

PECULIARITIES OF HYPERTENSION IN YOUTHS - A BRIEF OVERVIEW

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ABSTRACT

The data obtained from research proves that a growing number of children and adolescents develop hypertension frequently, a situation that challenges public health worldwide. A growing prevalence of hypertension in children and adolescents is likely to induce a growing prevalence of hypertension in young adults. Therefore, precisely defined protocols and software tools should aid primary health protection to overcome the difficulty in screening, identification and confirmation of high blood pressure conditions in youths. A specific approach to detecting hypertension in youths is monitoring blood pressure values during various cardiac stress tests which reveal the cases of the so-called "masked hypertension". Youths who suffer from high blood pressure should change their lifestyle, which includes: losing weight, regular physical activity, a well-balanced diet and reducing stress. In case of prior lack of physical activity, children and adolescents in question should begin with some easy and short physical exercises and gradually increase their frequency, intensity and/or duration over time. Additionally, it is very important to reduce sedentary activities that involve sitting at smartphones, tablets or computers to play video games, text people or use social networks, as well as watching TV. The diagnosis of elevated values of blood pressure in early age should result in efficient nonpharmacologic and pharmacologic treatments as valuable secondary prevention of unwanted cardiovascular disorders in later life.

Keywords: Children, adolescents, blood pressure, physical activity, obesity.



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THE GROWING PROBLEM OF HYPERTENSION IN YOUTHS

Hypertension is defined as the condition in which the blood pressure imposed on arteries is above the physiological values. The raised pressure under which the blood is transported to various organs causes their gradual damage. The most affected organs are the heart and blood vessels, which causes various cardiovascular diseases (ischemic heart disease, cerebrovascular accident (stroke), chronic kidney disease, etc.) that are the leading cause of death globally. The data obtained from research proves that a growing number of children and adolescents develop hypertension frequently, a situation that challenges public health worldwide (1-5). The frequency of hypertension in youths increased during the period from 1994 to 2022, whereas the current overall global rate is that 5% of the young persons under the age of 19 have hypertension (3). The main risk factors of hypertension in children and adolescents include obesity, premature birth, chronic diseases (of heart, kidneys, lungs, diabetes, etc.), medicines known to cause raised blood pressure (methylphenidate, steroids, etc.) and the period after the organ transplantation. Research conducted in different parts of the world indicates that the hypertension frequency in obese children and adolescents is up to 10% (6).

CAUSES OF HYPERTENSION IN YOUTHS

High blood pressure is a clearly defined, variable risk factor of an early-age disability and mortality (1). Although the majority of harmful cardiovascular conditions develop in adulthood, raised values of blood pressure can be diagnosed already in childhood and adolescence. The causes and pathogenic mechanisms of raised values of blood pressure in children and adolescents are insufficiently clarified. Primary artery hypertension in youths is a multifactor disease, but certain factors leading to its development are rather known and defined. The genetic component is a factor that may affect the values of blood pressure since it is related to a higher concentration of inflammatory mediators that contribute to the development of hypertension (2). Research has shown that the values of blood pressure between parents and their biological children are more closely connected than those between spouses or between parents and their adopted children (3). Obesity is one of the main risk factors of hypertension in children and adolescents. Overweight children ($\text{BMI} \geq 85$. percentiles) develop 2.6 times higher risk of hypertension while this rate is 9.2 times higher in obese children ($\text{BMI} \geq 95$. percentiles) (3). The cause-and-effect relation between obesity and high blood pressure is considered to develop before the age of five. The mechanisms by which obesity affects blood pressure values are still insufficiently explored, but they are known to include an excessive activation of the sympathetic nervous system, sodium metabolism disorders, oxidative stress, hemodynamic changes, disorders of the physiological functions of kidneys and of endocrine system. Physical activity is conversely related to obesity in childhood and is directly opposed to the obesity and hypertension

mechanisms (4). Visceral distribution of the adipose tissue, low level of physical activity and hypercaloric diets are among the most significant factors that lead to the increase of blood pressure in youths (5-8). Moreover, visceral distribution of the adipose tissue is related to the following metabolic factors: high BMI, insulin resistance, higher leptin levels in the circulation and higher concentration of the inflammatory markers (9,10). The accumulation of the visceral adipose tissue, closely related to the increase of the free fatty acids' contents and insulin resistance, additionally raises the risk of hypertension (11,12). Radiological analyses have confirmed that the anthropometric measurements of waist circumference, as well as the relation between the waist circumference and height in young people, are closely connected with the abdominal obesity and the accumulation of the visceral adipose tissue (13-15), which facilitates the monitoring of these risk factors. Hypertension in youths affects their adult life significantly since it increases the risk of developing certain unwanted cardiovascular conditions in their later age. The main hemodynamic change in primary hypertension in children, adolescents and young adults is the increase of cardiac output. Prolonged and severe hypertension may lead to the progression from the "cardiac" to the "vascular" phenotype with a higher systemic vascular resistance (16). Early diagnostics of high blood pressure and an adequate therapy directed towards the decrease of an excessive cardiac output in youths can prevent the progression to the "vascular" phenotype that is closely related to severe cases of hypertension at the old age. Extremely important are the findings that youths suffering from hypertension develop subclinical changes in their cognitive functions. Compared to the normotensive respondents, the adolescents with hypertension had worse results when doing the memory and attention tests (17,18).

