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THE ROLE OF VITAMINE D IN THE CLINIC OF CHRONIC KIDNEY DISEASE IN CHILDREN

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Abstract

Introduction. Knowledge of risk factors, progression mechanisms, and early predictors of chronic kidney disease (CKD) in children will help prevent the development of распишите аббревиатуру (ESRD) and forms the basis of a nephroprotective strategy.

The aim: To determine the frequency of vit D deficiency in children with kidney pathology and to substantiate the role of vit D in the prediction and progression of CKD in children.

Materials and methods: Clinical observational Case-Control study, the case group included 36 children from 0 to 17 years old inclusive with a diagnosis of chronic kidney disease (CKD), vitamin D disadvantage, who received treatment in the nephrology department of the Regional Children's Clinical Hospital. The control group included 54 children from 0 to 17 years old inclusive with a diagnosis of CKD with vitamin D disadvantage and \or with normal vitamin D content.

Results: n the case group, a naturally strong inverse relationship between vit D levels and arterial hypertension, sweating, irritability, edema, fatigue, and decreased appetite revealed. Correlation analysis showed an inverse relationship of average strength between vit D levels and laboratory indicators such as proteinuria, urinary syndrome, there is an inverse relationship of weak strength between vit D levels and concomitant diseases.

Conclusions: The main causes of the development of chronic kidney disease in children have been identified: UTI is complicated by urinary syndrome - 59%, congenital malformations - 24%, glomerular diseases - 17%. Significant features of the clinical course were determined: arterial hypotension syndrome - 32%; arterial hypertension syndrome – 3O.1%; left ventricular hypertrophy - 38.2%; anemia - 50.7%; increased uric acid in the blood - 38.4%; secondary hyperparathyroidism - 41.1%. In children of the main group, there is a strong direct relationship betwixt the level of vit D and GFR, vit D levels and the stage of CKD.

Key words: *chronic kidney disease, vit D, children, progression, prognosis.*

Аннотация

РОЛЬ ВИТАМИНА D В КЛИНИКЕ ХРОНИЧЕСКОЙ БОЛЕЗНИ ПОЧЕК У ДЕТЕЙ

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Введение. Знание факторов риска, механизмов прогрессирования, ранних предикторов ХБП у детей будут способствовать предупреждению развития тХПН и составляет основу нефропротективной стратегии.

Цель: определить частоту встречаемости дефицита витамина D у детей с патологией почек и обосновать роль витамина D в прогрессировании и прогнозировании ХБП у детей.

Методы. Клиническое обсервационное исследование Случай-Контроль, в группу случая включены 36 детей от 0 до 17 лет включительно с диагнозом хроническая болезнь почек (ХБП), имеющие дефицит витамина D, получивших лечение в отделении нефрологии Областной детской клинической больницы. В группу контроля включены 54 детей от 0 до 17 лет включительно с диагнозом ХБП с недостаточностью уровня витамина D и или с нормальным содержанием витамина D.

Результаты исследования В группе случай выявлена закономерно сильная обратная взаимосвязь между уровнем витамина D и артериальной гипертензией, потливостью, раздражительностью, отеками, утомляемостью,

снижением аппетита. Корреляционный анализ показал обратную связь средней силы между уровнем витамина D и такими лабораторными показателями, как протеинурия, мочевой синдром, отмечается обратная связь слабой силы между показателем витамина D и сопутствующими заболеваниями.

У детей контрольной группы также прослеживается сильная прямая связь между уровнем витамина D и СКФ, уровнем витамина D и стадией ХБП, корреляционный анализ показал обратную связь средней силы между уровнем витамина D и такими клиническими проявлениями, как отеки, раздражительность, утомляемость, артериальная гипертензия, снижение аппетита.

Заключение Определены значимые особенности клинического течения: синдром артериальной гипотензии - 32%; синдром артериальной гипертензии - 30,1%; гипертрофия левого желудочка - 38,2%; анемия- 50,7%; повышение мочевой кислоты в крови - 38,4%; вторичный гиперпаратиреоидизм - 41,1%.

Установлено, дефицит витамина D нарастает от стадии к стадии, при этом выявляется у 52% детей на второй стадии, и достигает максимума дефицита на пятой стадии, снижаясь в 10 раз.

