

THE IMPORTANCE OF THE RESISTANCE INDEX IN PREDICTING THE DEVELOPMENT OF CHRONIC KIDNEY DISEASE

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ABSTRACT

Purpose of the study: to identify the resistance index in predicting the development of chronic kidney disease in patients with metabolic syndrome. Material and methods of the study. Body mass index (BMI), complete blood count, blood biochemistry, albuminuria level and glomerular filtration rate (GFR), and renal artery Doppler ultrasound were determined in 205 patients with metabolic syndrome. **Results:** a model for predicting the development of chronic kidney disease was created for the early diagnosis of kidney damage in patients with metabolic syndrome, taking into account albuminuria, glomerular filtration rate and resistance index. **Conclusion:** Doppler ultrasound of the renal arteries is recommended for patients with impaired glucose tolerance.

Key words: metabolic syndrome, albuminuria, glomerular filtration rate, impaired glucose tolerance, resistance index, type 2 diabetes mellitus.

INTRODUCTION

The average prevalence in the world among men and women is 24%. If the ranch believed that metabolic syndrome is characteristic of older people, studies verified by the American Diabetes Association (American Diabetes Association) show an increase in the incidence among young people aged 20-29 years . It is assumed that by 2025 the number of patients with such a syndrome will be 300 million people. Therefore, the World Health Organization (WHO) considers MS a global epidemic. At the last international congress, metabolic syndrome (MS) (MSDA, 2017) was finally defined as a pandemic of the 21st century. The prevalence of MS among the population is 15-45% [3].

The Metabolic syndrome is a cluster of cardiovascular risk factors that adversely affect the development and progression of chronic kidney failure. According to the criteria of the World Health Organization, it is defined by visceral

adiposity, impaired glucose tolerance or insulin resistance, atherogenic dyslipidemia, raised blood pressure, and microalbuminuria with an albumin-to-creatinine ratio ≥ 30 mg/g. Because the kidney is a highly vascularized organ, it is especially susceptible for those microvascular changes [1,2].

Purpose of the study: to identify the resistance index in predicting the development of chronic kidney disease in patients with metabolic syndrome.

Material and methods:

The study involved 205 patients undergoing treatment in regional branches of the Bukhara Republican Specialized Cardiology Scientific and Practical Center and endocrinology dispensaries of the Bukhara region.

According to the prevalence of metabolic syndrome components, all patients were divided into 2 groups, namely: HC (hypercholesterolemia) + abdominal obesity + AG (arterial hypertension) + IGT (impaired glucose tolerance) with prevalence (1st group), HC + abdominal obesity + AG + DM (diabetes mellitus) with prevalence (2 groups). The average age of patients was 58.38 ± 1.16 years.

Group 1, i.e. patients with a predominance of impaired glucose tolerance + hypercholesterolemia + abdominal obesity + arterial hypertension, a total of 91 people, their average age was 58.38 ± 1.16 (women - 50, men - 41).

The 2nd group, namely patients with a predominance of type 2 diabetes mellitus + hypercholesterolemia + abdominal obesity + arterial hypertension, consisted of a total of 114 patients, whose average age was 58.24 ± 0.84 (women - 66, men - 48).

Distribution of the average age of patients with predominant components of metabolic syndrome

Age of the patient	Indicator or %	The advantage of impaired glucose tolerance + hypercholesterolemia + abdominal obesity + arterial hypertension			Advantage 2-type diabetes mellitus + hypercholesterolemia + abdominal obesity + arterial hypertension		
		General	Woman	Male	General	Woman	Male
Youth (18-44 years)	n	9	4	5	7	2	5
	%	9.9%	44.4%	55.6%	6.1%	28.6%	71.4%
Middle age (45-59 years)	n	45	21	24	53	34	19
	%	49.5%	46.6%	53.4%	46.5%	64.2%	35.8%
Older age (60-74 years)	n	31	22	9	52	30	22
	%	34%	71%	29%	45.6%	57.7%	42.3%

Old age (75-90 years)	n	6	3	3	2	-	2
	%	6.6%	50%	50%	1.7%		100%
General	n	91	50	41	114	66	48
	%	44.4%	55%	45%	55.6%	57.9%	42.1

A total of 50 female patients in Group 1, i.e. 55%, had a predominance of IGT, and 66 patients in Group 2, i.e. 57.9%, had a predominance of DM. However, in the majority of middle-aged patients participating in the study, 53.4%, i.e. 24 men, had a predominance of IGT, and 64.2%, i.e. 34 women, had a predominance of DM.

