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Research article

The prevalence of hypertension in school going children of Cairo, Egypt

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Abstract

Background: Pediatric hypertension is a field of increasing interest and importance. Early identification of children at risk for hypertension is important in its control to prevent the serious long-term complications associated with the condition. The purpose of this study was to determine the prevalence of hypertension and risk factors among school going children in the district of Shubra in Greater Cairo, Egypt.

Materials and Methods: School going children aged between 6 to 13 years were selected by a purposive sampling method and blood pressure measurements were taken by a mercury sphygmomanometer as per recommendation of the American Heart Association. Hypertension in children and adolescents continues to be defined as systolic BP and/or diastolic BP that is, on repeated measurement, greater than or equal to the 95th percentile.

Results: Total prevalence of hypertension in our study was 15.4%. Hypertension in males was 18.8% and 12.5% in females. Prevalence of obesity in hypertensive children was 20.9% against normotensive 14.4% ($P<0.05$). Prevalence of hypertension in children with a family history of hypertension was 68.78% and 4.22% in children without a family history of hypertension ($P=0.01$). Prevalence of obesity in family members was 54.15% in hypertensive and 28% in normotensive ($P<0.05$).

Conclusion: Prevalence of hypertension was 15.4% in the study subjects. We identified obesity and a family history of hypertension to be significantly associated with childhood hypertension.

Introduction

The importance of measuring blood pressure (BP) in childhood and adolescence has been widely recognized [1]. Elevated BP in children may be an early sign of essential (or primary) hypertension and childhood BP levels are predictive of adult BP levels [2]. Hypertension and prehypertension have been increasing among children and adolescents since the 1990s [3,4]. Hospitalization rates for children and adolescents with a diagnosis of hypertension have doubled from 1997 to 2006 [5]. Among children and adolescents with hypertension, as many as one in three has target organ damage, especially left ventricular hypertrophy [6,7]. Accumulating evidence supports the theory that elevated blood pressure levels in adolescence act as a precursor of elevated blood pressure in adulthood, making it important to identify elevated blood pressure in childhood [8]. An analysis of the National Childhood Blood Pressure database found that 14% of adolescents with

prehypertension developed elevated blood pressure within 2 years [9]. In 2004, the National High Blood Pressure Education Program (NHBPEP) Working Group on Children and Adolescents recommended that health-care providers measure blood pressure in children over three years of age when evaluated in a medical setting [10]. The Bright Futures guidelines developed by the American Academy of Pediatrics (AAP) at the request of the Health Resources and Services Administration (HRSA) recommend that children and adolescents between ages three and seventeen years receive blood pressure screening during their annual preventive care visit [11,12]. The National Quality Forum (NQF) has endorsed blood pressure screening as a performance measure. The NQF recommends that there be documented in the medical record as to whether the result is abnormal or normal for children during the year they reach age thirteen and during the year they reach age eighteen [13]. This study was conducted to observe the prevalence and risk factors for hypertension in children from the city of

Cairo, Egypt.

Experimental

This study was a cross-sectional study carried out from September 2010 to March 2011, in a non-fee paying primary and preparatory school in the district of Shubra in Greater Cairo. It was performed on 1,335 students aged between six and thirteen years. There were 600 boys and 735 girls. The students were almost of the same socioeconomic status. Written informed consent was taken after the study was explained to the children and their parents. The study was approved by the Ethics Committee of Al-Zahraa hospital.

