

A focus on paediatric hypertension

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"The cardiovascular benefits of reduced salt intake are on par with the benefits of population-wide reductions in tobacco use, obesity, and cholesterol levels. A regulatory intervention designed to achieve a reduction in salt intake of 3 g per day (...) would be more cost-effective than using medications to lower blood pressure in all persons with hypertension."

Kirsten Bibbins-Domingo et al., 2010

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Adult cardiologists and pediatricians usually think that arterial hypertension is a disease that typically develops only in adult life. However, a number of literature reports have demonstrated that this pathologic condition can begin early in childhood, as evidenced by occasional increases in blood pressure or abnormal blood pressure responses to physical or emotional stress [1].

A large number of adults worldwide are affected by high blood pressure, and because the latter tends to remain within the same percentiles throughout life, it has been hypothesized that hypertensive pressures can be tracked from childhood to adulthood. Thus, children with higher blood pressure values are more likely to become hypertensive adults [2].

This condition is called “hypertensive fingertip” [3].

High blood pressure or hypertension in paediatric age is defined as a blood pressure repeatedly above the 95th percentile of specific nomograms previously constructed on the basis of age, gender, and height [4].

The real worldwide prevalence of juvenile hypertension is unknown: in literature it ranges from 1% to about 10% in some isolated geographic areas. It depends on many factors: the most important are the method used to measure blood pressure (auscultatory or oscillometric), the number of measurements (one or more), and the ethnicity of the screened population [5].

In our personal experience, in a large cohort of Southern Italian children and adolescents ranging 10-15 years, the prevalence of hypertension was a little more than 9% [6].

Serious concerns have risen about the use of oscillometric device in measuring blood pressure in children. Being strongly influenced by arterial pressure waveforms, oscillometric monitors may produce inaccurate readings in patients, most of all if they are very young. The internal algorithms used by these devices to calculate systolic and diastolic blood pressure values from the oscillations of the brachial artery vary on the basis of the manufactures. Based on these premises, two different oscillometric devices may give different blood pressure readings for the same patient, even if used simultaneously [7].

Some problems – such as a cuff size greater or smaller than appropriate for mid upper arm circumference – can generally be avoided if the user follows a proper technique. Others – such as cuff inflation rate – can not be modified by the user

because they are programmed into the devices by the manufacturers.

Since many oscillometric devices have not been validated in paediatric age, caution must be given. As a general rule, in this age range auscultatory blood pressure measuring method must be preferred [7].

The number of recordings needed to determine blood pressure during childhood is still under debate.

Some authors advocate taking three pressures, and using the average of the three readings, or of the last two readings. Others recommend only one recording. The truth is that frequent measurements probably represent more accurately the state of the individual patient in terms of blood pressure. According to literature reports, elevated pressures must be confirmed on repeated visits before characterizing a child as having hypertension.

In fact, due to the instability of the blood pressure regulatory system in paediatric age, with frequent tachycardia and sharp raise in arterial pressure due to adrenergic hypertone associated with anxiety, extreme caution should be exercised before diagnosing a subject as hypertensive [3].

Even ethnicity may influence blood pressure values.

For example, African-American children and adolescents have blood pressure values higher than their Anglo-Saxon peers. Maybe higher rates of obesity and diabetes among them may explain this race-related difference. However it has also been found the existence of a gene which makes African-Americans much more salt sensitive to arterial pressure raising [8].

Several risk factors for developing paediatric hypertension have been identified: the most important are familial history of hypertension, low birth weight, excessive salt intake, overweight/obesity (**Tab. 1**) [9].

When healthy measures aimed at lowering blood pressure values (that is, body weight reduction, aerobic physical exercise, low sodium intake) have failed, a drug therapy is usually needed [10].

The aim of drug therapy should be not only to normalize blood pressure values, but also to prevent early organ dysfunction (left ventricular hypertrophy, albumin in the urine, progression to renal failure).

However, non-pharmacological therapy should be continued even subsequent to administration of pharmacological therapy.

Table 1. Different types of pathophysiological mechanisms inducing essential hypertension in children.

Etiologies	Pathophysiological mechanisms
Familial history	About 30 genes have been identified
Low birth weight/ prematurity at birth	Reduced nephrons number; reduced elastin synthesis
Excessive salt intake	Vasoconstriction (via intracellular calcium exchange)
Overweight/obesity	Increased sodium retention; renin-angiotensin-aldosterone system stimulation; endothelium-dependent vasoconstriction; sympathetic nervous system activation

Unfortunately, there is lack of data in literature relating to the timing of administration of pharmacological treatment. Consequently, the above-stated suggestions have been formulated on the basis of observations made in adults, and are based on clinicians' expertise.

Similarly, there is a paucity of data in literature relating to the actual efficacy of antihypertensive treatment in reversing organ dysfunction, particularly left ventricular hypertrophy [10].

The number of antihypertensive drugs specifically recommended for use in children has risen considerably in recent years, and includes beta-blockers, ACE inhibitors, angiotensin-receptor blockers, calcium channel blockers, and diuretics. All these have been proven to be safe and well-tolerated in children and adolescents. The first class to administer suggested by international guidelines is represented by ACE inhibitors.

Treatment should be begun using the lowest possible dose of a single compound. The dose should subsequently be increased gradually until the normal blood pressure values are achieved. If peak doses are reached without any appreciable benefit, or the young patient manifests adverse effects, it may be advisable to implement the therapy with a second drug that enhances efficacy of the first one. In this respect, the suggested associations are ACE inhibitor + diuretic, vasodilator + beta-blocker or diuretic.

The prescribing of combined therapy in young patients as a first step approach has not been investigated to date, with the exception of the association bisoprolol + hydrochlorothiazide. Based on these premises, a similar approach is not recommended [10]. In the next future, the development of new techniques, such as metabolomics, may enhance the evaluation of new therapeutic options, furthermore

contributing towards identifying patients at risk of manifesting adverse effects during treatment, predicting therapeutic response, and achieving the implementation of new tools focused on establishing an increasingly patient-oriented treatment (*tailored therapy*) [11].

To conclude, the worldwide increase of cardiovascular diseases among young people represents a serious concern.

For this reason, urgent behavioral measures capable of preventing the onset of cardiovascular diseases (promoting healthy lifestyle and nutrition as well as limiting salt and alcohol intake and quitting cigarette smoking) should be rapidly implemented. The described general measures, however, should be preceded by a systematic screening program capable of identifying individuals at high cardiovascular risk.

The easiest and most economical means of achieving this aim is by measuring arterial blood pressure in children and adolescents.

Declaration of interest

The Authors declare that there is no conflict of interest.

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The quote at the beginning of the article is taken from: Bibbins-Domingo K, Chertow GM, Coxson PG, Moran A, Lightwood JM, Pletcher MJ, Goldman L. Projected effect of dietary salt reductions on future cardiovascular disease. N Engl J Med. 2010;362(7):590-9.