Features of diagnostics and control of blood pressure in children: modern approaches in paediatrics

Características del diagnóstico y control de la presión arterial en niños: enfoques modernos en pediatría.

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Abstract

The article reviews modern approaches to diagnosis and control of blood pressure in children in pediatric practice. Arterial hypertension, previously associated mainly with the adult population, has been increasingly diagnosed in children and adolescents in recent decades. This is due to an increase in risk factors such as obesity, sedentary lifestyle and stress. The importance of timely diagnosis of arterial hypertension in children is due to possible long-term cardiovascular and general health consequences.

The authors also focus on specific features of blood pressure monitoring in children, including cuff selection, measurement algorithms and frequency of monitoring. Modern technologies, such as ambulatory blood pressure monitoring (ABPM) and self-monitoring methods, their advantages and disadvantages in pediatric practice are discussed. Special attention is paid to the developed blood pressure standards for children of different age groups, as well as the influence of factors such as height, weight and gender.

Preventive measures and intervention programmes to improve blood pressure control in children are also reviewed, including dietary recommendations, physical activity and drug therapy if it is necessary.

Keywords: blood pressure, arterial hypertension, children, diagnosis, control, ambulatory blood pressure monitoring (ABPM), pediatrics, risk factors, prevention.

Resumen

El artículo revisa los enfoques modernos para el diagnóstico y control de la presión arterial en niños en la práctica pediátrica. La hipertensión arterial, anteriormente asociada principalmente a la población adulta, se ha diagnosticado cada vez más en niños y adolescentes en las últimas décadas. Esto se debe a un aumento de factores de riesgo como la obesidad, el sedentarismo y el estrés. La importancia del diagnóstico oportuno de la hipertensión arterial en niños se debe a las posibles consecuencias cardiovasculares y de salud general a largo plazo.

Los autores también se centran en características específicas de la monitorización de la presión arterial en niños, incluida la selección del manguito, los algoritmos de medición y la frecuencia de la monitorización. Se discuten las tecnologías modernas, como la monitorización ambulatoria de la presión arterial (MAPA) y los métodos de autocontrol, así como sus ventajas y desventajas en la práctica pediátrica. Se presta especial atención a los estándares de presión arterial desarrollados para niños de diferentes grupos de edad, así como a la influencia de factores como la altura, el peso y el sexo.

También se revisan medidas preventivas y programas de intervención para mejorar el control de la presión arterial en niños, incluyendo recomendaciones dietéticas, actividad física y farmacoterapia si es necesario.

Palabras clave: presión arterial, hipertensión arterial, niños, diagnóstico, control, monitorización ambulatoria de la presión arterial (MAPA), pediatría, factores de riesgo, prevención.

Introducción

Arterial hypertension is one of the most common cardiovascular pathologies in adults; however, in recent years, the problem of high blood pressure (BP) has become relevant in the pediatric population[1]. With changing lifestyles associated with an increasing number of overweight children, sedentary behaviour, stress and changes in eating behaviour, arterial hypertension in children and adolescents is becoming more common. According to various studies, the incidence of hypertension in children and adolescents varies between 1-5%, which makes the problem of early diagnosis and control of BP in pediatric practice extremely important.

Despite considerable attention to arterial hypertension in adults, in children and adolescents the methods of diagnosis and control have their own peculiarities. Firstly, children have significantly different normative blood pressure values, which vary according to age, height and sex of the child. Secondly, it is important to choose the correct method of BP measurement, as errors can lead to hypo- or hyper diagnosis.

In addition, new techniques and technologies for blood pressure monitoring, such as ambulatory blood pressure monitoring (ABPM) and self-monitoring methods, have been emerging in recent years. These approaches allow more accurate assessment of BP in children, as well as identification of possible variability throughout the day. The introduction of these technologies into pediatric practice improves the diagnosis and management of patients with arterial hypertension.

In this regard, the study of modern approaches to the diagnosis and control of blood pressure in children is of particular importance. This article reviews the main methods, diagnostic criteria, and approaches to the prevention and control of arterial hypertension in children and adolescents.

