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## **Assessment of indicators of a kidney blood-groove at chronic pyelonephritis at patients with diabetes 2 types**

There was conducted investigation of the nephritic blood circulations in different levels of the nephritic arteries of 90 patients with the 2nd type of diabetes in combination with the chronic pyelo-nephritis in the phase of exacerbation and remission. There was determined disorder of the nephritic blood circulations in the form of the nephritic blood flow velocity lowering and the increasing of the nephritic vascular resistance in different levels of the nephritic arteries, the expressiveness of which is determined by the activity of the inflammatory process in kidneys.

*Key words:* diabetes mellitus, pyelonephritis, nephritic blood circulations, renal arteries, diabetic nephropathy.

*Background.* Chronic pyelo-nephritis is important complication of diabetes (DM), taking into consideration its prevalence, difficulty of achievement of full treatment, high frequency of a re-infection and development of complications as cortico-medullary abscess, the kidney anthrax, emphysematic pyelo-nephritis and pyelitis [1, 2]. Chronic pyelo-nephritis aggravate development of diabetes and result leading to decompensation, resistance to insulin, keto-acidosis and to diabetic coma [3]. The long time prolonged treatment, relapses and unsatisfactory results of antibacterial therapy of chronic pyelo-nephritis in patients with DM suggest about a role of violations of kidney hemodynamic in pathogenesis of aggravation of DM

The ultrasonic Doppler sonography (UZDG) of renal arteries (RA) is important method for investigation of blood circulation in diabetic nephropathy [4].

*Research objective:* to study of features of kidney haemodynamic at various levels of a renal artery using data obtained by UZDG depending on activity of chronic pyelo-nephritis at patients with diabetes 2 types.

*Material and methods:* 90 patients with chronic pyelo-nephritis (PN) with DM 2 types which were hospitalized in Regional Clinical Hospital of downtown Karaganda were examined. 2 groups of patients: Group 1 — relapse of chronic pyelo-nephritis (45 patients; 9 men, 36 women), the Group 2 — with remission of chronic pyelo-nephritis (45 patients; 18 men, 27 women). Average age of the Group 1 is  $53,4 \pm 0,90$  and average age of Group 2 is  $50,9 \pm 0,75$ . Both Groups were comparable according to the main characteristics of DM and chronic pyelo-nephritis.

Patients with accompanying urological pathology, with chronic renal failure which were expressed by a diabetic nefro-angiopathy, malignant hypertension were excluded from research. Control group: 20 patients with DM 2 types without chronic pyelo-nephritis.

All patient carried out UZDG on the ultrasonic Doppler system «Aloka-5000» (Japan), in real time with the convex sensor of 3,5 Megahertz. Analyzed data of power Doppler sonography with allocation of 4 degrees: 0 — kidney blood circulation without changes and is observed to the capsule of a kidney; 1 -easy decreasing of a blood circulation in a subcapsular space, 2 — moderate violation of kidney haemo dynamic; 3 — expressed decreasing of blood-circulation in cortical layer of kidneys. High-speed indicators of a circulation were investigated: peak of systolic speed of a blood circulation (V max), final diastolic speed of (V min), average speed of a blood-groove during complete cycle (V mean) and indicators of a vascular resistance, an index of resistance (RI), the pulsation index (PI), a systola-diastola ratio of speeds (Ratio) in distal parts of main of renal arteries, segmentar, intershare and arc arteries. The obtained data are processed using of program «Statistica-6,0.»

*Results and discussion.* Patients with chronic pyelo-nephritis in a phase have aggravations and remissions of DM in the mode of power Doppler sonography the color impoverishment of drawing of intra kidney vessels determined by circulator frustration in intra renal arteries was observed. In aggravation of inflammatory process at DM decreasing of blood circulation in subcapsular part was observed at 28 (52,9 %) patients, moderate violation of kidney haemo dynamics (the blood-groove was observed to a cortical layer, vascular drawing of a brain layer is not changed) was observed at 25 (47,1 %) patients. The blood circulation in

