

## Condition of the Cardiovascular System in Children with Chronic Glomerulonephritis

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**Abstract:** It has been revealed that SCS disorders in chronic glomerulonephritis are functional in nature and manifest themselves as a high frequency of vegetative-vascular disorders, the formation of second-arterial hypertension, disorders of cardiac rhythm and repolarization in the myocardium, as well as accompanied by compensatory changes in the structural and geometric parameters of the left heart chambers.

**Key words:** chronic glomerulonephritis, children, cardiovascular system.

### Introduction

Over the last decade, the interest in cardiovascular lesions in kidney disease has sharply increased. Thus, the risk of cardiac pathology in patients with chronic glomerulonephritis is significantly higher than in the general population. Patients with chronic kidney disease are referred to the category of the highest risk of cardiovascular complications. Therefore, in-depth study of the cardiovascular system is a necessary condition for comprehensive characterization of the clinical course of CGN. At the same time, the state of the heart and vessels largely determines the clinical picture and prognosis of the disease. According to observations, in CGN, besides secondary changes of cardiac muscle, caused by hypertension, there are primary ones, which occur simultaneously with kidney damage. Changes in systemic hemodynamics and vascular tone can be markers of the efficiency or ineffectiveness of the kidneys to maintain the BP level, which will provide the appropriate level of metabolism in the tissues. There is an aggravation of clinical manifestations of CGN in children due to the involvement of the cardiovascular system in the pathological process. Changes in the heart in children with CGN occur in more than half of cases, and more often in boys. Relationship between glomerulonephritis and the cardiovascular system.

The first "scientific" nephrologist is rightly considered to be Richard Bright (1789-1858), who first described the morphology of glomerulonephritis (GN), uremic pericarditis, and LV cardiac hypertrophy in kidney disease. Since the report of J. Qoothart (1879) on heart failure in GN and heart conditions in various diseases of the urinary

system organs are devoted to numerous studies. It should be noted that the streptococcal etiology of GN gives the possibility of simultaneous effect of streptococcal infection on other organs and systems, primarily on the cardiovascular. Therefore, an in-depth study of the cardiovascular system is a prerequisite for a comprehensive characterization of the clinical course of GN. At the same time, the state of the heart and blood vessels largely determines the clinical picture and prognosis of the disease. As observations have shown, in GN, in addition to secondary

As the observations have shown, apart from secondary changes in the heart muscle, caused by hypertension, there are primary changes that occur simultaneously with kidney damage. They are expressed in the presence of serous effusion in the interstitial tissue of myocardium, separating separate bundles of muscle fibers from each other. In addition, in the heart damage in acute GN it is necessary to distinguish a sudden increase of extracellular fluid volume with anuria followed by acute circulatory overload. GN as an immunocomplex disease is always accompanied by intrarenal hemodynamics disorder, which in its turn leads to systemic hemodynamics disorder and its parameters such as BP, MV and SV, cardiac index.

Vascular and hemodynamic effects in renal parenchymal diseases are the outcome of humoral, mediator and morphological disorders. Changes in systemic hemodynamics and vascular tone can be markers of the efficiency or ineffectiveness of renal activity to maintain the level of BP that will provide the appropriate to the needs of the body the level of metabolism in the tissues. Currently, there is a clear idea about the leading role of hemodynamic disorders in the development of GN, about the role of AH in the development of hemodynamic disorders in patients.

There is an aggravation of clinical manifestations of the disease in children due to involvement of cardiovascular system into pathological process. Changes in the heart in children with GN occur in more than half of cases, more often in boys. At the same time, the data on the state of central hemodynamics in GN in children and adults are quite contradictory. Hemodynamic studies are more often fragmentary. Most authors assess changes in some parameters of central hemodynamics and their correlations with humoral factors; cardiac activity with its autonomic supply; microcirculatory disorders and hemodynamics of individual vascular regions with the state of cardiac energy. A number of authors, analyzing the power of LV contraction, found in adult individuals with hypertension and chronic GN with hypertension, a greater adaptation to physical load in hypokinetic circulatory type.

This allowed them to consider the transition to hypodynamic type as an adaptive compensatory reaction aimed at maintaining a sufficient level of blood circulation in arterial hypertension. N.F. Solovieva (1994) considers eu- and hypokinetic types of hemodynamics in sympathetic hypertension in adults less prognostically favorable due to the development of cardiovascular complications due to low cardiac output and venous blood return at high RHR [46]. Thus, the literature data do not give a clear answer on the prognostic value of this or that type of hemodynamics in adults.

