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DIAGNOSIS AND TREATMENT OF RENAL ARTERIAL HYPERTENSION IN PEDIATRIC PRACTICE

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The article considers the problem of renal arterial hypertension as one of the frequent manifestations of secondary arterial hypertension in childhood, which contributes to an increase in the rate of disease progression. Symptoms of renal hypertension are due to the level of blood pressure, manifestations of cardiovascular disease and the presence of proteinuria. Blood pressure indicators were analyzed in 86 children with chronic kidney disease. According to the results of diurnal monitoring of blood pressure in 58.1±5.3 % (50/86) children, violations of the circadian rhythm of daily fluctuations in blood pressure were revealed. Renal arterial hypertension was diagnosed in 41.8±5.3 % (36/86) children. For doctors who observe pediatric patients, especially with kidney pathology, approaches to non-pharmacological and pharmaceutical treatment of renal hypertension in children are offered. These include physical activity correction, nutrition in accordance with the child's basic age needs, in combination with the appointment of renoprotective therapy. For initial treatment, it is recommended to use drugs from the group of inhibitors of angiotensin converting enzyme and blockers of angiotensin receptors.

Key words: renal arterial hypertension, children, diagnosis, renoprotection.

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ДІАГНОСТИКА ТА ЛІКУВАННЯ РЕНАЛЬНОЇ АРТЕРІАЛЬНОЇ ГІПЕРТЕНЗІЇ В ПЕДІАТРИЧНІЙ ПРАКТИЦІ

У статті розглядається проблема ренальної артеріальної гіпертензії, як однієї з частих проявів вторинної артеріальної гіпертензії в дитячому віці, яка сприяє збільшенню темпів прогресування захворювання. Прояви ренальної гіпертензії зумовлені рівнем артеріального тиску, характером ураження серцево-судинної системи та наявністю протеїнурії. Проведено аналіз показників артеріального тиску у 86 дітей з хронічним захворюванням нирок. За результатами добового моніторування артеріального тиску у 58,1±5,3 % (50/86) дітей виявлені порушення циркадності добового коливання артеріального тиску. Ренальна артеріальна гіпертензія встановлена 41,8±5,3 % (36/86) дітям. Для лікарів, які спостерігають педіатричних пацієнтів особливо з патологією нирок, запропоновано підходи до немедикаментозного і медикаментозного лікування ренальної гіпертензії у дітей. Серед яких проведення корекції фізичної активності, харчування відповідно до основних вікових потреб дитини, в поєднанні з призначенням ренопротекторної терапії. Для стартового лікування рекомендовано використовувати препарати групи інгібіторів ангіотензин перетворюючого ферменту і блокаторів рецепторів до ангіотензину.

Ключові слова: ренальна артеріальна гіпертензія, діти, діагностика, ренопротекція.

The study is a fragment of the research project "Medical and biological adaptation of children with somatic pathology in modern conditions" 0118U000925.

The problem of high blood pressure (BP) among the child population is very relevant, because of its prevalence, the increase in morbidity and progression during the patient's growing up. Cardiovascular diseases in the life of adult patient are one of the causes of disability or death. The prevalence of arterial hypertension (AH) in children with normal body mass is about 3.5 %, with overweight or obesity – up to 24.8 % [9].

The incidence of AH in young children is between 1 and 5 %, and in adolescents it can be up to 10 %. To date, there is an increase in secondary forms of hypertension up to 70–80 % in pediatric patients with various chronic conditions (kidney pathology, sleep obstructive apnea syndrome, as well as in children born with low body weight), of which from 5 % to 25 % have a renovascular etiology. Between 35 % and 45 % of adults with chronic kidney disease (CKD), which arose in childhood, have renal hypertension (RH) and a significantly higher risk of death from cardiovascular catastrophe [1, 4, 8].