Prevalence of obesity in patients with predominant components of metabolic syndrome (abdominal obesity).

Our study also includes patients with abdominal obesity of normal body weight, which was detected in 20 (22%) patients in the 1st study group and in 16 (14%) patients in the 2nd group, which is randomized, so its reliability is high. had an indicator ($p > 0.05$).

In the first study group, 38 patients (41.7%) were overweight, in the second study group - 38 patients (33.3%) - grade 1 obesity, 15 patients (13.2%) - grade 2 obesity. Grade 3 obesity was noted in 9 patients (8%) in patients of the 2nd study group. In the group of patients with a predominance of diabetes, all levels of obesity were detected, which is confirmed in scientific sources.

Distribution of arterial pressure levels in patients with predominant components of metabolic syndrome

Blood pressure levels	Indicator - %	GC + abdominal obesity + AG + IGT with predominance	GH + abdominal obesity + hypertension + diabetes with predominance	P
Normal and optimal blood pressure (120/139 – 80/89 mm Hg)	n	31	22	0.014
	%	34%	19.3%	
Arterial hypertension stage 1 (140/159-90/99 mmHg)	n	32	39	0.808
	%	35.2%	34.2%	
Arterial hypertension stage 2 (160/179 – 100/109 mmHg)	n	25	40	0.236
	%	27.5%	35%	
Arterial hypertension grade 3 ($\geq 180/110$ mmHg)	n	3	13	0.027
	%	3.3%	11.4%	

In the 1st group of our study, 32 patients (35.2%) had stage 1 arterial hypertension, and in the 2nd group, 40 patients (35%) had stage 2 arterial hypertension ($p > 0.05$). In patients with a predominance of IGT (1-2-3) levels of arterial hypertension - 66% in 60 patients, and in patients with a predominance of DM (1-2-3) levels of arterial hypertension was detected in 81% of 92 patients.

Results of the analysis of the level of albuminuria in assessing the functional status of the kidneys in patients with components of metabolic syndrome

Albuminuria levels	Indicator %	GC + abdominal obesity + AG + IGT with predominance	GH + abdominal obesity + hypertension + diabetes with predominance	P
A 1 (0-29.9)	n	44	50	0.310
	%	48.4%	44%	
A 2 (30-300)	n	45	59	0.914
	%	49.4%	51.6%	
A 3 (> 300)	n	2	5	0.122
	%	2.2%	4.4%	

P - is the reliability of differences between subgroups, according to Pearson's criterion χ^2

In the 1st group of our study, albuminuria of level A1 (normal albuminuria) in urine tests was observed in 44 patients (48.4%), and in the 2nd group - in 50 patients (44%). Level A2 was predominantly detected in 45 patients (49.5%) in the 1st group of the study and in 59 patients (51.6%) in the 2nd group ($p > 0.05$). It was noted that this indicator in the 2nd group was 1.04 times higher than in the 1st. Level A3 was predominantly found in 2 patients (2.2%) in the 1st group and in 5 patients (4.4%) in the 2nd group and was 2 times more common in the group with diabetes than in the group with IGT.

Analysis of glomerular filtration rate levels in assessing the functional state of the kidneys in patients with a predominance of metabolic syndrome components

SCF levels (by CKD stage)	Indicator %	GH + abdominal obesity + hypertension + diabetes with predominance	GH + abdominal obesity + hypertension + diabetes with predominance	Chapter 2	P	II min OR	II max OR
G1 (≥ 90 ml/min/1.73 m ²)	n	41	25	10.79	0,001	1.53	5.82
	%	45%	22%				
G2 (60-89 ml/min/1.73 m ²)	n	44	61	1.53	0.216	0.40	1.23
	%	48.4%	53.4%				
G3a (45-59 ml/min/1.73 m ²)	n	6	28	5.74	0,017	0.11	0.84
	%	6.6%	24.6%				

P is the reliability of differences between subgroups, according to Pearson's criterion χ^2

According to *M.E. Statsenko et al. (2019)* it can be assumed that this circumstance "equalizes" the importance of metabolic syndrome and type 2 diabetes mellitus as risk factors for the progression of CKD. That is, in the 1st group according to the level of SCF, stage 1 CKD was detected in 41 patients (45%), and in the 2nd group - in 25 patients (22%) ($p < 0.05$). This condition indicated a slightly increased or normal renal glomerular filtration (≥ 90 ml / min / 1.73 m²) due to the activity of compensatory mechanisms, as well as the absence of complaints about kidney damage in the anamnesis and the presence of organic changes. in the kidneys has not yet developed, but the hemodynamics of the renal arteries is subject to changes [3] (KDIGO, 2021).

