





BIBLIOGRAPHIC REVIEW

Theoretical aspects of hypertension in childhood and adolescence

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ABSTRACT

Introduction: high blood pressure in children and adolescents is an important health problem due to its increasing incidence and prevalence. **Objective:** to describe the useful theoretical elements on arterial hypertension in childhood and adolescence. **Methods:** at the "4 de Abril" Polyclinic in Guantánamo, between September and December 2021, a narrative review was carried out through searches in electronic databases (LILACS, PubMed, SciELO, Redalyc and Elsevier), of original articles and systematic reviews that include information related to arterial hypertension in childhood and adolescence. The Boolean operators AND, OR and NOT were used, as well as the advanced search strategy for the selection

of articles. The analysis of the most relevant information was carried out and thus the final report was formed, through the use of 25 published articles. **Results:** aspects were described that support that arterial hypertension in childhood and adolescence is considered a chronic disease, where several risk factors interact, and in which a healthy lifestyle allows the control of the disease. It was reflected that the disease has primary or secondary causes, the different types of arterial hypertension, as well as the criteria of the American and European Guidelines. **Conclusions:** the useful theoretical aspects about arterial hypertension in childhood and adolescence are described.

Keywords: Adolescent; Risk Factor's; Hypertension; Blood pressure

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INTRODUCTION

Arterial hypertension (AHT) in childhood and adolescence is a predictive risk factor for AHT and cardiovascular risk in adulthood⁽¹⁾.

Hypertension in children is defined as persistent systolic blood pressure (SBP) or diastolic blood pressure (DBP) above the 95th percentile for age, height, and sex (measured on three or more occasions in a period of one week). In adolescents ≥ 16 according to the European Guide, or ≥ 13 years according to the American Guide, the percentile values are not used, but the adult cut-off points are applied^(2,3).

Hypertension in children and adolescents is an important health problem due to its increasing incidence and prevalence⁽³⁻⁵⁾.

In general, in children it is estimated that the prevalence of AHT varies between 3 to 5%, although it has increased in recent years, related to the obesity epidemic. Higher figures are reported in adolescents, reaching up to 10 to 15%⁽⁶⁻⁸⁾.

In Argentina, more than one in 20 children and adolescents have AHT,⁽⁹⁾ while in the United States prevalence rates between 0.6 and 11% are reported⁽¹⁰⁾.

In Cuba, the prevalence of hypertension in adolescence is estimated at 2.7%, which is low compared to that of adults⁽¹⁰⁾.

When comparing these figures with those of adults, according to data from the III National Survey of risk factors and preventive activities of non-communicable diseases carried out in 2010-2011, the prevalence of AHT in Cuba is 30.9% in people aged 15 years or more, which means that there are 2.6 million people with AHT, slightly higher in urban areas (31.9%) than in rural areas (28.0%) and without significant differences by sex, with 31, 2% male and 30.6% female. There is a higher prevalence in black-skinned people with 40.4% than in white-skinned people with 30.1%⁽¹¹⁾.

It should be noted that the increased incidence of hypertension in childhood and adolescence is associated with risk factors, which can be modifiable and non-modifiable.^(12,13) Dyslipidemia, obesity, sedentary lifestyle and diabetes mellitus are they cite as the main risk factors, as well as smoking and factors related to heredity^(13,14).

Despite the advances made in Cuba in terms of the evaluation and management of HBP in children and adolescents, difficulties persist in terms of its identification, control and prevention, which results in the fact that very few children and adolescents are registered in medical offices as hypertensives, a situation that suggests that the diagnosis of this disease is not made early.⁽¹⁵⁾



From this arises the motivation to carry out this review and pose the following scientific problem: What are the theoretical aspects Useful on hypertension in childhood and adolescence?.

