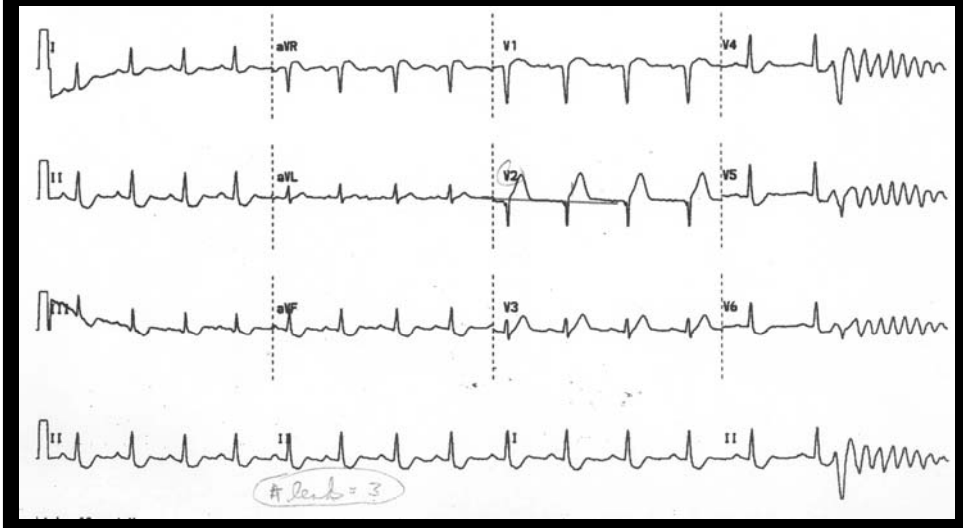
What does the ECG show before the Arrest ?

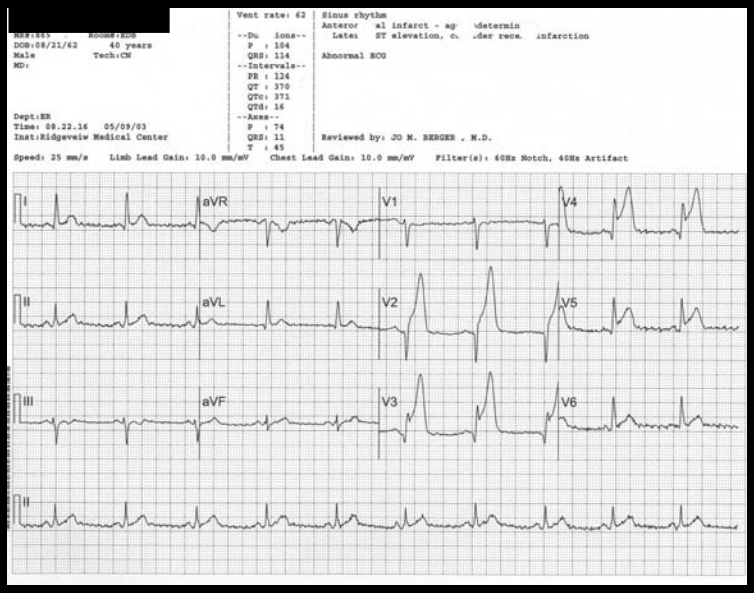
Scott W. Sharkey, MD
On behalf of the MHI Level 1 Program