Ключевые слова: *хроническая болезнь почек, витамин Д, дети, прогрессирование, прогнозирование.*

Түйіндеме

БАЛАЛАРДАҒЫ СОЗЫЛМАЛЫ БҮЙРЕК АУРУЫ КЛИНИКАСЫНДАҒЫ D ВИТАМИНІНІҢ РӨЛІ

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Өзектілігі Балалардағы созылмалы бүйрек ауруының (СБА) қауіп факторларын, прогрессия тетіктерін, ерте болжаушыларын білу (терминальды созылмалы бүйрек жекіліксіздігі) тСБЖ дамуының алдын алуға ықпал етеді және нефропротективті стратегияның негізін құрайды.

Мақсаты: бүйрек патологиясы бар балаларда D дәрумені тапшылығының жиілігін анықтау және балалардағы созылмалы бүйрек ауруының прогрессиясы мен болжауындағы D витаминінің рөлін негіздеу.

Материалдар мен әдістері. Клиникалық жағдай - бақылау зерттеуін, облыстық балалар клиникалық ауруханасының нефрология бөлімшесінде ем алған, Д витаминінің тапшылығы бар СБА диагнозы қойылған 0-ден 17 жасқа дейінгі 36 бала кіреді. Бақылау тобына 0 ден 17 жасқа дейінгі соның ішінде СБА диагнозымен қоса D дәрумені жеткіліксіз және\немесе қалыпты D дәрумені бар 54 бала кірді.

Зерттеу нәтижелері. Біздің зерттеуімізде D дәрумені деңгейі мен артериялық гипертензия, тершеңдік, ашуланшақтық, ісіну, шаршау, тәбеттің төмендеуі арасындағы табиғи күшті кері байланыс анықталды. Жағдай тобында D дәрумені деңгейі мен артериялық гипертензия, тершеңдік, ашуланшақтық, ісіну, шаршау, тәбеттің төмендеуі арасындағы табиғи күшті кері байланыс анықталды. Корреляциялық талдау D дәрумені деңгейі мен протеинурия, зәр шығару синдромы сияқты зертханалық көрсеткіштер арасындағы орташа күштің кері байланысын көрсетті, D дәрумені көрсеткіші мен қатар жүретін аурулар арасында әлсіз күштің кері байланысы байқалды.

Бақылау тобындағы балаларда D дәрумені мен GFR деңгейі, D дәрумені деңгейі мен ҚҚСД сатысы арасындағы күшті тікелей байланыс байқалады, корреляциялық талдау D дәрумені деңгейі мен ісіну, тітіркену, шаршау, артериялық гипертензия, тәбеттің төмендеуі сияқты клиникалық көріністер арасындағы орташа күшті кері байланысты көрсетті.

Қорытынды. Клиникалық ағымның маңызды ерекшеліктері анықталды: артериялық гипотензия синдромы- 32%; артериялық гипертензия синдромы - 30,1%; сол жақ қарыншаның гипертрофиясы - 38,2%; анемия - 50,7%; қандағы зәр қышқылының жоғарылауы - 38,4%; қайталама гиперпаратиреоидизм - 41,1%.

Д витаминінің жетіспеушілігі кезеңнен кезеңге дейін артады, ал екінші сатыдағы балалардың 52% - у анықталады және бесінші сатыдағы тапшылықтың максимумына жетеді, 10 есе төмендейді.

Түйінді сөздер *созылмалы бүйрек ауруы, Д дәрумені, балалар, прогрессия, болжау.*

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Introduction

CKD is a polymorphic symptom complex, and at advanced stages has a number of complications from many organ systems, thereby determining the prognosis of the disease and affecting the quality of life of patients. One of the significant aspects of this problem is the early diagnosis of both the disease itself and its complications [1-8].

Knowledge of risk factors, progression mechanisms, and early predictors of chronic kidney disease (CKD) in children will help prevent the development of terminal chronic renal failure (eSRD) and forms the basis of a nephroprotective strategy [1,2,3].

Given the insufficient data about the role of vit D deficiency in the progression of CKD, additional studies are needed to confirm the association of vit D deficiency in children with kidney pathology [4-8].

In each country, the prevalence of kidney diseases, risk factors, as well as the potential for the detection and treatment of such diseases should also be determined as a prerequisite for the fair prioritization and development of appropriate management [9-10].

