

Modern solutions for diagnosis of kidney in obese children

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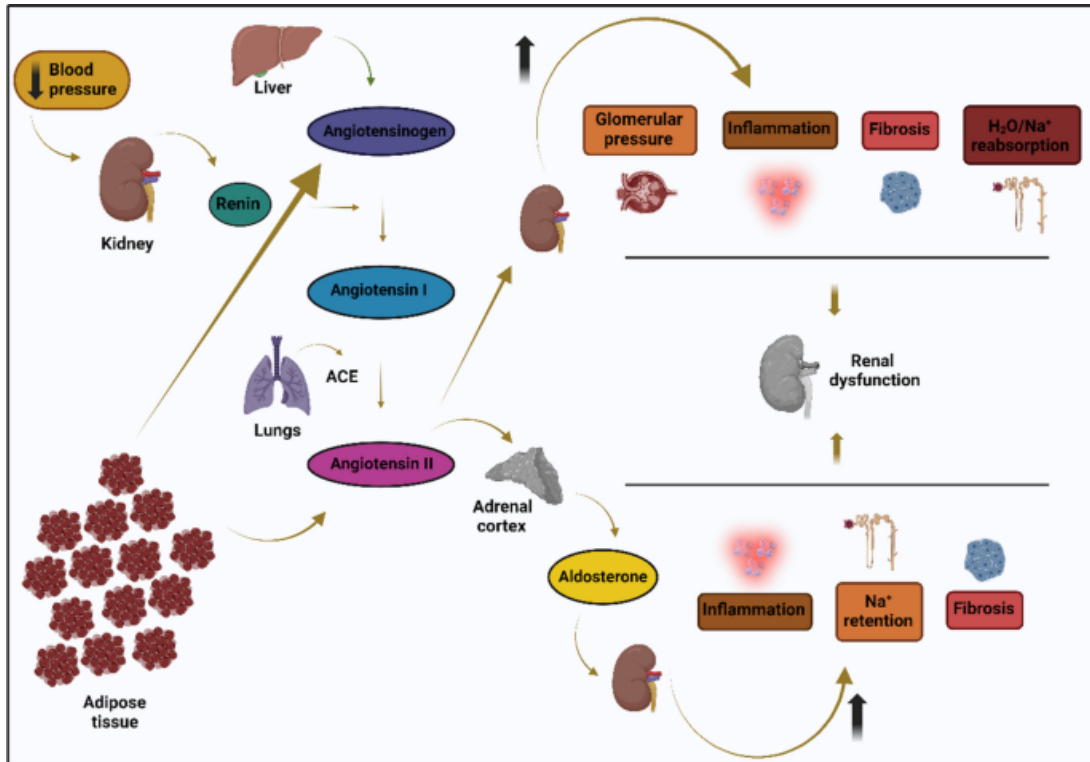
Conclusion. *The study of the vascular bed by the Doppler method makes it possible in practical medicine to evaluate the intrarenal hemodynamics of the vascular bed and the functioning of the organ itself. Dopplerographic examination is scanning in the pulse Doppler, color and power mapping modes. The pulse Doppler mode helps to evaluate the qualitative characteristics and speed indicators of renal hemodynamics. Today, the methods of color Doppler mapping and power Doppler have begun to be widely used to detect nephropathy. The main goal of these methods is to evaluate the dislocation of intrarenal vessels, their transverse diameter, as well as the degree of blood supply to the kidney tissue [3,6.8].*

Power Doppler allows visualization of low-velocity blood flow and is recommended for use in assessing normal intrarenal vascular network and identifying areas of ischemia in the kidneys [7,10,12]. Due to the use of power Doppler in 3D mode, it is recommended by scientists for visualization of small renal vessels, up to numerous interlobular arteries [14-16].

Keywords: *Color Doppler, ultrasound, elastography, Power Doppler mapping, Doppler mapping.*

Introduction. In publications of Russian and foreign scientists there are references to the classification of M. Bertolotto et al. (2000) for assessing the blood supply to the kidney using the power Doppler method. According to it, normal vascularization of the renal parenchyma and visualization of the interlobular vessels up to the capsule itself corresponds to 4 points. Under the condition of poor visualization of the distal sections of the interlobular arteries, the blood supply to the kidney corresponds to an assessment of 3 points, if the number of visualized interlobular vessels is reduced and they acquire a distorted appearance, according to the classification this corresponds to 2 points. 1 point of renal vascularization corresponds to single blood flow signals in the cortical layer, and at 0 points, parenchymal hemodynamics are not visualized [9,15].