Minneapolis Heart Institute Foundation
Minneapolis, Minnesota

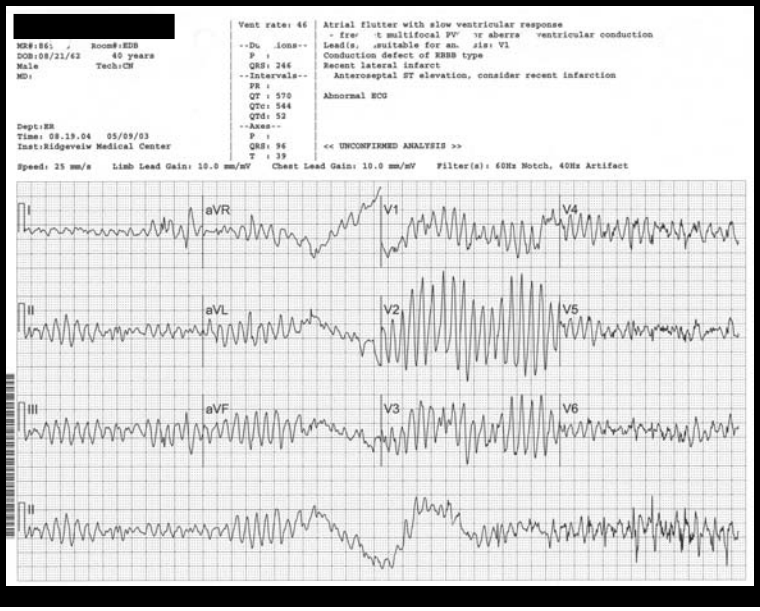
44 year old male with chest pain



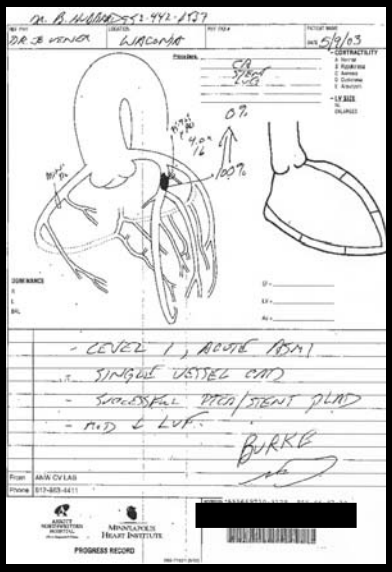
40 year old male with chest pain



40 year old male with chest pain



40 year old male with chest pain

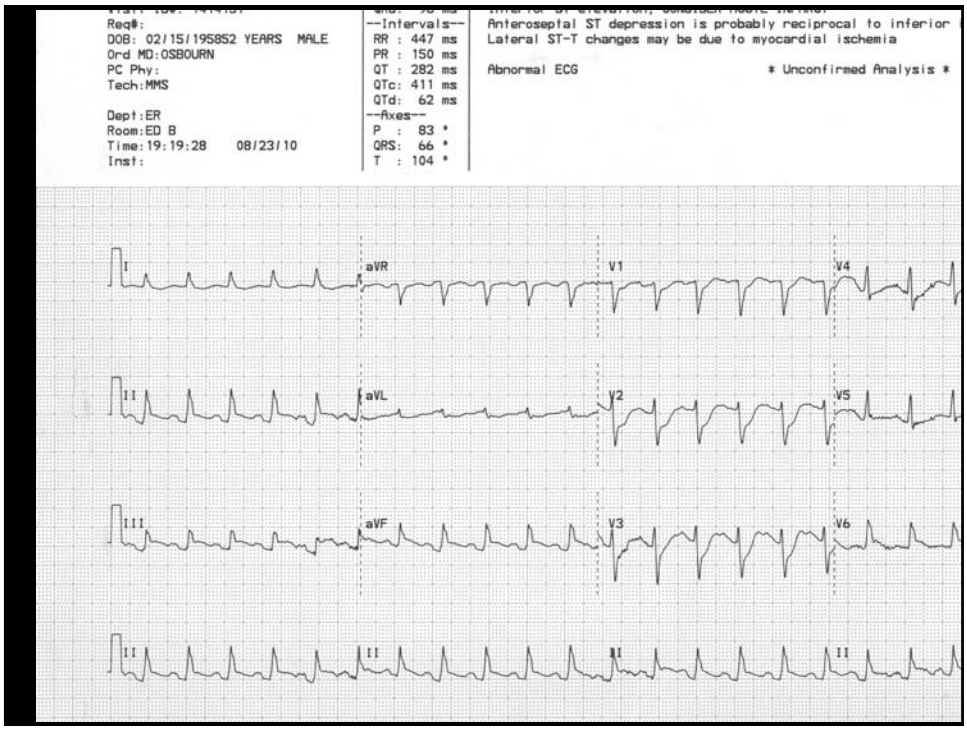


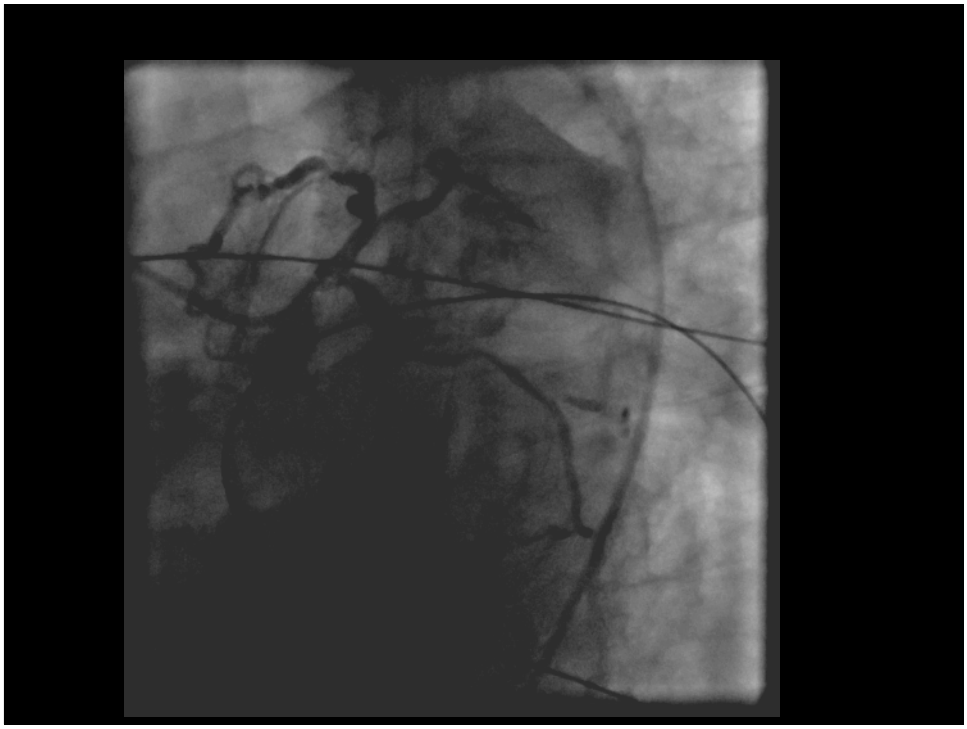
52 year old male
(Aug 23 2010)

- Collapsed while talking with wife
- 911 police administer CPR
- Fire dept: AED gives shock

52 year old male

- To Waconia ED unresponsisve
- ECG shown
- Troponin T <0.01 ng/ml





52 year old male

- To Minneapolis Heart Institute @ Abbott Northwestern
- Level 1 and Cool It. D/C Sept 8
- LV ejection fraction 65-70%