RH can be of two types. Parenchymal (renoparenchymal, nephrosclerotic) hypertension is a consequence of acute or subacute malignant glomerulonephritis, interstitial nephritis, chronic pyelonephritis, obstructive uropathy, vesicoureteral reflux, renal tuberculosis, acute and chronic renal disease, congenital kidney abnormalities, kidney problems due to systemic diseases, kidney injuries. Renovascular (vasorenal) hypertension occurs as a result of kidney ischemia and a decrease in pulse pressure, is formed when the renal artery and its branches are narrowed; in fibromuscular dysplasia, Takayasu's disease, thrombosis, Recklinghausen's disease, renal aneurysms, segmental hypoplasia, hemolytic uremic syndrome, renal vein thrombosis, renal vascular anomalies, systemic vasculitis, polycystic disease, nephroptosis. Renovascular hypertension is more typical for young children, when the possibilities for its correction mainly consist in effective interdisciplinary interaction and timely surgical correction. [5].

In patients with glomerular diseases, the prevalence of RH reaches 88 %, in children with hypo- or dysplastic kidney conditions – 38 %, with congenital or hereditary renal pathology – 57 % [11]. In young children with reflux nephropathy, RH develops in 10 %, in adolescence this index can increase to 18–20 %, in adults – up to 40 %.

The clinical picture of RH is determined by the level of hypertension, its stability, the nature of cardiovascular system lesion, the presence of urinary syndrome (especially proteinuria). It is important to remember that persistent diastolic hypertension leads to an increase in the size of the heart and changes in the fundus (in the form of swelling of the optic disc, retinal angiopathy). For a better assessment of blood pressure for a long time and to definitions the severity of RH, it is necessary to provide 24-hour ambulatory blood pressure monitoring (ABPM). Most patients with RH are classified as "non-dipper" (no physiological (10–22 %) decrease in blood pressure at night and in the morning). To reduce the risk of developing cardiovascular complications, it is necessary to prescribe a higher dose of antihypertensive drugs at night than in the morning or afternoon [6].

Angiotensin converting enzyme inhibitors (ACEI) are recommended for the treatment of hypertension in children and adolescents as first line drugs. In the absence of the effect of the maximum dose of an ACEI, angiotensin receptor blockers (ARBs) and diuretics are added, leaving calcium channel blockers in reserve for adults. The use of thiazide diuretics, for the purpose of treating RH in pediatric practice, remains controversial given their ineffectiveness with a glomerular filtration rate (GRF) of less than 60 ml/min. [7, 8].

The purpose of the work was to study blood pressure indicators in children with chronic kidney disease based on the results of daily monitoring to improve early diagnosis of renal hypertension and timely correction of therapy.

Materials and methods. 86 cases of CKD in children were analyzed that were inpatient treatment in the nephrology department of the KNP CHOR "Regional Children's Clinical Hospital" during 2018-2019. Among the examined 86 children, more than half were boys – 53 (61.6±5.2 %), and 33 girls (38.3±5.2 %), the mean age was 15.02±2.03 years. The patients were distributed according to the nosological forms of CKD: 40.6±5.3 % (35/86) of children had congenital anomalies of the urinary tract (CAUT), 30.2±4.9 % (26/86) chronic glomerulonephritis (CGN), 22.0±4.4 % (19/86) chronic pyelonephritis, 6.9±2.7 % (6/86) – hereditary nephritis in the form of Alport syndrome. All patients were examined according to the standard nephrological program to establish a diagnosis, with additional ABPM performed using the MDplus blood pressure monitoring complex (Russia, Novosibirsk).

For the correct assessment of BP indicators in children, we took into account the age, height and body weight of the child, used cuffs of the appropriate size, in accordance with the recommendations of the American Academy of Pediatrics (AAP), for the diagnosis and treatment of hypertension in children. During a standard examination, BP was measured only by the auscultatory method.

AH was diagnosed with an increase in the index over the 90th percentile. The comparison was carried out using tables of standard BP indicators recommended by the National Heart, Lung, and Blood Institute, department of Health and Human Services. (https://www.nhlbi.nih.gov/files/docs/guidelines/child_tbl.pdf) [2, 3]. For patients with CKD, lower blood pressure thresholds were used, which defined the 75th percentile, for patients without proteinuria, the 50th percentile, for patients with proteinuria, according to the recommendations of the European Society of Hypertension. When maintaining medical records, one should indicate the corresponding value of the percentile obtained to determine its degree of AH in accordance with the recommendation of the AAP, which are given in table 1 [9, 10].

