

Alteração de ECG em atletas – o que é normal e quando desconfiar?

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Appropriate interpretation of the athlete's electrocardiogram saves lives as well as money

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European Heart Journal 2007;28:1920–1922

ESC classification of ECG abnormalities in athletes

Group 1 (training-related)	Group 2 (training unrelated)
Sinus bradycardia	T-wave inversions
First-degree AV block	ST-segment depression
Incomplete RBBB	Pathological Q-waves
Early repolarization	Left atrial enlargement
Isolated QRS voltage criteria for LVH	Right atrial enlargement
	Left-axis deviation
	Right-axis deviation
	Right ventricular hypertrophy
	Ventricular pre-excitation
	Complete LBBB or RBBB
	Long-QT or short-QT interval
	Brugada-like early repolarization

Electrocardiographic interpretation in athletes: the 'Seattle Criteria'

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Kimberly G Harmon,¹ Hein Heidbuchel,¹² Joseph Marek,¹³ David S Owens,¹⁴
Stephen Paul,¹⁵ Antonio Pelliccia,¹⁶ Jordan M Prutkin,¹⁴ Jack C Salerno,¹⁷
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Br J Sports Med 2013;47:122–124

Box 1 Normal ECG findings in athletes

1. Sinus bradycardia (≥ 30 bpm)
2. Sinus arrhythmia
3. Ectopic atrial rhythm
4. Junctional escape rhythm
5. 1° AV block (PR interval > 200 ms)
6. Mobitz Type I (Wenckebach) 2° AV block
7. Incomplete RBBB
8. Isolated QRS voltage criteria for LVH
 - ▶ *Except:* QRS voltage criteria for LVH occurring with any non-voltage criteria for LVH such as left atrial enlargement, left axis deviation, ST segment depression, T-wave inversion or pathological Q waves
9. Early repolarisation (ST elevation, J-point elevation, J-waves or terminal QRS slurring)
10. Convex ('domed') ST segment elevation combined with T-wave inversion in leads V1–V4 in black/African athletes

Abnormal ECG finding	Definition
T-wave inversion	>1 mm in depth in two or more leads V2–V6, II and aVF, or I and aVL (excludes III, aVR and V1)
ST segment depression	≥0.5 mm in depth in two or more leads
Pathologic Q waves	>3 mm in depth or >40 ms in duration in two or more leads (except for III and aVR)
Complete left bundle branch block	QRS ≥120 ms, predominantly negative QRS complex in lead V1 (QS or rS), and upright monophasic R wave in leads I and V6
Intraventricular conduction delay	Any QRS duration ≥140 ms
Left axis deviation	–30° to –90°
Left atrial enlargement	Prolonged P wave duration of >120 ms in leads I or II with negative portion of the P wave ≥1 mm in depth and ≥40 ms in duration in lead V1
Right ventricular hypertrophy pattern	R–V1+S–V5>10.5 mm <i>AND</i> right axis deviation >120°
Ventricular pre-excitation	PR interval <120 ms with a delta wave (slurred upstroke in the QRS complex) and wide QRS (>120 ms)
Long QT interval*	QTc≥470 ms (male) QTc≥480 ms (female) QTc≥500 ms (marked QT prolongation)
Short QT interval*	QTc≤320 ms
Brugada-like ECG pattern	High take-off and downsloping ST segment elevation followed by a negative T wave in ≥2 leads in V1–V3
Profound sinus bradycardia	<30 BPM or sinus pauses ≥ 3 s
Atrial tachyarrhythmias	Supraventricular tachycardia, atrial-fibrillation, atrial-flutter
Premature ventricular contractions	≥2 PVCs per 10 s tracing
Ventricular arrhythmias	Couplets, triplets and non-sustained ventricular tachycardia

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Left axis deviation

−30° to −90°

Left atrial enlargement

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Comparison of Electrocardiographic Criteria for the Detection of Cardiac Abnormalities in Elite Black and White Athletes

Nabeel Sheikh, MRCP; Michael Papadakis, MRCP; Saqib Ghani, MRCP; Abbas Zaidi, MRCP; Sabiha Gati, MRCP; Paolo Emilio Adami, MD; François Carré, PhD; Frédéric Schnell, PhD; Mathew Wilson, PhD; Paloma Avila, MD; William McKenna, MD, DSc, FESC; Sanjay Sharma, MD, FRCP, FESC (UK)

Circulation. 2014;129:1637-1649.

