

# XXVI Giornate Cardiologiche Torinesi

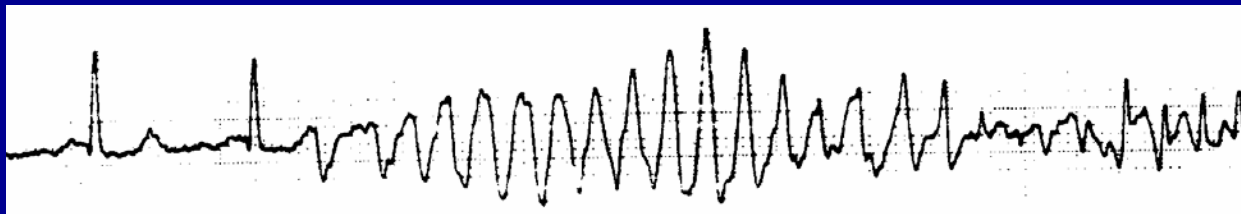
“ADVANCES IN CARDIAC ARRHYTHMIAS  
AND GREAT INNOVATIONS IN CARDIOLOGY”

Turin, October 23-25, 2014  
Centro Congressi Unione Industriale

## Asymptomatic High Risk Early Repolarization

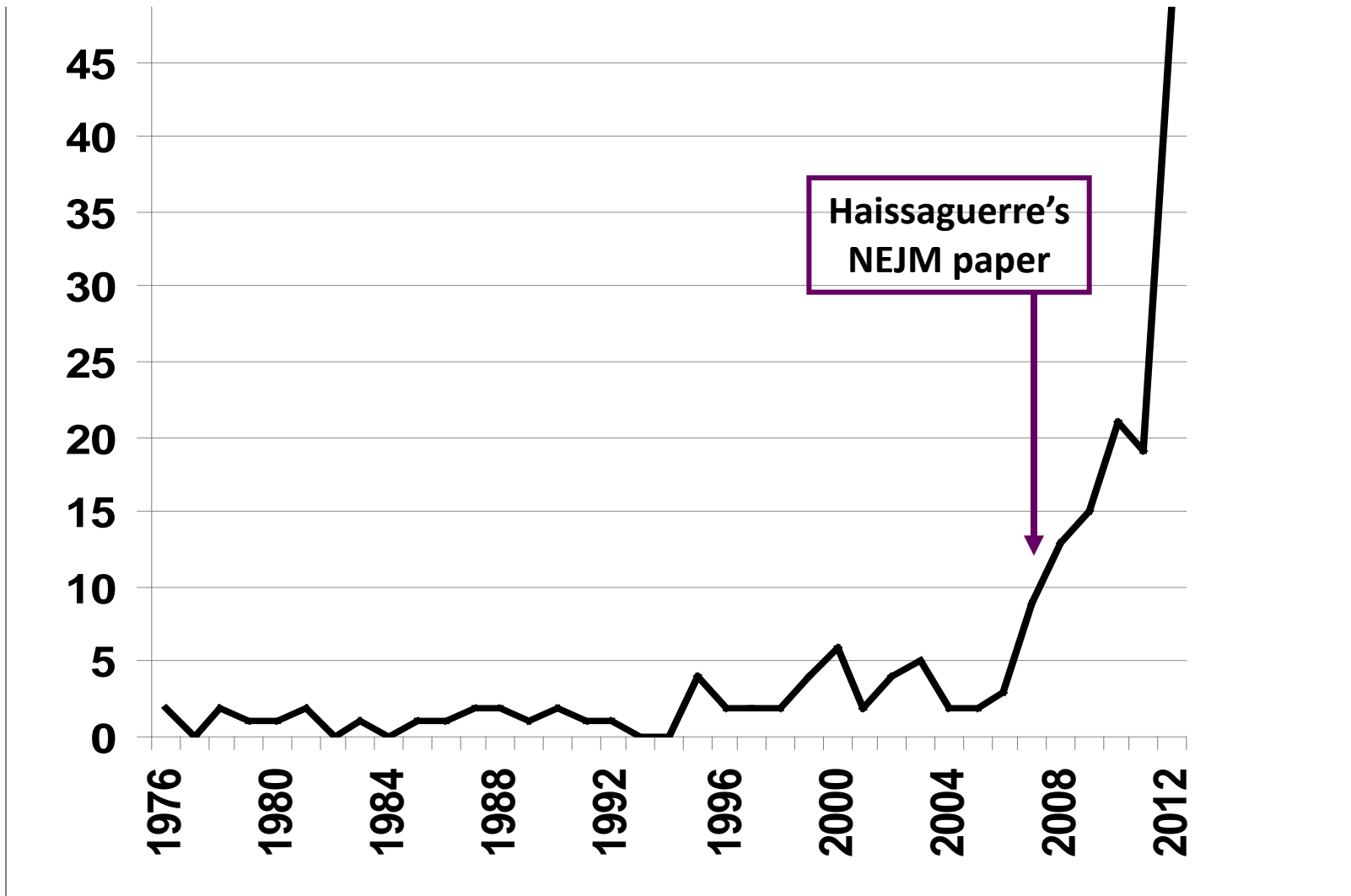
Raphael Rosso M.D

Tel Aviv Medical Center



Torino 2014

# Publications with the terms “early repolarization” or “J-waves” in the title.



**Ventricular Fibrillation in a Patient with Prominent J (Osborn) Waves and ST Segment Elevation in the Inferior Electrocardiographic Leads: A Brugada Syndrome Variant?**

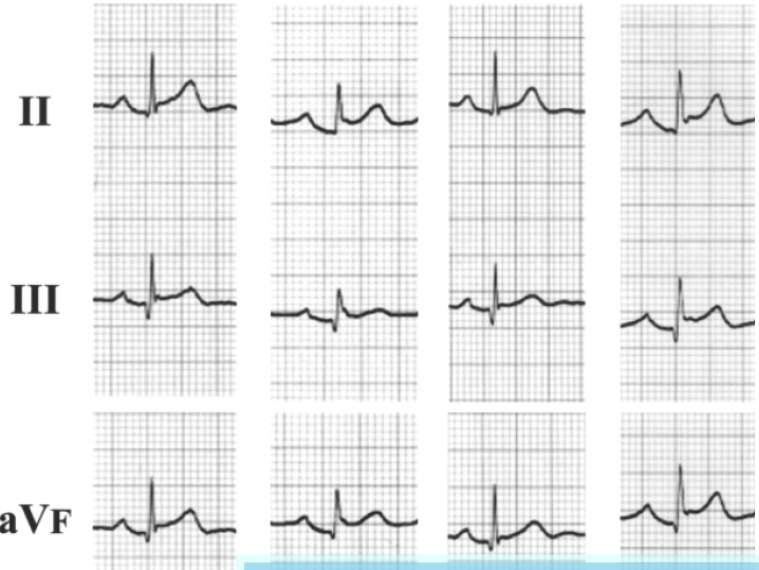
HARI KALLA, M.D., GAN-XIN YAN, M.D., Ph.D., and ROGER MARINCHAK, M.D.  
From Lankenau Hospital, Wynnewood, Pennsylvania



J Cardiovasc Electrophysiol 2000

**J Wave and ST Segment Elevation in the Inferior Leads  
A Latent Type of Variant Brugada Syndrome ?**

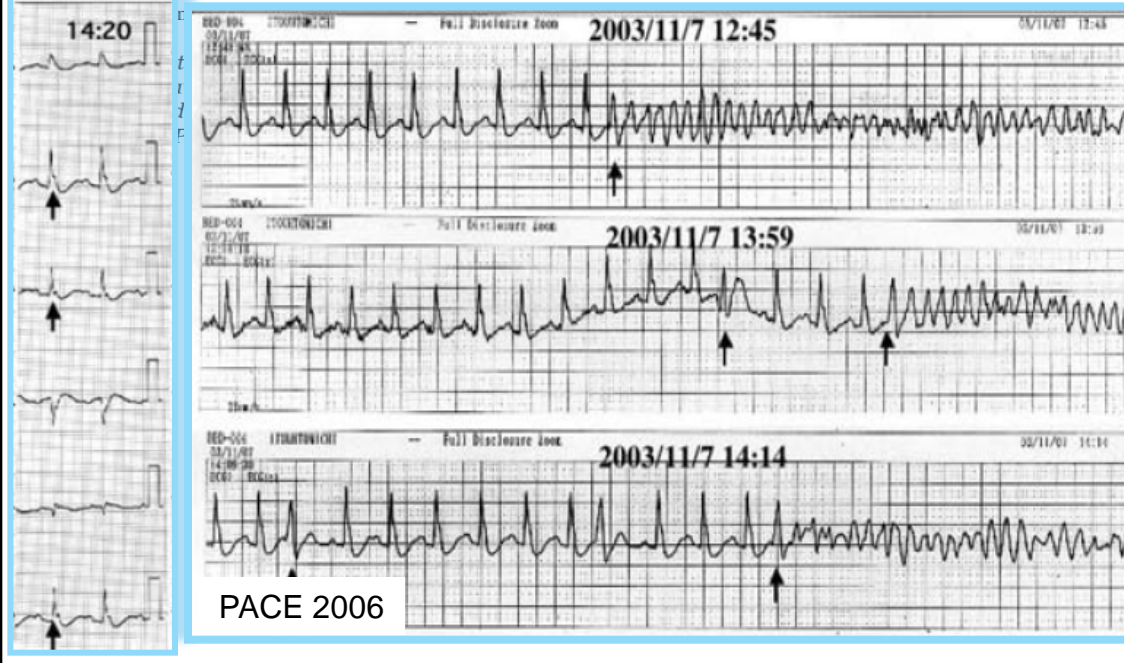
Makoto SAHARA,<sup>1</sup> MD, Kouichi SAGARA,<sup>1</sup> MD, Takeshi YAMASHITA,<sup>1</sup> MD, Tsuyoshi ABE,<sup>1</sup> MD, Hajime KIRIGAYA,<sup>1</sup> MD, Misao NAKADA,<sup>1</sup> MD, Hiroyuki INUMA,<sup>1</sup> MD, Long-Tai FU,<sup>1</sup> MD, and Hiroshi WATANABE,<sup>1</sup> MD



Japanese Heart Journal 2002

**Ventricular Fibrillation in a Patient with Prominent J Wave in the Inferior and Lateral Electrocardiographic Leads After Gastrostomy**

NORIHIRO KOMIYA, RYO IMANISHI, HIROAKI KAWANO, RIYAKO SHIBATA, MANABU MORIYA, SATOKI FUKAE, YOSHIYUKI DOI, KOJIRO NAKAO, SHINJI SETO, and KATSUSUKE YANO

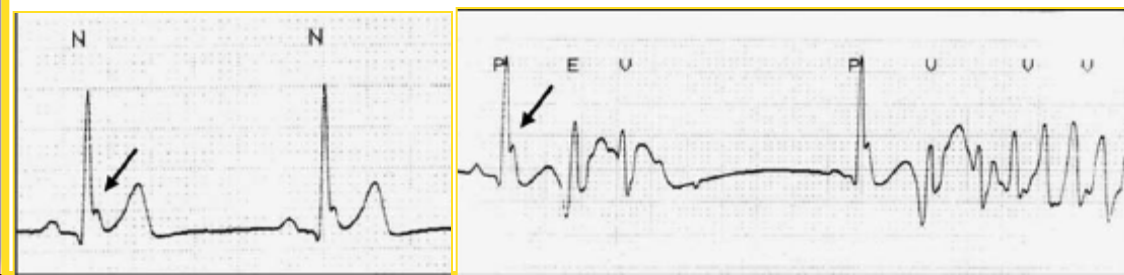


PACE 2006

**Characterization of J wave in a patient with idiopathic ventricular fibrillation**

HeartRhythm 2006

Tetsuji Shinohara, MD,\* Naohiko Takahashi, MD,\* Tetsunori Saikawa, MD,† Hironobu Yoshimatsu, MD\*



# What do we know about J-waves? RETROSPECTIVE CASE-CONTROL STUDIES.

ORIGINAL ARTICLE

## Sudden Cardiac Arrest Associated with Early Repolarization

Michel Haïssaguerre,  
Laurence Jesel,  
Jean-Luc Pasquière, M.D.,  
Sinildra Yli-Maury, M.D.,  
Philippe Mabo, M.D.,  
Solena Le Scouarnec,  
Thomas Rostocki, M.D.,  
Thomas Lavergne,  
Frederic Anselme,  
Ilang Tenenbaum,  
George D. Veenhuyzen,  
Pierre Jais, M.D.

### J-Point Elevation in Survivors of Primary Ventricular Fibrillation and Matched Controls

Incidence and Clinical Significance

Raphael Rosso, MD,\* Evgeni Kogan, MD,\* Bernard Belhassen, MD,\* Ugo Melvin M. Scheinman, MD,§ David Zeltser, MD,\* Amir Halkin, MD,\* Karin Heller, MD,\* Michael Glikson, MD,† Amos Katz, MD,‡ Sami Viskochil, MD,§

*From the Department of Cardiology, Soroka University Medical Center, Beer Sheva, Israel, and the Department of Cardiology, Soroka University Medical Center, Beer Sheva, Israel, and the Department of Cardiology, Soroka University Medical Center, Beer Sheva, Israel.*

### Ability of Terminal QRS Notching to Distinguish Benign from Malignant Electrocardiographic Forms of Early Repolarization

Faisal M. Merchant, MD<sup>a</sup>, Peter A. Noseworthy, MD<sup>a</sup>, Rory B. Weiner, MD<sup>a</sup>, Sheldon M. Singh, MD<sup>b</sup>, Jeremy N. Ruskin, MD<sup>b</sup>, and Vivek Y. Reddy, MD<sup>a,\*</sup>

Recent studies have suggested that early repolarization (ER) might be associated with up to 1/3 of idiopathic ventricular tachycardia/ventricular fibrillation (VT/VF) cases ("malignant" ER). We sought to identify electrocardiographic features to distinguish benign from malignant variants of ER. We reviewed the medical records for implantable-cardioverter defibrillators implanted at a single institution (1988 to 2008) to identify cases of idiopathic VT/VF. The electrocardiograms were scored for ER, defined as a  $\geq 0.1$ -mV elevation of the QRS-ST junction manifesting as J-point slurring or notching in 2 contiguous leads. We also identified a cohort of 200 healthy age- and gender-matched controls with electrocardiographic findings previously identified as normal ER ("benign" ER cohort). Of 1,224 consecutive implantable-cardioverter defibrillator implants, we identified 39 cases of idiopathic VT/VF. Of the 39 cases, 9 (23%) demonstrated ER. During a mean follow-up of  $7.2 \pm 4.6$  years, the combined end point of appropriate implantable-cardioverter defibrillator shocks or all-cause mortality occurred less frequently in cases of idiopathic VT/VF with ER than in those without ER (11% vs 30%, odds ratio 0.29, 95% confidence interval 0.03 to 2.69,  $p = 0.40$ ). A comparison of the electrocardiograms between those with malignant ER and controls demonstrated that QRS notching was significantly more prevalent among cases when

European Heart Journal Advance Access published October 29, 2009



European Heart Journal  
doi:10.1093/eurheartj/ehp4123

CLINICAL RESEARCH

## Mode of onset of ventricular fibrillation in patients with early repolarization pattern vs. Brugada syndrome

Gi-Byoung Nam<sup>1\*</sup>, Kwan-Ho Ko<sup>2</sup>, Jun Kim<sup>3</sup>, Kyoung-Min Park<sup>4</sup>, Kyoung-Suk Rhee<sup>5</sup>, Kee-Joon Choi<sup>1</sup>, You-Ho Kim<sup>1</sup>, and Charles Antzelevitch<sup>6\*</sup>

<sup>1</sup>Department of Internal Medicine, Jeon National University College of Medicine, 130-736, Pooongyo-dong 300-1, Songju, Seoul, Republic of Korea; <sup>2</sup>Health Medicine, Jeon National University College of Medicine, Seoul, Republic of Korea; <sup>3</sup>Division of Cardiology, Department of Internal Medicine, Pusan National University School of Medicine, Pusan National University Hospital, Busan, Republic of Korea; <sup>4</sup>Department of Internal Medicine, Sanggye Paik Hospital, College of Medicine, Inje University, Seoul, Republic of Korea; <sup>5</sup>Division of Cardiology, Department of Internal Medicine, Chonbuk National University, Chonbuk, Republic of Korea; and <sup>6</sup>Genetic Medical Research Laboratory, 2120 Bleeker Street, Uppsala, NY 13201-1187, USA.

