Реферати

НОВІ ПІДХОДИ ДО РЕЛАКСАЦІЇ ЖУВАЛЬНИХ М'ЯЗІВ І М'ЯЗІВ ШИЇ У ПАЦІЄНТІВ З М'ЯЗОВО-СУГЛОБОВОЮ ДИСФУНКЦІЄЮ СКРОНЕВО-НИЖНЬОЩЕЛЕПНОГО СУГЛОБА

Боян А.М.

Запропоновано нову методику черезшкірної електронейростимуляції жувальних м'язів і м'язів шиї, засновану на використанні низькочастотного біполярного імпульсного струму зі спеціальною формою і параметрами імпульсів, максимально наближених до форми і параметрів імпульсів в нервових волокнах. Проведено порівняльний аналіз міорелаксаційного ефекту застосування запропонованої методики черезшкірної електронейростимуляції (ЧЕНС) за допомогою розробленого пристрою та існуючої поширеної методики ЧЕНС з застосуванням апарату «Міомонітор J5», який генерує низькочастотний однополярний імпульсний струм. В результаті обробки одержаних даних методами варіаційної статистики доведено, що використання запропонованої методики міорелаксації достовірно забезпечує на 16-20% більш ефективне розслаблення жувальних м'язів і м'язів шиї з більш тривалим клінічним ефектом (p<0,05), ніж існуюча поширена методика зі застосуванням апарату «Міомонітор J5». Більший міорелаксаційний ефект було підтверджено також електроміографічним дослідженням жувальних м'язів і м'язів шиї.

Ключові слова: скронево-нижньощелепний суглоб, м'язово-суглобова дисфункція, черезшкірна електронейростимуляція.

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НОВЫЕ ПОДХОДЫ К РЕЛАКСАЦИИ ЖЕВАТЕЛЬНЫХ МЫШЦ И МЫШЦ ШЕИ У ПАЦИЕНТОВ С МЫШЕЧНО-СУСТАВНОЙ ДИСФУНКЦИЕЙ ВИСОЧНО-НИЖНЕЧЕЛЮСТНОГО СУСТАВА

Боян А.М.

Предложена новая методика чрескожной электронейростимуляции жевательных мышц и мышц шеи, основанная на использовании низкочастотного биполярного импульсного тока со специальной формой и параметрами импульсов, максимально приближенных к форме и параметрам импульсов в нервных волокнах. Проведен сравнительный анализ миорелаксирующего эффекта применения методики чрескожной электронейростимуляции ЧЕНС с помощью разработанного устройства и распространенной методики с применением аппарата «Миомонитор J5», который генерирует низкочастотный однополярный импульсный ток. В результате обработки полученных данных методами вариационной статистики доказано, что использование предложенной методики миорелаксации достоверно обеспечивает на 16-20% более эффективное расслабление жевательных мышц и мышц шеи с более длительным клиническим эффектом (p <0,05), чем существующая методика с применением аппарата «Миомонитор J5». Больший миорелаксирующий эффект был подтвержден также электромиографическим исследованием жевательных мышц и мышц шеи.

Ключевые слова: височно-нижнечелюстной сустав, мышечно-суставная дисфункция, чрескожная электронейростимуляция.

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L.I. Vakulenko[1], A.Ye. Abaturov[1], O.V. Kunak[2]
[1]SI "Dnipropetrovsk medical academy of Ministry of Health of Ukraine", Dnipro
[2]MI "Dnipropetrovsk Regional Children's Clinical Hospital" of Dnipropetrovsk Regional Council ", Dnipro

LEFT VENTRICULAR GEOMETRY IN CHILDREN WITH CHRONIC PYELONEPHRITIS AT EARLY STAGES OF THE CHRONIC KIDNEY DISEASE

E-mail: vakulenkol@ukr.net

The purpose of the study was to determine the features of the left ventricular geometry in children with chronic pyelonephritis at the initial stages of the CKD. The tendency towards a gradual increase of the left ventricular cavity with the chronic kidney disease progression has been established, so that in patients of group 3 the end-diastolic index and the end-systolic index were significantly different from the statutory indices. A statistically significant increase in the of myocardial mass index was recorded in patients of the 1 st (p = 0.02), 2nd (p = 0.016) and 3rd (p <0.001) groups. In general, left ventricular hypertrophy was determined in 15.4% of patients in the 1st group, 36.7% - in the 2nd group, 47% - in the 3 rd group. In children with chronic pyelonephritis from the early stage of chronic kidney disease, processes of left ventricular remodeling occur, which are characterized by the formation of predominantly eccentric hypertrophy.