Materials and methods

In the process of writing the paper, a study and analysis of modern scientific publications, guidelines and clinical recommendations related to blood pressure in children was carried out. This method includes the study of sources such as scientific articles, meta-analyses, systematic reviews and guidelines on the diagnosis, control and treatment of arterial hypertension in pediatrics. It summarizes existing evidence and identifies key approaches.

A comparison of different methods of blood pressure measurement in children (manual measurement, automatic tonometers, ambulatory monitoring and self-monitoring methods) has also been carried out. Comparative analysis helps to identify the advantages and disadvantages of different methods of diagnosing and controlling BP in children and adolescents, as well as their applicability in different age groups. Synthesis of information consists in generalizing and combining data obtained from different sources to form a holistic picture of diagnosis and monitoring of blood pressure in children. Synthesis allows the integration of theoretical knowledge with practical aspects of pediatric practice.

The systematization of the collected information on age-specific blood pressure norms, factor characteristics af-

fecting its level, and various methods of control made it possible to structure knowledge and clearly present information on classification and diagnostic standards.

The application of these theoretical methods provided a scientific basis for the analysis and systematization of information on modern approaches to the diagnosis and control of blood pressure in children.

Results

Arterial hypertension, previously considered a disease of predominantly adult population, has become increasingly relevant among children and adolescents in recent decades. The sharp increase in the number of cases of high blood pressure diagnosed in childhood is associated with global changes in lifestyle and environment. Modern children are increasingly exposed to risk factors previously common to adults: overweight and obesity, inappropriate diet high in salt and fat, sedentary lifestyle, increased stress levels and lack of physical activity[2].

The situation is aggravated by the fact that arterial hypertension in children and adolescents is often asymptomatic or with minimal clinical signs, which makes its timely detection difficult. At the same time, early onset of the disease can have serious health consequences, including target organ damage (heart, kidneys, brain) and increased risk of cardiovascular disease in adulthood[3]. Studies show that children with untreated hypertension are more likely to experience problems such as left ventricular hypertrophy, reduced renal function and atherosclerotic changes in blood vessels.

The peculiarities of diagnosing arterial hypertension in children are associated with the fact that blood pressure norms differ significantly depending on the age, sex and height of the child. This requires the use of special percentile tables that help determine whether the pressure level is within the normal range for a particular child. Unlike adults, who have a clear threshold of normal blood pressure (e.g. 120/80 mmHg), in children normal values vary and depend on many factors.

For an accurate diagnosis, it is also important to take blood pressure measurements correctly. Children and adolescents may have difficulty using standard adult tonometers, so the cuff size and other features of the procedure must be taken into account. In addition, ambulatory blood pressure monitoring (ABPM) is increasingly being used to more accurately assess blood pressure levels by recording readings throughout the day and detecting possible fluctuations. This method is important for confirming the diagnosis and determining the nature of hypertension - constant or episodic increase in BP[4].

Modern methods of blood pressure monitoring and control, including digital devices and mobile applications for self-monitoring, are being actively introduced into pediatric practice. They allow regular monitoring of the child's condition and timely correction of treatment[5]. In addition, an important part of prevention and treatment is the correction of lifestyle: diet, weight loss, increased physical activity, and stress control.

Thus, the increasing number of cases of arterial hypertension among children and adolescents requires the application of modern diagnostic and therapeutic approaches aimed at early detection and effective control of the disease to prevent the development of serious complications in the future.

Timely diagnosis of arterial hypertension in children is of great importance, as it can prevent the development of serious long-term consequences for the cardiovascular system and general health of the child. Unlike adults, in whom arterial hypertension often manifests itself more clearly; in children it may remain undetected for a long time, as it is asymptomatic or with minimal manifestations. However, even in the absence of symptoms, high blood pressure at an early age can cause significant damage to the cardiovascular system.

One of the most serious consequences of childhood hypertension is the development of left ventricular hypertrophy - thickening of the heart muscle, which can lead to heart malfunction and increase the risk of heart failure in the future[6]. Constant high blood pressure also negatively affects the condition of blood vessels, accelerating the process of atherosclerosis - the formation of plaques in the blood vessels, which can lead to coronary heart disease and strokes in the future.

In addition, arterial hypertension negatively affects the kidneys, being one of the leading causes of chronic renal failure. Children with hypertension often have changes in renal structures, which can impair the organ's function and lead to progressive deterioration in the future. Also, prolonged hypertension in childhood increases the likelihood of developing other metabolic disorders such as type 2 diabetes mellitus, which exacerbates the risk of cardiovascular disease.

