

HEART VALVES FUNCTION IN CHILDREN INTENSIVELY TRAINING SPORT*

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ABSTRACT

Little is known about athlete's heart in children. The aim of the study was to assess the incidence and significance of heart valve regurgitation in the children - pupils of so called sport mastership schools. There were 31 healthy subjects (16 girls and 15 boys) included in the study protocol and observed for three consecutive years. Their mean sport training time was 14,7 hours per week (girls training predominantly gymnastics) and 8,9 hours per week (boys training predominantly handball). The children were studied on three occasions, after about 1, 2, and 3 years of sport mastership school attendance. Their mean age during the first study was about 8,8 years (girls) and 11,2 years (boys).

Regurgitant flow of any heart valve was detected by Doppler color echocardiography in 11 children during the first study (35%), in 10 subjects after two years of sport training (32%), and after three years - in 12 young athletes (39%). Described regurgitations were predominantly negligible. In some children valvular insufficiency which was observed during the first examination disappeared after one or two following years of sport training and in not one case was significant progression observed. On the other hand, there were some children in whom valvular regurgitation was found for the first time during the second or third examination.

It was concluded that 3 years of sport training in children without heart disease is not associated with an increased risk of heart valve regurgitation.

Key words: child, sport, heart valves regurgitation

In the modern manuals of paediatrics (e.g. 10) or paediatric cardiology (1) one can find a term: athlete's heart. The features of so called "physiologic cardiac hypertrophy" (1, 3, 5) or atrioventricular heart block (10) in highly trained adult athletes are well known. On the other hand, there is only limited data concerning heart morphology and function in children intensively training sport though morphological and functional signs of adaptation are already appearing in children and young athletes (4).

In a previous study (7) we presented some changes in a group of 50 students after about a year of intensive sport training performed in Polish so called sport mastership schools. We were able to find rather high heart valve insufficiency rates (46%) in these studied subjects. Anyhow as many as 40% of cases were negligible. The more significant ones (of first or second degree) were detected only in 6% of young athletes.

It is known, as well, high incidence

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Table 1. *Characteristics of the studied children*

Sport discipline	Boys	Girls	Age (years)	Intensive sport training period (years)	Number of sport training hours per week*
Light athletics	–	1	13,3	0,4	12
Swimming	1	–	13,8	2,2	23
Gymnastics	–	15	8,5±0,3	1,6±0,5	14,7±2,4
Hand ball	14	–	11,0±0,1	0,5±0,1	8,9±0,3

* Notice that often these children during week-ends have sport games. Because it is irregular form of physical activity - these hours are not included to the table.

of cardiac murmur in children. In the basic French manual of pediatric cardiology edited by Dupuis et al. one can find an opinion that incidence of innocent cardiac murmur in the youngest patients is defined by different authors very differently, but it is general agreement concerning higher rate of innocent murmurs than the pathological ones (1).

Aim of the study

The aim of the present study was to evaluate valvular function in these children belonging to the described group which we were able to examine for three consecutive years of active sport training.

Methods

All together 31 subjects considered as healthy were followed up. There were 16 girls and 15 boys, aging during the first examination $8,8 \pm 1,3$ and $11,2 \pm 0,8$ years, respectively. Their short characteristics at a moment of our first examination are presented in table 1.

Heart valve function was studied using echocardiography (Hewlett-Packard color system). The study was performed always by the same doctor, using the same equipment. Heart valve insufficiency grade was described according generally accepted way (size and range of color marked regurgitant wave). The results of this study are presented in table II.

Results

From table 2 one can see that the valvular regurgitation rate in our selected material does not change very much throughout the first three years of sport training. Remember that there were only „healthy” subjects taken into consideration (according to modern criteria “trace” and even first degree regurgitation detected using Doppler techniques of mitral, tricuspid, and pulmonary valve is still considered physiological in children - 12). Thus, the total percentage of subjects with insignificant valve regurgitation practically did not change in time. It was interesting, that in some children the insufficiency, which was observed during the first examination disappeared after one or two additional years. On the other hand, there were the children in whom a regurgitation was found for first time during the second or third study. An interesting trend was noticed: the number of subjects with trace or first degree regurgitation of the mitral valve decreased in time while of the pulmonary valve - increased. Thus, after 1 year of training mitral regurgitation was seen in 7 subjects, and after 3 years - in 2 cases. Pulmonary valve regurgitant flow was detected in 3 children during the first study and in 8 cases after three years of training. Tricuspid valve insufficiency was found in 2 and 4 cases, respectively. An incidence of aortic valve regurgitation was negligible (only a “trace” during first study