Level 1 Acute Myocardial Infarction Database
@ Minneapolis Heart Institute

- March 2005-May 2010
- Acute ST-segment elevation MI (or LBBB)
- 2260 consecutive patients

Level 1 Acute Myocardial Infarction Database
@ Minneapolis Heart Institute

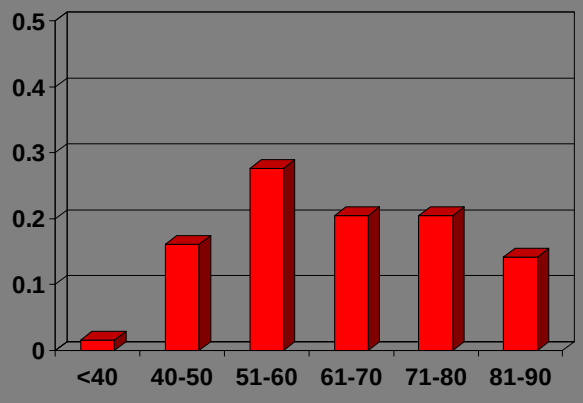
- Cardiac arrest: 254 (11.2%)
- " Level 1" for coronary occlusion: ~ 100%
- "Cool It" for cerebral anoxia: ~ 33%

Cardiac Arrest vs No Arrest

(Clinical Characteristics)

Arrest	No Arrest
• Age: 63 (53,75) years	• Age: 61 (52,74) years
• Age range: 33-87 years	• Age range: 33-99 years
• Female: 27.5%	• Female: 24%
• CP-ECG: 65 minutes	• CP-ECG: 143 minutes
• Active smoker: 41%	• Active smoker: 37.4%

Age Distribution of Cardiac Arrest Patients



Cardiac Arrest vs No Arrest

(Impact of cigarettes on age at presentation)

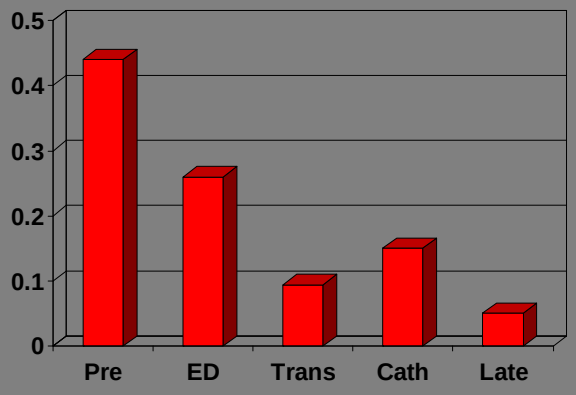
Arrest	No Arrest
• All : 63 (53,75) years	• All: 61 (52,74) years
• Active smoker: 55 years	• Active smoker: 54 years
• Never-smoked: 73 years	• Never smoked: 67 years

Level 1 Acute Myocardial Infarction Database
@ Minneapolis Heart Institute

• Not current smoker with cardiac arrest:

Median age: 71.5 years

Frequency of Cardiac Arrest by Location

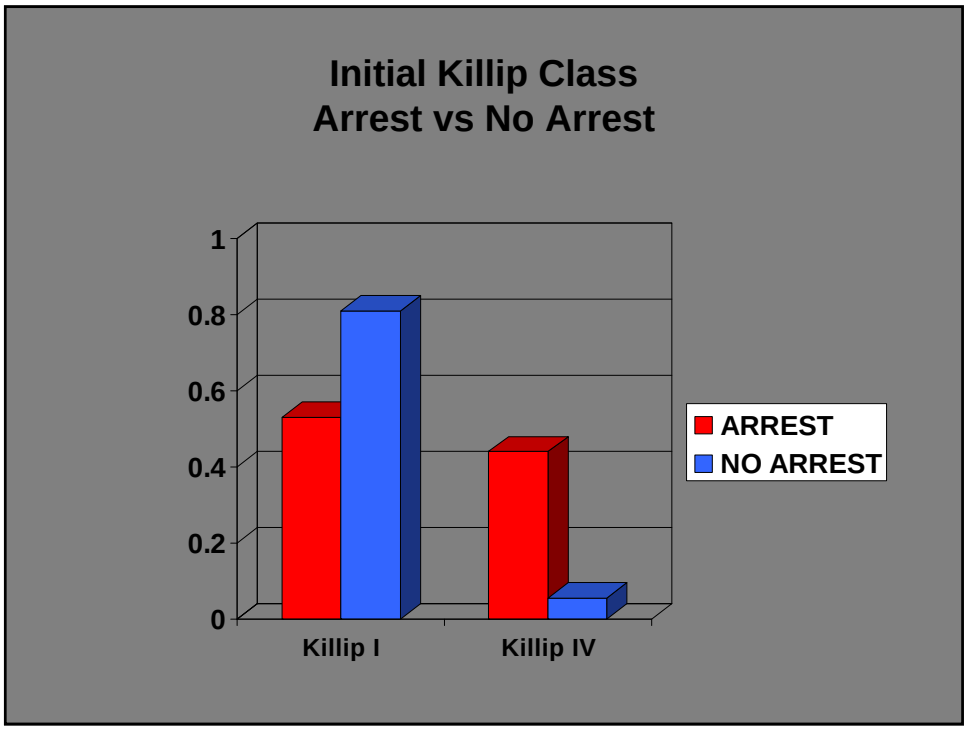


Level 1 Acute Myocardial Infarction Database
@ Minneapolis Heart Institute

- Pre-hospital cardiac arrest: 111 (44%)
- Not pre-hospital cardiac arrest: 143 (56%)