Timely detection of arterial hypertension in children and adolescents allows early prevention and treatment, which can significantly reduce the risk of these complications. Appropriate therapy and lifestyle changes ¬-such as weight control, increased physical activity, healthy diet and reduced stress levels-can effectively normalize blood pressure and prevent long-term adverse effects on child health[7].

Thus, timely diagnosis of arterial hypertension in childhood plays a key role in preventing serious cardiovascu-

lar, renal and other organ diseases in the future, providing children with a better quality of life and a favourable long-term prognosis.

Methods of diagnosing arterial hypertension in children include a number of procedures and tools aimed at accurately measuring blood pressure (BP), identifying possible causes of hypertension and determining the risk of complications.

Blood pressure (BP) measurement in the clinical setting is the most important method for the primary diagnosis of arterial hypertension in children. However, this process requires adherence to a number of specific conditions to obtain accurate and reliable results. Diagnosis in children has specific features that distinguish it from blood pressure measurement in adults[8].

One of the key challenges in measuring BP in children is finding the correct cuff size. The cuff should fit the circumference of the child's upper arm, as using an inappropriate cuff can lead to erroneous results. A cuff that is too small may overestimate blood pressure readings, while a cuff that is too large may underestimate them. It is generally accepted that the width of the cuff should be approximately 40% of the circumference of the upper arm and the length of the inflatable part should cover at least 80% of the length of the upper arm[9]. It is very important to maintain the correct position of the child's body during BP measurement. The child should be in a relaxed state, sitting on a chair with a straight back and relaxed arms. The legs should be flat on the floor, not crossed, and the arm on which the measurement is taken should be at the level of the heart. These conditions are important to obtain correct results, as incorrect posture can lead to distorted data.

Before starting BP measurement, the child should be at rest for at least 5 minutes, in a calm environment, avoiding physical activity, stress and external stimuli. Measurement is performed at least three times with an interval of 1-2 minutes between each measurement. The average of the three measurements is considered to be the most reliable. BP is often measured in both arms to detect possible asymmetry, which may also indicate pathological changes[10].

The method of BP measurement depends on the age of the child. In newborns and infants, the measurement is performed on the lower limb, more often on the thigh, using special pediatric tonometers.

In younger children (up to 3 years of age), measurement may be difficult due to the child's restlessness, so it is important to adapt the procedure as much as possible, e.g. to perform it in the presence of parents or to use playful elements to reduce stress.

In older children, standardized approaches are used, but with individual differences. For example, if a child is stressed or anxious at the sight of medical devices, this may cause a temporary increase in BP (white coat syndrome), which requires additional monitoring and repeated measurements at home[11].

Automated tonometers are increasingly used in pediatrics practice, especially in the home. However, they are not always accurate enough for young children, so mercury or aneroid tonometers are preferred in clinical practice. Automatic devices can give inaccurate results, especially if the cuff is incorrectly selected or the child moves during measurement. Nevertheless, they are convenient for regular BP monitoring at home, which allows you to monitor the dynamics of pressure and identify possible deviations.

Once the blood pressure is measured, the results are compared to the norms appropriate for the child's age, height and sex. Unlike adults, who have clear standards (e.g., 120/80 mm Hg), in children the norms vary depending on these factors. To determine if BP is normal, a percentile scale is used, where BP values above the 95th percentile are considered hypertension and values in the 90-95 percentile range are considered borderline. These tables provide a more accurate guide for assessing BP and determining the risk of hypertension.

Health care professionals play a key role in the correct measurement of BP in children. Professionals should be trained in the correct techniques and approaches to measuring BP, especially in young children. An individual approach to each patient is important, creating a comfortable environment that minimises the child's fears and prevents stressors that can temporarily increase blood pressure. It is important to explain the procedure to children and parents to avoid anxiety and obtain the most accurate results.

Thus, blood pressure measurement in clinical settings requires adherence to a number of methodological features that take into account physiological and emotional differences in children. An accurate approach to BP measurement is an essential step in the diagnosis of arterial hypertension and allows effective early detection of abnormalities, which is critical to prevent long-term complications.

