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

Dagmar I Keller,1,2 Mario Bizzini,3 Nina Feddermann,4 Astrid Junge,3 Jiri Dvorak3,5

ABSTRACT

Background Precompetition screening was implemented for male referees during the 2010 Fédération Internationale de Football Association (FIFA) Word 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 Cup1 and subsequently introduced it for female players; it is now mandatory in all FIFA competitions.2 PCMA was implemented for male referees selected for 2010 FIFA World Cup and data were published recently.3 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 male referees. In this study, the cardiovascular findings obtained in the PCMA of female referees and assistant referees selected for the FIFA Women’s World Cup 2011 were analysed.

METHODS

The PCMA protocol includes medical history, general physical examination, 12-lead resting ECG and transthoracic echocardiography. The standardised PCMAs were performed at the FIFA headquarter 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.1 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 SCD 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 71.5 (SD=11.5, range 48–95) g/m² and LV enddiastolic diameter index (LVEDI) 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 proper glucose level and normal blood pressure (94–110 mm Hg) of which one took regular non-steroidal painkillers which might have a negative effect on blood pressure.

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 compared to water sports athletes and lower compared to runners. Two (3.9%) referees had isolated increased diastolic (PWd) 8.3 (SD=1, range 6–10) mm, LV muscle mass index 71.5 (SD=11.5, range 48–95) g/m² and LV enddiastolic diameter index (LVEDI) 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).

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

<table>
<thead>
<tr>
<th>Echocardiographic finding</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>ECG finding</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 T-wave inversion in lead III</td>
<td>1/2</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>
</tbody>
</table>

AV, atrioventricular; LV, left ventricular; RBBB, right bundle branch block.

### 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.

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Contributors DIK performed cardiac examination, data analysis and manuscript writing. MB and NF: performed clinical examination. AJ and JD instrumented the study design, provided support and feedback at all stages of the study and heavily contributed to writing and reviewing the manuscript. All coauthors reviewed and improved the study.

Competing interests None.

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