Questionnaires sent to parents inquired about the child's age, gender, address, and health conditions, both previous and current. The questionnaire also asked whether there was a medical diagnosis of hypertension among blood-related family members and which family members exactly were affected. The child was classified as having a positive family history only if the disease was present in a first-degree relative. Measurements taken for each student were weight, height, and blood pressure. Weight was measured (to the nearest 0.5 kg) with the subject standing motionless on the weighing scale with feet 15 cm apart, and weight equally distributed on each leg. Height was measured (to the nearest 0.5 cm) with the subject standing in an erect position against a vertical scale of portable stadiometer and with the head positioned so that the top of the external auditory meatus was on a level with the inferior margin of the bony orbit [14]. Blood pressure (BP) measurements were taken using a mercury sphygmomanometer as per the recommendations of the NHBPEP [10]. The measurements were taken in a quiet room in the sitting posture with the arm resting on the table. Efforts were made to eliminate the factors, which may affect the blood pressure, e.g., anxiety, crying, exercise, etc. The average of three consecutive readings was taken as the blood pressure of the child. Children with hypertension were told to come back after a week to obtain a second reading to confirm hypertension. In 2004, the NHBPEP [10] defined hypertension in children and adolescents as systolic BP and/or diastolic BP that is at or above the 95th percentile for age, height and gender. Children with blood pressure between the 90th and 95th percentile are considered "pre-hypertensive" [15]. Body mass index (BMI), the body weight in kilograms divided by the square of height in meters, was used as the measure of obesity in this study. The International Obesity Task Force (IOTF) classification was utilized for the estimation of overweight and obese subjects.

Obesity in children was defined as children with a BMI value above the 95th percentile for a specific age and sex [16]. Data was analyzed using SPSS (Statistical Package for Social Science) version 17.

Results and Discussion

Results

A total of 1,335 children were enrolled in the present study. The ages ranged from 6 to 13 years old with a mean age of 10.47 ± 2.27 years. The gender distribution was 735 females (55.06%) and 600 males (44.94%). From the sample, 925 children had normal blood pressure (69.3%), 205 were prehypertensive (15.4%), and 205 were hypertensive (15.4%) (Table 1). There was a statistically significant increase in both systolic and diastolic blood pressure with increasing age (Table 2). The prevalence of prehypertension among female children (16%) was slightly higher than male children (14.5%). However, the prevalence of hypertension in male children (18.8%) was higher than female children (12.5%) (Table 3). (Table 4) shows that the prevalence of normal systolic BP in female and male children was 58.2% and 41.7%, respectively. The prevalence of systolic prehypertension in male children and female children was 61.7% and 38.2%, respectively. There was a statistically significant difference between the prevalence of systolic hypertension in male (56.6%) and female (43.3%) children. Also, the prevalence of normal diastolic BP in female children (56.63%) was higher than male children (43.37%). The prevalence of diastolic prehypertension in female children (54.50%) was higher than in male children (45.50%). There was a statistically insignificant difference between the prevalence of diastolic hypertension in male children (53.18%) and female children (46.82%). A positive family history of hypertension was reported for 141 (68.78%) of the hypertensive children, and 39 (4.22%) of the normotensive children (Table 5).

The prevalence of positive family history of obesity in the hypertensive group was 54.15% and 28% in the normotensive group. The normotensive group had a family history of obesity. 3.4% of hypertensive children belong to consanguineous marriage and 3.6% of normotensive children belong to consanguineous marriage (Table 6). (Table 7) shows that the increase in BMI percentiles was associated with a statistical significant increase in BP percentiles.

Table 1. Prevalence of BP levels in the studied children

Table 2: Prevalence of BP levels in the studied children							
Normal		Blood Pressure				Total No	%
		Prehypertension		Hypertension			
No.	%	No.	%	No.	%		
925	69.3%	205	15.4%	205	15.4%	1335	100%

Table 2. The mean values and standard deviation of systolic and diastolic blood pressure for each age group

Blood Pressure	Groups	No.	Range	Mean $\pm$ S.D.	F value	P value
Systolic BP	6- 7.9 years	208	(80 – 130)	101.47 $\pm$ 10.2	10.887	0.001
	8- 9.9 years	402	(80 – 150)	104.58 $\pm$ 12.42		
	10- 13 years	725	(80 – 150)	106.12 $\pm$ 13.67		
Diastolic BP	6- 7.9 years	208	(50 – 90)	65.63 $\pm$ 7.59		
	8- 9.9 years	402	(50 – 100)	67.62 $\pm$ 9.85		
	10- 13 years	725	(50 – 100)	68.82 $\pm$ 10.41		