Justification of the problem

In recent years, morbidity from AHT has increased. In this sense, the description of the theoretical aspects of the disease in early stages of life is of vital importance, due to its usefulness in the early and timely detection of asymptomatic children and adolescents, which also serves as a marker of risk of Future HTA in adulthood. The objective of the review is to describe the useful theoretical aspects of hypertension in childhood and adolescence.

METHOD

At the "4 de Abril" Polyclinic in Guantánamo, between September and December 2021, a narrative review was carried out through searches in electronic databases (PubMed, LILACS, SciELO, Elsevier and Redalyc). The Google Scholar search engine was also used on the Internet for original articles and systematic reviews, which were published in Spanish, Portuguese and English.

Inclusion criteria for the selection of works:

- Published papers that included information on AHT in childhood and adolescence, related to definition, classification, risk factors, BP measurement, other conditions with altered BP, and non-pharmacological treatment.
- Works on HTA in childhood with the above information published in the years 2016 to 2021.

Exclusion criteria for the selection of works:

- Papers that did not include information related to definition, classification, risk factors, BP measurement, other conditions with altered BP, and non-pharmacological treatment of AHT in childhood and adolescence.
- Published works on HTA in childhood and adolescence before 2016.
- Case presentations.

The Boolean operators AND, OR and NOT were used, as well as the advanced search strategy for the selection of articles.

Keywords were selected from a thesaurus: Descriptors in Health Sciences (DeCs), the search terms used were: adolescent, risk factors, hypertension and blood pressure.

As a result of the search, 51 articles were obtained, which were screened in order to keep only those that best described the elements considered in the review, according to the objective of the work.

Twenty-five articles were chosen to make up the review, in order to provide readers with the latest and most relevant information.

The information was validated through the application of theoretical methods, such as logical history and synthetic analytics and document analysis; as well as through the consultation of the opinions of experts on the subject matter of the review, which were contacted individually, without them being in contact.

DEVELOPMENT

Aspects to take into account in the definition of HBP in children and adolescents

In children, blood pressure varies depending on age, sex, and height, which makes it impossible to establish a single cutoff measure that defines hypertension. During the first month of life, systolic BP increases rapidly until 1 year of age, this increase slows until 5 years, and from this age until puberty, it increases at a rate of 1-2 mmHg per year and the diastolic 0.5-1 mmHg per year.

Between the ages of 13 and 18 there is again a notable increase in BP values, more evident in males. For this reason, the definition of HT in children and adolescents is based on values of normal distribution of BP in healthy children⁽¹⁶⁾.

Classification of hypertension in childhood and adolescence

According to causes, it can be primary or essential (when an identifiable cause is not found), and secondary (when a cause is identified). The essential form occurs in more than 50% of cases and is more common after six years of age, while the secondary appears more in newborns, infants, and young children^(2,5).

In relation to the essential form, the patient must be evaluated individually, taking into account the family history of AHT and/or cardiovascular disease, as well as the associated diseases that they may present, and the repercussion on the target organs (brain, eye, heart, kidney and blood vessels)^(9, 15).

Depending on staging, there are different considerations based on existing guidelines. One of them, developed by the Working Group on AHT in children and adolescents of the European Society of Hypertension (American Guidelines), and the other, the American Guidelines^(4, 17). (see Table 1).

Tabla 1. Classification of AHT in children and adolescents, according to the European and American Guidelines

AHT stages	European Guide		American Guide	
	<16 years	≥16 years	<13 years	≥13 years
Normal	<P90	<130/85 mmHg	<P90	<120/<80 mmHg
Normal-high	≥P90 - <P95	130-139/ 85-89 mmHg	≥P90 - <P95	120-129/<80 mmHg
Hypertension	≥P95			

Stage 1 Hypertension	≥P95 – P99 +5 mmHg	140-159/ 90-99 mmHg	≥P95 – <P95 +12 mmHg	130/80 - 139/89 mmHg
Stage 2 Hypertension	>P99+5 mmHg	160-179/ 100-109 mmHg	≥P95+12 mmHg	≥140/90 mmHg
Isolated systolic	PAS≥P95 y PAD<P90	≥140 y <90 mmHg	Not contemplated	

Source: Aparicio López C, Bozzani A, de Lucas Collantes C. Arterial hypertension in adolescence. Rev ADOLLESCERE 2019.

