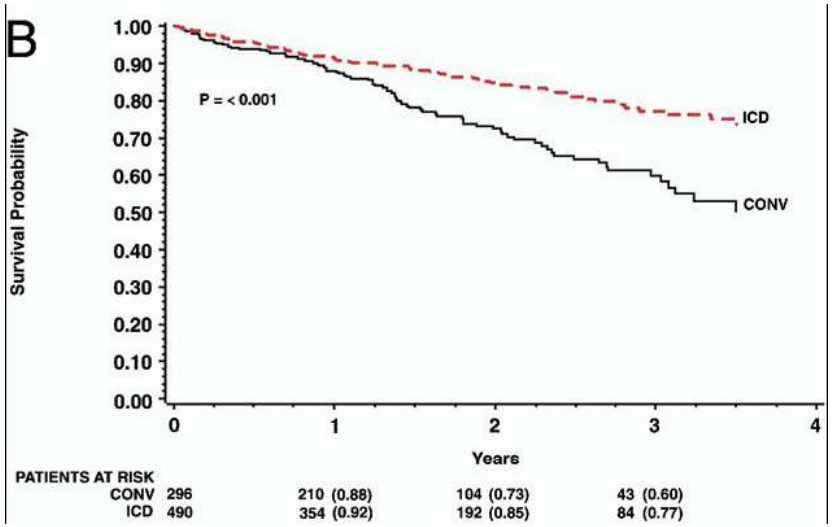
Probability of Survival in VHR Patients



Goldenberg et al, MADIT II, JACC 2008

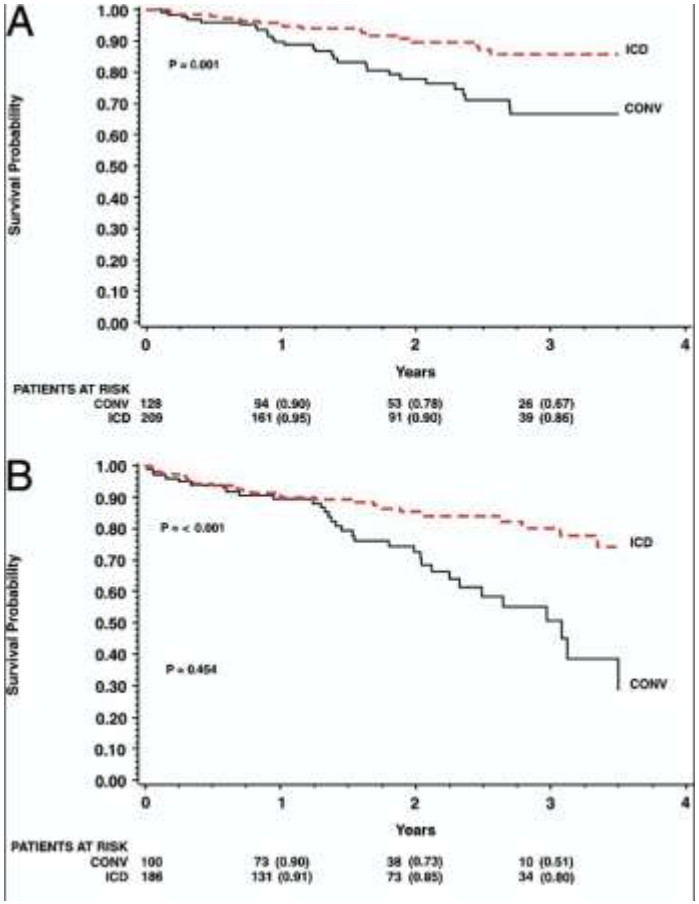
Risk score 0 or >1

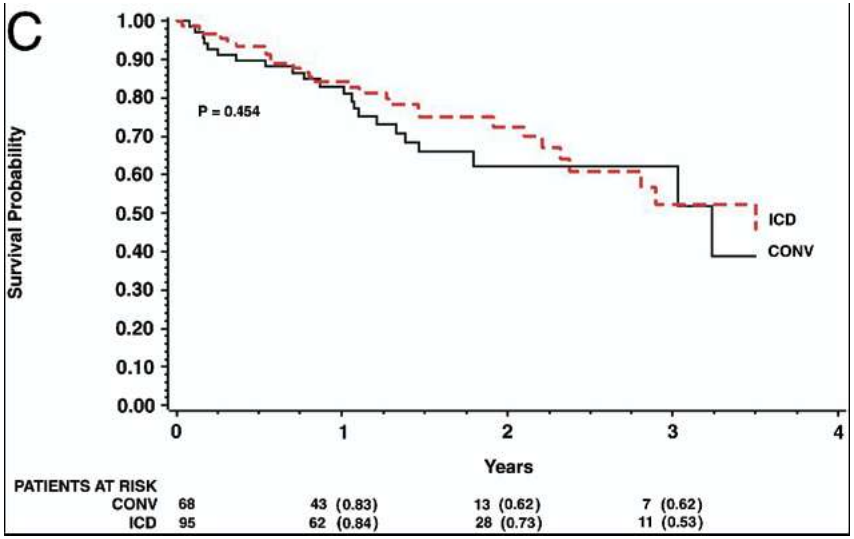




Goldenberg et al, MADIT II, JACC 2008

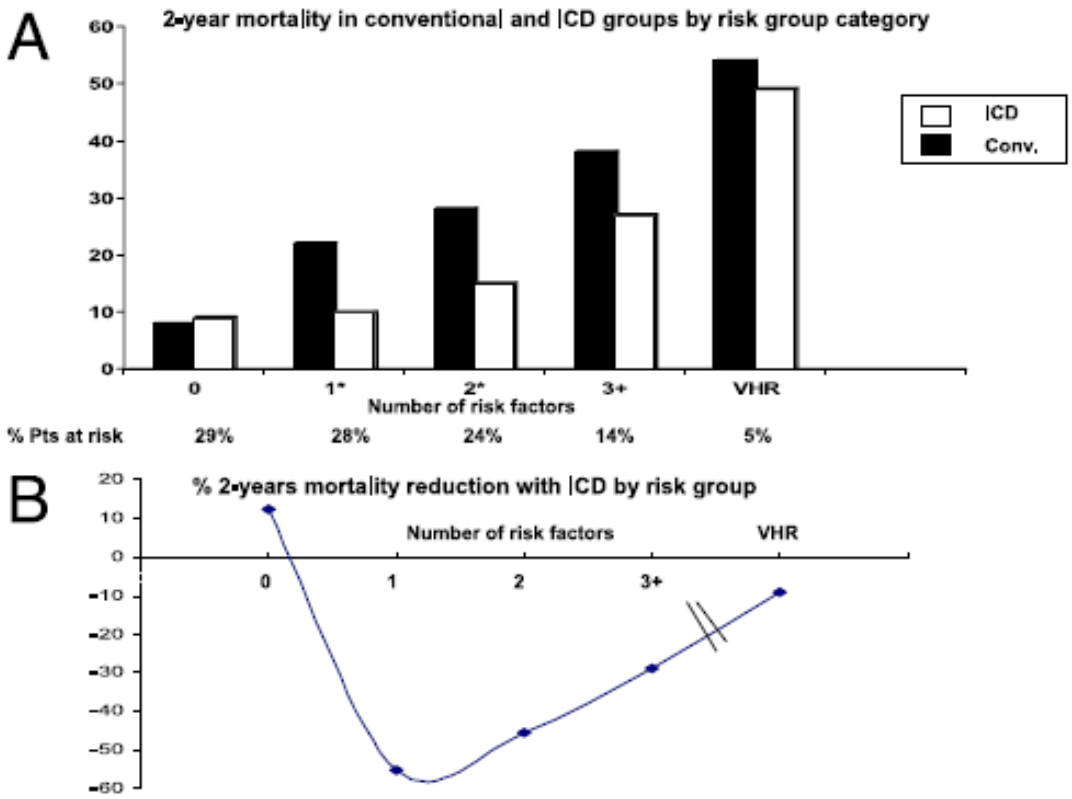
Risk score 1, 2, >3





Goldenberg et al, MADIT II, JACC 2008

U-Shaped Curve for ICD Efficacy



Goldenberg et al, MADIT II, JACC 2008

Do baseline characteristics accurately discriminate between patients likely versus unlikely to benefit from implantable defibrillator therapy?

Evaluation of the Canadian Implantable Defibrillator Study implantable cardioverter defibrillatory efficacy score in the Antiarrhythmics Versus Implantable Defibrillators Trial

Derek V. Exner, MD, MPH,[a,b] Robert S. Sheldon, MD, PhD,[a] Sergio L. Pinski, MD,[c] Jack Kron, MD,[d] Alfred Hallstrom, PhD,[e] and the AVID Investigators ***Calgary, Alberta, Canada, Bethesda, Md, Chicago, Ill, Portland, Ore, and Seattle, Wash***

Conclusion Of the 3 characteristics identified to predict ICD efficacy in CIDS, only depressed EF predicted ICD efficacy in AVID. Thus physicians faced with limited resources might elect to consider ICD therapy over antiarrhythmic drug use in patients with severely depressed EF values. (Am Heart J 2001;141:99-104.)