ABSTRACT

Background Precompetition screening was implemented for male referees during the 2010 Fédération Internationale de Football Association (FIFA) World Cup. In contrast, female football referees have been neglected in this respect although they experience similar physical work loads compared to male referees.

Methods The standardised football-specific Pre-Competition Medical Assessment (PCMA) was performed in 51 referees and assistant referees selected for the 2011 FIFA Women’s World Cup.

Results Family history for sudden cardiac death (SCD) was positive in four referees (7.8%), but cardiac examinations did not reveal any pathological findings. Training-unrelated ECG changes were identified in three referees (5.9%), all without correlates in echocardiography or clinical examination. Most common echocardiography findings (66.6%, n=34) were asymptomatic tricuspid and mitral regurgitations.

Conclusions During the present screening, no elite female referee was identified being at risk for SCD, and no referee had to be excluded from participating in the 2011 FIFA Women’s World Cup.

INTRODUCTION

Preparticipation screening programmes to prevent sudden cardiac death (SCD) among young athletes have been accepted based on numerous proposals.1–3 For elite male football players, the Fédération Internationale de Football Association (FIFA) introduced a standardised football-specific Pre-Competition Medical Assessment (PCMA) starting in the 2006 FIFA World Cup4 and subsequently introduced it for female players; it is now mandatory in all FIFA competitions.5 PCMA was implemented for male referees selected for the 2010 FIFA World Cup and data were published recently.6 Concerning female referees no data about PCMA have systematically been assessed, yet. Female referees experience similar physical work loads compared to male referees and therefore are at the same risk for SCD as a normal sport population or female referees (5.9%). All without correlates in echocardiography or clinical examination. Most common echocardiography findings (66.6%, n=34) were asymptomatic tricuspid and mitral regurgitations.

METHODS

The PCMA protocol includes medical history, general physical examination, 12-lead resting ECG and transthoracic echocardiography. The standardised PCMA were performed at the FIFA headquarters in Frankfurt from 17 to 19 June 2011. All subjects gave written informed consent. Experienced physicians including a cardiologist (DIK) conducted all examinations. ECG’s were analysed according to current recommendations of the European Society of Cardiology (ESC). Findings were grouped into common/training-related and uncommon/training-unrelated.7 Transthoracic echocardiographies were performed and interpreted based on current recommendations.8 Data were acquired for each referee on the ‘Pre-Competition Medical Assessment—Individual Report’ sheet, provided by F-MARC, Medical Research Office, Schulthess Clinic, Zuerich, Switzerland. Mean values and SDs were determined on the Microsoft Excel programme.

RESULTS

Nineteen female referees and 32 assistant referees underwent precompetition screening. Baseline characteristics were of an average age of 33.2 (SD=3.8, range 25–41) years, average height of 166 (SD=5.4, range 150–181) cm, average weight of 60.1 (SD=5.5, range 48–73) kg and average body surface area of 1.7 (SD=0.1, range 1.45–1.93) m². In family history, 19 (37%) referees reported hypertension, 11 (21.5%) diabetes mellitus, nine (17.6%) coronary heart disease (CHD), five (9.8%) stroke and two (3.9%) valvular heart disease. Three (5.9%) referees reported familial SCD, another one (2%) reported CHD due to CHD. In general medical history one (2%) referee reported diabetes mellitus type I and another (2%) a suprarenal hyperplasia. Allergies to pollen, food or antibiotics were common (n=17; 33.3%), three (5.9%) referees had exercise-induced asthma. No cardiovascular medication was reported but insulin. Non-steroidal painkillers were used regularly by 23 (45%) referees and 11 (21.5%) took antihistaminics.

Right arm systolic blood pressure was on an average 107.1 (SD=9.9, range 90–131) mm Hg, diastolic 67.3 (SD=10.2, range 48–95) mm Hg. Left arm systolic blood pressure was on an average 105.5 (SD=10.1, range 84–141) mm Hg, diastolic 67.2 (SD=9.2, range 49–95) mm Hg. The average heart rate at rest was 59.8 (SD=9.9, range 47–91) bpm.

Auscultation revealed in 16 (31%) referees a systolic heart murmur without echocardiography finding, though considered as ‘functional’. A mild systolic murmur was found in one referee (2%) with mild central aortic regurgitation with a tricuspid aortic valve with slight asymmetry of the cusps, in one (2%) with mild-to-moderate mitral regurgitation due to discrete myxoid changes without...
mitral valve prolapses and in one (2%) with a small ventricular septum defect (VSD). In one referee (2%) with a very mild systolic murmur, a very small VSD was detected.

Echocardiography findings are summarised in table 1. No referee revealed a hypertrophic left ventricle (LV) or cardiomyopathy. Average LV values were: interventricular septum diastolic (IVSd) 7.9 (SD=1, range 6–10) mm, posterior wall diastolic (PWd) 8.3 (SD=1, range 6–10) mm, LV muscle mass index 7.15 (SD=11.5, range 48–95) g/m² and LV enddiastolic diameter index (LVDDI) 51.5 (SD=9.1, range 35–73) mm/m². LV ejection fraction was on average 67.6 (SD=4.2, range 60–74) %. All had normal diastolic function (E/A 1.8, SD=0.3, range 3.1–1.2).