Table 1

Criteria for defining BP categories and the AH severity in children

Child is under 13 y.o.	Child is older than 13 y.o.
Normal BP: <90th percentile	Normal BP: <120/<80 mm Hg
Increased BP: ≥90th percentile to <95th percentile or 120/80 mm Hg to 95th percentile *	Increased BP from 120/<80 to 129/<80 mm Hg
AH 1st degree: ≥95th percentile to <95th percentile + 12 mm Hg or 130/80 to 139/89 mm Hg *	AH 1st degree: from 130/80 to 139/89 mm Hg
AH 2nd degree: ≥95th percentile + 12 mm Hg to 140/90 mm Hg *	AH 2nd degree: ≥140/90 mm Hg

Note * – choose the highest one, BP – blood pressure, AH – arterial hypertension.

All children underwent ABPM, which makes it possible to establish the mean values of blood pressure during the day, to exclude "white coat hypertension", to determine the circadian patterns of blood pressure, taking into account the influence of the sympathetic nervous system.

□□bl□2

The value of the 50th and 95th percentiles of SBP and DBP for children depending for sex, age, and height with ABPM

Height, cm	BP mm Hg					
	24-hour		day		night	
	percentiles					
	50th	95th	50th	95th	50th	95th
boys						
120	105/65	113/72	112/73	123/85	95/55	104/63
130	105/65	117/75	113/73	125/85	96/55	107/65
140	107/65	121/77	114/73	127/85	97/55	110/67
150	109/66	124/78	115/73	129/85	99/56	113/67
160	112/66	126/78	118/73	132/85	102/56	116/67
170	115/67	128/77	121/73	135/85	104/56	119/67
180	120/67	130/77	124/73	137/85	107/55	122/67
girls						
120	103/65	113/73	111/72	120/84	96/55	107/66
130	105/66	117/75	112/72	124/84	97/55	109/66
140	108/66	120/76	114/72	127/84	98/55	111/66
150	110/66	122/76	115/73	129/84	99/55	112/66
160	111/66	124/76	116/73	131/84	100/55	113/66
170	112/66	124/76	118/74	131/84	101/55	113/66
180	113/66	124/76	120/74	131/84	103/55	114/66

Note: SBP – systolic blood pressure, DBP – diastolic blood pressure, ABPM – ambulatory blood pressure monitoring.

Data processing was carried out using content analysis, empirical-theoretical research methods: abstraction, generalization, analysis and synthesis. Statistical analysis of the data was carried out using the statistical packages "EXCEL FOR WINDOWS" 2016. The data were processed using parametric and nonparametric statistical methods by calculating the arithmetic mean and its statistical error using the Student's t-test method, the results obtained are presented as the mean and the arithmetic mean error, with a confidence level of $p<0.05$.

Results of the study and their discussion. According to the value of the daily BP index, 4 variants were distinguished: "dippers" – daily index of 10–22 %; "non-dippers" – daily index 0–10 %; "over-dippers" – daily index over 22 %; "night-peakers" – daily index less than 0 %. Children with "dippers" type in 41.8±5.3 % (36/86) cases prevailed among our patients. The second most numerous "non-dippers" variant was found in 38.3±5.2 % (33/86) of children with no nighttime BP reduction. Attention is drawn to the "over-dippers" type in 19.7±1.1 % (17/86) children, indicating an excessive nighttime decrease in blood pressure. In general, 58.1±5.3 % (50/86) of children have violations of circadian patterns of daily fluctuations in BP.

In addition, the following ABPM parameters were analyzed: the time index of systolic blood pressure (TI SBP) and the time index of diastolic blood pressure (TI DBP), the magnitude and velocity of the morning rise of SBP and DBP. RH was diagnosed with an increase in IT SAT or IT DBP by more than 20–25 % in the daytime and by more than 10–15 % at night. According to IT SAT, daytime RH was found in 19.7±4.3 % (17/86) cases, according to IT DBP – 16.2±4.0 % (14/86) of cases. Nighttime RH by indicators of IT SAT was in 24.4±4.6 % (21/86), with IT DBP in 31.3±5.0 % (27/86) of cases. RH was found to be 41.8±5.3 % (36/86) in children (with various combinations of IT SBP and IT DBP disorders).

