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DAILY PROFILE OF BLOOD PRESSURE IN CHILDREN WITH MITRAL VALVE PROLAPSE

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The article presents results of the study of the daily profile blood pressure (BP) parameters in children with mitral valve prolapse (MVP). Daily profile of BP in children with MVP is characterized by unstable BP, increase of diastolic blood pressure (DBP) variability in the day and night periods and significant drop of DBP at night, as well as its decreased 24 hours index (over dipper). For children with primary MVP, lower average SBP values for 24 hours and average SBP values for the day period are significant ($p<0,05$). The maximum morning elevation of BP in children with MVP was observed on average 3 hours earlier than in healthy children, and the average rate of morning BP elevation in both groups was increased, which is a risk factor for the development of arterial hypertension. In children with MVP, vasomotor disturbances are more expressed in primary MVP, which may indicate that these patients have a congenital pathology of receptors to angiotensin, as well as hyperresponsiveness of blood vessels due to excessive autonomic responsiveness.

Key words: mitral valve prolapse, blood pressure, 24-hour blood pressure monitoring, children.

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The problem of diagnosis and treatment of mitral valve prolapse (MVP) in children remains relevant at present that is caused by the significant prevalence of this pathology among the child population and by the possibility of the emergence of such serious complications as infective endocarditis, mitral insufficiency, cardiac rhythm disturbance, detachment of papillary chords that occur in 2-4% of patients with MVP [5, 6, 7, 10, 13].

The term "mitral valve prolapse" means the deflection of the leaflet(s) of the mitral valve (MV) into the left atrial cavity (LA) during left ventricular (LV) systole, but it is diagnostically significant that the deflection of the MV leaflets exceeds the level of the atrioventricular ring by more than 3 mm [5, 9, 10].

Prevalence of MVP among children of different age is different and, depending on the method of examination, diagnostic criteria and study contingents it is 1.8% - 38% [5, 8].

There is currently no single classification of MVP. It is common to single out primary and secondary MVP [6, 11, 13]. Primary MVP is not associated with the primary heart diseases. The cause of its occurrence is a genetically determined defect of collagen, which leads to the "weakness" of the connective tissue of the MV leaflets and, as a consequence, to their prolapse into the cavity of the left atrial cavity [9, 12].

Secondary MVP is developed on the background of various diseases (carditis, cardiomyopathy, congenital heart defect, arrhythmia, autonomic dysfunction, thyrotoxicosis, etc.). In addition, there are MVPs of anterior, posterior or both leaflets according to the number of affected MV leaflets. According to the time of origin, there are early systolic, late systolic or pansystolic MVPs. According to the degree of deflection of the MV leaflets, MVPs are divided into those of:

– the 1st degree (3–5 mm);
– the 2nd degree (6–9 mm);
– the 3rd degree (more than 9 mm).

By the existence of hemodynamic abnormalities – without mitral regurgitation and with mitral regurgitation. Also, by the existence of structural changes in the MV leaflets, the following forms of MVP are distinguished – classical (presence of myxomatous changes) and nonclassical (absence of such changes).

When studying the indicants of autonomic homeostasis, the majority of patients with MVP are characterized by the presence of initial sympathicotonia and excessive autonomic responsiveness. The course of the disease is often accompanied by paroxysmal autonomic insufficiency in the form of generalized sympathetic-adrenal or vago-insular crises [1, 2, 4].

In the literature there are various data on the value of blood pressure (BP) in children with MVP. It is more common that an unstable BP and arterial hypotension occur in children with MVP, and during sympathetic-adrenal crises BP is elevated [6, 10].

To study the profile of BP in children and adolescents the 24-hour blood pressure monitoring is used. This method allows to study BP indicants for 24 hours, determine the chronobiological indicants and exclude the so-called "office hypertension" or "white-coat hypertension", which is often the cause of overdiagnosis of hypertension in children and adolescents [3].

The purpose of our study was to determine the characteristics of the daily profile of BP in children and adolescents with various forms of MVP.