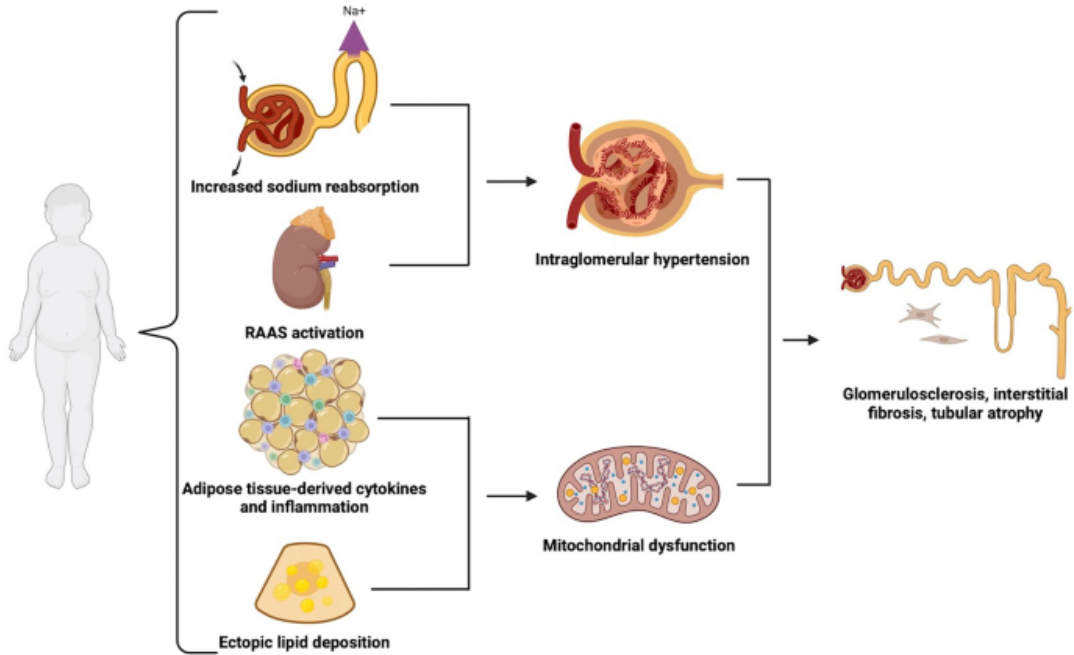
Color Doppler mapping evaluates systolic and diastolic blood flow velocity of the intrarenal vascular architecture, which indirectly reflects the filtration capacity of the kidneys. Blood flow velocity criteria depending on the level of the arteries: the level of the interlobar arteries - systolic blood flow velocity is normally 30-40 cm/s, and the average blood flow velocity is about 20 cm/s; the level of the arcuate arteries - systolic blood flow velocity is 20-30 cm/s, the average velocity is about 15 cm/s; the level of the interlobular arteries of the cortex - systolic blood flow velocity is 15-20 cm/s, the average velocity is about 10 cm/s.



In the studies of V. V. Bekezin (2017) it was shown that the maximum blood flow velocity in the renal vein in an unchanged kidney is 21.9 ± 1.7 cm/s. The minimum blood flow velocity in the renal vein should not normally be lower than 10 cm/s. A decrease in blood flow velocity in the distal parts of the renal vein indicates hypertension in the veins of the renal parenchyma [12-14].