According to different authors, acute and chronic GN in 70% of cases is accompanied by structural and functional myocardial changes. The works of Rakhmanov Z.K. and Beglarov R.O. (1998) in the study of functional state of LV myocardium in children with GN are of certain interest.

The studies have shown that in children with primary HN there are significant changes in the functional state of LV myocardium and peripheral hemodynamics that should be considered in

the planning of adequate therapeutic measures in this category of patients .L.Z. Akhmedova (2004, 2005) based on the study of secretory activity of sympathetic-adrenal system in HN in children revealed its activation and influence on AH depending on the form and course . Persistent AH, accompanying some variants of GN, promotes myocardial hypertrophy, and subsequently cardiosclerosis; transient BP elevations do not significantly affect myocardial status .If A.I. Dyadyk et al. (1997) argue that persistent AH, accompanying some variants of HF, leads to LV myocardial hypertrophy, followed by cardiosclerosis, and transient BP increases essentially do not influence myocardial status.

Usov (1996) adheres to the opposite point of view. Studying the state of central and regional hemodynamics, myocardial contractility, renin activity and plasma aldosterone content in inflammatory renal diseases in adults, the author revealed that their disorders occur already at the beginning of the disease and increase after AH accession. At the same time, the author did not observe significant differences between the indices of cardiac output, regional hemodynamics, myocardial contractility, renin-angiotensin-aldosterone system and electrolyte exchange in patients with chronic inflammatory kidney disease with symptomatic hypertension. This suggests similar mechanisms of AH development in these patients. In patients with inflammatory kidney disease with normal blood pressure, the author identified the predominance of hyperkinetic type of circulation.A.P. Schroeder, B.O. Kristensen, C.B. Nielsen et al. (1997) found by EchoCG in adult patients with chronic HF in remission to have higher indexes and decreased systolic systolic function of the LV. In addition, diastolic LV dysfunction was observed [58].Nevertheless, the outcome of HF in each particular patient remains uncertain . The great importance of hemodynamic disorders in the progression of the disease, as well as the simplicity of their study method, justify the search for new hemodynamic criteria in the possible chronicity of HN.A.M. Shutov, N.Y. Marder and G.A. Khamidulina (2005) studied clinical manifestations of chronic heart failure in patients with chronic kidney disease by EchoCG method and clarified the functional state of heart, revealed LV hypertrophy, diastolic dysfunction in the main contingent of patients .The work of A.S. Doletsky et al. devoted to the study of circulatory disturbances and its correction in children with acute renal failure on the background of hemolytic-uremic syndrome . The authors determined the types of hemodynamics in children with this pathology, as well as the course and prognosis of children with uremia, often depending on timely detection and correction of cardiovascular system disorders.So, analysis of the literature suggests that the cardiovascular system is mainly reflected in chronic renal failure, in GN in both children and adults. At the same time, the functions of all circulatory compartments are affected. At the same time the data on the degree of involvement of vessels and heart in the pathological process are contradictory.At the same time the data on the state of central hemodynamics, state of vessels in GN in children and adults are quite contradictory, in this connection we set a goal to study the state of cardiovascular system in patients with CHGN.

## MATERIALS AND METHODS

34 children with CGN were examined, 56.1% of them had nephrotic form, 43.9% - hematuric form. Diagnoses were formulated according to the International Classification of Diseases X revision (Geneva, 1995), clinical classification of chronic glomerulonephritis (Vinnitsa, 1979). The control group consisted of 32 healthy children. All children were examined at the nephrological department of KhorezmRegional Specialized Multiprofile Medical Center. The

children's age ranged from 7 to 15 years. Besides medical history taking, all the children underwent complex clinical, laboratory and instrumental examination, including biochemical blood analysis, general urine analysis, urine pH. The functional state of the kidneys was assessed according to the results of the Zimnitsky's test, the drying test, endogenous creatinine clearance, and serum urea level.

To evaluate clinical and functional state of the heart we conducted ECG registration on 6-channel electrocardiograph "CARDIOFAX ECG 882-OK", cardiac echocardiography on "SIM-5000" apparatus. The following additional examinations were made if necessary: ultrasound investigation, excretory urography, radioisotope study, consultations of narrow specialists.