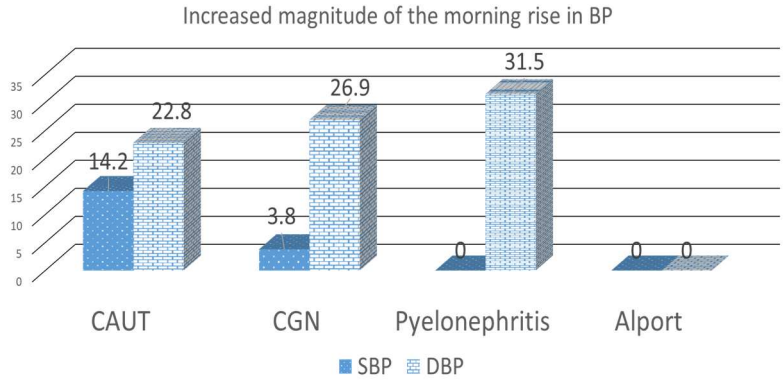

Fig. 1. Patients with increased value of size morning rise in SBP and DBP (BP – blood pressure, CAUT – congenital anomalies of the urinary tract, CGN – chronic glomerulonephritis, SBP – systolic blood pressure, DBP – diastolic blood pressure).

Changes in the magnitude and velocity of morning rise depending on the nosological form are presented in fig. 1 and 2.

In the each group, patients with increased values of the morning rise in BP due to DBP prevailed. This percentage was significantly higher among children with CGN and amounted to 26.9±8.8 % (7/26),

p=0.004, and children with pyelonephritis 31.5±10.9 % (6/19), p=0.014. Thus, for children with CKD in the background of different nosological forms an increase in DBP is characteristic, which is a significant predictor of the development of cardiovascular diseases in the future.

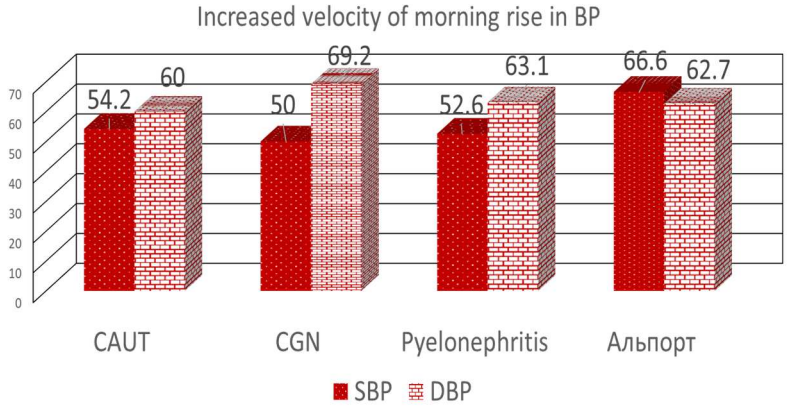

Fig. 2. Patients with increased the velocity of the morning rise in SBP and DBP (BP – blood pressure, CAUT – congenital anomalies of the urinary tract, CGN – chronic glomerulonephritis, SBP – systolic blood pressure, DBP – diastolic blood pressure).

As a result of the analysis of the velocity of the morning rise in BP, it was found that more than half of the children in the each group had an increased velocity of the morning rise in BP according to SBP in 53.4±5.4 % cases, according to DBP in 62.7±5.2 %. This indicates the presence of hyperactivation of the sympathetic-adrenal system in children with CKD.

After assessment of changes in BP in the examined children, the medical recommendations on the regimen, nutrition and renoprotective therapy were supplemented, taking into account the stage of CKD.

According to the National Kidney Foundation recommendations for slowing the progression of CKD in children with AH, our patients received the following recommendations:

– losing weight to reduce the risk of developing other serious health problems, such as diabetes and heart disease, which can worsen the course of RH;

– reduce the use of table salt and salty snacks – food should be undersalted;

– avoid the use of substances that can increase BP (smoking, caffeine, tonic drinks);

– be a physically active person on a regular basis.