The AMAD provides data on blood pressure fluctuations throughout the day, making it possible to identify the time of day when blood pressure rises and to assess the impact of daily activity, stress and other factors. In some children, BP levels may only rise in the clinical setting due to the stress of a doctor's visit. The AMAD can iden-

tify such cases where BP at home remains within normal limits, which is important for a correct diagnosis.

Data obtained during the night can be critical for the diagnosis and detection of hypertension that is not evident during the day. AMAD helps to evaluate the effectiveness of prescribed therapy and to make changes in treatment if necessary.

Before monitoring begins, it is important to explain to the child and parents how the procedure will be performed to reduce anxiety and prepare them to wear the device. Ensure that the child has no contraindications for the AMAD. The tonometer is placed on the child's arm, usually on the non-working arm, above the elbow. The device must be properly secured to avoid displacement during wearing.

For 24 hours, it is important that the child continues with the usual routine, including physical activity, eating and sleeping. Excessive exercise and stressful situations should be avoided. It is recommended to keep a diary in which parents can record physical activity, meals, stressful situations and other important events that may affect blood pressure[13].

Despite its many benefits, the AMAD has some limitations. Wearing the device may be uncomfortable for some children, especially young children, and may cause negative emotions. In rare cases, automatic devices may give erroneous readings due to improper attachment, movement of the child during measurement, or other factors. AMAD results require qualified interpretation to avoid incorrect conclusions and inadequate treatment.

New monitoring devices and techniques are emerging as technology advances and can improve the quality of diagnosis. For example, the development of wearable devices that can monitor blood pressure in real time offers the possibility of more accurate monitoring of a child's health. The integration of AMAD with mobile applications and telemedicine platforms opens new horizons for remote health monitoring and management.

AMAD is an important tool in the diagnosis of arterial hypertension in children, providing a complete picture of the child's health status and allowing treatment to be tailored according to the findings. Its effective use facilitates early detection and correct management of hypertension, which is critical to prevent long-term complications[14].

Self-monitoring of blood pressure (BP) is an important adjunct to professional diagnostic and monitoring methods, particularly in the context of the management of arterial hypertension in children and adolescents. This approach provides an opportunity for parents and children themselves to be actively involved in the process of health monitoring, which can significantly improve the effectiveness of treatment and quality of life.

Self-monitoring allows you to take into account your child's lifestyle and adapt your treatment regimen based on the findings, including changes in diet, physical activity and stress. Self-measurement of BP can help reduce fear of medical procedures and reduce the likelihood of high blood pressure due to the stress of a doctor's visit.

It is important to use tonometers specifically designed for children. They should be accurate and easy to use. It is recommended to choose automated models that are easy to use at home. Before measuring, the child should be in a calm state for at least 5 minutes. Measurements are taken in a sitting position, with a relaxed arm at heart level.

It is recommended to measure BP at the same time every day to obtain comparable data. You should also record the values before taking medication and a few hours afterwards. It is important to record all measurements in a special diary, recording the date, time, BP level and possible factors that may have influenced its change (e.g. physical activity, stressful situations, diet). This will help the physician to better understand the dynamics of the condition[15].

Teaching parents and children the correct methods of self-monitoring is critical to the success of this approach. Involving children in the process of self-monitoring can be psychologically beneficial. It helps shape their responsibility for their own health, which is important for later adulthood. In addition, teaching children self-monitoring skills can reduce the level of anxiety associated with medical procedures.

With the development of technology, self-monitoring of BP is becoming more and more accessible and convenient. Modern monometers can be connected to mobile applications that allow you to track data in real time, keep statistics and receive reminders when a measurement is needed. This makes the process more interactive and convenient for children and their parents.

Self-monitoring of blood pressure is an important tool in the management of arterial hypertension in children. It not only allows timely detection of changes in health status, but also promotes responsibility for one's own health. Proper education, use of appropriate devices and keeping a measurement diary can improve the effectiveness of monitoring and improve the quality of life of children with hypertension.

Clinical examination and history taking are important steps in the diagnosis of arterial hypertension in children. These methods help the physician to obtain a complete picture of the patient's health status, identify possible causes of hypertension and determine the need for further testing or treatment. Gathering anamnesis includes detailed information about the child's health, family history and lifestyle. This process identifies potential risk factors and causes of arterial hypertension.

