

COMPREHENSIVE ULTRASOUND DIAGNOSTICS OF GLOMERULONEPHRITIS IN CHILDREN

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Abstract. *Glomerulonephritis is a group of immune kidney diseases characterized by primary glomerular lesion and subsequent involvement in the pathological process of interstitium with a tendency to progression, transition to nephrosclerosis and the development of chronic renal failure syndrome. Until recently, there were no highly informative methods of reliable assessment of hemodynamic changes in the kidneys in nephrology. With the advent of Dopplerography methods in medicine, attempts have been made to use them for dynamic assessment of blood flow in the kidneys. Dopplerography methods are used, as a rule, to diagnose lesions of the main arteries having a relatively large diameter. However, the assessment of Dopplerographic indicators at various levels of the renal artery in glomerulonephritis in children is very relevant.*

Keywords: *children, kidneys, glomerulonephritis, ultrasound diagnostics, dopplerography.*

Relevance. Glomerulonephritis (GL) is a group of diseases with immuno-inflammatory lesions of the glomeruli (Sethi S., 2012; Kronbichler A. et al., 2015; Couser W.G., 2016). The classic representative of the GN group is postinfectious GN (PIGN), which can have both acute and chronic course.

In 1/3 of cases, acute PIGN becomes chronic. Chronic GN is a steadily progressing disease, cases of recovery from it are casuistically rare. In countries with a high socio-economic level of development, chronic GL ranks third among the causes of chronic kidney disease (CKD), and in a number of Asian and African countries - the first, which is due to the high prevalence of infectious diseases in the latter, the lack of conditions for effective treatment of diseases that contribute to the development of GL (Ayodele O.E., Alebiosu C.O., 2010; Jha V. et al., 2013).

In Uzbekistan, GL acts as the leading cause of terminal chronic renal failure, incompatible with life and requiring expensive renal replacement therapy (dialysis, transplantation of a donor kidney) (Bikbov B.T., Tomilina N.A. 2016). Currently, to establish the nature of the clinical course - acute and chronic course of GN, clinical and anamnestic data, general laboratory, biochemical studies of blood and urine, radiation research methods, determination of glomerular filtration rate - GFR (Mukhin N.A. et al., 2011) are used.

However, in clinical practice, difficulties often arise in the timely differentiation of acute GL and exacerbation of chronic GL at an early stage of the disease due to the lack of specific criteria for their diagnosis. It is usually possible to establish chronic GL when significant, irreversible damage to the kidneys has already occurred with the development of nephrosclerosis and the opportunity for timely diagnosis and treatment that prevents the progression of the pathological process in the kidneys has been missed.

The purpose of the study. Assessment of renal vascular hemodynamics in various clinical forms of glomerulonephritis in children.

Material and methods. To achieve this goal, a study was conducted of 74 children with GL, and 15 practically healthy children aged 3 to 18 years. The National Medical Center's nephrourology department was treating and examining the patients while they were hospitalized patients. Solving the issues of diagnosis, we were guided by the classification adopted at the All-Union Symposium of Pediatricians and Nephrologists [2]. All patients were examined in a state of preserved kidney function and were divided into 3 clinical groups. In Group 1 included children with nephrotic AGN syndrome (22 patients: boys - 16, girls - 6); group 2 consisted of children with nephrotic syndrome with hematuria (89 patients, including boys — 5, girls - 4); and group 3 consisted of children with nephrotic CGN (43 patients: boys - 27, girls - 16). Treatment of patients with CGN was carried out in the conditions of the nephrological department in a differentiated manner, taking into account the clinical form of the disease and the functional state of the kidneys, by traditional methods of pathogenetic therapy. Repeated examination of patients was carried out after reaching remission.

In addition to clinical examination, paraclinical methods were also used. Ultrasound examination (ultrasound) was performed on all patients in dynamics, during various periods of kidney disease activity, and included a complete examination of the abdominal organs in B -mode and a subsequent triplex kidney scan, including a greyscale mode, a flow cartogram and a spectral analysis of blood flow. The study was carried out on an APLIO 500 ultrasound machine using a convex sensor with a scanning frequency of 3.5 and 7.5 MHz.