Regardless of the original cause, chronic kidney disease this is a clinical syndrome characterized by a gradual loss of kidney function over time [11]. In particular, in the recommendations "Kidney Disease Improving Global Outcomes" (KDIGO) CKD is defined as a violation of the structure or function of the kidneys observed for more than 3 months, with health consequences.

According to the recommendations of KDIGO, CKD is presence of structural or functional kidney hurt, or reduce the glomerular filtration rate is lower 6O ml / min / 1.73 m2 for over 3 months. Consequently, the term CKD determine renal dysfunction as a continuous, discrete't alter in renal function. This complicates the learning of the prevalence of CKD.

The serum concentration of 25(0H) D is the best indicator of vit D status, since it reflects the total amount of vit D produced in the skin and obtained from food and dietary supplements (vit D in the form of a mono-drug or multi-vit Dand vitamin-mineral complexes), and has a fairly long half-life in the blood - about 15 days [12].

Vit D deficiency, both determined by levels of 25(0H) D less than 3O ng/ml and less than 2O ng/ml, is widespread worldwide.

Currently, insufficiency, and to a greater extent deficiency of 25(0H) D, is a pandemic affecting the predominant part of the general population, including children and adolescents [13].

The global consensus on the treatment and prevention of rickets recommends the prophylactic intake of vit D at a dosage of 400 IU/day in children of the first year of life at least 600 IU / day - in children older than one year [14]. Currently, there is a draft National Program "Vit D deficiency in children and adolescents of the Russian Federation: modern approaches to correction" (2017), which is based on existing consensus and recommendations [15,16].

Materials and methods. Clinical observational Case-Control study. The paper examines the data of patients who were on inpatient treatment in the nephrology department of the Regional Children's Clinical Hospital (Karaganda) with a diagnosis of chronic kidney disease. The observation period was 2018-2021. The case group included 36 children from 0 to 17 years of age inclusive with a diagnosis of chronic kidney disease (CKD) with vit D deficiency.

The control group included 54 children from 0 to 17 years old inclusive with a diagnosis of CKD with insufficient vit D levels and with normal vit D content. The sources of information were the medical records of the inpatient patient (f-003/u), extracts from the medical record of the inpatient patient (f-027-1/u).

-The criteria for inclusion of patients in the study were:

+ children's age;

+ the presence of CKD of different stages.

-Exclusion criteria:

+non-compliance with the criteria for inclusion in the study;

+refusal of the patient's parent from further participation in the study.

+ To conduct the study, the approval of the bioethics Committee in the JSC "MUK" dated September 27, 2019, Protocol No. 2

The glomerular filtration rate was calculated using the Schwartz formula [https://boris.bikbov.ru/2013/07/21/kalkulyator-skf-rascheta-skorosti-klubochkovoy-filtratsii/]:

GFR = Height (cm) / serum creatinine (mmol/L) × coefficient (ml/min/ 1.73 m^2).

The level of glomerular filtration rate (GFR) standardized on the body surface below 90 ml/min/1.73 m2 was considered a criterion for reducing kidney function.

All the children we observed with a decrease in glomerular filtration rate (GFR <60 ml/min / 1.73 m2) for 3 months were treated with stage 3 chronic kidney disease.

To describe the central position and absolute spread of the data, the mean value and standard deviation "M ± S" were used, and to estimate the relative spread, the coefficient of variation V was used, which characterizes the uniformity of the indicator and allows you to compare the uniformity of different indicators, regardless of their scale and units of measurement. If the coefficient of variation is less than 1O %, then the degree of data dispersion is considered insignificant, from 10% to 20% – average, more than 2O % and less than or equal to 33% – significant; if the value of the coefficient of variation does not exceed 33%, then the aggregate is considered homogeneous, if more than 33%, then heterogeneous. To describe the structure of the indicator, the median and quartiles "Me" and minimum and maximum were used to estimate the range of fluctuations of the indicator "Min; Max".

Statistical processing of the obtained results was carried out by nonparametric methods, the reliability of differences betwixt qualitative data was assessed using the criterion $\chi 2$ Pearson. Differences were considered significant (* – $p < 0.05$, ** – $p < 0.01$, *** – $p < 0.001$).

