Assessment of Risk Factors for Arterial Hypertension among the High Skilled Football Referees

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Abstract.

Arterial hypertension in athletes leads to the development of hypertrophic cardiomyopathy, which is a cause of sudden death in young athletes in a third of cases. Professional activities of football referees are associated with significant physical exertion and require their body’s optimal functional state and regular exercise. The objective of the research was to determine the prevalence of arterial hypertension and the degree of hypertension development risk among high skilled football referees. 176 individuals participated in the study including 72 referees and 104 assistant referees at the age of 22 to 44 years. Normal arterial blood pressure was determined in 79.17 % of referees and 71.15 % of assistant referees. Two (1.92 %) assistant referees suffered from hypotension. One referee (1.39 %) had second degree hypertension, 5 (6.94 %) referees and 12 (11.54 %) assistants suffered from first degree hypertension. High-normal arterial blood pressure was determined in 9 (12.50 %) of referees, and 16 (15.39 %) of assistant referees. Heart rate was significantly higher in the assistant referees than in referees. Cases of high arterial blood pressure and overweight were also observed in assistant referees more often. The average value of hypertension development risk level constituted 11.07±1.00 points among the referees and 10.30±0.67 (p<0.05) among the assistant referees. The risk level was significantly higher in the group with elevated blood pressure (16.27±1.15) compared with the group having normal blood pressure (8.43±0.46). Blood pressure measurement is a must method of examination among football referees before the start and during of their professional activities. The findings indicate the necessity for change in the lifestyle of high skilled football referees.
**Problem statement and analysis of the recent research**

Arterial hypertension (AH) takes leading place in the world among causes of morbidity and mortality, and is a major risk factor for cardiovascular disease (CVD).

Analysis of CVD mortality among men has shown that the risk of CVD in people with AH increases linearly from 15% at the age of 30 to 134% at the age of 80, even without concomitant risk factors. The presence of concomitant risk factors increases additionally CVD risk by 56% [1].

In addition to common risk factors for hypertension athletes have specific risk factors such as high sodium intake, frequent stress (including during sports events), the use of medicines, and others [2]. AH in an athlete leads to the development of hypertrophic cardiomyopathy, which is the leading cause of sudden death in young athletes according to the Minneapolis National Heart Institute [2, 3]. Thus, blood pressure measurement is included to standard examination of young athletes before the activity, developed to prevent sudden death [2, 4].

During the match football referees and assistant referees are exposed to considerable physical and psycho-emotional exertion. Depending of the competition rank, referees cover the distance from 6 to 12 km, and the assistant referees from 2 to 6 km during the match [5]. Such level of exertion requires optimum functional status of their body and regular training during the season.

The objective of the research was to determine the prevalence of AH and the level of hypertension development risk among high skilled football referees.

**Materials and methods of the research**

An examination was conducted as a part of a comprehensive annual medical examination in Government Institution “Ukrainian Medical Center of Sports Medicine Ministry of Health of Ukraine”. The research involved 176 individuals including 72 referees and 104 assistant referees at the age from 22 to 44 (30.71±0.37), involved in football matches of the highest, first and second league of Ukraine.

Blood pressure measurement at rest and the definition of blood pressure category was performed according to the European clinical guidelines for the management of arterial hypertension [6].

The risk of hypertension development was determined in 121 individuals. For this purpose, we used a chart of determining the degree of individual risk of AH development. It included such factors as genetic predisposition, age, body weight, presence of dyslipidemia, hyperuricemia, diabetes, high normal blood pressure, neuro-circulatory dystonia, increased heart rate (HR), past traumatic brain injuries, psychotraumas, personality’s characterological characteristics, the use of salt more than 5-6 grams per day, regular consumption of coffee, alcohol, smoking, psycho-emotional exertion at work, physical activity [7]. All referees and assistant referees were divided into two groups according to the level of blood pressure.

Anthropometric parameters were measured using stadiometer and scales. Body height and weight were determined, body mass index (BMI) was calculated.

Statistical processing of the results was performed using EXCEL and STATISTICA 8.0 (StatSoft, USA) programs. Type of parameters distribution was analyzed according to Shapiro-Wilk W test. Statistical significance of differences between values was determined by Mann–Whitney U test. Spearman correlation coefficient was used to study the relation of the variables [8]. Threshold level of statistical significance of the results was taken p<0.05.

**Results of the research**

General characteristics of groups according to age and sport experience, anthropometry data and the results of blood pressure measurement are presented in Table 1.

The conducted analysis showed that referees’ body height and weight are significantly higher than that of assistant referees. Taking into account the lack of differences in the calculated BMI
between referees and assistant referees, it could be noted that the referees have higher body weight due to the higher body height (since from 315 to 360 g is accounted per a centimeter of height depending on the type of body build). The average age, sports experience, BMI and blood pressure were not significantly different.