Key words: children, chronic pyelonephritis, chronic kidney disease, hypertrophy of the left ventricle

The study is a fragment of the research project "Development of methods for diagnosis and correction of the target organs hemodynamics disorders in somatic diseases accompanied by cardiovascular complications in children", state registration No. 0116U004963.

Cardiovascular diseases (CVD) are the most important concomitant pathologies affecting the long-term survival of patients with the chronic kidney disease (CKD) [6]. As in adults, cardiovascular pathology leads to the majority of deaths in children with CKD, since these patients have a high prevalence of traditional and uremia-associated risk factors for cardiovascular diseases [9, 15]. In children and adolescents with CKD, cardiovascular complications usually have a subclinical course, starting their development at the early stages [12, 13]. Among cardiovascular pathologies in patients with CKD both in

adults and children, the most common is left ventricular hypertrophy (LVH) which, according to the researchers, has the morbidity rate of 17% to 49% [2]. LVH develops early and progresses along with CKD, and if not treated, there exists an increased risk of cardiovascular complications and mortality [2]. In dialysis patients, LVH closely correlates with arterial hypertension and volume overload, which leads to concentric and eccentric changes in the left ventricular geometry [10]. The geometry status of the left ventricle at the early CKD stages [12, 13] is less-understood. In adult patients with CKD, assessment of the renal failure effect on the left ventricular geometry is often complicated by the presence of coronary heart disease and/or diabetes mellitus. The absence of these states in the pediatric population permits to study the interaction between renal failure and left ventricular geometry more accurately. Information on the morbidity rate and variants of LV geometry in children, published as of today, is limited by relatively small, separate groups of patients. In childhood, an early stages of CKD, pathological types of left ventricular geometry are most often detected, which apparently result from the interaction of cardiac load and non-hemodynamic factors [13].

The formation of cardiovascular nonadaptive changes with the CKD progression, particularly at the early stages, remains an urgent problem for further study.

The purpose of the present study was to determine the features of the left ventricular geometry in children with chronic pyelonephritis at the initial stages of CKD.

Materials and methods. We examined 196 children aged 6 to 17 years (76 boys, 120 girls) with chronic pyelonephritis (CPN) who were undergoing the inpatient treatment at the Nephrology Department of the MI “Dnipropetrovsk Regional Children's Clinical Hospital of DRC”. The planned clinical trial was approved by the Bioethics Committee of the SI “Dnipropetrovsk Medical Academy of the Health Ministry of Ukraine” and was carried out in accordance with the guidelines of the Helsinki Declaration (1975). All participants and/or their parents were fully informed about the methods and scope of the study and gave written informed consent for participation.

The criteria for inclusion of patients in the study were: the presence of a voluntary informed consent of the child and his/her parents to participate in clinical trials; age of patients from 6 to 17 years 11 months 29 days; presence of the verified chronic pyelonephritis diagnosis; absence of clinical and laboratory signs of the chronic pyelonephritis exacerbation. The criteria for the patients exclusion from the study were: refusal of the child or his/her parents to participate in the clinical trial; the presence of congenital heart defects or other primary cardiac diseases, acute infections. Clinical-laboratory and instrumental examinations were carried out at the Clinical Diagnostic Laboratory and the Department of Ultrasound Diagnostics of the ME “Dnipropetrovsk Regional Children's Clinical Hospital of DRC”. The level of biochemical parameters (urea, creatinine, uric acid, electrolytes, albumin) necessary for determining the real functions status was measured. The glomerular filtration rate was calculated using the formula according to Schwartz et al. Chronic kidney disease was diagnosed based on the criteria recommended by NKF - K / DOQI (2002), Hogg R.J. et al (2003).

Echocardiography (EchoCG) and dopplerechocardiography (DEchoCG) were performed simultaneously on the Acuson CV70 ultrasound scanner (Siemens) in the M and 2D mode, as well as using the Doppler in the pulse mode (PW) according to the standard procedure. The main indices of systolic and diastolic function of the left ventricle (LV) were determined, including end-diastolic index (EDI), end-systolic index (ESI), ejection fraction (EF).