If the ratio of the difference of the compared averages to the difference error is less than 2, then the discrepancy betwixt the averages was considered unproven, if the ratio is not greater than 2, then it was considered non-random.

To establish the relationship betwixt the individual indicators, the correlation coefficient was determined.

The correlation coefficient of Spearman's nonparametric method was used to assess the differences in the frequency of signs in the compared groups.

To test the null hypothesis that Spearman's general

correlation coefficient is equal to zero with the competing hypothesis Hi. p ≠ 0 at the significance level α, it is necessary to calculate the critical point:

$$T_{kp} = t(\alpha,k)\cdot\sqrt{\frac{1-p^2}{n-2}}$$

where "n" is the sample size;

"p" is Spearman's sample correlation coefficient:

t(α, κ) - the critical point of the two-sided critical region, which is found by the table of critical points of the Student's distribution, by the level of significance of α and the number of degrees of freedom k = n-2. when $|p| < T_{kp}$ -no reasons to reject the null hypothesis. The correlation betwixt qualitative characteristics is insignificant. when |p|>Tkp - the null hypothesis is rejected. There is a significant correlation betwixt qualitative characteristics. The level of statistical significance was fixed at the error probability level of O.O5.

Statistical data processing was performed using the Statistica 10 and SAS JMP 11 application software packages.

During statistical data processing, methodological guidelines on the main methodological techniques of statistical analysis in biological and medical research were used [4].

Results

Analysis of the incidence and frequency of chronic kidney disease in children.

In the nephrological department of the Regional Children's Clinical Hospital during 2020-2022, 1,643 children with pathology of the urinary system received treatment.

Among the examined children, stage 1 CKD in 90 children (70.0%), stage 2 CKD in 17 children (18.9%), stage 3 CKD in 8 children (8.9%), stage 5 CKD in 2 children (2.2%). (Figure 1)

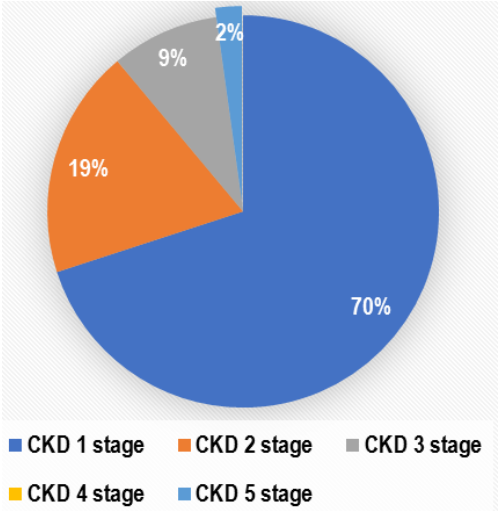

Figure 1. The structure of the incidence. of CKD by stages.

The main causes of the development of chronic kidney disease in children have been identified: UTI is an complicated by urinary syndrome - 59%, congenital malformations - 24%, glomerular diseases - 17%. Significant features of the clinical course were determined: arterial hypotension syndrome - 32.88%; arterial hypertension syndrome - 30.14%; left ventricular hypertrophy - 38.36%; anemia - 50.68%; increased uric acid in the blood - 38.36%; secondary hyperparathyroidism - 41.1%.

According to the results of the study, vit D deficiency was diagnosed in 36 people (40%), insufficiency in 17 people (18.9%), normal vit D levels in 37 people (41.1%). (Figure 1). The prevalence of vit D deficiency and insufficiency in children is 54 (54.8%) per 100 people. (Figure 2).

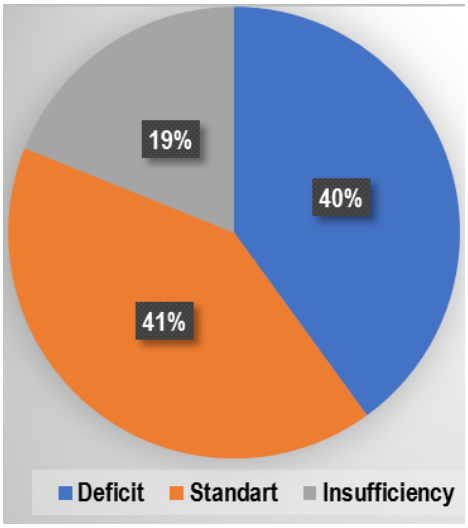

Figure 2. Prevalence of vit D deficiency in children.