Received 20 December 2008; revised 23 April 2009; accepted 11 June 2009

### Circadian variation of late potentials in idiopathic ventricular fibrillation associated with J waves: Insights into alternative pathophysiology and risk stratification

Yoshiaki Abe, MD, Takanori Ikeda, MD, FACC, Takehiro Tsukada, MD, Haruhisa Ishiguro, MD, Mitsuaki Miwa, MD, Mutsumi Miyakoshi, MD, Hisaaki Mera, MD, Satoru Yusu, MD, Hideaki Yoshino, MD, and Masahito Hara, MD, PhD, *from the Second Department of Internal Medicine, Kyorin University School of Medicine, Tokyo, Japan.*

**BACKGROUND** The presence of J waves on ECGs is related to idiopathic ventricular fibrillation (VF).

**OBJECTIVE** The purpose of this study was to investigate the pathophysiology of J waves by assessing risk markers that reflect physiologic abnormalities.

**DESIGN** The study enrolled 22 idiopathic VF patients (17 men, 5 women; mean age  $36 \pm 13$  years). Patients were divided into two groups according to the presence or absence of J waves. Following risk stratification were assessed: late potentials (LPs; a repolarization abnormality marker) for 24 hours using a newly developed signal-averaging system, and T-wave alternans and QT dispersion (repolarization abnormality markers). Frequency-domain heart rate variability (HRV), which reflects autonomic modulation, also was assessed. The results were compared to those of control subjects with J waves and 50 with no J wave, matched by age and gender to the idiopathic VF patients.

**RESULTS** J waves were present in 7 (32%) idiopathic VF patients. The incidence of LP in the idiopathic VF J-wave group was higher than in the idiopathic VF non-J-wave group (86% vs 27%,  $P = 0.001$ ). In contrast, repolarization abnormality markers did not differ between the two groups. In the idiopathic VF J-wave group, circadian changes in LP parameters (fQRS, RMS<sub>60</sub>, LAS<sub>60</sub>) were

observed and were pronounced at nighttime; this was not the case in the idiopathic VF non-J-wave group and the control J-wave group. High-frequency components (vagal tone index) on frequency-domain HRV analysis were associated with J waves in idiopathic VF patients ( $P < .05$ ).

**CONCLUSION** Idiopathic VF patients with J waves had a high incidence of LP showing circadian variation with night ascendancy. J waves may be more closely associated with depolarization abnormality and autonomic modulation than with repolarization abnormality.

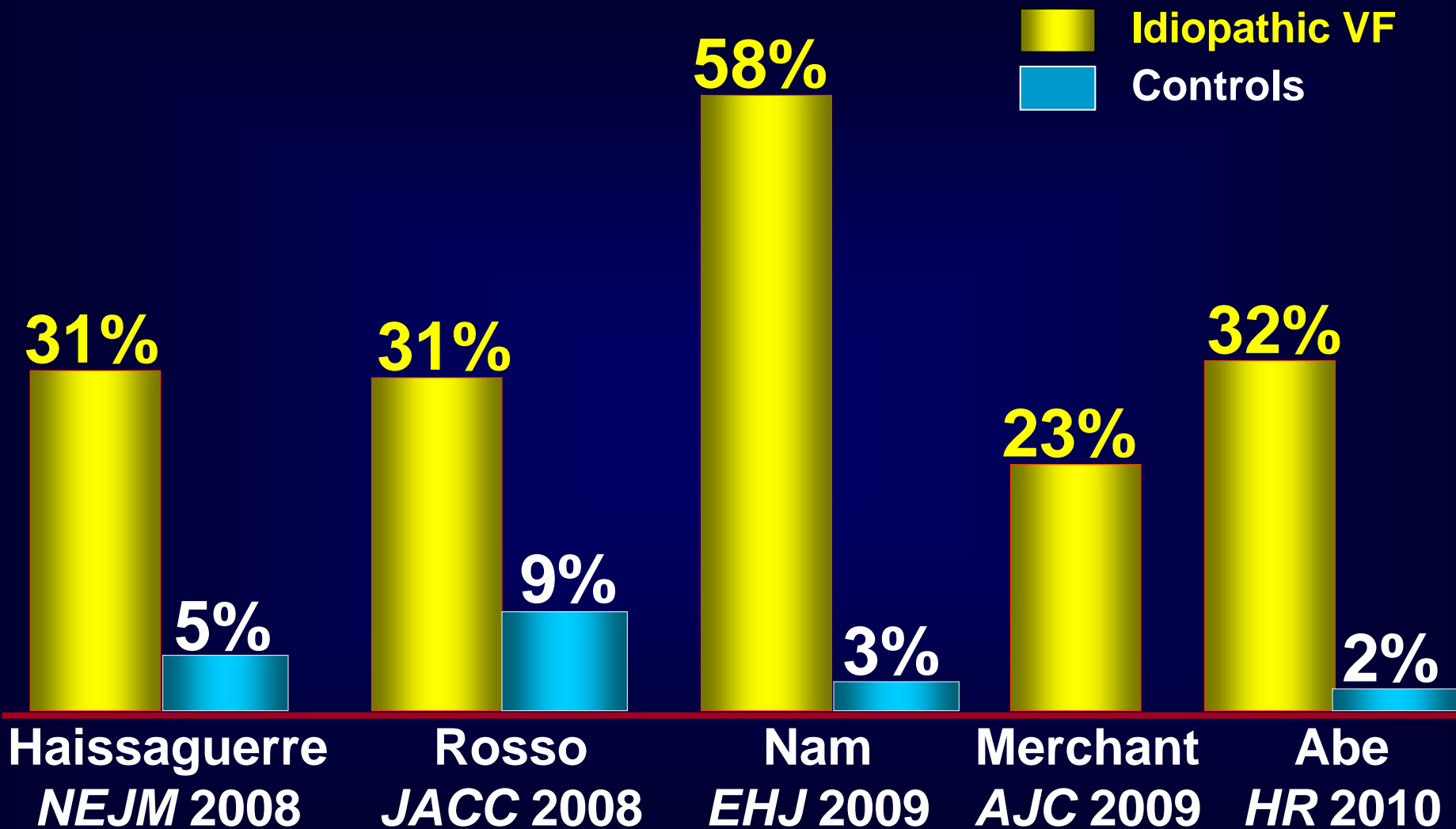
**KEYWORDS** Circadian variation; Depolarization abnormality; Idiopathic ventricular fibrillation; J wave; Late potentials

**ABBREVIATIONS** fQRS = filtered QRS duration; HF = high frequency; HRV = heart rate variability; LAS<sub>60</sub> = duration of low-amplitude signals ( $<40 \mu V$ ) in terminal filtered QRS complex; LF = low frequency; LP = late potential; QTd = QT dispersion; RMS<sub>60</sub> = root mean square voltage of terminal 40 ms of filtered QRS complex; TWA = T-wave alternans; VF = ventricular fibrillation

(Heart Rhythm 2010;7:675-682) © 2010 Heart Rhythm Society. All rights reserved.



# Prevalence of Early Repolarization in Patients with Idiopathic VF and controls.



# What do we know about J waves?

## Early repolarization as a predictor of arrhythmic and nonarrhythmic cardiac events in middle-aged subjects



M. Juhani Junttila, MD,<sup>\*</sup> Jani T. Tikkanen, MD,<sup>\*</sup> Tuomas Kenttä, PhD,<sup>\*</sup> Olli Anttonen, MD,<sup>†</sup> Aapo L. Aro, MD,<sup>‡</sup> Kimmo Porthan, MD,<sup>‡</sup> Tuomas Kerola, MD,<sup>†</sup> Harri A. Rissanen, MSc,<sup>§</sup> Paul Knekt, MD,<sup>§</sup> Heikki V. Huikuri, MD<sup>\*</sup>

From the <sup>\*</sup>Medical Research Center Oulu, University of Oulu and University Hospital of Oulu, Oulu, Finland, <sup>†</sup>Department of Internal Medicine, Päijät-Häme Central Hospital, Lahti, Finland, <sup>‡</sup>Division of Cardiology Heart and Lung Center, Helsinki University Central Hospital, Helsinki, Finland, and <sup>§</sup>National Institute for Health and Welfare, Helsinki, Finland.

**BACKGROUND** Early repolarization (ER) in the inferior/lateral leads predicts mortality, but whether ER is a specific sign of increased risk for arrhythmic events is not known.

**OBJECTIVE** The purpose of this study was to study the association of ER and arrhythmic events and nonarrhythmic morbidity and mortality.

**METHODS** We assessed the prognostic significance of ER in a community-based general population of 10,846 middle-aged subjects (mean age 44 ± 8 years). The end-points were sustained ventricular tachycardia or resuscitated ventricular fibrillation (VT-VF), arrhythmic death, nonarrhythmic cardiac death, new-onset atrial fibrillation (AF), hospitalization for congestive heart failure, or coronary artery disease during mean follow-up of 30 ± 11 years. ER was defined as ≥0.1-mV elevation of J point in either inferior or lateral leads.

**RESULTS** After including all risk factors of cardiac mortality and morbidity in Cox regression analysis, inferior ER (prevalence 3.5%) predicted VF-VT events (n = 108 [1.0%]) with a hazard ratio (HR) of 2.2 (95% confidence interval [CI] 1.1–4.5, P = .03) but not nonarrhythmic cardiac death (n = 1235 [12.2%]), AF (n = 1659 [15.2%]), congestive heart failure (n = 1752 [16.1%]), or coronary

artery disease (n = 3592 [32.9%]) (P = NS for all). Inferior ER predicted arrhythmic death in cases without other QRS complex abnormalities (multivariate HR 1.68, 95% CI 1.10–2.58, P = .02) but not in those with ER and other coexisting abnormalities in QRS morphology (HR 1.30, 95% CI 0.86–1.96, P = .22).

**CONCLUSION** ER in the inferior leads, especially in cases without other QRS complex abnormalities, predicts the occurrence of VT-VF but not nonarrhythmic cardiac events, suggesting that ER is a specific sign of increased vulnerability to ventricular tachyarrhythmias.

**KEYWORDS** Sudden death; Electrocardiogram; J waves; Early repolarization; QRS abnormality

**ABBREVIATIONS** AF = atrial fibrillation; CAD = coronary artery disease; CHF = congestive heart failure; CI = confidence interval; ER = early repolarization; HR = hazard ratio; LVH = left ventricular hypertrophy; VF = ventricular fibrillation; VT = ventricular tachycardia

(Heart Rhythm 2014;11:1701–1706) © 2014 Heart Rhythm Society. All rights reserved.

**Conclusions**—We found no significant association between any components of early repolarization and cardiac mortality. (*Circulation*. 2011;124:2208–2214.)

PURPOSE: We patients with "e with those who METHODS: In selected ECGs f nations. Exclud judged to be abr in 2000 by card 670), or being b characteristics and o were compared v variance, logistic formation on ex RESULTS: Pati to be male (81% [n =

first described only 34 years after the Dutch physi- Klatsky, *Am J Med* 2003

### METHOD

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### Abstract

**Background:** Early repolarization (ER) is associated with sudden cardiac death in middle-aged subjects. We sought to determine ER prevalence in a population-based case-cohort study. *Health Research in the Region of Aug*

First described by Klatsky, *Am J Med* 2003

Sudden cardiac death is a major health issue, and accounts for 200 000 to 400 000 deaths per year in the United States.<sup>1,2</sup> Coronary artery disease, cardiomyopathy, left ventricular hypertrophy, valvular disease, congenital heart disease, and primary electrophysiological abnormalities are the major causes of sudden cardiac death.<sup>1,2</sup> Approximately 50% of sudden cardiac

proportion (1% to 13%) in previous reports.<sup>3–6</sup> Although conventionally considered benign,<sup>3</sup> it is potentially arrhythmogenic,<sup>6</sup> and in 2 clinical case-control studies, patients with a history of idiopathic ventricular fibrillation (VF) showed an increased prevalence of ER.<sup>7,8</sup> It has recently been reported that ER in the inferior leads is associated with increased risk of

Published July 23, 2011

CLINICAL RESEARCH

with J-point elevation in a biracial population

Soliman<sup>4</sup>, Richard S. Crow<sup>5</sup>, and

Medicine, University of North Carolina at Chapel Hill School of Global Public Health, Chapel Hill, NC, USA; <sup>2</sup>Department of Epidemiology and Biostatistics, University of North Carolina at Chapel Hill Gillings

thmia and early repolarization, an electrocardiogram (ECG) J-point. Little is known about this relationship in

### Early Repolarization on Electrocardiogram

Kikira Tsuneto, MD, PhD; Misa Imaizumi, MD, PhD; Mami Akahoshi, MD, PhD

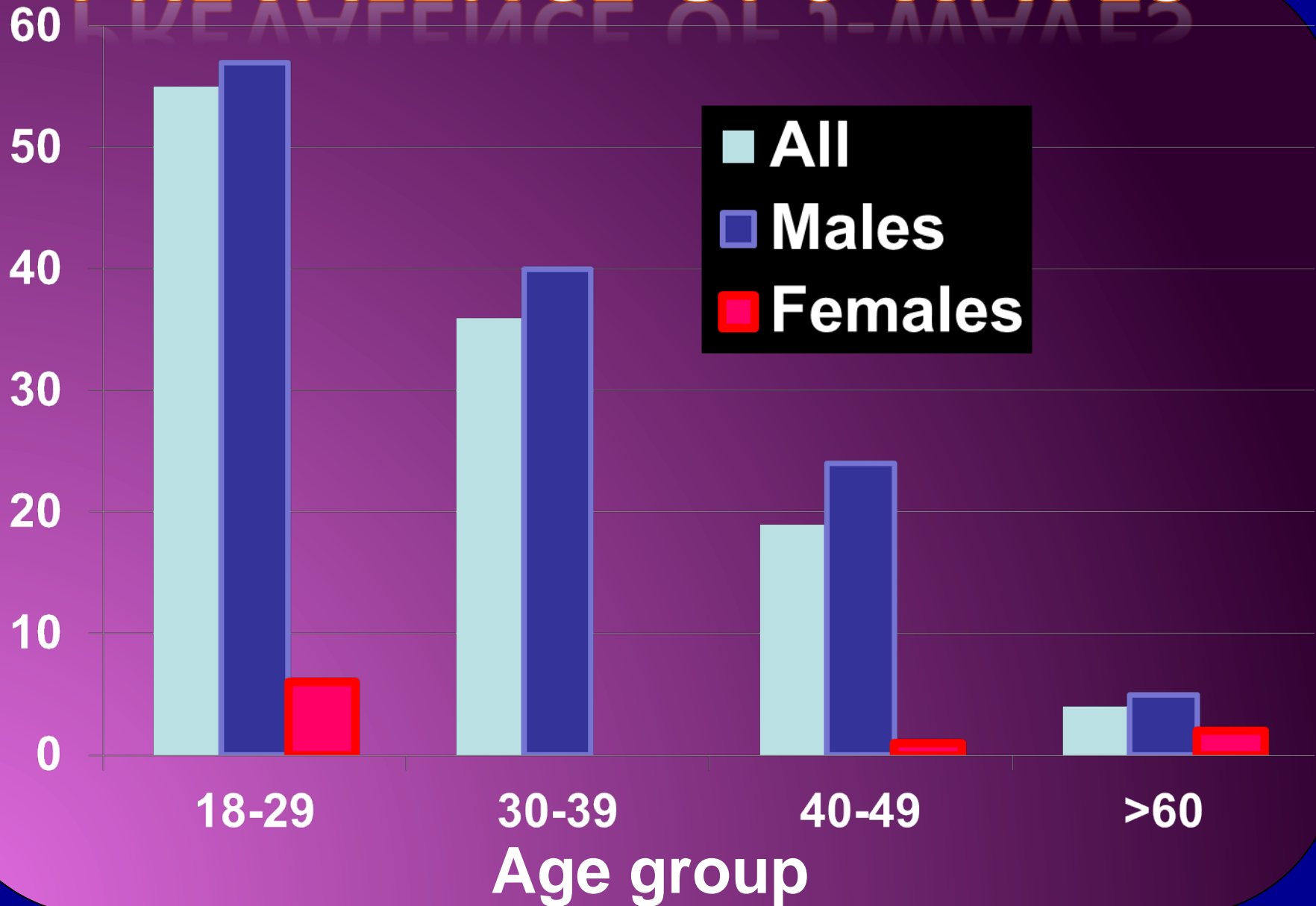
J-point elevation and QRS notching or slurring are common ECG findings in survivors who were examined at least once between August and December 2004. We defined early repolarization as a J-point elevation of at least 2 inferior and/or anterior leads. We identified 1429 early repolarization cases and an incidence rate of 715 per 100 000 person-years (95% confidence interval, 1.12–1.12) (95% confidence interval, 0.60 to 0.93; P<0.01) and all-cause mortality in addition, both slurring and notching were related to mortality (HR, 1.06 to 4.12; P=0.03), as was early repolarization (HR, 1.29 to 4.83; P<0.01).

Key Words: death, sudden ■ epidemiology ■ electrocardiography ■ mortality

Oh my God, I have a J wave in my ECG!