Table 3. Prevalence of Systolic and diastolic hypertension in relation to age groups

Table 3. Prevalence of systolic and diastolic hypertension in relation to age groups								
Age Groups	Systolic Blood Pressure (BP)						Chi-Square	P-value
	Normal		Prehypertension		Hypertension			
	No.	%	No.	%	No.	%		
Group I (6-7.9 y)	137	12.58	48	47.06	23	16.09	89.338	0.001
Group II (8-9.9 y)	326	29.94	24	23.53	52	36.36		
Group III (10-13 y)	626	57.48	30	29.41	69	47.55		
Age Groups	Diastolic Blood Pressure (BP)						Chi-Square	P-value
	Normal		Prehypertension		Hypertension			
	No.	%	No.	%	No.	%		
Group I (6- 7.9 y)	114	12.00	69	32.70	24	13.87	97.306	0.001
Group II (8- 9.9 y)	293	30.74	27	12.80	83	47.98		
Group III (10- 13 y)	544	57.26	115	54.50	66	38.15		

Table 4. Frequency distribution of the hypertensive cases in both sexes

Sex	Blood Pressure						P-value
	Normal		Prehypertension		Hypertension		
	No.	%	No.	%	No.	%	
Male	400	66.7	87	14.5	113	18.8	0.188
Female	525	71.4	118	16.0	92	12.5	

Table 5. Frequency distribution of the systolic blood pressure (SBP) and/or diastolic blood pressure (DBP) levels in both sexes

Sex	Systolic Blood Pressure						Chi-Square	P-value
	Normal		Prehypertension		Hypertension			
	No.	%	No.	%	No.	%		
Male	455	41.78	63	61.76	82	56.64	23.978	0.001
Female	634	58.22	39	38.24	62	43.36		
Total	1089	100%	102	100%	144	100%		

Sex	Diastolic Blood Pressure						Chi-Square	P-value
	Normal		Prehypertension		Hypertension			
	No.	%	No.	%	No.	%		
Male	413	43.37	96	45.50	92	53.18	5.719	0.057
Female	538	56.63	115	54.50	81	46.82		
Total	951	100%	211	100%	173	100%		

Table 6. Consanguinity, positive family history of hypertension, and obesity's effect on childhood hypertension

History	Groups	Blood Pressure					
		Normal		Prehypertension		Hypertension	
		No.	%	No.	%	No.	%
Consanguinity	Negative	891	96.32	197	96.10	198	96.59
	Positive	34	3.68	8	3.90	7	3.41
	Total	925	100	205	100	205	100
F.H. of HTN	Negative	886	95.78	85	41.46	64	31.22
	Positive	39	4.22	120	58.54	141	68.78
	Total	925	100	205	100	205	100
F.H. of Obesity	Negative	666	72.00	75	36.59	94	45.85
	Positive	259	28.00	130	63.41	111	54.15
	Total	925	100	205	100	205	100

Table 7. Blood pressure of the study participants according to BMI categories

BMI	Blood Pressure						P-value
	Normal		Prehypertension		Hypertension		
	No.	%	No.	%	No.	%	
Normal Weight	784	70.4	160	15.2	168	14.4	0.006
Over Weight	78	69.0	21	18.6	14	12.4	
Obese	64	58.2	23	20.9	23	20.9	

Discussion

In the present study, the prevalence of both prehypertension and hypertension in the entire group of children was at the same value of 15.4%. The prevalence rates of hypertension vary among different studies from different countries.