Cardiac Arrest
Initial Killip Class

Arrest	No Arrest
• I: 53%	• I: 81%
• II: 1.5%	• II: 1.6%
• III: 1.5%	• III: 1%
• IV: 44% (Cardiogenic shock)	• IV: 5.5% (Cardiogenic shock)

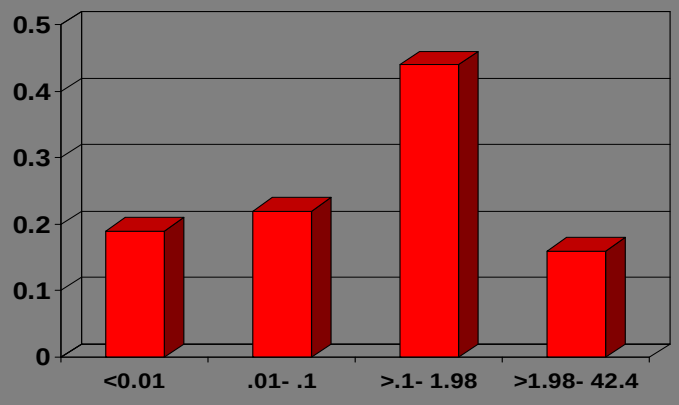


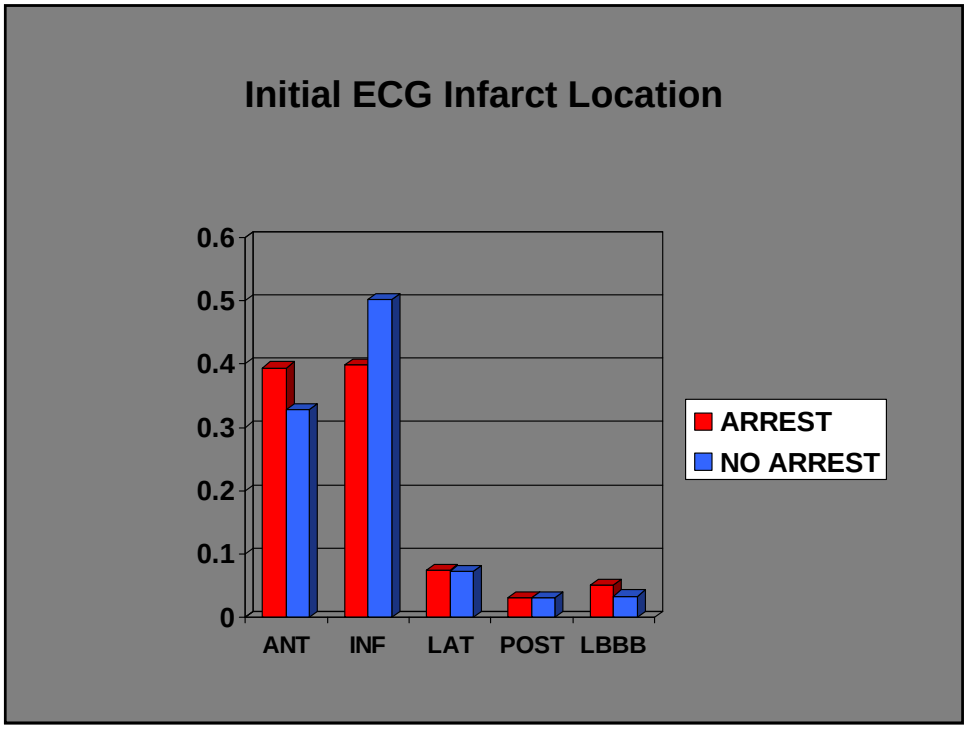
Cardiac Arrest vs No Arrest

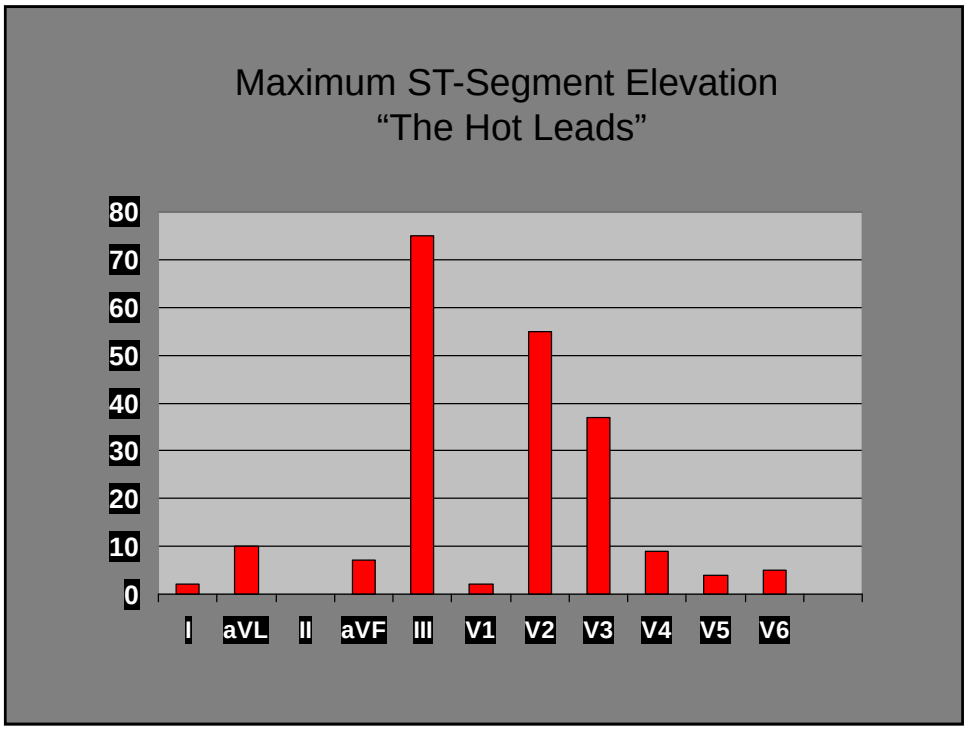
(Clinical Characteristics)