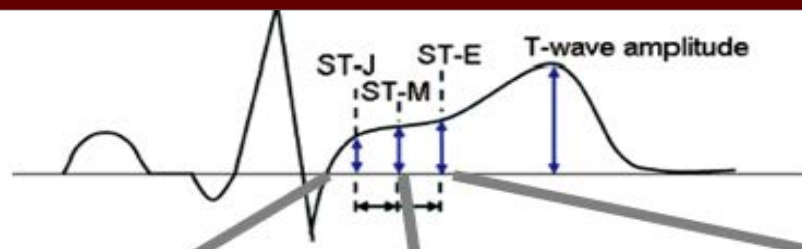


# PREVALENCE OF J-WAVES

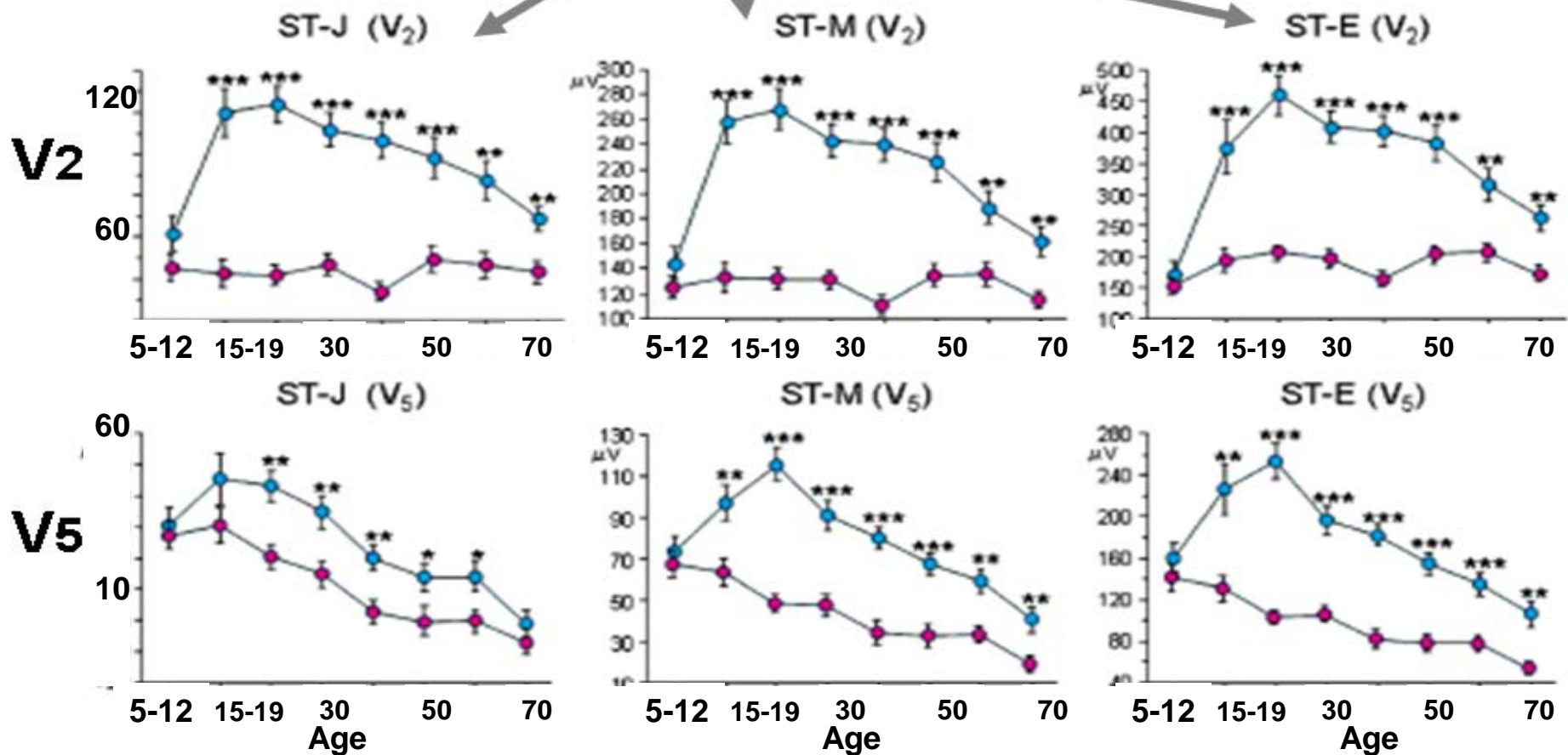




# Effects of age and gender on J-point and ST-segment in the healthy population



● Males  
● Females



# When should we worry?

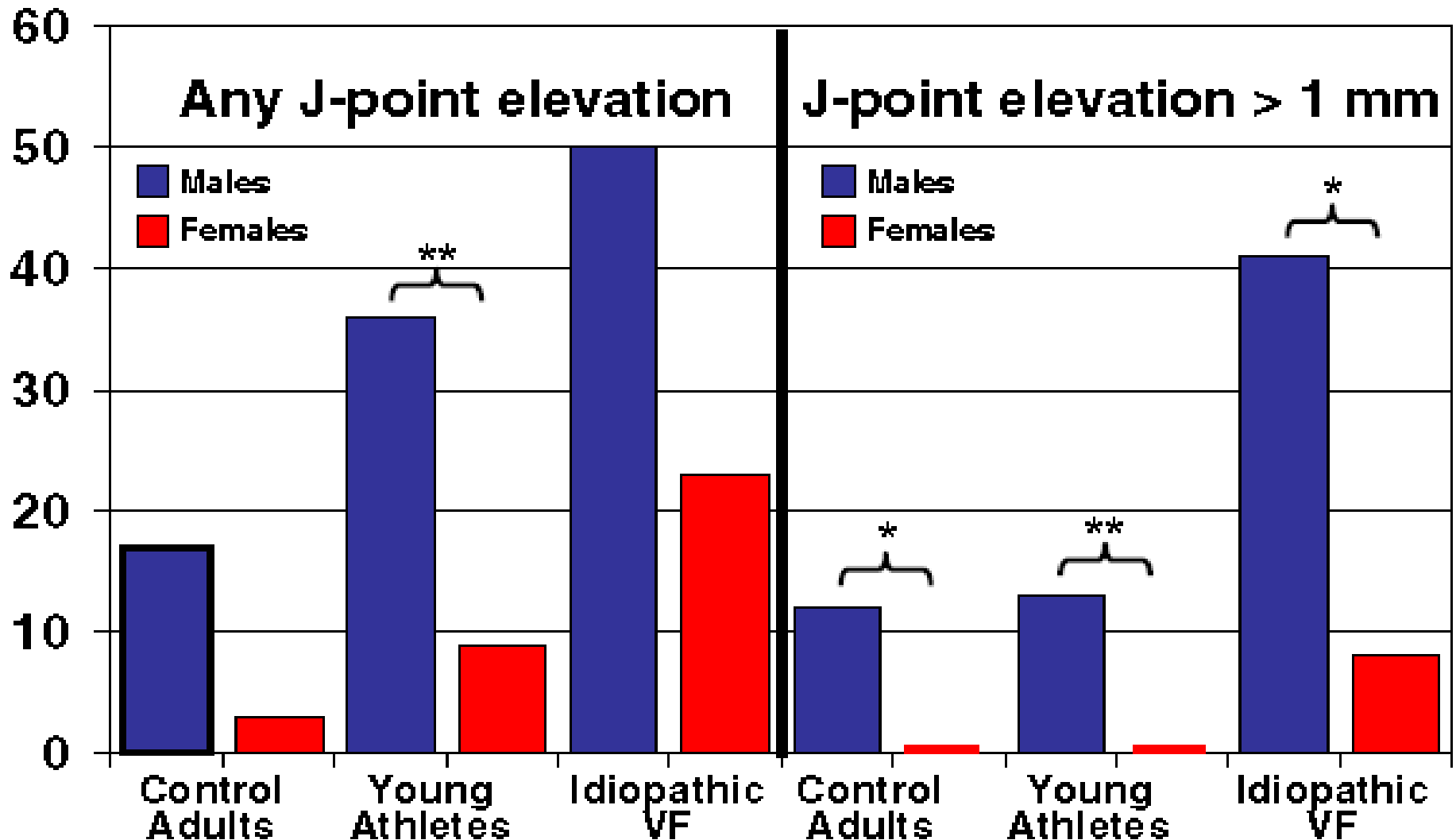


**Approach to early repolarization.**

## **Clinical clues:**

- 1. Gender.**
- 2. History of syncope.**
- 3. Familial sudden death?**

# Influence of Gender on the Incidence of J-Point Elevation in the Different Patient Groups





# Risk stratification of early repolarization

---

**History of symptoms: syncope?**

**Vagal syncope**



**Ignore the ECG**



**Leave him alone  
despite ER +**

**Malignant syncope**



**Ignore the ECG**



**Investigate despite  
absence of ER**

# Risk stratification of early repolarization

---

**Familial history of sudden death?**

**YES**



**Ignore the ECG**



**Investigate despite  
ER -**

**No**



**Ignore the ECG**



**Leave him alone  
despite ER**

## The Early Repolarization Pattern in the General Population

Clinical Correlates and Heritability

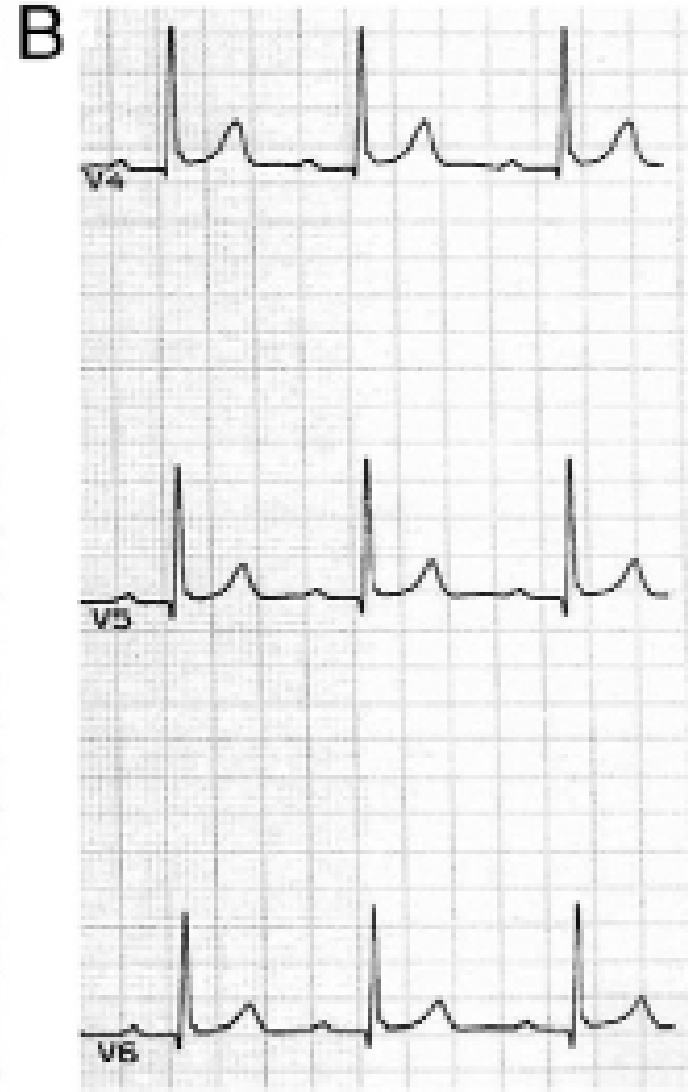
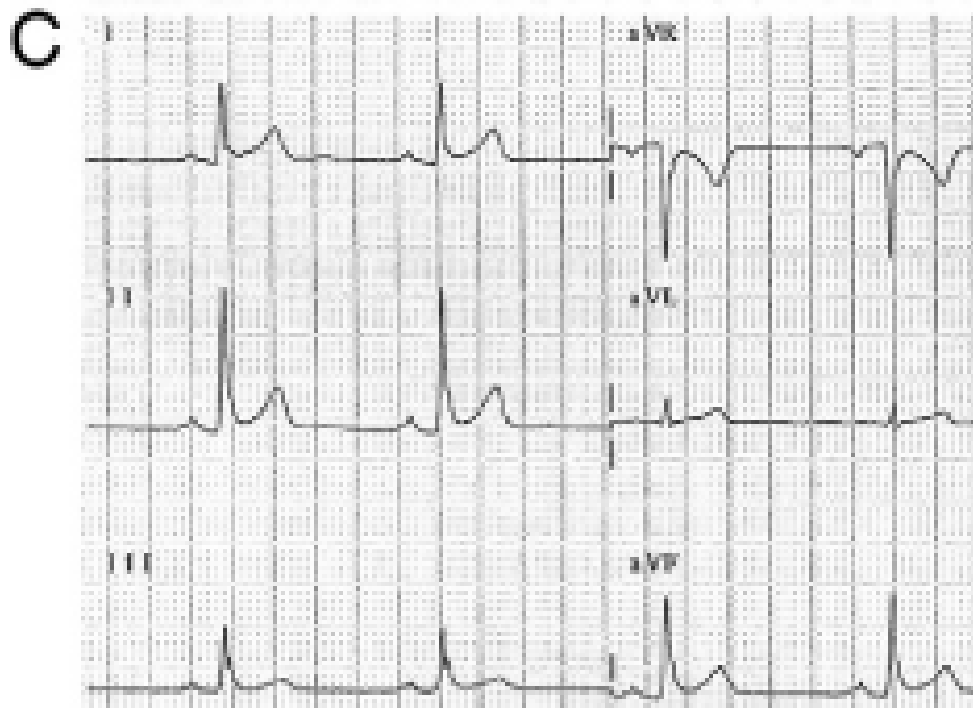
Peter A. Noseworthy, MD,\*† Jani T. Tikkanen, MB,‡ Kimmo Porthan, MD,§  
Lasse Oikarinen, MD, PhD,§ Arto Pietilä, MSc,¶ Kennet Harald, MSc,¶ Gina M. Peloso, MA,#\*\*  
Faisal M. Merchant, MD,\* Antti Jula, MD, PhD,¶ Heikki Väänänen, LIC Sc,§||  
Shih-Jen Hwang, PhD,#†† Christopher J. O'Donnell, MD, MPH,#†† Veikko Salomaa, MD, PhD,¶  
Christopher Newton-Cheh, MD, MPH,\*†# Heikki V. Huikuri, MD‡

*Boston, Cambridge, and Framingham, Massachusetts; Oulu, Helsinki, and Turku, Finland;  
and Bethesda, Maryland*

### Third generation Framingham Heart Study.

- Total: 9,444.
- 5% of ALL had early repolarization.
- 12% of siblings of individuals with ER also had ER [Odds ratio 2.2 (1.0 -4.9)]