Refined Criteria Training Related Normal Variants

*Not Warranting Further Investigation**

- Sinus bradycardia
- First-degree AV block
- Incomplete RBBB
- Early repolarisation
- Isolated QRS voltage criteria for LVH

Refined Criteria Borderline Variants

Potentially Warranting Further Investigation

- Left atrial enlargement
- Right atrial enlargement
- Left axis deviation
- Right axis deviation
- Right ventricular hypertrophy
- TWI up to V4 in BAst

Refined Criteria Training Unrelated Changes

Warranting Further Investigation

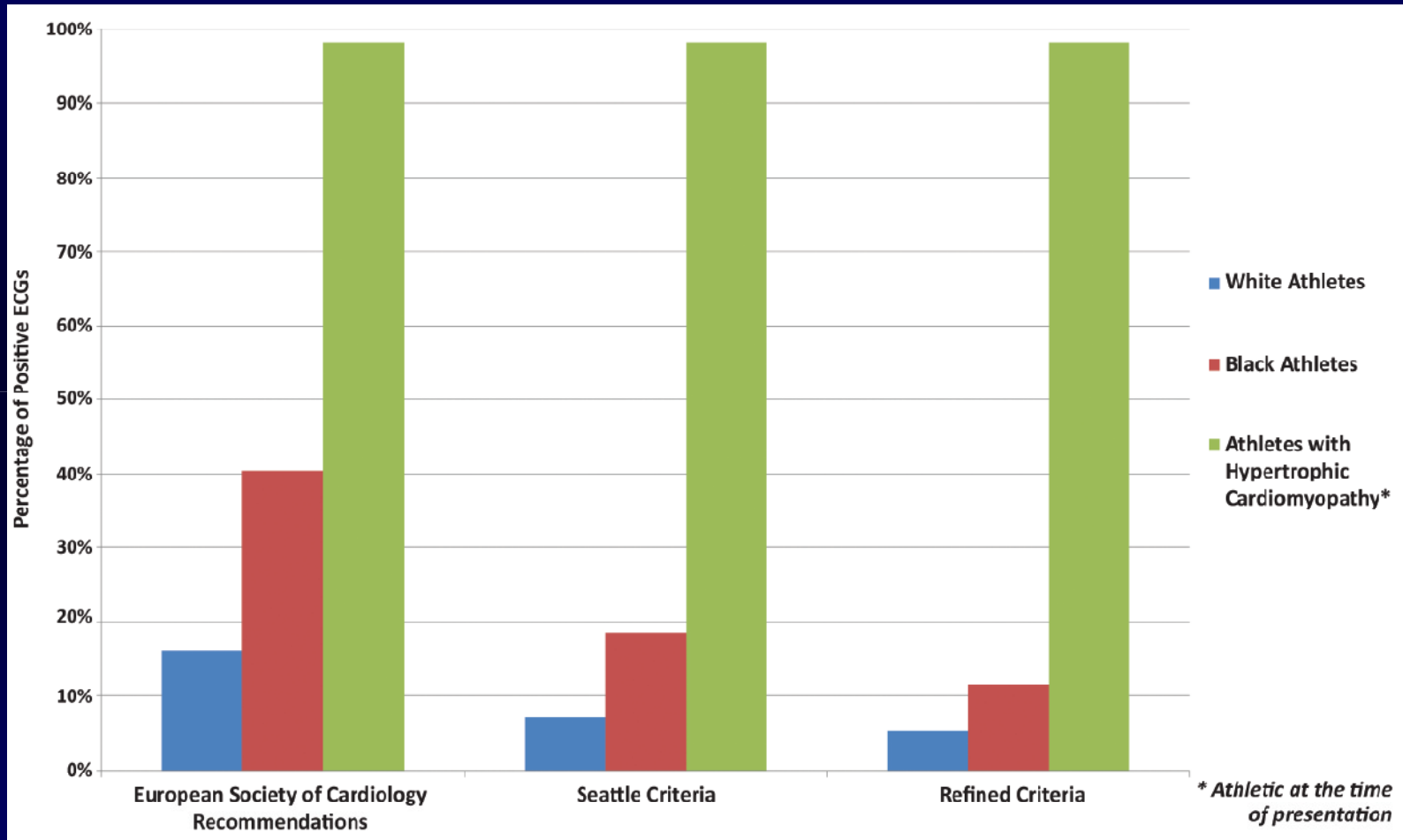
- ST-segment depression
- Pathological Q-waves
- Ventricular pre-excitation
- TWI beyond V1 in WAs
beyond V4 in BAs
- Complete LBBB or RBBB
- QTc ≥ 470 ms in males
 ≥ 480 ms in females
- Brugada-like ER
- Atrial or vent. arrhythmias
- ≥ 2 PVCs per 10 sec tracing