It is important to find out if there is a family history of hypertension, cardiovascular disease, diabetes or other chronic diseases. The presence of a family predisposi-

tion may indicate a high risk of hypertension in the child. All previous illnesses, surgeries and injuries are clarified. Particular attention is paid to the presence of kidney disease, endocrine disorders (e.g., hypothyroidism or pheochromocytoma), which may be secondary causes of hypertension. Allergies, drug intolerances and current medications that the child is taking should also be enquired about.

The doctor should find out the child's habits: level of physical activity, sleep patterns, diet, presence of stress and emotional tension. Overweight and obesity are important risk factors for hypertension, so it is necessary to assess the child's body mass index (BMI).

It is also important to learn about habits related to salt, sugar, fast food and sugary drinks, as well as time spent in front of screens (TV, computer, mobile devices)[16].

The physical examination helps the doctor determine the child's physical condition and identify possible signs that indicate the presence of hypertension or other conditions. BP is measured several times using the correct technique to get reliable results. It is important to record BP in both arms if necessary. The child's height and weight are measured to calculate body mass index (BMI) to assess obesity and its associated risks.

The doctor listens to the heart and lungs, checks the pulse in the extremities, and examines the skin. He or she will look for signs of cardiac hypertrophy or other abnormalities. Physical examination may also assess the presence of oedema on the extremities, which may indicate kidney problems that contribute to an increase in BP.

Assessment of target organ function, such as the eyes (examination of the ocular fundus to detect changes associated with hypertension) and respiratory status. If the physician identifies risk factors or suspicion of secondary arterial hypertension during the history and physical examination, further investigations may be required.

If endocrine disorders such as hyperthyroidism or pheochromocytoma are suspected, tests for thyroid hormone levels, cortisol and other hormones may be prescribed. Echocardiography (cardiac ultrasound) allows you to assess the structure and function of the heart, to identify signs of left ventricular hypertrophy, as well as other anomalies that can occur against the background of long-term arterial hypertension. Ultrasound of the kidneys helps to identify possible structural changes or anomalies that may be the cause of hypertension. Examination of blood flow in large vessels may reveal stenosis or other abnormalities affecting blood pressure levels.

Based on the collected anamnesis, physical examination and additional tests, the doctor makes a comprehensive diagnosis and treatment plan. It is important to establish an accurate diagnosis, determine the type and degree of hypertension (primary or secondary), as well as identify co morbidities that may affect the choice of therapy.

The clinician should also discuss with the parents and child the importance of adhering to guidelines, scheduling regular check-ups and following an individualised treatment plan. This ensures a comprehensive approach to the management of the child with hypertension and reduces the risk of future complications.

Clinical examination and history taking are the most important steps in the diagnosis of arterial hypertension in children. These methods help to gain a complete picture of the child's health status, identify possible causes of hypertension and determine the next steps in treatment. This comprehensive approach provides better management of the child's condition and helps prevent long-term complications.

The treatment of arterial hypertension in children is a multilevel process that includes both non-medication and medication. It is important to take into account the age of the child, the degree of hypertension, co morbidities and individual characteristics.

Prevention of arterial hypertension in children is important because early intervention can significantly reduce the risk of developing this condition and its long-term complications. The main aspects of prevention include lifestyle changes, educational programmes, regular check-ups and early diagnosis. It is important to inform parents about risk factors for arterial hypertension such as obesity, sedentary lifestyle, poor diet and stress. Education programmes should include advice on healthy lifestyles and regular health monitoring.

It is also important to introduce programmes to raise awareness of healthy eating and the importance of physical activity in schools. Physical education lessons and sports activities should become part of children's daily lives. The use of media and social networks to disseminate information on the prevention of arterial hypertension and other cardiovascular diseases can include videos, articles, infographics and other formats.

Good nutrition plays a key role in developing healthy habits in children. It is important to involve them in cooking and food selection so that they can learn to choose healthy foods. It is recommended to limit the consumption of salt, sugar and saturated fats. Supporting family traditions of healthy eating, such as eating together, can also significantly improve children's eating habits.

