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FEATURES OF THE SHIN RHEOGRAM VALUES IN VOLLEYBALL PLAYERS

Abstract. *The paper presents the features of the time, amplitude and derived values in the shin rheovasogram of young volleyball players. We found out that volleyball players have higher values of the arterial tone, time of ascending part of the rheovasogram and slow blood supply and lower values of dicrotic index, duration of the cardiac cycle and the time of the descending part of the rheovasogram compared to those in non-athletes.*

Key words. *Shin rheovasogram, volleyball players, adolescence.*

Introduction. Nowadays one of the main links in athletes' achieving a high level of skill is to maximize their adaptation, including cardiovascular system, to different exercises. The fact is that as a result of constant, intense exercise, the circulatory system undergoes some changes[1]. Diseases of the cardiovascular system has long been a main target for studying. Despite medical advances and scientific discoveries, diseases of the cardiovascular system in athletes are not fully understood and have a lot of unsolved issues. Particular attention is drawn to the early diagnosis, easy availability, high sensitivity of the examination of an athlete that provides a unified approach to the prevention of overtraining state and to a detection of early pathological changes that occur in people who are professionally involved in sports. Studying peripheral hemodynamics is required for the formation of scientific and methodological recommendations for monitoring, optimizing and maximizing circulation system in terms of training and competitive activities [2].

Rheovasography as relatively fast, affordable and non-invasive method for diagnosing peripheral circulation is very important in the implementation of the diagnosis of peripheral arteries and veins, accompanied by partial narrowing or complete obturation of blood vessels, which in turn causes some changes in blood flow to the studied areas of the body [3]. That is why in the US, Japan and most European

countries rheovasography is a part of the screening recommendations on cardiovascular disease for professional athletes [4].

Objective: To establish the changes of time, amplitude and derivatives of these parameters in rheovasogram of the shin in young volleyball players.

Materials and methods. The study involved 133 young boys (from 17 to 21). The control group consisted of 74 young men who were not involved in sports and were virtually healthy at the time of the survey. The main group consisted of 59 highly qualified volleyball players (from the first adult category to the masters of sports). All the volleyball players had sports experience at least 3 years and at the time of the survey were in the preparatory period of the training cycle. Rheovasography parameters were determined by computer diagnostic complex that provides simultaneous registration of electrocardiogram, phonocardiogram, basic and differential tetrapolar rheogram and blood pressure. Assessments of quantitative parameters were conducted after the time, amplitude indicators and their derivatives by Ronkin and Ivanov technique [5]. Analysis of the results was performed using STATISTICA 5.5 (license № AXXR910A374605FA) using nonparametric methods. The reliability of the difference between the indices of quantitative values were determined using the U-Mann-Whitney test.

Results and discussion. After analyzing temporal parameters of the shin rheovasogram,

we found out that volleyball players' cardiac cycle length was reliably shorter than in boys who are not involved in sports (Table. 1). The time of the rheovasogram ascending part, which is independent of heart rate and reflects the period of full disclosure of the vessels and provides clear information on the state of the vascular wall [5], in volleyball players, in contrast, is reliably longer than that in the boys from the control group. We have found that volleyball players had two more statistically significant lower indices: the time of the

descending part of the rheovasogram and rapid blood supply, and the duration of slow blood filling in them is reliably longer than in non-athletes (see Table. 1).

We found a slight increase ($p > 0.05$) of the values of base impedance in the volleyball players, which reflects the resistance of tissues, when weak electric current of high frequency passes through them. All other amplitude parameters have no reliable differences compared with non-athletes. (table 2). We found out that the dicrotic index in volleyball

Table 1

Features of time parameters (c) of the shin rheogram in volleyball players ($M \pm \sigma$)

Value	Volleyball players	Control	p
Duration of the cardiac cycle	0,921±0,127	0,995±0,162	p<0,01
Time of the ascending part	0,150±0,024	0,146±0,038	p<0,01
Time of the descending part	0,771±0,122	0,846±0,151	p<0,001
Time of the rapid blood supply	0,060±0,023	0,062±0,037	p>0,05
Time of the slow blood supply	0,090±0,012	0,085±0,011	p<0,05

Table 2

Features of amplitude values (Ohm) of the shin rheogram in volleyball players ($M \pm \sigma$)

Value	volleyball players	Control	p
The base impedance	69,03±9,902	66,97±10,62	p>0,05
Amplitude of the systolic wave	0,055±0,014	0,053±0,015	p>0,05
Amplitude of incisure	0,018±0,007	0,020±0,010	p>0,05
Diastolic wave amplitude	0,021±0,006	0,023±0,009	p>0,05
Amplitude of the rapid blood supply	0,023±0,006	0,022±0,005	p>0,05

players was significantly lower than in the control group (Table. 3), since this figure mainly reflects the tone of the arterioles and depends on the peripheral vascular resistance [6]. Its reduction can be considered as an example of rational adaptation of the cardiovascular system in volleyball players for regular physical activity. The difference between the diastolic index values of athletes and young men who are not involved in sports, is not reliable, but we observed a slight decrease in this value in volleyball players. Average speeds of rapid and slow blood supply have no significant differences between comparison groups. The increase in the tone of the arteries which was found in a group of volleyball players is

noteworthy. Compared with the control group they had reliably higher value in the tone of arteries and arterial tone indices of large, medium and small diameters (see Table 3). Playing volleyball has a significant impact on the development of skeletal muscles of the lower extremities, as evidenced by the increase in their circle size of femur and tibia [7]. It is the development of skeletal muscles that causes the increase in vascular tone of the shin in volleyball players.

Indicators of the arterial tone affect the time values of the rheovasogram particularly on the slow blood supply, as its value is mainly due to tonic properties of the vascular wall of small and medium-sized arteries [5].

Table 3

Features of performance of ratios of amplitude and time parameters in the rheogram of the shin in volleyball players ($M \pm \sigma$).

Value	volleyball players	Control	p
Dicrotic index (%)	32,34±13,36	37,85±17,06	p<0,05
Diastolic index(%)	38,43±8,350	42,66±11,28	p>0,05
The average speed of rapid blood supply (Ohm/s)	0,416±0,129	0,414±0,149	p>0,05
The average speed of slow blood supply (Ohm/s)	0,348±0,097	0,375±0,118	p>0,05
Indicator of the tone of arteries (%)	16,07±2,880	14,45±3,404	p<0,001
Indicators of the tone of large diameter arteries (%)	6,135±2,491	5,669±2,766	p<0,05
Indicators of the tone of arteries of medium and small diameter (%)	9,449±1,613	8,324±2,059	p<0,001
Ratio of arterial tone (%)	69,08±30,93	74,91±45,39	p>0,05

Conclusions. 1. Compared to non-athletes, volleyball players have reliably higher values of overall tone of arteries and arteries of different diameter, time of ascending part of the rheovasogram and slow blood supply.

2. The dicrotic index, duration of the cardiac cycle, time of the descending part of the rheovasogram are reliably smaller in volleyball players than in non-athletes.

Prospects for further research. The results of this study might be used when evaluating prognostic parameters of the shin rheovasogram in volleyball players to achieve their results.

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