# Prevalence of J-Point Elevation in Sudden Arrhythmic Death Syndrome Families



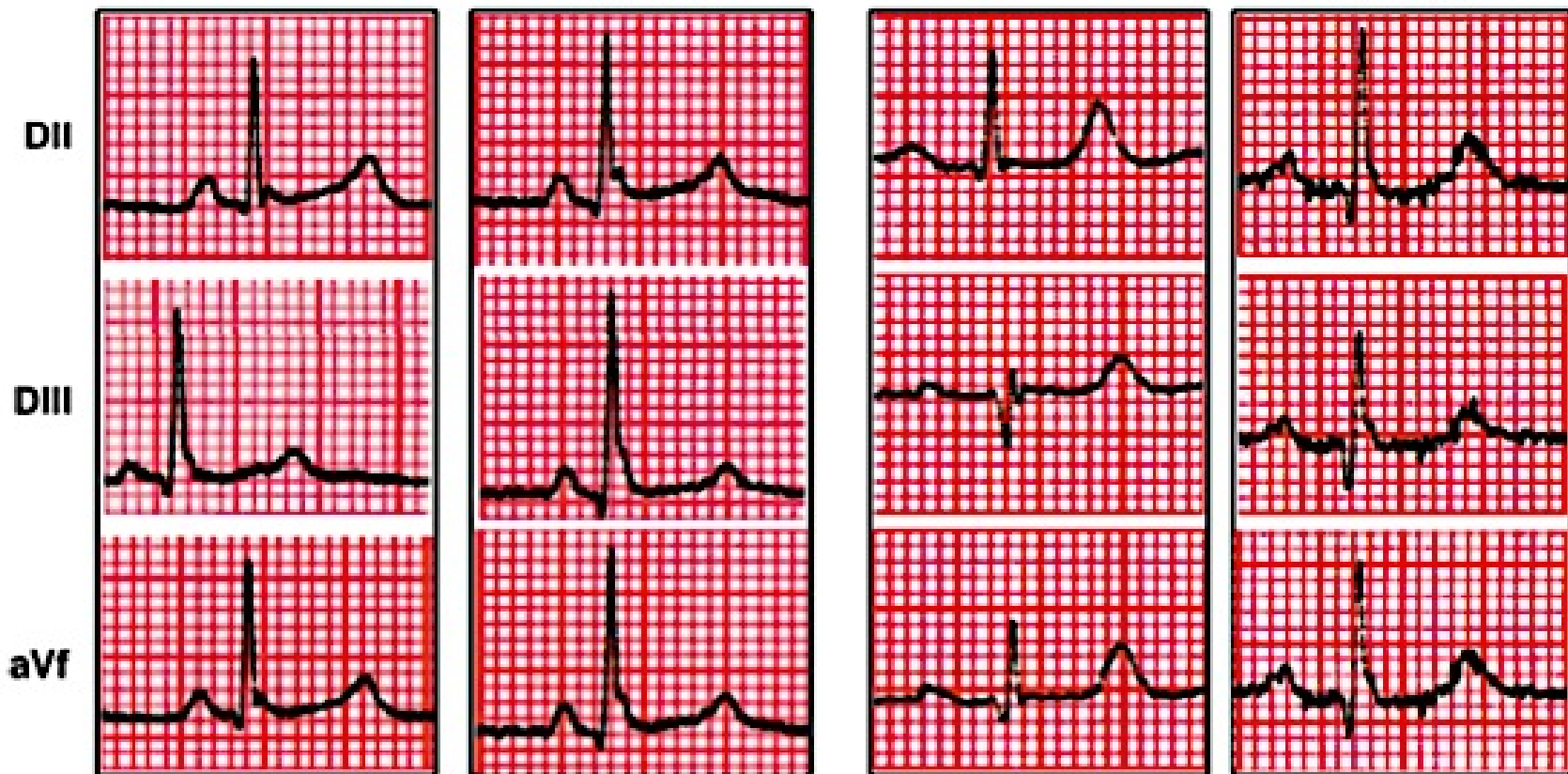


# Identification of large families with early repolarization syndrome

Gourraud, JACC  
2012

Valsalva

Valsalva



Individual III-20

Individual IV-5

Family C

Family B

# How common is a history of sudden death among patients with idiopathic VF ?

**Idiopathic VF with  
early repolarization.**

**16%**

**Idiopathic VF with  
normal ECG**

**9%**

*Haissaguerre, NEJM 2008.*

**0**

**0**

*Rosso, JACC 2008.*

**14%**

**7%**

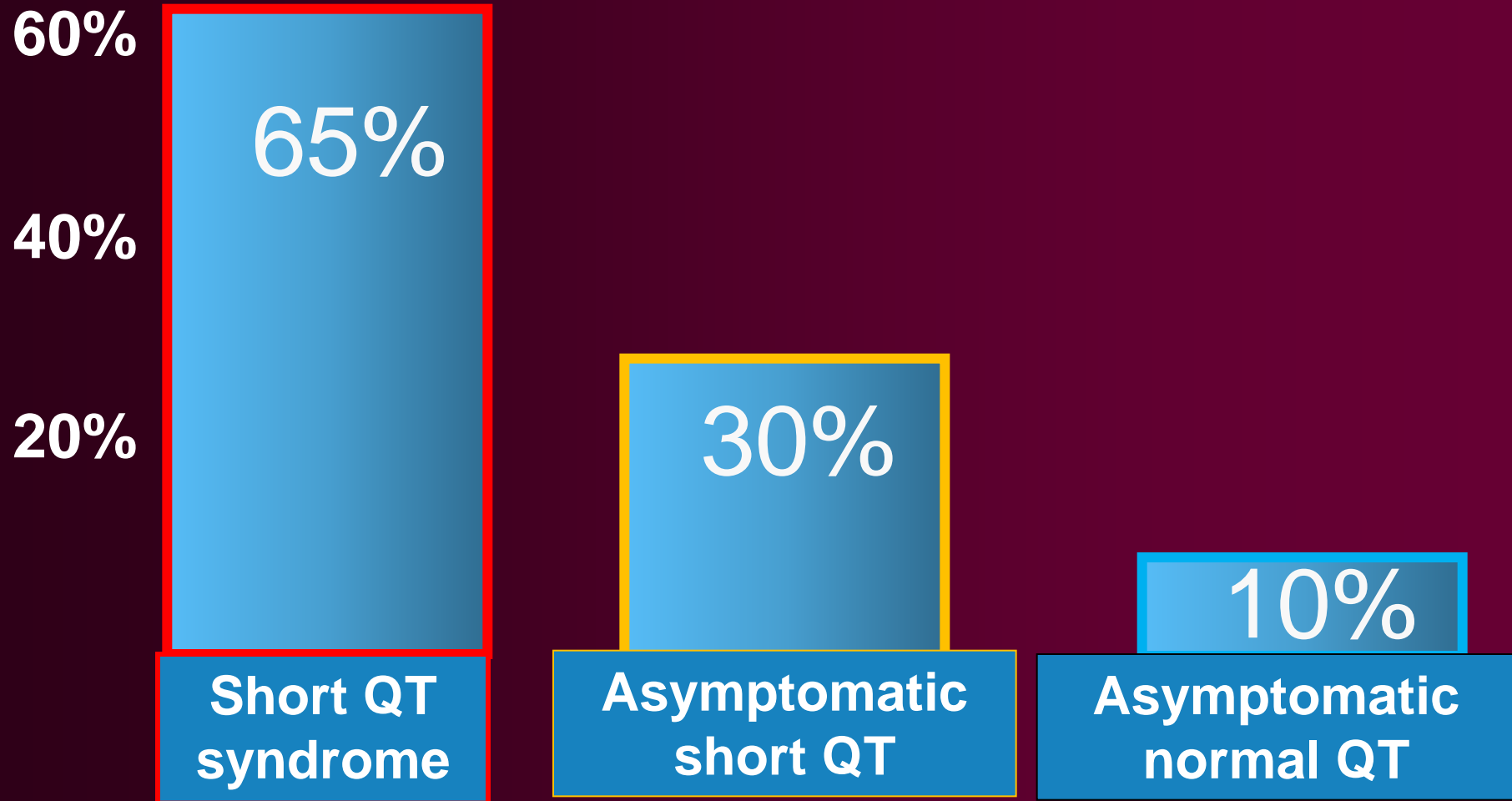
*Abe, Heart-Rhythm 2010.*

# Risk stratification of early repolarization

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**The ECG: which features?**

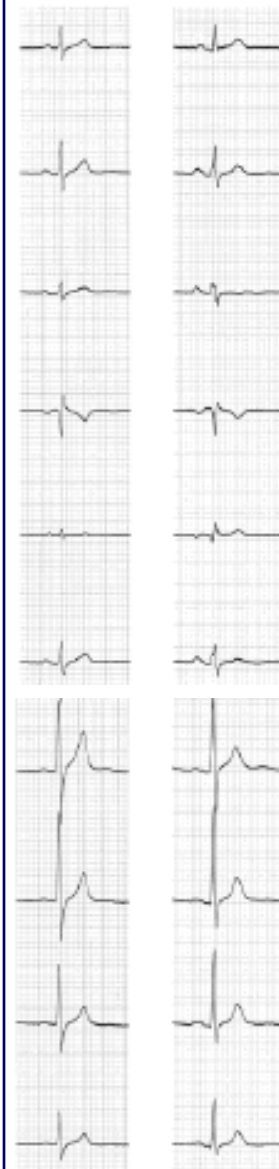
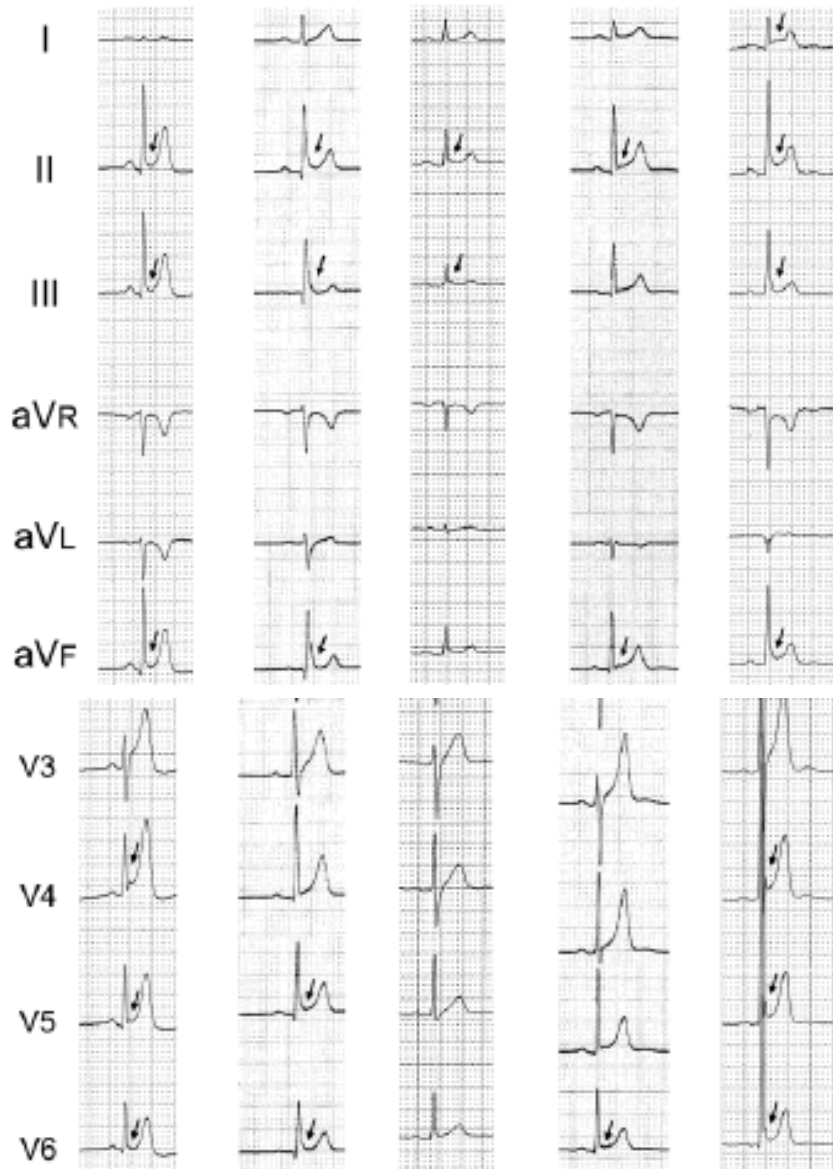
# Early repolarization pattern in patients with SQTS, controls with short QT and controls with normal QT.