Also, if necessary, we recommended changing the child's diet, taking into account the fact that it should contain the basic necessary nutrients to meet the physiological needs of a growing child's body for energy, taking into account the main nosological form of renal disease. A balanced diet will help normalize BP by reducing the excitability of the central nervous system, improve the functional state of the kidneys and adrenal cortex, and thereby normalize the water-salt balance and vascular tone.

All of the above requirements are met by the DASH (Dietary Approaches to Stop Hypertension) dietary recommendations, which provide for the predominance of fruits, vegetables, low-fat dairy products, whole grains and legumes in the diet of a person with AH, limiting sugar and salt intake. Adherence to a hyponatric diet reduces the risk of fluid retention in the body and thereby reduces the severity of AH.

In order to normalize body weight and support physical activity, all children over 5 years old and adolescents were recommended to devote at least 30 minutes daily to morning exercises or moderate dynamic (aerobic) physical activity.

Treatment effectiveness must be assessed by the level of proteinuria and BP. To obtain the desired result of treatment, its dose-dependent effect should be adhered when calculating the daily dose of an ACEI. With an antihypertensive purpose 0.2–0.4 mg/kg/day should be prescribed, for antiproteinuric action 0.5–0.8 mg/kg/day should be prescribed, for an anti-sclerotic effect 0.9–2.0 mg/kg/day should be used. In case of insufficient therapeutic effect from the maximum dose of the drug in monotherapy, a combination of different groups of drugs is required.

In children with CKD, ACEI were prescribed for renoprotective purposes in 67.4±5.0 % (58/86) patients, including patients with established RH (36/86) who received ACEI at different doses. Combined antihypertensive therapy was received by 23.2±4.5 % (20/36) of children with CKD and RH.

It should be remembered that with a significant decrease in BP, renal perfusion may deteriorate, even if the level of peripheral blood pressure is normal. In this case, ABPM and Doppler ultrasonography of the renal vessels will help to resolve the issue of the dosage of antihypertensive drugs.

When a pediatric patient has CKD and/or AH, the risk of progression of the pathological condition and the development of complications always increases. Early detection and timely examination of patients is part of the success in preventing the progression of these conditions. Taking measures to prevent complications and renoprotective therapy can stop the progression of RH. The standard of the effectiveness of all therapeutic measures remains the absence of progression and damage to target organs, as indicators of adequately and timely initiated renoprotection. Thus, primary care physicians, if they find risk factors or symptoms of CKD and RH in their patients, need to conduct an examination to clarify the genesis of the disease and determine treatment tactics.

1. Identification of risk factors in the analysis of family history and accounting of past diseases, operations associated with the pathology of the cardiovascular and urinary systems;

2. To perform a minimal examination: auscultatory blood pressure measurements using an age cuff; common urine analysis; determine the content of creatinine, urea and blood electrolytes, lipid profile and total cholesterol; echoscopic examination of the kidneys for all children under 6 years old, or patients over 6 years old with identified changes in previous analyzes. All of these tests can be used on an outpatient basis. If there is convincing evidence of the renal genesis of AH, the child should be referred to a specialized pediatric department for further examination.

Additional examination of pediatric patients may include: determination of the activity of renin, aldosterone in plasma, Doppler ultrasonography, renal scintigraphy (possibly after a test with captopril), computed tomography and magnetic resonance angiography of the kidneys.

The drug of choice in pediatric practice for starting renoprotective therapy is an ACEI, with timely dose adjustment or the use of combinations with other drugs from the groups of beta-blockers, calcium channel blockers or diuretics.

According to the results of ABPM, violations of the circadian patterns of blood pressure were revealed in 58.1±5.3 % (50/86) children. This fact makes it necessary to prescribe a larger dose of antihypertensive drugs in the evening than in the morning or afternoon to reduce the risk of cardiovascular complications [6].

It was found that more than half of children with CKD have an increased velocity of the morning rise in BP. RH was diagnosed in 41.8±5.3 % (36/86) of the examined children with CKD. Combined therapy of two antihypertensive drugs received 55.5±8.3 % (20/36) of patients with RAH. The latter group of patients has a tendency to rapid progression of CKD, which is consistent with the literature data [4, 11].