Due to the fact that the examination was carried out in children of various age (from 6 to 18 years old) having different physical development indices (height, body weight), morphometric parameters of the heart were normalized by the area of the body (B). The indices obtained in the previous study of 230 healthy children and adolescents were considered to be the normal values [1]. To determine the type of LV geometry, the LV relative walls thickness (LVRWT) was calculated, the LV myocardium mass (LVMM) and the LV myocardium mass index (LVMMI) were measured. LVMM was calculated using the Devereux and Reichek formula (1977). The LVMM z-scores according to height were calculated according to Foster et al. (2008). Index of LVMM (LVMMI) was obtained by dividing the LVMM by the height (mass [g]/height $[m]^{2.7}$) according to de Simone G. et al. (1992) to normalize and linearize the interaction between the LVMM and the height. LV hypertrophy was determined when the LVMMI was $\geq$ 95 percentile for healthy children and adolescents according to Khoury PR. et al. (2009). Since the LVMMI which is indexed according to the height, does not completely take into account changes due to the growth, we also used z-scores based on the age and gender according to Khoury PR. et al. (2009). According to the classification suggested by A. Ganau and supplemented by D. Levy, depending on the LVMMI and LVRWT value, the types of LV geometry were determined.

Measurement of the office blood pressure (BP) was performed during echocardiography after the patient's sitting for 10-15 minutes in a relaxed position.

The results were processed statistically using the Statistica 8.0 software. Verification of the distribution compliance to the Gauss' law was carried out using one of the test statistics: Shapiro-Wilk or $\chi 2$ Pearson. Given that most of the samplings were inconsistent with the Gauss' law, the results are presented as the median (Me) and the interquartile range (Q25; Q75). The Mann-Whitney criterion was used to compare the groups. The correlation and one-factor dispersion analysis was performed to determine the interaction between the indices. The difference between values was considered statistically reliable with the significance test level amounting $p < 0.05$.

Results of the study and their discussion. In all of the examined patients chronic pyelonephritis was secondary, which was due to the presence of dysmetabolic nephropathy in 48.5% of patients, functional urodynamics disorders (neurogenic dysfunction of the urinary bladder) - in 27.6% of patients, organic urodynamics disorders (congenital renal and/or urinary tract anomalies) – in 56.1% of children. The background pathology combination was registered in 32.1%.

Patients were divided into groups depending on the stage of chronic kidney disease: the first group included 149 children with CKD stage 1, the 2nd group - 30 patients with CKD stage 2, the 3rd group - 17 patients with CKD stage 3. From among 196 patients examined, 68 of them were treated with angiotensin-converting enzyme inhibitors (ACEI), i.e. 20.8% with CKD stage 1, 80.0% with CKD stage 2, 76.5% with CKD stage 3, respectively.

Basic clinical data and renal functions parameters are presented in table 1.

Table 1

Basic clinical data and renal functions indices of the patients

Index	Groups of examined patients		
	1st group (n=149)	2nd group (n=30)	3d group (n=17)
Gender, m/f	76/73	14/16	10/7
Age, years	10.87(6.34;16.27)	11.28(6.46;16.72)	11.08(7.8;15.86)
Height (z-score)	0.05(-0.10;0.52)	-0.09(-1.05;0.10)	-0.88(-2.16;-0.33)*
Body mass (z-score)	0.01(-0.39;0.41)	-0.95(-1.67;0.02)	-0.98(-1.59;0.01)*
BMI (z-score)	0.32(-0.29;0.69)	0.27(-0.35;0.66)	-0.97(-1.71;0.35)
Hemoglobin, g/l	123(115;135)	122(113;129)*	105(92;112)*
Systolic BP, mm Hg.	115 (110;122)	116(112;126)	122 (118;128)*
Diastolic BP, mm Hg.	71 (66;79)	73(65;82)	83(77;87)*
GFR ml/min.	116.0(96.0;134.0)	72.0(66.7;82.0)*	40.6(36.8;51.8)*#
Blood serum uric acid, mmol/l	0.34(0.28;0.40)	0.33(0.27;0.39)	0.45(0.38;0.61)*#

Note. * - reliable difference while comparing to the 1st group indices, # - reliable difference while comparing to the 2nd group indices.

Patients in groups did not differ in age and gender. Patients with CKD stage 3 as compared to children with CKD stage 1 had reliably lower growth rates ($p = 0.012$), body weight ($p = 0.031$), and statistically higher systolic ($p = 0.035$) and diastolic BP levels ($p = 0,029$).

The comparative analysis of the echocardiographic examination results is presented in table 2.

