

Alina-Costina LUCA,  
Adriana SOUSSIA,  
Daniela LUCA

"Gr. T. Popa" University of Medicine and Pharmacy Iasi

# MANAGEMENT OF THE ARTERIAL HYPERTENSION IN PEDIATRIC POPULATION

Review  
Article

---

## Keywords

*Primary Arterial Blood Pressure,  
Secondary arterial Blood Pressure,  
Obesity*

---

## JEL Classification

*I10*

---

## Abstract

*Blood pressure is a condition whose frequency continues to increase in pediatric ages. This cardiovascular pathology is often secondary to another condition such as parenchymal kidney disease or aortic coarctation. The integration of blood pressure measurement into the routine pediatric examination made it possible to detect asymptomatic secondary hypertension as well as to identify new cases of primary hypertension in the child. The epidemic of childhood obesity tends to increase blood pressure and precipitates complications. Diagnosing this pathology and implementing a healthier lifestyle or medication as early as possible will help reduce morbidity and even mortality by avoiding the progression of high blood pressure to adulthood.*

## INTRODUCTION

High blood pressure (HTA) is one of the most common cardiovascular diseases characterized by complications that may occur in the absence of treatment (Kliegman, 2007). In pediatric population, systemic HTA is not common but may be a consequence of pathology (secondary HTA - parenchymal or vascular renal disease, aortic coarctation, endocrine diseases). But, due to epidemiological monitoring of recent years, there has been noted an increase in the prevalence of primary HTA, especially in school-age children (Ciofu, 2002). Moreover, blood pressure (TA) values tend to increase over time, so essential HTA in childhood may be a significant cause for morbidity and even mortality in adults (Ciofu, 2002, Kliegman, 2007).

## EPIDEMIOLOGY

Childhood obesity epidemic, increased risk for developing left ventricular hypertrophy, the relation between HTA and the early onset of atherosclerosis are some of the reasons why early treatment of this cardiovascular pathology should be initiated whose frequency among children has been steadily increasing. Primary HTA is common in adolescents and is due to cumulative risk factors such as obesity or a family history of hypertension (Luma&Spiotta, 2006). In newborn babies, the occurrence of HTA is about 0.2%, and it increases in the first decade to about 1% and continues to grow to 1.2%, even reaching 13% at older ages (Luca, 2011, Sharma, et al., 2010).

## DEFINITION

From a pediatric perspective, it is difficult to estimate the value of a normal mean tension as it is influenced by both objective (sex, age, waist) and subjective (resting and activity conditions, dorsal or seated position) factors (Luca, 2011). To set a diagnosis for HTA, multiple measurements of blood pressure are needed (Kliegman, 2007) and their fitting into age and waist specific percentiles (Ciofu, 2002)

## CLINICAL PICTURE

### Newborns and infants

In this age group, a number of factors contributing to the onset of HTA can be identified using anamnesis such as: prematurity, bronchopulmonary dysplasia, growth deficit, skull or abdominal

trauma, including diet and sleep pace, living and working conditions of parents (Luca, 2011).

### Child and adolescent

Primary HTA may be asymptomatic in this age group. HT is slightly elevated and may be accidentally detected in a routine exam or check-ups for sports competitions (Kliegman, 2007).

Secondary HTA may show moderate to severe TA values and become symptomatic when sustained or aggravated.

Clinical manifestations are specific to pre-existing pathology, but sometimes other symptoms may also be associated: headache (often occipital in the morning when waking-up), physical asthenia, anorexia, visual disturbances, epistaxis, palpitations, non-specific precordialgies (Kliegman, 2007, Luca, 2011). The signs correlated with other pathologies are described in Table 2 (Luca, 2011).

## PARACLINICAL EXAMINATIONS

### Primary HTA

This category associates various risk factors, so laboratory tests for the determination of HDL-cholesterol, triglycerides and serum glucose are useful in addition to anamnesis and clinical examination. In children from families with a history of type 2 diabetes, glycosylated hemoglobin dosing and glucose tolerance test should be performed (Falker, 2004).