Legend: P90: 90th percentile; P95: 95th percentile; P99: 99th percentile; SBP: systolic blood pressure; DBP: diastolic blood pressure.

The authors refer that the reference guide in Cuba is the American one, they also believe that the main differences with that of Europe lie in: the ages adopted, the definition of grades 1 and 2 of AHT, which means that the number of children diagnosed with AHT is greater according to the criteria of the American Guide. On the other hand, the European Guide includes isolated systolic AHT in adolescents, but the American Guide does not. For researchers, the usefulness of the American Guide lies in the fact that it reduces the age of applying the adult criteria from 13 years of age, which helps this criterion for the diagnosis of HBP, that is, this Guide increases the number of children who will be labeled as hypertensive, although not the number of those who need to be treated pharmacologically.

Related to grades 1 and 2, Aparicio et al.⁽¹⁶⁾ suggest that the difference in concept of these grades of AHT does not increase the number of patients requiring drug treatment, but it does increase the number of clinical controls and the use of monitoring. BP outpatient (ABPM) to confirm AHT.

AHT risk factors.

Risk factors can be:

- Not modifiable: age, sex, black race, family history (HTN and congenital kidney disease, obesity, cardiovascular and cerebrovascular diseases, hereditary nephropathy; personal history (solid organ and bone marrow transplantation, congenital heart disease, prematurity, oligohydramnios, anoxia, low birth weight, growth retardation, known renal disease, or renal or urologic malformation).
- Behavioral modifiable: smoking, alcohol, other drugs, sedentary lifestyle, stress, poor eating habits at an early age (especially high salt and saturated fat intake), ingestion of drugs that increase BP (non-steroidal anti-inflammatory drugs, corticosteroids, oral contraceptives, nasal decongestants, caffeine, tricyclic antidepressants, amphetamines and the like)
- Modifiable metabolic factors (overweight, obesity, dyslipidemia, diabetes mellitus, hypercholesterolemia^(8, 12, 13, 15, 18, 19)).

In the case of family history, when both parents are hypertensive, their children have a 50/50 chance of inheriting the condition. If only one is, the figure drops to 33%.

It should be added that the association between obesity and hypertension in children has been demonstrated in different ethnic and racial groups; where it has been observed that overweight children and adolescents are 4.5 and 2.4 times more likely to have systolic and diastolic arterial hypertension, respectively⁽¹³⁾.

Vitón Castillo et al.⁽²⁰⁾ described that smoking is one of the main risk factors for the development of AHT.

Adolescent smokers are more likely to suffer cardiovascular complications due to the production of two main effects: atherogenic (endothelial damage, decreased HDL cholesterol, platelet activation, and release of free fatty acids) and thrombogenic (platelet activation, increased fibrinogen, release of thromboxane and decreased production of prostacyclin). In addition, tobacco contributes to myocardial ischemia by unbalancing the availability of oxygen, through sympathetic-adrenal activation, vasoconstriction, and the production of carboxyhemoglobin from carbon monoxide⁽²⁰⁾.

The early detection of hypertensive children has great significance as a marker of hypertension risk during adulthood. For this reason, health actions must have a preventive approach, fundamentally based on the study of the predisposing factors of hypertension in children⁽¹³⁾.

The authors have observed that, in primary health care, there is a lack of perception of the Risk Factors (RF) that act as a predisposition to the appearance of AHT in children and adolescents. They agree with Lurbe E et al.⁽²¹⁾, in that relatively little attention has been paid to the problem of arterial hypertension in these age groups.

Due to the foregoing, researchers are of the opinion that there is a need for basic health teams to act in the timely and early identification of RF, in order to carry out health actions for their control from childhood and adolescence.