**Table 1**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Referees (n=72)</th>
<th>Assistant referees (n=104)</th>
<th>Total group (n=176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>30.40±0.62</td>
<td>30.92±0.46</td>
<td>30.71±0.37</td>
</tr>
<tr>
<td>Sports experience, years</td>
<td>20.78±0.90</td>
<td>21.36±0.84</td>
<td>21.10±0.61</td>
</tr>
<tr>
<td>Body height, cm</td>
<td>184.44±0.59</td>
<td>180.08±0.50*</td>
<td>181.86±0.41</td>
</tr>
<tr>
<td>Body weight, kg</td>
<td>77.99±0.76</td>
<td>75.39±0.65</td>
<td>76.46±0.50</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>22.91±0.17</td>
<td>23.24±0.17</td>
<td>23.11±0.12</td>
</tr>
<tr>
<td>Heart rate at rest, beats• min⁻¹</td>
<td>68.21±1.04</td>
<td>72.33±0.82*</td>
<td>70.64±0.66</td>
</tr>
<tr>
<td>BP, mmHg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>systolic</td>
<td>119.10±1.37</td>
<td>120.27±1.27</td>
<td>119.79±0.93</td>
</tr>
<tr>
<td>diastolic</td>
<td>75.14±1.09</td>
<td>75.18±0.85</td>
<td>75.16±0.67</td>
</tr>
</tbody>
</table>

* - results difference is significant, p<0.05

Excessive weight was detected in 3 referees and 15 assistant referees. Normal blood pressure was determined in 79.17 % referees and 71.15 % assistant referees. 2 assistant referees had hypotension, which we considered to be a variant of the normal. One referee had second degree hypertension. First degree AH was observed in 5 referees and 12 assistant referees. High normal blood pressure was determined in 9 referees and 16 assistant referees. The detection rate of abnormalities in body weight and blood pressure are presented in the table 2.

**Table 2**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Referees (n=72)</th>
<th>Assistant referees (n=104)</th>
<th>Total group (n=176)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive body weight, %</td>
<td>4.17</td>
<td>14.42</td>
<td>10.23</td>
</tr>
<tr>
<td>High normal blood pressure, %</td>
<td>12.50</td>
<td>15.39</td>
<td>14.20</td>
</tr>
<tr>
<td>First degree hypertension, %</td>
<td>6.94</td>
<td>11.54</td>
<td>9.66</td>
</tr>
<tr>
<td>Second degree hypertension, %</td>
<td>1.39</td>
<td>0.00</td>
<td>0.57</td>
</tr>
<tr>
<td>Hypotension, %</td>
<td>0.00</td>
<td>1.92</td>
<td>1.14</td>
</tr>
</tbody>
</table>

The heart rate in assistant referees was significantly higher than in the referees. Cases of high arterial blood pressure and overweight were also observed in assistant referees more often. Correlation between blood pressure and body weight was not determined. These differences can be explained by dissimilarity in physical activity of referees and assistant referees during the match and training [5].

Analysis of the data indicated high prevalence of hypertension among referees and assistant referees of the professional teams. The number of cases of high normal blood pressure that may lead to hypertension in the absence of correction of risk factors draws special attention. Therefore, the level of individual hypertension risk was determined [7].
The mean value of AH development risk level constituted 11.07±1.00 points in referees, and 10.30±0.67 points in assistant referees (p>0.05). All referees and assistant referees were divided into 2 groups according to blood pressure level. The groups accounted 88 people with normal blood pressure and 33 people with high blood pressure. Risk level was significantly higher in the group with high blood pressure (16.27±1.15) compared with the group having normal blood pressure (8.43±0.46).

Among the factors that determine the risk of hypertension among referees and assistants a burdened familial history was detected in 17.89 % of patients, dyslipidemia in 33.06 % of cases, hyperuricemia in 9.92 %, past traumatic brain injuries in 5.69 % of cases, irritable nervous system in 24.39 % of patients, psycho-emotional exertion at work in 13.10 % of cases, excessive use of salt in 14.63 % of patients, tobacco in 13.01 % of cases. 53.66 % of referees and assistant referees consume 1-2 cups of coffee per day, and 4.88 % of referees and assistant referees consume more than 3 cups per day.

Physical exertion during the performance of professional duties contributes to the increase in blood pressure [7]. Therefore, we may assume that football referees and assistant referees have one more additional risk factor.

According to the European Guidelines for the management of arterial hypertension the lifestyle changes can safely and effectively delay the development of hypertension or prevent it in people without hypertension, delay the start of drug therapy or prevent its necessity in patients with first degree hypertension [6].

Most hypertension risk factors are modified, therefore, lifestyle change at the early stages of referees’ sports activity is advisable to prevent the development of hypertension.

**Conclusions**

1. Blood pressure measurement is compulsory method of football referees’ examination before and during their professional activities.
2. Arterial hypertension prevalence among high skilled football referees constitutes 10.23 %, and high normal blood pressure is recorded in 14.20% individuals.
3. High blood pressure is more common in assistant referees that may be related to their specific physical activity.
4. Significantly higher risk level in the group with high blood pressure indicates the significant influence of the risk factors on the development of hypertension and the necessity of lifestyle changes of high skilled football referees.

**Prospects of further research** involve the analysis of the types of cardiovascular system response to exercise of football referees.

**References**


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