CHRONIC KIDNEY DISEASE IN CHILDREN: PECULIARITIES OF MULTIPARAMETER ECHOGRAPHY

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https://doi.org/10.5281/zenodo.10380502

Abstract. *The most pressing problems facing modern pediatrics and nephrology is chronic kidney disease (CKD) which is associated with an orderly onset of disorders in patients in childhood, a constant increase in the incidence of chronic progressive kidney disease and the occurance of chronic renal failure (CRF). Despite recent advances in nephrology, reducing the risk of problems associated with delayed CRF and reduced kidney function remains a challenge in the early detection and prevention of kidney disease of various etiologies.*

Keywords: *kidney, labarotory diagnostics, complex echography, Doppler sonography, chronic kidney disease.*

Relevance. An abnormality in creatine levels over a period of several month to several years is called chronic kidney disease (CKD). CKD is based on the degree of kidney damage calculated from the Reduced Glomerular Filtration Rate (GFR) (i.e.<60ml/min per 1.7m for more than three months).

Ultrasonography is non-invasive and inexpensive examinations with sufficient anatomical details necessary for diagnosing kidney diseases without irradiation or contrasting of the patient and therefore has replaced standard radiography in our country and abroad [3-5].

All of these factors contribute to the early detection and prediction of renal dysfunction necessary for making a therapeutic decision. When using echography in the B-mode the length of the kidney, the thickness and echogenicity of the renal parenchyma are studied, in addition, this mode makes it possible to detail the pelvicalyceal systems [6]. This information helps to determine the degree of damage to the renal parenchyma and the possibility of ero-reversebility [7,8], as well as decide on a kidney biopsy [9].

In interstitial fibrosis and glomerulosclerosis, due to fibrosis, the echogenicity of the parenchyma increases [10], and an increase in echogenicity can also occur with interstitial inflammation. There is a significant correlation between kidney length, parenchymal echogenity, glomerular sclerosis or tubular atrophy.

Kidney morphology can be determined using a number of methods, including measuring the length, and volume of the kidneys, as well as the thickness of the renal cortex. Kidney function can also be assessed from kidney length, cortical thickness and important clinical decisions can be made based on this. Therefore, dynamic echographic studies are carried out to detect insufficiency in the progression of renal recovery. Although renal parenchymal volume is a fairly accurate measurement in patients with end-stage renal disease, in healthy patients' measurement of the longitudinal length kidney is sufficient. Ultrasound is an informative method to confirm renal failure and progression of the disease.

Purpose of the study. To study the possibilities of complex echography in the diagnosis of chronic kidney disease in children.

Material and research methods. All examinations were carried out in the radiology departments of the National Children's Medical Center and the clinic of the TashPMI, from

January to October 2022. All children referred for kidney ultrasound with elevated creatinine were taken into account, the total number of patients was 70 children.

The study group included children with stage 3/4/5 CKD and GFR<60ml/min, and children older than 10years (41(58.5%) boys and 29(41.5%) girls were included in the study. Patients with acute kidney injury, transplanted kidney, children on hemodialysis, chronic liver disease solitary kidney were excluded from the study. Complex echography of the kidneys was performed using a standard ultrasound machine Aplio500 (Japan) in gray scale, color Doppler mapping and pulsed wave Doppler using a convex transducer with a frequency of 3.5-5.0 MHz. the echogenicity of the parenchyma of both the liver and kidneys was assessed using imaging with low tissue harmonics and speckle reduction to reduce intratissue displacement. Gain and temporal gain compensation were adjusted manually. Volume and thickness were measured in a segment perpendicular to the presumed longitudinal axis of the kidney according to longitudinal imaging. It was not necessary to hold the ultrasonic transducer perpendicular to the skin, but the level of this cross section was placed close enough to the hilum of the kidney, but at the same time free from the pelvis.

Research results. The term CKD refers to progressive kidney damage that may worsen over time and is due to structural or functional problems. The kidneys stop functioning as the damage worsens, whether or not there is a decline in GFR. This is evidenced by histological data, changes in markers of kidney damage or variations in imaging tests.

In the course of the study we studied the functional ability of the kidneys in CKD using complex ultrasound methods, determining GFR using serum creatinine in our study was 1.25mg/dl for grade 0, 1.85mg/dl for grade 1, 2.5 mg/dl for grade II, 3.27 mg/dl for grade III and 5.03 mg/dl for grade 4. The main ultrasound criteria in the greyscale mode were an uneven increase in the echogenicity of the renal parenchyma, with a decrease in the thickness of the renal parenchyma. As the pathological process progressed, a decrease in the-anterior-posterior size of the kidneys was determined as well as unevenness and tuberosity of the contours, which meant cortical fibrosis. This study showed that the average thickness of the renal parenchyma was 8.3mm. As echogenicity increased, a decrease in mean parenchymal thickness was observed. The main features of changes in CFM ultrasound parameters in children with CKD included asymmetry of hemodynamic parameters, diffuse depletion of the intrarenal vascular pattern due to reduction or absence of small branches of segmental arteries, blood flow turbulence, and the presence of unusual thinned and deformed vessels. It was determined that in patients with stage 2 CKD there were significantly more pronounced violations of the color flow parameters than in patients with stage 1 CKD, including blood flow turbulence (Vmax-52.5 and Vmin-33.3), asymmetry of hemodynamic parameters (Vmax-52.5 and Vmin-33.3) location of rare thin and deformed vessels (Vmax34.4 and Vmin-1.5) and diffuse loss of vascularization (Vmax-52.5 and Vmin-33.3).

PW Doppler showed that children with CKD were much more likely to have decreased maximum systolic velocity and minimal diastolic velocity than children without symptoms of CKD. With the progression of the disease, there was a decrease in systolic velocity of blood flow in the interpolar arteries in patients with stage IV-V CKD compared with the stage III. In patients with stage 1-2 CKD, diastolic blood flow velocity decreased significantly as CKD progressed, indicating impaired intrarenal hemodynamics. Diastolic blood flow velocity decreases to 5.2% as CKD progresses (stages 3-4). Dopler indices of resistance index in interlobar arteries in patients with stage 1-2 CKD corresponded to normal values, while this study had the lowest informative value. As the disease progressed, the systolic-diastolic ratio increased. Allowing this indicator to be used both for early diagnosis and for predicting the progression of CKD in children. With further progression of the disease, a violation of renal hemodynamics was revealed in the form of decrease in intrarenal blood flow with an increase in the resistivity index as well as an increase in

the ratio of systolic to diastolic. As serum creatinine increases, the echogenicity of the renal cortex increases. Because changes in renal echogenicity are irreversible, an echographic classification of CKD can be done to assess the severity of CKD.

Conclusions. Thus, the best echographic parameter correlated with serum creatinine level, the echogenicity of the renal cortex and its gradation in comparison with the longitudinal length, thickness of the parenchyma and the thickness of the cortical layer in patients with CKD, Doppler ultrasound also replaces X-ray angiography and the advantage of this method over other imaging methods is that provides real-time assessment of blood flow time

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