### Secondary HTA

*Laboratory tests* include: blood count (anemia), the urine and uroculture summary exam (chronic pyelonephritis or other kidney diseases), dosage of creatinine and serum urate (renal impairment), plasma renin activity (renal or renovascular parenchymal dysfunction), determination of potassium (monitoring of diuretic therapy), lipid and carbohydrate profile, urinary and plasma catecholamines, metanephrine, vanillo-mandelic acid (pheochromocytoma), 24-hour plasma and urinary aldosterone levels, 24-hour dosing of urinary cortisol, or even a pregnancy test (Kliegman, 2007, Luca, 2011).

*Ophthalmological exam* may reveal the modifications in the retina produced by HTA (Luca, 2011). *Thoracic radiography* is an exploration used to detect left ventricular hypertrophy and to calculate the cardiothoracic index (, Falker, 2004, Luca, 2011).

The *electrocardiogram* determines the electrical activity of the heart and is useful in calculating the Sokolov-Lyon index or the ST segment and T-wave changes in left ventricular hypertrophy (Huff, 2002, Luca, 2011). *Echocardiography* is required

to identify chronicization of HTA by affecting the target organs, namely, left ventricular hypertrophy (Luca, 2011). *Renal ultrasonography* is a non-invasive method used to monitor morphology, kidney size, cortical thickness, and potential obstruction of the urinary tract (Lurbe, E. Et al. 2016, Pagonas, Vlatsas & Westhoff, 2013).

## COMPLICATIONS

The elevated and sustained TA values result in rapid and progressive deterioration of the central nervous system with myocardial, visual and renal involvement (Falker, 2004).

### Left ventricular hypertrophy

The most common complication in child and adolescent is left ventricular hypertrophy (HVS) (Falker, 2004).

In order to identify modifications in the heart, echocardiography is used providing information about left ventricular wall thickness (VS) and the interventricular septum, VS mass, SIV / posterior wall of VS ratio, and VS geometry (Luca, 2011). The development of HVS requires the establishment or pharmacological treatment intensification, and the need for periodic follow-up using echocardiography (Falker, 2004).

### Hypertensive Encephalopathy

Hypertensive encephalopathy is a complication of a primary HTA that is inadequately treated.

The onset is acute through headache, nausea, vision disturbance, neural deficits and convulsions (Dinsdale, 1982 Gifford, 1991, Jones, Egelhoff & Patterson, 1997). Children are more likely than adults to develop hypertensive encephalopathy that should be differentiated from stroke or arachnoid haemorrhage (Falker, 2004).

### Hypertensive retinopathy

Eyeball is another organ affected by high blood pressure values. By examining the fundus, we may observe the papillary edema in hypertensive retinopathy. This change occurs due to increased pressure of the cerebrospinal fluid as a consequence of cerebral edema. Therefore, patients with hypertensive encephalopathy are prone to another complication, namely, retinopathy.

The papillary edema observed by eye exam can make the difference between Stage III and IV, the latter presents a more limited prognosis (Brodsky, 2010).

## TREATMENT

The treatment aims to reduce TA values below the 95<sup>th</sup> percentile for each age category (Luca, 2011).

## Non-pharmacological treatment

Adopting appropriate hygienic-dietary measures produces beneficial changes in the heart by lowering TA to normal values in children with mild or moderate HTA (Luca, 2011). Most patients in this category are obese. *Weight loss* precedes the decrease in TAS and removes cardiovascular risk factors such as dyslipidemia and insulin resistance (Williams, et al, 2002). *Reduction of salt intake* affects TA values. For ages 4-8, daily sodium intake is 1.2g/day, and for ages over 8, it is 1.5g/day (Parati, et al, 2008). Children should be trained to monitor their time spent in sedentary activities and should practice regular *physical exercise* (Krebs & Jacobson, 2003). *Reduction of stressful activities* is an important approach as stressful events in the family, at school or in social groups can influence the child's lifestyle making the child adopt unhealthy habits (smoking, alcohol consumption) (Monyeki & Kemper, 2008).

