PLACE 2026
PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

CONGRESSO
ROMA, 25 - 27 Giugno 2026

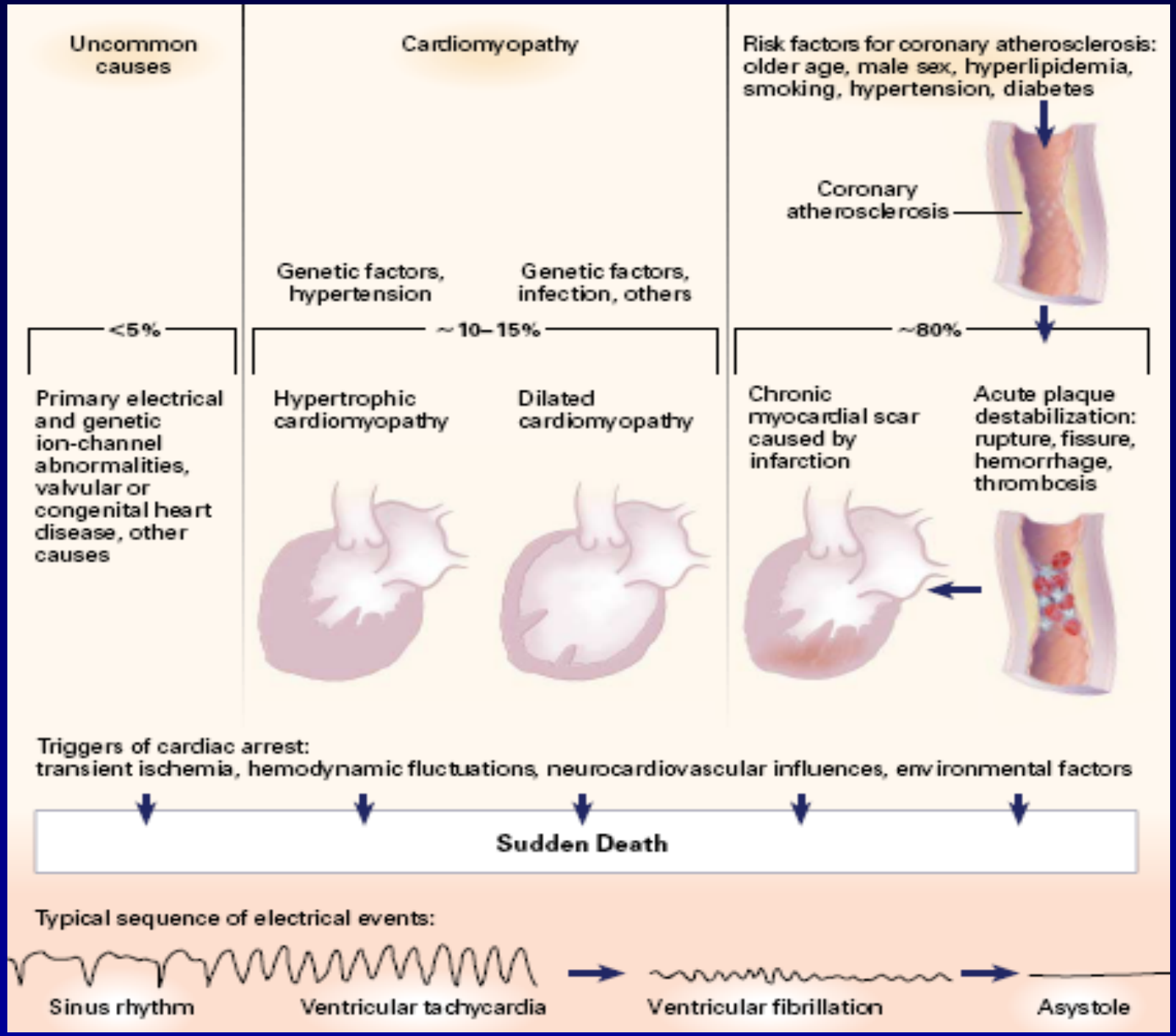
L'ICD OGGI: DECISIONI DIFFICILI TRA TERAPIE DISEASE-MODIFYING, RISCHIO ARITMICO, PROGNOSI E QUALITÀ DI VITA

Indicazione dell'ICD per la prevenzione primaria nell'HFrEF ischemico: a che punto siamo?

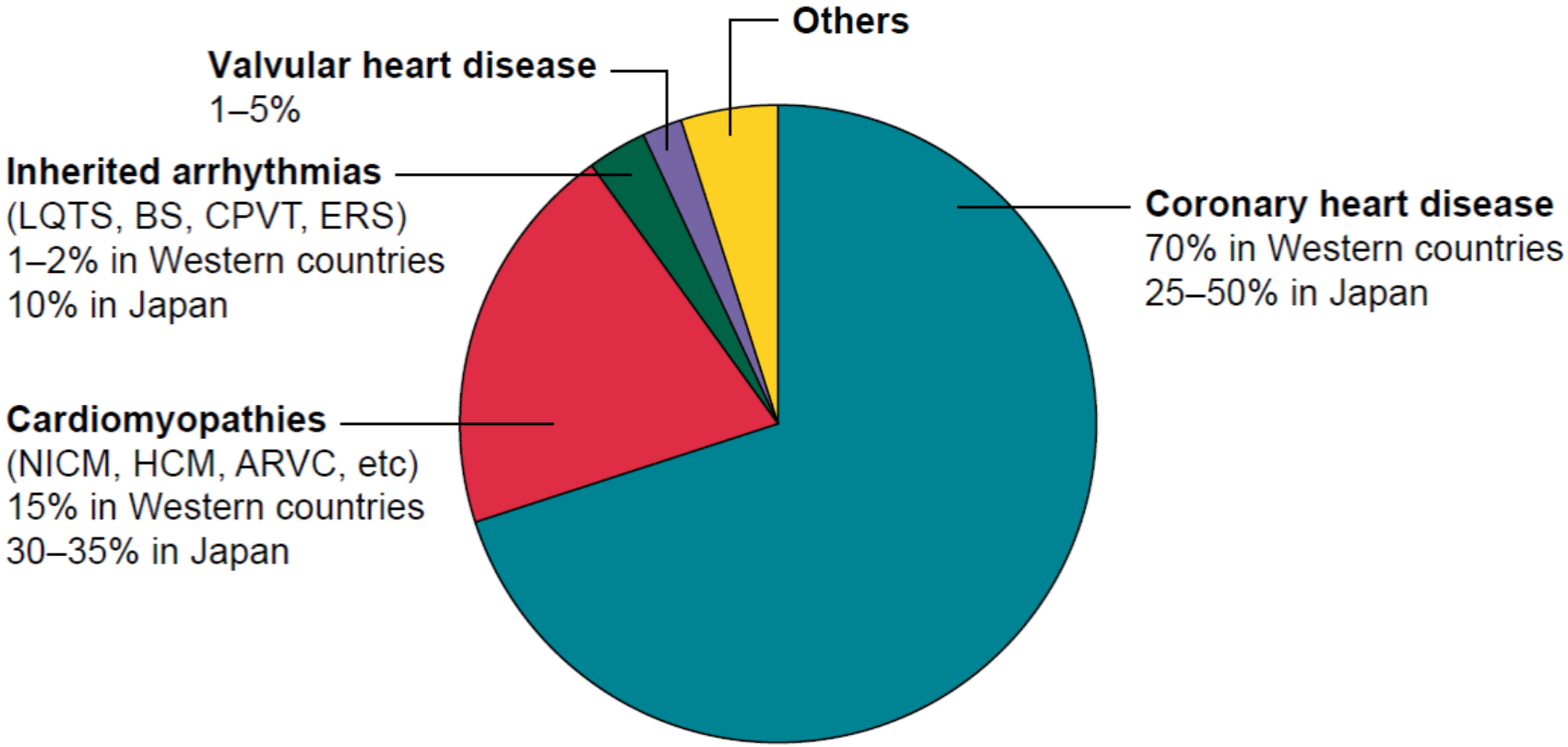
Matteo Santamaria, MD, PhD
Direttore UOC Aritmologia ed Elettrofisiologia
Responsible Research Hospital
Campobasso

SUDDEN CARDIAC DEATH (SCD)

EPIDEMIOLOGY

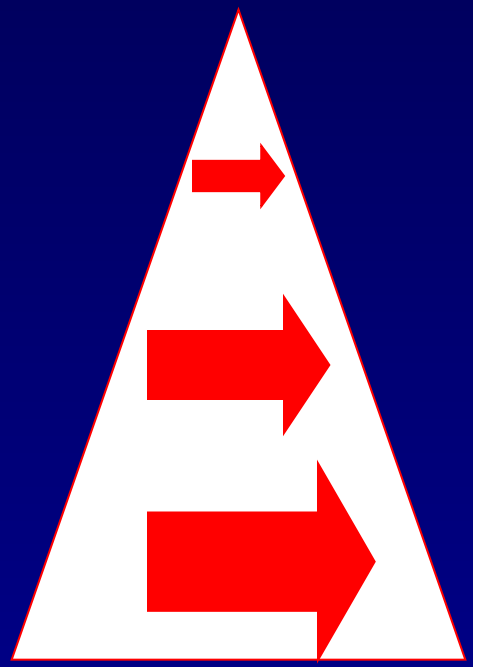


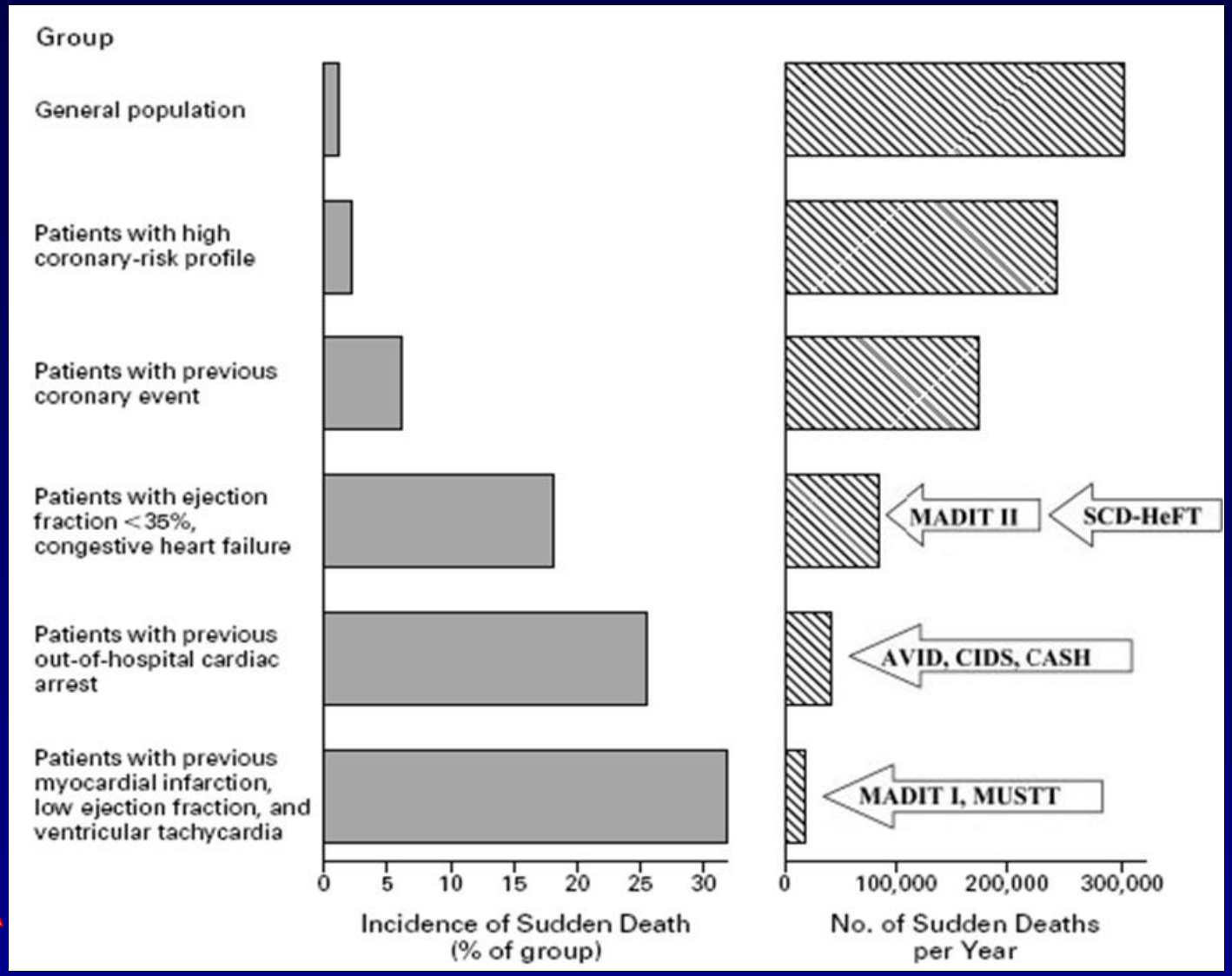
Causes of SCD in Western countries and Japan



From Wong, Heart Lung Circul (2018).

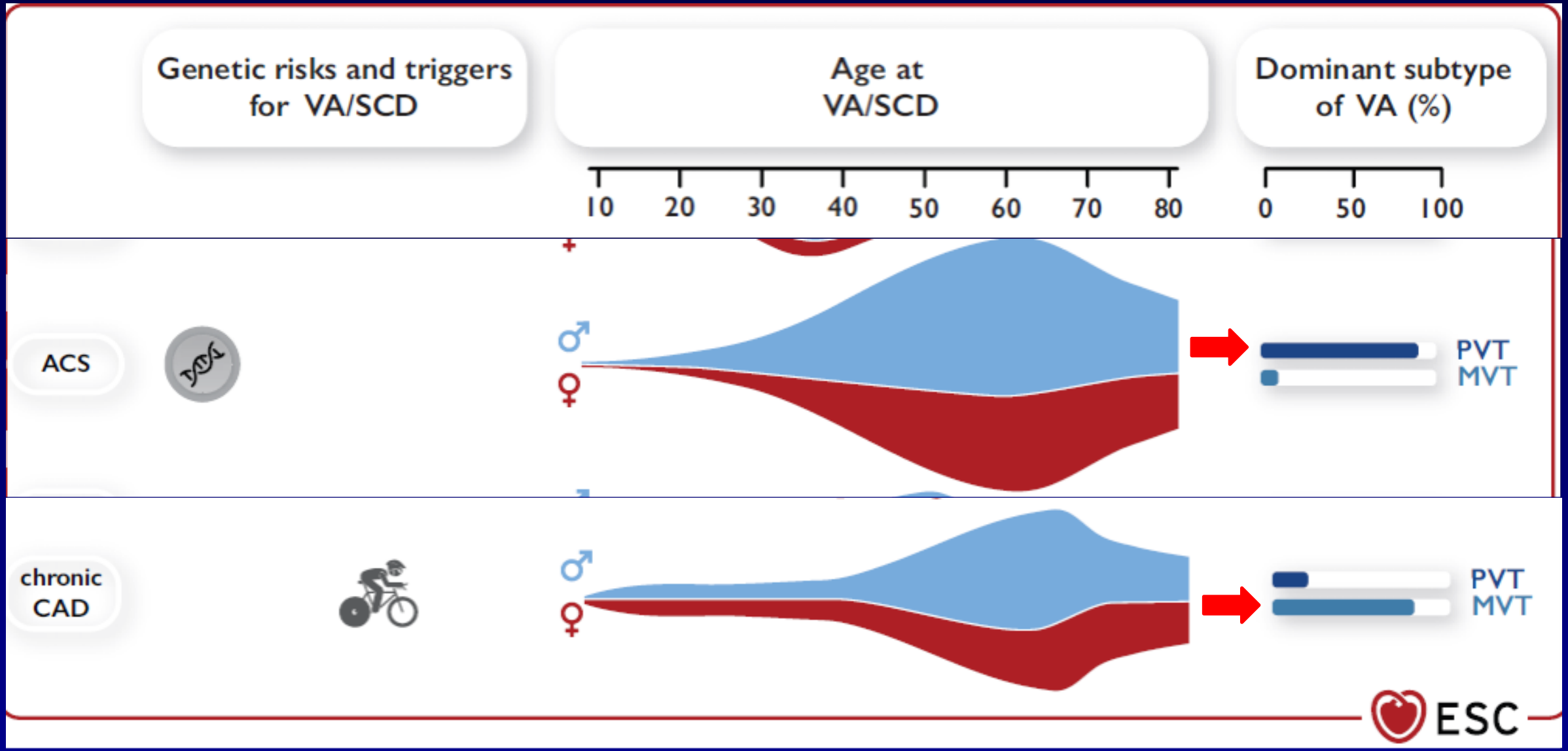
VERY HIGH RISK SUBGROUPS





General population: unselected population age greater than or equal to 35 y

Modified from Myerburg RJ et al., Circulation 1998


Genetic risks and triggers for VA/SCD
Age at VA/SCD
Dominant subtype of VA (%)
10
20
30
40
50
60
70
80
0
50
100
ACS
PVT
MVT
chronic CAD
PVT
MVT
ESC

Risk prediction of sudden cardiac death in general population

- ✓ Approximately 50% of cardiac arrests occur in individuals without a known heart disease, but **most** suffer from **concealed ischaemic heart disease**.

- ✓ As a consequence, the **most effective approach to prevent SCD in the general population** resides in quantification of the individual risk of developing ischaemic heart disease based on risk score charts, **followed by the control of risk factors** such as total serum cholesterol, glucose, blood pressure, smoking and body mass index.

- ✓ Approximately 40% of the observed reduction in SCD is the direct consequence of a reduction of CAD and other cardiac

Risk prediction of sudden cardiac death in patients with Ischemic Heart Disease

- ✓ For more than two decades investigators throughout the world have envisioned a broad range of 'indicators' for SCD occurring in the setting of ischemic heart disease.

- ✓ Several markers of risk of SCD have been proposed for patients with myocardial ischaemia:
  - late potentials (high negative predictive value)
  - heart rate variability
  - baroreflex sensitivity
  - QT interval dispersion
  - microvolt T-wave alternans (Fast Fourier Transform)
  - heart rate turbulence

Non-invasive

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Noninvasive Risk Assessment Early After a Myocardial Infarction

The REFINE Study

Derek V. Exner, MD, MPH,*† Katherine M. Kavanagh, MD,*‡ Michael P. Slawnych, MD, PHD,*
L. Brent Mitchell, MD,* Darlene Ramadan, BSN,* Sandeep G. Aggarwal, MD,*
Catherine Noullett, RN,* Allie Van Schaik, RN,‡ Ryan T. Mitchell, BSC,* Mariko A. Shibata, BSC,*
Sajad Gulamhussein, MD,‡ James McMeekin, MD,* Wayne Tymchak, MD,‡
Gregory Schnell, MD,* Anne M. Gillis, MD,* Robert S. Sheldon, MD, PHD,*
Gordon H. Fick, PHD,† Henry J. Duff, MD,* for the REFINE Investigators

Calgary and Edmonton, Canada

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CLINICAL RESEARCH Post-Infarction Risk

Noninvasive Risk Assessment Early After a Myocardial Infarction

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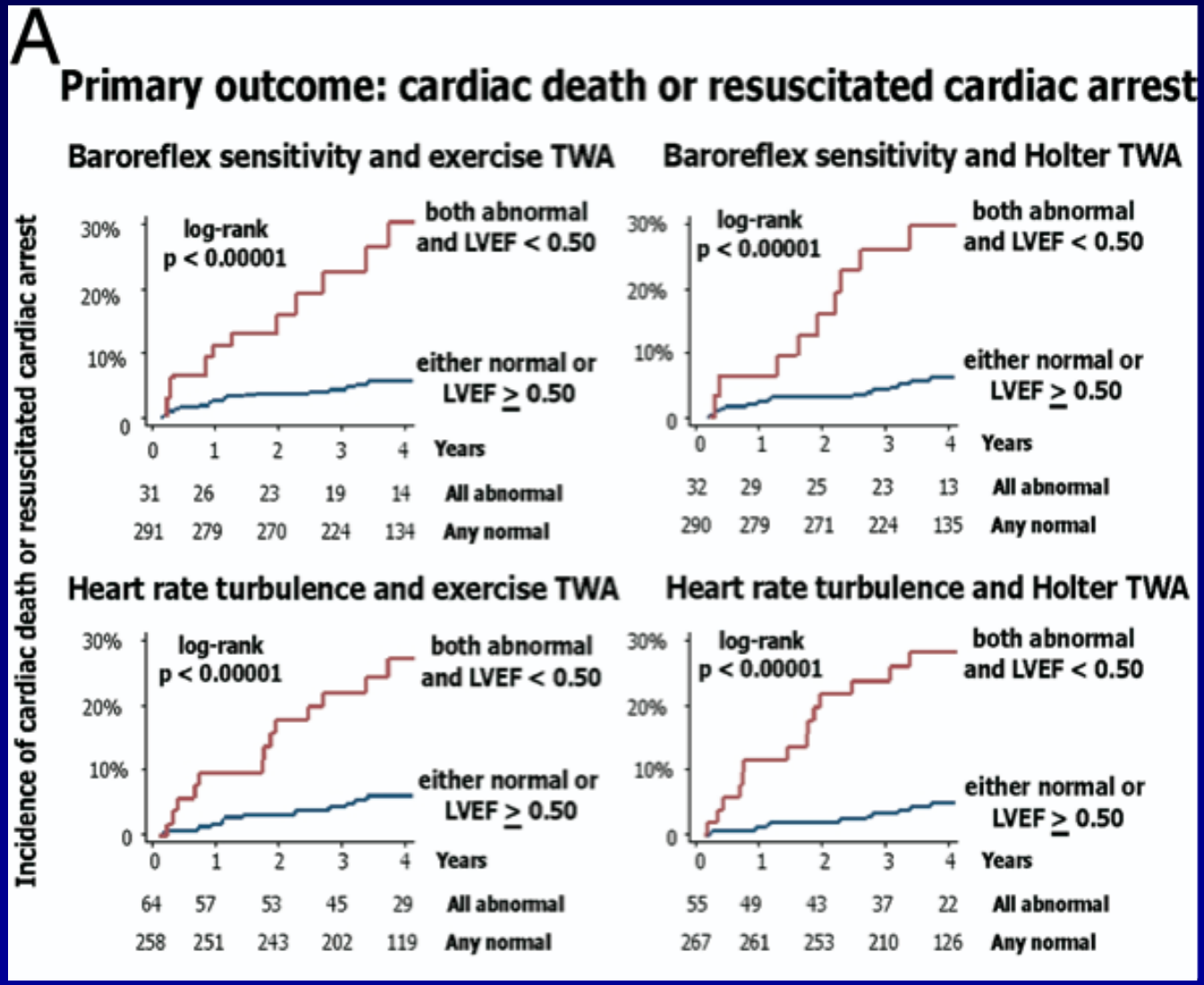
Calgary and Edmonton, Canada

- ✓ Patients (n 322) with an ejection fraction (EF) < 0.50 in the initial week after MI were followed up for a median of 47 months.
- ✓ Serial assessment of baroreflex sensitivity, heart rate turbulence (HRT), T-wave alternans (TWA, Holter and ergometric test), and EF was performed
- ✓ The primary outcome was cardiac death or resuscitated cardiac arrest.
- ✓ All cause mortality and fatal or nonfatal cardiac arrest were secondary outcomes

- ✓ Impaired HRT, abnormal TWA, and an EF < 0.50 beyond 8 weeks after MI reliably identify patients at risk of serious events



Risk prediction of sudden cardiac death in patients with Ischemic Heart Disease

- ✓ However, despite the promising outcomes of the early studies, **none of these 'predictors' has influenced clinical practice.**

- ✓ As a consequence, the only indicator that has consistently shown an association with increased risk of sudden death in the setting of ischemic heart disease **remain LV ejection fraction (LVEF)**

- ✓ This variable has been used for more than a decade to target the use of an ICD for primary prevention of SCD, often in combination with NYHA class.

