

MORPHOFUNCTIONAL AND REACTIVE CHANGES IN THE THYMUS AND IMMUNE STRUCTURES OF THE SMALL INTESTINE IN EXPERIMENTAL METABOLIC SYNDROME

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Abstract. 65 patients with metabolic syndrome were examined. In addition to clinical data, complex studies of the functional state of the small intestine with sequential use of loading tests with mono-, di- and polysaccharides were used in the examination of patients.

Keywords: small intestine; metabolic syndrome; absorption; digestion.

INTRODUCTION

Metabolic syndrome (MS) is highly prevalent, including in Russia, reaching 25–50% among the adult population [1; 2]. The main components of the cascade of disorders in MS — abdominal obesity, hyperlipidemia, tissue insulin resistance, arterial hypertension — are closely related to the functional state of the digestive organs [3]. Nevertheless, in the literature, MS is more often discussed from the standpoint of its participation in damage to the cardiovascular system.

MATERIALS AND METHODS

A total of 65 patients with MS were examined. The average age was 50.62 ± 1.55 years. MS was confirmed using the diagnostic criteria for MS. Pathology of the digestive system was verified based on clinical symptoms, laboratory and instrumental examination results. Body mass index (BMI) was determined by the ratio of weight in kg to height in m^2 . The state of lipid, protein and carbohydrate metabolism was assessed by the level of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), triglycerides (TG), total protein, protein fractions

and glucose in the blood. The level of protein and albumin was determined by the biuret method using a photometer [2]. Protein fractions were studied by paper electrophoresis using a standard technique. TC was studied by the Ilk method [7]; TG - according to the unified method of reaction with acetylacetone after extraction with a mixture of heptane and isopropyl alcohol [5].

RESULTS AND DISCUSSION

The functional state of the small intestine was studied using complex diagnostic tests: a glucose test (after taking 50 g of glucose) was used for an isolated study of resorptive processes; the state of parietal digestion in the intestine was assessed by the degree of absorption of 50 g of the disaccharide sucrose, cavity digestion - by the degree of absorption of 50 g of the polysaccharide soluble starch, while taking into account the increase in glycemia after 30, 60 and 120 minutes. The control group consisted of 30 practically healthy individuals aged 18 to 62 years. The results of the study are presented in international SI units and subjected to statistical processing, which included traditional methods for calculating relative (P) and average values (M) with the determination of their error ($\pm m$). The reliability of differences in the indicators and mean values was assessed using parametric (Student's t-test, differences were considered reliable at $p < 0.05$) criteria. All the examined patients had abdominal obesity, the average WC in women was 106 ± 4.6 cm, in men - 107 ± 5.8 cm. BMI in the group of patients with MS was 32.26 ± 0.76 , which is significantly higher than the BMI of the control group - 23.15 ± 0.56 , $p < 0.05$. Most patients (92%) suffered from arterial hypertension (AH): grade 1 hypertension - in 36% of patients, grade 2 - in 52%, grade 3 - in 12%. Changes in lipid metabolism in patients with MS were of the nature of severe hyperlipidemia. The level of total cholesterol (6.08 ± 0.16 mmol/l, $p < 0.05$) was higher than in the control group (4.99 ± 0.32 mmol/l). Along with this, hypertriglyceridemia was observed (2.83 ± 0.34 mmol/l) compared to the control (1.48 ± 0.29 mmol/l, $p < 0.05$) and a decrease in the content of HDL-C - 0.86 ± 0.14 mmol/l (in the control group - 1.4 ± 0.11 mmol/l, $p < 0.05$). The

majority of patients with MS (97%) showed an increase in the atherogenic coefficient (AC) level - 5.21 ± 0.28 , while the average risk (AC from 3 to 4) was observed in 27.6%, high risk (AC > 4) - in 69.4% of patients.

During the examination, all patients with MS were found to have some diseases of the digestive organs: chronic pancreatitis - in 89% of those examined, fatty hepatosis - in 42%, chronic acalculous cholecystitis - in 39%, cholelithiasis - in 8%, postcholecystectomy syndrome - in 11%, bile duodenogastric reflux - in 32% of cases, chronic gastritis - in 63%, gastroesophageal reflux disease - in 57%, chronic colitis - in 29%, diverticulosis of the colon - in 2.6% of cases, peptic ulcer in remission - in 11%. The data obtained indicate widespread involvement of the digestive organs in the pathological process in MS and are consistent with the results of other authors [1]. Most of the examined patients with MS (82.9%) had clinical signs of intestinal damage. Thus, the following manifestations of local enteral syndrome were found: diarrhea - in 33.3% of patients, polyfecalia - in 47.6%, rumbling in the abdomen - in 82.9%, flatulence - in 82.9%, pain in the umbilical region - in 66.7%. The patients had general symptoms of enteral damage: trophic disorders (brittle nails, hair loss, dry skin) - in 88% of patients, glossitis and angular stomatitis - in 20%, bleeding gums - in 34.8%, twilight vision disorder - in 11.9%.

Impaired protein metabolism in MS was characterized by a decrease in the level of total serum protein (72.7 ± 1.21 and 78.37 ± 2.12 g/l, $p < 0.05$). A significant decrease in blood albumin was observed in patients (43.05 ± 1.14 g/l) compared to the control group (47.37 ± 0.74 g/l, $p < 0.05$). Hypoproteinemia may be caused by impaired absorption of amino acids by the small intestine and the resulting increase in the loss of amino acids with feces [2], a decrease in the synthesis of amide groups in general, as well as glutamine by the intestinal mucosa [3].

CONCLUSION

All patients with MS showed clinical symptoms of small intestine damage, manifested by local enteral symptoms (stool disorder, rumbling, flatulence, pain in the umbilical region) and general symptoms (brittle nails, hair loss, dry skin, twilight vision disorder, metabolic disorders). When studying the functional state of the small intestine, disorders were noted at all stages of the hydrolysis-resorption conveyor.

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