Materials and methods. 42 children (20 girls and 22 boys) aged 9 to 14 were examined. Diagnosis of MVP was determined by performing ultrasound of heart with the use of doppler echocardiography and color flow mapping.

The children under study were divided into 2 groups: 30 children with primary MVP (1st group) and 12 children with secondary MVP (2nd group).

Among the children of the 1st group, MVP of the 1st degree was diagnosed in 25 children (83.3%), MVP of the 2nd degree was diagnosed in 5 patients (16.7%). Myxomatous degeneration of valves was found in 8 children (26.6%). Minimal mirtal regurgitation was found in 14 children (46.6%).

Among the children of the 2nd group, MVP of the 1st degree was diagnosed in 10 patients (83.3%), MVP of the 2nd degree – in 2 children (16.7%). Minimal mirtal regurgitation was found in 5 children (41.7%).

The 24-hour blood pressure monitoring was carried out using BP monitors of the company"IKS-Techno" (Ukraine).

Evaluation of the 24-hour blood pressure monitoring data was carried out according to generally accepted methods [3]. The following indicants were studied:

Average 24 hours systolic BP, average 24 hours diastolic BP, average daily systolic BP, average nocturnal systolic BP, average daily diastolic BP, average nocturnal diastolic BP, coefficients of variation (CV) of SBP and DBP day and night, BP load of SBP and DBP day and night, 24 hours indices of SBP and DBP, time index of hypotension (TIH) of SBP and DBP day and night, the time of the maximum morning BP, the time of the minimum nocturnal BP, the level of the maximum morning BP, the level of the minimum nocturnal BP, the morning surge in BP and the rate of morning SBP elevation.

Statistical analysis of the results was carried out using the Student's test.

Results of the study and their discussion. The average values of BP in children with primary and secondary MVP for 24 hours, day and night period were within the 5-95 percentile and were respectively: average 24 hours systolic BP - 106.2 ± 1.1 and 114.4 ± 2.6 mm Hg, average 24 hours diastolic BP – 60.5 ± 1.2 and 66.3 ± 1.7 mm Hg, and in children with primary MVP significantly lower indices of average 24 hours systolic BP were detected ($p<0.05$) (table 1).

During the day, the indicants of the average daily systolic BP in the group of children with primary MVP were significantly lower than in the group of children with secondary MVP ($p<0.05$) and equaled to 109.4 ± 1.5 and 117.6 ± 1.7 mm Hg respectively, and the average daily diastolic BP is 62.8 ± 1.4 and 68.1 ± 1.8 mm Hg.

During the night, lower indicants of BP were also observed in the group of children with primary MVP. Thus, the average nocturnal systolic BP in children with primary MVP was 97 ± 1.3 mm Hg and in children with secondary MVP - 101.9 ± 1.4 mm Hg, and the average nocturnal diastolic BP was 50.0 ± 1.2 and 56.0 ± 1.6 mm Hg respectively. The presence of myxomatous degeneration of mitral valves did not reveal significant differences in the level of the average 24 hours systolic BP and average 24 hours diastolic BP in comparison with the group of children with MVP without structural changes in MV leaflets and were 105.9 ± 1.2 and 107.8 ± 0.9 mm Hg respectively.

Table 1

Average values of 24-hour blood pressure monitoring in children with mitral valve prolapse (n=42)

Indicant of 24-hour blood pressure monitoring, mm Hg	Primary MVP (n=30)	Secondary MVP (n=12)
average 24 hours SBP	106.2±1.1	114.4±2.6*
average 24 hours DBP	60.5±1.2	66.3±1.7
average daily SBP	109.4±1.5	117.6±1.7*
average daily DBP	62.8 ±1.4	68.1±1.8
average nocturnal SBP	97±1.3	101.9±1.4
average nocturnal DBP	50.0±1.2	56.0±1.6

Note: *p<0,05

When assessing the magnitude of the coefficient of variation (CV) in children with MVP, an increase in DBP variability day and night was revealed. During the day CV of daily diastolic BP was 17.8 ± 1.1% in the group of children with primary MVP, 19.1 ± 1.7% in the group with secondary MVP, and

during the night - 15.2 ± 1.5% and 15.8 ± 0.8% respectively. CV of systolic BP in both groups was not significantly different in both groups and was within normal range (table 2).

