The association of nonspecific T wave changes with ischemic heart disease

MAELYNN LA, M2, UNIVERSITY OF SOUTH ALABAMA COLLEGE OF MEDICINE
MENTORS: DR. CHRISTOPHER MALOZZI, D.O., AND DR. BASSAM OMAR, M.D., PHD
Introduction

- ECGs are a noninvasive test that can reveal significant cardiac pathology
- T waves represent ventricular repolarization
- Minor or nonspecific T wave changes are often described as borderline findings on ECGs
- Link between these nonspecific findings and ischemic heart disease is not well established across all groups
- Calculating the prevalence of these abnormalities and comparing them within groups (ex Whites vs AAs)
- Possible use as an indication of the need for earlier evaluation
T wave morphology

- Normal
- Biphasic
- Bifid / notched
- Broad / slow
- Flat

Nonspecific ST-T wave abnormalities

- Hyperkalemia
- Repolarization Variant
- Ischemia
- Strain
- Prolonged QT interval
Previous literature

- Kannel, et al (1987): calculating risk of developing overt CHD based on Framingham study, ages 35-94, mainly Whites, prevalence was 8.5% M and 7.7% F

- Kumar, et al (2008): based on Cardiovascular Heath Study, data from adults greater than 65 y.o., low number of AAs, hazard ratio for CHD death was 1.6

- Rollin, et al (2016): middle aged men without existing CHD from PRIME study, 2-3 fold higher risk of death, MI, and angina pectoris; echos not performed
Methods

- Develop a searchable PDF database of all ECGs from January 2015 to March 2015 via ECG Intellispace
- Identify patients with nonspecific/borderline T abnormalities
- Develop a patient database on Excel with data from the ECG and results from patient chart review on Soarian EMR
- Exclusions: ages < 19 y.o., atrial flutter, left without being seen
- Perform statistical analysis: prevalence, t-test, ANOVA, chi squared test

Variables of interest
- Age
- Sex
- Race
- BMI
- Hx of HTN, DM, and smoking
- Ischemic workup reports: echocardiogram, cath, and stress test documentation closest to date of ECG or 6 months before the date
Modalities of ischemic evaluation

- Stress testing
  - Exercise (treadmill) ECG

- Nuclear perfusion imaging
Modalities of ischemic evaluation

- Cardiac catheterization
  - Normal
  - Mild (30-50%)
  - Moderate (50-70%)
  - > 70% stenosis in a single vessel -> PCI
  - Severe multi-vessel disease -> CABG
Modalities of ischemic evaluation

- Echocardiography
  - Assessment of wall motion abnormalities
  - Left ventricular ejection fraction (EF)
Demographic results

- 2825 ECGs analyzed with 582 encounters noting nonspecific T wave abnormalities
- Total prevalence of nonspecific T wave abnormalities: 20.6%

![Prevalence of Nonspecific T wave Abnormalities by Race](image)

- Whites: 36%
- AA: 62%
- Hispanic: 1%
- Other: 1%
Prevalence results

- Age: 52.2 ± 16.1 years
- BMI: 30.6 ± 9.12 kg/m²
- HTN: 63.4%
Conclusions pt. 1

- Approximately 50 stress tests and 60 caths in our sample
- Analysis of cath and stress test findings are very limited due to small number of these tests being performed in our sample
- Could not establish a significant correlation between nonspecific T wave abnormalities with ischemia due to this limitation
- However, ischemia cannot be excluded as a cause of this abnormality
- Prevalence data is of interest
- Ejection fraction analysis between subgroups
### Ejection fraction analysis

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<tr>
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<th>n</th>
<th>Mean</th>
<th>Standard Deviation</th>
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<tbody>
<tr>
<td><strong>Males</strong></td>
<td>110</td>
<td>52.9</td>
<td>14.9</td>
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<tr>
<td>White Males</td>
<td>39</td>
<td>54.7</td>
<td>12.7</td>
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<tr>
<td><strong>AAMs</strong></td>
<td>66</td>
<td>51.6</td>
<td>16.3</td>
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<tr>
<td>Females</td>
<td>137</td>
<td>58.0</td>
<td>13.1</td>
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<tr>
<td>White Females</td>
<td>49</td>
<td>57.1</td>
<td>14.2</td>
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<tr>
<td>AAFs</td>
<td>85</td>
<td>58.2</td>
<td>12.6</td>
</tr>
<tr>
<td>Whites</td>
<td>88</td>
<td>56.1</td>
<td>13.5</td>
</tr>
<tr>
<td>African Americans</td>
<td>151</td>
<td>55.3</td>
<td>14.7</td>
</tr>
<tr>
<td>Age &gt; 60 yo</td>
<td>97</td>
<td>55.9</td>
<td>13.7</td>
</tr>
<tr>
<td>Age &lt; 60 yo</td>
<td>150</td>
<td>55.6</td>
<td>14.5</td>
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### Comparisons

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<tr>
<td>Student t-test</td>
<td></td>
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<tr>
<td>W vs F</td>
<td>0.005</td>
</tr>
<tr>
<td>W vs AA</td>
<td>0.70</td>
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<tr>
<td>&lt; 60 yo vs &gt; 60 yo</td>
<td>0.90</td>
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<tr>
<td>ANOVA</td>
<td>WM vs WF vs AAM vs AAF</td>
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Conclusions pt. 2

- Significantly lower EF in AAMs with nonspecific T wave abnormalities on ECG compared to other groups is a novel finding.
- The cause of decreased LV systolic function is unclear.
- Suggests the need of earlier ischemic evaluation in this population.
Future suggestions

- Expand the patient database to ideally encompass all of 2015
- Perform chi squared test if an adequate number of stress test/cath reports have been compiled
- Focus on causes of the lowered EF of AAMs
- Other studies that can utilize the ECG database