- ✓ Despite the fact that LVEF is not an accurate and highly reproducible clinical parameter, it is **still used to select patients for ICD implantation**

Risk prediction of sudden cardiac death in patients with Ischemic Heart Disease

- ✓ Among emerging variables that look promising for predicting SCD are biochemical indicators such as the B-type natriuretic peptide and N-terminal pro-B-type natriuretic peptide, which have shown encouraging results in preliminary investigations

European Journal of Heart Failure (2009) **11**, 958–966
doi:10.1093/eurjhf/hfp123

Brain natriuretic peptide for the prediction of sudden cardiac death and ventricular arrhythmias: a meta-analysis

Paul A. Scott[1,*], James Barry[1], Paul R. Roberts[1,2], and John M. Morgan[1,2]

- ✓ Meta-analysis: 14 studies
- ✓ The measurement of BNP has significant value in predicting SCD and VA.
- ✓ However, the benefit of BNP testing in addition to other risk stratification tests is unclear and BNP needs to be evaluated prospectively in combination with other complementary risk

Summary estimates of likelihood ratios and relative risks in 14 studies of brain natriuretic peptide to predict sudden cardiac death or ventricular arrhythmias

Summary estimates	RR (95% CI)	PLR (95% CI)	NLR (95% CI)	Number of studies
Studies to predict SCD				
All	3.68 (1.90, 7.14)	1.70 (1.44, 2.01)	0.45 (0.28, 0.73)	6
Subgroups				
Patient with known heart disease	4.59 (2.41, 8.74)	1.81 (1.53, 2.14)	0.36 (0.19, 0.67)	5
Patients with LVEF ≤40%	20.13 (3.96, 102.37)	2.13 (1.1, 4.3)	0.082 (0.02, 0.39)	2
Studies to predict appropriate ICD therapy				
All	2.54 (1.87, 3.44)	1.92 (1.46, 2.52)	0.54 (0.45, 0.65)	8
Subgroups				
Patients with IHD	2.76 (1.57, 4.84)	2.26 (1.41, 3.61)	0.5 (0.34, 0.73)	5

- ✓ A raised BNP predicted SCD with a relative risk of 3.68 [95% confidence interval (CI) 1.90, 7.14]

B-type natriuretic peptide is a major predictor of ventricular tachyarrhythmias.

Levine YC, Rosenberg MA, Mittleman M, Samuel 1, Methachittiphan N, Link M, Josephson ME, Buxton AE.
Heart Rhythm. 2014 Jul;11(7):1109-16

- ✓ **Aim of the study:** To determine whether N-terminal pro-B-type natriuretic peptide (NT-proBNP) or B-type natriuretic peptide (BNP) are independent predictors of ventricular arrhythmias in patients receiving primary prevention ICDs.
- ✓ **Methods:** 161 patients with NT-proBNP levels and 403 patients with BNP levels at the time of ICD implantation were retrospectively assessed for the occurrence of first appropriate ICD therapy and mortality.
- ✓ Elevated baseline NT-proBNP and BNP levels **are independently associated with the risk for ventricular tachyarrhythmias** (in multivariable Cox proportional hazards regression analysis, NT-proBNP or BNP levels in the upper 50th percentile were the strongest predictor of ICD therapy after adjustment for sex, age, LVEF,

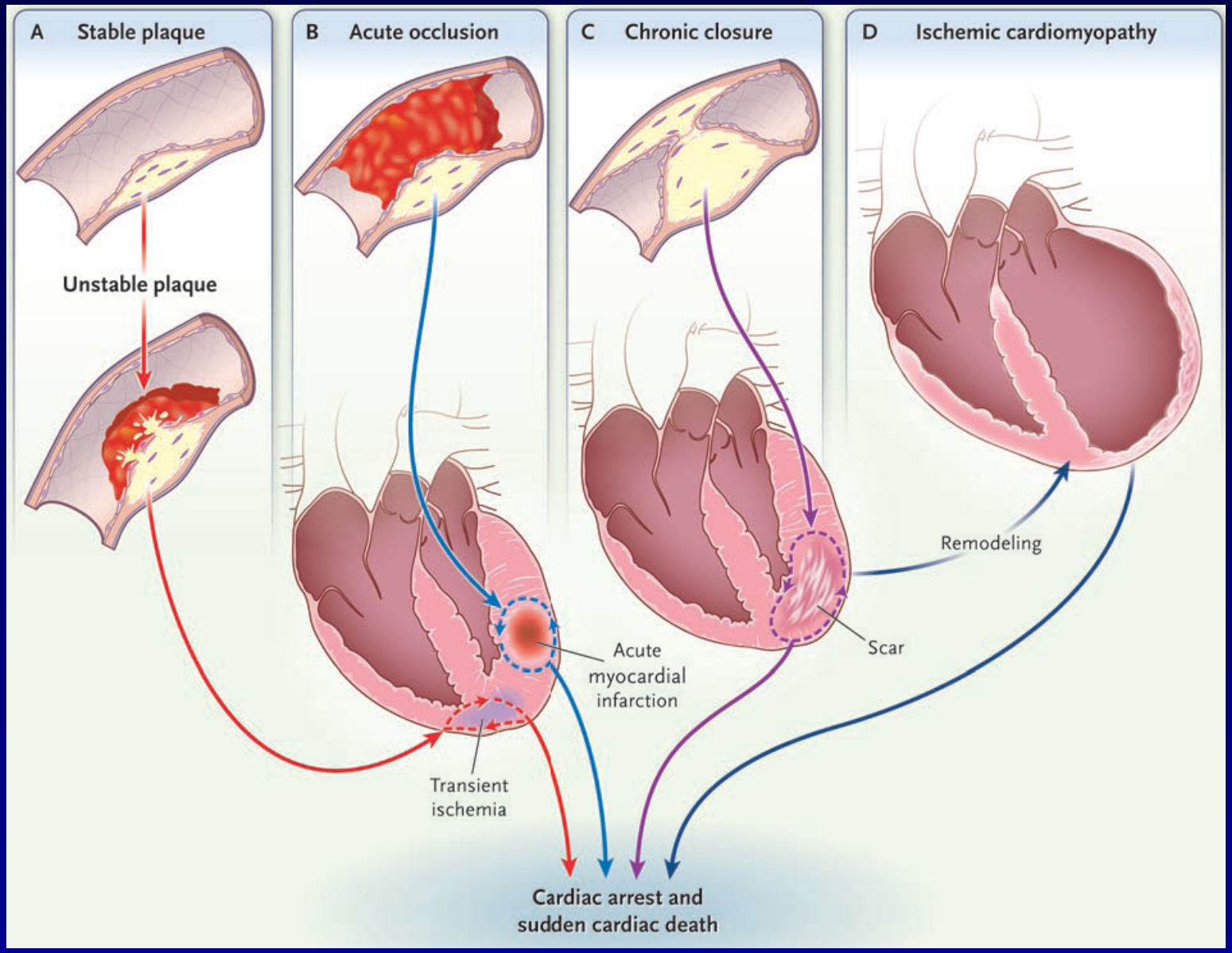
Prerequisites and mechanisms for arrhythmogenesis

- ✓ During the **acute phase of MI**, **VF or polymorphic VT** is triggered by the presence of ischemia

- ✓ During the period **after MI**, SCD may be caused by different mechanisms:
  - ❖ post-infarction areas, including regional and intramural fibrotic zones and scars, remain electrically unexcitable and may form local conditions for re-entry leading to sustained **monomorphic VT**.
  - ❖ LVEF reduction and HF lead to enhanced sympathetic activity that predisposes to electrical instability and arrhythmogenesis.
  - ❖ LV dilation contributes to the appearance of electrical heterogeneity, anisotropy and temporal dispersion of

Prerequisites and mechanisms for arrhythmogenesis

- ✓Re-entry constitutes the major mechanism responsible for ventricular arrhythmias appearing in acute and chronic CAD and is significantly related to heterogeneity / anisotropy



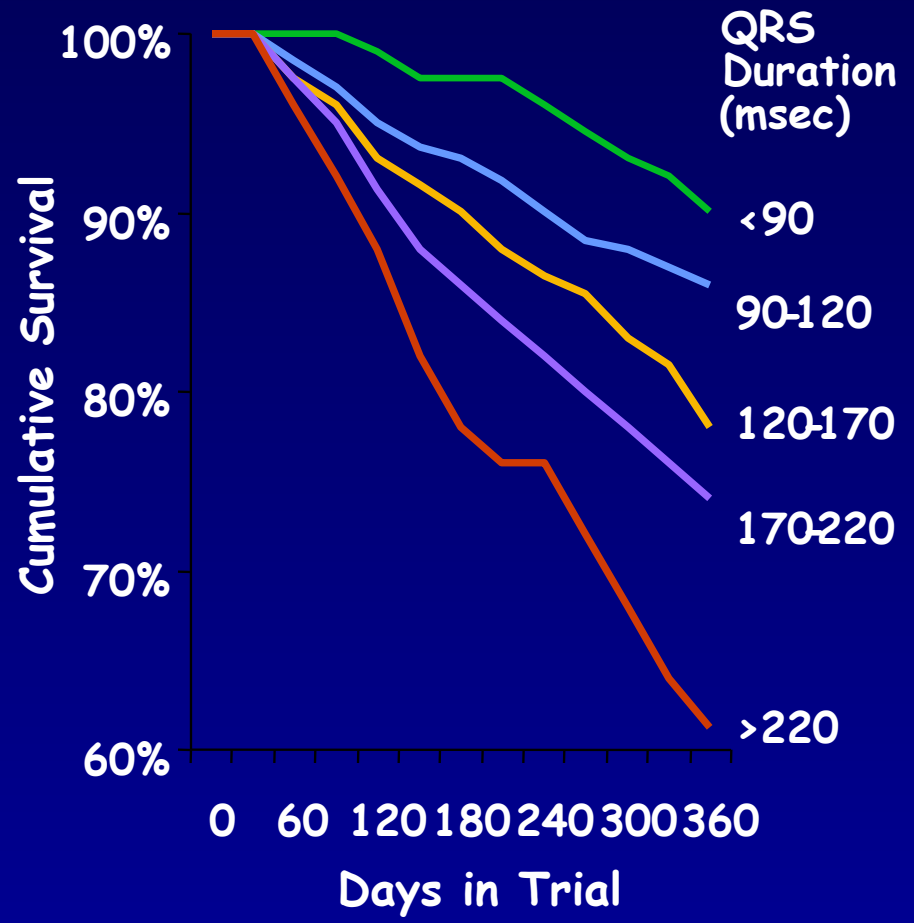
N Engl J Med 2008;359:2245-53.

Prognostic markers and their association with the pathophysiological substrate of SCD

1. Myocardial substrate lesions and post-infarction fibrosis	3. Impaired autonomic nervous system function
LVEF	HR
QRS & LBBB	HRV
SAECG **(Late potentials)**	HRT
fragmented QRS	DC
MRI **(Late Enhancement)**	BRS
PVBs & NSVT	HR recovery after exercise
NYHA class	
2. Abnormal repolarisation	**4. Inducibility**
QT	EPT
QTd	
T wave alternans	
QT/RR	
QTVI	
TWV	

Risk stratification schemes are based on markers that, by identifying the arrhythmic substrate and the severity of the arrhythmia mechanisms present, are also considered to quantify the risk of SCD

QRS complex and mortality



- VEST study analysis
- NYHA class II-IV
- 3,654 ECGs
- QRS duration was found to be an <u>independent predictor of mortality</u>

Adapted from V Gottipaty, MD.

Left Ventricle Ejection Fraction

- ✓ The impaired left ventricular systolic function is the consequence of post-infarction fibrosis.

- ✓ The deterioration in systolic function is accompanied by other disturbances:
  - ✓ action potential prolongation
  - ✓ changes in intracellular calcium homeostasis
  - ✓ increase in the dispersion of repolarization
  - ✓ accumulation of connective tissue into the cellular gap junctions
  - ✓ neurohormonal activation.

- ✓ **Therefore, the presence of a low LVEF reflects not only the anatomical dysfunction, but also the**

Left Ventricle Ejection Fraction

- ✓ The annual arrhythmic mortality post-MI increases as LVEF decreases:
  - ✓ in patients with LVEF >30% it was 3.2%;
  - ✓ in patients with a diminished LVEF between 21-30% it rose to 7.7%;
  - ✓ In patients with LVEF <20% the annual arrhythmic mortality climbed to 9.4%
- ✓ A metaanalysis of 20 studies showed that the critical zone of LVEF< 30-40% was correlated with a 4.3 hazard ratio for major

Left Ventricle Ejection Fraction

- ✓ However the prognostic ability of LVEF has several limitations:
  - ✓ LVEF measurements show intra- and interobserver variability;
  - ✓ systolic function may present temporal variability depending on interventions such as coronary artery bypass, percutaneous coronary intervention, and pharmacological treatment, as well as the natural evolution of the disease;
  - ✓ LVEF is correlated **more with total mortality** than with SCD;
  - ✓ LVEF has **low sensitivity**, as **two thirds of SCDs** occur in patients with

SCD/VA risk stratification in ischemic HFrEF
Different settings

- ✓ Early after myocardial infarction
- ✓ Post-ischemic dilated cardiomyopathy (reduced LV ejection fraction, heart failure)

European Heart Journal (2015) **36**, 2793–2867
doi:10.1093/eurheartj/ehv316

ESC GUIDELINES

2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

The Task Force for the Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death of the European Society of Cardiology (ESC)

Risk stratification for sudden cardiac death early (within 10 days) after myocardial infarction

Recommendations	Class[a]	Level[b]	Ref.[c]
PVS may be considered early after myocardial infarction in patients with reduced LVEF (≤40%) to assess the risk of sudden death.	IIb	B	280–282
Non-invasive tests (e.g. microvolt T-wave alternans, tests for autonomic dysfunction or SA-ECG) are not recommended for risk stratification in the early phase after myocardial infarction.	III	B	283, 284

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 9, 2004 VOL. 351 NO. 24

Prophylactic Use of an Implantable Cardioverter–Defibrillator after Acute Myocardial Infarction

Stefan H. Hohnloser, M.D., Karl Heinz Kuck, M.D., Paul Dorian, M.D., Robin S. Roberts, M.Tech., John R. Hampton, M.D., Robert Hatala, M.D., Eric Fain, M.D., Michael Gent, D.Sc., and Stuart J. Connolly, M.D., on behalf of the DINAMIT Investigators*

DINAMIT

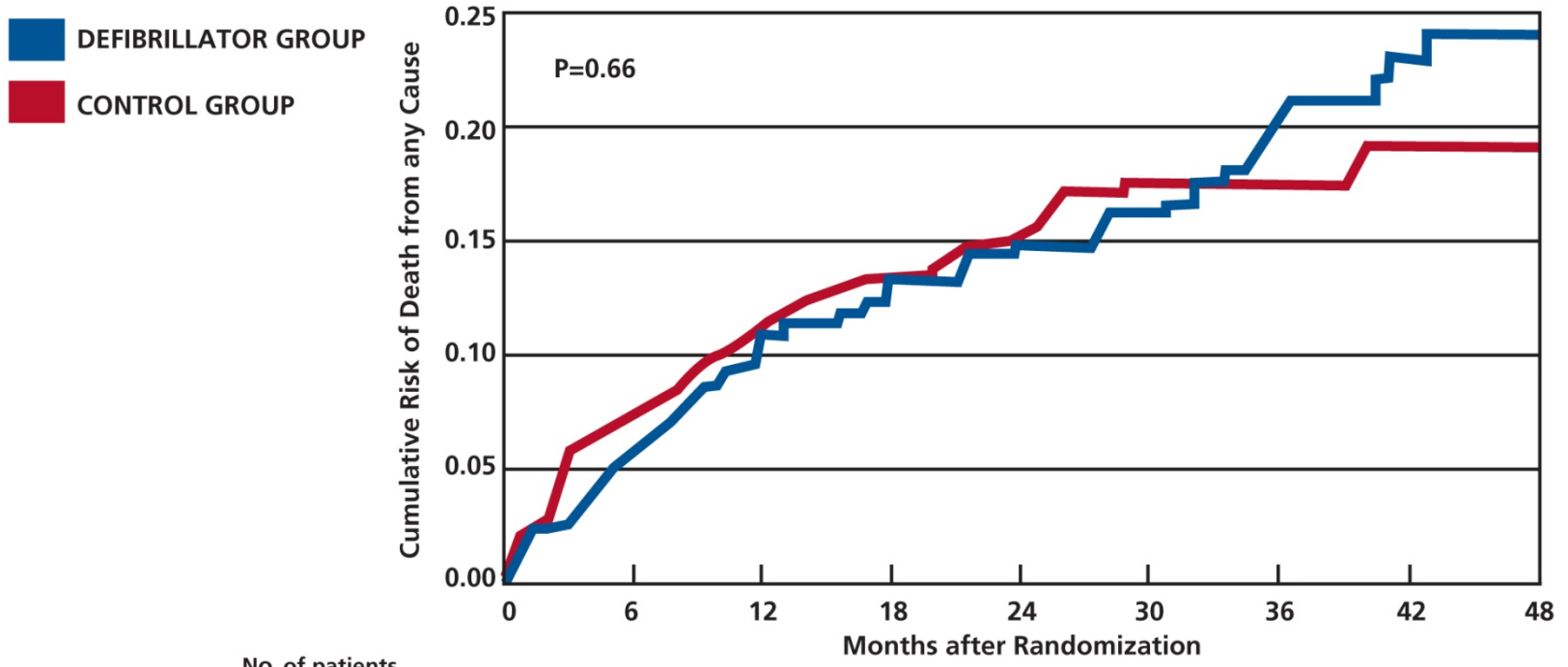
ICD in acute MI

- ✓ The Defibrillator in Acute Myocardial Infarction Trial
- ✓ Hypothesis: Would prophylactic ICDs implanted immediately following an MI reduce mortality?
- ✓ Patient population: 674
- ✓ Inclusion criteria
  - ✓ Myocardial infarction **at least 6 but no more than 40 days** prior to enrollment
  - ✓ LVEF < 35%
  - ✓ Impaired cardiac autonomic function (depress heart-rate variability or elevated average 24-hour heart rate on Holter)
- ✓ Study design: randomized to 2 arms
  - ✓ ICD
  - ✓ No ICD

DINAMIT

ICD in acute MI

Overall mortality (death from any cause)

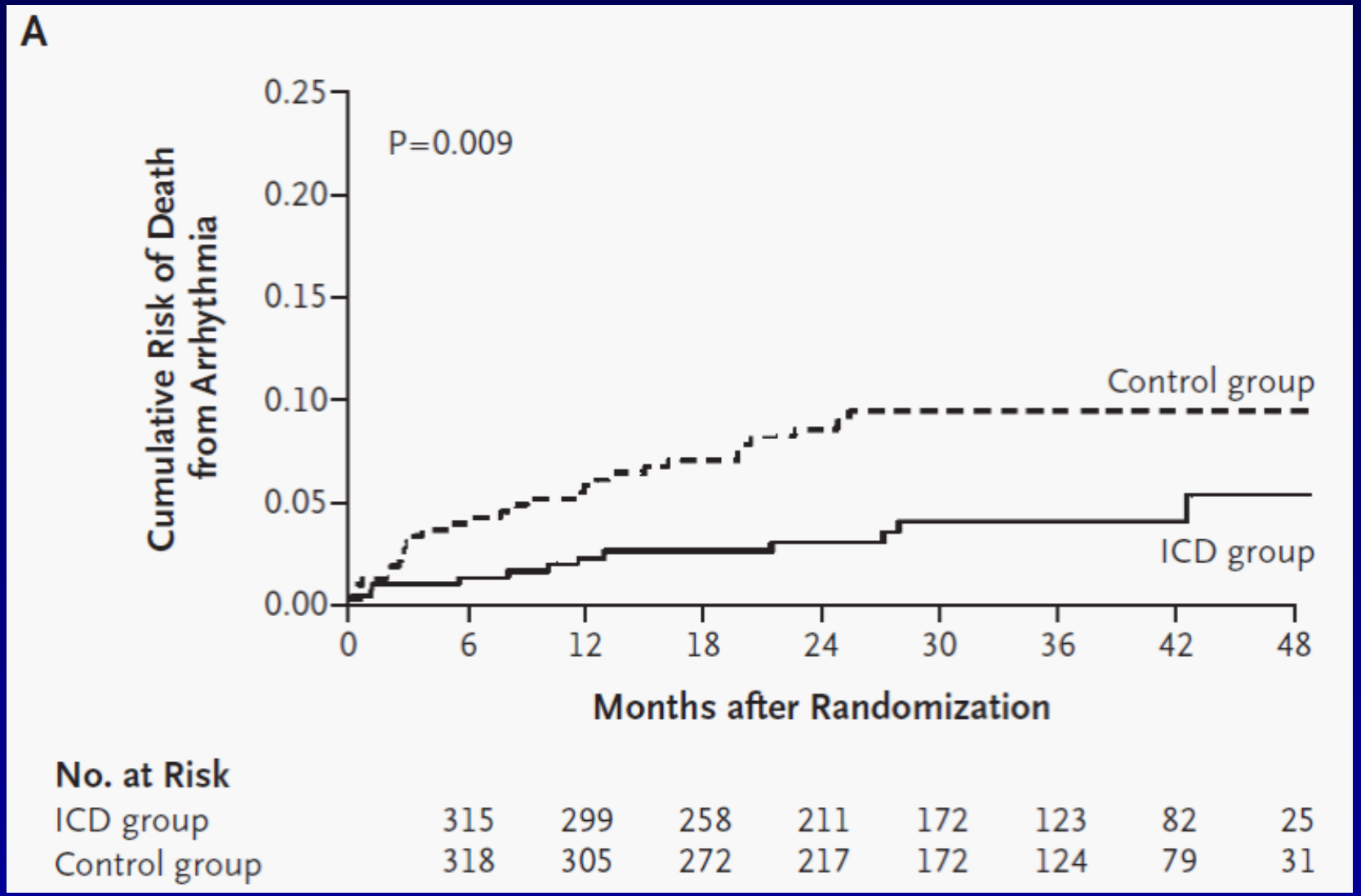


No. of patients

Defibrillator Group:	315	299	258	211	172	123	82	25
Control Group:	318	305	272	217	172	124	79	31

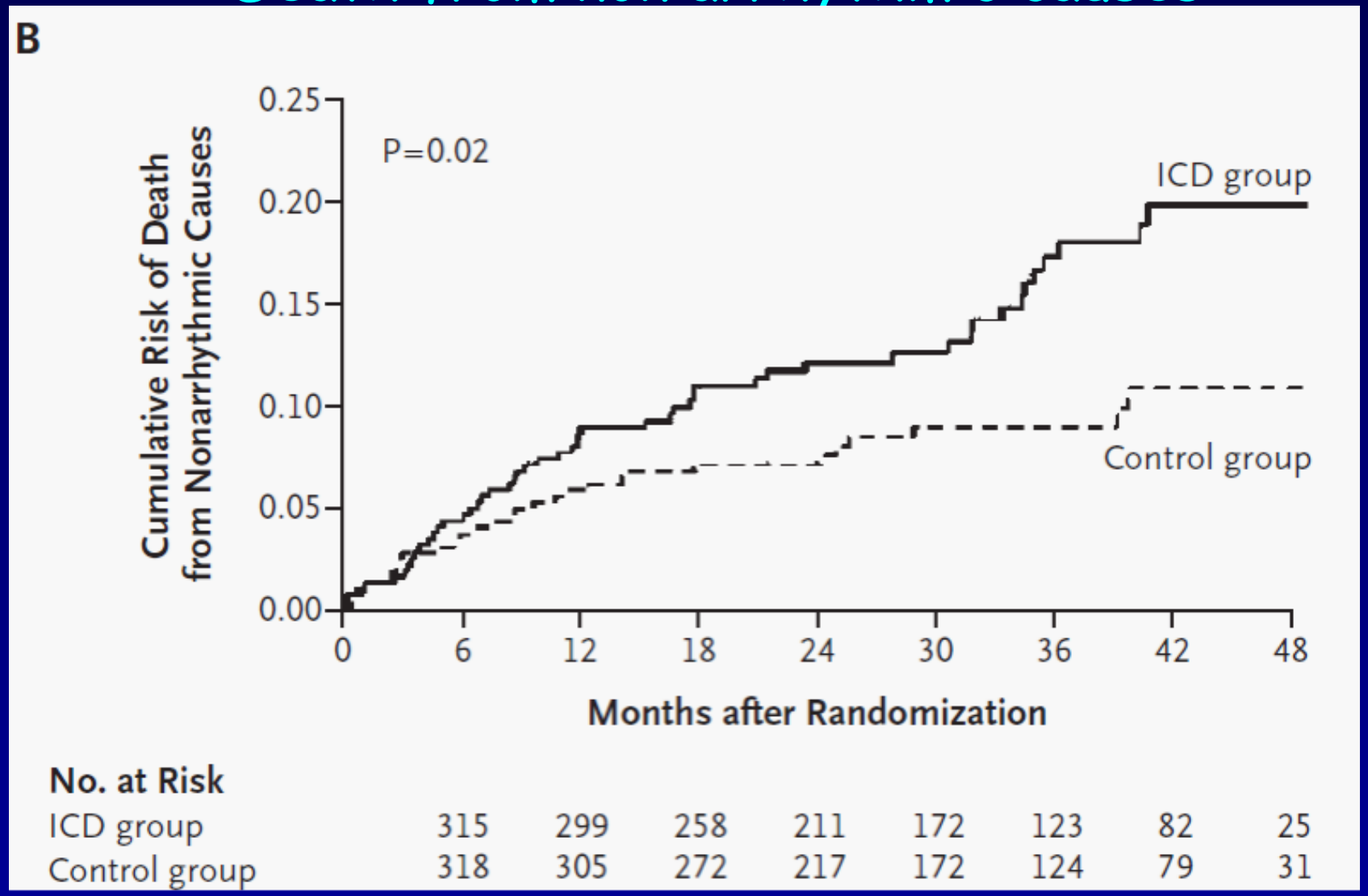
DINAMIT

Death from arrhythmia



DINAMIT

Death from non arrhythmic causes



DINAMIT

Results

- ✓ Prophylactic ICD therapy does not reduce overall mortality in high-risk patients who have recently had a myocardial infarction.
- ✓ Although ICD therapy was associated with a reduction in the rate of death due to arrhythmia, that was offset by an increase in the rate of death from nonarrhythmic causes

ESC
European Society of Cardiology

European Heart Journal (2021) **42**, 3599–3726
doi:10.1093/eurheartj/ehab368

ESC GUIDELINES

2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

Primary prevention

ICD implantation is not recommended within 40 days of a MI as implantation at this time does not improve prognosis.[177,178]	III	A

Early (<40 days) temporary use of a WCD may be considered in the presence of specific conditions such as pre-existing LVEF impairment, incomplete revascularization and arrhythmia occurring 48h after the onset of ACS

A wearable ICD may be considered for patients with HF who are at risk of sudden cardiac death for a limited period or as a bridge to an implanted device.[173–176]	IIb	B

ZOLL® LifeVest®

FACT SHEET

36 percent reduction in total mortality at 90 days in post-MI, low-EF LifeVest patients[1]

WHAT IS LIFEVEST?