Physical activity is an integral part of a healthy lifestyle. It is recommended to increase children's physical activity by including active play, gyms and participation in sports in their daily lives. Establishing "screen-free" times when children can play outside or engage in physical activity without the use of gadgets contributes to improved physical well-being.

Stress management is another important aspect of health. Teaching children and parents relaxation, meditation and emotion management techniques can have a

positive impact on overall health. Psychological support and stress management training can help to manage emotions and increase resilience to stressful situations.

Regular health checks are crucial for early detection and control of arterial hypertension in children. Regular blood pressure checks are recommended, especially in children with risk factors. Screening should be done as part of preventive check-ups with pediatricians or in school health offices. In addition, regular height and weight measurements will help to monitor BMI and identify cases of overweight early, allowing for timely intervention and lifestyle changes. It is important that the doctor actively discusses children's health with parents, providing recommendations on how to reduce risks and maintain a healthy lifestyle.

Family involvement in the process of developing healthy habits is also important. Creating a supportive environment where the whole family is actively involved in lifestyle changes increases the likelihood that children will follow their parents' lead. Joint physical activities such as walking, cycling or playing sports together not only promote physical development but also strengthen family relationships. Cooking together and teaching children the basics of healthy eating helps to establish healthy habits for the future.

The use of technology for monitoring and learning is also becoming increasingly relevant. Mobile applications can be useful for tracking physical activity and food intake, allowing parents and children to monitor their habits and record changes. Implementing telemedicine solutions for regular health monitoring allows doctors to more quickly identify problems and discuss issues with patients. Creating online resources and support groups where parents can share experiences and receive advice on hypertension prevention and healthy lifestyles fosters a community that supports children's health and well-being.

Prevention of arterial hypertension in children requires a comprehensive approach that includes education, healthy habits, regular check-ups and active family involvement. Applying these strategies early in life can significantly reduce the risk of hypertension and its complications in the future, ensuring healthy development and a good quality of life for children.

Prevention of arterial hypertension in children cannot be effective without taking into account social and cultural factors that influence lifestyle, dietary habits and the availability of resources for an active life. A variety of aspects of society, including economic status, educational attainment and cultural traditions, can have a significant impact on children's health.

The socioeconomic status of a family often determines the level of access to healthy food and exercise opportunities. In low-income families, it is generally more difficult to provide a varied and balanced diet, which can lead to an increased risk of overweight and hypertension. Problems with access to fresh fruit and vegetables, as well as to sports grounds and facilities where children can engage in physical activity, exacerbate the situation. It is therefore important to develop programmes to improve access to healthy food and physical activity in vulnerable communities.

Cultural traditions also play a significant role in shaping dietary habits and lifestyles. Some cultures may have habits associated with high-calorie food consumption and sedentary lifestyles that increase the risk of arterial hypertension. Educational programmes targeting changes in cultural aspects of diet and physical activity may promote healthier habits among children and their families.

Social connections and community support are also important for hypertension prevention. Support groups for parents and children that promote healthy lifestyles can foster positive habits and create a support network. Participation in such groups can help parents share experiences and receive guidance on diet and physical activity.

Education plays a key role in the prevention of arterial hypertension. School health programmes should be integrated into the classroom, providing children with knowledge about nutrition, physical activity and stress management. Such programmes can include hands-on activities, cooking classes and active games to promote healthy habits from an early age.

Collaboration between different sectors of society, including health, education and local government, is important. Creating partnerships between schools, health care providers and local organizations can help with arterial hypertension prevention initiatives aimed at children and their families. For example, local authorities can support programmes to improve infrastructure for physical activity, such as improving parks and creating safe places to play.

Thus, prevention of arterial hypertension in children requires a comprehensive approach that takes into account social and cultural factors. Working together, different sectors of society can create a supportive environment that promotes healthy lifestyles and reduces the risk of future hypertension.

Conclusions

Arterial hypertension, previously thought to be predominantly an adult disease, is increasingly being diagnosed in children and adolescents, requiring attention from the medical community. Early diagnosis of hypertension in children is essential to prevent long-term complications such as cardiovascular disease, stroke and renal failure.

The use of various methods, including AMAD and self-monitoring, provides more accurate and complete data on blood pressure status. These methods help to identify hidden cases of hypertension and help to tailor treatment.