Watanabe (Shimizu), *HeartRhythm* 2010

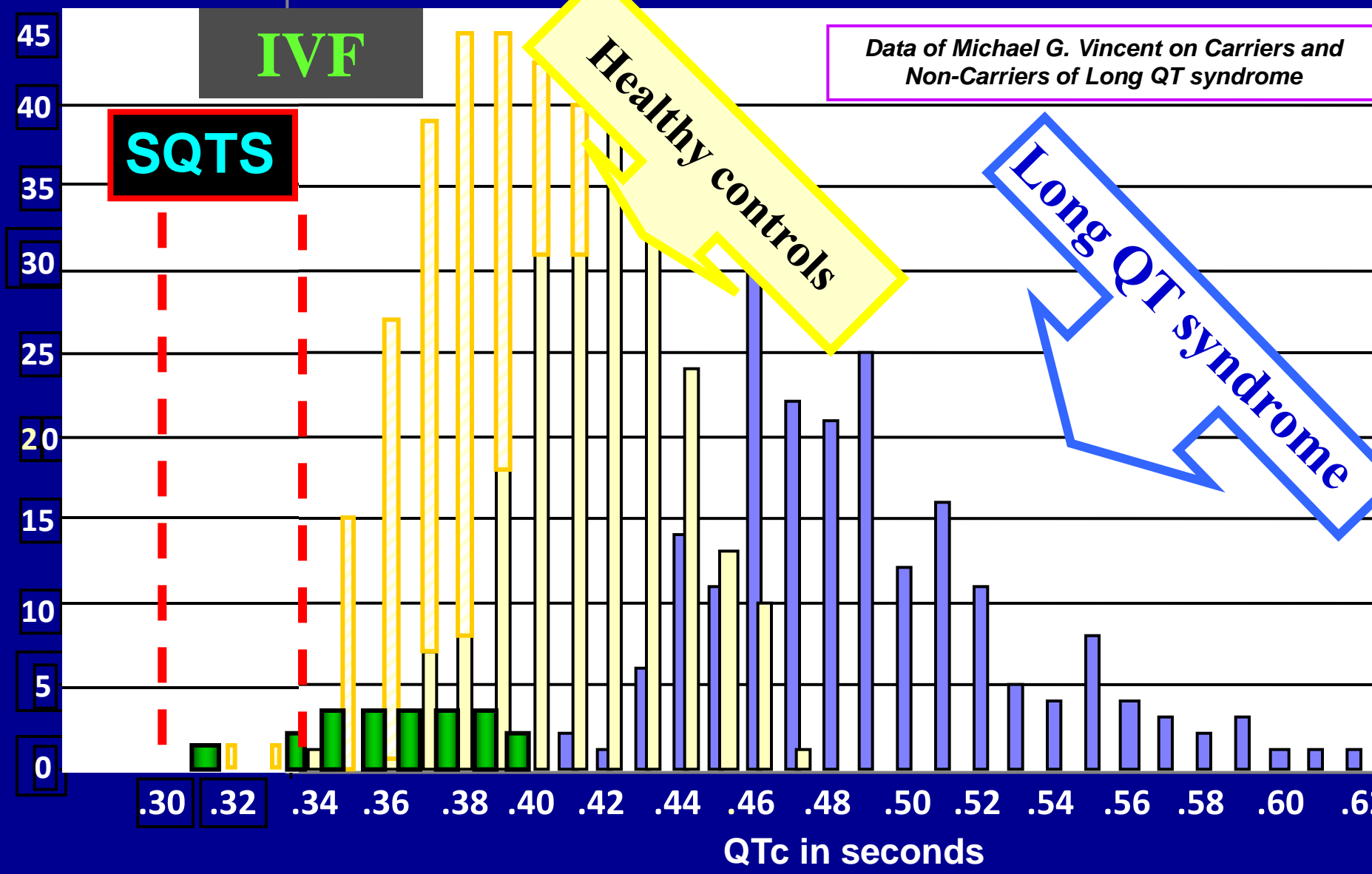


# Short QT syndrome

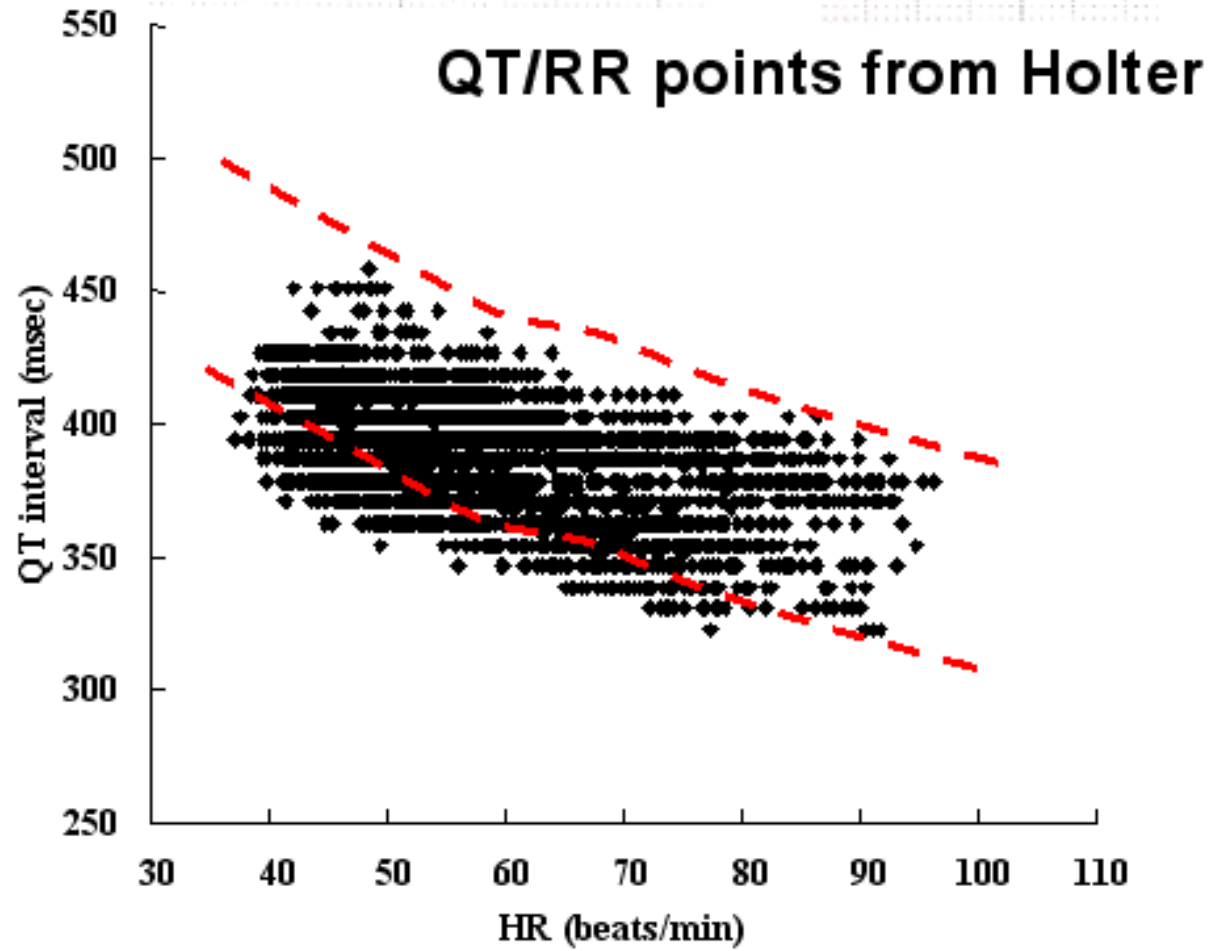
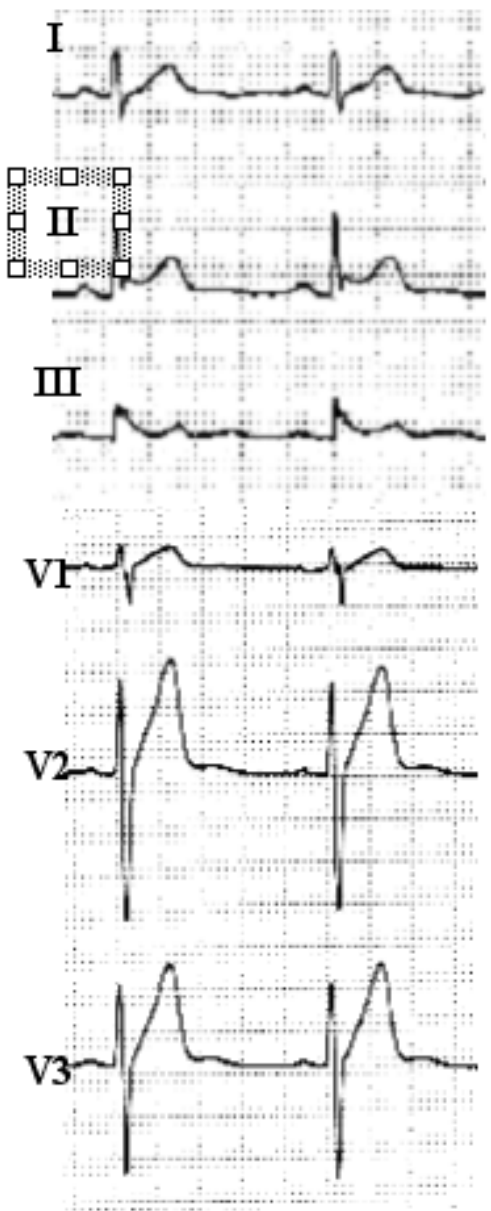
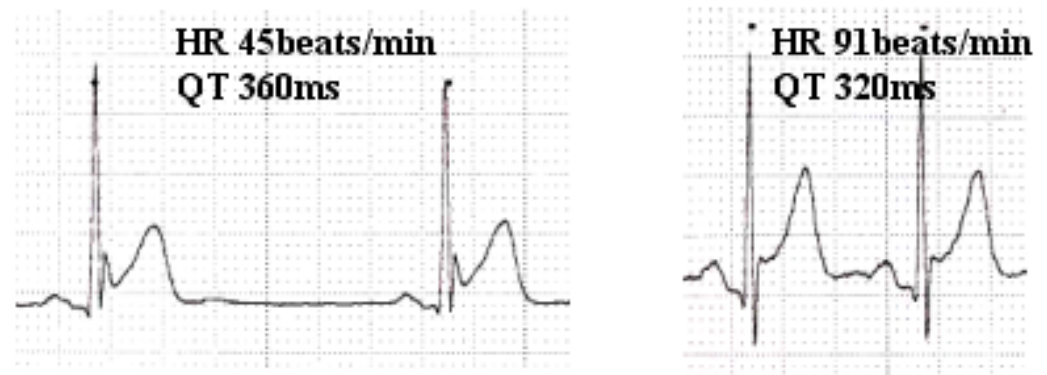


# Asymptomatic short QT

# Idiopathic VF: A short QT syndrome with not-so-short QT interval.



**Male, 33 years old.  
Idiopathic VF**



**Akira Fujiki, personal communication, 2005.**

# How to distinguish malignant from benign early repolarization ?

## Type of early repolarization

J-wave > QRS slurring > ST-elevation

Rosso, *JACC* 2008  
Merchant, *AJC* 2009

## Amplitude of the J-wave.

2 + 0.9 vs. 1.2 + 0.4

Haissaquerre. *NEJM* 2008

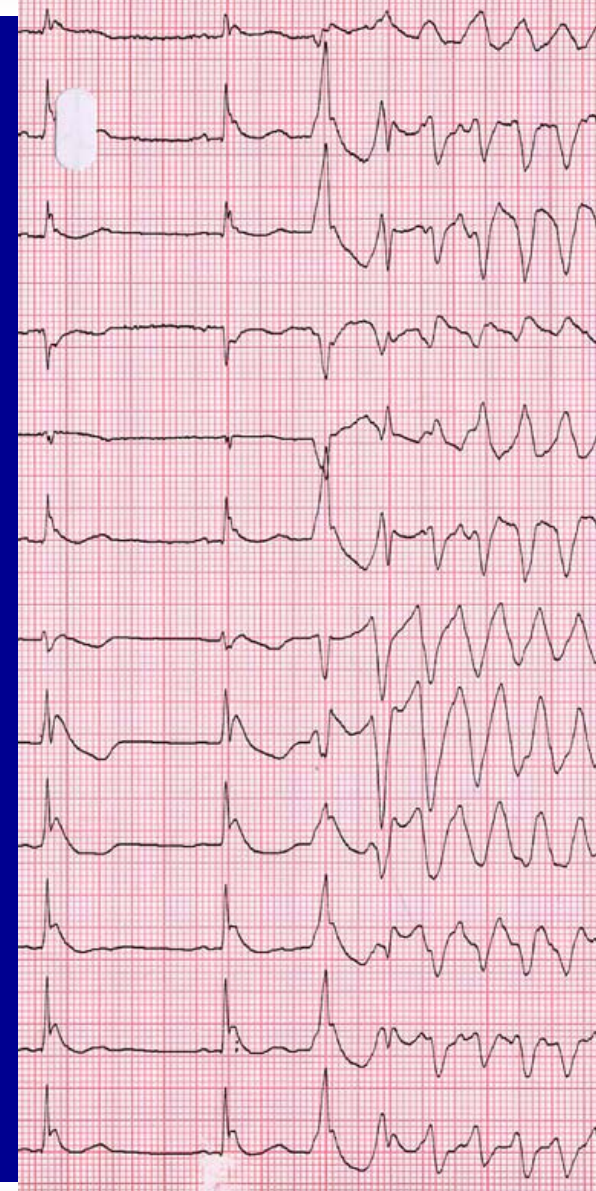
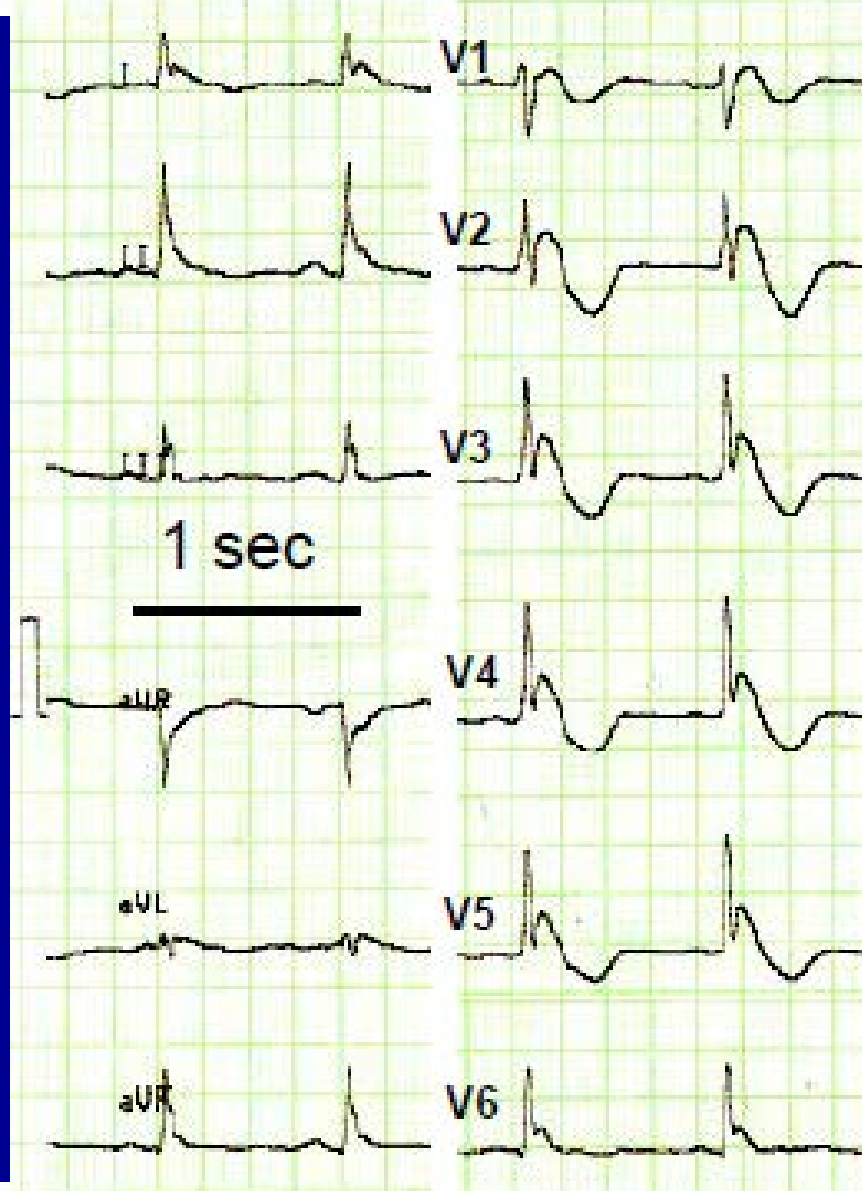
1.4 vs. 0.9 (N.S.)

Rosso, *JACC* 2008

>2 mm=High risk

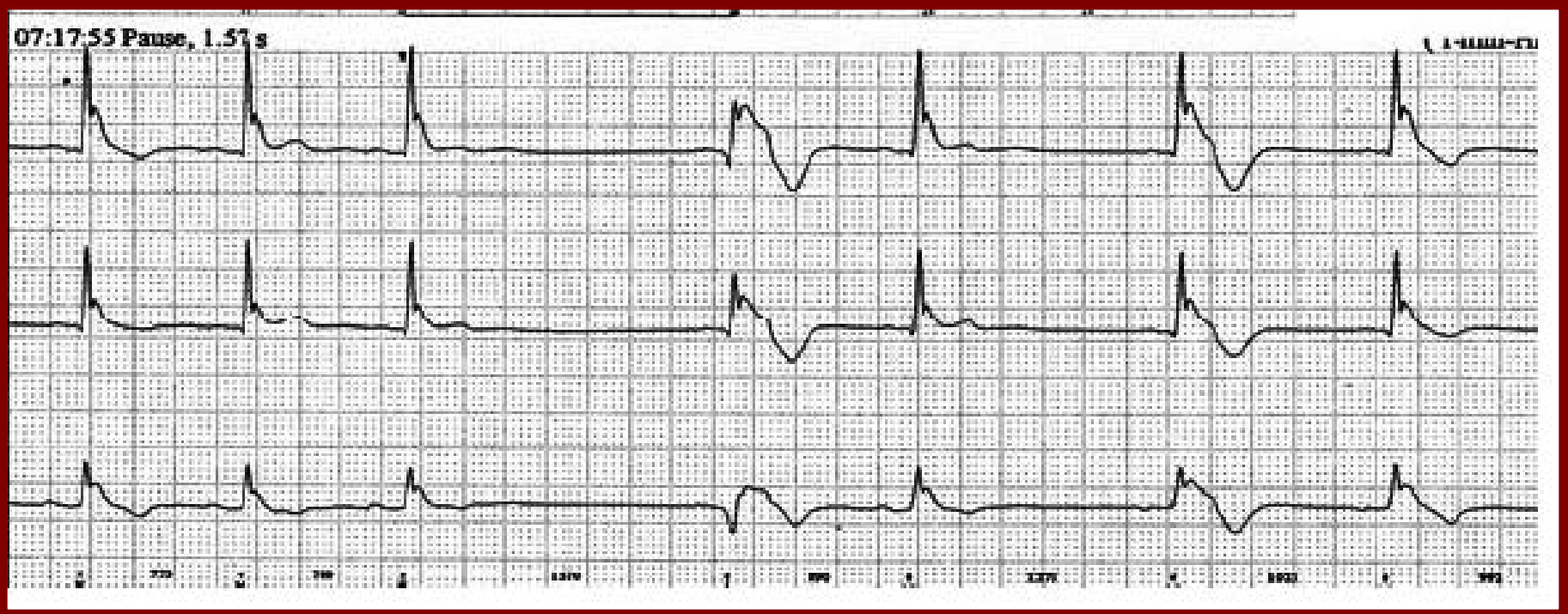
Tikkanen, *NEJM* 2009

# Idiopathic-VF: arrhythmic storm with giant J-wave responsive to isoproterenol



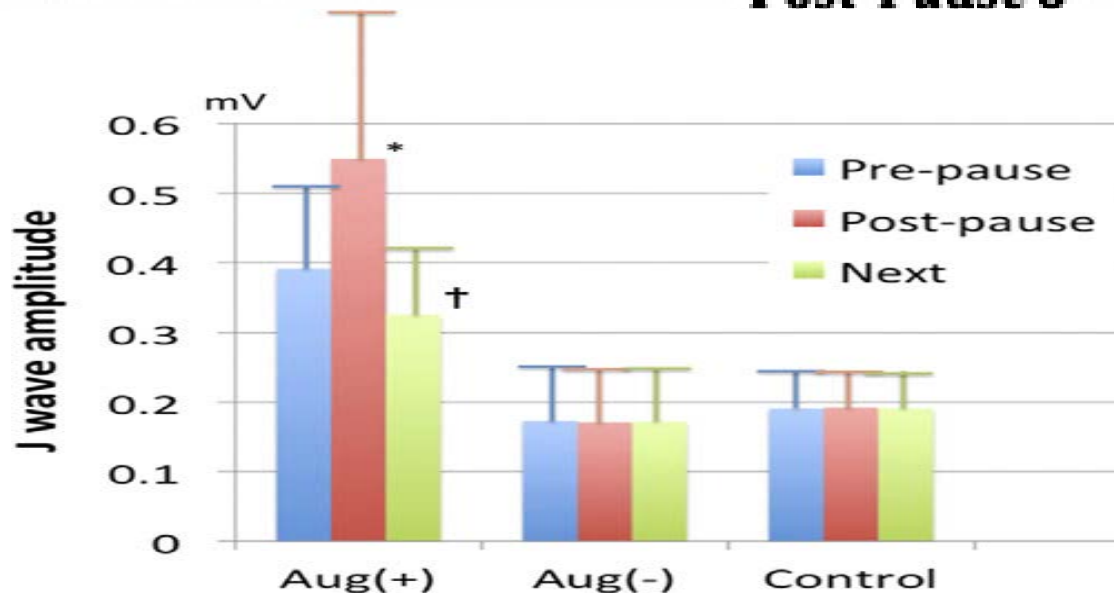
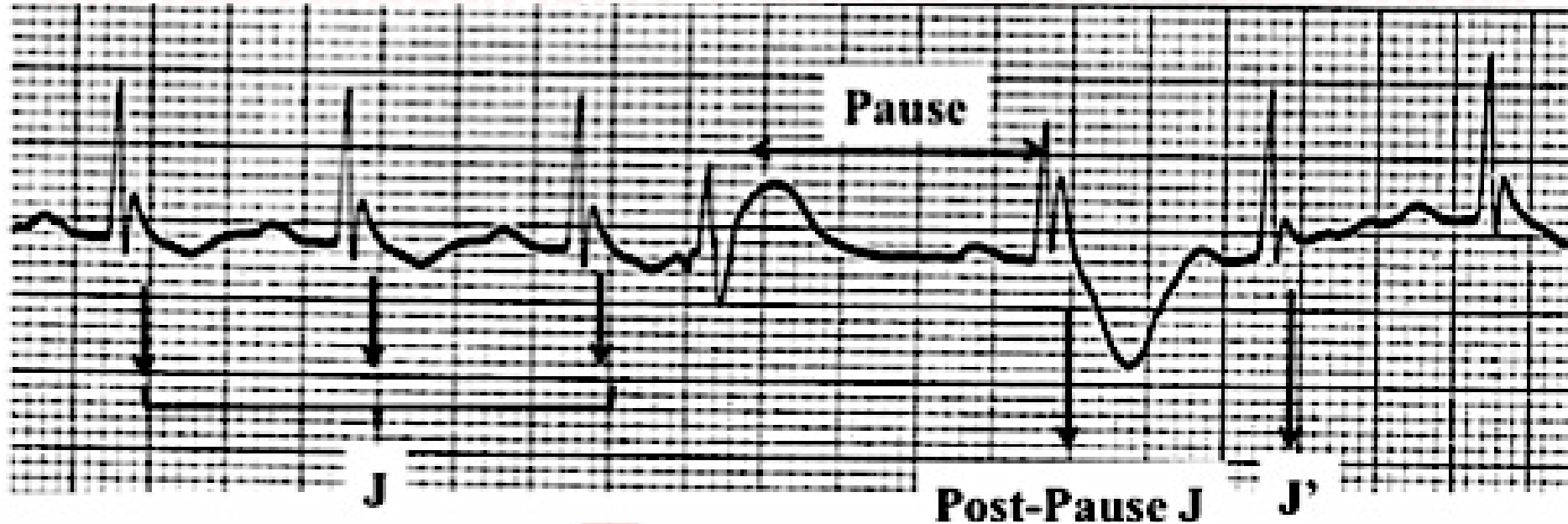