The LifeVest® wearable cardioverter defibrillator (WCD) is worn by patients at risk of sudden cardiac death (SCD) for an average of three months. LifeVest provides patients peace of mind, knowing they are protected while their long-term SCD risk is assessed by their doctor. LifeVest is prescribed for a wide range of patients, including those who recently suffered a heart attack or have a new diagnosis of heart failure.

Heart, Lung and Circulation (2016) 25, 1055–1062
1443-9506/04/$36.00
http://dx.doi.org/10.1016/j.hlc.2016.04.007

REVIEW

Programmed Ventricular Stimulation to Risk Stratify for Early Cardioverter-Defibrillator Implantation to Prevent Tachyarrhythmias following Acute Myocardial Infarction (PROTECT-ICD): Trial Protocol, Background and Significance

Sarah Zaman, MBBS, PhD [a,b], Andrew J. Taylor, MBBS, PhD [c,d], Martin Stiles, MBChB, PhD [e], Clara Chow, MBBS, PhD [f,g,h], Pramesh Kovoor, MBBS, PhD [f,g*]

" is an ongoing Australian- led multicentre randomised controlled trial targeting prevention of sudden cardiac death in patients who have at least moderately reduced cardiac function (EF ≤ 40%) following a myocardial infarct (MI). The primary objective of the trial is to assess whether electrophysiological study to guide prophylactic implantation of an implantable cardioverter-defibrillator (ICD) early following MI (first 40 days) will lead to a significant reduction in sudden cardiac death and non-fatal arrhythmia"

Recommendations for risk stratification and treatment of ventricular arrhythmias
early after myocardial infarction

Reassessment of the LVEF before 6 weeks following MI may not discriminate between myocardial stunning and remodelling.

Recommendations	Class[a]	Level[b]
Risk stratification		
Early (before discharge) assessment of LVEF is recommended in all patients with acute MI.[567,568]	I	B
In patients with pre-discharge LVEF ≤40%, re-evaluation of LVEF 6–12 weeks after MI is recommended to assess the potential need for primary prevention ICD implantation.[568,573,574]	I	C
Treatment of VAs		
Catheter ablation should be considered in patients with recurrent episodes of PVT/VF triggered by a similar PVC non-responsive to medical treatment or coronary revascularization in the subacute phase of MI.[332]	IIa	C

Risk stratification in patients with ischemic heart disease and reduced LV ejection fraction

(Heart Failure patients)

Sudden Cardiac Death (SCD)

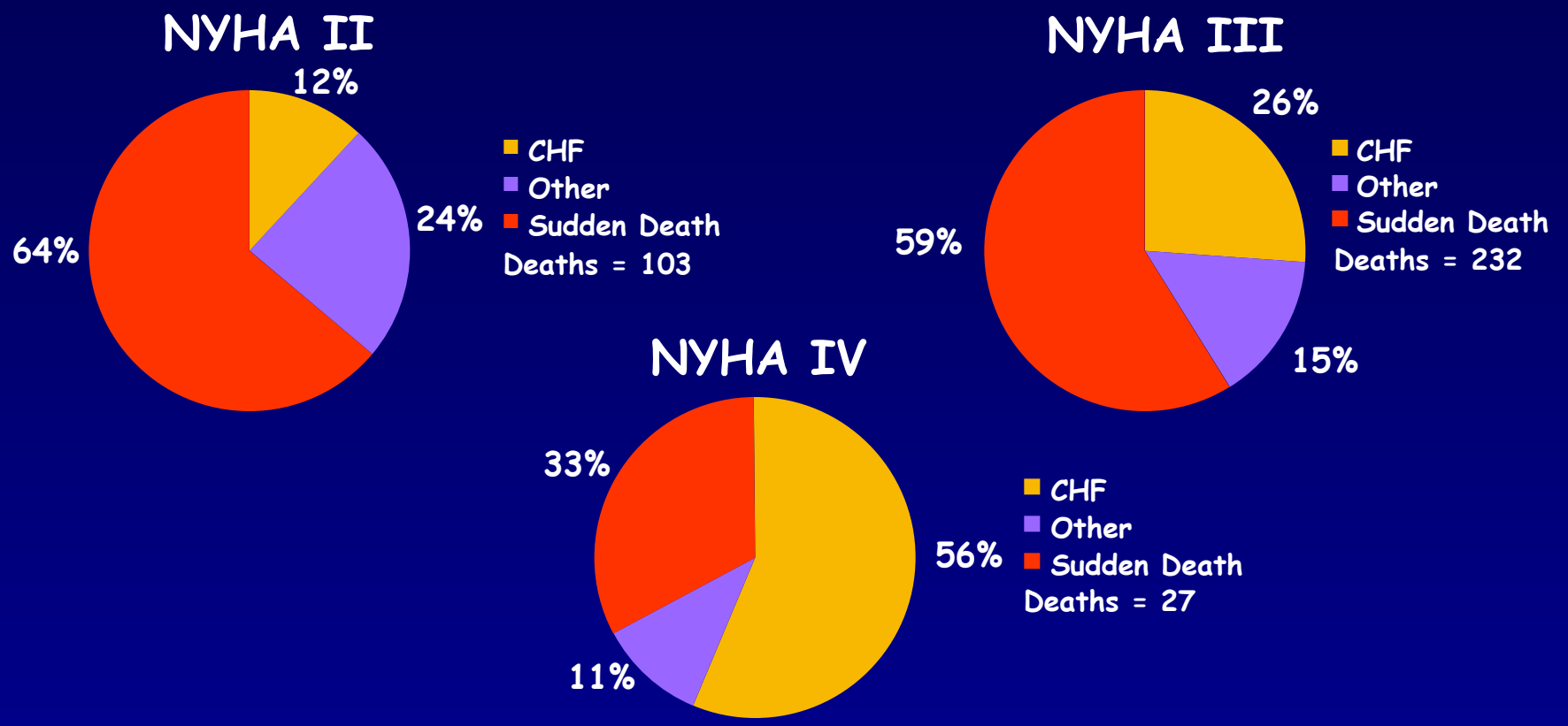
High risk in HEART FAILURE patients

- Heart failure patients experience SCD at six to nine times the rate of the general population[1]
- Sudden death is the predominant mode of death in mild to moderate (NYHA II-III) heart failure[2]

[1]American Heart Association. 2002 heart and stroke statistical update. American Heart Association, 2001.
[2]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;353:2001-07.

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.

PRIMARY PREVENTION of SCD in Heart Failure

(prevention of SCD in individuals without a history of cardiac arrest or sustained VT)

WHEN AN ICD IMPLANT IS INDICATED ?

RANDOMIZED TRIALS

randomized, prospective, controlled trials in patients with a history of previous myocardial infarction and depressed EF.

(ischemic dilated cardiomyopathy)

- ✓ MADIT
- ✓ MUSTT
- ✓ MADIT II

MADIT

IMPROVED SURVIVAL WITH AN IMPLANTED DEFIBRILLATOR IN PATIENTS WITH CORONARY DISEASE AT HIGH RISK FOR VENTRICULAR ARRHYTHMIA

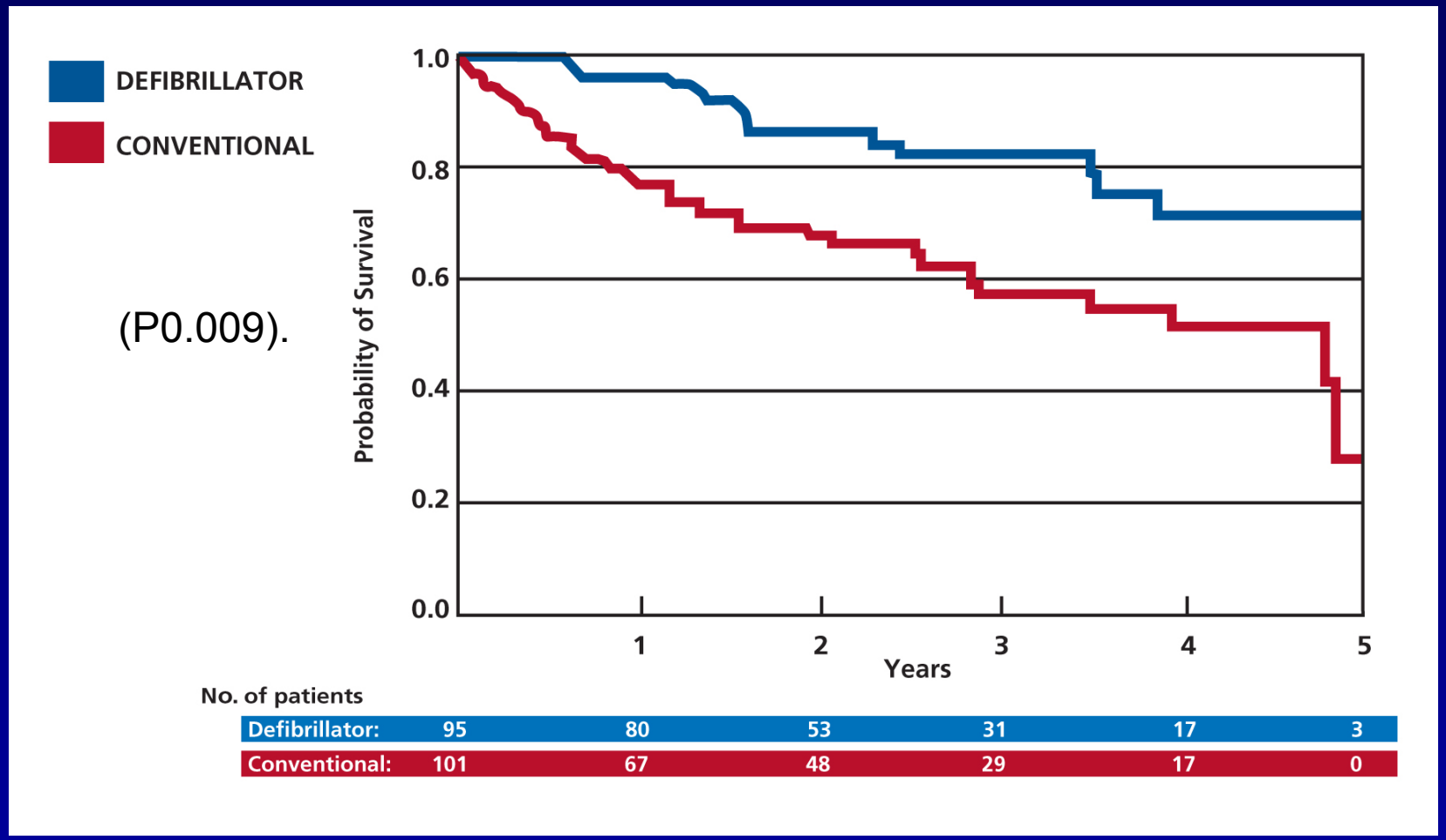
ARTHUR J. MOSS, M.D., W. JACKSON HALL, PH.D., DAVID S. CANNOM, M.D., JAMES P. DAUBERT, M.D., STEVEN L. HIGGINS, M.D., HELMUT KLEIN, M.D., JOSEPH H. LEVINE, M.D., SANJEEV SAKSENA, M.D., ALBERT L. WALDO, M.D., DAVID WILBER, M.D., MARY W. BROWN, M.S., AND MOONSEONG HEO, PH.D., FOR THE MULTICENTER AUTOMATIC DEFIBRILLATOR IMPLANTATION TRIAL INVESTIGATORS*

N Engl J Med 1996

- ✓ Multicenter Automatic Defibrillator Implantation Trial
- ✓ multicenter, randomized, controlled trial
- ✓ 196 pts
- ✓ Inclusion criteria:
  - ✓ Prior myocardial infarction (MI)
  - ✓ NSVT
  - ✓ LVEF ≤ 35%
  - ✓ Positive EP study (inducible SVT)
- ✓ Study design: randomized to 2 arms
  - ✓ ICD

MADIT: results

- ICD patients reduced their risk of all-cause mortality by a significant 54% compared to patients on conventional drug therapy



MADIT Take-Aways

✓ There was a significant and provable mortality benefit to prophylactic ICD implantation in "high-risk" patients

✓MADIT defined high risk as patients who had a prior MI, were inducible in the EP lab, and had systolic impairment (LV disfunction)

MUSTT

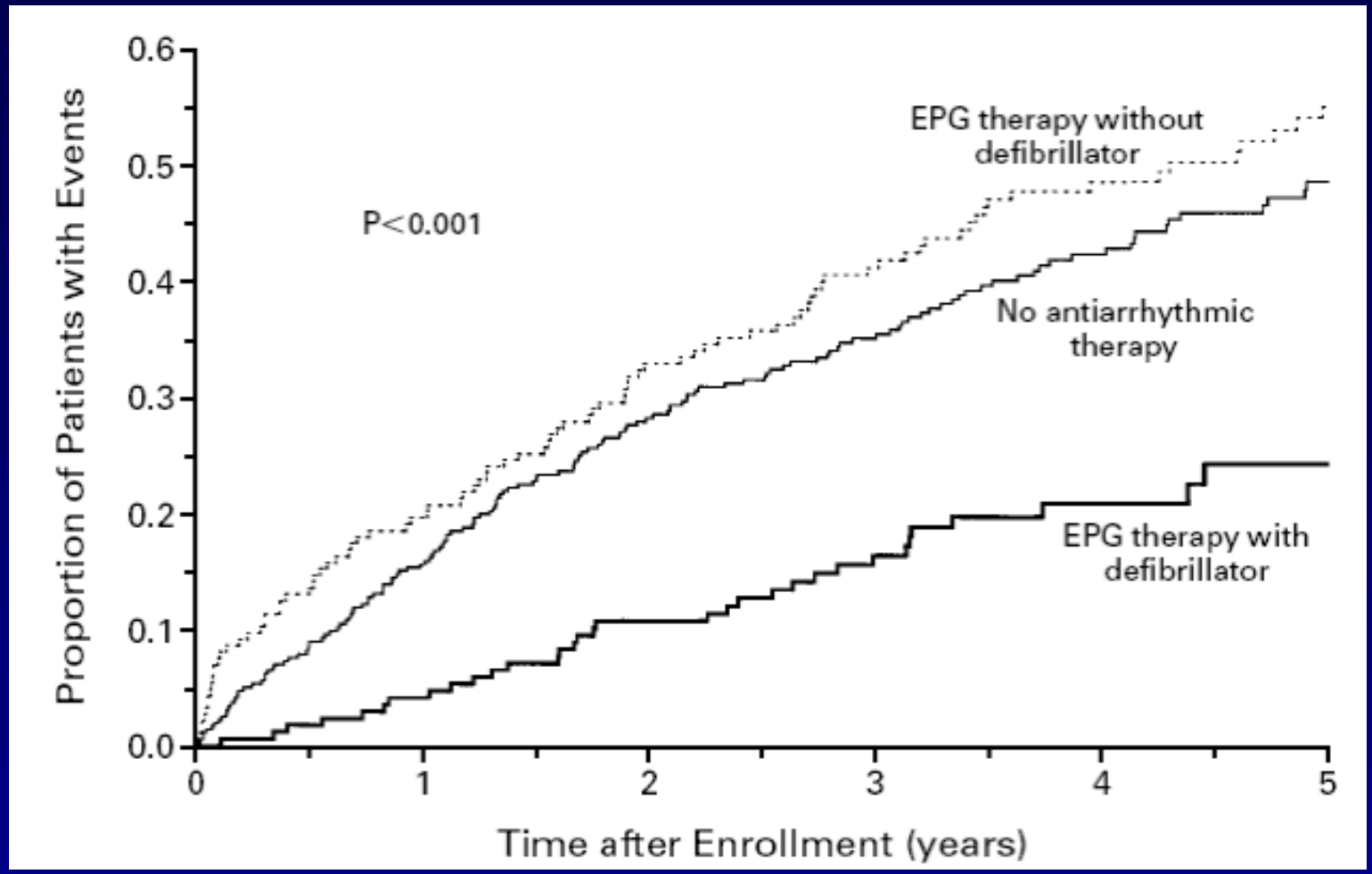
A RANDOMIZED STUDY OF THE PREVENTION OF SUDDEN DEATH IN PATIENTS WITH CORONARY ARTERY DISEASE

ALFRED E. BUXTON, M.D., KERRY L. LEE, PH.D., JOHN D. FISHER, M.D., MARK E. JOSEPHSON, M.D., ERIC N. PRYSTOWSKY, M.D., AND GAIL HAFLEY, M.S., FOR THE MULTICENTER UNSUSTAINED TACHYCARDIA TRIAL INVESTIGATORS*

N Engl J Med 1999;

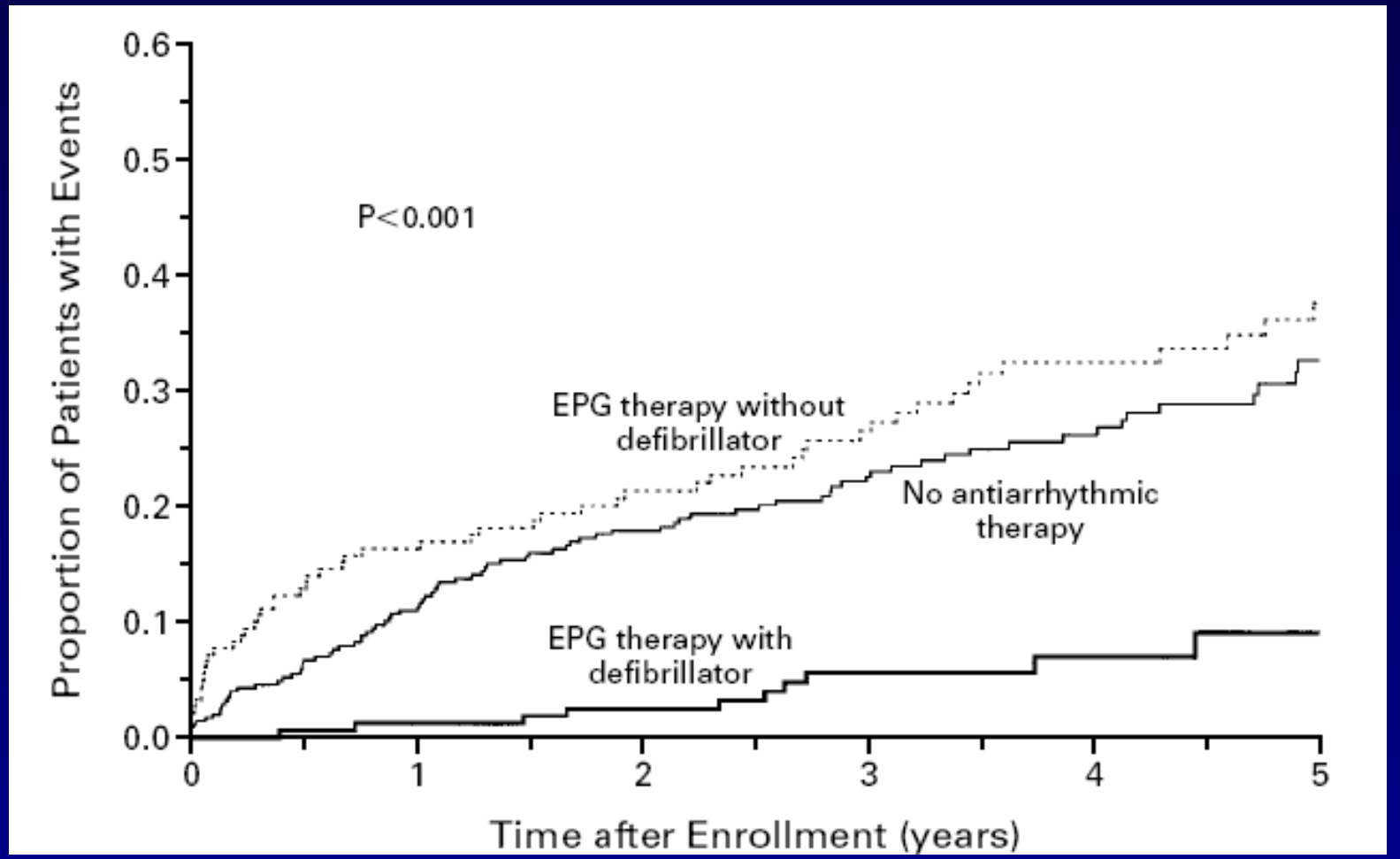
- ✓ Multicenter Unsustained Tachycardia Trial
- ✓ Patient population: 704
- ✓ Inclusion criteria:
  - ✓ Coronary artery disease (CAD)
  - ✓ LVEF ≤ 40%
  - ✓ Asymptomatic unsustained VT (in 6 months pre-enrollment)
  - ✓ sustained VT induced at EP study
- ✓ Study design: randomized to 2 arms
  - ✓ EP-guided therapy resulting in drug and/or device therapy (in case of drug failure in preventing VT induction)
  - ✓ No antiarrhythmic therapy

MUSTT: results



Kaplan–Meier Estimates of the Rates of **Overall Mortality** According to Whether the Patients Received Treatment with a Defibrillator.