SIGNIFICANCE OF EARLY DETECTION

A growing prevalence of hypertension in children and adolescents is likely to induce a growing prevalence of hypertension in young adults. Therefore, precisely defined protocols and software tools should aid primary health protection to overcome the difficulty in screening, identification and confirmation of high blood pressure conditions in youths. This is particularly significant due to a constantly increasing rate of obesity in children, which is one of the main risk factors of primary hypertension in children and adolescents (19,20). A specific approach to detecting hypertension in youths is monitoring blood pressure values during various cardiac stress tests which reveal the cases of the so-called "masked hypertension". Elevated blood pressure readings are thus identified in youths whose blood pressure is otherwise normal when not exposed to physical activities (21). After the initial diagnosis of elevated blood pressure, it is recommended that children and adolescents be referred to a nephrologist, cardiologist or endocrinologist for further examination. In children and adolescents with secondary hypertension, early diagnosis determines the therapy that treats the principal cause of hypertension. The primary hypertension diagnosis should be followed by nonpharmacologic treatments (decrease of weight in cases of overweight or obesity,

regular physical activity, lower intake of sodium) and pharmacologic treatments to significantly decrease the risks of unwanted cardiovascular disorders in later life (22,23).

LABORATORY CARDIAC STRESS TESTS IN DIAGNOSTICS

Physical activities of both submaximal and maximal intensity are expected to moderately raise blood pressure in youths (21,24). Although the physiological mechanism that causes an increase of systolic blood pressure is well explained, there is little data related to the changes of blood pressure values depending on the kind, duration and intensity of physical activity. Standardized laboratory cardiac stress tests, which include riding an ergo bike or running on a treadmill, are used to assess the cardiovascular system of young people, particularly those who train regularly and/or play competitive sports. In practice, measuring blood pressure when the individual is not physically active identifies children and adolescents with high blood pressure (values above 95. percentiles according to current guidelines) who are further referred to additional diagnostic procedures and potential treatment. On the other hand, children and adolescents with normal blood pressure when inactive (values below 95. percentiles according to current guidelines) who have additional risk factors of cardiovascular diseases (e.g., overweight/obesity, abnormal lipid status, abnormal glucose tolerance/diabetes, family history of cardiovascular diseases and/or evident lack of physical activity) can benefit from cardiac stress tests when their condition is evaluated (24,25). An excessive increase of blood pressure (related or not related to the heart rhythm) during cardiac stress tests indicates the necessity of further analysis (21). However, there is not enough data at present to establish general guidelines for measuring blood pressure during cardiac stress tests in order to assess the risks of cardiovascular diseases in children and adolescents.

NONPHARMACOLOGIC TREATMENT

Youths who suffer from high blood pressure should change their lifestyle, which includes: losing weight, regular physical activity, a well-balanced diet and reducing stress. In case of prior lack of physical activity, children and adolescents in question should begin with some easy and short physical exercises and gradually increase their frequency, intensity and/or duration over time. Additionally, it is very important to reduce sedentary activities that involve sitting at smartphones, tablets or computers to play video games, text people or use social networks, as well as watching TV. These activities should be reduced to a maximum of two hours a day and parents are expected to set an example in this regard. Youths with elevated blood pressure can increase their physical activity by participating in spontaneous physical activities, organized programs of physical exercises or playing sports, which all require that their parents be directly involved. Spontaneous physical activities include walking to and from school, riding a bike, spending free time in recreational centers or on family picnics (25-29). Classes of

physical education in preschool, primary and secondary education should be crucial in raising the level of physical activity since they are adequately planned and without charge. Moreover, physical education in schools can potentially initiate children to develop the need for physical activity so that it becomes their regular habit. Therefore, parents should be constantly advised to have a positive influence on their children regarding classes of physical education (28). The diagnosis of elevated blood pressure in youths who already play sports leads to certain limitations of those activities that cause abrupt increase of cardiac frequency up to the maximum values, increase of peripheral resistance and cardiac output. These sports include skiing, gymnastics and athletics (30). However, this does not mean that children and adolescents with elevated blood pressure cannot occasionally play these sports for recreation.

CONCLUSION

There is still little research conducted on the values of blood pressure in youths considering the relevance of this topic. The diagnosis of elevated values of blood pressure in early age should result in efficient nonpharmacologic and pharmacologic treatments as valuable secondary prevention of unwanted cardiovascular disorders in later life. The application of the latest guidelines, equipment and methods of treatment for determining the values of blood pressure and physical constitution is assumed to yield relevant results that can be further used. Firstly, determining the frequency of hypertension in youths can be an initial step towards planning the measures to be taken in public health. Secondly, determining the link between blood pressure and physical constitution in children and adolescents can be fundamental for planning efficient nonpharmacologic treatments for hypertension.

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