Trends in Athlete ECG interpretation in a large youth cardiovascular screening organization

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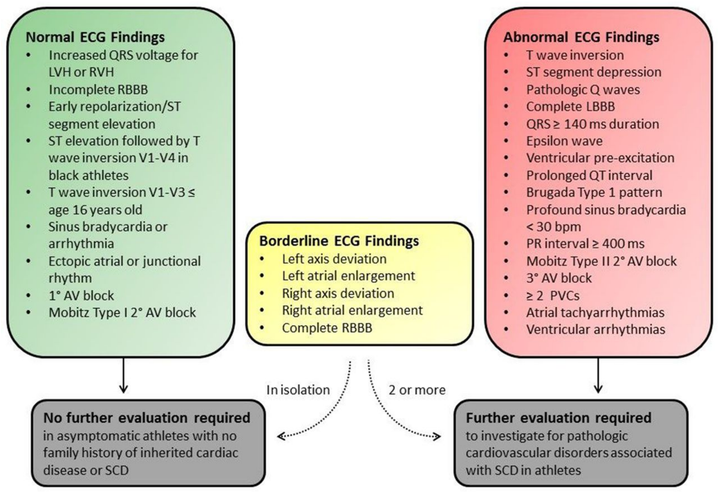
Background

Sudden cardiac death is the leading cause of mortality in athletes during sport. Screening electrocardiography (ECG) in athletes has rapidly evolved, with improved sensitivity and specificity as evidence-based ECG interpretation criteria are continually developing. While identifying an abnormal ECG finding can be lifesaving, falsely interpreting a benign finding as abnormal can lead to unnecessary testing, costs, and anxiety for patients and family. The need to examine current clinician practices and subsequent education in a large organization dedicated to youth cardiovascular screening has not been formally assessed.

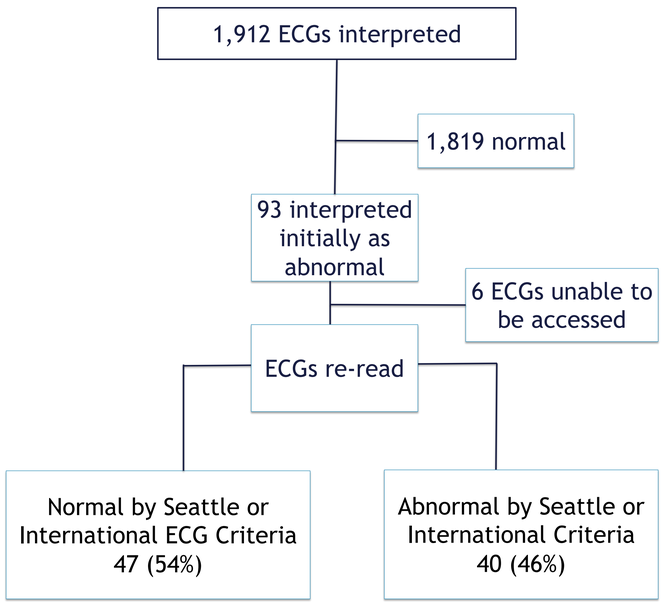
Methods

We analyzed the performance of all physicians reading screening ECGs from HeartBytes, a database from SimonsHeart, a large, non-profit organization providing cardiovascular screenings for adolescent students and athletes. 34 adult and pediatric cardiologists read 1,912 ECGs at 13 screening events from October 2016 to September 2018. We determined the frequency that ECGs were interpreted as abnormal, then independently re-read each ECG with two expert clinicians to assess for adherence to "Seattle Criteria" or current International Criteria, depending on when the screening occurred. To identify areas for improved practices, we determined the most common reasons ECGs were falsely interpreted as abnormal.

International Athlete ECG Criteria



Flowchart of screened individuals



Reasons for False and True Positive ECG Findings

False positives by International Criteria (n)	
TWI	20
LVH	18
IVCD <140ms	6
RBBB in isolation	5
RAD in isolation	5
LAD in isolation	4
Accessory pathway misidentified	4
LAA in isolation	2
J-wave/Early repolarization	2
PACs	2
Junctional rhythm	1
Isolated PVC	1
Non-pathologic q-waves	1
1st deg AVB < 400 msec	1
Sinus bradycardia >30 bpm	1
Ectopic atrial rhythm	1

True positives by International Criteria (n)	
Abnormal TWI V1-V3 <16y old	12
Accessory pathway	4
Long QT	3
IVCD >140ms	3
2 PVCs or more	2
RBBB + RAD	1
Biatrial enlargement	1
Brugada pattern	1

Results

Of 1,912 consecutive screening ECGs performed, 93 (4.9%) were initially interpreted as abnormal. 6 abnormal ECGs were unable to be accessed and were excluded. 47 of the ECGs interpreted as abnormal (54%) were normal variants when independently re-read strictly by Seattle or International criteria, respective to when the screening took place. The most common reasons for falsely abnormal ECG reads when interpreting exclusively by international ECG criteria were: normal variant T-wave inversions (TWI) (20), left ventricular hypertrophy (18), interventricular conduction delay (IVCD) <140 msec (6), isolated right bundle branch block (5), and right axis deviation (5). The most common appropriately identified ECG findings were: abnormal TWI (12), accessory pathway (4), prolonged QT interval (3), and IVCD (3).

The number of true abnormal ECGs was lower when ECGs were re-read by International Criteria (25 total, 1.3% of all ECGs) compared to Seattle Criteria (45 total, 2.5% of all ECGs). The most common reason for ECGs read as true positive by Seattle Criteria but negative by International Criteria was due to the change in how TWIs are interpreted as abnormal (13 of 20 ECGs).

Conclusion

- Though screening ECG successfully identified a number of significant abnormalities, approximately half of ECGs interpreted as abnormal did not meet athlete ECG criteria.
- This study highlights the importance of instituting quality control measures for guideline-based practices and continued clinician education in a rapidly evolving field.
- Emphasis should be placed on educating clinicians on updates from the recent 2017 International Criteria, particularly regarding changes in interpreting T-wave inversions and left ventricular hypertrophy.

heartbytes
a SIMON'S Heart project

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