MUSTT: results



Kaplan–Meier Estimates of the Rates of **Cardiac Arrest or Death from Arrhythmia** According to Whether the Patients Received Treatment with a Defibrillator.

MUSTT: results

- ✓ ICD patients had a significant **27% reduction** in risk for arrhythmic death or death from cardiac arrest compared to patients not receiving any therapy

- ✓ **EPG drug therapy (AADs) had worse mortality and event rates than no therapy**!!!!

PROPHYLACTIC IMPLANTATION OF A DEFIBRILLATOR IN PATIENTS WITH MYOCARDIAL INFARCTION AND REDUCED EJECTION FRACTION

ARTHUR J. MOSS, M.D., WOJCIECH ZAREBA, M.D., PH.D., W. JACKSON HALL, PH.D., HELMUT KLEIN, M.D., DAVID J. WILBER, M.D., DAVID S. CANNOM, M.D., JAMES P. DAUBERT, M.D., STEVEN L. HIGGINS, M.D., MARY W. BROWN, M.S., AND MARK L. ANDREWS, B.B.S., FOR THE MULTICENTER AUTOMATIC DEFIBRILLATOR IMPLANTATION TRIAL II INVESTIGATORS*

MADIT II

N Engl J Med 2002

- ✓ Multicenter Automatic Defibrillator Trial II
- ✓ Hypothesis : Would MI survivors with a low ejection fraction derive mortality benefits from a prophylactic ICD (even without an EP study)?
- ✓ Patient population: 1,232
- ✓ Inclusion criteria:
  - ✓ Prior myocardial infarction (MI)
  - ✓ LVEF < 30%; **NYHA I-IV**
- ✓ Exclusion criteria
  - ✓ MI within 30 days of enrollment
  - ✓ Standard ICD indication

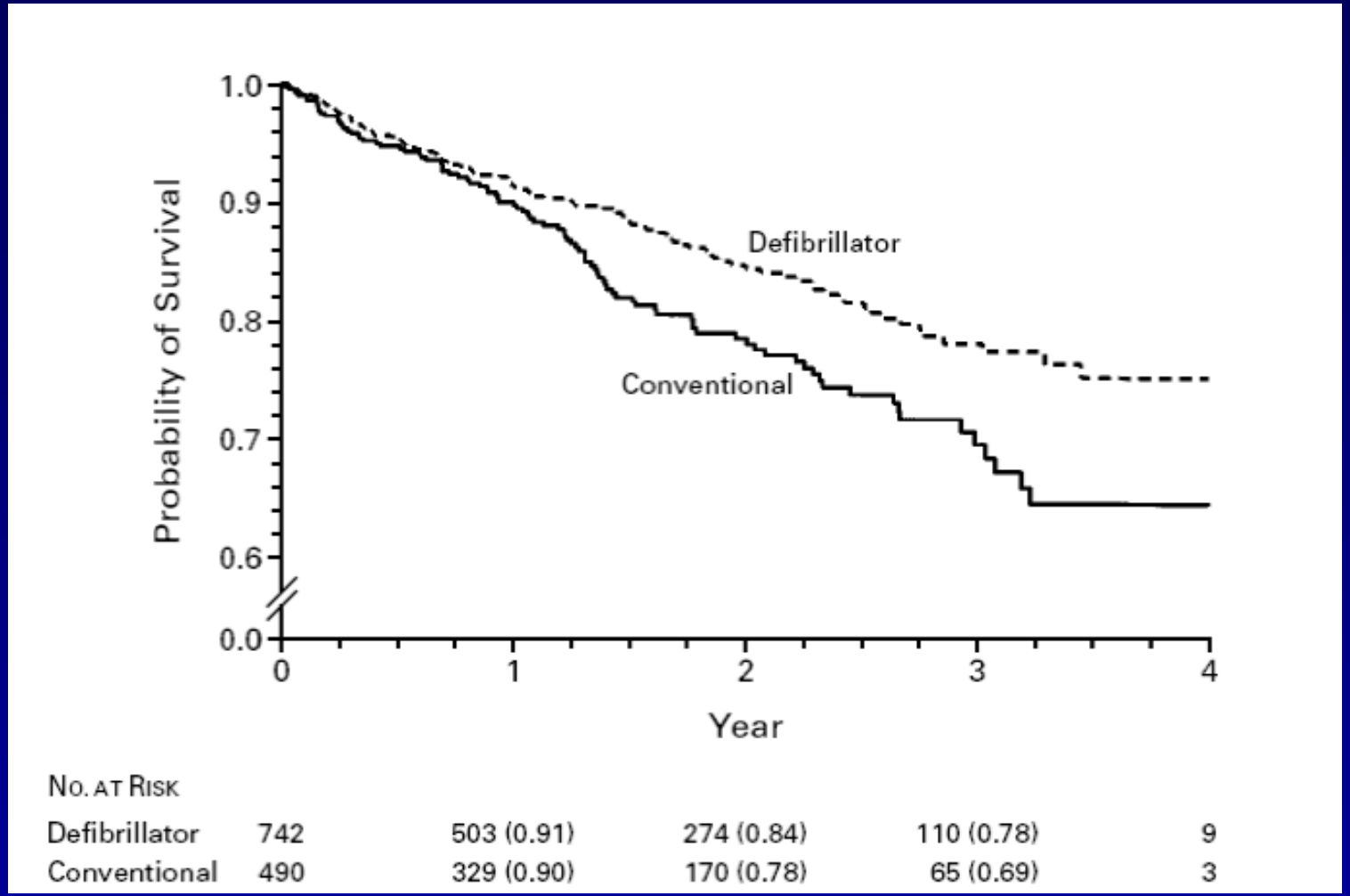
Unlike the prior MADIT study, patients did not undergo an EP study

MADIT II: results

ICDs significantly reduced the risk of death by 31% compared to drug therapy

MADIT II

⬇ 31%



No. at Risk

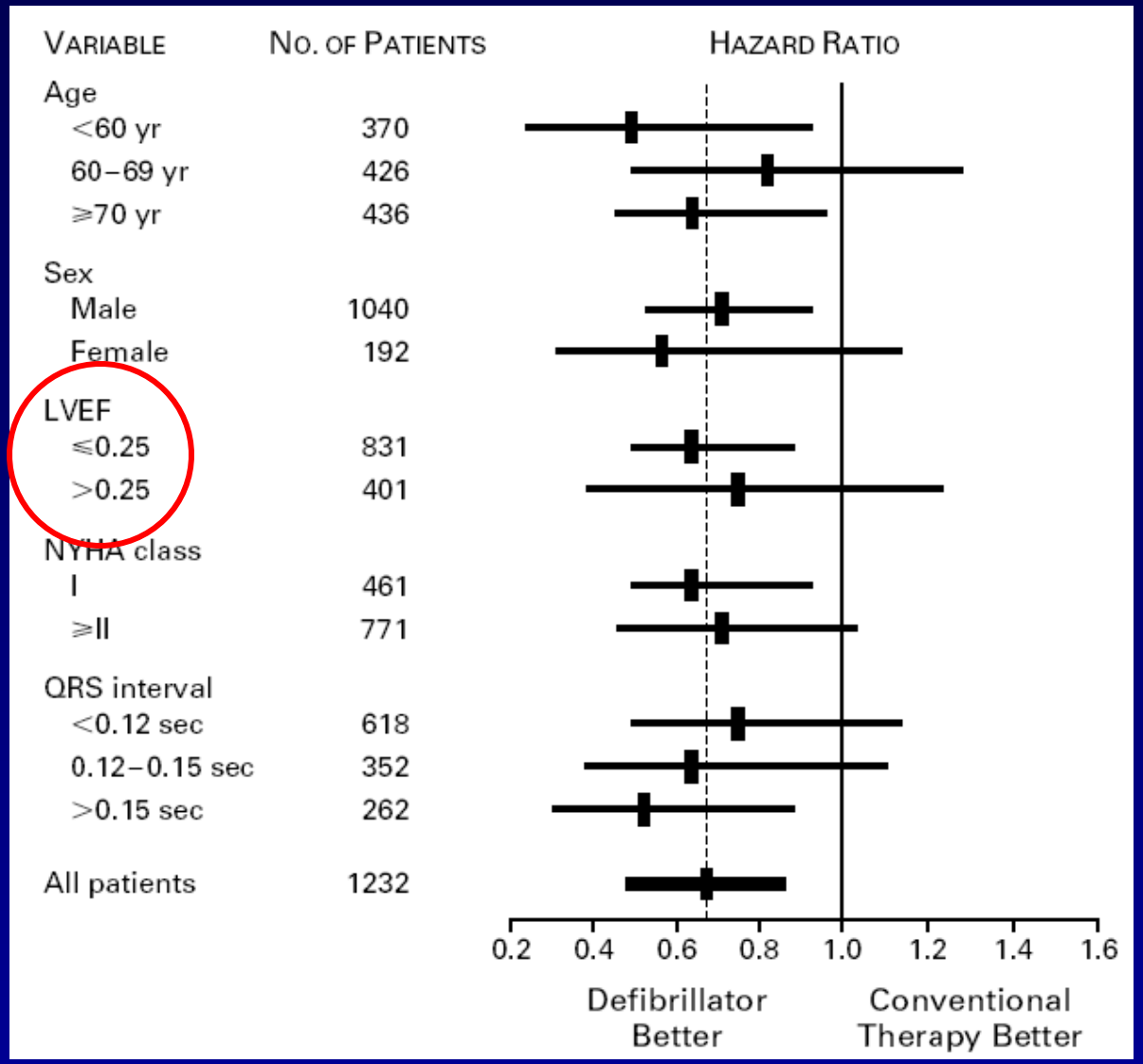
Defibrillator	742	503 (0.91)	274 (0.84)	110 (0.78)	9
Conventional	490	329 (0.90)	170 (0.78)	65 (0.69)	3

MADIT II: results

TABLE 1. CLINICAL CHARACTERISTICS OF THE 1232 PATIENTS.*

CHARACTERISTIC	DEFIBRILLATOR GROUP (N=742)	CONVENTIONAL-THERAPY GROUP (N=490)
Age (yr)	64±10	65±10
Male sex (%)	84	85
NYHA functional class (%)†		
I	35	39
II	35	34
III	25	23
IV	5	4
Treatment for hypertension (%)	53	53
Diabetes (%)	33	38
Current or former cigarette smoker (%)	80	82
Coronary bypass surgery (%)	58	56
Coronary angioplasty (%)	45	42
Interval of >6 mo between most recent myocardial infarction and enrollment (%)	88	87
Cardiac findings at enrollment (%)		
Blood urea nitrogen >25 mg/dl (8.92 mmol/liter)	29	32
Atrial fibrillation	9	8
QRS interval ≥0.12 sec	50	51
Nonspecific conduction defect	22	26
Right bundle-branch block	9	7
Left bundle-branch block	19	18
Left ventricular ejection fraction	23±5	23±6
Medications at last contact (%)‡		
Amiodarone	13	10
Angiotensin-converting–enzyme inhibitors	68	72
Beta-blockers	70	70
Calcium-channel blockers	9	9
Class I antiarrhythmic agents	3	2
Digitalis	57	57
Diuretics	72	81
Lipid-lowering statin drugs	67	64

MADIT II: results



MADIT II: take-aways

- ✓ This study proved that ICDs confer mortality benefits over and above pharmacological therapy for patients with a prior MI and poor systolic function, even if there is no evidence of arrhythmia

- ✓ **MADIT II expanded ICD indications to include a vast primary-prevention population**

- ✓ Why did MADIT II mortality benefits take a while to show up, while in MADIT the benefits were evident almost immediately? Theories include:
  - ✓ MADIT II patients had a lower rate of mortality than MADIT
  - ✓ MADIT used stronger risk stratification
  - ✓ MADIT II patients were on better cardiac drugs

randomized, prospective, controlled trials in heart failure patients with LV dysfunction regardless of the aetiology

(ischemic and non-ischemic dilated cardiomyopathy)

- ✓ COMPANION
- ✓ SCD-HeFT

Cardiac-Resynchronization Therapy with or without an Implantable Defibrillator in Advanced Chronic Heart Failure

Michael R. Bristow, M.D., Leslie A. Saxon, M.D., John Boehmer, M.D., Steven Krueger, M.D., David A. Kass, M.D., Teresa De Marco, M.D., Peter Carson, M.D., Lorenzo DiCarlo, M.D., David DeMets, Ph.D., Bill G. White, Ph.D., Dale W. DeVries, B.A., and Arthur M. Feldman, M.D., Ph.D., for the Comparison of Medical Therapy, Pacing, and Defibrillation in Heart Failure (COMPANION) Investigators*

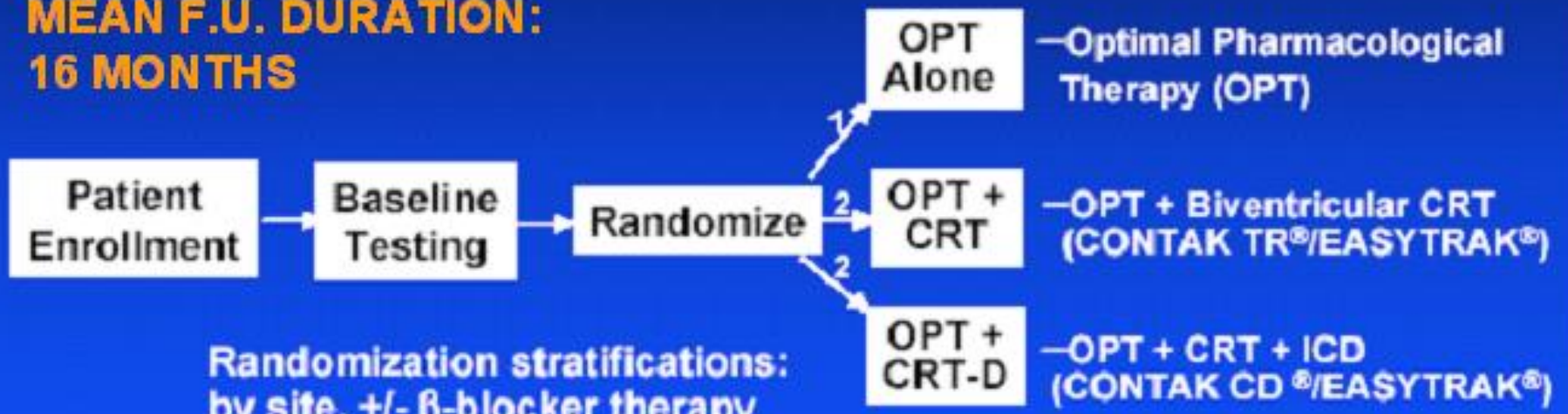
N Engl J Med 2004;350:2140-50.

COMPANION: *Study Design*

controlled, randomized, open-label trial

Patients randomized 1:2:2 to one of the following three arms:

MEAN F.U. DURATION: 16 MONTHS

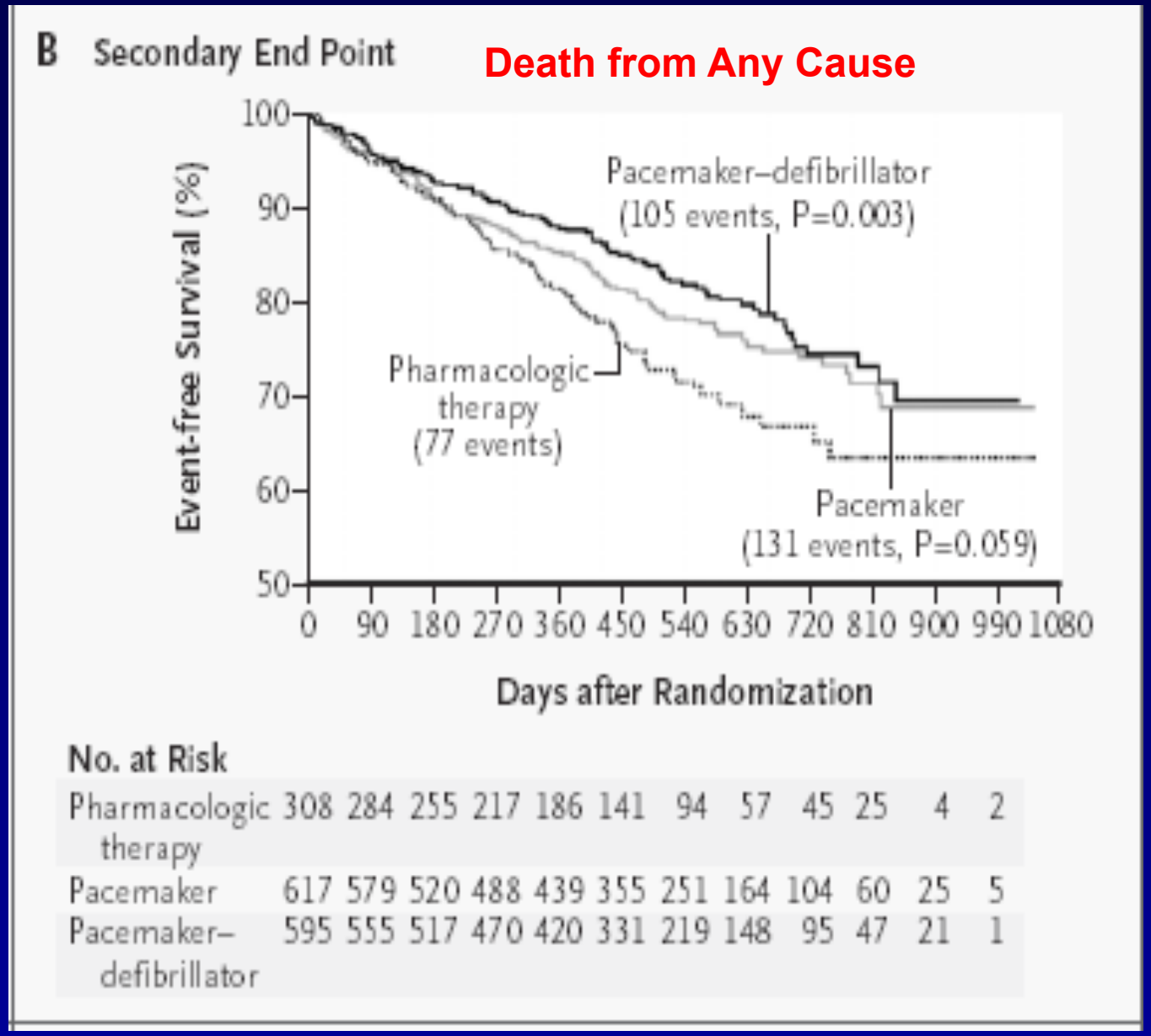


Randomization stratifications: by site, +/- β-blocker therapy

Target Time to Implant ≤2 days from randomization

ACC Late-Breaker 3/31/03 Preliminary Results

COMPANION ↓ 36%



Cardiac-Resynchronization Therapy with or without an Implantable Defibrillator in Advanced Chronic Heart Failure

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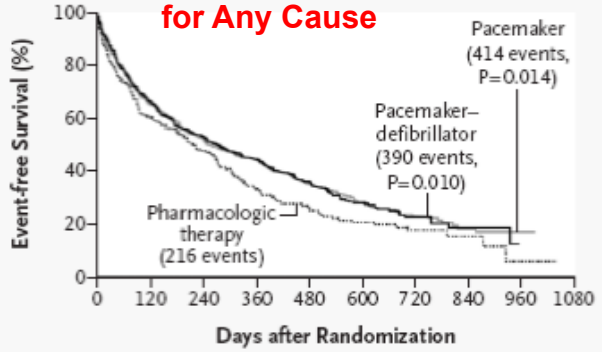
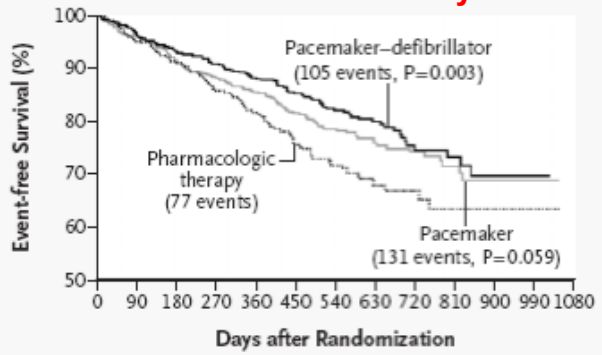
N Engl J Med 2004;350:2140-50.

A Primary End Point — Death from or Hospitalization for Any Cause



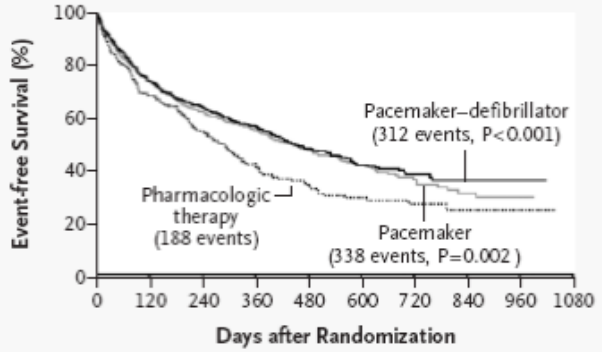
No. at Risk									
Pharmacologic therapy	308	176	115	72	46	24	16	6	1
Pacemaker	617	384	294	228	146	73	36	14	3
Pacemaker–defibrillator	595	385	283	217	128	61	25	8	0

B Secondary End Point — Death from Any Cause



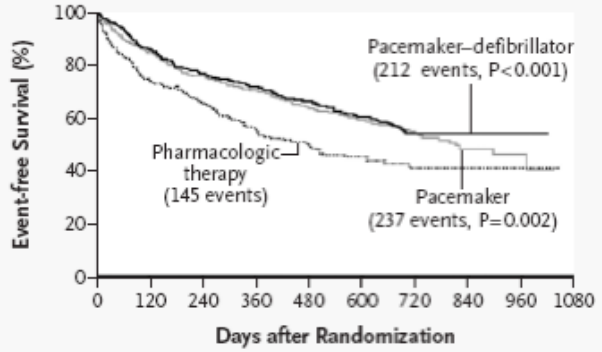
No. at Risk													
Pharmacologic therapy	308	284	255	217	186	141	94	57	45	25	4	2
Pacemaker	617	579	520	488	439	355	251	164	104	60	25	5
Pacemaker–defibrillator	595	555	517	470	420	331	219	148	95	47	21	1

C Death from or Hospitalization for Cardiovascular Causes



No. at Risk									
Pharmacologic therapy	308	199	134	91	56	29	20	8	2
Pacemaker	617	431	349	282	194	102	51	22	5
Pacemaker–defibrillator	595	425	341	274	167	89	45	20	3

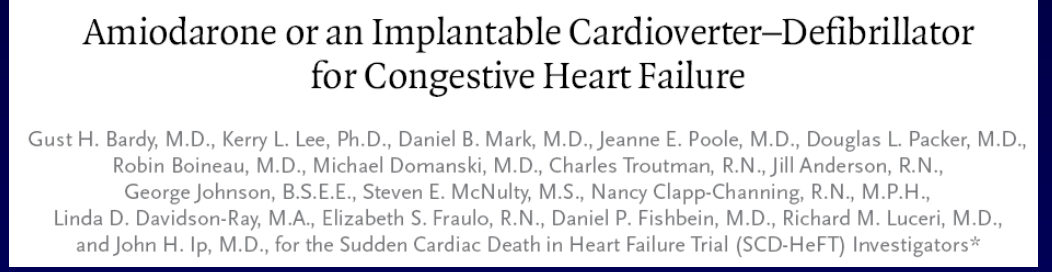
D Death from or Hospitalization for Heart Failure



No. at Risk									
Pharmacologic therapy	308	216	161	118	76	39	28	11	2
Pacemaker	617	498	422	355	258	142	75	35	9
Pacemaker–defibrillator	595	497	411	343	228	131	71	27	5

Kaplan–Meier Estimates of the Time to the Primary End Point of Death from or Hospitalization for Any Cause (Panel A), the Time to the Secondary End Point of Death from Any Cause (Panel B), the Time to Death from or Hospitalization for Cardiovascular Causes (Panel C), and the Time to Death from or Hospitalization for Heart Failure (Panel D).

