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THE SIGNIFICANCE OF DUPLEX SCAN IN CHRONIC KIDNEY DISAESE DURING CORONAVIRUS INFECTION

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✓ ***Resume***

Unfortunately, in some patients with acute kidney injury, complications may occur that do not return kidney function to its original state. It is an acute lesion that subsequently progresses to chronic renal failure and patients need to be monitored by nephrologists throughout their lives.

The research included wide Doppler ultrasound control of the kidneys in dynamics of 39 patients with chronic kidney disease (CKD). The research will help define the etiology of CKD, prescribe adequate nephroprotective therapy, predict the seriousness of CKD, and diagnose the progression of CKD to chronic renal failure.

Keywords: acute kidney injury, patient management, duplex scanning, coronavirus

ЗНАЧЕНИЕ ДУПЛЕКСНОГО СКАНИРОВАНИЯ ПРИ ХРОНИЧЕСКОМ ПОРАЖЕНИИ ПОЧЕК ПРИ КОРОНАВИРУСНОЙ ИНФЕКЦИИ

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✓ ***Резюме***

К сожалению, у некоторых больных с острым повреждением почек могут возникать осложнения, которые не возвращают функцию почек в исходное состояние. Это острое поражение, которое впоследствии прогрессирует до хронической почечной недостаточности, и пациенты должны находиться под наблюдением нефрологов на протяжении всей жизни.

В исследование проведено ультразвуковой допплер-контроль почек в динамике у 39 больных с хронической болезнью почек (ХБП). Исследование позволит определить этиологию ХБП, назначить адекватную нефропротекторную терапию, прогнозировать тяжесть ХБП, диагностировать прогрессирование ХБП до хронической почечной недостаточности.

Ключевые слова: острая почечная недостаточность, ведение больных, дуплексное сканирование, коронавирус.

KORONAVIRUSLI INFEKSIYADA SURUNKALI BUYRAK SHIKASTLANISHIDA ULTRATOVUSHLI DOPPLEROGRAFIYANING AHAMIYATI

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O'tkir buyrak shikastlanishi bilan og'rigan ba'zi bemorlarda afsuski, buyrak funksiyasi asl holatiga qaytmaydigan asoratlar yuzaga kelishi mumkin. Bu o'tkir zararlanish bo'lib, u keyinchalik asta-sekin surunkali buyrak yetishmovchiligiga o’tadi va bemorlar butun umri davomida nefrologlarning kuzatuviga muhtoj bo’lishadi.

Tadqiqot surunkali buyrak shikastlanishi (SBK) bo'lgan 39 bemorda davodan oldin va keyingi dinamikada buyraklarning keng qamrovli dopplerli ultratovush tekshiruvini o’tkazilishini o'z ichiga oladi. Tadqiqot SBK etiologiyasini aniqlashga, adekvat nefroprotektiv terapiyani buyurishga, SBK ning og'irligini bashorat qilishga va SBKning surunkali buyrak yetishmovchiligiga o’tishini tashxislashga imkon beradi.

Kalit so’zlar: o'tkir buyrak shikastlanishi, bemorlarni olib borish, ultratovushli dopplerografiya, koronavirus.