### Results and discussion

The study of the medical history of the observed children showed that the debut of CGN fell on early and preschool age, the average age of onset of the disease being, respectively,  $6.9 \pm 0.5$  years.

$6.9 \pm 0.5$  years. Duration of CGN course was  $5.7 \pm 0.4$  years. At the time of investigation, 64.7% of children with CGN had laboratory activity of the process and 35.3% in clinical and laboratory remission, respectively. Clinical examination of children with CGN revealed intoxication (52.9%), pain (25.3%), edema (52.9%) and dysuric (26.4%) syndromes. Undifferentiated connective tissue dysplasia syndrome (NDDS) was diagnosed with high frequency. Moderate and severe NDDS were significantly more frequently determined in CGD patients in comparison with controls (67.4% and 15.6%,  $p < 0.01$ ). The average number of phenotypic signs per 1 patient in the main group was 2 times greater than in the control group ( $4.1 \pm 0.3$  and  $2.6 \pm 0.2$ ,  $p < 0.01$ ). Apart from phenotypic signs of dysplasia, abnormal structures of the urinary system were revealed in 61.7% of children with CGN in the form of renal malpositioning, hypoplasia, renal doubling, etc. Blood pressure level in 52.9% of children was within the norm.

"High normal" BP was found in 47.5 % of observations in children with CGN, secondary arterial hypertension in 23.5 % of cases, respectively. It was found that the autonomic dysfunction syndrome was significantly more frequent in children of the main group relative to the control group (73.5 % and 9.3 %,  $p < 0.01$ ). At the same time, vagotonic dysfunctions the vagotonic type of initial vegetative tone (68%) was predominant, eutonia was detected in less than a quarter of patients (24.0%), the sympathoThere were revealed predominance of ECG changes in the main group versus the control (87.5% and 15.6%,  $p < 0.01$ ). Atrial rhythm or pacing driver migration (14.7% and 3.1%,  $p < 0.05$ ), sinus bradycardia (11.7% and 3.1%,  $p < 0.05$ ) were more frequently found among cardiac rhythm disorders in children patients. The changes of repolarization processes in myocardium were registered in 44.1% of cases in the study group and in 6.2% of cases in the control group ( $p < 0.01$ ). There were no significant differences in ECG examination depending on the severity and laboratory activity of the process. Ultrasound examination of the main follow-up group showed high percentage of dysplastic changes as abnormal LV chords (singular apical, median-apical - 75%, multiple - 23.5%), mitral valve prolapse (23.5%), valve dysfunction accompanied by mitral (14.7%) and tricuspid (11.7%) regurgitation.

Analysis of structural-geometric parameters of left heart chambers revealed a significant increase in LV size in children of the main group compared to healthy children ( $2.6 \pm 0.01$ ,  $p < 0.05$ ). Volumetric indexes of LV (KDO, CSF) tended to increase in children with CGN

compared with control. There were differences in structural and volumetric parameters of the left chambers depending on the disease severity. tendencies for increased LV volumes (CRC, CSF). The findings can indicate the presence of LV volume overload in CGN patients and, probably, the development of left heart chamber remodeling as eccentric LV myocardial hypertrophy at disease progression.

Almost one third of the main group patients (29.4%) had a hypokinetic type, which tended to be higher in comparison with children from the control group. Hyperkinetic type occurred in single observations. Elevation of total peripheral vascular resistance (TPR) was observed more frequently in the study group than in the control group both in eukinetic (23.5%,  $p<0.05$ ), and hypokinetic types of hemodynamics (17.6%,  $p<0.05$ ). we have not obtained There were no differences in changes of RPS depending on laboratory activity and severity of pathological process in the kidneys.

### Conclusions

Cardiovascular disorders in CHGN are of functional nature and manifest in the form of high frequency of vegetative vascular disorders, secondary arterial hypertension formation, stress of adaptive mechanisms, disorders of cardiac rhythm and repolarization in myocardium. The increase in severity of clinical and functional changes in ChGF is accompanied by compensatory changes in structural-geometric parameters of the left heart chambers, the increase in asynchronous motion of LV myocardium regions, the decrease in contribution of regions to the total cardiac output. Eukinetic and hypokinetic types of hemodynamics in children with chronic glomerulonephritis are often accompanied by the increased total peripheral vascular resistance.

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