Studies conducted in China and Iran reported that the prevalence of prehypertension and hypertension was around 15% and 20%, respectively, in children [17, 18]. These values are partially similar to the estimated prevalence in the current study. On the other hand, other studies on prehypertension and hypertension among children showed that the prevalence rates are estimated to be 3% – 4% [19-21]. The prevalence rates of prehypertension and hypertension in a study done on Egyptian adolescents aged 11-19 were 5.7% and 4.0%, respectively [22]. The results obtained from this study's sample of school going children could be partly explained by a high prevalence of hypertension in the Egyptian adult population [23].

In Baghdad, the overall prevalence of hypertension was 1.7% [24]. Compared to other Arab countries, much lower values were found in Israeli Arab children; the BP was elevated in 7.7% of the studied children [25]. In Kuwaiti children the overall prevalence of hypertension was 5.1% [26]. Overall, the prevalence rates of hypertension in the previously discussed countries vary widely. This difference in results can be related to sample size, age, and ethnic differences among the studied groups.

In the present study, we found a statistically significant association between obesity and hypertension: 20.9% of the obese children had hypertension while 14.4% of the non-obese children had hypertension. Moreover, there was a larger prevalence of prehypertension in obese children as compared to normal weight children (20.9% versus 15.2%, respectively). Similar observations also were reported in a previous Egyptian study [22]. Also, this result was comparable to other previous studies in Hungary [27], in India [28] and Iran [18].

An obese child presents a clear risk of becoming prehypertensive or hypertensive. That risk is four times greater than that of a child of normal weight [29]. The intensified effect of BMI on BP levels may relate to an elevated activity of the sympathetic nervous system [30]. A previous study observed that there was a positive correlation between blood pressure and obesity and reported that among all demographic and clinical factors analyzed, BMI was most strongly associated with hypertension [31]. Therefore, it is very important to prevent excess weight gain in childhood. Also, in the present study, positive family history

of hypertension was also strongly associated with hypertension. Family history of hypertension was a significant risk factor for hypertension as evident in other studies [28, 32].

In our study, we found that the prevalence of hypertension increases with age. This phenomenon is probably caused by the growth of the child. Blood pressure in children is related to somatic growth and increase in height, skeletal maturation, and sexual maturation. Moreover, given the presence of an increase of BMI with age, the elevated BP values can also be attributed to a parallel change in BMI [33].

In the present study, there was a larger prevalence of prehypertension in girls (16%) than in boys (14.5%). The higher prevalence of prehypertension in girls than in boys may be related to significant physiological changes of puberty where menarche and the development of secondary sexual characteristics impose tension and anxiety on girls in our relatively conservative society and hence higher BP profiles [24]. The prevalence of hypertension in boys (18.8%) was slightly higher than girls (12.5%), with no statistically significant difference between them (P value= 0.188). This data is in agreement with other studies [34, 35, 24].

We found that the prevalence of systolic hypertension in male children was higher than in female children and the difference was statistically significant. The prevalence of diastolic hypertension in males was higher than in females and the difference was statistically insignificant. This is in agreement with previous studies [34, 36, 37, 24].

Previous studies support the preponderance of systolic hypertension. Indirectly, systolic hypertension in children represents an early stage of primary hypertension that may be a sign of basal sympathetic nervous system hyperactivity. If these high levels of SBP persist, they could lead to a substantial increase in adult BP levels, which would ultimately lead to increased cardiovascular morbidity, and mortality in the next generation [38]. In fact, the youth with high normal BP were more likely to become hypertensive as adults [39].

Conclusion

The result of our study confirms that there is a significant high prevalence of childhood prehypertension and hypertension among Egyptian school children from Cairo, Egypt. To review, in the present study, we found that hypertension increases with age among males. Gender,

obesity, and positive family history of hypertension were found to be associated with hypertension in children. Obesity and positive family history of hypertension are the most important contributing factors for childhood prehypertension and hypertension. Prevention and control mechanisms are needed in Egypt in order to decrease the number of children developing hypertension as adults.

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