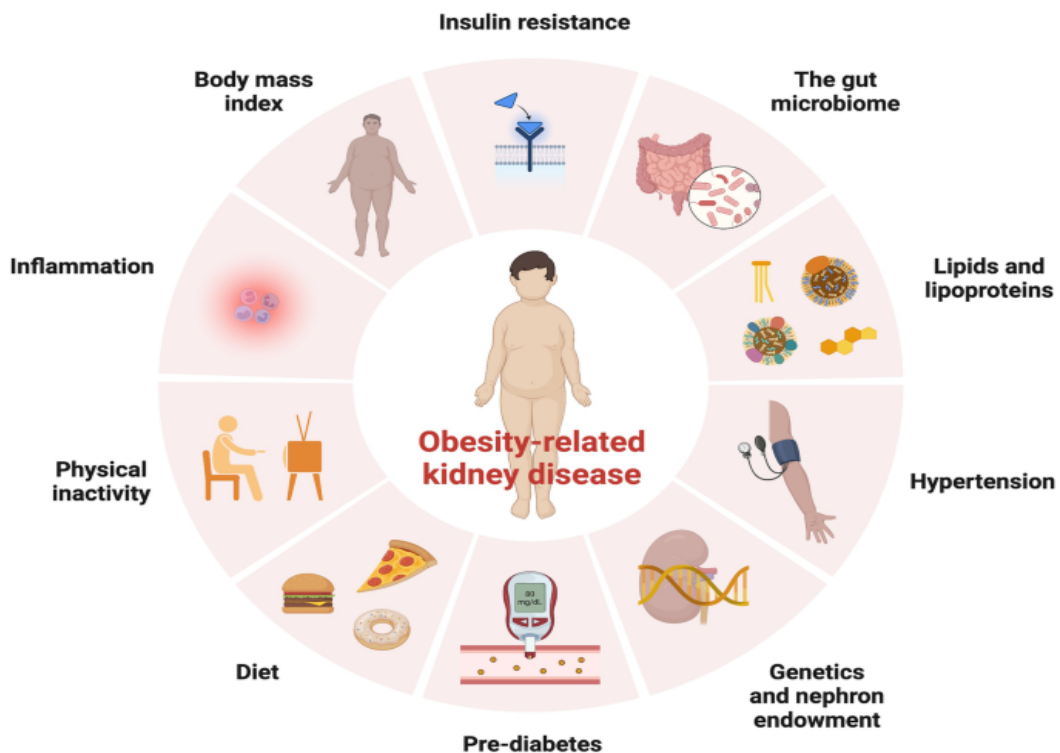
After the introduction of such an ultrasound mode as color Doppler mapping into practice, it became possible to measure the diameter and topography of the renal vessels, as well as to assess the vascularization of the renal parenchyma [21-24]. Schwartz G. J. in 2009 showed that in overweight children, in order to determine the severity of kidney damage, along with an assessment of the glomerular filtration rate and microalbuminuria , it is necessary to use color Doppler mapping [18-19]. Some authors note that in children with 3rd and 4th degree obesity, the type of blood flow according to color Doppler mapping is characterized by hyperperfusion glomerular apparatus of the kidney and microalbuminuria .

In case of acceleration of glomerular filtration in children and adolescents with excess weight and obesity, the increase in systolic blood velocity in the renal vessels recorded by Doppler ultrasonography may indicate intrarenal hypertension. A number of observations of children with obesity have established a decrease in the diameter of the renal vessels, which undoubtedly leads to hypoxia of the renal parenchyma. In children with visceral obesity, the presence of a complex of factors such as microalbuminuria , parenchymatous and functional disorders of the kidneys, established by the results of digital Doppler mapping, makes it possible to improve the diagnosis of kidney damage in obesity [16-19].



Power Doppler mapping is a new type of color Doppler mapping that reflects renal vessels even of small diameter and with low blood flow velocity [24-25]. Power Doppler mapping is highly informative, accurate, and sensitive when examining the kidneys in the pediatric population.

Shear wave elastography is a completely new direction of ultrasound research methods, the main purpose of which is to assess the elasticity or rigidity of renal tissue. An increase in this indicator indicates the onset of changes in the parenchyma [14]. The principle of the method is the production of a shear wave by ultrasound sources with subsequent recording of the speed of its passage through the parenchyma of a particular organ. Shear wave elastography has begun to be widely used in the diagnosis of diseases of the hepatobiliary system and glandular organs [15.18]. In recent years, isolated publications have appeared in the literature on the use of this method in uronephrology [15].



From today's perspective, the use of ultrasound examination of the kidneys in the form of a complex of B-mode, shear wave elastography mode and power Doppler mapping allows us to assess the structural and functional state of the kidneys, as well as to conduct early and timely detection of nephropathy in children suffering from obesity.

Thus, modern ultrasound methods for diagnostics of nephropathy are relevant, especially in childhood and adolescence. The use of shear wave elastography and power Doppler mapping acquire special significance for assessing partial renal functions in children and adolescents with obesity, which is why the purpose of our study was determined.

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