Findings of the 12-lead resting ECG are shown in table 2. Three (5.9%) referees revealed training-unrelated changes, which were T-wave inversions in all cases.

**DISCUSSION**

This study presents the first data of precompetition screening of female football referees selected for the 2011 FIFA Women’s World Cup. No elite female referee was identified being at risk for SCD and had to be excluded from participation.

The four (7.8%) referees with a positive family history of SCD revealed no abnormal findings in clinical examination. In contrast, no history of SCD was obvious in the male referees PCMA. This difference might be explained by lacking information about the family history in some subjects on the one hand and lacking data about the correct cause of death on the other hand. One (1.9%) referee with diabetes mellitus type I had a positive family history for diabetes which is inline with the male referee assessment.

In personal history allergies were most frequently found (n=17, 33.3%), three (5.9%) had exercise-induced asthma (EIA). The incidence of EIA is supposed to be higher in football referees.9 Two (3.9%) referees had isolated increased diastolic (PWd) 8.3 (SD=1, range 6–10) mm, LV muscle mass index 7.15 (SD=11.5, range 48–95) g/m² and LV enddiastolic diameter index (LVDDI) 51.5 (SD=9.1, range 35–73) mm/m². LV ejection fraction was on average 67.6 (SD=4.2, range 60–74) %. All had normal diastolic function (E/A 1.8, SD=0.3, range 3.1–1.2).

Findings of the 12-lead resting ECG are shown in table 2. Three (5.9%) referees revealed training-unrelated changes, which were T-wave inversions in all cases.

**CONCLUSIONS**

PCMA is a feasible tool to identify referees at risk for SCD and has to be repeated on a regular base. No elite female referee was identified being at risk for SCD and had to be excluded from participating in the 2011 FIFA Women’s World Cup.

**Acknowledgements** We gratefully acknowledge the FIFA for the funding of this study. We greatly appreciate the support of and collaboration with Mrs Sonia Denoncourt, Head of Women’s FIFA Refereeing and of Mr Edgar Strelsov, FIFA Refereeing Department.

**Competing interests** None.

**Ethics approval** Institutional Review Board.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Open Access** This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 3.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/3.0/

---

**Table 1** Number and percentages of referees with echocardiographic findings

<table>
<thead>
<tr>
<th>Transthoracic echocardiography</th>
<th>Referees (number/percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tricuspid regurgitation</td>
<td>25/49</td>
</tr>
<tr>
<td>Mitral regurgitation</td>
<td>9/17.6</td>
</tr>
<tr>
<td>Aortic regurgitation</td>
<td>1/2</td>
</tr>
<tr>
<td>Ventricular septum defect</td>
<td>2/3.9</td>
</tr>
</tbody>
</table>

**Table 2** Number and percentages of referees with ECG findings

<table>
<thead>
<tr>
<th>12-Lead resting ECG</th>
<th>Referees (number/percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training-related ECG changes and common</td>
<td></td>
</tr>
<tr>
<td>Sinus bradycardia</td>
<td>28/54.9</td>
</tr>
<tr>
<td>First-degree AV-block</td>
<td>2/3.9</td>
</tr>
<tr>
<td>Notched QRS in V1 or incomplete RBBB</td>
<td>7/13.7</td>
</tr>
<tr>
<td>Early repolarisation</td>
<td>2/3.9</td>
</tr>
<tr>
<td>Isolated QRS voltage criteria for LV hypertrophy</td>
<td>1/2</td>
</tr>
<tr>
<td>Training-unrelated ECG changes and uncommon</td>
<td></td>
</tr>
<tr>
<td>T-wave inversion</td>
<td></td>
</tr>
<tr>
<td>Isolated in V2</td>
<td>1/2</td>
</tr>
<tr>
<td>Isolated in lead aVL</td>
<td>1/2</td>
</tr>
<tr>
<td>In lead III and aVL</td>
<td>1/2</td>
</tr>
<tr>
<td>AV, ativoventricular; LV, left ventricular; RBBB, right bundle branch block.</td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


FIFA Women's World Cup 2011: Pre-Competition Medical Assessment of female referees and assistant referees

Dagmar I Keller, Mario Bizzini, Nina Feddermann, Astrid Junge and Jiri Dvorak

doi: 10.1136/bjsports-2012-091436

Updated information and services can be found at:
http://bjsm.bmj.com/content/47/3/179

References
This article cites 9 articles, 4 of which you can access for free at:
http://bjsm.bmj.com/content/47/3/179#BIBL

Open Access
This is an open-access article distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits use, distribution, and reproduction in any medium, provided the original work is properly cited, the use is non commercial and is otherwise in compliance with the license. See: http://creativecommons.org/licenses/by-nc/3.0/ and http://creativecommons.org/licenses/by-nc/3.0/legalcode

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections
Open access (275)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/