SCD-HeFT



Amiodarone or an Implantable Cardioverter–Defibrillator for Congestive Heart Failure

Gust H. Bardy, M.D., Kerry L. Lee, Ph.D., Daniel B. Mark, M.D., Jeanne E. Poole, M.D., Douglas L. Packer, M.D., Robin Boineau, M.D., Michael Domanski, M.D., Charles Troutman, R.N., Jill Anderson, R.N., George Johnson, B.S.E.E., Steven E. McNulty, M.S., Nancy Clapp-Channing, R.N., M.P.H., Linda D. Davidson-Ray, M.A., Elizabeth S. Fraulo, R.N., Daniel P. Fishbein, M.D., Richard M. Luceri, M.D., and John H. Ip, M.D., for the Sudden Cardiac Death in Heart Failure Trial (SCD-HeFT) Investigators*

- ✓ Sudden Cardiac Death in Heart Failure Trial
- ✓ Hypothesis:

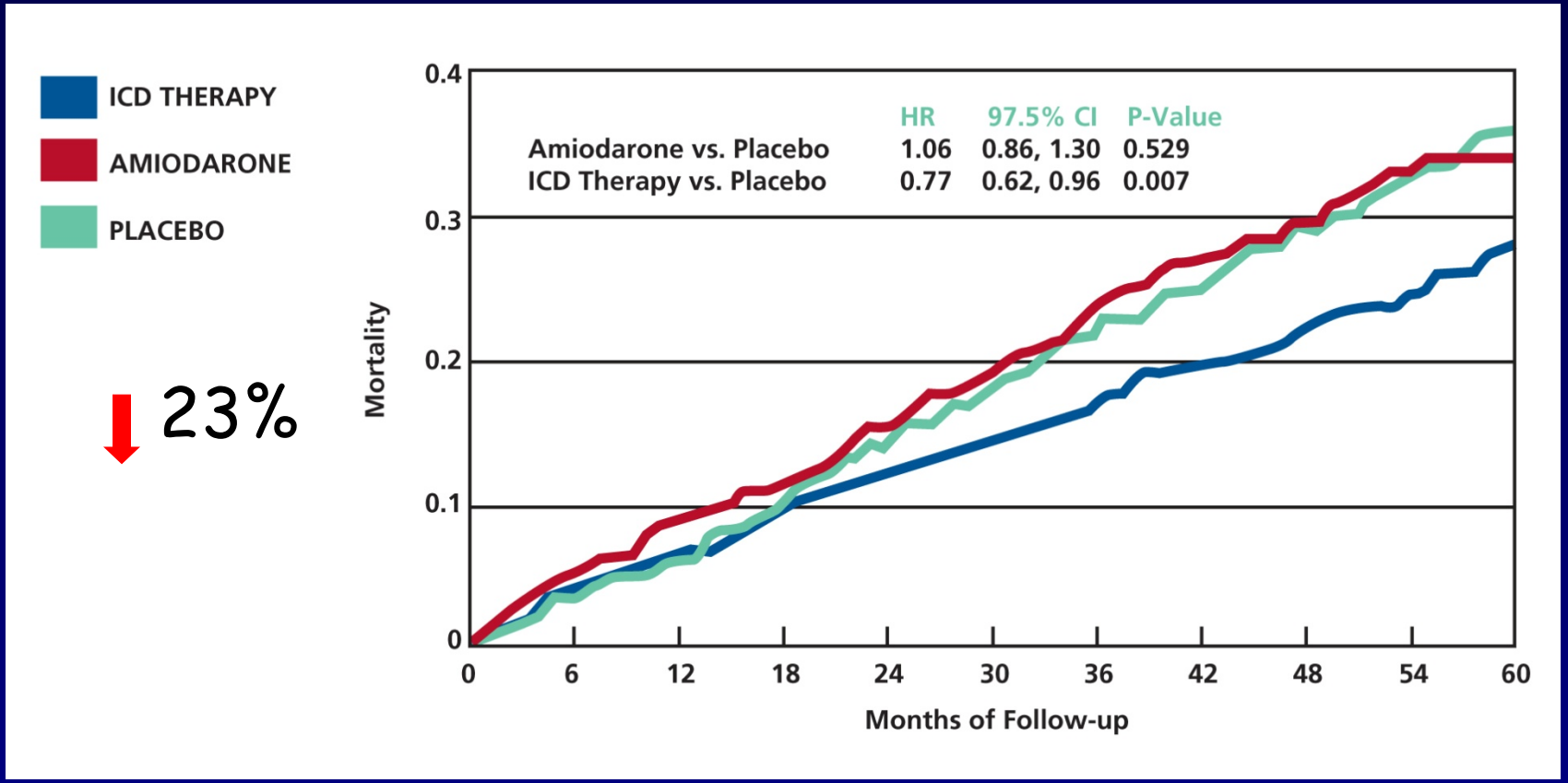
  Which works better to reduce all-cause mortality in NYHA Class II and III patients, a prophylactic ICD or amiodarone?
- ✓ Patient population: 2,521, mean F.U. 45.5 months
- ✓ Inclusion criteria: **both ischemic and nonischemic cardiomyopathies**

  CHF NYHA Class II or III

  LVEF < 35%

  All patients in optimal medical therapy (BB, ACE-I etc.)
- ✓ Study design: randomized to 3 arms
  - ICD
  - Amiodarone
  - Placebo (no ICD, no amiodarone)

SCD-HeFT



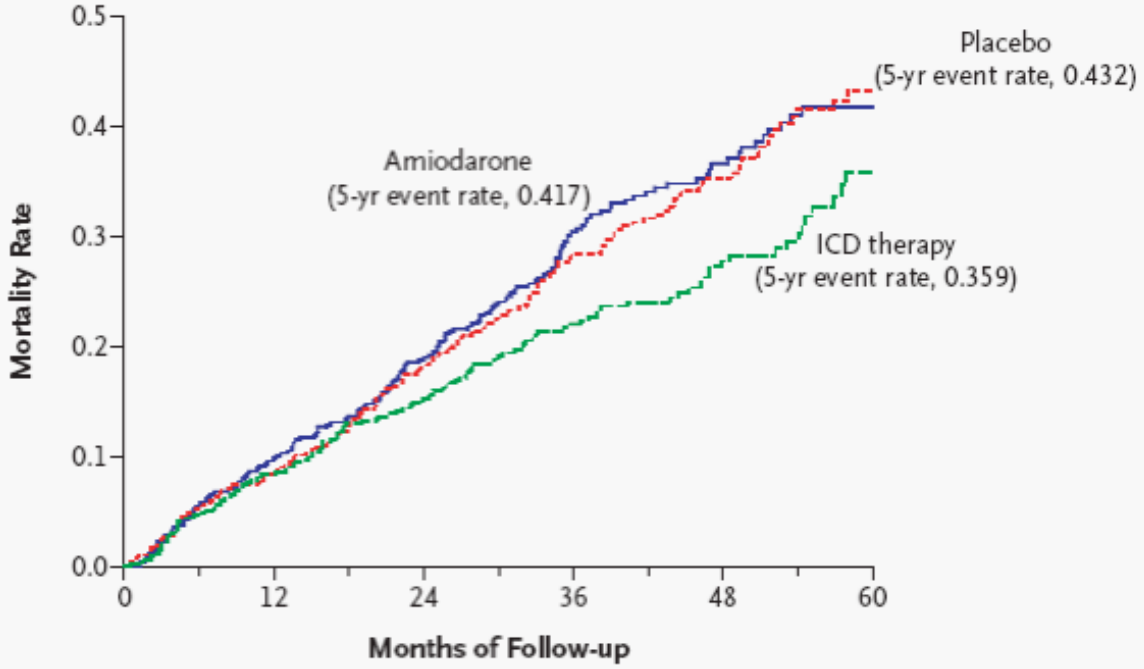
- ✓ Results: In patients with NYHA class II or III CHF and LVEF of 35 percent or less, amiodarone has no favorable effect on survival, whereas single-lead, shock-only ICD therapy reduces overall mortality by 23 percent.

SCD-HeFT

Ischemic HF

Death from Any Cause

	Hazard Ratio (97.5% CI)	P Value
Amiodarone vs. placebo	1.05 (0.81–1.36)	0.66
ICD therapy vs. placebo	0.79 (0.60–1.04)	0.05



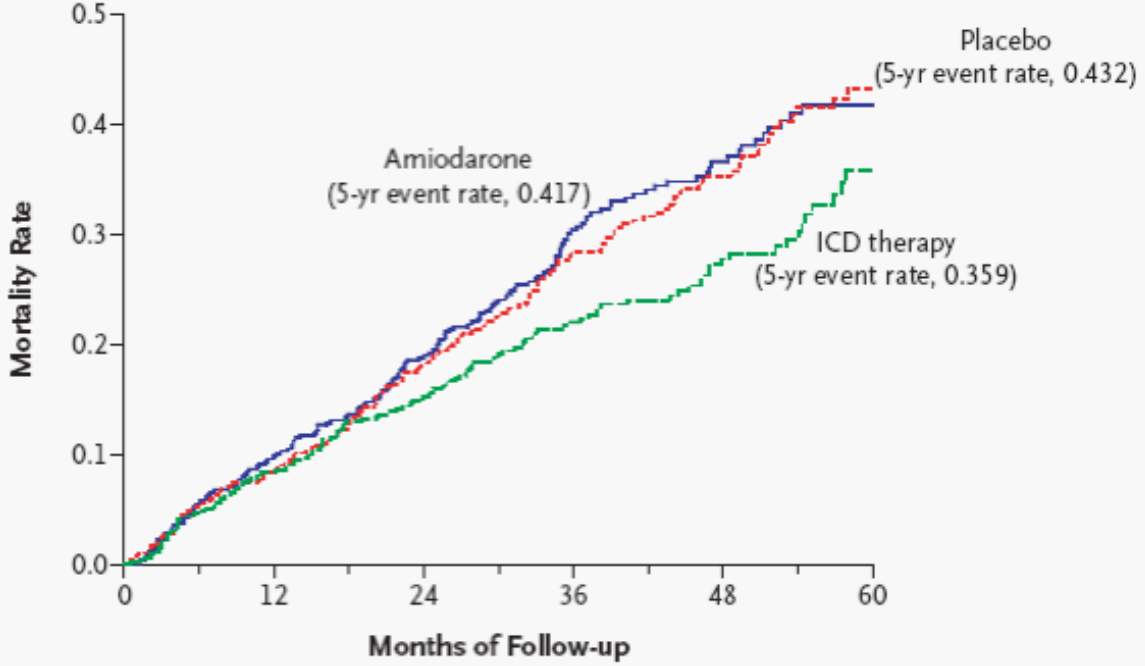
No. at Risk						
Amiodarone	426	384	346	227	130	46
Placebo	453	415	370	244	152	48
ICD therapy	431	395	365	244	144	48

SCD-HeFT

Non-ischemic HF

Death from Any Cause

	Hazard Ratio (97.5% CI)	P Value
Amiodarone vs. placebo	1.05 (0.81–1.36)	0.66
ICD therapy vs. placebo	0.79 (0.60–1.04)	0.05



No. at Risk						
Amiodarone	426	384	346	227	130	46
Placebo	453	415	370	244	152	48
ICD therapy	431	395	365	244	144	48

The NEW ENGLAND JOURNAL of MEDICINE

N Engl J Med 2017;377:41-51.

ORIGINAL ARTICLE

Declining Risk of Sudden Death in Heart Failure

Li Shen, M.B., Ch.B., Pardeep S. Jhund, M.B., Ch.B., Ph.D.,
Mark C. Petrie, M.B., Ch.B., Brian L. Claggett, Ph.D., Simona Barlera, M.Sc.,
John G.F. Cleland, M.D., Ph.D., Henry J. Dargie, M.B., Ch.B.,
Christopher B. Granger, M.D., John Kjekshus, M.D., Ph.D.,
Lars Køber, M.D., D.M.Sc., Roberto Latini, M.D., Aldo P. Maggioni, M.D.,
Milton Packer, M.D., Bertram Pitt, M.D., Scott D. Solomon, M.D.,
Karl Swedberg, M.D., Ph.D., Luigi Tavazzi, M.D., Ph.D., John Wikstrand, M.D., Ph.D.,
Faiez Zannad, M.D., Ph.D., Michael R. Zile, M.D., and John J.V. McMurray, M.D.

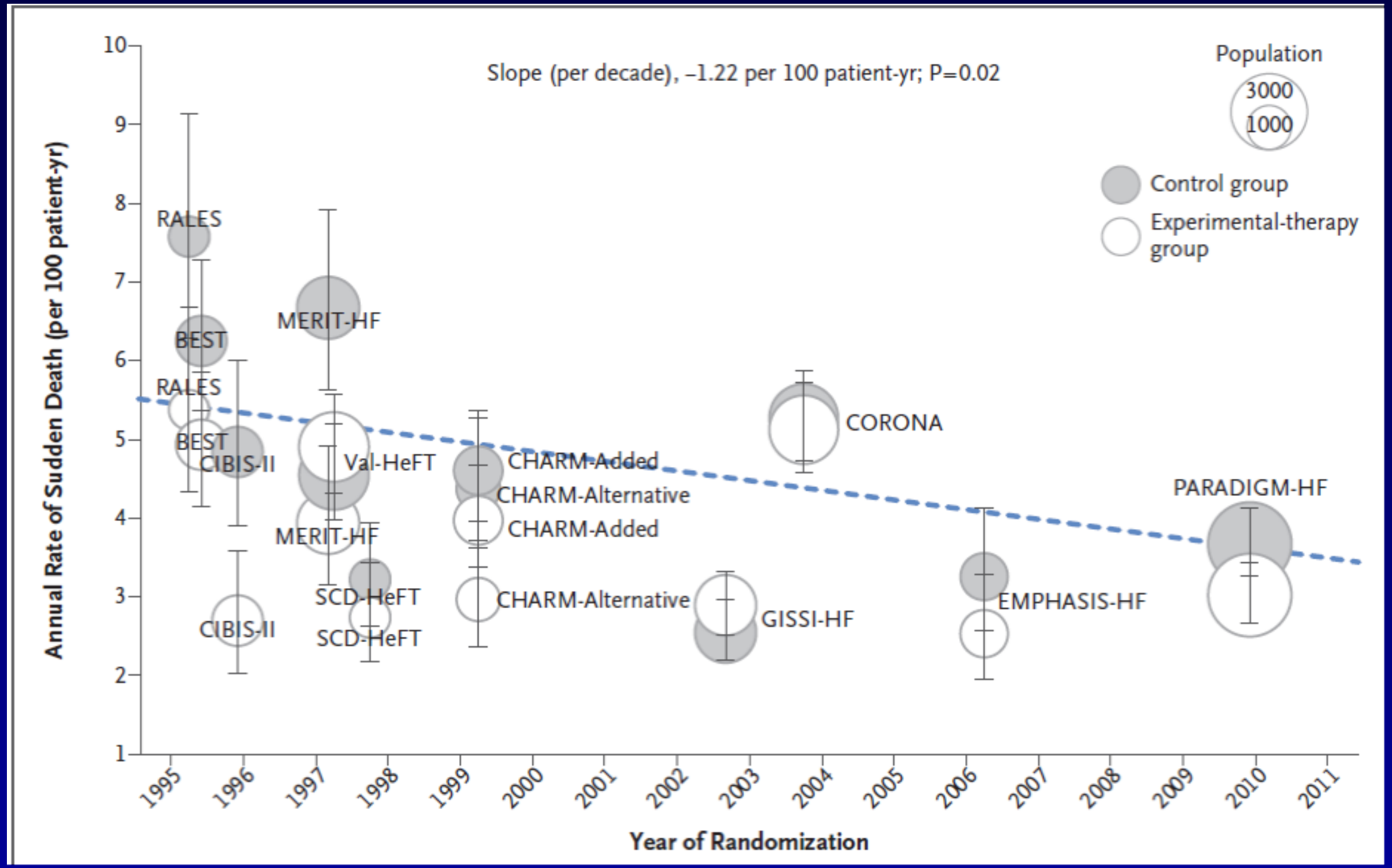
ORIGINAL ARTICLE

Declining Risk of Sudden Death in Heart Failure

- ✓ A larger analysis of 40,195 patients from 12 clinical trials investigating patients with systolic heart failure over a 19-year period, demonstrating a reduction in SCD by 44% over time due to the improved application of guideline-based therapy.
- ✓ This finding is consistent with a cumulative benefit of evidence-based medications on this cause of death
- ✓ **Although not yet formally evaluated, novel therapies such as angiotensin receptor–neprolysin inhibitors (ARNIs) and sodium-glucose cotransporter 2 (SGLT2) inhibitors may further reduce this risk**

Table 1. Trials Included in the Analysis, According to Trial Period.

Trial Acronym*	Trial Period	No. of Patients		Randomized Comparison
		Included in Original Report	Included in This Analysis†	
RALES	March 1995–Aug. 1998	1663	1663	Spironolactone vs. placebo
BEST	May 1995–July 1999	2708	2617	Bucindolol vs. placebo
CIBIS-II	Nov. 1995–March 1998	2647	2647	Bisoprolol vs. placebo
MERIT-HF	Feb. 1997–Oct. 1998	3991	3991	Metoprolol vs. placebo
Val-HeFT	March 1997–May 2000	5010	5010	Valsartan vs. placebo
SCD-HeFT	Sept. 1997–Oct. 2003	2521	1692	ICD vs. amiodarone vs. placebo
CHARM-Alternative	March 1999–March 2003	2028	1960	Candesartan vs. placebo (in patients who could not take ACE inhibitors)
CHARM-Added	March 1999–March 2003	2548	2448	Candesartan vs. placebo (added to ACE-inhibitor therapy)
CORONA	Sept. 2003–May 2007	5011	4875	Rosuvastatin vs. placebo
GISSI-HF	Aug. 2002–March 2008	4574	3820	Rosuvastatin vs. placebo
EMPHASIS-HF	March 2006–May 2010	2737	2316	Eplerenone vs. placebo
PARADIGM-HF	Dec. 2009–March 2014	8399	7156	Angiotensin–neprilysin inhibitor vs. enalapril


Slope (per decade), –1.22 per 100 patient-yr; P=0.02
Population
3000
1000
Control group
Experimental-therapy group
Annual Rate of Sudden Death (per 100 patient-yr)
Year of Randomization
RALES
BEST
RALES
BEST
CIBIS-II
CIBIS-II
MERIT-HF
Val-HeFT
MERIT-HF
SCD-HeFT
SCD-HeFT
CHARM-Added
CHARM-Alternative
CHARM-Added
CHARM-Alternative
CORONA
GISSI-HF
EMPHASIS-HF
PARADIGM-HF

Balancing the Risk of Sudden Death Versus Death from Competing Causes

- ✓ In real terms most patients will have to survive many years to derive true prognostic benefit from an ICD.

- ✓ In light of this, it is not surprising that 85/ 131 (65%) of patients in the control arm of DANISH died due to causes other than SCD additionally illustrating the significance of the competing risk of death from alternate nonsudden cause in this population.

ESC European Society of Cardiology

European Journal of Heart Failure (2022) **24**, 1460–1466
doi:10.1002/ejhf.2594

REVIEW ARTICLE

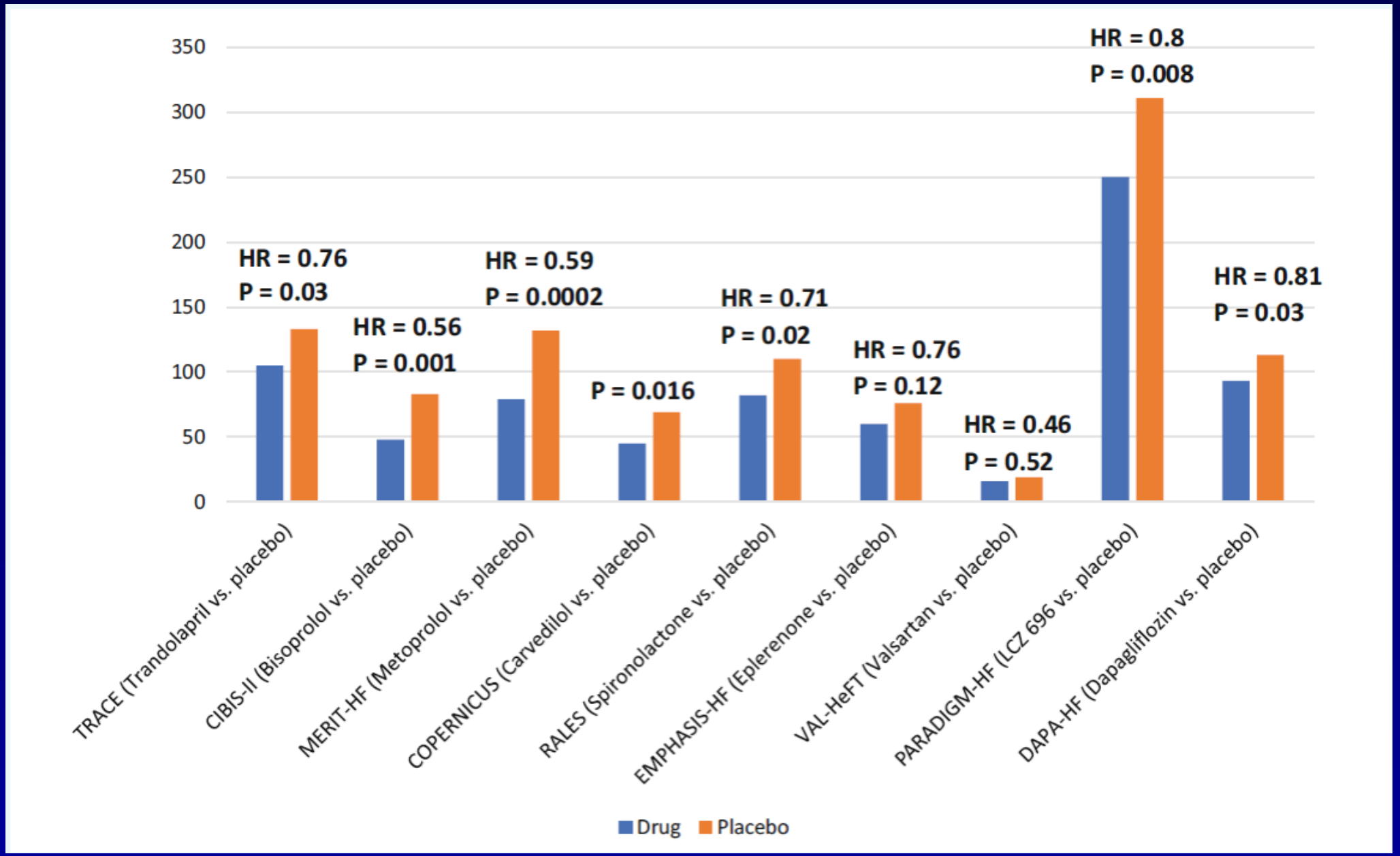
Prevention of sudden death in heart failure with reduced ejection fraction: do we still need an implantable cardioverter-defibrillator for primary prevention?