Table 2

Average values of the coefficient of variation in children with mitral valve prolapse (n=42)

Indicant of 24-hour blood pressure monitoring, %	Primary MVP (n=30)	Secondary MVP (n=12)
CV of daily SBP	11.3±1.3	11.8±0.8
CV of daily DBP	17.8±1.1	19.1±1.7
CV of nocturnal SBP	10.9±0.7	9.8±0.7
CV of nocturnal DBP	15.2±1.5	15.8±0.8

Note: BP load in children with MVP in both groups was within normal range (up to 25%), day and night DBP in children with primary MVP was 0%.

The maximum average value of SBP above 95 percentile in children in the group with primary MVP was 150 ± 0.41 mm Hg, and in the group with secondary MVP was 149.4 ± 1.21 mm Hg. The maximum average value of DBP above 95 percentile was 100.5 ± 0.31 mm Hg and 98.1 ± 1.21 mm Hg respectively. The time index of hypotension (TIH) only in 3 children with primary MVP with the phenomena of myxomatous degeneration of MV leaflets exceeded 25%. However, there were lower average values of TIH of DBP in day (16.1 ± 0.28 and 12.45 ± 0.87 mmHg, respectively, in groups) and night (12.46 ± 0.41 and 11.6 ± 0.77 mm Hg) periods (Table 3).

Table 3

Average values of the time index of hypotension in children with mitral valve prolapse (n=42)

Indicant of 24-hour blood pressure monitoring, %	Primary MVP (n=30)	Secondary MVP (n=12)
TIH of daily SBP	3.86±0.18	6.5±0.54
TIH of daily DBP	16.1±0.28	12.45±0.87
TIH of nocturnal SBP	4.63±0.12	9.2±0.83
TIH of nocturnal DBP	12.46±0.41	11.6±0.77

Note: *p<0,05

The average value of minimal SBP in children with MVP was not different in groups and was not recorded below 5 percentile, which was 80.4 ± 0.13 mm Hg in children with primary MVP, and 81.4 ± 0.61 mm Hg in the group of children with secondary MVP. The average value of the minimum DBP was 39.4 ± 0.21 and 39.6 ± 0.2 mm Hg, respectively. 24 hours index for SBP in both groups was within normal range (dipper), and for DBP it was below normal range (over dipper) and in the group of children with primary MVP it was 24.4 ± 0.22%, and in the group of children with secondary MVP - 22, 4 ± 0.37%.The minimal nocturnal SBP (nocturnal SBP min) in children with primary MVP was observed on average at 3.05 ± 0.1, and in the group with secondary MVP - at 3.02 ± 0.21. The maximum morning BP elevation in all children was observed on average at 8.3 ± 0.1, that is 3 hours earlier than in healthy children (at 11). The morning surge in BP in both groups was within normal range and equaled to 43.96 ± 0.24 mm Hg in the group with primary MVP, and 44.9 ± 0.71 mm Hg in the group with secondary MVP. The average rate of morning BP elevation in both groups was increased and equaled to 8.79 ± 0.14 mm Hg per hour and 8.98 ± 0.41 mm Hg per hour respectively in groups, which is a risk factor for the development of arterial hypertension (table 4).

Table 4

Average value of indicants of 24-hour blood pressure monitoring in children with mitral valve prolapse (n=42)

Indicant of 24-hour blood pressure monitoring	Primary MVP (n=30)	Secondary MVP (n=12)
Nocturnal SBP min, mm Hg	80.4±0.13	81.4±0.61
SBP max, mm Hg	124.36±0.26	126.3±0.55
Morning surge in BP, mm Hg	43.96±0.24	44.9±0.71
Rate of morning SBP elevation, mm Hg per hour	8.79±0.14	8.98±0.41

Note: *p<0.05

Conclusions

1. Daily profile of BP in children with MVP is characterized by unstable BP, and the average values of SBP and DBP for 24 hours, day and night periods are within 5-95 percentiles.
2. For children with primary MVP, lower average SBP values for 24 hours (average 24 hours SBP - 106.2 ± 1.1 mmHg) and average SBP values for the day period (average daily SBP – 109.4±1.5 mmHg) are significant (p<0,05), compared with the group of children with secondary MVP (114.4 ± 2.6 mm Hg and 117.6 ± 1.7 mm Hg respectively).