Analysis of renal artery hemodynamics by glomerular filtration rate categories depending on the age and gender of patients (RI = 0.56 – 0.65)

Number of patients (total)		205 patients with MS components											
Groups		with a predominance of IGT (91 people)						with prevalence of diabetes (114 people)					
GFR categories and albuminuria levels		G1 (A1A2A3)		G2 (A1A2A3)		G3a (A1A2A3)		G1 (A1A2A3)		G2 (A1A2A3)		G3a (A1A2A3)	
Parts of the renal artery	Renal localization/ Indicator	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Main renal artery	V max, cm/s	60.32	58.12	57.9	54.95	49.5	48.67	54.64	55.48	57	54.3	51.21	51.4
	Vmin, cm/s	15.88	15.44	14.2	14	12.33	12	13	13	13	12.33	11.54	11.68
	RI	0.73*	0.73*	0.75*	0.74*	0.75*	0.75*	0.76*	0.76*	0.77*	0.77*	0.77*	0.77*
Segmental renal artery	V max, cm/s	34	33.66	32.95	32.77	29.5	29.17	33,32	34	32	32.87	31.5	32.6
	Vmin, cm/s	10	9.83	9.20	9	8.17	8.17	8.48	8.64	7.97	8.15	7.5	7.6
	RI	0.70*	0.70*	0.72*	0.72*	0.72*	0.72*	0.74*	0.74*	0.75*	0.75*	0.76*	0.76*
Interlobular renal artery	V max, cm/s	20.44	21.3	19.56	20.52	20	20.5	20.56	21.11	20.79	21.67	21.1	21.6
	Vmin, cm/s	6.02	6.2	5.63	5.86	5.3	5.33	5.49	5.57	5.28	5.47	5.18	5.3
	RI	0.70*	0.70*	0.71*	0.71*	0.74*	0.73*	0.73*	0.73*	0.74*	0.74*	0.75*	0.75*

* – reliability of correlation $p < 0.05$

In patients with a predominance impaired glucose tolerance RI = 0.73-0.75 in the main renal artery in the right and left kidney, RI = 0.70-0.72 in the segmental renal artery in the right and left kidney, in the right and left kidney RI = 0.70-0.73 was noted in the interlobular renal artery ($p>0.05$).

In patients with a predominance 2-type diabetes mellitus RI = 0.76-0.77 in the main renal artery in the right and left kidney, RI = 0.74-0.76 in the segmental renal artery in the right and left kidney, in the right and left kidney RI = 0.73- In the interlobular renal artery, a value of 0.75 was noted ($p>0.05$).

Prognostic model of the risk of decompensation of the CKD and the development of the terminal stage according to the class of CFR G1, G2, G3a, albuminuria levels and an increased resistance index

Albuminuria levels	RI index change	Probability of a decrease in the amount of SCF in 2 years	G1	G2	G3a
A1	RI = 0.65	5 ml/min/1.73 m ²	There is no danger	There is no danger	Low risk
	RI = 0.70	10 ml/min/1.73 m ²	Low risk	Low risk	Moderate risk
A2	RI = 0.75 – 0.80	15 ml/min/1.73 m ²	Moderate risk	Moderate risk	High risk
A3	RI = 0.80	20 ml/min/1.73 m ²	High risk	Extremely high risk	Extremely high risk
	RI = 0.85	25 ml/min/1.73 m ²	Extremely high risk	Extremely high risk	Extremely high risk

Summary. Depending on the presence of metabolic syndrome components, the application of the preclinical stage of renal damage assessment algorithm by assessing renal damage at the G1 level of the ball filtration rate RI to stage 3b chronic kidney disease and at the A1 level of albuminuria will be the basis for reducing the risk of developing metabolic syndrome. the origin of chronic kidney disease and its complications.

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