## Pharmacological treatment

Pharmacological treatment should be recommended for patients with secondary HTA and for patients with primary HTA non-compliant with hygiene and diet regimen. Initially, monotherapy with conversion enzyme inhibitors, angiotensin receptor blockers, beta-blockers, calcium channel blockers or diuretics is recommended (Luca, 2011).

## CONCLUSIONS

Essential HTA discovered in childhood or during adolescence may have continuity in adult life (Kliegman, 2007). Early identification of HTA in a child involves early intervention that may influence the natural evolution of this pathology, with a decrease in mortality and morbidity (Yuvaraj, et al., 2014).

## REFERENCES

- [1] Brodsky, M.C.(2010). *Pediatric Neuro-Ophthalmology*. New York Dordrecht Heidelberg London: Springer.
- [2] Ciofu, E. (2002). Hipertensiunea arterială sistemică la copil. In Ciofu, E. *Esențialul în pediatrie*, București: Editura Medicală Amaltea.
- [3] Dinsdale, H.B. (1982). Hypertensive encephalopathy. *Stroke, Journal of the American Heart Association*, 13(5), 717–19.
- [4] Falker, B. (2004). The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics*, 114, 555–76.
- [5] Gifford, R.W. (1991). Management of hypertensive crises. *JAMA*, 266(6), 829–35.

- [6] Huff, J. (2002). *ECG Workout, Exercise in Arrhythmia Interpretation*, Lippincott.
- [7] Jones, B.V., Egelhoff, J.C., & Patterson, R.J. (1997) Hypertensive Encephalopathy in Children. *AJNR*, 18(1), 101-6.
- [8] Kliegman, R.M. (2007). *Nelson textbook of pediatrics* (18th Ed), Elsevier Inc.
- [9] Krebs, F.N., & Jacobson, M.S. (2003). Prevention of pediatric overweight and obesity. *Pediatrics*, 112(2), 424–30.
- [10] Luca, C.A. (2011). Hipertensiunea arterială la copil. In Iordache, C.N. *Tratat de pediatrie*, Iași: Editura "Gr. T. Popa".
- [11] Lurbe, E., Agabiti-Rosei, E., Cruickshank, J.K. et al. (2016) 2016 European Society of Hypertension guidelines for the management of high blood pressure in children and adolescents, *Journal of Hypertension*, 34(10), 1887-920.
- [12] Luma, G.B., & Spiotta, R.T. (2006). Hypertension in Children and Adolescents. *American Academy of Family Physicians*, 73(9), 1158-68.
- [13] Monyeki, K., & Kemper, H. (2008). The risk factors for elevated blood pressure and how to address cardiovascular risk factors: a review in paediatric populations. *Journal of Human Hypertension*, 22(7), 450-59.
- [14] Pagonas, N., Vlatsas, S., & Westhoff, T.N. (2013). Diagnostic use of sonography in the evaluation of hypertension. In Gunarathne, G. *Advancements and breakthroughs in ultrasound imaging*. InTech.
- [15] Parati, G., Stergiou, G.S., Asmar, R. et al. (2008) European Society of Hypertension guidelines for blood pressure monitoring at home: a summary report of the Second International Consensus Conference on Home Blood Pressure Monitoring. *Journal Hypertension*, 26(8), 1505–26.
- [16] Sharma, A., Grover, N., Kaushik, S. et al. (2010). Prevalence of hypertension among school children in Shimla, *Indian Pediatrics*, 47(10), 873-876.
- [17] Williams, C.L., Hayman, L.L., Daniels, S.R. et al. (2002). Cardiovascular health in childhood: A statement for health professionals from the Committee on Atherosclerosis, Hypertension, and Obesity in the Young (AHOY) of the Council on Cardiovascular Disease in the Young, American Heart Association. *Circulation*, 106(1), 143–60.
- [18] Yuvaraj, B.Y., Nagendra Gowda, M.R., Rajeev, K.H. et al. (2014). A Study on Hypertension in School Children of Chitradurga District, Karnataka, *Global Journal of Medical research (K) Interdisciplinary*, 14(1), 1-6.