Magdy Abdelhamid[1]*, Giuseppe Rosano[2], Marco Metra[3], Stamatis Adamopoulos[4], Michael Böhm[5], Ovidiu Chioncel[6], Gerasimos Filippatos[7], Ewa A. Jankowska[8], Yury Lopatin[9], Lars Lund[10], Davor Milicic[11], Brenda Moura[12], Tuvia Ben Gal[13], Arsen Ristic[14], Amina Rakisheva[15], Gianluigi Savarese[10], Wilfried Mullens[16], Massimo Piepoli[17], Antoni Bayes-Genis[18], Thomas Thum[19], Stefan D. Anker[20], Petar Seferovic[21], and Andrew J.S. Coats[22]

"with the current use of **disease-modifying therapies,** we might need to reconsider the need and timing for the use of ICD as primary prevention of SD, especially in HF of non-ischaemic aetiology"

(the benefit of ICD in patients with symptomatic HFrEF caused by coronary artery disease has been well documented)

Efficacy of ACE inhibitors/angiotensin receptor blockers, beta-blockers, mineralocorticoid receptor antagonists, ARNI and SGLT2 inhibitors compared with control for the **prevention of sudden death in HF trials.**



ESC European Society of Cardiology

European Heart Journal (2020) **41**, 3437–3447
doi:10.1093/eurheartj/ehaa226

CLINICAL RESEARCH
Heart failure/cardiomyopathy

Clinical effectiveness of primary prevention implantable cardioverter-defibrillators: results of the EU-CERT-ICD controlled multicentre cohort study

Markus Zabel [1,2]*, Rik Willems [3], Andrzej Lubinski [4], Axel Bauer[5,6,7], Josep Brugada [8], David Conen[9,10], Panagiota Flevari[11], Gerd Hasenfuß[1,2], Martin Svetlosak [12], Heikki V. Huikuri[13], Marek Malik[14], Nikola Pavlović[15], Georg Schmidt[6,16], Rajevaa Sritharan[1], Simon Schlögl[1,2], Janko Szavits-Nossan [17], Vassil Traykov [18], Anton E. Tuinenburg [19], Stefan N. Willich[20], Markus Harden [21], Tim Friede [2,21], Jesper Hastrup Svendsen [22,23], Christian Sticherling [9†], and Béla Merkely[24†]; the EU-CERT-ICD Study Investigators

ESC European Society of Cardiology
European Heart Journal (2020) 41, 3437–3447
doi:10.1093/eurheartj/ehaa226
CLINICAL RESEARCH
Heart failure/cardiomyopathy

Clinical effectiveness of primary prevention implantable cardioverter-defibrillators: results of the EU-CERT-ICD controlled multicentre cohort study

- ✓ EU-CERT-ICD is a prospective investigator-initiated, controlled cohort study, was conducted in 44 centres and 15 European countries. It aimed to assess **current clinical effectiveness of primary prevention ICD therapy.**
- ✓ 2327 patients with ischaemic cardiomyopathy (ICM) or dilated cardiomyopathy (DCM) and guideline indications for prophylactic ICD implantation
- ✓ In contemporary ICM/DCM patients (LVEF ≤35%, narrow QRS), primary prophylactic ICD treatment was **associated with a 27%** lower mortality after adjustment.
- ✓ There appear to be patients with less survival advantage, such as

Circulation

ORIGINAL RESEARCH ARTICLE

Association Between Use of Primary-Prevention Implantable Cardioverter-Defibrillators and Mortality in Patients With Heart Failure

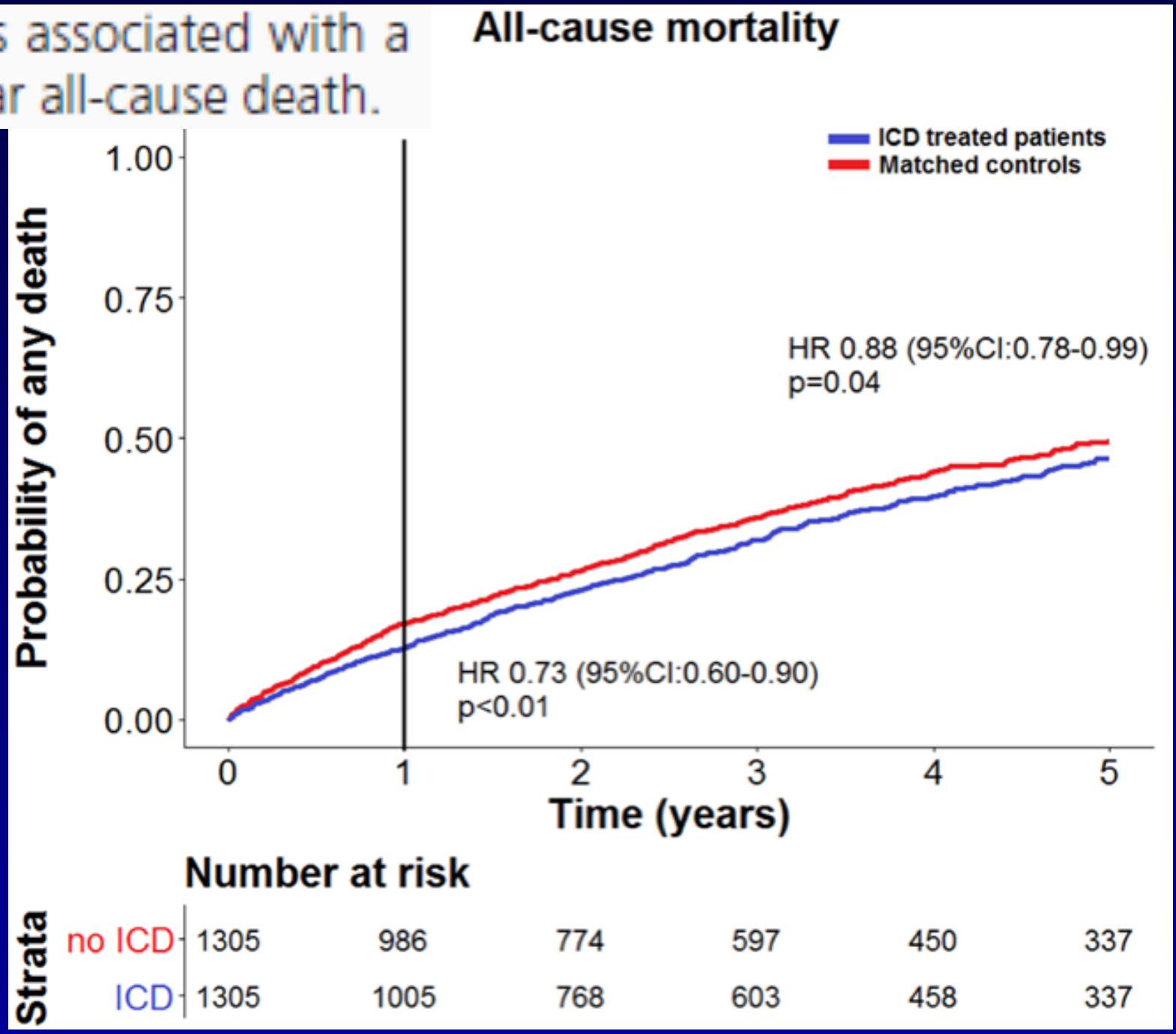
A Prospective Propensity Score–Matched Analysis From the Swedish Heart Failure Registry

Circulation. 2019;140:1530–1539.

SwedeHF (the Swedish Heart Failure Registry)

CONCLUSIONS: In a contemporary heart failure with reduced ejection fraction population, ICD for primary prevention was underused, although it was associated with reduced short- and long-term all-cause mortality. This association was consistent across all the investigated subgroups. These results call for better implementation of ICD therapy.

Primary-prevention ICD use was associated with a reduced risk of 1-year and 5-year all-cause death.



ESC
European Society of Cardiology

European Heart Journal (2022) **43**, 3997–4126
https://doi.org/10.1093/eurheartj/ehac262

ESC GUIDELINES

2022 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

Recommendations for risk stratification, sudden cardiac death prevention, and treatment of ventricular arrhythmias in chronic coronary artery disease and reduced EF

Risk stratification and primary prevention of SCD

ICD therapy is recommended in patients with CAD, symptomatic heart failure (NYHA class II–III), and LVEF ≤35% despite ≥3 months of OMT.[354,356]	I	A

Recommendations for risk stratification, sudden cardiac death prevention, and treatment of ventricular arrhythmias in chronic coronary artery disease and reduced EF

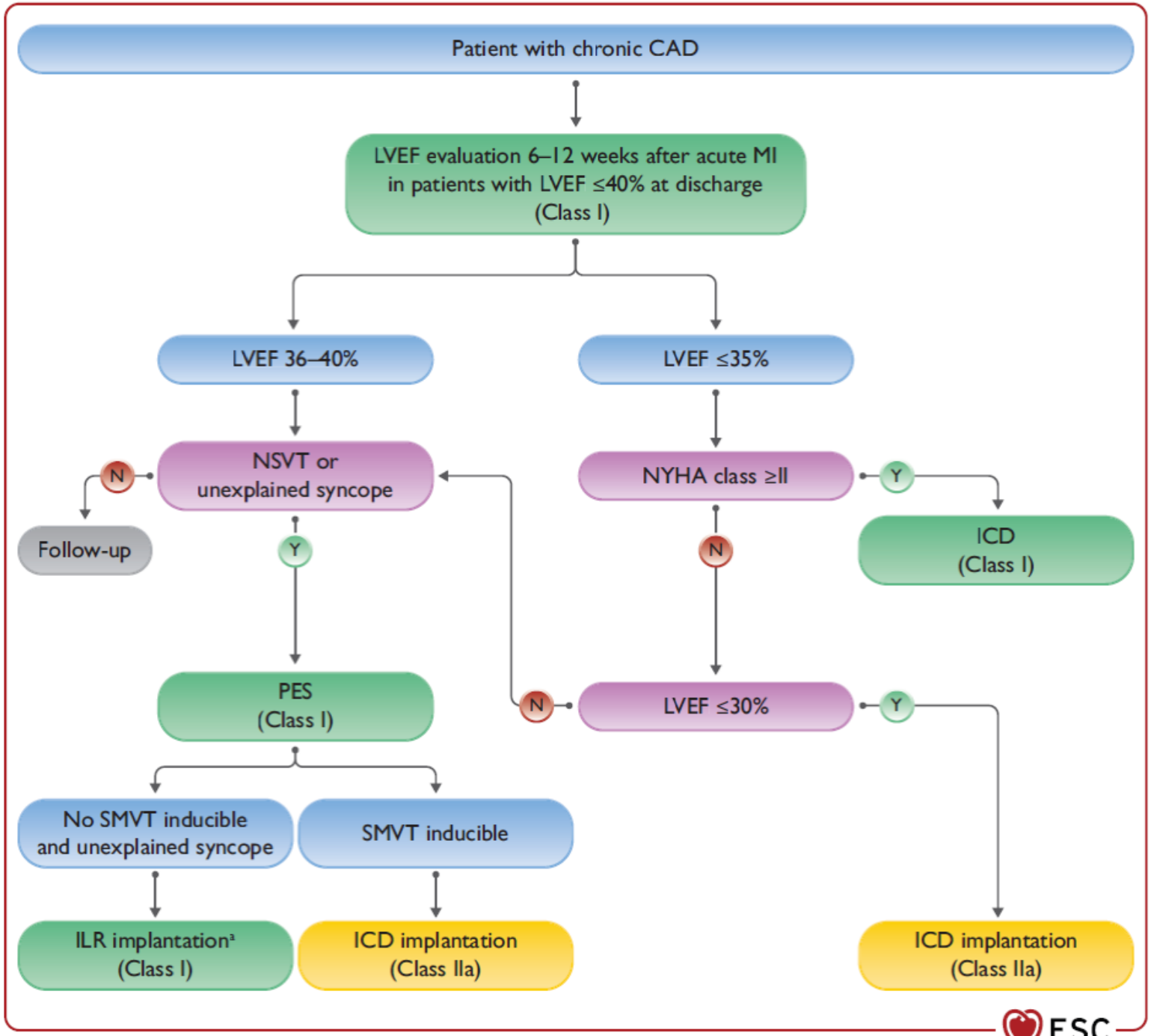
Risk stratification and primary prevention of SCD

Coronary artery disease

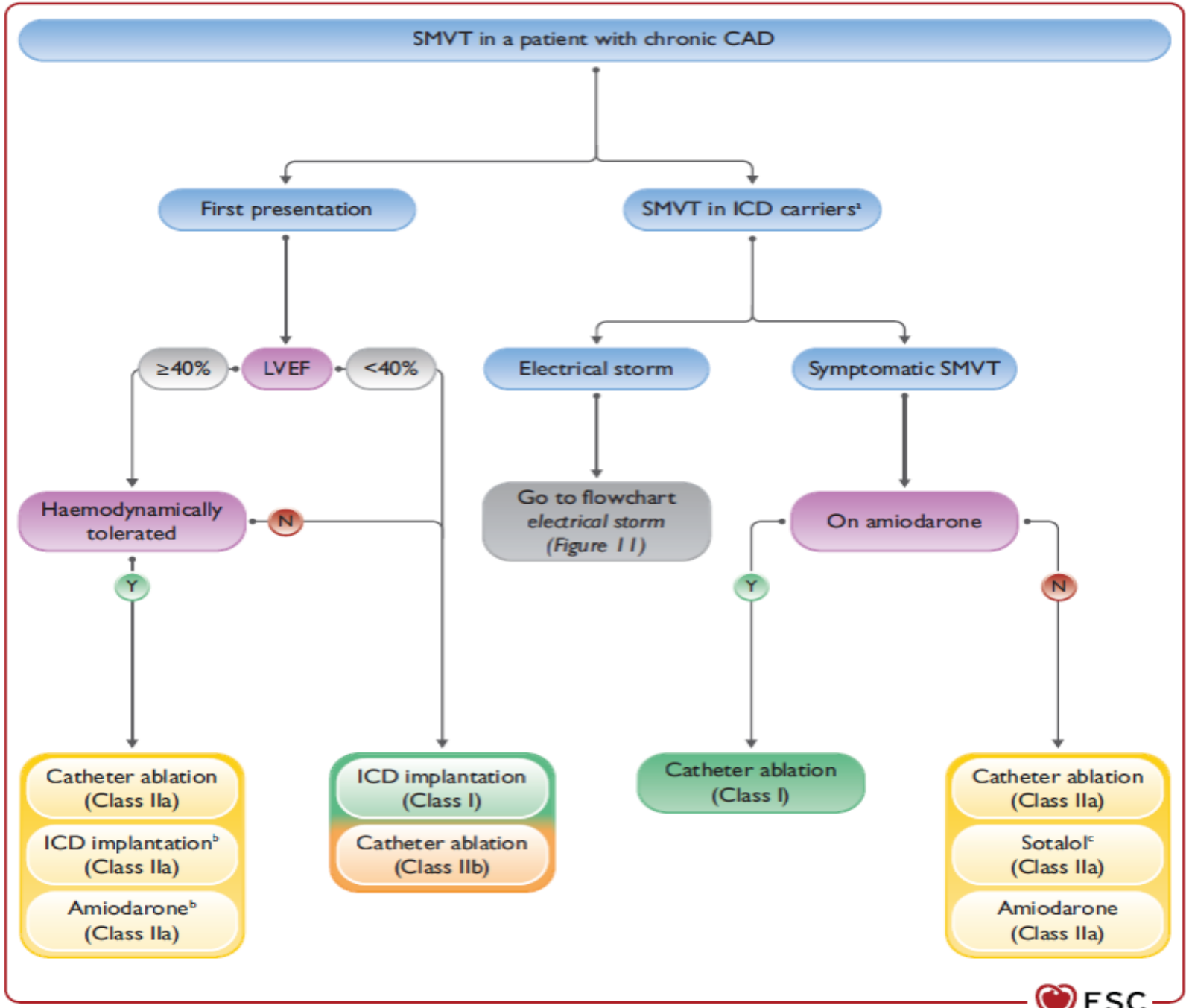
NEW in 2022 GL !!!

ICD therapy should be considered in patients with CAD, NYHA class I, and LVEF ≤30% despite ≥3 months of OMT.	IIa
ICD implantation should be considered in patients with CAD, LVEF ≤40% despite ≥3 months of OMT and NSVT, if they are inducible for SMVT by PES.	IIa
In patients with CAD and haemodynamically well-tolerated SMVT and LVEF ≥40%, catheter ablation in experienced centres should be considered as an alternative to ICD therapy, provided that established endpoints have been reached.[b]	IIa

Algorithm for risk stratification and primary prevention of sudden cardiac death in patients with chronic coronary artery disease and reduced ejection fraction



Algorithm for the management of sustained monomorphic VT in patients with chronic CAD



Avoid upgrading procedure when CRT indication is clear !!!

Recommendations	Class[a]	Level[b]
When an ICD is indicated, it is recommended to evaluate whether the patient could benefit from CRT-defibrillator.[367]	I	C

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European Society of Cardiology
European Heart Journal (2021) **42**, 3599–3726
doi:10.1093/eurheartj/ehab368

ESC GUIDELINES

2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

Developed by the Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

Management of HFrEF

To reduce mortality - for all patients

ACE-I/ARNI | BB | MRA | SGLT2i

To reduce HF hospitalization/mortality - for selected patients

Volume overload

Diuretics

Green for Class of recommendation I; Yellow for Class of recommendation IIa

SR with LBBB ≥ 150 ms	*SR with LBBB 130–149 ms or non LBBB≥ 150 ms*
CRT-P/D	CRT-P/D
Ischaemic aetiology	*Non-ischaemic aetiology*
ICD	ICD

Primary prevention		
An ICD is recommended to reduce the risk of sudden death and all-cause mortality in patients with symptomatic HF (NYHA class II–III) of an ischaemic aetiology (unless they have had a MI in the prior 40 days—see below), and an LVEF ≤35% despite ≥3 months of OMT, provided they are expected to survive substantially longer than 1 year with good functional status.[161,165]	I	A

Primary prevention

ICD implantation is not recommended within 40 days of a MI as implantation at this time does not improve prognosis.[177,178]	III	A

Primary prevention

ICD therapy is not recommended in patients in NYHA class IV with severe symptoms refractory to pharmacological therapy unless they are candidates for CRT, a VAD, or cardiac transplantation.[179–183]	III	C

ELECTRICAL STORM (ES)

- The implantable cardioverter-defibrillator (ICD) significantly **enhances survival** in patients with malignant ventricular tachyarrhythmias, but the recurrence of ventricular tachycardia (VT)/ventricular fibrillation (VF) **can still be a cause of death.**

- More specifically, electrical storm (ES), characterized by very frequent arrhythmic episodes resulting in appropriate ICD shocks, is a frightening event associated with poor short- and long-term prognoses.

- **ES definition**: the occurrence of ≥3 episodes of VT separated by > 5 minutes during a 24-hour period, each resulting in an appropriate shock by the ICD.*

*** Zipes DP et al. ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. J Am Coll Cardiol. 2006;48:247–346.**

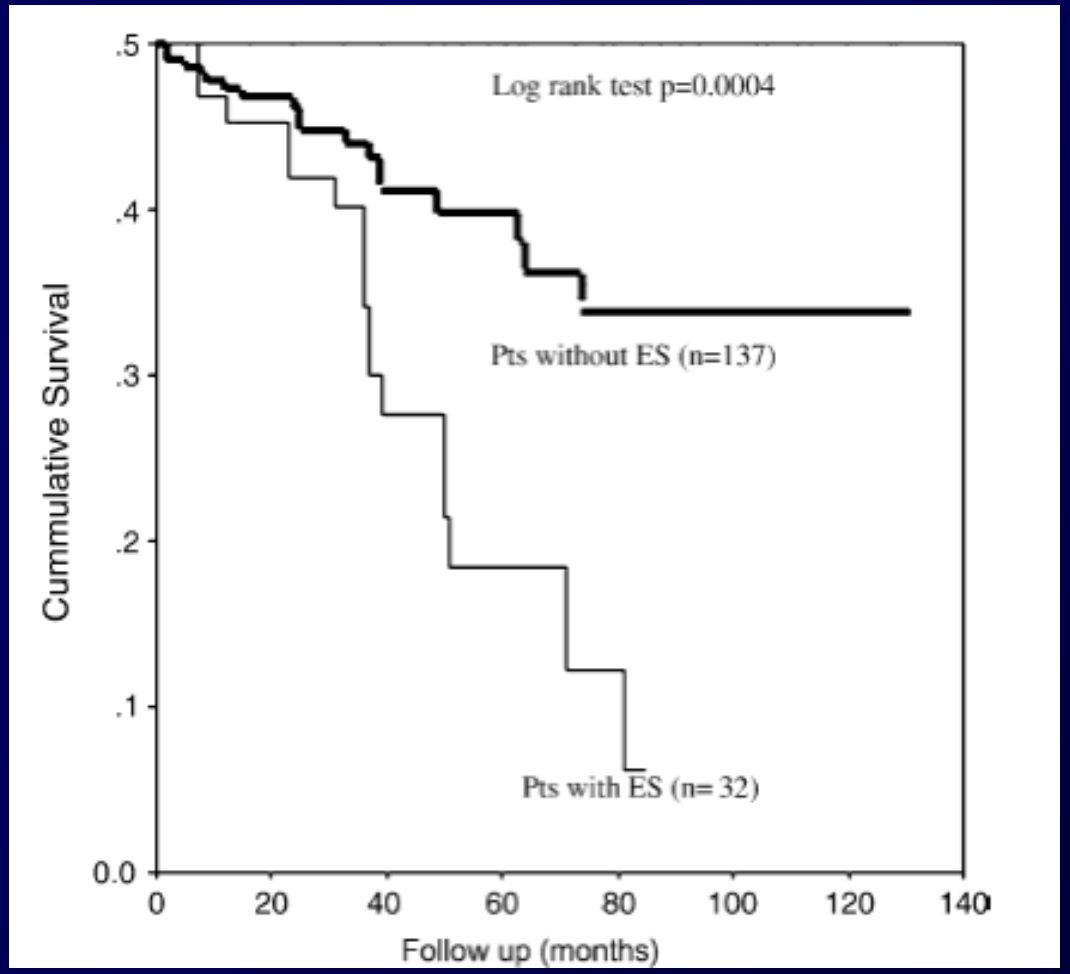
ELECTRICAL STORM (ES)

ES is a strong independent predictor of death in ICD patients (mortality between 38%-53%).

Gatzoulis KA et al. Europace 2005; 7:184-92.

Exner DV, Circulation 2001;103: 2066-71.

Verma A, J Cardiovasc Electrophysiol 2004;15: 1265-70.



