**Table 1. Electrocardiographic abnormalities in the children aged 12 to 17 years**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Patient numbers, N (%)** | | **p value** |
| **Athletes (n = 86)** | **Controls (n = 74)** |
| QTc prolongation ≥ 440 ms | 2 (2.3) | 0 | 0.187 |
| Bradycardia < 2nd percentile | 5 (5.8) | 3 (4.1) | 0.611 |
| Ventricular repolarization abnormalities | 4 (4.7) | 3 (4.1) | 0.854 |
| Atrioventricular block I | 2 (2.3) | 0 | 0.187 |

The values are given as absolute patient numbers and proportions (%) in the group

**Table 2. Heart rate in the children aged 12 to 17 years (24-hour ECG monitoring)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter, Me [Q1; Q3], bpm** | **Athletes (n = 86)** | **Controls (n = 74)** | **p value** |
| Mean daily HR | 84 [78; 91] | 93 [83; 100] | < 0.001 |
| Minimal daily HR | 56 [52; 61] | 59 [52; 65] | 0.118 |
| Maximal daily HR | 150 [128; 159] | 159 [147; 184] | 0.001 |
| Mean night HR | 60 [55; 64] | 65 [59; 70] | < 0.001 |
| Minimal night HR | 49 [47; 55] | 52 [46; 55] | 0.568 |
| Maximal night HR | 94 [86; 107] | 113 [103; 120] | < 0.001 |

Bpm, beats per minute; HR, heart rate

**Table 3. Heart rate variability indices in the adolescents**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter, Me [Q1; Q3]** | **Athletes (n = 86)** | **Controls (n = 74)** | **p value** |
| VLF, ms2 | 5118 [3892; 6443] | 3505 [2190; 4867.7] | 0.006 |
| LF, ms2 | 2989 [1967; 3800] | 1944.5 [1205.5; 2815] | 0.003 |
| HF, ms2 | 1544 [881; 2132] | 871 [464; 1337.5] | 0.002 |
| TP, ms2 | 9781 [7173; 13739] | 6564 [4329; 9625] | 0.016 |
| LF/HF | 2.16 [1.48; 2.69] | 2.28 [1.78; 2.98] | 0.316 |

HF, high frequency range; LF, low frequency range; LF/HF, sympathetic to parasympathetic autonomic balance ratio; TP, total power; VLF, very low frequency range

**Table 4.** Cardiac biomarkers levels in the adolescents aged 12 to 17 years

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Biochemical marker, Me [Q1; Q3] | Athletes (n = 86) | Controls (n = 74) | Upper normal limit | P value |
| CPK, U/L | 157 [98.3; 223.7] | 123.2 [92.8; 190] | 270 | 0.157 |
| CPK-МВ, U/L | 17.5 [13; 21.2] | 15.1 [12.8; 17] | 24 | 0.002 |
| hsCRP, mg/L | 0.82 [0.31; 1.63] | 1.23 [0.41; 1.7] | 5 | 0.118 |
| AST, U/L | 13 [10.7; 17.4] | 17.3 [14.2; 19.8] | 38 | 0.001 |
| LDH, U/L | 162 [146; 196.5] | 193.1 [134.1; 235.1] | 279 | 0.034 |
| NT-proBNP, mg/mL | 48.2 [30; 73.1] | 49.2 [27.9; 79.8] | 125 | 0.860 |
| Troponin I, ng/mL | 0.09 [0; 0.29] | 0.30 [0.06; 0.322] | 0.5 | 0.011 |
| MMP1, ng/mL | 4.3 [2.7; 7.4] | 3.66 [2.5; 5.2] |  | 0.246 |
| MMP2, pg/mL | 204.8 [158.1; 283.1] | 236.45 [193.7; 318.6] |  | 0.001 |
| MMP9, ng/mL | 61.6 [39.4; 88.4] | 67.37 [60.29; 80.71] |  | 0.050 |
| TIMP1, ng/mL | 182.1 [124.9; 237.2] | 127.21 [98.76; 156.67] |  | < 0.001 |
| TIMP2, ng/mL | 109.6 [97.2; 120.2) | 193.8 [167.1; 236.7] |  | 0.002 |
| TIMP4, ng/mL | 976 [833.5; 1198.2] | 818 [625; 1078] |  | 0.006 |
| MMP2/TIMP2 | 1.87 [1.48; 2.34] | 1.243 [0.968; 2.034] |  | 0.003 |

AST, aspartate aminotransferase; CPK, creatine phosphokinase; CPK MB, creatine phosphokinase, MB fraction; hsCRP, highly sensitive C-reactive protein; LDH, lactate dehydrogenase; MMP, matrix metalloproteinase; NT-proBNP, N-terminal pro-brain natriuretic peptide; TIMP, tissue inhibitor of metalloproteinase

**Table 5. Main echocardiographic parameters in the adolescents aged 12 to 17 years**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter, Me [Q1; Q3]** | **Athletes (n = 86)** | **Controls (n = 74)** | **p value** |
| Interventricular septum, mm | 8 [7; 8] | 8 [7; 8] | 0.7 |
| LV posterior wall, mm | 8 [7; 8] | 8 [7; 8] | 0.117 |
| End diastolic LV diameter, mm | 46 [44; 48.7] | 45 [42; 48] | 0.082 |
| End systolic LV diameter, mm | 27 [25; 29] | 26 [24.75; 29] | 0.316 |
| LVMMI, g/m2 | 31.31 [28.7; 36.6] | 25.82 [22.25; 28.07] | < 0.001 |
| LV relative thickness | 0.33 [0.32; 0.36] | 0.33 [0.31; 0.37] | 0.583 |
| Ejection fraction, % | 71 [69; 73] | 68.5 [65; 74] | 0.097 |
| RV diastolic length, mm | 66 [63; 70] | 62.5 [54; 68.25] | < 0.001 |
| RV diastolic area, cm2 | 13.5 [11.7; 15.6] | 11.9 [9.1; 15.1] | 0.002 |
| RV systolic length, mm | 52 [48.2; 57.7] | 46 [39; 51.25] | < 0.001 |
| RV systolic area, cm2 | 8.05 [7.02; 9.4] | 6.6 [4.8; 8.53] | < 0.001 |

LV, left ventricle; LVMMI, left ventricular myocardial mass index; RV, right ventricle

**Table 6. The correlations between instrumental and biochemical indices in the adolescents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **AVNN** | **VLF** | **HF** | **RVAs** |
| MMP1 | r = -0.439, р = 0.004 |  |  |  |
| MMP2 |  |  |  | r = 0.316, p = 0.048 |
| TIMP4 | r = 0.405, р = 0.008 |  | r = 0.336, р = 0.031 |  |
| Troponin I |  | r = 0.461, р = 0.002 |  |  |
| LVMMI |  | r = 0.312, р = 0.040 |  |  |

AVNN, average NN duration; HF, high frequency range; LVMMI, left ventricular myocardial mass index; MMP, matrix metalloproteinase; RVAs, right ventricular systolic area; TIMP, tissue inhibitor of metalloproteinase; VLF, very low frequency range