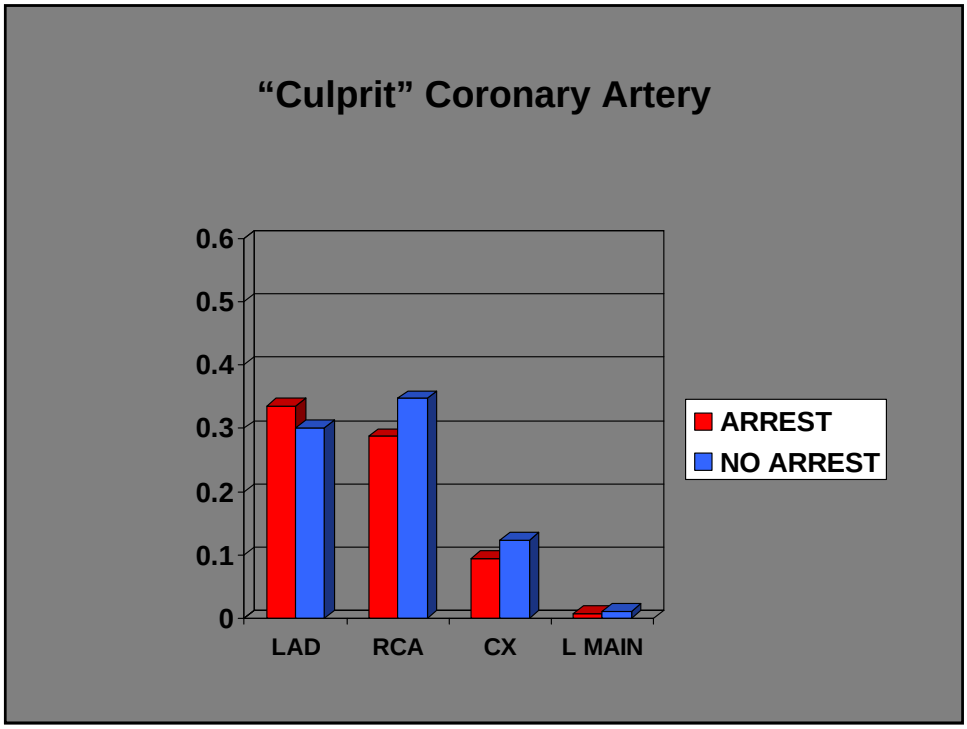
Arrest	No Arrest
• Inotropic drug: 35%	• Inotropic drug: 6%
• Intra-aortic balloon: 28%	• Intra-aortic balloon: 5%
• Ventilator: 67%	• Ventilator: unknown

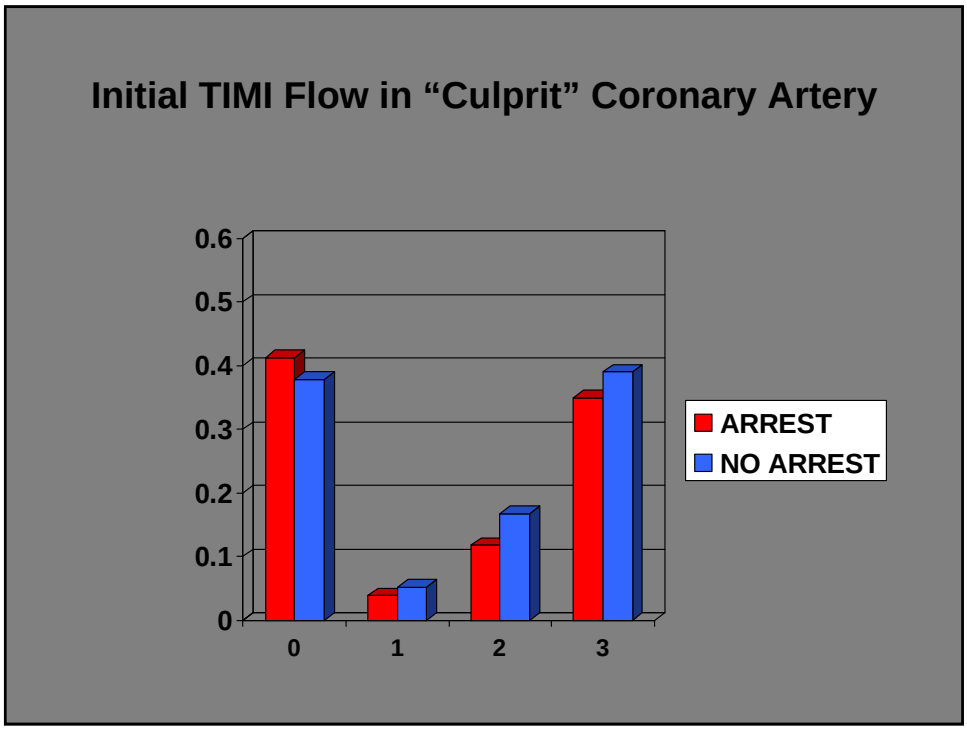
Cardiac Arrest Patients
Distribution of Initial Troponin T (ng/ml)