VT catheter ablation as a treatment of electrical storm

Catheter Ablation for the Treatment of Electrical Storm in Patients With Implantable Cardioverter-Defibrillators

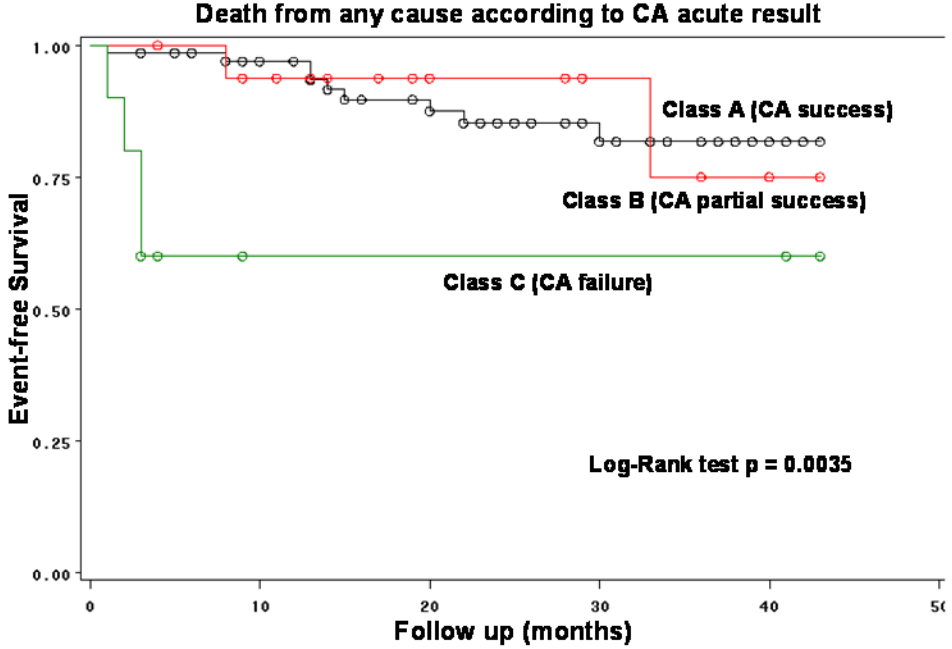
Short- and Long-Term Outcomes in a Prospective Single-Center Study

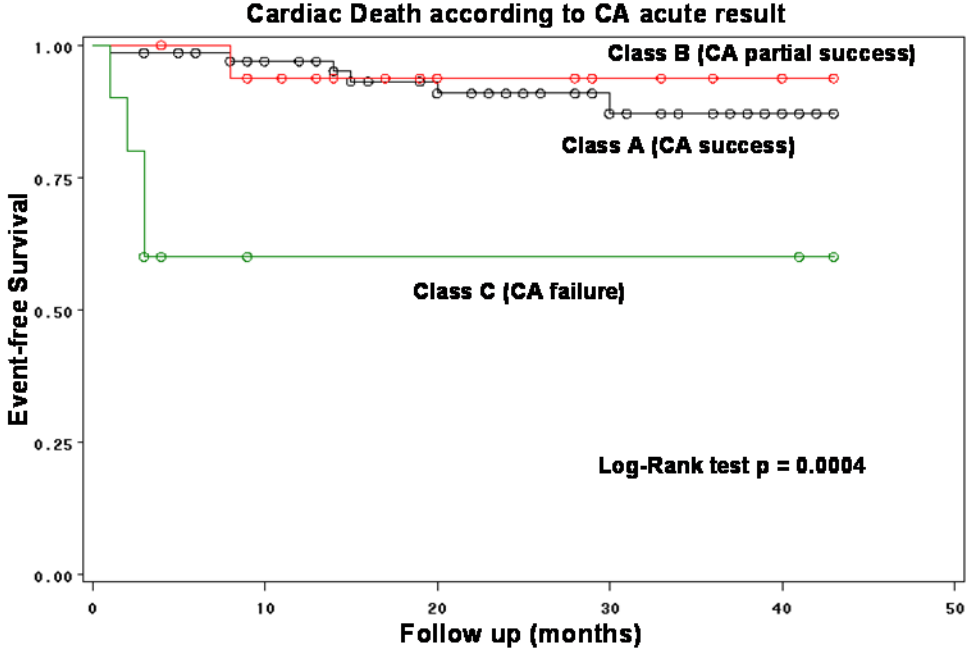
Corrado Carbucicchio, MD; Matteo Santamaria, MD; Nicola Trevisi, MD; Giuseppe Maccabelli, MD; Francesco Giraldi, MD; Gaetano Fassini, MD; Stefania Riva, MD; Massimo Moltrasio, MD; Manuela Cireddu, MD; Fabrizio Veglia, PhD; Paolo Della Bella, MD

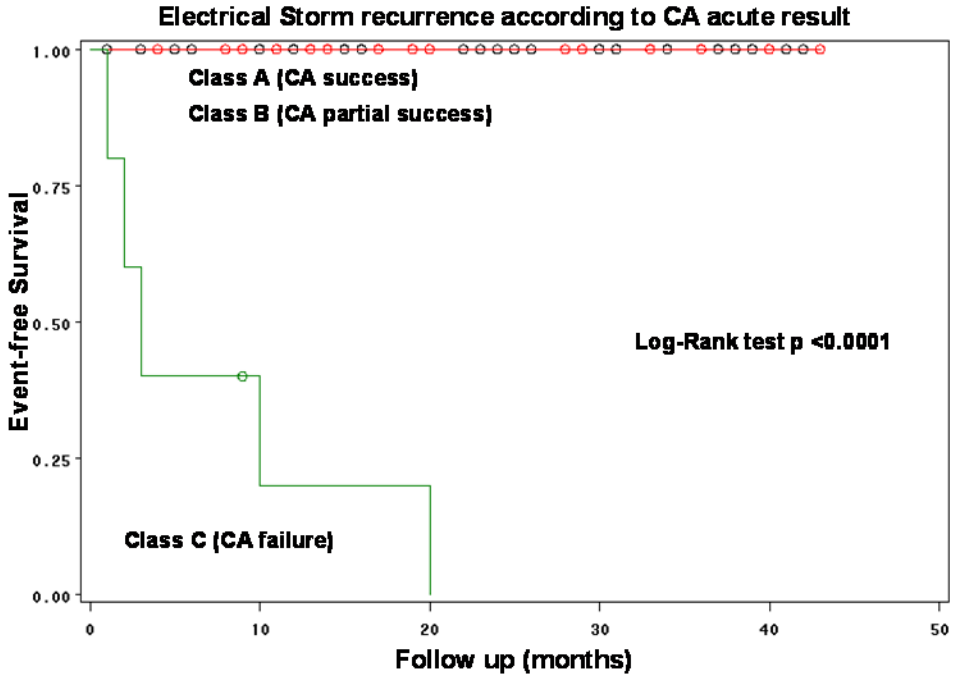
AIM OF THE STUDY

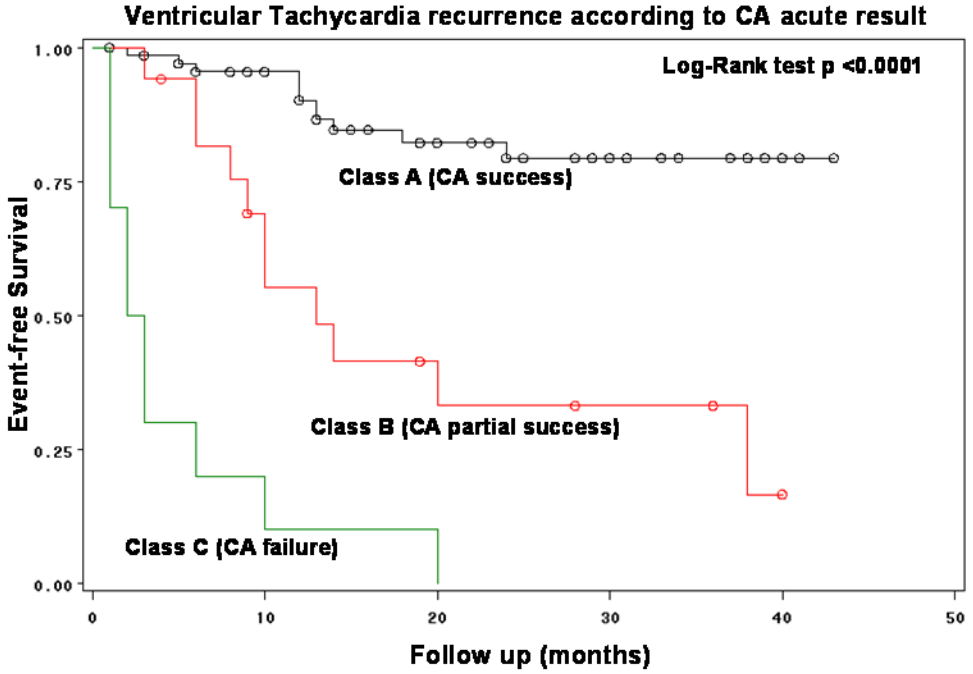
✓ to prospectively assess the **short-term** efficacy of *CA* when applied extensively in a series of consecutive patients referred for drug-refractory ES.

✓ to analyze the impact of *CA outcome* (acute) on long-term arrhythmia recurrence and on patient survival to support its earlier and wider use in the


Death from any cause according to CA acute result
Event-free Survival
1.00
0.75
0.50
0.25
0.00
Class A (CA success)
Class B (CA partial success)
Class C (CA failure)
Log-Rank test p = 0.0035
0
10
20
30
40
50
Follow up (months)


Cardiac Death according to CA acute result
Event-free Survival
1.00
0.75
0.50
0.25
0.00
Class B (CA partial success)
Class A (CA success)
Class C (CA failure)
Log-Rank test p = 0.0004
0
10
20
30
40
50
Follow up (months)


Electrical Storm recurrence according to CA acute result
Event-free Survival
1.00
0.75
0.50
0.25
0.00
Class A (CA success)
Class B (CA partial success)
Log-Rank test p <0.0001
Class C (CA failure)
0
10
20
30
40
50
Follow up (months)


Ventricular Tachycardia recurrence according to CA acute result
Event-free Survival
1.00
0.75
0.50
0.25
0.00
Log-Rank test p <0.0001
Class A (CA success)
Class B (CA partial success)
Class C (CA failure)
0
10
20
30
40
50
Follow up (months)

Circulation

ORIGINAL RESEARCH ARTICLE

Does Timing of Ventricular Tachycardia Ablation Affect Prognosis in Patients With an Implantable Cardioverter Defibrillator? Results From the Multicenter Randomized PARTITA Trial

Paolo Della Bella, MD; Francesca Baratto, MD; Pasquale Vergara, MD PhD; Patrizia Bertocchi, MD; Matteo Santamaria, MD, PhD; Pasquale Notarstefano, MD; Leonardo Calò, MD; Daniela Orsida, MD; Luca Tomasi, MD; Marcello Piacenti, MD; Stefano Sangiorgio, MD; Francesco Pentimalli, MD; Etienne Pruvot, MD; João De Sousa, MD; Frederic Sacher, MD; Massimo Tritto, MD; Luca Rebellato, MD; Thomas Deneke, MD; Salvo Andrea Romano, MD; Martina Nesti, MD; Alessio Gargaro, MSc; Daniele Giacopelli, MSc; Giovanni Peretto, MD; Andrea Radinovic, MD

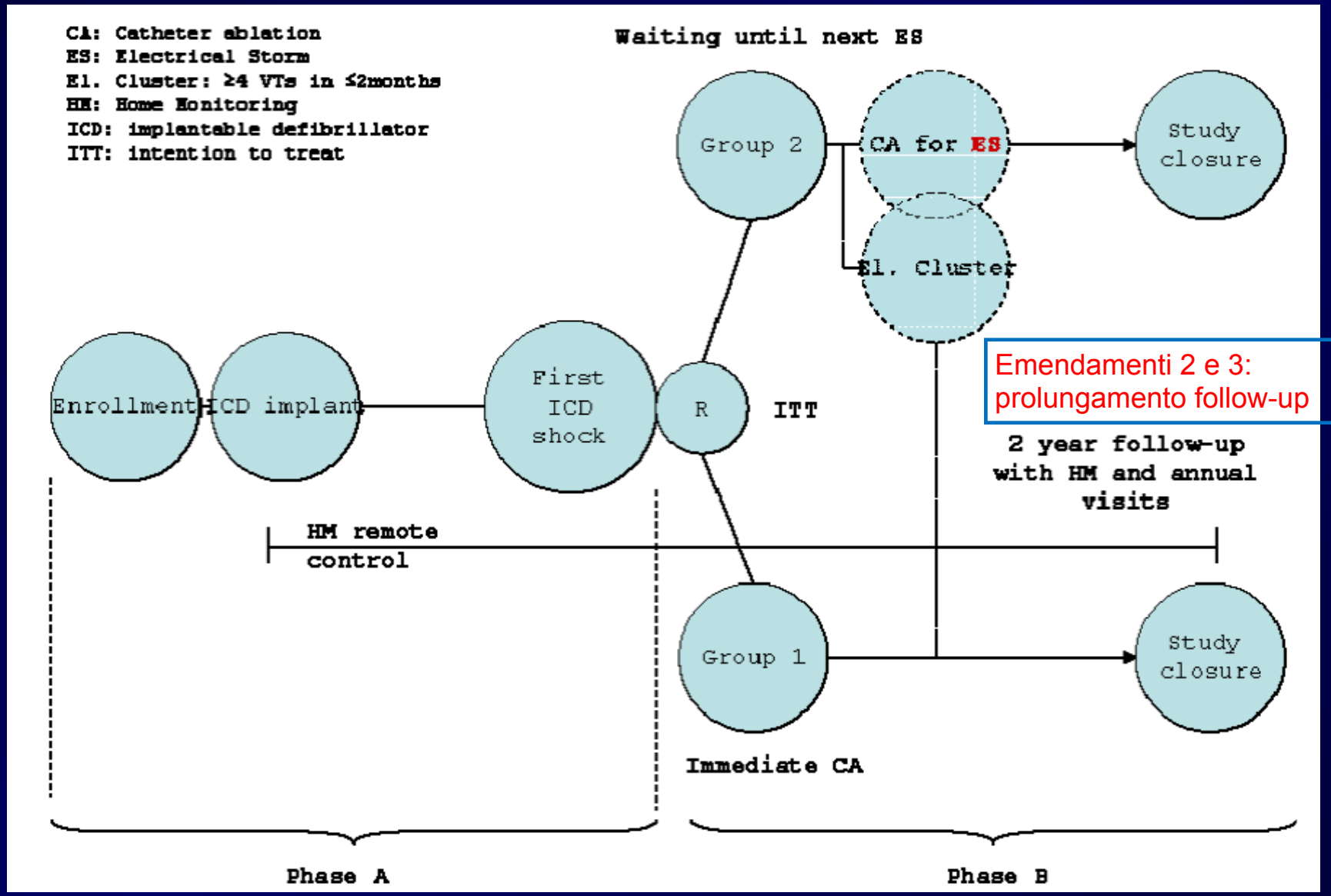
Circulation. 2022;145:1829–1838.

PARTITA *Newsletter*

Is **P**rognosis **A**ffected by
Radiofrequency **A**bla**TI**on **T**iming?

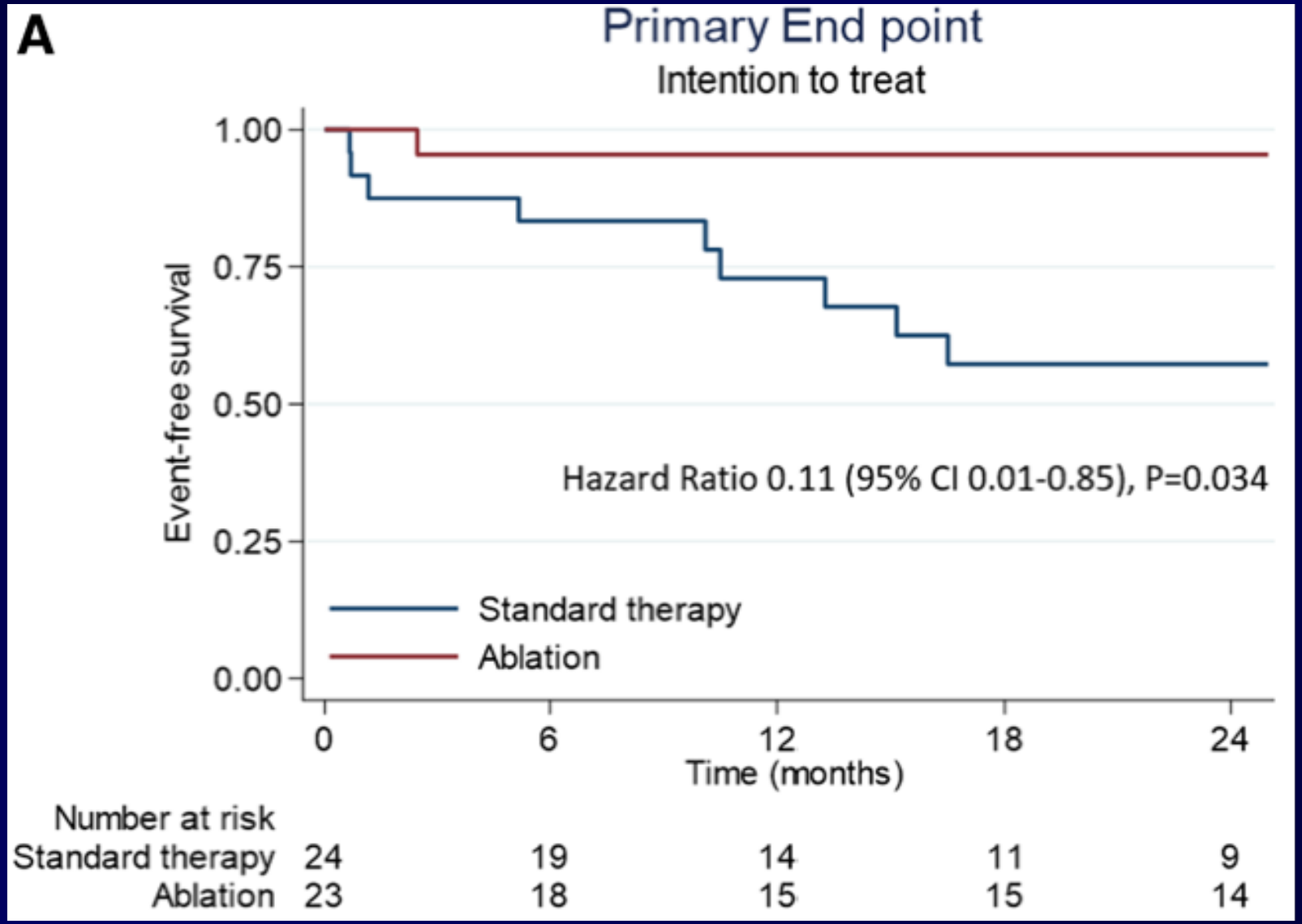
Site	*City*	*Enrollments*	*Randomized*
Ospedale San Raffaele	Milano	138	11
Fondazione Giovanni Paolo II	Campobasso	67	12
A.O Desio e Vimercate	Desio	66	1
Policlinico Casilino	Roma	45	0
Ospedale S. Donato	Arezzo	53	9
A.O. Sant'Antonio Abate	Gallarate	36	0
Fondazione G. Monasterio	Pisa	22	0
A.O.U. Integrata di Verona	Verona	21	0
A.O. Valtellina e Valchiavenna	Sondrio	14	0
Lausanne Hospital	Lausanne	9	0
Hospital Santa Maria	Lisboa	9	1
Ospedale San Paolo	Savona	8	0
Hôpital cardiologique du Haut-Lévêque	Bordeaux	5	0
Ospedale Mater Domini	Castellanza	4	1
Ospedale Santa Maria della Misericordia	Udine	3	0
Herz-und Gefäss-Klinik	Bad Neustadt	2	0
	Total	500	35