creased in kidneys was asymmetrical, with prevalence of changes in the left kidney. The qualitative analysis Doppler analysis data showed a low systolic and diastolic blood circulation that points to increase of peripheral resistance in kidney vessels. At remission of chronic pyelonephritis in DM the decreasing of circulation in subcapsular part was observed in 29 (64,5 %) patients, moderate violation of kidney haemo dynamics (circulation traced to cortical layer, vascular drawing of a brain layer is not changed) was observed in 11 (24,4 %) patients, the expressed violation of kidney haemo dynamics (circulation in cortical layer is not defined, vascular drawing of a brain layer is impoverished in the form of a reduction arc and «strippings» of intershare vessels in 5 (11,1 %) patients. The blood circulation in kidneys was symmetric.

Quantitative analysis of the Doppler data showed a presence of violations of kidney haemo dynamics in aggravation phase as in phase of remission of chronic pyelo-nephritis. Regardless of activity of inflammatory process in kidneys expressed violations of kidney haemo dynamics were observed characterized by considerable decrease of speeds of kidney blood circulation ( $V_{max}$ ,  $V_{min}$ ,  $V_{mean}$ ) with distinct increase of indexes of vascular resistance (Ratio PI, RI) at the level of the main trunk, segmentary, intershare and arc arteries.

Thus, the analysis of indicators of kidney haemodynamics at chronic pyelonephritis in patients with DM 2 type, demonstrated revealed hypoperfusion of kidneys with increasing of vascular resistance at all levels of renal arteries that showed about essential haemodynamic changes in the microcirculation in comparison with control. In turn, decrease in a kidney blood-circulation creates a favorable conditions for maintenance and further progressing of inflammatory process in kidneys.

We carried out the analysis of Doppler parameters of a kidney blood-groove depending on a phase of chronic pyelonephritis at SD 2 types (Table 1). Apparently, reliable distinctions between groups are revealed at the level of the main trunk, intershare, arc arteries. Lower values  $V_{max}$ ,  $V_{mean}$  at the level of the main trunk of PAS in a phase of an exacerbation of chronic pyelonephritis in comparison with a remission phase at SD were noted 2 types. Thus it should be noted that reliable changes are revealed at the level of the main trunk left by PAS ( $p < 0,001$ ). Authentically higher PI values in the main trunk left by PAS in a phase of an exacerbation of chronic pyelonephritis, than in a remission phase were noted at SD 2 types.

Table 1

**Indicators of kidney blood circulation at an aggravation  
and remission of chronic pyelo-nephritis at patients with diabetes 2 types**

Indicators	Control DM without PM		DM+PM relapse		DM+PM remission	
	right	left	right	left	right	left
<b>Main trunk</b>						
V max cm/c	69,8±2,34	71,9±2,54	52,4±2,53***	46,8±1,68***	53,04±2,29***	56,3±2,07***###
V min cm/c	28,8±1,22	29,0±1,32	18,8±1,04***	16,9±0,75***	17,4±1,06***	19,2±1,15***
V mean cm/c	37,5±1,17	38,6±1,56	27,5±1,74***	22,7±0,99***	29,7±1,60***	31,2±1,36***###
Ratio	2,46±0,07	2,53±0,08	2,93±0,13**	2,87±0,10*	3,43±0,24***	3,38±0,24**
PI	1,07±0,02	1,11±0,04	1,28±0,05**	1,31±0,04**	1,21±0,05*	1,18±0,03 #
RI	0,58±0,01	0,59±0,01	0,63±0,01**	0,63±0,01*	0,65±0,01**	0,65±0,01**
<b>Segmental VP</b>						
V max cm/c	51,2±2,25	56,6±2,80	44,8±1,95*	38,4±1,90***	40,7±1,90***	40,2±1,74***
V min cm/c	22,2±1,41	24,07±1,24	17,4±0,79**	14,7±0,79***	15,02±0,95***	14,7±0,72***
V mean cm/c	28,6±1,48	30,4±1,54	23,4±1,14**	20,7±1,23***	24,3±1,54*	23,2±1,27***
Ratio	2,36±0,06	2,35±0,03	2,67±0,09**	2,64±0,07**	3,01±0,18**	2,88±0,15**
PI	1,01±0,02	1,06±0,02	1,15±0,02***	1,16±0,04*	1,07±0,03	1,08±0,02
RI	0,57±0,01	0,57±0,006	0,60±0,01	0,60±0,01**	0,61±0,01*	0,61±0,01**
<b>Interglobular VP</b>						
V max cm/c	44,3±2,43	45,9±2,34	35,2±1,88**	34,05±2,01***	30,1±1,68***#	28,3±1,74***#
V min cm/c	21,7±1,56	19,8±0,99	14,4±0,82***	13,2±0,68***	11,6±0,76***#	11,02±0,69*** #