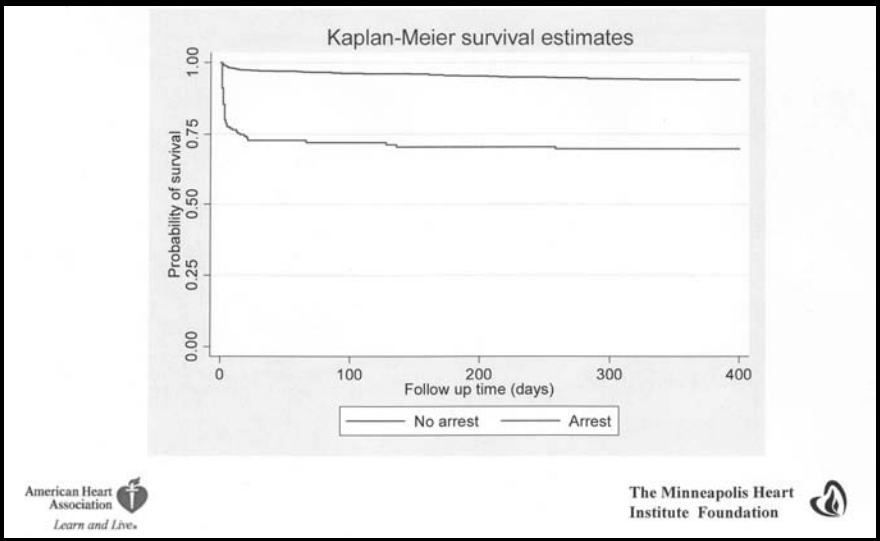






Cardiac Arrest Outcome

Arrest	No Arrest
• Hosp death: 31.9%	• Hosp death: 2.5%
• 30 day death: 32%	• 30 day death: 3.0%
• 1 year death: 39.8%	• 1 year death: 6.1%
• Hosp LOS: 6.5 days	• Hosp LOS: 3 days



Level 1 Acute Myocardial Infarction Database
@ Minneapolis Heart Institute

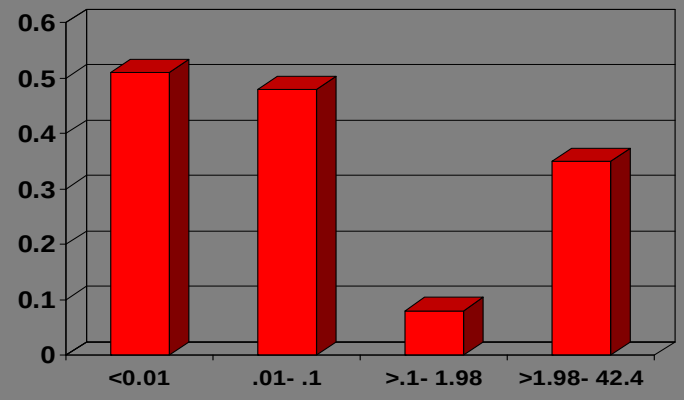
Hospital mortality

- Pre-hospital cardiac arrest: 36 (32%)
- Not pre-hospital cardiac arrest: 45 (31.5%)

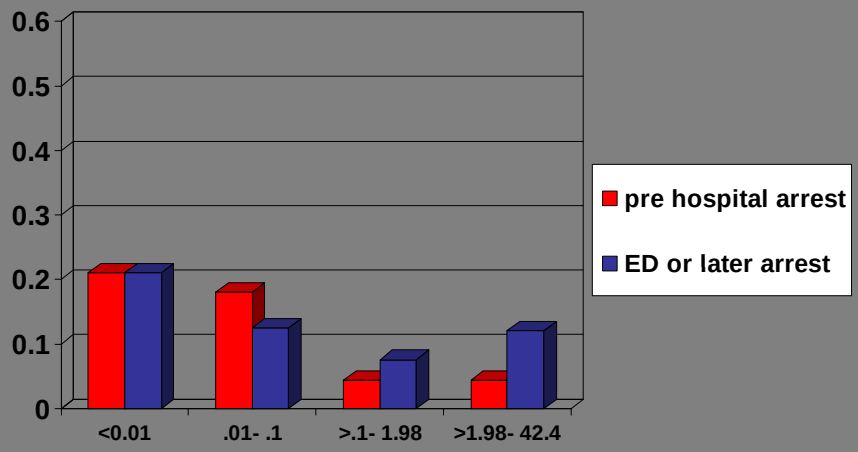
Hospital Mortality vs Killip Class Cardiac Arrest Patients

- Killip Class I Hospital Mortality: 9.9%
- Killip Class 4 Hospital Mortality: 65.4%

