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The Role of Predictors in the Development of Arrhythmia and Cardiac Conduction Disorders in Highly Qualified Football Players

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Abstract

Purpose of the study: To assess the degree of adaptation of the cardiovascular system to increased physical activity in professional football players with heart rhythm disturbances. Material and methods: 138 players were observed, who performed for 6 professional football clubs of the major league, with the help of clinical, instrumental and functional methods of research of the cardiovascular system. Results: Analysis of the results of ECG showed that 24.6

Index terms— heart rhythm disturbances; physical performance in athletes; maximum oxygen consumption; adaptation to physical activity.

1 Introduction

According to various studies, in professional athletes, ECG changes during chronic overstrain of the cardiovascular system, requiring an indepth examination of a cardiologist, account for up to 40%, while in people who go in for sports only periodically -12% [1,2]. Modern standards in the interpretation of ECG in athletes. It should provide for the determination of changes in indicators both in relation to the healthy part of the general population and in relation to the ECG indicators in athletes, which are defined as the norm and reflect the physiological adaptation to physical activity [3].

During routine examinations, professional athletes often reveal electrocardiographic and hemodynamic disorders, which can be both a consequence of maladjustment processes and a consequence of organic cardiological pathology [4].

In this regard, it is of interest to comprehensively analyze heart rhythm disturbances in highly qualified athletes and to determine the patterns of their development along with their influence on the general physical characteristics of athletes.

2 Purpose of the study:

To assess the indicators of adaptation of the cardiovascular system to increased physical activity in professional football players with heart rhythm disturbances.

3 II.

4 Material and Research Methods

The study was conducted on the basis of the Republican Scientific and Practical Center for Sports Medicine from 2019 to 2022. In total, 138 football players were surveyed, playing for 6 professional football clubs of the highest league of the Republic of Uzbekistan. The age of the athletes at the time of the study was 18 -37 years old, and the sports experience was 5-15 years (the experience of sports activity took into account only performances for a professional club) years. Exclusion criteria from the study:

-Acute and exacerbation of chronic diseases at the time of the study; -Taking any medications.

41 The following methods were used to examine the footballer: collection and analysis of anamnestic data;
42 electrocardiography (ECG); veloergometry (VEM); determination of physical work ability according to the PWC
43 170 /Kr test; determination of the value of the maximum oxygen consumption (MOC).

44 Physical performance was assessed using the PWC 170 submaximal test and its modified version -the PWCAF
45 test according to V.L. Karpman et al. (1988) [7], adapted for people of different ages. The calculation of A the
46 MPC was also carried out using the formulas proposed by Karpman for the value of PWC 170 .

47 Statistical processing of the results was carried out using the standard MS Office 2019 software package.

48 5 III.

49 6 Results

50 When analyzing the ECG results of 138 professional football players, numerous changes were found that can be
51 regarded as relatively safe and do not require specific treatment. The percentage of football players who had
52 an absolutely normal ECG at rest, according to all generally accepted criteria, was relatively low -24.6% (34
53 athletes). Among this group of football players, no pathological changes in the ECG were noted in the process
54 of stress testing.

55 The largest proportion of the surveyed football players had ECG changes, which are not considered the norm
56 in the general population, but occur with a fairly high frequency in professional athletes. They are typical
57 (frequent or "benign") signs for athletes that do not require additional examination and treatment in the absence
58 of complaints and signs of organic heart damage [6]. These include sinus bradycardia (heart rate less than
59 55 beats/min), deceleration of conduction along the right bundle branch, severe sinus arrhythmia, pacemaker
60 migration within the sinus node, and 1st degree AV block. The number of football players who had at least
61 one of these conditions was 74 (53.6%) out of 138. The distribution of "benign" rhythm disturbances is shown
62 in Figure 1. The graph shows that in the greatest number of cases, sinus bradycardia was determined -51.3%.
63 Pacemaker migration ranked second in frequency of occurrence and occurred in 36.5% of football players. Other
64 types of rhythm disturbances were much less common, sinus arrhythmia -in 6.6%, and incomplete right bundle
65 branch block and 1st degree AV block -in 2.7% of cases each.

66 The number of football players with identified "potentially dangerous" [6] heart rhythm disorders was 30
67 subjects (21.8%). The distribution of rhythm disturbances is shown in Figure 2. The graph shows that
68 supraventricular and ventricular extrasystoles were most often detected in this group of athletes, in 30% and
69 33.3% of cases, respectively. All patients, in whom ES was detected at resting ECG, underwent further more in-
70 depth examination during the day. As a result, it was revealed that 40% of footballers have premature ventricular
71 contraction (PVC) corresponding to grade 1 according to Lown, while 50% of them have PVC corresponding
72 to grade 2, and 10% -to grade 3. In athletes with Supraventricular arrhythmia (SVA), single extrasystole (ES)
73 prevailed (44.4%), paired ones were found in 2 athletes (22.2%), in all other cases, allorhythmia was determined
74 by the type of tri-and quadrhemia.