Table 2

Main morphologic parameters of the left ventricle in the examined children (Me (Q25;Q75))

Index, units of measure	Groups of examined patients		
	1st group (n=149)	2nd group (n=30)	3d group (n=17)
EDI, ml/m^2	54.5(47.8; 63.0)	57.9 (53.5; 66.2)	62.9*(59.9; 71.6)
ESI, ml/m^2	21.5(17.0; 27.2)	20.9(14.5; 22.6)	22.1*(19.5; 26.3)
EF, %	62.6(58.2; 67.7)	63.9(60.9; 69.2)	63.4(63.1; 69.2)
MMI (g/m^{2,7})	30.9*(26.2; 35.6)	31.7*(28.0; 39.2)	34.2*(30.7; 44.1)
MMI (z-score)	0.37(-0.17; 2.07)	1.69*(1.04; 2.67)	2.42*(1.79; 3.09)
LVRWT	0.37(0.34; 0.43)	0.36(0.25; 0.51)	0.36(0.33; 0.39)

Note. * - the reliable difference compared to the normal values.

The tendency towards a gradual increase of the left ventricular cavity during the CKD progression was established, so that in patients with CKD stage 3, EDI ($p = 0.008$) and ESI ($p = 0.011$) are reliably different from the normal values. A statistically significant increase in MMI in children with chronic pyelonephritis was also found already at the 1st stage of CKD ($p = 0.02$), as compared to the normal values. In patients with CKD stages 2 and 3, MMI is also reliably higher as compared to healthy persons ($p = 0.016$ and $p < 0.001$). The LV hypertrophy was determined in 15.4% of patients with CKD stage 1, 36.7% of patients with CKD stage 2 and 47% of patients with CKD stage 3.

While determining the correlation between MMI and the main clinical parameters and indices of renal functions, a negative correlation was found with growth (z-score) (r = -0,29, p = 0,022), hemoglobin levels (r = -0.27, p = 0.030) and GFR (r = -0.31, p = 0.036), and a positive correlation with blood uric acid level (r = 0.29, p = 0.026) was established. There were no statistically significant correlations between MMI and BP. Types of the LV geometry are presented in table 3.

Table 3

Incidence of LV geometry types in children with chronic pyelonephritis

LV geometry types	Groups of examined patients		
	1st group (n=149)	2nd group (n=30)	3d group (n=17)
Normal geometry of LV	81.2% (121)	53.3% (16)	47.1% (8)
Eccentric hypertrophy of LV	10.7% (16)	26.7% (8)	29.4% (5)
Concentric hypertrophy of LV	4.7% (7)	10.0% (3)	17.6% (3)
Concentric remodeling of LV	3.4% (5)	10.0% (3)	5.9% (1)

As it can be seen from table 3, with the CKD progression the relative number of patients with normal LV geometry (81.2% and 47.1%, p = 0.0019) is likely to decrease, and the relative number of patients with concentric LV hypertrophy (4.7% and 17.6%, p = 0.0406) and eccentric LV hypertrophy (10.7% and 29.4%, p=0.0371) is statistically significantly growing.

Based on the results obtained, in children with chronic pyelonephritis already at the initial CKD stages, changes in the heart echomorphology were revealed, namely occurrence of LV remodeling processes. Our data are consistent with the results of the ESCAPE Trial Group [3], which demonstrated the presence of the LV pathological geometry in 43.3% of children with CKD stages 2-3. Hypertrophy of LV as a predictor of future cardiovascular events was detected in 21.4% of the examined patients with CKD, and in 40.2% of patients with CKD stages 2-3, which coincides with the data of the Italian researchers who diagnosed LVH in 55% of children (n = 272) with CKD stages 2-4 [4].

The obtained data regarding the predominance of eccentric hypertrophy in the structure of the LV pathological geometry are consistent with the results of Matteucci M.C. et al., which have shown that the LV eccentric hypertrophy was the most common form of remodeling in patients with CKD in childhood [8]. In our study, it is shown that with the CKD progression, the number of patients with concentric hypertrophy, which is considered to be the most unfavorable variant of the LV pathological geometry [11], is growing (from 10.7% in CKD stage 1 to 29.4% in CKD stage 3). According to the results of 4C Study [13], it is the LV concentric hypertrophy which is the basic form of the LV pathological geometry and was recorded in two thirds of children with LV hypertrophy. This discrepancy with our data and the results of the ESCAPE Trial Group are probably due to the fact that patients with CKD stages 3-5 were included into the above study. The determined correlations between the MMI and the height, hemoglobin levels, GFR and blood uric acid reflect the non-hemodynamic aspects of cardiovascular disorders development in patients with CKD. The regularity of these interactions is confirmed by the results in the adult population [7].