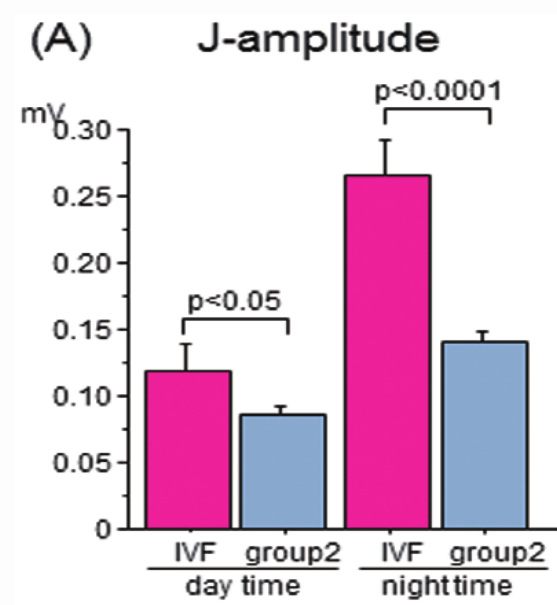
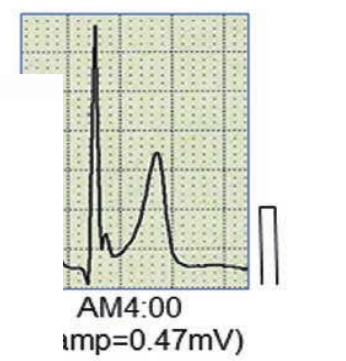
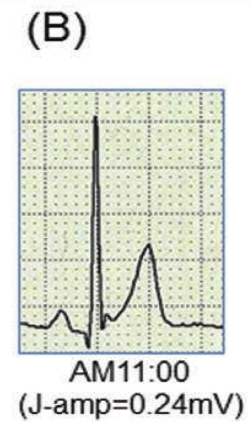
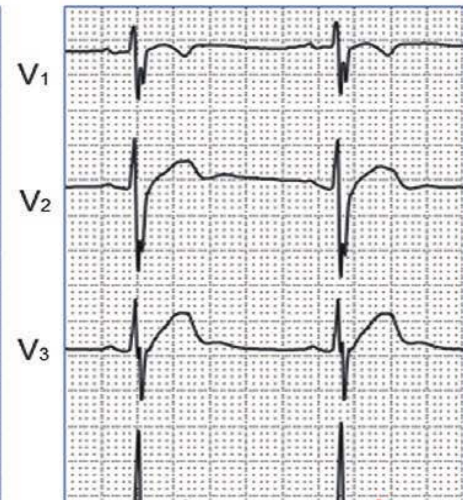
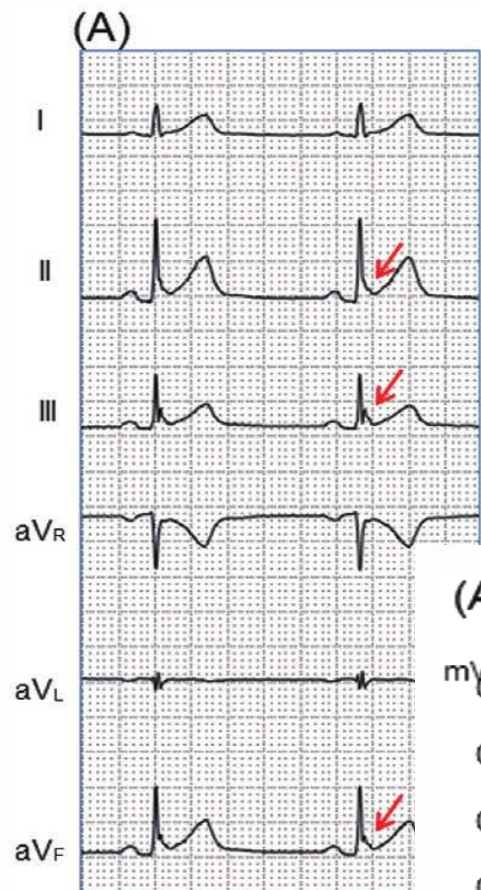
# Bradycardia-dependent J-wave augmentation.



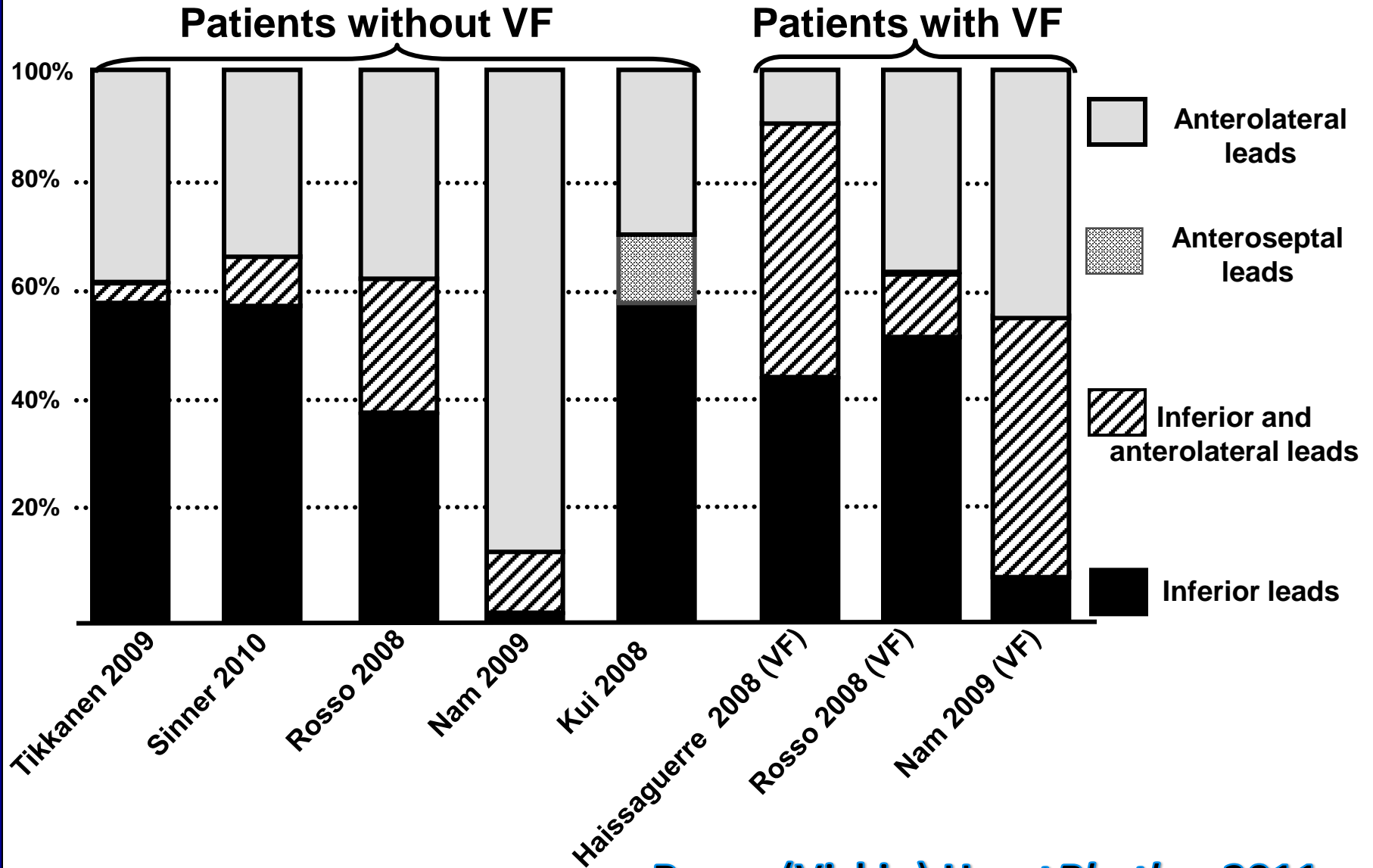


# PAUSE DEPENDENT J-WAVE AUGMENTATION





# Distribution of J-waves and early repolarization



# Long-Term Outcome Associated with Early Repolarization on Electrocardiography

Jani T. Tikkanen, B.S., Olli Anttonen, M.D., M. Juhani Juntila, M.D.,  
Aapo L. Aro, M.D., Tuomas Kerola, M.D., Harri A. Rissanen, M.Sc.,  
Antti Reunanen, M.D., and Heikki V. Huikuri, M.D.

## ABSTRACT

### BACKGROUND

Early repolarization, which is characterized by an elevation of the QRS–ST junction (J point) in leads other than  $V_1$  through  $V_3$  on 12-lead electrocardiography, has been associated with vulnerability to ventricular fibrillation, but little is known about the prognostic significance of this pattern in the general population.

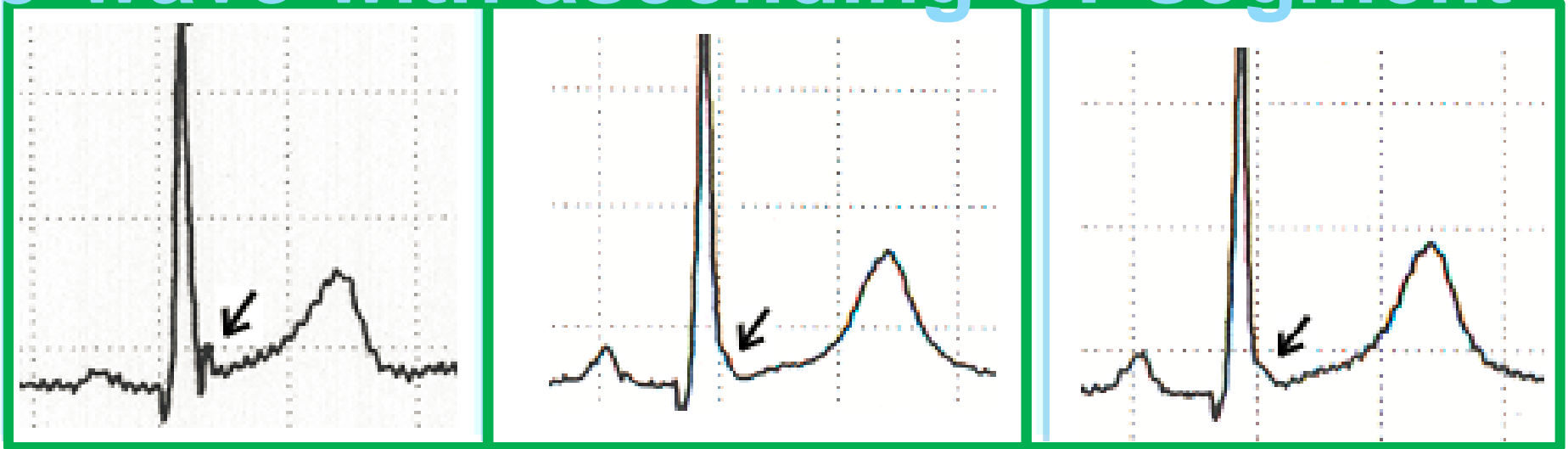
### METHODS

We assessed the prevalence and prognostic significance of early repolarization on 12-lead electrocardiography in a community-based general population of 10,864 middle-aged subjects (mean [ $\pm$ SD] age, 44 $\pm$ 8 years). The primary end point was death from cardiac causes, and secondary end points were death from any cause and death from arrhythmia during a mean follow-up of 30 $\pm$ 11 years. Early repolarization was

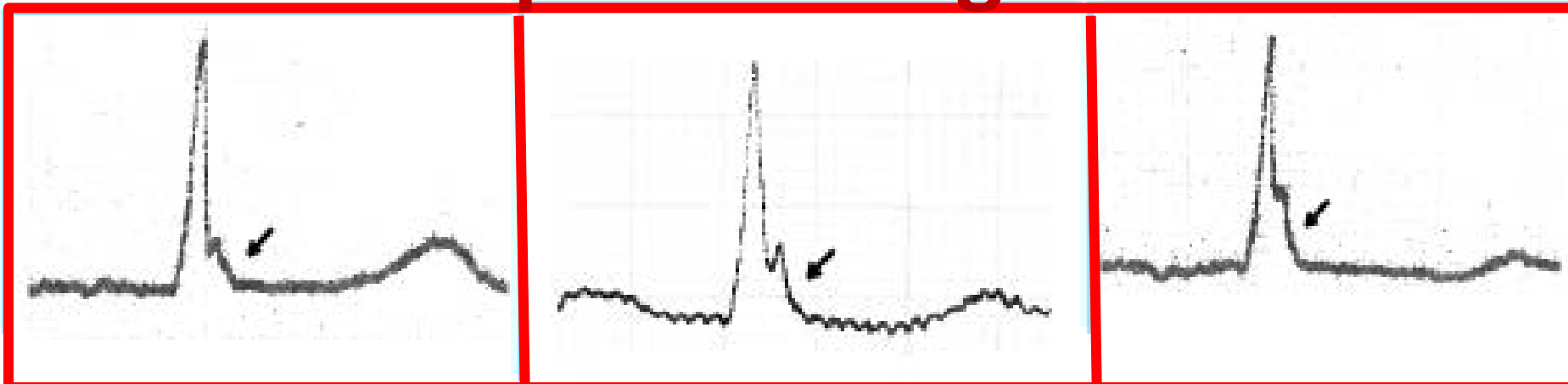
## Early Repolarization: Electrocardiographic Phenotypes Associated with Favorable Long-Term Outcome

Jani T Tikkanen, Juhani M Junttila, Olli Anttonen, Aapo L Aro, Samuli Luttinen, Tuomas Kerola, Solomon J Sager, Harri A Rissanen, Robert J Myerburg, Antti Reunanen, and Heikki V Huikuri  
CIRCULATIONAHA/2010/014068 [R1]

### J-wave with ascending ST-segment

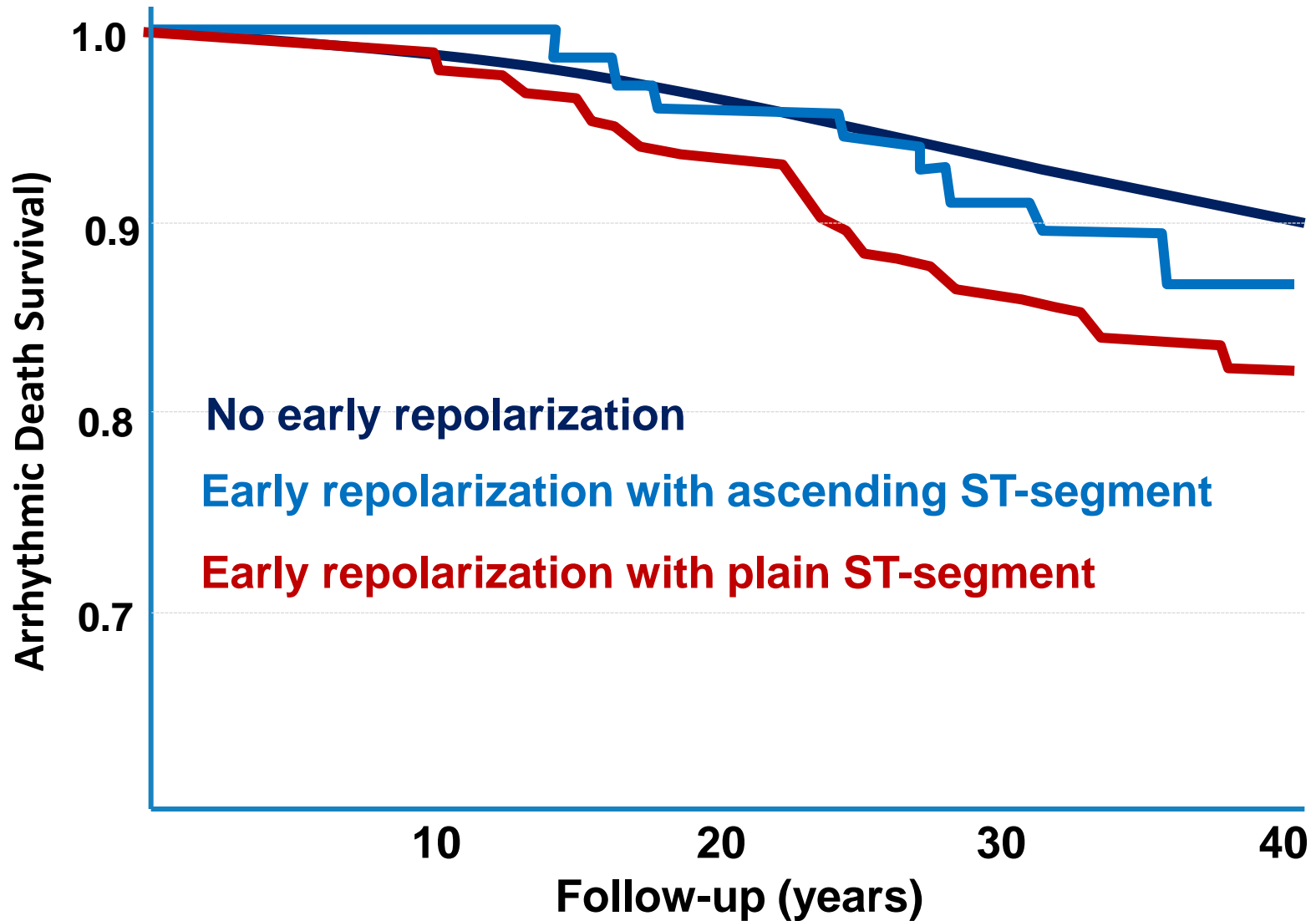


### J-wave with plain ST-segment



# Only the “plain-type” ST –segment predicts long-term arrhythmic risk in patients with early repolarization.

Tikkanen, *Circulation* 2011.