75 The results of assessing the general physical performance and maximum oxygen consumption (MOC) in the
76 football players we examined are presented in Table 1. The results showed that the PWC 170 index in the group
77 of "potentially dangerous" heart rhythm disturbances was significantly ($P < 0.05$) lower than in football players
78 with "benign" heart rhythm disturbances and in the group with normal ECG. In turn, the indicators of athletes
79 with "benign" rhythm disturbances were also significantly higher than those of athletes with a normal ECG. A
80 similar trend was observed in the MOC. The lowest average MOC values -48.3 ± 1.64 ml/min/kg were observed
81 in football players with "potentially dangerous" rhythm disturbances.

82 7 Discussion

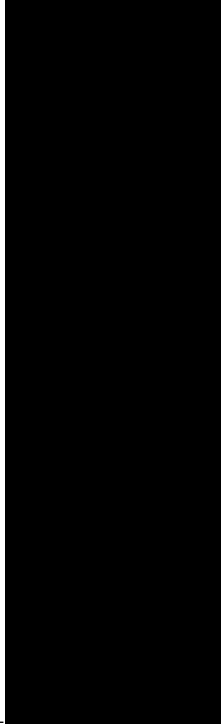
83 Heart rate variability under conditions of adaptation of the body to tense muscular activity is a manifestation of
84 the physiological mechanism of mobilization of the functional reserves of the heart. An increase in the functional
85 reserve during adaptation of the body to continuous muscular activity occurs in 2 ways: by increasing the reserve
86 level during urgent adaptation and as a result of long-term adaptation, which is characterized by a decrease in
87 the initial level of functioning. Mobilization of functional reserves of urgent adaptation to physical activity is
88 characterized by a period of functional stress [5, 7].

89 The process of mobilization of functional reserves with increased muscular activity has a direct dependence on
90 the level of functioning of the body, and inverse dependence on the level of mobilization of functional reserves.
91 The decrease in heart rate variability characterizes the degree of increased mobilization of the body's functional
92 reserves. The independent development of cardiac arrhythmias without the presence of certain diseases may be
93 associated with an abnormal location of the pathways in the heart, which can be manifested by the presence of
94 additional pathways and the peculiarities of the sensitivity of pacemaker cells to adrenergic influences [8,9,10].
95 Thus, according to the concept proposed above, the results of the studies carried out can be explained by the fact
96 that more significant heart rhythm disturbances in the group with "potentially dangerous" rhythm disturbances
97 are a manifestation of maladjustment of the football player's body to physical activity, which is confirmed by
98 reduced indicators of physical workability and aerobic performance (MOC). "Benign" ECG abnormalities, in
99 turn, are a manifestation of an increase in the body's adaptation to increased physical activity in athletes with

100 "benign" rhythm disturbances, which was confirmed by the highest indices of physical performance and aerobic
101 performance (MOC).
102 V.

103 8 Conclusion

104 Thus, on the basis of functional tests of veloergometry (VEM), it was found that a group of football players with
105 potentially dangerous rhythm disturbances showed a statistically significant decrease in physical performance
106 and MOC. The presence of "benign heart rhythm disturbances" in football players is an indicator of a high level
of physiological adaptation of the cardiovascular system of athletes to increased physical activity.



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Figure 1: Figure 1 :

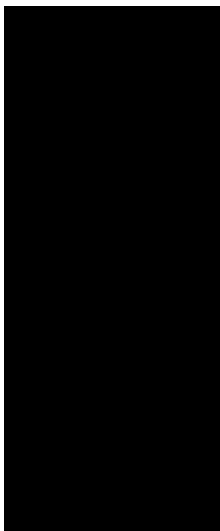


Figure 2:

107

2

Figure 3: Figure 2 :

1

	Group with "potentially dangerous" rhythm disorders n = 30	Group with "benign" rhythm disturbances n = 74	Group with normal ECG n = 34
?WC 170 (kgm/min/kg)	16.75 ± 0.45 * ^	19.9 ± 1.42 *	18.2 ± 1.38
MOC (ml/min/kg)	48.3 ± 1.64 * ^	57.64 ± 2.42 *	53.46 ± 1.82

* -differences in comparison with the indices of the group with normal ECG are statistically significant ($P < 0.05$)
 ^-differences compared to those of the group with "benign" rhythm disturbances are statistically significant ($P < 0.05$)
 IV.

Figure 4: Table 1 :

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