Notes. Significance of differences compared with patients without diabetes chronic pyelonephritis \* —  $p < 0,05$ ; \*\* —  $p < 0,01$ ; \*\*\* —  $p < 0,001$ . Significant of difference between the DM + HP exacerbation and remission \* —  $p < 0,05$ ; \*\* —  $p < 0,01$ ; \*\*\* —  $p < 0,001$ .

At an assessment of change of a kidney blood-groove at the level of intershare renal arteries the tendency to increase in high-speed indicators of a blood-groove ( $V_{max}$ ,  $V_{min}$ ) in a phase of an exacerbation of chronic pyelonephritis in comparison with a remission phase ( $p < 0,05$ ) at sick SD 2 types is noted. Reliable

distinctions in indicators of average speed of a blood-groove and indexes of vascular resistance it isn't revealed. The tendency to higher PI values in right arc PA in a phase of an exacerbation of chronic pyelonephritis in comparison with a remission phase was traced ( $p < 0,05$ ) whereas left arc PA of reliable distinctions it isn't revealed. The analysis of indicators of kidney haemo dynamics in the studied groups at the level of segmentary PASES allows to note lack of reliable distinctions on key parameters of a kidney blood-groove.

Thus, the phase of an exacerbation of pyelonephritis is characterized by lower blood-groove in the main arteries and higher in intershare arteries and increase of kidney vascular resistance in the main trunk and arc arteries.

The obtained data testify to informational content of indicators of a blood-groove at the level of the main, intershare, arc renal arteries in definition of an active phase of chronic pyelonephritis at patients with diabetes 2 types.

Conclusions:

1. Violations of kidney haemo dynamics at chronic pyelonephritis at patients with diabetes 2 types are characterized by decrease in a kidney blood-groove with the simultaneous growth of indexes of vascular resistance at various levels of renal arteries.

2. In an exacerbation of chronic pyelonephritis at patients with diabetes 2 types in comparison with a phase of remission are revealed decrease of a blood-groove in the main arteries and increase in intershare arteries, and also increase of vascular resistance at the level of the main trunk and arc renal arteries.

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### **Диабеттің 2-түрімен ауратын науқастарда созылмалы пиелонефритте бүйрек қан ағысының көрсеткіштерін бағалау**

Диабеттің 2-түрімен ауыратын 90 науқастың созылмалы пиелонефрит қабынуы және уақытша оңалуы кезінде бүйректің әр түрлі деңгейдегі артерияларындағы бүйрек гемодинамикасына зерттеу жүргізілді. Бүйрек гемодинамикасының бұзылуы бүйрек қан айналысының жылдамдығының төмендеуімен және әр түрлі деңгейдегі бүйрек артериясында бүйрек тамырларындағы кедергінің жоғарлауымен байқалып, айқындылығы бүйректегі қабынудың белсенділігімен байланысы анықталды.

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### **Оценка показателей почечного кровотока при хроническом пиелонефрите у больных сахарным диабетом 2 типа**

Авторами исследовалось состояние функции почек при сахарном диабете. У 90 пациентов, больных сахарным диабетом 2 типа в сочетании с хроническим пиелонефритом, в фазах обострения и ремиссии изучено состояние почечного кровообращения. Выявлено достоверное снижение скорости кровотока, а также понижение и повышение сосудистого сопротивления на различных уровнях артерий почек, которые обусловлены активностью воспалительного процесса в почках.