Remark The level of reliability of the differences in absolute frequencies betwixt the groups was determined by the criterion z (* – p< 0,05; ** – p< 0,01; *** – p< 0,001).

It was found that vit D deficiency increases from stage to stage, while it is detected in 52% of children at the second stage, and reaches a maximum deficiency at the fifth stage, decreasing by 10 times.

When analyzing qualitative indicators using the Z-criterion, arterial hypertension was significantly more common in children with CKD with vit D deficiency and in children with CKD without vit D deficiency in the main group-58%, compared with the control group-16%, urinary syndrome in the main group -66%, in the control group - 18%, edema in the main group was found in 77%, in the control group - in 33%. Sweating was significantly more common in children of the main group-83%, control group-29%, proteinuria in children of the main group-80%, control group-31%, irritability in the main group -83%, control group -24%. There was a statistically significant increase in temperature in children of the main group -77%, control – 35% of cases, fatigue in the main group – 86% of children, in the control group – 29%, frequent urination in the main group was found in 61% of children, in the control group – in 31% of the studied. The relationship betwixt factorial and performance characteristics is statistically significant at a significance level of p <0.05. (Figure 3. Comparative characteristics of qualitative indicators in children with CKD with vit D deficiency and in children with CKD without vit D deficiency).

The data obtained in this study correspond to data in other scientific papers, according to which irritability, fatigue, sweating are most common in children with vit D deficiency.

Table 1. **Comparative characteristics of qualitative indicators using the Z-criterion in children with CKD with vit D deficiency and in children with CKD without vit D deficiency.**

Indicator		Main group 36		Control group 54		Test statistics: z	p- value
		abs	%	abs	%		
Gender	M	13	36,11	21	38,889	-0,266276851	0,790
	W	23	63,89	33	61,111	0,266276851	0,790
Arterial hypertension	No	15	41,6667	45	83,333	-4,107919181	<0,001
	Yes	21	58,3333	9	16,667	4,107919181	<0,001
bacteriuria	No	15	41,6667	34	62,9623	-1,987391816	0,047
	Yes	21	58,3333	20	37,037	1,987391816	0,047
paleness	No	13	36,1111	39	72,222	-3,397948297	0,001
	Yes	23	63,8889	15	27,778	3,397948297	0,001
pain during urine-emission	No	20	55,5556	37	68,519	-1,250199346	0,211
	Yes	16	44,4444	17	31,481	1,250199346	0,211
hematuria	No	23	63,8889	37	68,519	-0,456435465	0,648
	Yes	13	36,1111	17	31,481	0,456435465	0,648
dysuric syndrome	No	21	58,3333	18	33,333	2,344725476	0,019
	Yes	15	41,6667	36	66,667	-2,344725476	0,019
leukocyturia	No	14	38,8889	29	53,704	-1,378422823	0,168
	Yes	22	61,1111	25	46,296	1,378422823	0,168
urinary syndrome	No	12	33,3333	44	81,481	-4,615465416	<0,001
	Yes	24	66,6667	10	18,519	4,615465416	<0,001
edema	No	8	22,2222	36	66,667	-4,132202659	<0,001
	Yes	28	77,7778	18	33,333	4,132202659	<0,001
burdened heredity	No	26	72,2222	34	62,963	0,912870929	0,361
	Yes	10	27,7778	20	37,037	-0,912870929	0,361
increase in relative density	No	16	44,4444	36	66,667	-2,091045107	0,037
	Yes	20	55,5556	18	33,333	2,091045107	0,037
sweats	No	6	16,6667	38	70,37	-4,993078212	<0,001
	No	30	83,3333	16	29,63	4,993078212	<0,001
proteinuria	No	7	19,4444	37	68,519	-4,562640436	<0,001
	Yes	29	80,5556	17	31,481	4,562640436	<0,001
irritability	No	6	16,6667	41	75,926	-5,513691294	<0,001
	Yes	30	83,3333	13	24,074	5,513691294	<0,001
decreased appetite	No	14	38,8889	37	68,519	-2,778933897	0,005
	Yes	22	61,1111	17	31,481	2,778933897	0,005
concomitant diseases	No	27	75	42	77,778	-0,305233848	0,760
	Yes	9	25	12	22,222	0,305233848	0,760
stage of CKD	1	24	66,6667	39	72,222	-0,563436169	0,573
	2	5	13,8889	12	22,222	-0,989469127	0,322
	3	5	13,8889	3	5,5556	1,360931352	0,174
	4	0	0	0	0		
	5	2	5,55556	0	0	0,891401	0,373
temperature	No	8	22,2222	35	64,815	-3,962965617	0,191
	Yes	28	77,7778	19	35,185	3,962965617	<0,001
fatigue	No	5	13,8889	38	70,37	-5,255237015	<0,001
	Yes	31	86,1111	16	29,63	5,255237015	<0,001
frequent urination	No	14	38,8889	37	68,519	-2,778933897	<0,001
	Yes	22	61,1111	17	31,481	2,778933897	0,005