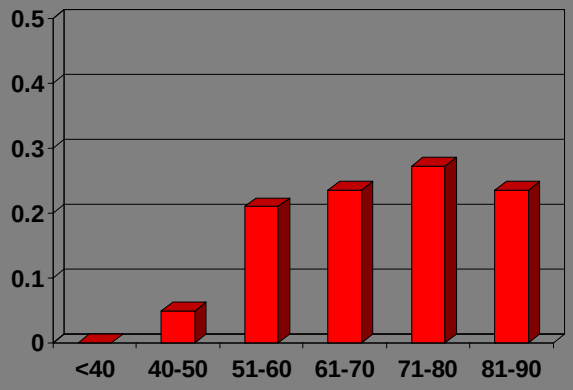
Cardiac Arrest Patients
Hospital mortality vs Initial Troponin T (ng/ml)

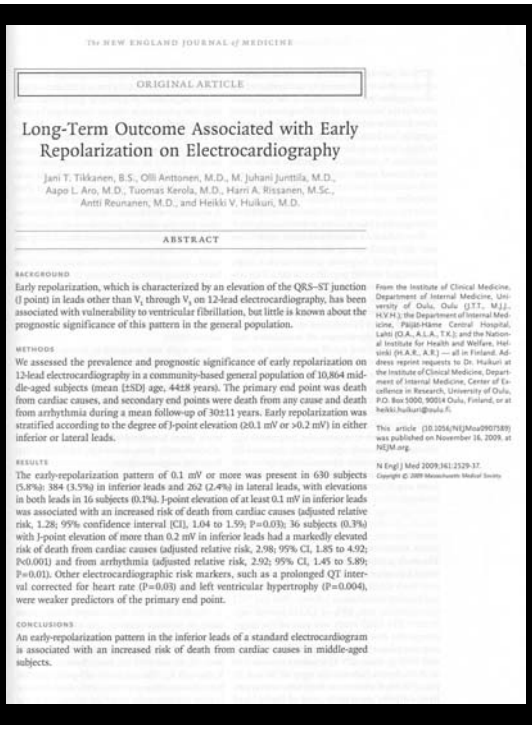


Cardiac Arrest Patients
Arrest Location vs Initial Troponin T



Age Distribution of Cardiac Arrest Patients who died in Hospital





The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Long-Term Outcome Associated with Early Repolarization on Electrocardiography

Jani T. Tikkanen, B.S., Olli Anttonen, M.D., M. Juhani Junttila, 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_4 through V_6 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 [±SD] age, 44±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±11 years. Early repolarization was stratified according to the degree of J-point elevation (≥0.1 mV or >0.2 mV) in either inferior or lateral leads.

RESULTS

The early-repolarization pattern of 0.1 mV or more was present in 630 subjects (5.8%): 384 (3.5%) in inferior leads and 262 (2.4%) in lateral leads, with elevations in both leads in 16 subjects (0.1%). J-point elevation of at least 0.1 mV in inferior leads was associated with an increased risk of death from cardiac causes (adjusted relative risk, 1.28; 95% confidence interval [CI], 1.04 to 1.59; P=0.03); 36 subjects (0.3%) with J-point elevation of more than 0.2 mV in inferior leads had a markedly elevated risk of death from cardiac causes (adjusted relative risk, 2.98; 95% CI, 1.85 to 4.92; P<0.001) and from arrhythmia (adjusted relative risk, 2.92; 95% CI, 1.45 to 5.89; P=0.01). Other electrocardiographic risk markers, such as a prolonged QT interval corrected for heart rate (P=0.03) and left ventricular hypertrophy (P=0.004), were weaker predictors of the primary end point.

CONCLUSIONS

An early-repolarization pattern in the inferior leads of a standard electrocardiogram is associated with an increased risk of death from cardiac causes in middle-aged subjects.