Relevance

Kidney disease more than doubles the risk of death from coronavirus infection. In recent years, there has been an increase in the number of patients with chronic kidney disease (CKD) requiring hemodialysis treatment. More and more patients with CKD due to chronic kidney disease (CKD) are admitted to intensive care units. Often, the development of severe acute renal failure (ARF) can be prevented, especially at the Risk and Injury stages (according to the RIFLE classification). In this regard, it is extremely important to identify patients at risk and conduct nephroprotective therapy [2,6]. Nephroprotection is a therapy aimed at protecting the nephron and maintaining kidney function in conditions of damage. In our center, work is underway to improve the tactics of nephroprotection in this category of patients [1,5,9]. The following algorithm is proposed: primary nephroprotection (to prevent damage to the tubules); secondary nephroprotection (reduce damage to the already affected tubules, accelerate the regeneration of the epithelium). Primary nephroprotection - prevention of severe damage to the tubules, maintenance of adequate blood inflow and outflow through the renal arteries and veins, which is possible at the Risk (R), Injury (I) stages and in the first hours of the Failure (F) stage according to the RIFLE classification, - provides for: causes; maintaining adequate cardiac output; maintenance of normovolemia; maintaining adequate ventilation of the lungs (correction of hypoxia); correction of hypertension and hypotension, clinically significant arrhythmias; correction of anemia; anti-inflammatory therapy; adequate antibiotic therapy; removal or adequate drainage of the focus of intoxication (purulent focus). Secondary nephroprotection is possible at stages F, Loss (L) (drug therapy + dialysis technologies + other efferent methods). By the nature of the conduction, it is possible to distinguish drug and non-drug nephroprotection. Drug nephroprotection: first of all, maintaining the volume of circulating blood with adequate infusion media, the introduction of drugs that improve renal blood flow and stimulate diuresis, plasma alkalization if necessary, antibiotic therapy, adequate analgesia, etc. Non-drug nephroprotection is aimed at: speedy recovery of urine passage (stenting, nephrostomy, removal of stones, tumors, etc.); instrumental improvement of systemic blood flow (counterpulsation in cardiogenic shock, pericardial puncture in case of tamponade and severe exudative pericarditis, stenting and balloonization of the renal artery in case of thrombosis or stenosis, etc.); early elimination or drainage of the focus of intoxication; cooling, elastic bandaging in the distal direction, immobilization, gentle transport in case of prolonged compression syndrome [5,7]. The general principle of nephroprotection: exclude the introduction of nephrotoxic drugs (antibiotics, NSAIDs, radiopaque agents, diuretics for a long time and in exorbitant dosages), strict control of infusion therapy and other fluid intakes, the use of alternative ways of detoxification (gastrointestinal lavage, therapeutic diarrhea, etc.), drainage, sanitation, elimination of the center of intoxication. The tactics of nephroprotection depends on the etiology of CKD (prerenal, renal, subrenal or on the background of chronic renal failure (CRF)) and the stage (oliguria, recovery of diuresis, rehabilitation). The aim of the work is to evaluate the possibilities of complex ultrasound examination (ultrasound) of the kidneys with Doppler scanning of the renal vessels in the choice of nephroprotection tactics in patients with CKD [8].

The purpose of the study significance of duplex scan in chronic kidney damage with coronavirus infection

Materials and methods

For the period from December 2021 to November 2022, 39 patients with acute renal failure were examined on the basis of the intensive care unit of the BOMC. Of these, 23 men and 16 women. The age of the patients ranged from 22 to 69 years. Depending on the etiological factor, all patients were divided into 4 groups: group 1 — 8 patients with prerenal acute renal failure; 2nd — 11 patients with renal acute renal failure; 3rd — 6 patients with subrenal acute renal failure; 4th — 14 patients with acute renal failure on the background of chronic renal failure. All patients underwent general clinical, biochemical studies, electrocardiogram, echocardiogram, computed tomography and ultrasound of the abdominal cavity and retroperitoneal space. In addition, all patients underwent ultrasound Doppler scanning of the renal vessels (color Doppler mapping and pulsed wave Dopplerography) using the Aplio-A 450 expert-class apparatus (Canon, Japan) in dynamics. Dopplerography of the abdominal aorta was performed. The anatomical features of the vessels were studied to exclude deformities. Peak systolic (Vps), end diastolic (Ved) blood flow velocity and resistance index (RI) were determined

automatically at the level of the main renal artery and its segments (arc, interlobar and segmental vessels). Each patient underwent at least 2 complex ultrasound examinations in the stage of oligoanuria (OA) and restoration of diuresis (in the phase of polyuria). After clarification of the cause and nature of renal failure, renoprotective therapy was prescribed (improvement of renal blood flow, stimulation of diuresis, improvement of tubular patency, restoration of urine passage, etc.); 36 patients underwent hemodialysis treatment, 3 patients underwent prolonged veno-venous hemodiafiltration. Vascular access was provided by the formation of an arteriovenous shunt on the forearm or the installation of a two-way catheter into a large vessel, more often into the subclavian vein. Hypocoagulation was performed with unfractionated or low molecular weight heparin (Clexane, Fraxiparin, etc.).