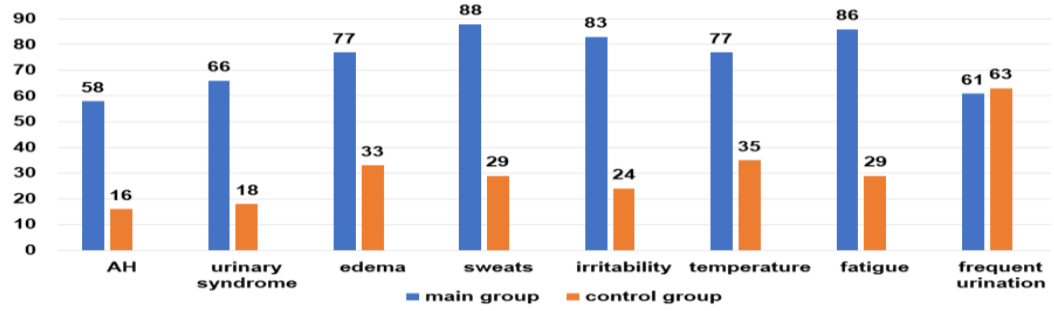

Figure 3. Comparative characteristics of qualitative indicators in children with CKD with vit D deficiency and in children with CKD without vit D deficiency.

Table 2. **Comparative characteristics of qualitative indicators using the Z-criterion in children of the main group, depending on gender.**

Indicator		Girls		Boys		Test statistics: z	p-value abs
		23		13			
		abs	%	abs	%		
AH	No	9	39,13043	6	AH	No	9
	Yes	14	60,86956	7	53,84615	Yes	14
bacteriuria	No	12	52,17391	3	bacteriuria	No	12
	Yes	11	47,82608	10	76,92307	Yes	11
paleness	No	7	30,43478	6	pain during urine-emission	No	7
	Yes	16	69,56521	7	53,84615	Yes	16
pain during urine-emission	No	15	65,21739	5	hematuria	No	15
	Yes	8	34,78260	8	61,53846	Yes	8
hematuria	No	17	73,91304	6	dysuric syndrome	No	17
	Yes	6	26,08695	7	53,84615	Yes	6
dysuric syndrome	No	10	43,47826	11	leukocyturia	No	10
	Yes	13	56,52173	2	15,38461	Yes	13
leukocyturia	No	11	47,82608	3		No	11
	Yes	12	52,17391	10	76,92307	Yes	12
urinary syndrome	No	7	30,43478	5	urinary syndrome	No	7
	Yes	16	69,56521	8	61,53846	Yes	16
edema	No	5	21,73913	3	edema	No	5
	Yes	18	78,26086	10	76,92307	Yes	18
burdened heredity	No	17	73,91304	9	burdened heredity	No	17
	Yes	6	26,08695	4	30,76923	Yes	6
increase in relative density	No	11	47,82608	5	increase in relative density	No	11
	Yes	12	52,17391	8	61,53846	Yes	12
sweats	No	3	13,04347	3	sweats	No	3
	Yes	20	86,95652	10	76,92307	Yes	20
proteinuria	No	4	17,39130	3	proteinuria	No	4
	Yes	19	82,60869	10	76,92307	Yes	19
irritability	No	4	17,39130	2	irritability	No	4
	Yes	19	82,60869	11	84,61538	Yes	19
decreased appetite	No	10	43,47826	4	decreased appetite	No	10
	Yes	13	56,52173	9	69,23076	Yes	13
concomitant diseases	No	17	73,91304	10	concomitant diseases	No	17
	Yes	6	26,08695	3	23,07692	Yes	6
stage of CKD	1	18	78,26086	6	stage of CKD	1	18
	2	2	8,695652	3	23,07692	2	2
	3	1	4,347826	4	30,76923	3	1
	4	0	0	0	0	4	0
	5	2	8,695652	0	0	5	2
temperature	No	4	17,39130	4	temperature	No	4
	Yes	19	82,60869	9	69,23076	Yes	19
fatigue	No	4	17,39130	1	fatigue	No	4
	Yes	19	82,60869	12	92,30769	Yes	19
frequent urination	No	9	39,13043	5	frequent urination	No	9
	Yes	14	60,86956	8	61,53846	Yes	14