Modern technologies such as wearable devices and artificial intelligence-based applications play a significant role in monitoring children's health, providing timely data and improving the quality of diagnosis. Effective treatment of arterial hypertension in children should be based on a comprehensive approach that includes lifestyle changes, drug therapy and educational programmes for parents and children.

Successful prevention and treatment of hypertension depend on addressing social and cultural factors that influence lifestyle and dietary habits. Educational programmes should be adapted to the characteristics of different communities. Collaboration between different specialists, including paediatricians, cardiologists, nutritionists and psychologists, is necessary to achieve better results in the treatment and prevention of arterial hypertension in children. It is important to continue research on arterial hypertension in children to identify new risk factors, develop more effective methods of diagnosis and treatment, and evaluate the impact of modern technology on health management.

Arterial hypertension in children is a serious problem that requires a comprehensive approach to diagnosis, treatment and prevention. Timely intervention and the use of modern technologies can significantly improve treatment outcomes and quality of life in children with this condition.

References

1. Juhola J., Magnussen C.G., Viikari J.S.A., et al. Tracking of serum lipid levels, blood pressure, and body mass index from childhood to adulthood: the Cardiovascular Risk in Young Finns Study. *J Pediatr.* 2011;159:584–590.
2. Chen X., Wang Y. Tracking of blood pressure from childhood to adulthood: a systematic review and meta-regression analysis. *Circulation.* 2008;117:3171–3180.
3. Theodore R.F., Broadbent J., Nagin D., et al. Childhood to early-midlife systolic blood pressure trajectories: early-life predictors, effect modifiers, and adult cardiovascular outcomes. *Hypertension.* 2015;66:1108–1115.
4. Urbina E.M., Khoury P.R., Bazzano L., et al. Relation of blood pressure in childhood to self-reported hypertension in adulthood: the international childhood cardiovascular cohort consortium. *Hypertension.* 2019;73:1224–1230.
5. Lurbe E., Agabiti-Rosei E., Cruickshank J.K., et al. 2016 European Society of Hypertension guidelines for the management of high blood pressure in children and adolescents. *J Hypertens.* 2016;34:1887–1920.
6. Koebnick C., Black M.H., Wu J., et al. The prevalence of primary pediatric prehypertension and hypertension in a real-world managed care system. *J Clin Hypertens (Greenwich)* 2013;15:784–792.
7. Rabi D.M., McBrien K.A., Sapir-Pichhadze R., et al. Hypertension Canada's 2020 comprehensive guidelines for the prevention, diagnosis, risk assessment, and treatment of hypertension in adults and children. *Can J Cardiol.* 2020;36:596–624.
8. Ding L, Singer A, Kosowan L, Dart A. Pediatric hypertension screening and recognition in primary care clinics in Canada. *Paediatr Child Health*. Published online October 11, 2021.
9. Shapiro D.J., Hersh A.L., Cabana M.D., et al. Hypertension screening during ambulatory pediatric visits in the United States, 2000-2009. *Pediatrics.* 2012;130:604–610.
10. Rea C.J., Brady T.M., Bundy D.G., et al. Pediatrician adherence to guidelines for diagnosis and management of high blood pressure. *J Pediatr.* 2022;242:12–17e1.
11. Kaelber D.C., Liu W., Ross M., et al. Diagnosis and medication treatment of pediatric hypertension: a retrospective cohort study. *Pediatrics.* 2016;138
12. Dionne J.M. Evidence gaps in the identification and treatment of hypertension in children. *Can J Cardiol.* 2020;36:1384–1393.
13. Xu X., Ding X., Zhang X., et al. Genetic and environmental influences on blood pressure variability: a study in twins. *J Hypertens.* 2013;31:690–697.
14. Giri A., Hellwege J.N., Keaton J.M., et al. Trans-ethnic association study of blood pressure determinants in over 750,000 individuals. *Nat Genet.* 2019;51:51–62.
15. Woroniecki R.P., Kahnauth A., Panesar L.E., Supe-Markovina K. Left ventricular hypertrophy in pediatric hypertension: a mini review. *Front Pediatr.* 2017 May 11;5:101.
16. Goodwin J.E., Geller D.S. Glucocorticoid-induced hypertension. *Pediatr Nephrol.* 2012 Jul 1;27(7):1059–1066.