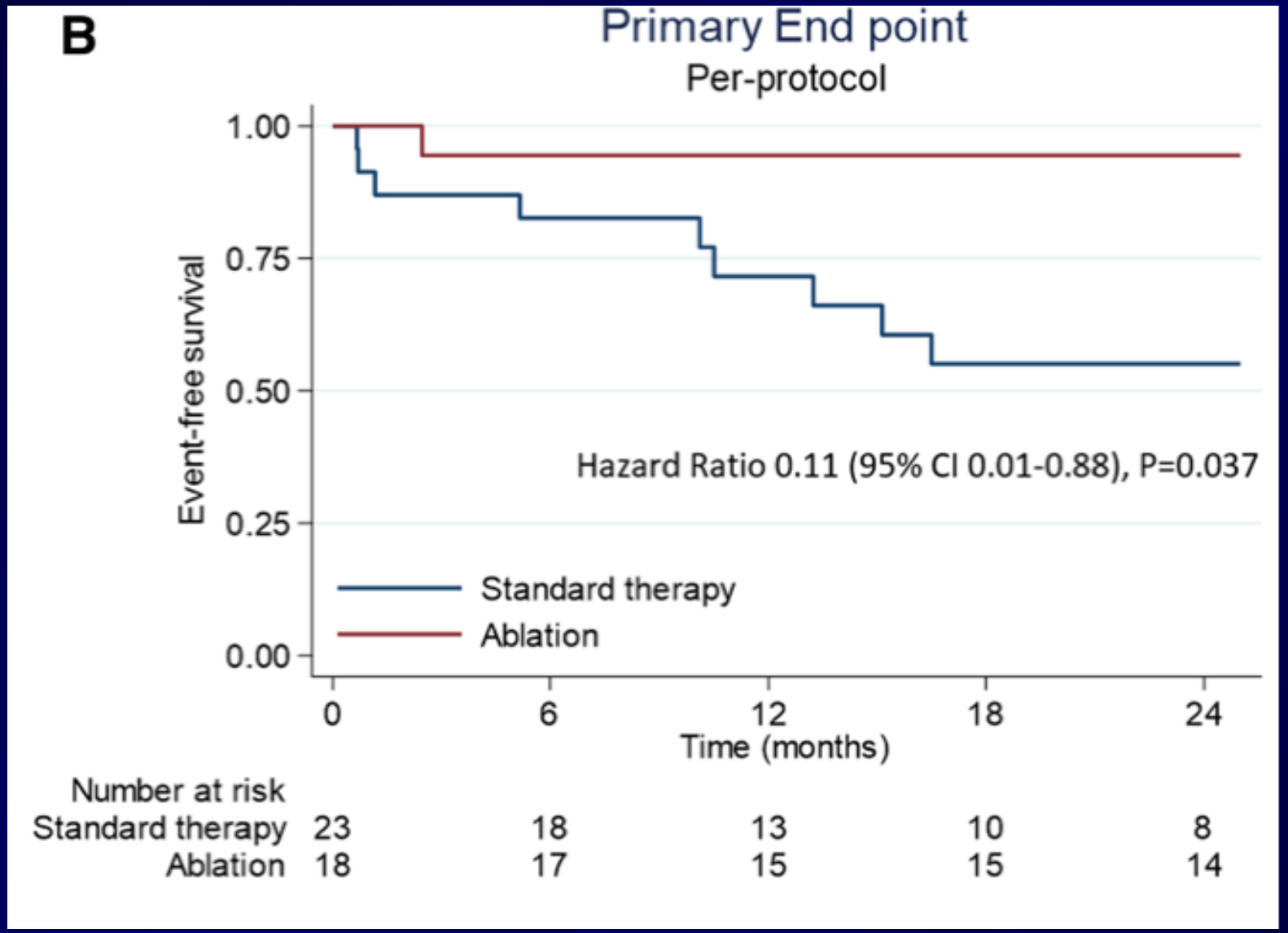
Flowchart dello studio

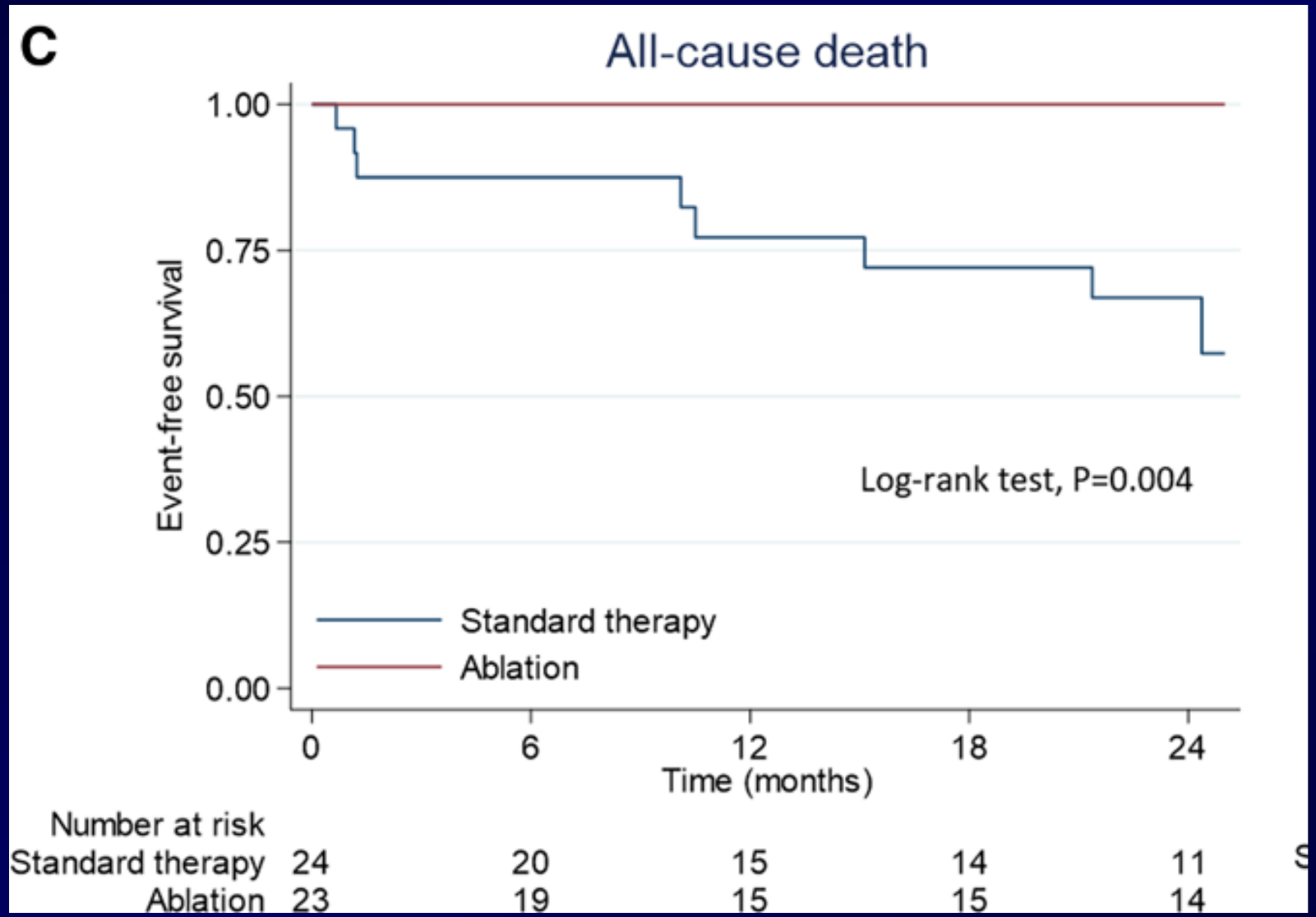


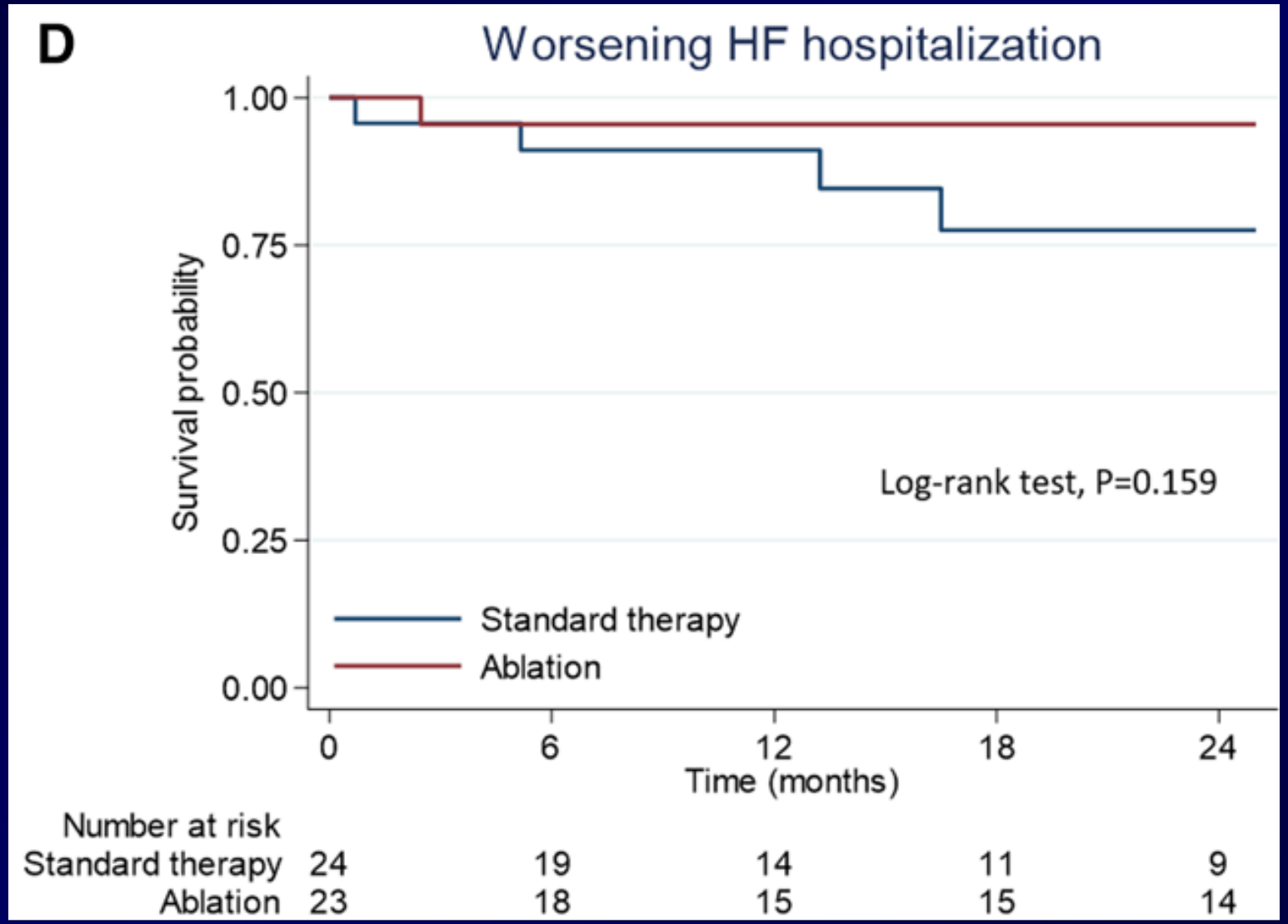
Emendamenti 2 e 3: prolungamento follow-up

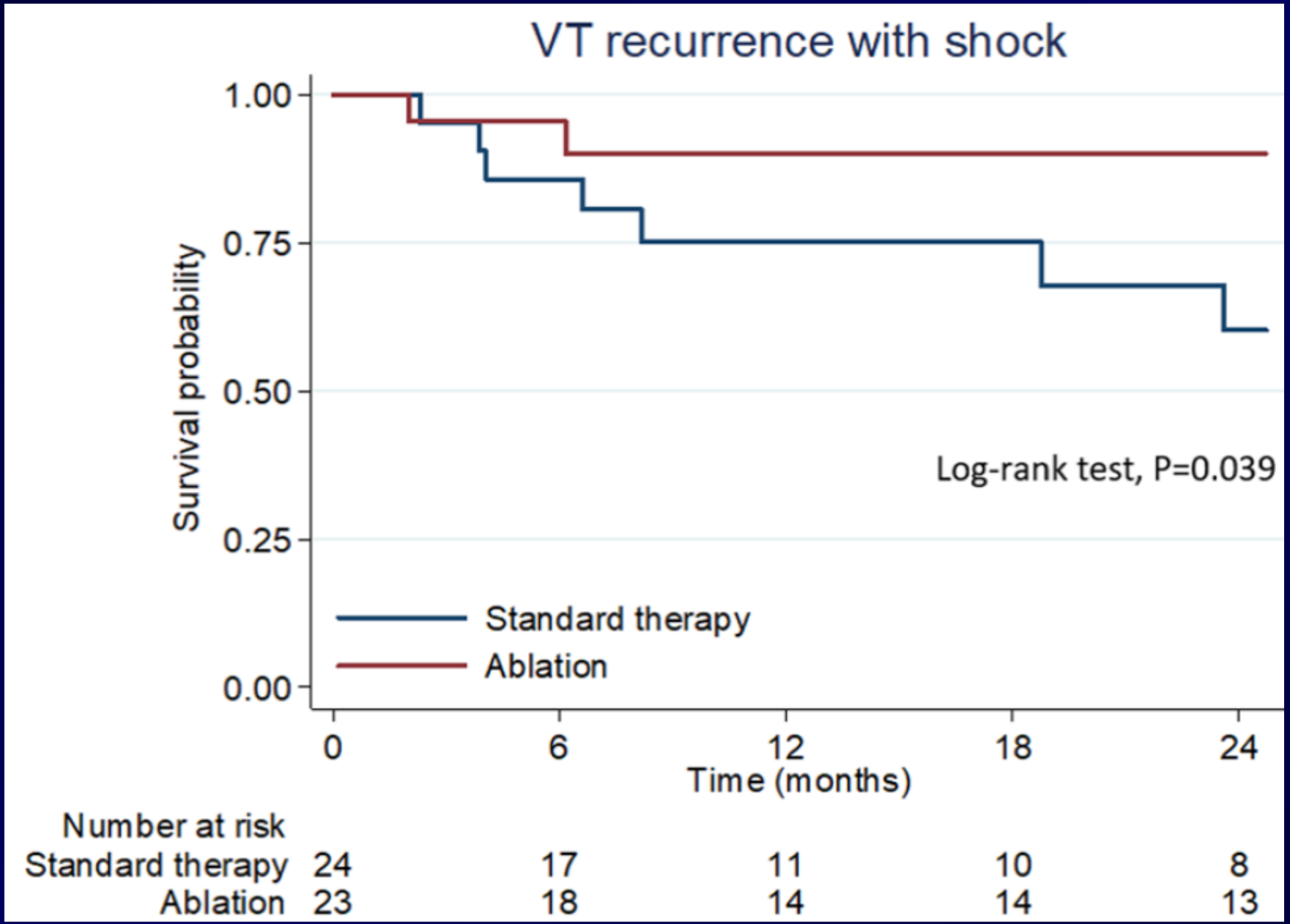
The primary end point was a composite of death from any cause or hospitalization for worsening heart failure




B
Primary End point
Per-protocol
1.00
0.75
0.50
0.25
0.00
Event-free survival
Hazard Ratio 0.11 (95% CI 0.01-0.88), P=0.037
Standard therapy
Ablation
0
6
12
18
24
Time (months)
Number at risk
Standard therapy 23 18 13 10 8
Ablation 18 17 15 15 14


C
All-cause death
1.00
0.75
0.50
0.25
0.00
Event-free survival
Log-rank test, P=0.004
Standard therapy
Ablation
0
6
12
18
24
Time (months)
Number at risk
Standard therapy 24 20 15 14 11
Ablation 23 19 15 15 14


D
Worsening HF hospitalization
1.00
0.75
0.50
0.25
0.00
Survival probability
Log-rank test, P=0.159
Standard therapy
Ablation
0
6
12
18
24
Time (months)
Number at risk
Standard therapy 24 19 14 11 9
Ablation 23 18 15 15 14


VT recurrence with shock
1.00
0.75
0.50
0.25
0.00
Survival probability
Log-rank test, P=0.039
Standard therapy
Ablation
0
6
12
18
24
Time (months)
Number at risk
Standard therapy 24 17 11 10 8
Ablation 23 18 14 14 13

ESC
European Society of Cardiology
European Heart Journal (2022) **43**, 3997–4126
https://doi.org/10.1093/eurheartj/ehac262

ESC GUIDELINES

2022 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

Management of electrical storm

"Successful ablation was associated with a significant reduction in VT and electrical storm recurrence and improved long-term survival in retrospective analyses"

Catheter Ablation for the Treatment of Electrical Storm in Patients With Implantable Cardioverter-Defibrillators

Short- and Long-Term Outcomes in a Prospective Single-Center Study

Corrado Carbucicchio, MD; Matteo Santamaria, MD; Nicola Trevisi, MD; Giuseppe Maccabelli, MD; Francesco Giraldi, MD; Gaetano Fassini, MD; Stefania Riva, MD; Massimo Moltrasio, MD; Manuela Cireddu, MD; Fabrizio Veglia, PhD; Paolo Della Bella, MD

***330 Carbucicchio C, Santamaria M et al . Circulation 2008**

Mild to moderate sedation is recommended in patients with electrical storm to alleviate psychological distress and reduce sympathetic tone.	I	C
Antiarrhythmic therapy with beta-blockers (non-selective preferred) in combination with intravenous amiodarone is recommended in patients with SHD and electrical storm unless contraindicated.[317,318]	I	B
Intravenous magnesium with supplementation of potassium is recommended in patients with TdP.[295]	I	C
Isoproterenol or transvenous pacing to increase heart rate is recommended in patients with acquired LQT syndrome and recurrent TdP despite correction of precipitating conditions and magnesium.	I	C
Catheter ablation is recommended in patients presenting with incessant VT or electrical storm due to SMVT refractory to AADs.[330,331]	I	B

Take home messages

✓ Most non invasive methods of SCD risk stratification in IHD need more evidence to be applied in clinical practice (actually not indicated)

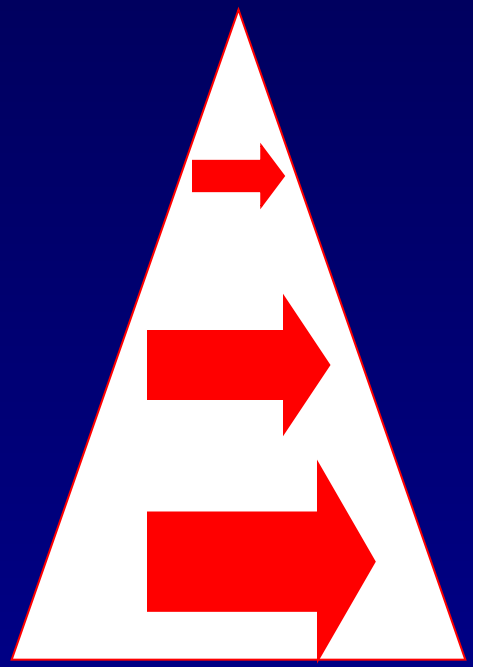
✓ LVEF remains the most important (although not accurate) marker of increased SCD risk but excluded a lot of patients (two thirds of SCDs occur in patients with an LVEF>35%)

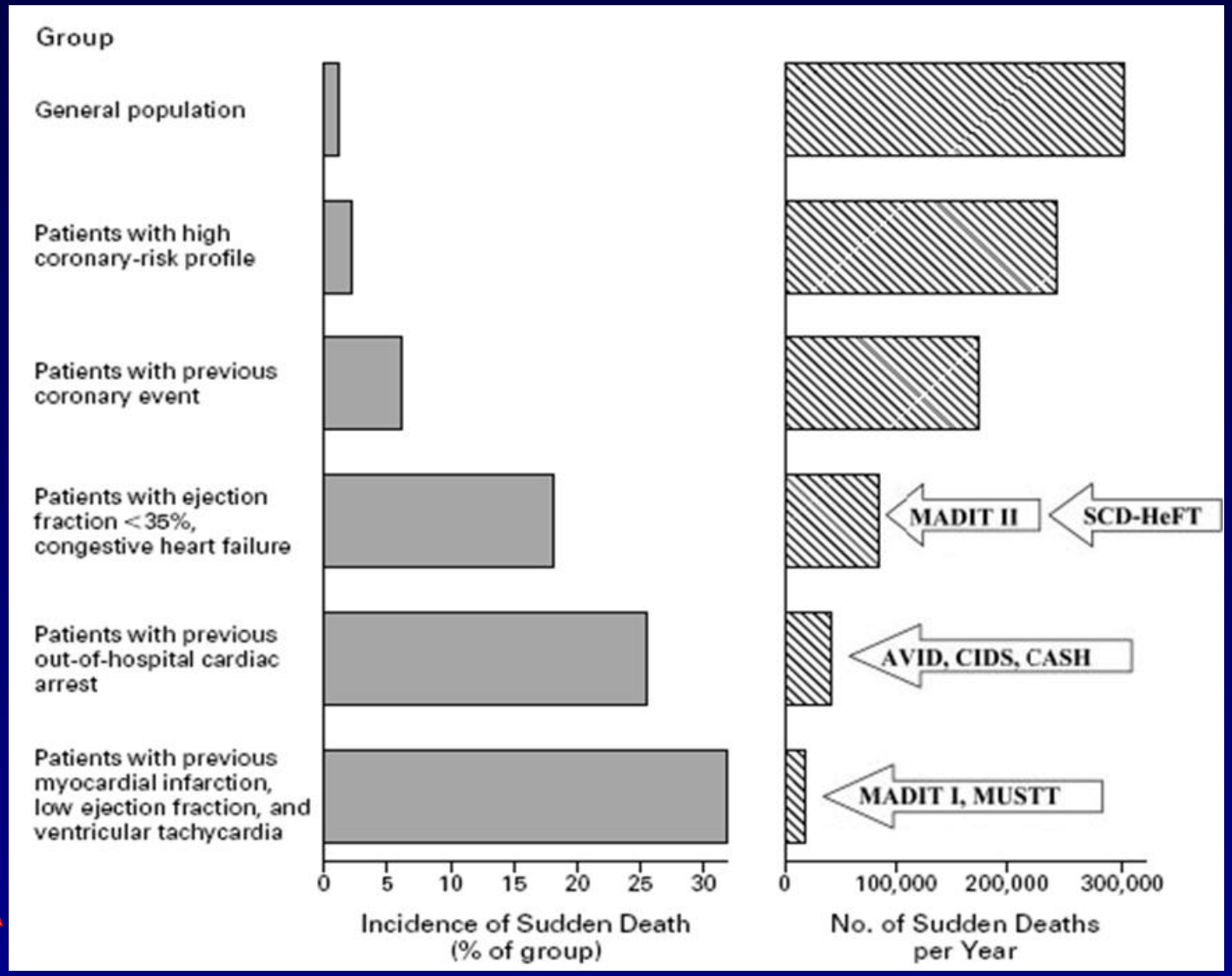
✓ ICD is the mainstay therapy in selected patients groups (secondary prevention; primary prevention in pts with reduced LVEF and more than 40 days after MI)

✓ Tailored Therapies - Precision Medicine

✓ Public access defibrillation (PAD) programs are needed to obtain a

VERY HIGH RISK SUBGROUPS





General population: unselected population age greater than or equal to 35 y

Modified from Myerburg RJ et al., Circulation 1998

Review

The Effectiveness and Cost Effectiveness of Public-Access Defibrillation

Roger A. Winkle, MD

Electrophysiology, Cardiovascular Medicine and Cardiac Arrhythmias, East Palo Alto, California

Europace (2016) **18**, 398–404
doi:10.1093/europace/euv218

CLINICAL RESEARCH
Sudden death and ICDs

Better management of out-of-hospital cardiac arrest increases survival rate and improves neurological outcome in the Swiss Canton Ticino

Romano Mauri[1,2], Roman Burkart[1], Claudio Benvenuti[1], Maria Luce Caputo[1,3], Tiziano Moccetti[1,3], Alessandro Del Bufalo[1,3], Augusto Gallino[1,4], Carlo Casso[1,5], Luciano Anselmi[1,5], Tiziano Cassina[6], Catherine Klersy[7], and Angelo Auricchio[1,3]*

Review | Journal of INTERNAL MEDICINE

doi: 10.1111/joim.12064

Out-of-hospital cardiac arrest: 10 years of progress in research and treatment

J. Hollenberg, L. Svensson & M. Rosenqvist

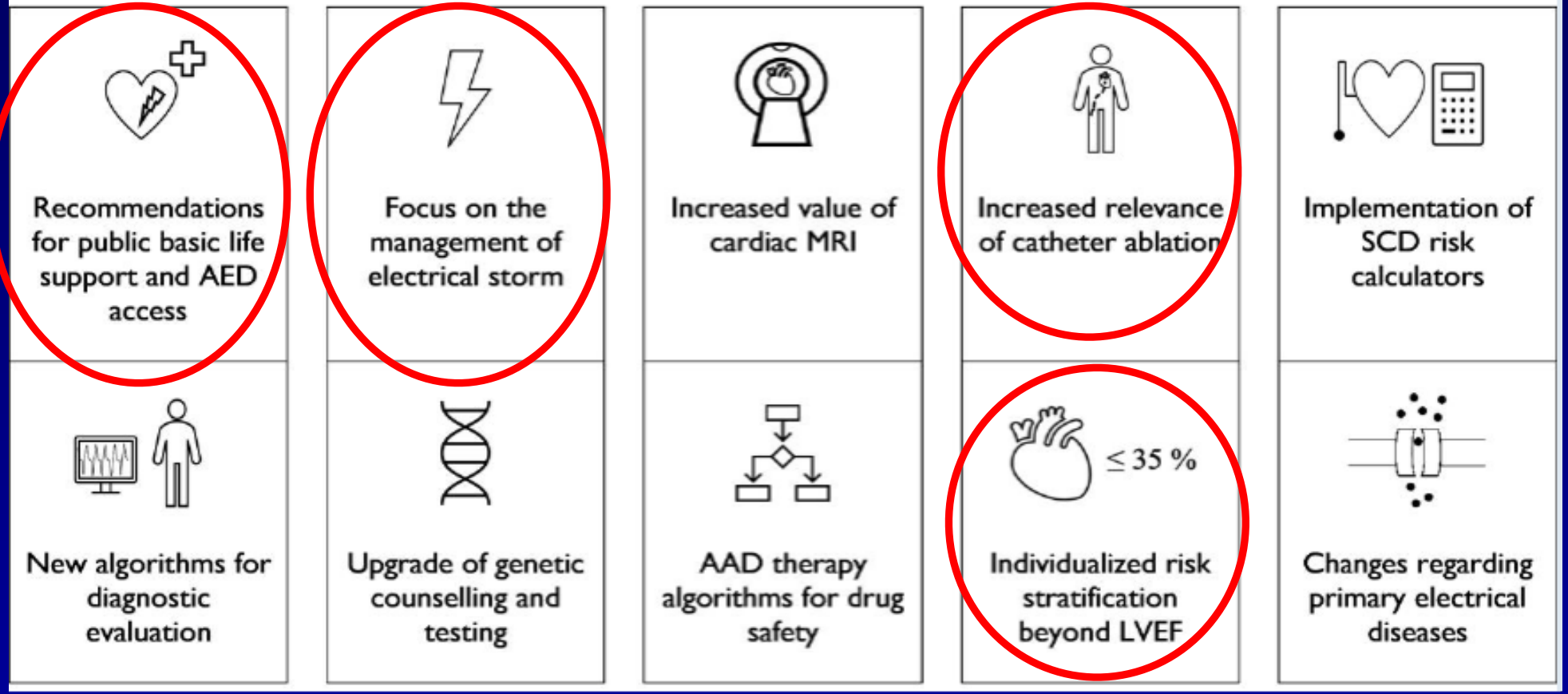
From the Section of Cardiology, Department of Clinical Science and Education, Karolinska Institutet, Södersjukhuset, Stockholm, Sweden

ESC European Society of Cardiology
Europace (2023) 25, 1–12
https://doi.org/10.1093/europace/euad091
VIEWPOINT

Spotlight on the 2022 ESC guideline management of ventricular arrhythmias and prevention of sudden cardiac death: 10 novel key aspects

Hilke Könemann [1]*, Nikolaos Dagres
Christian Sticherling [4], Katja Zeppenf
Lars Eckardt [1]

10 novel key points of the 2022 ESC guidelines on ventricular arrhythmias and sudden cardiac death



RRH EP Team