What does the ECG show before the Arrest?

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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 unresponsive

• 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)*

<table>
<thead>
<tr>
<th>Arrest</th>
<th>No Arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: 63 (53,75) years</td>
<td>Age: 61 (52,74) years</td>
</tr>
<tr>
<td>Age range: 33-87 years</td>
<td>Age range: 33-99 years</td>
</tr>
<tr>
<td>Female: 27.5%</td>
<td>Female: 24%</td>
</tr>
<tr>
<td>CP-ECG: 65 minutes</td>
<td>CP-ECG: 143 minutes</td>
</tr>
<tr>
<td>Active smoker: 41%</td>
<td>Active smoker: 37.4%</td>
</tr>
</tbody>
</table>

### Age Distribution of Cardiac Arrest Patients

![Age Distribution](chart)
# Cardiac Arrest vs No Arrest

*Impact of cigarettes on age at presentation*

<table>
<thead>
<tr>
<th></th>
<th>Arrest</th>
<th>No Arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>63 (53,75) years</td>
<td>61 (52,74) years</td>
</tr>
<tr>
<td>Active smoker</td>
<td>55 years</td>
<td>54 years</td>
</tr>
<tr>
<td>Never-smoked</td>
<td>73 years</td>
<td>67 years</td>
</tr>
</tbody>
</table>

## Level 1 Acute Myocardial Infarction Database

@ Minneapolis Heart Institute

- Not current smoker with cardiac arrest:
  
  Median age: 71.5 years
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**

<table>
<thead>
<tr>
<th>Arrest</th>
<th>No Arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: 53%</td>
<td>I: 81%</td>
</tr>
<tr>
<td>II: 1.5%</td>
<td>II: 1.6%</td>
</tr>
<tr>
<td>III: 1.5%</td>
<td>III: 1%</td>
</tr>
<tr>
<td>IV: 44% (Cardiogenic shock)</td>
<td>IV: 5.5% (Cardiogenic shock)</td>
</tr>
</tbody>
</table>

#### Initial Killip Class

**Arrest vs No Arrest**

- **Killip I**
  - **Arrest**: 0.6
  - **No Arrest**: 0.4

- **Killip IV**
  - **Arrest**: 0.8
  - **No Arrest**: 0.2
Cardiac Arrest vs No Arrest
(Clinical Characteristics)

<table>
<thead>
<tr>
<th>Arrest</th>
<th>No Arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Inotropic drug: 35%</td>
<td>• Inotropic drug: 6%</td>
</tr>
<tr>
<td>• Intra-aortic balloon: 28%</td>
<td>• Intra-aortic balloon: 5%</td>
</tr>
<tr>
<td>• Ventilator: 67%</td>
<td>• Ventilator: unknown</td>
</tr>
</tbody>
</table>

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

Maximum ST-Segment Elevation
“The Hot Leads”
Cardiac Arrest Outcome

<table>
<thead>
<tr>
<th>Arrest</th>
<th>No Arrest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosp death: 31.9%</td>
<td>Hosp death: 2.5%</td>
</tr>
<tr>
<td>30 day death: 32%</td>
<td>30 day death: 3.0%</td>
</tr>
<tr>
<td>1 year death: 39.8%</td>
<td>1 year death: 6.1%</td>
</tr>
<tr>
<td>Hosp LOS: 6.5 days</td>
<td>Hosp LOS: 3 days</td>
</tr>
</tbody>
</table>

Kaplan-Meier survival estimates

- No arrest
- Arrest
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

2010 Miracle on Ice Conference
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Age Distribution of Cardiac Arrest Patients who died in Hospital

![Bar chart showing age distribution of cardiac arrest patients who died in hospital. The chart indicates a peak in the 71-80 and 81-90 age groups.]

Long-Term Outcome Associated with Early Repolarization on Electrocardiography

*Original Article*

**Title:** Long-Term Outcome Associated with Early Repolarization on Electrocardiography

**Authors:**
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**Abstract:**

This study evaluated the long-term outcome associated with early repolarization on electrocardiography. The primary endpoints were death from cardiac causes and all-cause mortality. The study included patients with early repolarization patterns as defined in the literature. The results showed a significant association between early repolarization and increased risk of death from cardiac causes and all-cause mortality. The findings highlight the importance of identifying patients with early repolarization patterns in order to improve outcomes.

**Keywords:**
- Electrocardiography
- Early repolarization
- Long-term outcome
- Cardiac arrest
- Mortality

**References:**

[1] [Link to reference 1]
[2] [Link to reference 2]
[3] [Link to reference 3]
[4] [Link to reference 4]
[5] [Link to reference 5]
[6] [Link to reference 6]
[7] [Link to reference 7]

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**Funding:**

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**Conflict of Interest:**

The authors declare no conflicts of interest.

[Copyright Internet address]
Fig. 1A. Baseline Electrocardiograms of Two Male Subjects with J-point Elevation of Less Than 0.5 mV in the Inferior Leads

In two subjects with J-point elevation of more than 0.5 mV in the inferior leads, Subject 1 has a reversed J-point elevation (arrow) and Subject 2 has a normal J-point elevation. Subject 1 died from arrhythmia during the follow-up period.

Fig. 1B

Survival Free of Death from Arrhythmia

<table>
<thead>
<tr>
<th>Years</th>
<th>No J-point elevation</th>
<th>J-point elevation &gt;0.2 mV in inferior leads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>P&lt;0.001</td>
</tr>
<tr>
<td>0</td>
<td>10,234</td>
<td>9561</td>
</tr>
<tr>
<td>10</td>
<td>9561</td>
<td>8357</td>
</tr>
<tr>
<td>20</td>
<td>8357</td>
<td>6485</td>
</tr>
<tr>
<td>30</td>
<td>6485</td>
<td>1708</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No. at Risk

No J-point elevation: 10,234, 9561, 8357, 6485, 1708
J-point elevation: 36, 34, 23, 15, 1
Figure 1: Kaplan-Meier Curves for Death from Cardiovascular and Non-Cardiovascular Causes in Subjects with J-Pt Mutation.

Subjects with J-point elevation of more than 35 mm in theinferior leads on standard 12-lead electrocardiograms who had an unadjusted observed risk of death was 0.08 (95% confidence interval: 0.01 to 0.47; P = 0.02). (Panel A) The same subjects had an unadjusted relative risk of death from arrhythmia of 3.94 (95% CI, 1.94 to 7.99; P < 0.001) in Panel B (unpublished data).
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 < 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