Along with this, even at the outpatient stage, patients with elevated BP over the 95th percentile should be prescribed non-drug treatment of AH, regardless of the need for pharmacological drugs [12]. Non-drug treatment of AH includes: correction of the daily regimen with sufficient exposure to fresh air; optimization of physical activity; rational nutrition; reduction of excess body weight, getting rid of bad habits (if the teenager already has it). The drug treatment of RH consists in the use of drugs with 100 % renoprotective effect.

Conclusions

1. When observing pediatric patients with CKD, it is necessary to provide: correct BP measurement using an age cuff; planned minimum laboratory and instrumental examination (clinical analysis of blood and urine, determination of creatinine and blood urea, ultrasound examination of the kidneys), preventive measures for complications and renoprotective therapy will stop the progression of RH.

2. For the purpose of timely detection of AH and early prescription of measures for its correction, it is advisable for all children with chronic heart failure to recommend daily monitoring of BP with the calculation of the rate of morning dynamics and the time index of SBP and DBP.

3. For 68.6±5.0 % (59/86) of children with CKD, a violation of circadian patterns of BP in the form of “non-dippers” and “over-dippers” is characteristic. 41.8±5.3 % (36/86) patients had RH. Combined antihypertensive therapy with ACEI + ARBs received 55.5±8.3 % (20/36) patients.

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THE CONDITION OF THE PERIODONTAL TISSUES IN CHILDREN WITH DELAYED TEETH ERUPTION

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The study of the periodontal tissues in children with delayed teeth eruption is of significant scientific and practical interest and an urgent task for dentistry. A survey of 124 children of 7 and 8 years of both sexes was conducted and comprehensive study of the periodontal tissues was performed in this children. The results of the studies indicate a high prevalence and intensity of the periodontal tissue diseases in the children 7 and 8 years old with delayed teeth eruption. As a result, a high need for children with delayed teeth eruption in the treatment of inflammatory diseases of the periodontal tissues and the need of developing a therapeutic and preventive complex for this category of children were identified.

Key words: gingivitis, delayed teeth eruption, oral health, survey, children.

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СТАН ТКАНИН ПАРОДОНТА У ДІТЕЙ З ЗАТРИМКОЮ ПРОРІЗУВАННЯ ПОСТІЙНИХ ЗУБІВ

Вивчення тканин пародонта у дітей із затримкою прорізування зубів становить значний науково -практичний інтерес і є актуальним завданням для стоматології. Проведено обстеження 124 дітей 7-8 років обох статей і проведено комплексне дослідження тканин пародонту у них. Результати досліджень свідчать про високу поширеність та інтенсивність захворювань тканин пародонта у дітей 7 та 8 років із затримкою прорізування зубів. В результаті було виявлено високу потребу дітей із затримкою прорізування зубів у лікуванні запальних захворювань тканин пародонта та необхідність розробки лікувально-профілактичного комплексу для цієї категорії дітей.

Ключові слова: гінгівіт, затримка прорізування зубів, здоров'я порожнини рота, опитування, діти.

The work is a fragment of the research project "Correction of pathogenetic mechanisms of disorders of carbohydrate and lipid metabolism in the body and tissues of the oral cavity in patients depending on environmental and nutritional factors affecting carbohydrate and lipid metabolism", state registration No. 0118U006966.

Recent studies denote a high prevalence of inflammatory diseases of the periodontal tissues in children [9, 10, 11]. Most often, children are diagnosed with chronic catarrhal gingivitis, the prevalence of which reaches 80 % according to some authors [1, 6].

Periodontal diseases are characterized by morphological and functional changes in the tissues, the prevalence and severity of which depends on the state of somatic health of the child, the level of oral hygiene and age-related structural features of the periodontal tissues [7, 12]. Untimely diagnosis and treatment of inflammatory diseases leads to impairment in the formation of the periodontal tissues in children, which subsequently often causes severe and irreversible damage to the periodontal tissues in adulthood. Therefore, the paramount task of pediatric dentistry is a timely diagnosis of the periodontal tissue diseases and treatment taking into account the age-related structural features of the periodontal tissues, as well as the etiological and pathogenetic characteristics of the disease.

Important causes of the inflammatory process in the tissues of the periodontium are diseases of the nervous and endocrine systems [8, 14, 15]. The above disturbances can also cause changes in the timing of