When analyzing the data obtained, a statistically significant relationship betwixt qualitative laboratory, clinical indicators and gender was not revealed.

Table 3. Comparative characteristics of qualitative indicators using the Z-criterion in children of the control group, depending on gender.

Indicator		Girls		Boys		Test statistics: z	p-value abs
		33		21			
		abs	%	abs	%		
AH	No	30	90,9091	15	AH	No	30
	Yes	3	9,09091	6	28,571	Yes	3
bacteriuria	No	18	54,5455	16	bacteriuria	No	18
	Yes	15	45,4545	5	23,81	Yes	15
paleness	No	23	69,697	16	paleness	No	23
	Yes	10	30,303	5	23,81	Yes	10
pain during urine-emission	No	25	75,7576	12	pain during urine-emission	No	25
	Yes	8	24,2424	9	42,857	Yes	8
hematuria	No	20	60,6061	17	hematuria	No	20
	Yes	13	39,3939	4	19,048	Yes	13
dysuric syndrome	No	12	36,3636	6	dysuric syndrome	No	12
	Yes	21	63,6364	15	71,429	Yes	21
leukocyturia	No	16	48,4848	13	leukocyturia	No	16
	Yes	17	51,5152	8	38,095	Yes	17
urinary syndrome	No	28	84,8485	16	urinary syndrome	No	28
	Yes	5	15,1515	5	23,81	Yes	5
edema	No	22	66,6667	14	edema	No	22
	Yes	11	33,3333	7	33,333	Yes	11
burdened heredity	No	18	54,5455	16	burdened heredity	No	18
	Yes	15	45,4545	5	23,81	Yes	15
increase in relative density	No	20	60,6061	16	increase in relative density	No	20
	Yes	13	39,3939	5	23,81	Yes	13
sweats	No	27	81,8182	11	sweats	No	27
	Yes	6	18,1818	10	47,619	Yes	6
proteinuria	No	24	72,7273	13	proteinuria	No	24
	Yes	9	27,2727	8	38,095	Yes	9
irritability	No	25	75,7576	16	irritability	No	25
	Yes	8	24,2424	5	23,81	Yes	8
decreased appetite	No	23	69,697	14	decreased appetite	No	23
	Yes	10	30,303	7	33,333	Yes	10
concomitant diseases	No	22	66,6667	20	concomitant diseases	No	22
	Yes	11	33,3333	1	4,7619	Yes	11
stage of CKD	1	23	69,697	16	stage of CKD	1	23
	2	8	24,2424	4	19,048	2	8
	3	2	6,06061	1	4,7619	3	2
	4	0	0	0	0	4	0
	5	0	0	0	0	5	0
temperature	No	21	63,6364	14	temperature	No	21
	Yes	12	36,3636	7	33,333	Yes	12
fatigue	No	27	81,8182	11	fatigue	No	27
	Yes	6	18,1818	10	47,619	Yes	6
frequent urination	No	27	81,8182	10	frequent urination	No	27
	Yes	6	18,1818	11	52,381	Yes	6

When analyzing the data obtained, in the control group, frequent urination was significantly more common in boys – 52%, in girls - 18%.

The relationship betwixt factorial and performance characteristics is statistically significant at a significance level of $p < 0.05$.

