Childhood and Adolescent Obesity as a Cardiovascular Risk Factor

Posted on October 24, 2019

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Obesity as a Public-Health Epidemic

The increase in the incidence of obesity has become an epidemic in both adults and children. It is believed that an adult person is overweight if his body mass index is 25 to 29.9 kg / m2 and obese – if the BMI is more than 30 kg / m2. If the body weight is two or more times higher than the normal weight, then they say morbid obesity.

Prevalence of Obesity in the United States

At present, obesity has become a serious problem in the United States. During the 1980-the 1990s, the prevalence of obesity increased by 50% and continues to increase. If 40 years ago only 25% of American adults suffered from overweight or obesity, today this figure has grown to almost 70%. In addition, the proportion of the population with morbid obesity is growing faster than the proportion of Americans with overweight or moderate obesity. According to Mandviwala, Khalid & Deswal (2016), smoking, alcoholism, and poverty increase the risks of gaining excess weight. If current trends continue, obesity in the US will soon overtake smoking and become the leading cause of death that could be prevented. Moreover, if we fail to stop the epidemic of obesity in the near future, then the increase in the life expectancy of a person will stop, and the process can turn in the opposite direction.

Obesity Mortality and Cardiovascular Risk

Obesity is an important factor determining the probability of death of a person. Thus, it is proved that both general obesity and abdominal (mainly in the abdomen and upper body) are associated with an increased risk of premature death. However, doctors talk about the “paradox of obesity”: despite the fact that it is a risk factor for hypertension, heart failure, and coronary heart disease, studies indicate that in the presence of extra pounds, people with these diseases often have a more favorable prognosis than patients with normal weight.

Structure and Circulation of the Human Heart

The heart is an organ, mainly consisting of a special cardiac cross-striated muscle tissue (myocardium). Two auricles and two ventricles of the heart are organized into two circles of circulation: small (pulmonary), through which blood is enriched with oxygen, and large, through which the blood carries oxygen throughout the body (Landsberg et al., 2013).

Systole and Diastole in Cardiac Function

They talk about the two main phases of the heart: systole (contraction) and diastole (relaxation). In the phase of systole, two stages can be distinguished:

1) First, atrial contraction occurs, and blood from them enters the ventricles;

2) Then the ventricles contract and the blood from them gets from the left ventricle – to the organs of the body and from the right – to the lungs.

Effects of Obesity on Cardiac Workload

In the phase of diastole, the heart muscle relaxes, and the blood fills the atria: the left atrium – is oxygen-enriched blood from the lungs, and the right – is oxygen-poor blood from the organs and tissues. Obesity affects the amount of blood that passes through the heart. The greater volume of blood is more pressing on the walls of the blood vessels; that is, the body is forced to adapt to large loads. Consider how this happens.

Blood Volume Cardiac Output and Vascular Resistance

With obesity, the total volume of blood increases, and, accordingly, Lavie, Milani, & Ventur (2009) state the amount of blood ejected by the heart per unit of time. In general, the increase in cardiac output is due to the growth of the stroke (systolic) volume of the heart – the amount of blood ejected by the heart in one contraction (systole). In addition, the heart rate usually slightly increases – thanks to the activation of the sympathetic nervous system. Usually, in full patients, the volume of cardiac output increases with weight gain, and the level of peripheral vascular resistance remain low at any arterial pressure, that is, the tonus of the vessel walls decreases inversely with obesity. It is believed that this is an adaptive mechanism that allows maintaining, to a certain degree, the normal pressure and resistance of the walls of the vessels in the body (Lavie, Milani, & Ventur, 2009). However, he cannot fully compensate for the negative effects of obesity. With an increase in the stretching of the heart muscle, the force of the heart contractions increases; that is, the pressure on the vessels

increases. Therefore, obese patients are more likely to be hypertensive than lean people, and as a rule, weight gain is associated with increased blood pressure.

Ventricular Enlargement and Cardiac Remodeling

As the volume and pressure increase when blood is filled in the heart, in people with excess weight and obesity, the left ventricle chamber often increases (Lands Berg et al., 2013). In addition, the risk of hypertrophy (increase) of the left ventricle increases regardless of age and blood pressure. The probability of changes in the structure of the heart increases: concentric remodeling of the myocardium and left ventricle. Remodeling means a whole complex of changes occurring in the heart: thickening of the walls and the muscle fibers themselves, an increase in the number of components of the cardiac striated muscles, and the like. In addition to hypertrophy of the left ventricle, obesity is often the cause of enlargement of the left atrium; this is due to an increase in the volume of circulating blood and changes in the volume of filling of the left atrium during diastole (relaxation). All these changes increase the risk of developing heart failure. An increase in the left atrium also increases the risk of atria fibrillation and related complications.

The Obesity Paradox in Heart Failure

Researchers believe that being overweight can be a kind of protection. Progressing heart failure is a catabolic state (decay state), and in patients with heart failure and obesity, the metabolic reserve is higher. It has also been shown that fatty tissue produces soluble receptors for tumor necrosis factor-alpha and can play a protective role in obese patients and acute or chronic heart failure by binding TNF-α and neutralizing their negative biological effects. In addition, lipoproteins (cholesterol) circulating in the blood, whose level is elevated in obese patients, bind and neutralize lipopolysaccharides, which play a role in stimulating the production of inflammatory cytokines, thereby protecting the patient (Landsberg et al., 2013).

Conclusion on Weight Loss and Cardiovascular Prevention

The vast majority of studies confirm the effect of obesity on the development and progression of cardiovascular diseases. Despite the existence of the paradox of obesity, according to which people with excess kilograms and cardiovascular diseases have a more favorable prognosis than thin patients with the same diagnosis, studies suggest that weight loss is effective for the prevention and treatment of cardiovascular diseases. According to scientists, more research is needed because if the current epidemic of obesity continues, soon we can witness the sad end of the epic to increase life expectancy.

References

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