Myocardial Creatinkinase as a Possible Predictor of Myocardial Changes in Children with Bicuspid Aortic Valve

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Abstract

In the study the changing of basic parameters of Doppler heart ultrasound in children with bicuspid aortic valve is shown. It was established diminishing of left ventricle systolic and diastolic volumes and reverse correlations of these values with myocardial creatine kinase activity. This enzyme considers as a possible predictor of early myocardial hypertrophy in this group of patients.

Keywords: children, congenital heart disease, bicuspid aortic valve, myocardial creatine kinase, Doppler heart ultrasound

Introduction

Bicuspid aortic valve (BAV) is the most common congenital heart disease among adults. Based on a surgery and autopsy data it is considered that in adults the presence of bicuspid aortic valve significantly increases the risk of morbidity and mortality from valvular dysfunction, endocarditis and aortal dissection [8]. Controversially, in children this abnormality is entity mostly underestimated due to the asymptomatic condition of the patients and absence in them of heart failure and other severe cardiac complications within the pediatric age. But the BAV should not considered as a benign condition because the development of an eccentric cardiac chambers hypertrophy due to elongation of myocytes starts in childhood [5] and can lead the patient to advanced cardiac disease.
It is known that myocardial creatininkase (CK-MB) could serve as a prognostic and diagnostic marker in myocardial infarction and cardiac ischemia [1-4, 6, 9]. In young children CK-MB elevation takes place during the newborn period and infancy [7]. Increasing of the enzyme is also described in young persons with left ventricular hypertrophy and cardiac chambers enlargement during physical training [5].

According to mentioned above the purpose of the study was to investigate the levels of CK-MB in children with BAV and their interrelations with basic parameters according to heart Doppler ultrasound anatomy.

Materials and methods

The study conducted in 2 groups of patients. The first group of 21 patients aged 7-17 years were affected with bicuspid aortic valve. 31 otherwise healthy children relevant by sex and age and without congenital heart diseases made the control group. In all groups were no any prominent clinical signs of cardiac failure. The average age at diagnosis was 7.87 ± 1.16 yr with prevailing of males 16 (76 %). In all children with BAV early development were unchanged. Most common concomitant conditions were the frequent viral syndromes in 11 patients (52 %), angina in 4 cases (19 %), chronic tonsillitis with adenoiditis in 5 patients (24 %) that resulted to adenoidectomy in 2 cases. By clinical examination the coincident congenital conditions were observed in 4 BAV children. They were a criptorchidismus and inguinal hernia in 2 patients, dwarfism and mental retardation by 1 case.

The detection of CK-MB (U/l) was conducted by immunologic method with NAC activator using the “Roche –Diagnostics” kit. Doppler heart ultrasound was conducted with “Medison -8000” scanner using of 2,5 MHz transducer. There were measured such parameters of echocardiography as a pulmonary artery (PA) and aorta (A) diameters in mm, left atrium longitudinal dimension (LALD), left atrium transversal dimension (LATD), right atrium longitudinal dimension (RALD), right atrium transversal dimension (RATD), right ventricle longitudinal dimension (RVLD), right ventricle transversal dimension (RVTD), left ventricle diastolic dimension (LVDd), left ventricle systolic dimension (LVDs) ventricular septum depth (VSd) , left ventricle posterior wall depth (LVPWd), left ventricle diastolic volume (LVold) in ml, left ventricle systolic volume (LVols), systolic volume (S Vol), ejection fraction (Ejefc) in %, mitral valve bloodstream velocity (MVV) in m/s, tricuspid valve bloodstream velocity (TVV), aortal valve bloodstream velocity (AVV), mitral valve pressure gradient (MVPG) in mm Hg, aortal valve pressure gradient (AVPG), tricuspid valve pressure gradient (TVPG), pulmonary artery valve pressure gradient (PAVPG). The data were processed with standard Statistica 6.0 package using Student t-test and correlation analysis. P value < 0,05 was taken as a significant. Competing interests were none stated. The study was approved by the Ethics Committee of the Hospital and Medical University.
Myocardial creatinkinase as a possible predictor of myocardial changes

Results

At the first stage of investigations the heart Doppler ultrasound parameters in two groups has been studied with revealing of some significant differences between RALD – 38,9 ± 2,09 mm in BAV group vs. 23,4 ± 1,73 mm in control group respectively (p<0,05), LVDs - 22,85 ± 1,54 mm vs 27,38 ± 2,0 mm (p<0,05), AVV – 1,73 ± 0,18 m/s vs. 0,85 ± 0,02 m/s (p<0,05), AVPG – 14,69 ± 2,84 mm Hg vs. 2,71 ± 0,17 mm Hg respectively (p<0,05). Thus, despite increasing AVV and AVPG that was the reflection of structural anatomy in the anomaly in bicuspid aortic valve children there were additionally established relative RALD enlargement and LVDs decreasing.