Result and discussion

At the stage of oligoanuria, 37 patients had hemodynamically significant impairments of renal blood flow, which was manifested by a decrease in linear velocities in the main trunk of the renal arteries, as well as in segmental, interlobar and arcuate arteries (Table 1). In 95% of patients, a decrease in blood flow in the abdominal aorta was detected, while its structural changes (aneurysm of the supra- and infrarenal sections) were detected only in three patients. Four patients had thrombosis of the main renal artery of the only functioning kidney. In four cases, despite a significant increase in the level of urea and, to a lesser extent, creatinine in the blood plasma, blood flow velocities in the renal vessels were within normal values. Resistance indices were increased in 35 patients. 2 patients with normal RI "resolved" during conservative therapy. A correlation analysis was carried out between RI and the duration of the OA stage, and a strong positive relationship was found. The higher the resistance index at admission, the greater the duration of OA. We obtained the following data: with RI in the trunk of the main renal artery > 0.78, the duration of the oligoanuria stage was more than 3 weeks; with an RI in the trunk of the main renal artery from 0.70 to 0.78, the duration of the stage of oligoanuria was from 2 to 3 weeks; with RI in the trunk of the main renal artery < 0.70, the duration of oligoanuria was less than 1 week. Thus, already at admission of patients it was possible to speak about the severity of acute renal failure. With a resistance index > 0.78, acute renal failure was assessed as severe, with resistance index values from 0.70 to 0.78, moderate acute renal failure was diagnosed, and with a resistance index < 0.70, mild acute renal failure.

Table 1.

Renal artery blood flow parameters

Parameters	Cause of ARF	Stage of ARF		N
		Oligoanuria	Polyuria	
Vps, см/с	Prerenal Renal Postrenal OPN against the background of chronic renal failure	39,98±0,20 36,01±0,53 62,03±0,17 41,09±0,23	58,10±072 47,23±0,60 69,30±0,23 48,72±0,86	73,0±4,2
Ved, см/с	Prerenal Renal Postrenal OPN against the background of chronic renal failure	4,10±1,12 3,9±0,18 11,18±0,09 5,12±1,08	15,05±1,46 10,08±0,9 16,60±0,15 9,37±1,14	26,0±3,8
RI	Prerenal Renal Postrenal OPN against the background of chronic renal failure	0,86±0,02 0,95±0,02 0,75±0,02 0,82±0,02	0,78±0,01 0.59±0,34 0,65±0,03 0,80±0,26	0,62±0,05

The features of changes in the size and structure of the kidneys in groups with acute renal failure of various origins were revealed. In all groups of patients, there was a significant increase in the volume of the kidneys in the stage of oligoanuria, followed by a decrease in the stage of recovery of diuresis. The morphological substrate for the increase in the size of the kidneys and their structural elements was pronounced edema. A comparative assessment of the thickness of the cortical layer did not reveal significant differences between the groups of acute renal failure of various genesis. The echogenicity of the cortical layer of the renal parenchyma was significantly increased in all the studied patients, most pronounced in toxic interstitial nephritis. In 39% of patients, the renal parenchyma was thickened up to 2.6

cm or more, the pyramids were liquid. These changes were combined with the "wet lung" picture, in 2 patients - with alveolar pulmonary edema. Thus, an increase in RI in acute renal failure in the OA stage was to some extent associated with edema of the kidney parenchyma and infiltration of the interstitial tissue. In the stage of polyuria, RI approached normal values, linear blood flow velocities increased, starting from the arcuate arteries, which indicated an improvement in intrarenal hemodynamics with further restoration of renal functions. During the transformation of ARF into CRF in the stage of recovery of diuresis, the RI values remained high, and the linear blood flow velocities were low, despite the restoration of diuresis, a decrease in the level of urea and creatinine in the blood plasma. Moreover, RI increased in 3 patients, which is explained by the formation of nephrosclerosis in CKD. 1 of them continued hemodialysis treatment in chronic hemodialysis units. Visual assessment of renal blood flow according to color Doppler mapping and pulsed Dopplerography (duplex scanning) at the stage of oligoanuria revealed: 1) signs of its depletion in the cortical layer of the renal parenchyma at the level of the arcuate and interlobar arteries, weak signals; 2) decrease in diastolic flow, up to its complete absence; 3) increase in the speed of venous flow due to shunting; 4) in 2 patients, the presence of reverse blood flow in diastole; 5) 1 patient had complete absence of blood flow. After the treatment, in the stage of recovery of diuresis, the following was observed: 1) restoration of blood flow, starting from the arcuate and interlobar arteries; 2) normalization of the shape of the Doppler curve; 3) decrease in echogenicity and thickness of the parenchyma, restoration of the size of the kidneys and corticomedullary differentiation.

Conclusion

Performing a complex ultrasound of the kidneys with duplex scanning of blood vessels allows:

- clarify the cause of the AKI;
- prescribe nephroprotective therapy taking into account the cause and prevent the development of multiple organ disorders and irreversible changes in the kidneys;
- assess the severity of AKI already at admission to the department;
- evaluate the effectiveness of the therapy;
— to diagnose the transformation of AKI into CRF during treatment.

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