In our study, statistically significant correlations between the MMI and BP were not found, although there are works that demonstrate the probable correlation between these parameters in patients with CKD [5, 7]. Absence of correlations between the indices of the "office" BP and the MMI can be explained by the fact that 87.2% of children with CKD stages 2-3 received ACE inhibitors for over a year. This hypothesis is confirmed by the results of the studies demonstrating that prolonged treatment with ACE inhibitors promoted regression of LV hypertrophy both in patients with arterial hypertension [14] and patients with CKD [8].

Conclusions

1. Children with chronic pyelonephritis undergo left ventricular remodeling processes from the early stage of a chronic kidney disease.

2. Progression of chronic pyelonephritis is associated with an increased risk of the left ventricle remodeling.

3. Remodeling of the left ventricle in children with chronic pyelonephritis and chronic kidney disease is characterized by the development of pathological left ventricular geometry predominantly in the form of eccentric hypertrophy.

4. The risk factors of left ventricular remodeling in patients with chronic kidney disease are the hemoglobin level, the level of uric acid in the blood, glomerular filtration rate.

Prospects for further research lie in the study of the endothelial dysfunction effect on the processes of the left ventricle remodeling in children with chronic kidney disease, starting with the early stages.

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Реферати

ГЕОМЕТРІЯ ЛІВОГО ШЛУНОЧКА У ДІТЕЙ З ХРОНІЧНИМ ПІЄЛОНЕФРИТОМ НА ПОЧАТКОВИХ СТАДІЯХ ХРОНІЧНОЇ ХВОРОБИ НИРОК

Вакуленко Л.І., Абатуров О.Є., Кунак О.В.

Метою роботи було визначення особливостей геометрії лівого шлуночка у дітей з хронічним пієлонефритом на початкових стадіях хронічної хвороби нирок. Встановлено тенденцію до поступового збільшення порожнини лівого шлуночка протягом прогресування хронічного захворювання нирок, так що у хворих 3-ї групи кінцево-діастолічний індекс і кінцево-систолічний індекс достовірно відрізнялися від нормативних показників. Реєструвалося статистично значуще збільшення індексу маси міокарда у дітей 1-ї (p = 0,02), 2-ї (p = 0,016) і 3-ї (p <0,001) груп. В цілому, гіпертрофія лівого шлуночка визначалася у 15,4% хворих 1-ї групи, 36,7% - 2-ї групи, 47% - 3-ї групи. У дітей з хронічним пієлонефритом, вже на ранній стадії хронічної хвороби нирок відбуваються процеси ремоделювання лівого шлуночка, що характеризуються формуванням переважно ексцентричної гіпертрофії.

Ключові слова: діти, хронічний пієлонефрит, хронічна хвороба нирок, гіпертрофія лівого шлуночка.

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ГЕОМЕТРИЯ ЛЕВОГО ЖЕЛУДОЧКА У ДЕТЕЙ С ХРОНИЧЕСКИМ ПИЕЛОНЕФРИТОМ НА РАННИХ СТАДИЯХ ХРОНИЧЕСКОЙ БОЛЕЗНИ ПОЧЕК

Вакуленко Л.И., Абатуров А.Е., Кунак .Е.В.

Целью работы было определение особенностей геометрии левого желудочка у детей с хроническим пиелонефритом на начальных стадиях хронической болезни почек. Установлена тенденция к постепенному увеличению полости левого желудочка в течение прогрессирования хронического заболевания почек, так что у больных 3-й группы конечно-диастолический индекс и конечно-систолический индекс достоверно отличались от нормативных показателей. Регистрировалось статистически значимое увеличение индекса массы миокарда у детей 1-й (p = 0,02), 2-й (p = 0,016) и 3-й (p <0,001) групп. В целом, гипертрофия левого желудочка определелялась у 15,4% больных 1-й группы, 36,7% - 2 -й группы, 47% - 3-й группы. У детей с хроническим пиелонефритом, уже ранней стадии хронической болезни почек происходят процессы ремоделирования левого желудочка, характеризующиеся формированием преимущественно эксцентрической гипертрофии.

Ключевые слова: дети, хронический пиелонефрит, хроническая болезнь почек, гипертрофия левого желудочка.

Рецензент Крючко Т.О.