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Metabolic Syndrome as A Pediatric Problem

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Abstract. The etiology, pathogenesis, and epidemiology of metabolic syndrome in childhood and adolescence are discussed. Criteria for diagnosing the main components of the metabolic syndrome are proposed: obesity, arterial hypertension, hyperglycemia, hypertriglyceridemia, hypoalphacholesterolemia. The problem of metabolic syndrome is considered from the standpoint of vascular risk, issues of diagnosing damage to the cardiovascular system and the development of endothelial dysfunction, arterial hypertension, and dyslipoproteinemia are discussed. Approaches to prevention and treatment are outlined.
Keywords: children and adolescents, metabolic syndrome, obesity, insulin resistance, arterial hypertension.

INTRODUCTION

According to modern concepts, the term “metabolic syndrome” is understood as a symptom complex characterized by increased body weight, insulin resistance and hyperinsulinemia. These disorders lead to disorders of carbohydrate, lipid, purine metabolism, arterial hypertension and are accompanied by changes in the hemostatic system and the occurrence of chronic subclinical inflammation [1, 2]. Shifts in hormonal-metabolic status in metabolic syndrome cause early development of atherosclerotic changes in blood vessels, which creates the preconditions for the emergence and rapid progression of diseases such as coronary heart disease, hypertension, diabetes mellitus, leading to early disability and premature death. [3].

MATERIALS AND METHODS

Recently, metabolic syndrome has been considered as a multidisciplinary problem and is the subject of close study by endocrinologists, cardiologists, and general practitioners. Considering that the onset of cardiovascular diseases already occurs in childhood, metabolic syndrome is beginning to be recognized as an important pediatric problem. Early detection of this condition and elimination of unfavorable clinical and metabolic abnormalities can contribute to more successful prevention of cardiovascular pathology, starting from childhood.

RESULTS AND DISCUSSION

Epidemiology of metabolic syndrome

The frequency of metabolic syndrome among the adult population is high—about 25%. The prevalence of this condition is even higher among adults suffering from obesity, type II diabetes mellitus, and arterial hypertension. Accurate data on the prevalence of metabolic syndrome in the pediatric population are unknown, which is due to the lack of unified criteria for its detection in children. However, according to epidemiological studies, the frequency of metabolic syndrome among adolescents in the American population ranges from 4 to 7.6%. The prevalence of metabolic syndrome increases sharply among obese children and adolescents, reaching 30–50% [4].

Pathogenesis of metabolic syndrome

The triggering pathophysiological mechanism of insulin-resistant syndrome is a decrease in the response of insulin-sensitive tissues to exogenous or endogenous insulin, which leads to a decrease in the supply of glucose to the tissues [1]. The synthesis and secretion of insulin by pancreatic cells increases compensatoryly. Hyperinsulinemia occurs, which is a key link in the development of metabolic syndrome, causing a cascade of unfavorable metabolic and hemodynamic disorders. Hyperinsulinemia first reduces sensitivity and then blocks insulin receptors, as a result of which glucose and fats supplied with food are deposited in adipose tissue. In addition, hyperinsulinemia suppresses the breakdown of fat, contributing to the progression of abdominal obesity.

Components and criteria for diagnosing metabolic syndrome

Taking into account that the metabolic syndrome is represented by a complex of biochemical and clinical characteristics, it is customary to distinguish individual components of this condition. Due to the different target priorities of cardiologists or endocrinologists, based on conceptual ideas about the

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pathogenesis and prognosis of metabolic syndrome, the definition and diagnostic criteria for the main components of metabolic syndrome have some differences.

Obesity

An extremely important problem in pediatrics is the sharp increase in the incidence of obesity, the main clinical component of the metabolic syndrome [3]. The incidence of obesity is increasing in both developed and developing countries. According to recent population studies, the incidence of overweight in the United States among children aged 2 to 5 years is 22.6%, among children and adolescents aged 6 to 19 years it increases to 31% [2]. It should be emphasized that the degree of stability of body weight values from childhood to adolescence increases 4 times.

There are several methods for diagnosing obesity. The body mass index, which is the ratio of body weight in kilograms to height in meters squared, is most often used for this purpose. In the adult population, uniform criteria are used to identify individuals with overweight and obesity based on body mass index values. Thus, overweight is considered when a body mass index is 25-29.9 kg/m2, obesity is considered when a body mass index is more than 30 kg/m2. Considering that anthropometric parameters in children and adolescents depend on age and gender, percentile tables of the distribution of these indicators in the population taking these parameters into account are used to diagnose overweight.

The risk group for the development of overweight includes children and adolescents in cases where the body mass index is between the 85th and 90th percentile. There is disagreement on the question of what body mass index is classified as obesity. A number of authors propose to consider the body mass index corresponding to the 90th percentile as overweight/obesity, while other authors suggest the 95th percentile to be considered overweight/obesity. It is undoubtedly more advisable to use unified criteria for body mass index, adjusted for age and sex, and corresponding to the criteria for adults, to determine overweight and obesity in children and adolescents, since these values determine the high risk of developing cardiovascular diseases.

Insulin resistance

Overweight and obesity are among the most important risk factors for type II diabetes mellitus. It should be emphasized that with the increase in the incidence of obesity, the prevalence of type II diabetes mellitus in children and adolescents has increased 10-fold. Moreover, according to T. Hannon et al., all new cases of diabetes mellitus were found in children with a body mass index of more than 37.7 kg/m2 [3].

Insulin resistance is currently regarded as the main pathogenetic mechanism of metabolic syndrome. Insulin resistance is a common condition in the adult population. Thus, according to the American Association of Clinical Endocrinologists, from 70 to 80 million Americans suffer from insulin resistance [4].

Endothelial dysfunction as a marker of vascular risk

In recent years, much attention has been paid to the significance of endothelial dysfunction in the progression of arterial hypertension. Insulin resistance and concomitant hyperinsulinemia lead to endothelial dysfunction, promote proliferation of smooth muscle cells, increase the sensitivity of the endothelium to pressor agents, narrowing the lumen of blood vessels, which increases overall peripheral vascular resistance. Endothelial dysfunction can be considered as a marker of early atherosclerotic changes in the vascular wall.

CONCLUSION

Metabolic syndrome, which is the cause of the development of major cardiovascular diseases (coronary heart disease, hypertension) and type II diabetes mellitus, manifests itself starting from childhood. At the same time, the importance of metabolic disorders as risk factors for athero-, thrombo- and diabetogenic complications increases from childhood to adolescence, which allows us to consider this condition as an important pediatric problem.

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