The peak systolic blood flow velocity (Vps), the end diastolic velocity (EDV) and the time-averaged maximum blood flow velocity (Tmax) in the trunk of the renal artery, in the segmental, interlobular and arc arteries were determined. However, given that the accuracy of determining absolute blood flow rates largely depends on the magnitude of the angle between the long axis of the vessel and the ultrasound beam, and for distal renal arteries it is difficult to control, the assessment of renal hemodynamics was carried out by calculating "almost angle-independent" indices - resistance index RI (norm 0.6-0.7), pulsator index PI (the norm is 1.0-1.5) and the systolic-diastolic S/D ratio (the norm is 2.5-3.5). There was a significant high degree of direct correlation between all three indices of vascular resistance ($r=0.92$; -0.96 , <0.05). The total examination time ranged from 15 to 35 minutes.

We did not find significant age differences among healthy children, so we considered it possible to use the average values obtained in the group.

The results of the study. Analysis of pulse dopplerometry indicators showed that with all the nosological forms under consideration, violations of renal hemodynamics are noted during the active period of the disease. The most preserved blood flow was observed in patients with acute GL, nephrotic form. In this group, renal hemodynamic parameters were slightly lower than normal only at the level of the arc artery. They were not disturbed in the larger arteries. When analyzing the parameters of pulse Dopplerometry in the active period of GL without extrarenal manifestations, it was found that with AGN, all indicators of vascular resistance at all levels of the renal artery remained almost within the normal range, with the exception of a slight decrease in PI at the level of the arc artery.

The echo graphic picture of chronic glomerulonephritis in the greyscale mode depended on the phase and duration of the disease, so in the initial stages it was possible to note a slight increase in kidney volume and a slight increase in the echogenicity of the parenchyma. There were also more pronounced violations of CDK indicators: turbulence of blood flow (31.3%), asymmetry

of hemodynamic parameters (34.4%), location of rare, thinned and deformed vessels (6.3%), diffuse depletion of vascularization (31.3%).

When analyzing the velocity parameters of pulse dopplerometry in the active stage of CGN in children, there were no violations in large vessels, but starting from the interlobular artery they decreased, characterized by a significant decrease in diastolic blood flow velocity (Vd): 7.4 ± 0.08 mm/sec and 9.33 ± 0.28 mm/sec, respectively, $p < 0.05$. An increase in the resistance index (Ri) (norm 0.6-0.7) was also noted, amounting to in the trunk of the renal arteries (0.72 ± 0.04 , $p < 0.05$), in the segmental artery (0.65 ± 0.06 , $p < 0.05$), in the interlobular arteries (0.60 ± 0.04 , $p < 0.05$) and in the arc artery (0.53 ± 0.04 , $p < 0.05$); the pulsator index (Pi) (norm 1.0-1.5) was in the trunk of the renal arteries (1.47 ± 0.15), in the segmental artery (1.22 ± 0.18), in the interlobular arteries (1.00 ± 0.10 , $p < 0.05$); the systolic-diastolic ratio (S/D) (norm 2.5-3.5) was in the trunk of the renal arteries (3.52 ± 0.39), in the segmental artery (3.08 ± 0.39 , $p < 0.05$), in the interlobular arteries (2.41 ± 0.27 , $p < 0.05$) and in the arc artery 2.24 ± 0.14 .

In the absence of extrarenal manifestations, the blood flow suffered mainly in the small (arc) arteries of the kidneys and was characterized by a decrease in vascular resistance indices. During the subsiding of GN, blood flow disorders in the form of a decrease in resistance indices occurred only in the arc artery. During remission, there was also no complete normalization of vascular resistance indicators (a slight decrease in indicators at the level of the arc artery was detected).

Thus, in the active period, with all the considered variants, there were violations of renal blood flow. However, it was most preserved in patients with the hematuria form of GL.

Conclusions. Thus, according to pulse Dopplerometry, the state of renal blood flow in GL is disturbed at various levels of the renal artery (in the trunk of the renal artery, segmental, interlobular and arc arteries). The most pronounced hemodynamic disorders are observed in the small arteries of the kidneys - interlobular and, especially, arc. At the same time, blood flow in large arteries can remain normal.

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