3. In children with MVP, there was an increase of DBP variability in the day and night periods, a significant drop of DBP at night, as well as its decreased 24 hours index (over dipper).
4. The maximum morning elevation of BP in children with MVP was observed on average 3 hours earlier than in healthy children, and the average rate of morning BP elevation in both groups was increased, which is a risk factor for the development of arterial hypertension.
5. In children with MVP, vasomotor disturbances are more expressed in primary MVP, which may indicate that these patients have a congenital pathology of receptors to angiotensin, as well as hyperresponsiveness of blood vessels due to excessive autonomic responsiveness.

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Реферати

ДОБОВИЙ ПРОФІЛЬ АРТЕРІАЛЬНОГО ТИСКУ У ДІТЕЙ З ПРОЛАПСОМ МІТРАЛЬНОГО КЛАПАНА

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В статті авторами представлені результати дослідження показників добового профілю артеріального тиску (АТ) у дітей з пролапсом мітрального клапана (ПМК). Добовий профіль АТ у дітей з ПМК є нестабільним з підвищеною варіабельністю діастолічного АТ (ДАТ) у денний та нічний періоди, значним зниженням ДАД у нічний період, а також низьким добовим індексом ДАД (over dipper). У дітей з первинним ПМК достовірно ($p<0,05$) більш низькі показники середнього систолічного АТ (САТ) за добу та середнього САТ у денний період. Максимальний ранковий підйом АТ у дітей з ПМК спостерігався на 3 часи раніше, ніж у здорових дітей, а середня швидкість ранкового підйому АТ в обох групах підвищена, що є фактором ризику розвитку артеріальної гіпертензії. Виявлені вазомоторні порушення, які більш виражені у дітей з первинним ПМК, підтверджують наявність у таких пацієнтів вродженої патології рецепторів до ангіотензину, а також наявність гіперреактивності судин внаслідок надлишкової вегетативної реактивності.

Ключові слова: пролапс мітрального клапана, артериальний тиск, добовий моніторинг артериального тиску, діти.

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СУТОЧНЫЙ ПРОФИЛЬ АРТЕРИАЛЬНОГО ДАВЛЕНИЯ У ДЕТЕЙ С ПРОЛАПСОМ МИТРАЛЬНОГО КЛАПАНА

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В статье авторами представлены результаты исследования показателей суточного профиля артериального давления (АД) у детей с пролапсом митрального клапана (ПМК). Суточный профиль АД у детей с ПМК характеризуется нестабильным АД с повышенной вариабельностью диастолического АД (ДАД) в дневной и ночной периоды, значительным падение ДАД в ночное время, а также пониженным суточным индексом ДАД (over dipper). Для детей с первичны ПМК характерны достоверно ($p<0,05$) более низкие показатели среднего систолического АД (САД) за сутки и среднего САД за дневной период. Максимальный утренний подъем АД у детей с ПМК отмечался в среднем на 3 часа раньше, чем в норме у здоровых детей, а средняя скорость утреннего подъема АД в обеих группах повышена, что является фактором риска развития артериальной гипертензии. Выявленные вазомоторные нарушения у детей с ПМК, более выраженные в группе детей с первичным ПМК, подтверждают наличие у этих пациентов врожденной патологии рецепторов к ангиотензину, а также наличие гиперреактивности сосудов вследствие избыточной вегетативной реактивности.

Ключевые слова: пролапс митрального клапана, артериальное давление, суточный мониторинг артериального давления, дети.

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