Taking into account the possibility of CK-MB changing in correspondence to heart chambers geometry we have studied enzyme's serum levels in children with bicuspid aortic valve compared with the control group. The values consisted of 28,89 ± 1,93 U/l in BAV children vs. 24,49 ± 1,65 U/l in healthy ones respectively (p<0,05) and has exceeded the reference points in the main group (7,0 - 24,0 U/l) recommended by kit provider. The obtained results were the grounds for further investigation with Doppler echocardiography of possible CK-MB influence on heart chambers dimensions in bicuspid aortic valve children.

The paired correlations (R) between CK-MB levels (U/l) and variability of essential echocardiographic parameters in children making “bicuspid aortic valve pattern” and “normal heart” are represented in the table 1. As it is seen the most significant differences between the affected patients and children of control group were obtained for LATD (R= - 0,33 and R= 0,20 respectively), LVDd (R= - 0,45 vs. R= – 0,30), LVDs (R= -0,19 vs. R= -0,38), LVold (R= -0,57 vs. R= - 0,36), S Vol (R= - 0,51 vs. R= -0,34), TVPG (R= 0,46 vs. R= 0,17), PAVV (R= 0,42 vs. R= -0,03), PAVPG (R= 0,42 vs. R= 0,07).

Table 1.
The most significant correlation coefficients and their validity (P) of basic echocardiographic parameters and CK-MB levels (U/l) in children.

<table>
<thead>
<tr>
<th>Echocardiographic parameters</th>
<th>Patients with bicuspid aortic valve</th>
<th>P</th>
<th>Children of control group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>LATD, mm</td>
<td>- 0,33</td>
<td>0,06</td>
<td>0,20</td>
<td>0,40</td>
</tr>
<tr>
<td>LVDd, mm</td>
<td>- 0,45</td>
<td>0,04</td>
<td>- 0,30</td>
<td>0,11</td>
</tr>
<tr>
<td>LVDs, mm</td>
<td>- 0,19</td>
<td>0,40</td>
<td>- 0,38</td>
<td>0,04</td>
</tr>
<tr>
<td>LVold, ml</td>
<td>- 0,57</td>
<td>0,0003</td>
<td>- 0,36</td>
<td>0,07</td>
</tr>
<tr>
<td>LVols, ml</td>
<td>- 0,54</td>
<td>0,0007</td>
<td>- 0,47</td>
<td>0,01</td>
</tr>
<tr>
<td>S Vol, ml</td>
<td>- 0,51</td>
<td>0,002</td>
<td>- 0,34</td>
<td>0,14</td>
</tr>
<tr>
<td>PAVV, m/s</td>
<td>0,42</td>
<td>0,01</td>
<td>- 0,03</td>
<td>0,92</td>
</tr>
<tr>
<td>PAVPG mm Hg</td>
<td>0,42</td>
<td>0,01</td>
<td>0,07</td>
<td>0,82</td>
</tr>
</tbody>
</table>
Discussion

Thereby, in children with bicuspid aortic valve the local hemodynamic changing in anomalous area are combined with certain longitudinal enlargement of right atrium together with decreasing of left ventricle diastolic volume without clinical signs of cardiac failure at this stage of disease development. In the same time the elevated levels of CK-MB in these patients and their significant negative correlations with left ventricle systolic and diastolic volumes can reflect not only valvular but also concomitant myocardial damages in progress in BAV children. For our opinion these data cannot be explained clearly only by hemodynamic disturbances in valve area but also by existing of common reason provoking heart changes. These changes remind the left ventricle hypertrophy as it described in physical training when the elevation of the CK-MB levels starts much earlier than consequent myocardial remodeling [5].

Conclusion

CK-MB may serves as a predictor of early subclinical myocardial changes in bicuspid aortic valve children.

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