CAN WE DEVELOP UNIFORM SCREENING PARAMETERS FOR ECG?

Prevention of SCD in the Young CSRC Think Tank 2.20.15
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CAN WE DEVELOP UNIFORM SCREENING PARAMETERS FOR ECG?

YES
BACKGROUND

- Electrocardiography – cornerstone in cardiac evaluation
- Non-invasive, readily available, inexpensive, socially acceptable
- For effective screening, accurate population-based ECG values are required to distinguish normal from abnormal
  - NHLBI working group Screening to prevent Sudden Cardiac Death in the Young*: need to define ECG norms in the US
    - Decrease cost (decrease false +)
    - Increase effectiveness (decrease false -)

BACKGROUND

Current Norms for ECG Values in the Young

• Few normal ECG studies adjusted for age
• Limitations in prior pediatric studies
  – International, non – U.S. populations, caucasion
  – Failure to adjust for gender and/or race
  – Small sample size
  – Single clinical sites
  – Inconsistent methodology
    • Inclusion/Exclusion criteria, ECG recording
BACKGROUND

Example: Variable Results Current ECG Norms

- Median & 98% R wave V6 for adolescents – 30 percent difference

<table>
<thead>
<tr>
<th>Study</th>
<th>Center</th>
<th>Year</th>
<th>Total N</th>
<th>Median R V6</th>
<th>98% R V6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davignon</td>
<td>Canada</td>
<td>1979</td>
<td>2100</td>
<td>1.5 mV</td>
<td>2.3 mV</td>
</tr>
<tr>
<td>Rijnbeek</td>
<td>Holland</td>
<td>2001</td>
<td>2000</td>
<td>2.0 mV</td>
<td>3.1 mV</td>
</tr>
</tbody>
</table>

- In order to develop uniform parameters for effective ECG screening need to better define normal
FIRST STEP – UNIFORM PARAMETERS SCREENING

Definition U.S. ECG Norms

• NHLBI Pediatric Heart Network funded study
  – *Retrospective*, multicenter – 19 sites U.S. and Canada
  – Database of 3600 children with normal echocardiograms
    • ~2800 ECGs
    • Inclusion Criteria:
      – Normal children
      – Age 0 – 18 years
    • Exclusion Criteria:
      – Acquired or CHD (congenital heart disease)
      – Acute or systemic disorder (including hypertension)
      – FH cardiomyopathy, 1st degree relative with CHD
First Step – PHN Retrospective Normal ECG Study

• **Primary Aim:**
  To calculate **ECG values for normal children** using the multicenter database

• **Primary Outcome:**
  Range of normal values for common resting ECG measurements adjusted for age, gender, and race
  
  - 6 age groups
    - <1 m
    - >1 y <3 y
    - ≥5 y <12 y
  - 2 gender groups
    - ≥1 m <1 y
    - ≥3 y <5 y
    - ≥12 y <18 y
  - 3 race groups
    - White
    - African-American
    - Other
First Step – PHN Retrospective Normal ECG Study

• **Secondary Aim 1:**
  To evaluate the effects of other potential confounders (weight independent of height, body size, ethnicity) on ECG measurements

• **Secondary Aim 2:**
  To correlate LV mass and size determined by echo with common ECG measures of left ventricular forces for patients enrolled by the PHN Echo Z-Score project
NEXT STEPS – UNIFORM PARAMETERS

ECG SCREENING

2. Prospective validation of PHN retrospective study
   – ECG norms stratified by age, gender and race
     • If indicated, validation of confounders
       – Weight
       – Body size
       – Ethnicity

3. Effect of differing sampling rates / filter settings on normal pediatric ECG data
   – Likely higher ECG sampling rates will make pediatric ECG data more accurate
NEXT STEPS – UNIFORM PARAMETERS ECG SCREENING

• Determine accurate ECG parameters for patients with cardiac diseases that cause SCD in the young stratified by age, gender, race
  – Hypertrophic and dilated cardiomyopathy
  – Inherited arrhythmia syndromes
  – Wolf-Parkinson-White syndrome
  – Arrhythmogenic right ventricular cardiomyopathy
  – etc.

Some causes of SCD in the young will not be amenable to ECG screening
NEXT STEPS –
UNIFORM PARAMETERS ECG SCREENING

• Determine **optimal timing and ECG cut points** for discrimination of normal children from those with relevant cardiac disease

• Determine best methodology for cost effective collection and analysis of ECGs utilized in screening for prevention of SCD in the young
  – Number of leads, placement specifications, sampling rate
  – Automatic versus manual analysis
YES

• WE CAN DEVELOP UNIFORM SCREENING PARAMETERS FOR ECG

• MULTISTEP PROCESS

• FIRST STEP UNDER WAY
THANKS