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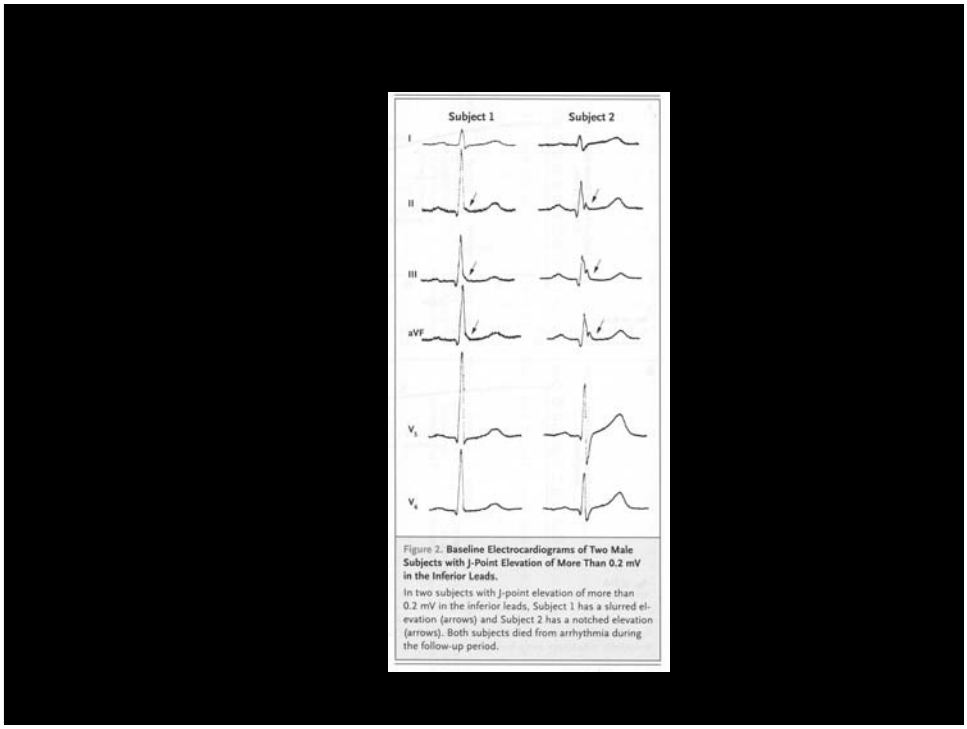
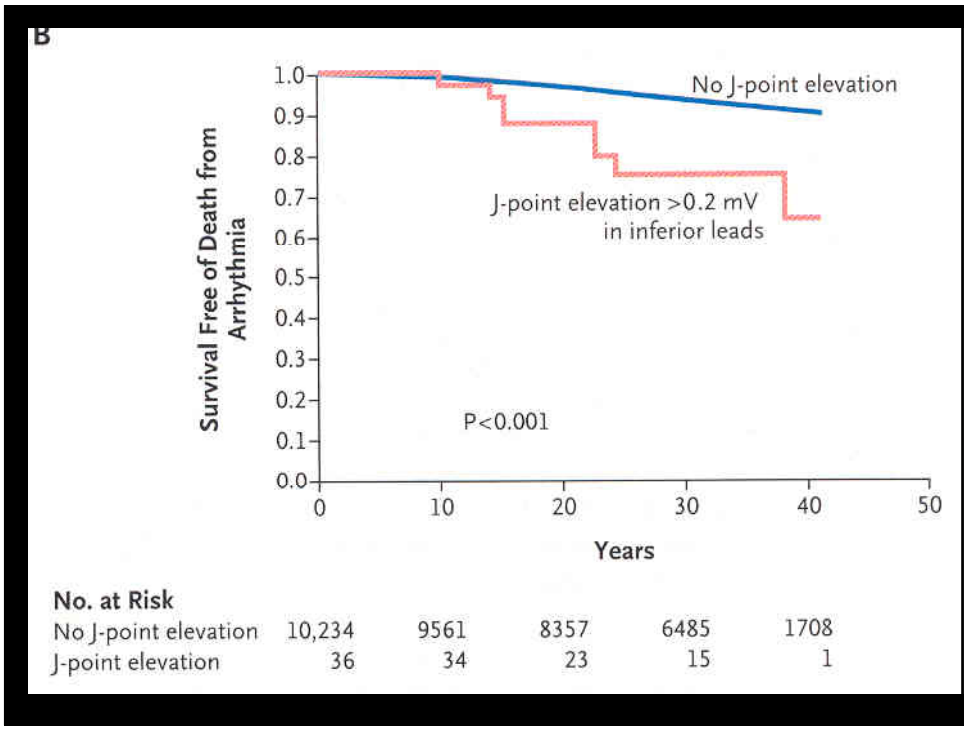


Figure 2. **Baseline Electrocardiograms of Two Male Subjects with J-Point Elevation of More Than 0.2 mV in the Inferior Leads.**

In two subjects with J-point elevation of more than 0.2 mV in the inferior leads, Subject 1 has a slurred elevation (arrows) and Subject 2 has a notched elevation (arrows). Both subjects died from arrhythmia during the follow-up period.



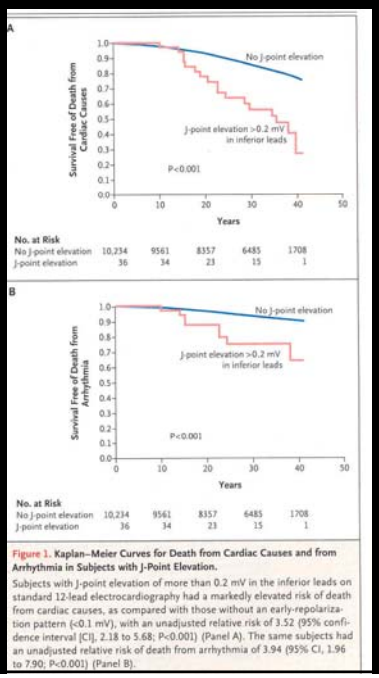


Figure 1. Kaplan–Meier Curves for Death from Cardiac Causes and from Arrhythmia in Subjects with J-Point Elevation.

Subjects with J-point elevation of more than 0.2 mV in the inferior leads on standard 12-lead electrocardiography had a markedly elevated risk of death from cardiac causes, as compared with those without an early-repolarization pattern (<0.1 mV), with an unadjusted relative risk of 3.52 (95% confidence interval [CI], 2.18 to 5.68; P<0.001) (Panel A). The same subjects had an unadjusted relative risk of death from arrhythmia of 3.94 (95% CI, 1.96 to 7.90; P<0.001) (Panel B).

Conclusions

- Acute ST-elevation MI is a frequent cause of cardiac arrest (ventricular fibrillation)

- Ventricular fibrillation is a time dependent and early event

Conclusions

- Acute coronary artery occlusion creates an electrically unstable heart

- With the exception of cardiogenic shock, no single clinical feature (age, ecg,infarct artery) identifies the patient at risk for cardiac arrest

Conclusions

- Hospital mortality is substantial
  (over 30%)
  and usually due to cardiogenic shock

Conclusions

- Nearly one half of patients are $\leq$ 60 years old (& active smokers)

- Cigarette smoking promotes premature coronary artery thrombosis

Conclusions

- The post-hospital 1 year outcome of patients with ST-elevation MI and cardiac arrest is no different than those without cardiac arrest

- Long term cardiac and neurologic outcome is under active study