



## **PATHOGENETIC RELATIONSHIP OF METABOLIC DISORDERS IN PATIENTS WITH ARTERIAL HYPERTENSION AND DIABETES TYPE 2**

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### **Annotation**

The article deals with the mechanisms of progression of metabolic disorders in patients with concomitant course of hypertension and diabetes mellitus type 2. The most important is the state of insulin resistance, carbohydrate metabolism disturbances, the development of atherogenic dyslipidemia and systemic inflammation in correlation with the imbalance of adipocytokines, which contributes to high risk cardiovascular.

**Keywords:** arterial hypertension, diabetes mellitus type 2, metabolic disorders, insulin resistance.

### **Introduction**

Recent studies have established that a high level of insulin in the blood serum can accelerate the development of atherosclerotic processes [3; 4]. Insulin resistance (IR) is considered not only as the main link in the development of type 2 diabetes and its complications, but also as a component involved in the pathogenesis of atherosclerosis, hypertension and other diseases [5; 6]. Epidemiological data show that approximately 80-90% of patients with type 2 diabetes are overweight or obese. Thus, the presence of grade I obesity doubles the risk of developing type 2 diabetes, grade II - 5 times, grade III - more than 10 times. The distribution of fat plays a special role [7]. It was found that the accumulation of visceral fat is associated with impaired glucose tolerance and IR, regardless of body weight [8]. Adipose tissue is an endocrine organ that is a site for the synthesis of a large number of hormones and bioactive peptides. There is evidence that some substances synthesized by adipose tissue can interfere with insulin signaling and cause IR in the early stages of prediabetes [10].





In a study conducted with Bobronnikov L.R., Bilovol O.M. et al., the trophological status of 74 patients with hypertension and type 2 diabetes was analyzed: the 1st group consisted of 38 patients with hypertension, the 2nd group - 36 patients with concomitant AG and type 2 diabetes [9]. Analysis of the trophological status revealed features for both groups. Patients with BMI in the range of 18.5-24.9 kg / m<sup>2</sup> (5 patients), identified in the group with the progression of isolated hypertension. However, grade III obesity (BMI exceeds 40.0 kg / m<sup>2</sup>) was observed in two patients with hypertension and in 6 patients with concomitant hypertension and type 2 diabetes. The vast majority of patients with isolated and combined course of the disease (67.5% and 55.1%, respectively) had a BMI in the range of 30-34.9 kg / m<sup>2</sup>. Thus, in patients with AH and a BMI of 30-34.9 kg / m<sup>2</sup>, men prevail (72.4%), and with a BMI of 35-39.9 kg / m<sup>2</sup> or more, women (74.6%).

Indicators of lipid levels in patients with concomitant arterial hypertension and type 2 diabetes, characterized by the progression of atherogenic dyslipidemia. The level of triglycerides in the blood serum of patients with AH and type 2 diabetes is 1.5 times higher ( $p < 0.05$ ) than in patients of group 1, and 2.2 times higher than those of the control group ( $p < 0.05$ ) ... A decrease in HDL cholesterol in patients with hypertension and type 2 diabetes was observed significantly more often than in the control group (55.2% and 23.5%, respectively;  $p < 0.05$ ). In patients with concomitant diseases, BMI of 30-34.9 kg / m<sup>2</sup> had lower HDL levels compared to the value of this indicator in the comparison group ( $p < 0.05$ ). The progression of lipid disorders in patients with a concomitant course of the disease, depending on BMI: the maximum values of TS and TG were observed at a BMI of 35-40 kg / m<sup>2</sup> ( $p = 0.242$ ,  $p = 0.052$ , respectively), and the concentration of HDL in the blood serum had the lowest value.

Concomitant and type 2 diabetes led to an increase in the ratio of the atherogenic index (IS) by 2.3 times compared with the control and 1.2 times compared with the comparison group, which indicates the progression of atherosclerotic lesions of the blood vessels [1-7].

Analysis of insulin resistance (IR) indices in patients of both groups showed that the maximum values of the HOMA-IR index, insulin and C-peptide were found in patients of group 2 compared with indicators of group 1 and controls ( $p = 0.000$ ;  $p = 0.008$ ;  $p = 0.004$ , respectively), which indicates the progression of hyperinsulinemia associated with the presence of type 2 diabetes [8-14]. The HOMA-IR index exceeded the control values by 2.1 times in the group of patients with an isolated course of the disease and 2.4 times was significantly higher in patients with concomitant hypertension and type 2 diabetes ( $p = 0.004$ ).





The revealed statistically significant relationship between the levels of glucose ( $r = 0.52$ ;  $p = 0.04$ ), C-peptide ( $r = 0.64$ ;  $p = 0.0001$ ), BMI ( $r = 0.56$ ;  $p = 0.0052$ ) and the level of MC ( $r = 0.62$ ;  $p = 0.054$ ) confirms the hypothesis that IR affects the development of dyslipidemia and is associated with inflammation in patients with concomitant hypertension and type 2 diabetes.

Impaired glucose tolerance (IGT) in patients with hypertension was observed in 9.5% of cases ( $p < 0.05$ ), while in patients of group 2 - in 96.7% ( $p < 0.05$ ). A significant increase in the level of HbA1c, observed in patients of the 2nd group compared with the control ( $p < 0.05$ ), confirms the negative effect of excess weight on carbohydrate metabolism and unsatisfactory compensation of carbohydrate metabolism, which increases metabolic disorders and causes atherosclerotic vascular lesions in patients. In the 1st group, in a single case (7.6%), there was a significant increase in the level of FBG in comparison with the control group ( $p < 0.05$ ), which is explained by the presence of abdominal obesity, since overweight is one of the reasons for the progression of IR, the maximum value this indicator was achieved in patients with concomitant hypertension and type 2 diabetes ( $p < 0.05$ ).

In both groups, there was a significant increase in the content of TNF- $\alpha$  in the blood serum compared with the control group ( $p < 0.05$ ). The greatest increase by 2.5 times ( $p < 0.001$ ) was observed with the concomitant course of hypertension and type 2 diabetes [15-18]. Serum CRP levels exceed control values in both groups of examined patients ( $p < 0.05$ ). The greatest increase in CRP indices (2.2 times) was observed in patients with concomitant pathology ( $p < 0.05$ ) and correlated with BMI ( $r = 0.43$ ;  $p < 0.001$ ), FBG level ( $r = 0.48$ ;  $p < 0.001$ ) and the TG level ( $r = 0.37$ ;  $p < 0.04$ ), the HOMA-IR index ( $r = 0.46$ ;  $p < 0.001$ ).

Output. It has been established that the mechanisms of metabolic disorders in patients with concomitant hypertension and type 2 diabetes are characterized by:

1. Insulin resistance and the progression of the development of atherogenic dyslipidemia;
2. Increases in markers of systemic inflammation are most pronounced in overweight and obese patients.
3. Comprehensive diagnostics of hypertension and type 2 diabetes will contribute to the individualization of preventive and therapeutic measures, as well as the establishment of control over the progression of atherosclerosis and a decrease in cardiovascular risk.



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