When is BP measured in children and adolescents?

In 2016 and 2017, the European and American guidelines for AHT in children and adolescents were published, respectively, which update the previously existing ones and redefine the diagnostic criteria. They include aspects of ambulatory monitoring, white-coat AHT and masked AHT, the etiological and target organ study, as well as the non-pharmacological and pharmacological management of AHT^(1, 17).

BP in these age groups should be measured in:

- Children under three years of age if they have risk factors.
- Children from three years of age, once a year. If the child has obesity or other risk factors, BP must be checked at each health check-up, both in the child and in his family.
- Teenagers.

If the BP is normal, it is recommended to take it again in 1-2 years, taking advantage of other clinical visits. In children with diseases or risk factors for developing AHT, its annual measurement is recommended before the age of 3.

With reference to the above, in the authors' opinion, many professionals are not clear about when they should start measuring BP in children; others do not measure or record it during the physical examination, which means that few children and adolescents are classified as hypertensive^(10, 22).

BP measurement in the upper extremity

The initial recording of BP can be with an oscillometric or auscultatory device. The patient must be seated with the feet resting on the floor and relaxed during three to five minutes, and with the arm resting at the level of the heart.^(9, 11) You should not have done intense physical exercise, smoked or ingested food, caffeine or alcoholic beverages for at least 30 minutes before the measurement. In infants and other special conditions it is measured in the supine position. In diabetic patients, standing BP should also be measured.

BP must be measured three times at three-minute intervals, discarding the first measurement and taking the average of the remaining two. Initially, it has to be measured in both arms and if there is a discrepancy, choose the arm with the higher value as a reference. The American Guidelines recommend measuring in the right arm (for consistency with the reference values and to avoid low BP measurements due to coarctation of the aorta).

In the auscultatory method, the bell of the stethoscope should be located over the radial artery, in the antecubital fossa. Palpate radial pulse, inflate cuff until pulse disappears, deflate to 2 mmHg/sec, note BP, at which pulse reappears: systolic blood pressure (SBP) (1st Korotkoff sound), note BP on disappearance of the sounds or the 5th Korotkoff sound: diastolic blood pressure (DBP).

It is recommended to choose a cuff whose width is 40% of the child's arm circumference measured at the midpoint of the acromion to the olecranon and whose length covers 80% to 100% of that circumference. Additionally, the cuff should be installed at the midpoint between the olecranon and acromion, with the elbow flexed at 90°. If the cuff is too small, you should go to the next size.⁽⁹⁾ In other words, it must be taken into account that the sphygmomanometer cuff must cover 2/3 of the arm's length.

It should also be taken into account not to round off the PA figures and the use of the 5th Korotkoff sound as DAP, with the exception of some children in whom the sounds tend not to disappear, in which the 4th sound will be used⁽¹¹⁾.

BP measurement in the lower extremity

It can be in the middle third of the thigh (femoral artery), the length of the bladder of the cuff must cover 80% of the circumference of the thigh and the width 40%. It is also possible to take

BP around the calves (popliteal artery), over the ankle (posterior tibial artery), around the foot (pedial artery).

If the initial record is high, greater than or equal to the 90th percentile, two additional measurements should be taken during the same visit (separated by at least three minutes) and the average of the last two should be taken. If these values were obtained by auscultatory method, this average is used to determine the BP category in which the child is.

If the average value was obtained by the oscillometric method, and the average BP is equal to or greater than the 90th percentile of BP, two recordings must be made by auscultatory method and the value averaged to define the BP category in which the child is.

Various studies have shown that oscillometric devices overestimate the value of SBP and DBP compared to BP records obtained by auscultatory methods. In addition, target organ involvement correlates better with AHT diagnosed by the latter method. For these reasons, ideally the final diagnosis of AHT should be made with an auscultatory method⁽⁹⁾.