Discussion

To date, chronic kidney disease in children is a complex multidisciplinary problem due to the development of frequent complications from many organ systems, often accompanied by disability, a significant deterioration in the quality of life of children and teenagers, as well as a high

risk of mortality [1-2, 4-5]. Moreover, CKD in childhood is characterized by its clinical course features, which are of fundamental importance and deserve special attention in terms of diagnosis and development of patient management tactics. At the same time, to date, despite the achievements of modern nephrology and pediatrics, the issues of early detection and reduction of the risk of complications of CKD remain unresolved, which requires the use of preventive measures and their adequate correction [10, 15].

The studied data indicate a high incidence of nephrological pathology in children, the number of which continues to increase annually. In 2022, the incidence reached 620 cases (in 2020 – 492 children, p <0.001). Thus, the dynamics of morbidity is disappointing. There is an annual increase (in 2020, renal pathology was diagnosed in 492 children, and in 2021 – 531 children (an increase of 7.9%), in 2022 -620 children (an increase of 16.7%). Thus, the increase from 2020 to 2022 was 26% (p <0.001). ***The main causes about development of chronic kidney disease in children have been identified***: UTI is complicated by urinary syndrome ***- 59%, congenital malformations - 24%, glomerular diseases - 17%. Significant features of the clinical course were determined: arterial hypotension syndrome - 32.88%; arterial hypertension syndrome - 30.14%; left ventricular hypertrophy - 38.36%; anemia - 50.68%; increased uric acid in the blood - 38.36%; secondary hyperparathyroidism - 41.1%.***

When analyzing qualitative indicators using the Z - criterion, children with CKD with vit D deficiency and children with CKD without vit D deficiency were significantly more distributed in

- arterial hypertension in the main group – 58%, in the control group – 16%,
- urinary syndrome in the main group – 66%, in the control group – 18%,
- edema in the main group occurred in 77%, in the control group - in 33%.
- sweating in children of the main group-83%, control-29%,
- proteinuria in children of the main group-80%, control-31%,
-irritability in the main group -83%, in the control group-24%.

Statistically significant was:

- increase in body temperature in children of the main group -77%, control – 35% of cases,
- fatigue in the main group – 86% of children, in the control group – 29%,
- frequent urination in the main group occurred in 61% of children,
- in the control group – in 31% of the examined.

The relationship betwixt factorial and performance characteristics is statistically significant at a significance level of p <0.05.

According to the results of the study, vit D deficiency was diagnosed in 36 people (40%), insufficiency in 17 people (18.9%), normal vit D levels in 37 people (41.4%). The prevalence of vit D deficiency and insufficiency in children is 54 cases (54.8%) per 100 people.

It has been found that vit D deficiency increases from stage to stage, while it is detected in 52% of children at the second stage, and reaches a maximum deficiency at the fifth stage, decreasing by 10 times. When analyzing statistically significant correlations in children of the main group, there is a strong direct relationship betwixt the level of vit D and GFR, the level of vit D and the stage of CKD [6-11]. The results obtained in our study also indicated a relationship betwixt clinical signs and vit D levels. A naturally strong inverse relationship betwixt vit D levels and arterial hypertension, sweating, irritability, edema, fatigue, and decreased appetite was revealed. Correlation analysis showed an inverse relationship of average strength betwixt vit D contents and laboratory indicators such as proteinuria, urinary syndrome. There is also an inverse relationship of weak strength betwixt the vit D index and concomitant diseases.

In children of the control group, there is also a strong direct relationship betwixt the level of vit D and GFR, the level of vit D and the stage of CKD. Correlation analysis showed an inverse relationship of average strength betwixt vit D levels and clinical manifestations such as edema, irritability, fatigue, hypertension, decreased appetite. In the control group, there is an inverse relationship of weak strength betwixt the vit D index and concomitant diseases. There is an inverse relationship betwixt vit D levels and laboratory indicators: hematuria, proteinuria, urinary syndrome.

The results of this study demonstrate that vit D deficiency is common in children with CKD. Determination of vit D levels in children with CKD is important for timely correction and prevention of further progression of CKD. Timely replacement therapy will improve the quality of life of a child with CKD and prevent the development of complications.

Contribution of the authors:

Dyussenova S.B. - scientific consulting, work with the editorial board.

Sarmankulova G. A. and Tlegenova K. S. – examination of children in the department, selection of children for analysis. Sabieva M.M. – search for literature. Kurilova V. V. – statistical processing of the material.

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