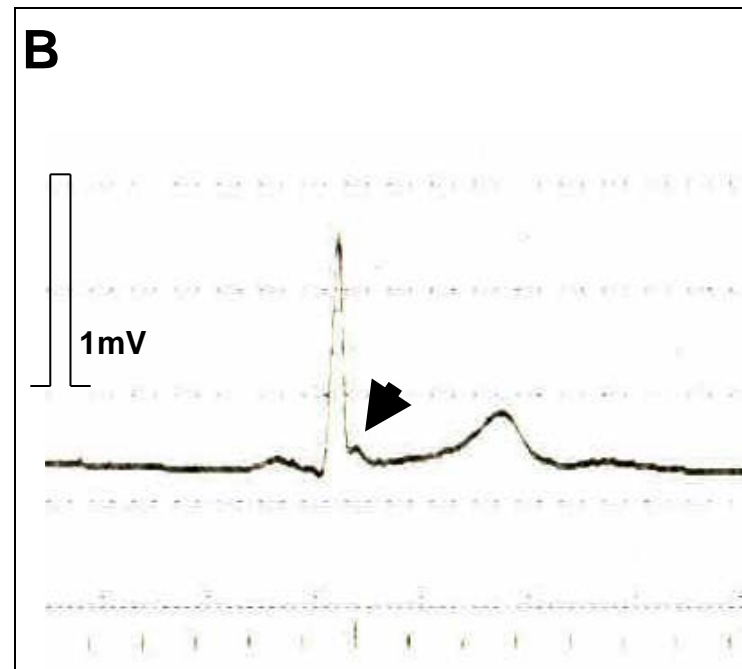
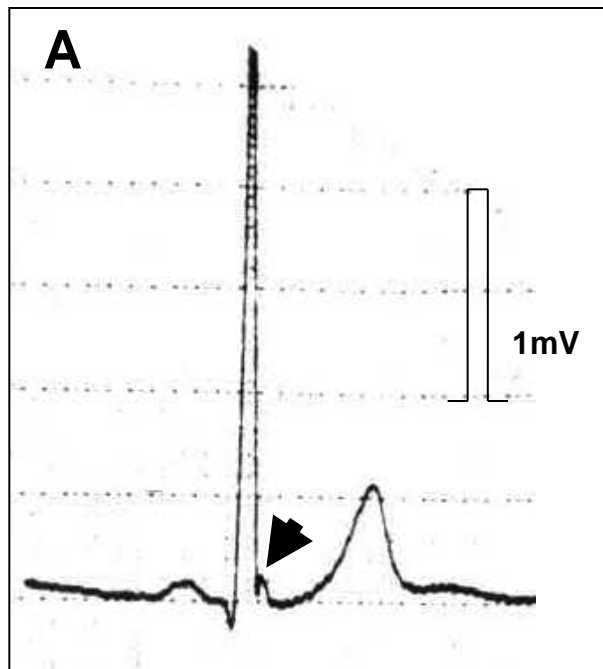




# J-Point Elevation in Survivors of Primary Ventricular Fibrillation and Matched Control Subjects

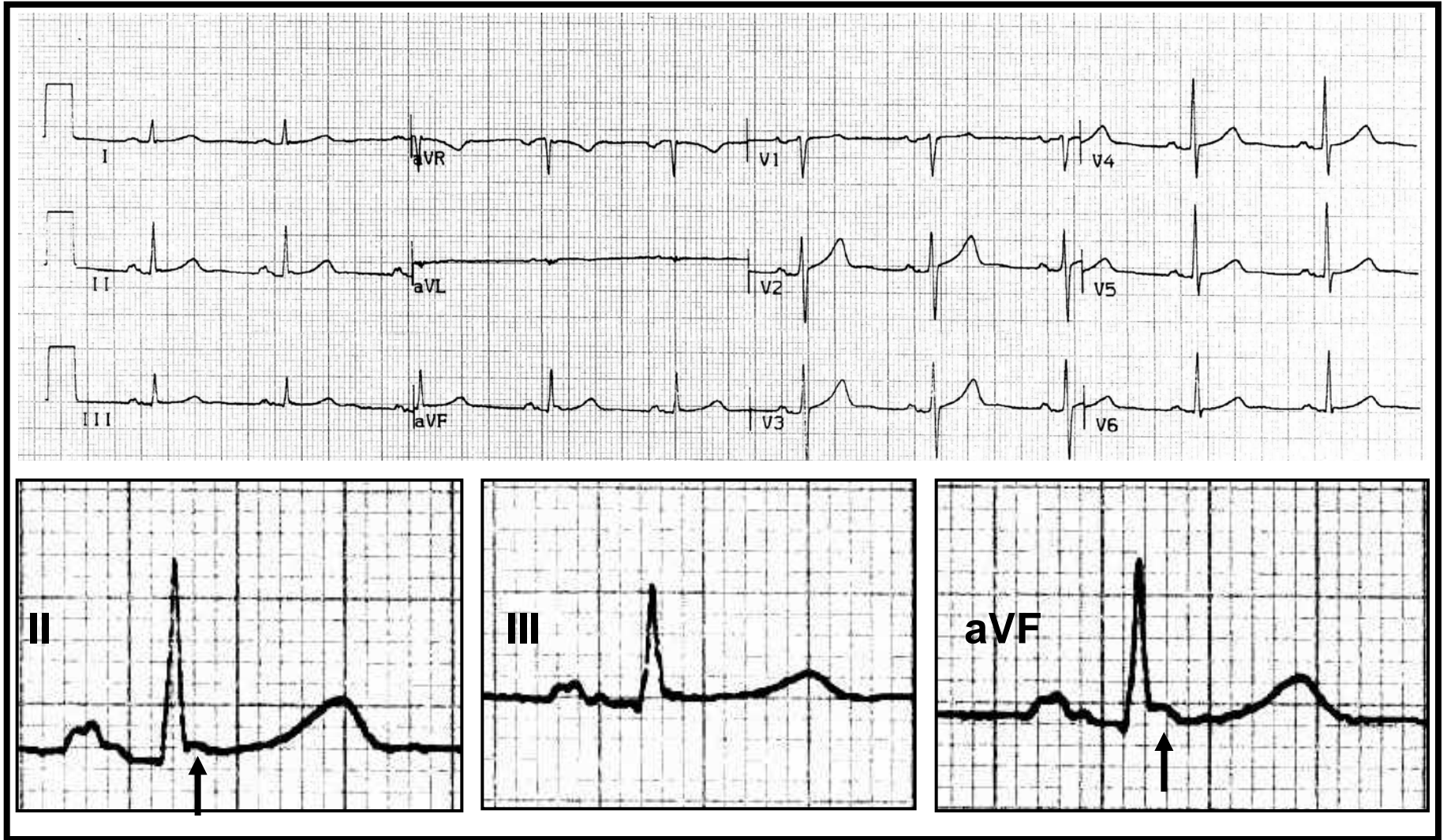
Incidence and Clinical Significance

Distinguishing “benign” from “malignant early repolarization:”  
The value of ST-segment morphology.



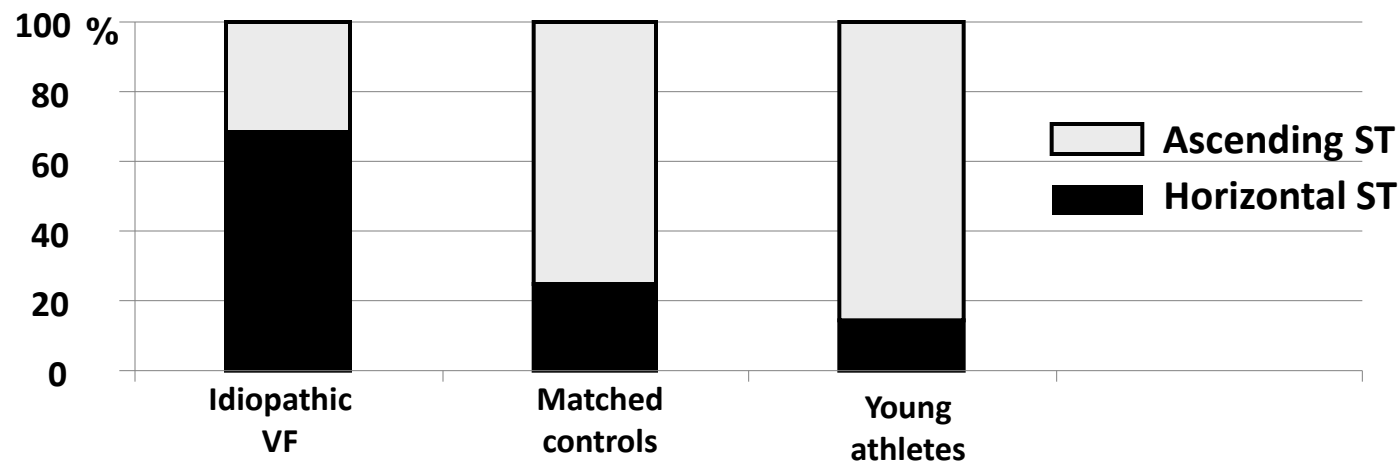
Rosso, Viskin. *HeartRhythm* 2012

Figure 2.

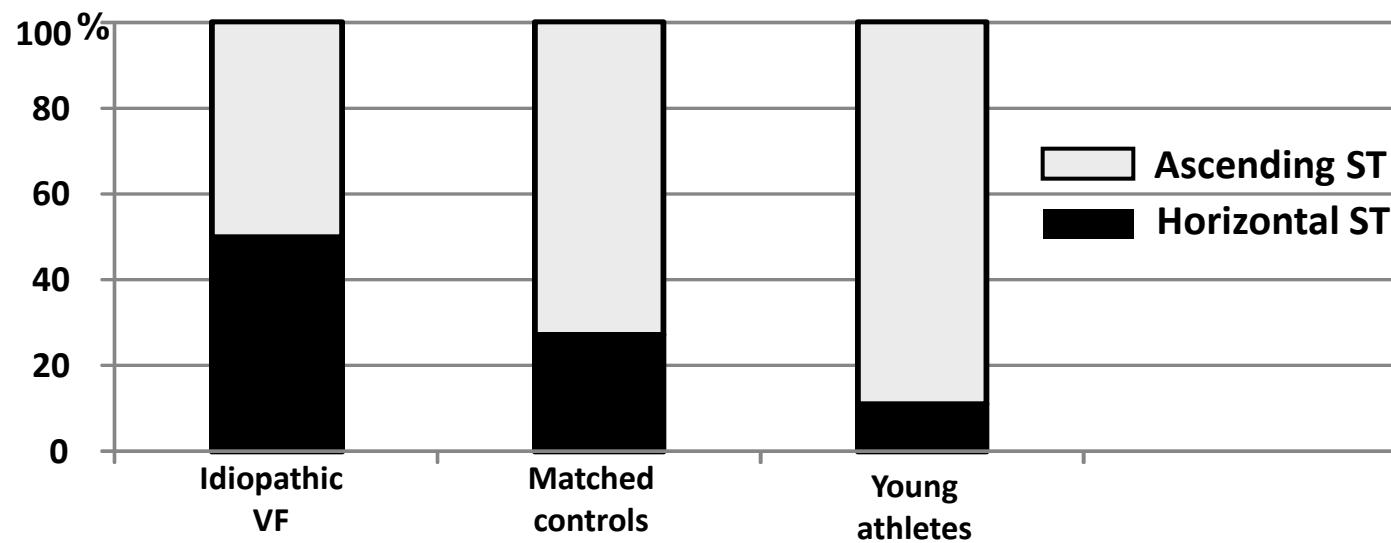


**A**

Distribution of ascending vs. horizontal ST elevation among patients with J-waves

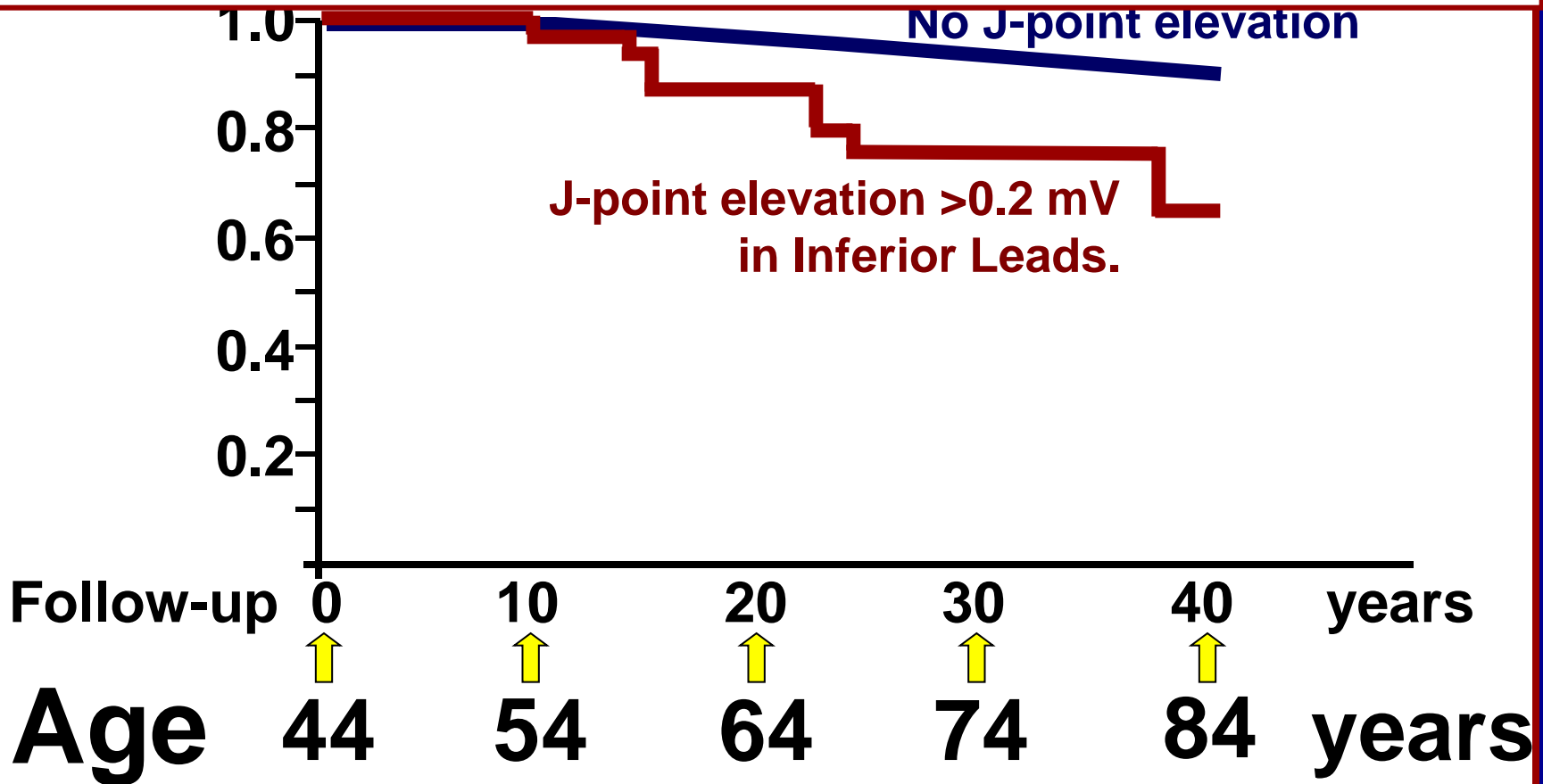
**Patients with J-point elevation or slurred-R-wave.****B**