In accordance with international recommendations, it must be certified if the oscillometric device is validated, repeated measurements are also necessary to confirm HBP. The American guide recommends at least three determinations⁽¹⁵⁾.

The authors, in their experience during the rotations carried out by the family doctor's and nurse's offices, have verified that the measurement of BP in childhood and adolescence is applied very infrequently, which leads to a failure in the diagnosis. and a hidden morbidity of AHT in these age groups. They also believe that early detection of hypertensive children and adolescents marks the risk of the disease in adulthood; aspect that is of great value for its early detection.

Other conditions with altered BP

It is important to recognize three states in which the BP is not normal, but there is still no sustained AHT, and they can be predictive of this disease in the future⁽⁹⁾:

- **White coat HBP:** This type of HBP is considered to be people who have elevated BP in front of the doctor and it is normal when it is measured by non-medical personnel outside of this context (relatives, neighbors, nurses or other people or technicians).
- **Masked AHT:** it is the reverse phenomenon, BP is normal in the consultation and elevated outside of it ^(9,22, 11, 24).
- **Isolated systolic AHT:** this is the most frequent type of AHT in adolescents, possibly due to the greater elasticity of the large arteries. It has been considered by the European Guide, but not by the American Guide^(21,11).

The research team, after having reviewed the literature in depth, emphasizes that the prognostic significance of these phenomena is not well known, but in the case of masked hypertension, they are related to an increased risk of suffering from hypertension in adulthood and with possible

end-organ damage, such as: cerebrovascular disease, left ventricular hypertrophy, renal disease, carotid intima-media thickening, seizures, stroke, visual disturbances, hypertensive retinopathy, hypertensive choroidopathy, venous hemorrhage retinal and increased intraocular pressure

Generalities of non-pharmacological treatment

Interventions related to modifying lifestyles constitute the central axis of the prevention of AHT and are an inseparable part of the comprehensive treatment of hypertensive patients⁽²⁶⁾. All hypertensive patients should make lifestyle changes, these have a positive impact on both BP control^(6, 11, 24).

Childhood is the ideal time for primary prevention, in which healthy lifestyles are promoted, based on behavioral modifications of eating habits and physical activity. The health team, the school and the family must participate in this battle⁽¹¹⁾.

Children and adolescents must have adequate eating habits, such as a low salt, sugar and calorie diet; incorporation of fruits, vegetables and greens, which are a source of antioxidants; eliminate high-fat processed foods; limit the intake of alcoholic beverages.

At the same time, an adequate body weight must be achieved, obesity and overweight avoided, through diet and regular physical exercise. In addition to avoiding sedentary activities of more than 2 hours a day, moderate to intense aerobic physical activity for 30-60 minutes is recommended for children over 5 years of age, in addition to physical exercise at least 3 days a week. Participation in sports competition should not be limited except in uncontrolled grade 2 HTA. Sedentary hours in front of the television, video games and the computer should be reduced to two hours a day; responsibility that belongs to the family, and not only to the hypertensive patient⁽¹⁶⁾.

A smoke-free environment should also be promoted, encouraging parents to quit smoking and avoid it in adolescents, as well as alcohol and drug use^(1, 11).

The authors emphasize that the most important thing is health education, with the purpose of achieving healthy lifestyles and thus avoiding the appearance of the disease, lack of control or complications when the diagnosis has been made. To ensure that this is done early, it is necessary for the family doctor to include BP measurement during the physical examination in all children over three years of age, or with some risk factor⁽⁹⁾.

CONCLUSIONS

Useful theoretical aspects of hypertension in childhood and adolescence are described. This pathology constitutes a risk marker for suffering from the disease in adulthood.



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JRT: participated in the contribution of the idea; formulation of the objectives, study design and general goals of the investigation. In addition, in the preparation, creation and presentation of the work for publication, that is, in the original draft and approval of the work.

KPM: participated in data cleaning, development of the review, and supply of study and review materials.

RCG: participated in the maintenance of the data, the preparation and creation of the work.

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