Table 2. Number and percent of children in whom regurgitant heart valve flow was detected

Insufficiency of:	Mitral valve	Tricuspid valve	Pulmonary valve	Aorta valve	Together
After one year of training	7 (23%)	2 (6%)	3 (10%)	1 (3%)	11 (35%) *
After two years of training	3 (10%)	2 (6%)	6 (19%)	0	10 (32%) **
After three years of training	2 (6%)	4 (13%)	8 (26%)	0	12 (39%)* **

* During the first examination in 1 child regurgitant flow through tricuspid and pulmonary valve was found. In another subject the regurgitation of mitral and pulmonary valves were detected.
** During the second examination in 1 child regurgitant pattern of tricuspid and pulmonary valve flow was found.
*** During the third examination in 1 child regurgitant flow of mitral and tricuspid valve was observed. In another case the regurgitation of tricuspid and pulmonary valve was found.

in case). It should be stressed, however, that the total percentage of children with heart valves regurgitation was almost stable throughout the whole observation period and in not one case a significant progression of regurgitation between the first and the third examination was observed. Let us notice, as well, that according to modern literature (12) heart valve regurgitation rate in the population of “healthy” children is high, not lower than in our group of studied young athletes.

Thus, it can be stated that attending Polish sport mastership schools is not linked with the higher risk of valvular regurgitation.

Discussion

Our findings seem to be in partial agreement with some data observed in the literature. E.g. in 1988 Pollak et al. studied (6) valvular function in the group of young women training very intensively running and compared the data with those obtained in the subjects moderately trained and the control ones. In the cited study in the subgroup of highly trained long distance runners the rate of tricuspid regurgitation was very high (93%), in moderately trained runners tricuspid valve insufficiency was much lower (57%). In control subjects the corresponding rate was only 24%. The rate of pulmonary regurgitant flow pattern obtained during the cited studies was 87%, 57%,

and 18%, respectively. Mitral regurgitation was found in 20% of very well trained subjects, 35% in moderately trained ones, and 17% in the control group. At last an aortic regurgitant flow pattern was found only in one subject belonging to heavy runners. The authors of the discussed studies came to the conclusion that tricuspid and pulmonary regurgitation is significantly more common in highly trained adult athletes. On the other hand the cited authors write that the color Doppler regurgitant flow found during echocardiography does not necessarily signify pathologic regurgitation. Similar results showing high incidence of mitral leaflet prolapse and of valvular regurgitation in athletes practicing different sport disciplines were detected by the use of Doppler techniques in 1993 by Vasconcelos et al (11). Rowland et al. in 1987 and 1994 described the groups of prepubertal male runners (9) and swimmers (8) who underwent careful cardiological examination. The cited authors came to conclusion that the study failed to identify clinical features of “athlete’s heart” in competitive child endurance runners compared to non-trained subjects (9). The results of earlier studies of these authors were not very much different (8).
On the other hand, Hollmann et al (2) using x-ray and echocardiography observed within 2 years significant differences between swimming-trained and untrained children.

Trying to understand the real sense of our finding (rather high incidence of valvular insufficiency in young athletes) one should remember that the Doppler technique is only an additional examination. Yock et al. discussing the clinical value of valvular discrete abnormalities detected using Doppler study entitled the paper: Is continuous wave Doppler too sensitive in diagnosing of pathologic valvular regurgitation? (13). It is known, as well, that using echocardiography one can find valvular insufficiency in healthy children very often. Its incidence is increasing with age (12). Thus, Wojtowicz et al in 1994 gave even a shocking title to their work: Valvular regurgitation in children - valvular disease or physiology? (12). Cited authors found valvular insufficiency in majority of their children. Using color echocardiography the observed single valve regurgitation in 56% of subjects aged 1 day-18 years. The incidence of two valves insufficiency was 44% (12). Not only these authors used the term: "physiological regurgitation" in children.

In many studies like in our own, the frequency of physiological pulmonic and tricuspid valve regurgitation in children was higher than in mitral and aortic valves.

Our findings perhaps cannot be directly compared with the results of studies performed in adult athletes. It should be remembered that the children examined in this study were, first of all, school pupils. They rather live like their colleagues from ordinary schools, go through similar school learning program etc. Their time of intensive sport training is still limited. Thus, they are not exactly like adult sportsmen.

It is thought however, that sport mastership school students should remain under careful pediatric and cardiologic control because some risks connected with intensive sport training seem to be well documented especially in the subjects who were not carefully cardiologically examined.

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