Obesity and Overweight Interconnected Hypertension-A Common Condition not to be Overlooked Since Pediatric Ages

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Since 1960s when the Framingham Heart Study demonstrated the linkage between hypertension and bodyweight the interest in this subject has grown ever since. Presently it lies in its growing prevalence, tracking to adult ages and risk for suffering from cardiovascular diseases and mortality.

The pathophysiology of this linkage is far beyond the present scope, but two facts are behind this: abdominal obesity and insulin resistance. Thus the consequences of both on sympathetic activity, leptin, renin-angiotensin system, sodium balance and epigenetic factors can have therapeutical implications [1].

In adults, blood pressure is regularly assessed, particularly if suffering from overweight, due to the fact that 75 % of hypertension is related directly to obesity [2]. This is not the case in pediatric patients where primary hypertension is not very common and this together with other factors to be commented on later has led to a certain omission in regular pediatric check-ups including obese children. However, according to the U.S. Preventive Service Task Force data, 11 % of obese children have high blood pressure [3] and the increasing prevalence parallels the degree of obesity [4]. Prevalence in Europe is greater with a range of 35 % to 39 % over 25000 overweight or obese children according to three different ethnicities [5]. In different countries with different income rates this association of hypertension and obesity has also been demonstrated although sample size is smaller.

The blood pressure tracking or keeping in the same centile over time is probably the reason why adult cardiologists and WHO have claimed for prevention starting at pediatric ages. The prospective Finns-Study [6] showed how the hypertension and blood lipids increase as the BMI does. Another basic study carried out in Denmark [7] and after a follow up of 25 years of 275,000 children of 7-13 years pointed out that besides the tracking, for each unit of BMI-z score increment the coronary disease risk (lethal or not) also rises 17%.

The interest of raised blood pressure in children is that this already implies an organic alteration although it is not clinically apparent. In a previous study of ours [8] on 101 obese children the thickness of interventricular septum and greater left ventricular mass were already present in comparison to the matched control group. This is in agreement with the findings that

hypertension leads to left ventricular hypertrophy [9]. Another deleterious fact is the association with heart failure, coronary disease and death before 55 years of age which has been linked to hypertension in pediatric ages [10]. The Iceland study [11] on target-organ damage later in life at a mean of 58 years showed a significant correlation between both coronary disease and adult hypertension when the adolescent blood pressure was $\geq$ 95th centiles. Karen McNiece [12] using the National High Blood Pressure norms, to be commented below, disclosed in adolescents not only the left ventricular hypertrophy but higher insulin levels with similar glucose levels compared to the controls [13]. This is an additional fact favoring insulin resistance with all the well-known consequences

After this analysis the appropriate clinical identification of pediatric elevation in blood pressure or better pre-hypertension, is compulsory and to rule out causes other than obesity. It is worth checking the existence or not of the metabolic syndrome that will put over the track of other comorbidities. Due to the normal variation of blood pressure as growth progresses the norms given in 2004 by the Working Group on High Blood Pressure in Children and Adolescents [13] have been widely accepted. The cutoff values refer to gender and height (instead of age) of the child and results are registered in 50th, 90th, 95th and $>95^{\text{th}}$ centiles for both systolic and diastolic values. Because the heights of children are grouped in percentiles (5th to 95th) the use of computer programs facilitates the use of this important tool. Pre-hypertension is considered when the mean of the three (or two) figures for systolic or diastolic is between 90th and 95th centiles and hypertension when above 95th centile. A simpler tool for identifying children and adolescents needing further evaluation of blood pressure was required. As implied table was originally conceptualized by Kaelberg and Pickett [14] with a reduction of 412 values checking over the original 3 and 4 tables. This idea was also taken by others and later on these simpler cutoff values were gathered by Ingelfinger [15] as in the table (Table 1). Concerning the method for measuring blood pressure traditionally the auscultatory techniques (mercury column or aneroid devices) have been recommended and can still be considered as a reference, but the device variability and the subjectivity that they imply and the frequent persistence of

Table 1: Blood-Pressure Thresholds Indicating the Need for Further Evaluation, Intervention, or Both*.

Years of Age	Boys SBP DBP	Girls SBP DBP	Boys and Girls SBP DBP
3	100 59	100 61	≥100 >60
4	102 62	101 64	≥100 >60
5	104 65	103 66	≥100 >60
6	105 68	104 68	≥105 >70
7	106 70	106 69	≥105 >70
8	107 71	108 71	≥105 >70
9	109 72	110 72	≥110 >75
10	111 73	112 73	≥110 >75
11	113 74	114 74	≥110 >75
12	115 74	116 75	≥115 >75
13	117 75	117 76	≥115 >75
14	120 75	119 77	≥115 >75
15	120 76	120 78	≥120 >80
16	120 78	120 78	≥120 >80
17	120 80	120 78	≥120 >80
≥18	120 80	120 80	≥120 >80

*The threshold for further evaluation or intervention is based on cut of points for hypertension from the fourth report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. DBP denotes diastolic blood pressure, and SBP systolic blood pressure [15].

the 5th Korotkoff sound are giving way to the modern automated oscillometric devices.

Primary prevention actions are the same as those of pediatric obesity prevention but early stages of hypertension would imply a modification of the cardiovascular risks mostly carried out in individualized prevention. Preventing obesity from pregnancy, modification of lifestyle from early childhood and appropriate diet is the most efficient and normal way to keep blood pressure below 90th centile. Treatment (ACE inhibitors) is restricted to severe cases (95th centile + 5 mm Hg) or secondary hypertension.

The last message is that pediatric hypertension should not be missed nor mismanaged then the routine measuring of blood pressure in overweight/ obese children and adolescent is primordial. We should transmit the idea that all these age-specific requirements should not impair this important action as in some places or institutions occur nowadays [16]. This has a special connotation when dealing clinically with obesity comorbidities whether in children or adults. Due to important future consequences, this becomes crucial particularly when in the case of overweight or obesity a weight reduction can push back not only the present alterations but also the risk of a serious condition such as cardiovascular disease when these children reach adult ages.

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