Distribution of ascending vs. horizontal ST elevation among patients with J-waves

**Patients with J-point elevation**

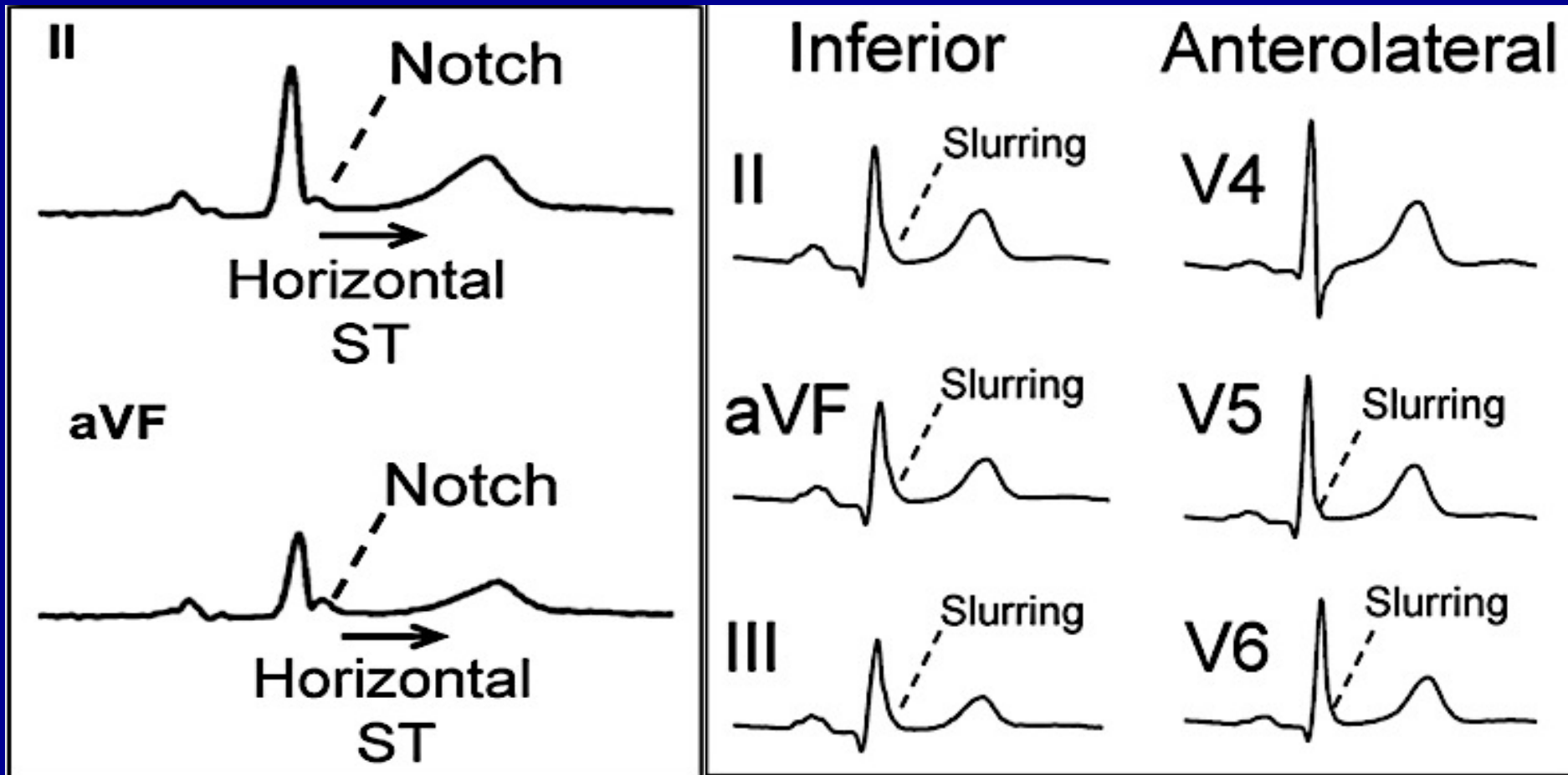


Will you still need me, will you still feed me, when I'm 64...



# Clinical Characteristics and Prevalence of Early Repolarization Associated With Ventricular Arrhythmias Following Acute ST-Elevation Myocardial Infarction

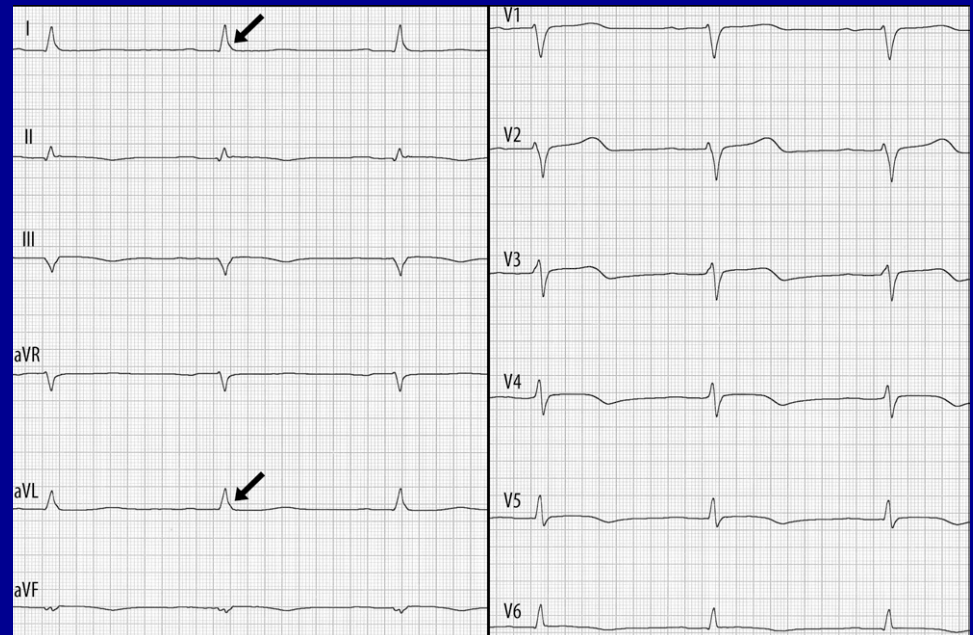
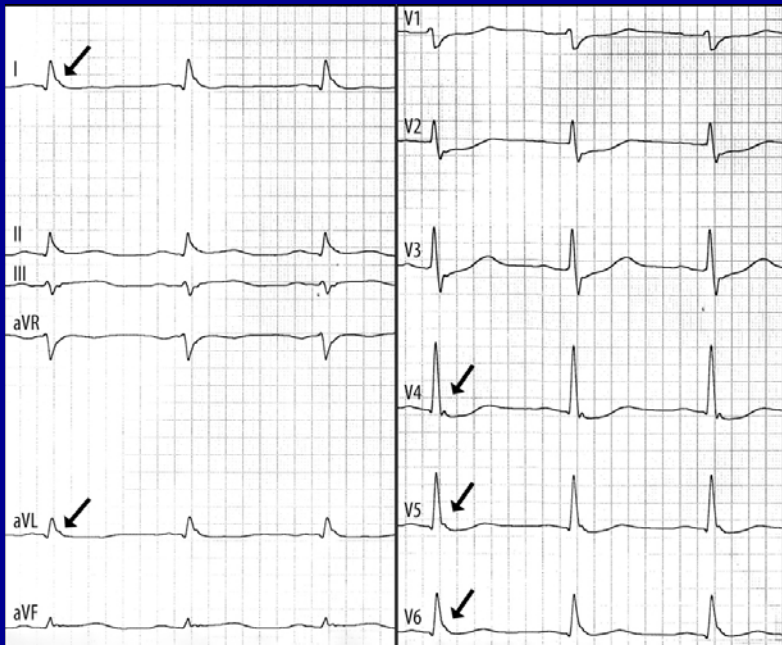
Ravi B. Patel, MD<sup>a,†</sup>, Leonard Ilkhanoff, MD<sup>a,b,†</sup>, Jason Ng, PhD<sup>b</sup>, Moulin Chokshi, MD<sup>a</sup>, Anas Mouchli, MD<sup>a</sup>, Satish Jacob Chacko, MD<sup>a</sup>, Haris Subacius, MA<sup>b</sup>, Sanjay Bhojraj, MD<sup>a</sup>, Jeffrey J. Goldberger, MD, MBA<sup>a,b</sup>, and Alan H. Kadish, MD<sup>a,b,\*</sup>



## Early repolarization pattern is associated with ventricular fibrillation in patients with acute myocardial infarction

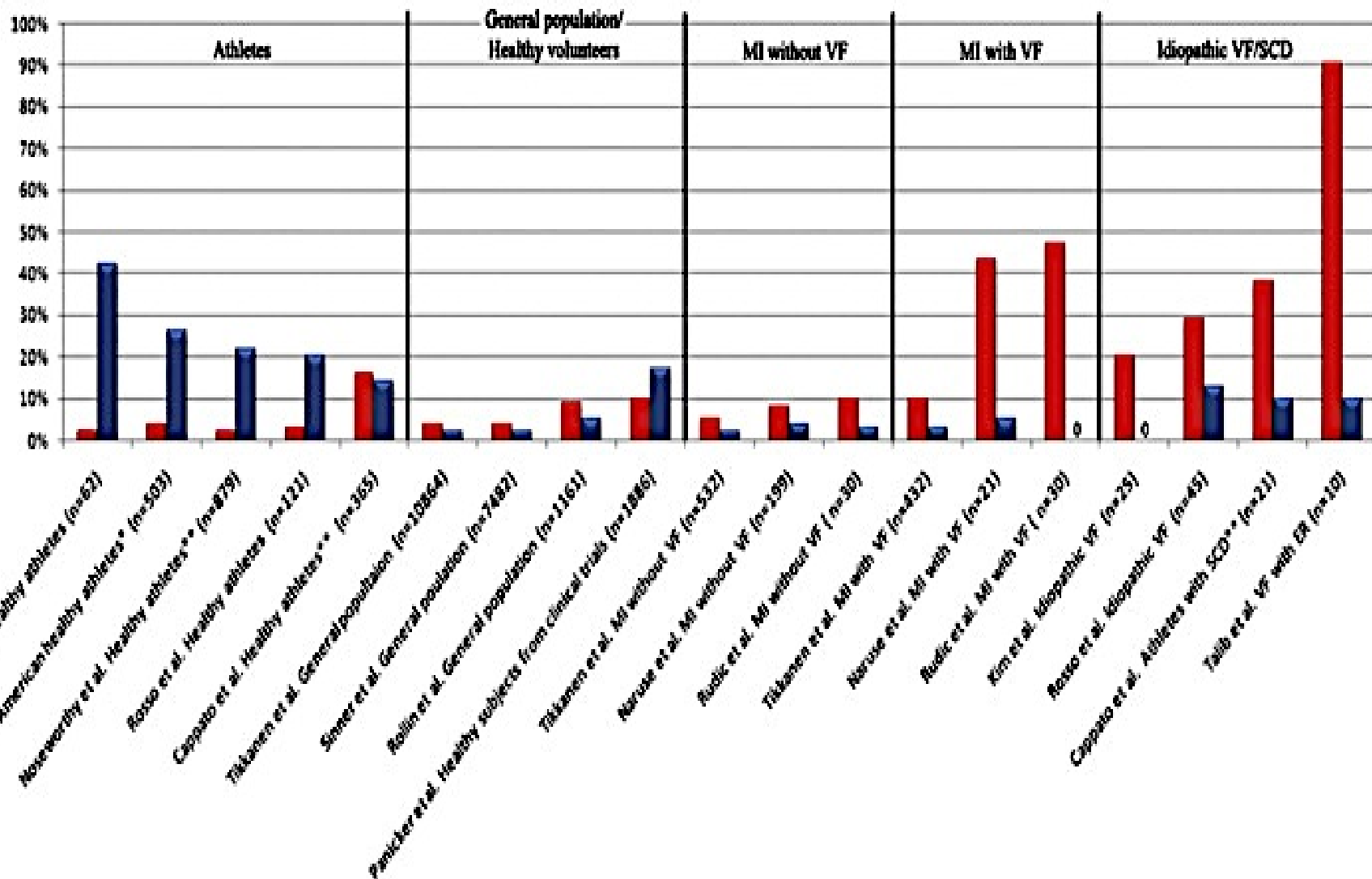
Boris Rudic, MD,\* Christian Veltmann, MD,\* Esther Kuntz,\* Michael Behnes, MD,\* Elif Elmas, MD,\* Torsten Konrad, MD,\* Jürgen Kuschyk, MD,\* Christel Weiss, PhD,<sup>†</sup> Martin Borggrefe, MD,\* Rainer Schimpf, MD\*

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■ Horizontal/descending ER variant ■ Ascending ER variant

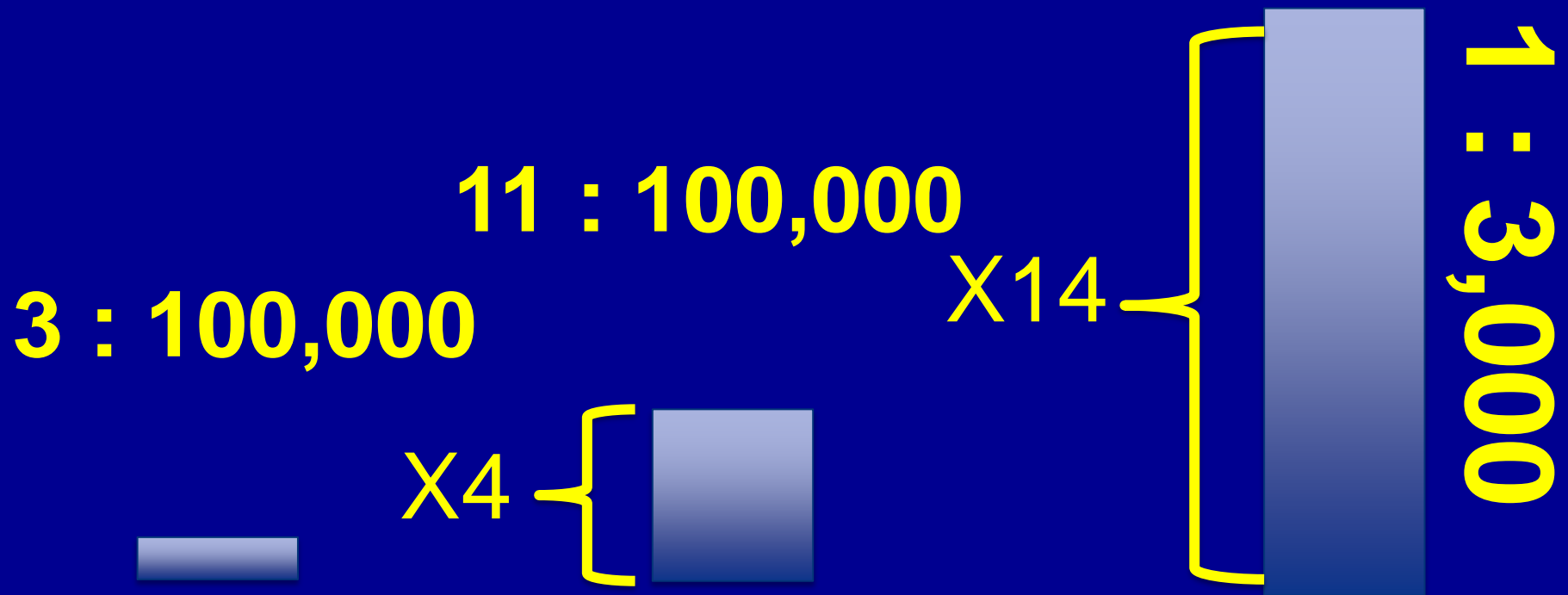


# Risk of dropping dead (asymptomatic young individuals).

Someone  
like me

With  
J-Waves

With J-waves  
and malignant ST



# Approach to the patient with ER

**Malignant syncope**



**Ignore the ECG**



**Treat him regardless**

**ER +**

**Asymptomatic**



**"simple ER"**



**Ignore the ECG**

# Approach to the patient with ER

Asymptomatic but  
bad looking ER



- Diffuse J waves •
- >2mm •
- Higher amplitude at night •
- Post pause J wave •
- augmentation
- Flat ST •



Consider ILR



NSVTs, frequent short  
coupled PVCs



Treat the patient



**YOU ARE NOT THE ONLY ONE WITH A DIFFICULT JOB**