*If present in ISOLATION**

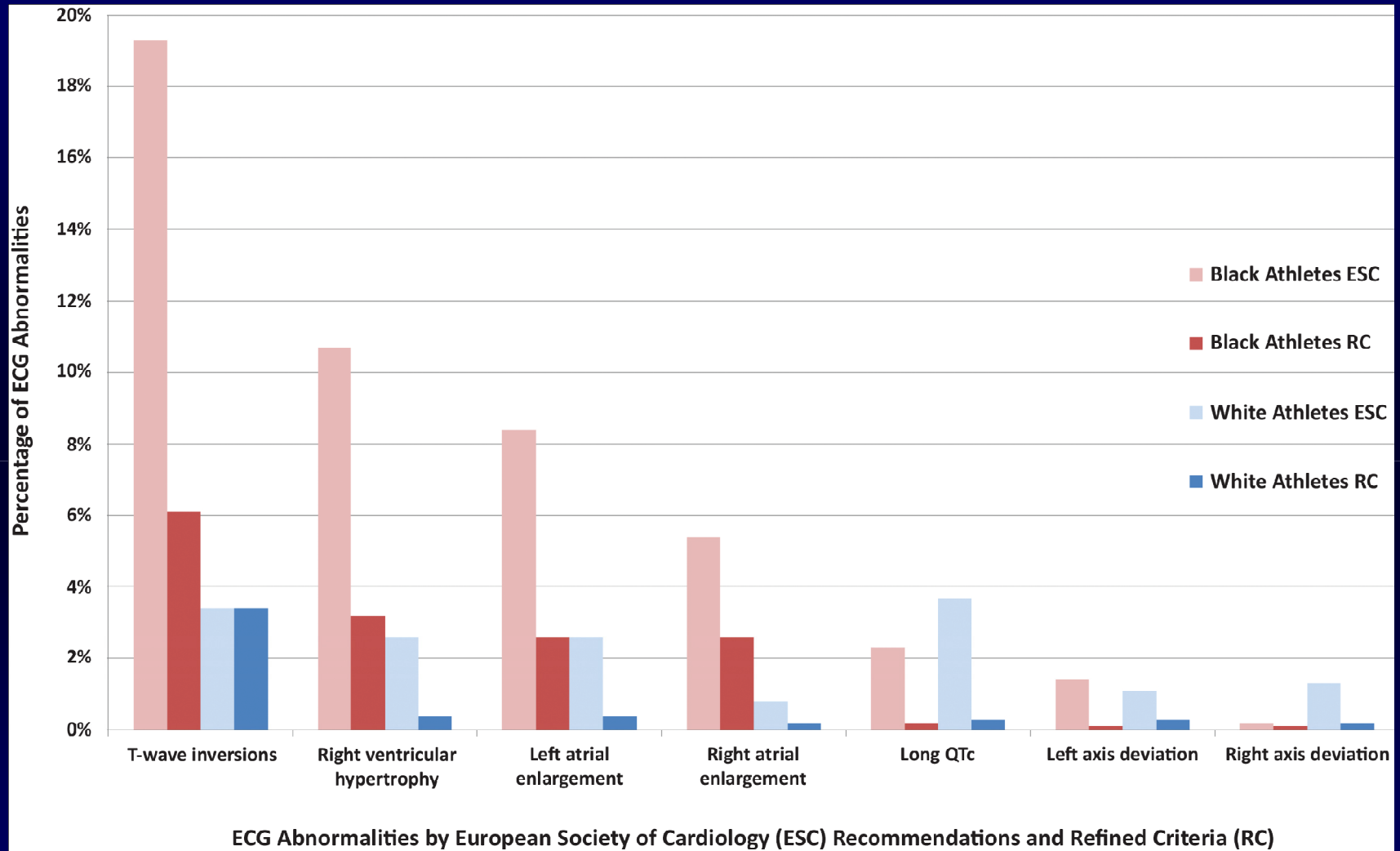
If TWO OR MORE present

Circulation. 2014;129:1637-1649

The number of positive ECGs produced by the 3 different ECG screening criteria.



Circulation 2014;129:1637-1649



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Prevalence of abnormal electrocardiograms in a large, unselected population undergoing pre-participation cardiovascular screening

Antonio Pelliccia^{1*}, Franco Culasso², Fernando M. Di Paolo¹, Domenico Accettura³, Rocco Cantore⁴, Walter Castagna⁵, Alberto Ciacciarelli⁶, Gioberto Costini⁷, Biagio Cuffari⁸, Enrico Drago⁹, Vittorio Federici¹⁰, Carlo Gabriele Gribaudo¹¹, Giancarlo Iacovelli¹², Luigi Landolfi¹³, Giuseppe Menichetti¹⁴, Umberto Olla Atzeni¹⁵, Attilio Parisi¹⁶, Angelo R. Pizzi¹⁷, Michele Rosa¹⁸, Fabio Santelli¹⁹, Franco Santilio²⁰, Alberto Vagnini²¹, Maurizio Casasco²², and Luigi Di Luigi²³

European Heart Journal 2007;28: 2006–2010

Mandatory Electrocardiographic Screening of Athletes to Reduce Their Risk for Sudden Death

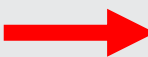
Proven Fact or Wishful Thinking?

Arie Steinvil, MD,* Tamar Chundadze, MD,* David Zeltser, MD,* Ori Rogowski, MD,* Amir Halkin, MD,† Yair Galily, PHD,‡ Haim Perluk, MD,§ Sami Viskin, MD†

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J Am Coll Cardiol 2011;57:1291–6

Table 1 Prevalence of ECG abnormalities in an unselected population of 32 652 young individuals undergoing the pre-participation cardiovascular screening

ECG abnormalities	Athletes, <i>n</i> (%)
Negative T-waves in precordial/standard leads	751 (2.3)
RBBB	351 (1.0)
Increased R/S wave voltages (suggestive of LVH)	247 (0.8)
Left anterior fascicular block	162 (0.5)
Pre-excitation pattern	42 (0.1)
LBBB	19 (0.1)
Prolonged corrected QT interval	1 (0.003)
Others (incomplete RBBB, prolonged PR interval, early repolarization pattern)	2280 (7.0)
Total	 3853 (11.8)