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A study of blood pressure profile in school children in rural and urban area in and around Karad

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Abstract
Background: Hypertension (HTN) is the common and potent universal contributor to cardiovascular mortality. There are not many studies done about the prevalence of HTN in rural school children.
Objectives: The present study was done in school children to know the occurrence/prevalence of HTN and to study the relation of HTN with age, sex, BMI & family history.
Study Design: It is a cross sectional study done in randomly selected rural school children in the age group of 6-16 yrs. The study sample includes apparently healthy 1000 children. For each child, BMI was calculated & 3 BP recordings were taken.
Results: In the present study, prevalence of systolic HTN was 2.7% in males & 1.5% in females with overall 1.5%. Prevalence of obesity was 6%. 6.7% obese and 13.3% overweight children were hypertensive. Out of 20 hypertensive children only 14(70%) had family history of HTN present.
Conclusion: HTN is a major risk factor for cardiovascular & cerebrovascular disease. In the present study prevalence of HTN was 2% with male preponderance (2.7:1.5). Obesity is an important risk factor for cardiovascular complications. In the present study prevalence of HTN was 6.7% in obese and 13.3%in over weight school children.

Keywords: obesity, HTN, school children

Introduction

Hypertension is one of the major diseases, which is killing majority of population in the entire world. Majority of them is of essential type. In childhood systemic hypertension is a major condition, with estimated population prevalence of 1-2% in the developed countries [1]. Although no such statistics are available for Indian scenario, but there is every reason to believe that the state of affairs is in no way better than any other Western countries.

In the past decade, many workers have confirmed that familial aggregation of blood pressure occurs among adults, and such an aggregation, has been traced to childhood, as early as one year of age and there is some evidence to believe that such an aggregation begins somewhere between the firrst week and first month of life [2]. Blood pressure in children is a reliable predictor of adult blood pressure level, therefore it is important to diagnose children and adolescents who are at increased risk of developing essential hypertension as adults [3].

Ideally hypertension or tendency for hypertension should be detected as early in life as possible. According to Nelson, to increase early detection of hypertension, accurate blood pressure measurements should be part of the routine annual physical examination of all children, three years or older [4]. However it is not possible to record reliable blood pressures by conventional methods in children below 6-7 years of age [5]. Hence the ideal age, would be between 6-15 years, i.e. school children. NIH Task force of USA has even recommended that blood pressure measurements along with weight and height should be recorded in children, at least once a year [6].

Many studies have been done in Western countries on this subject and normal standards for blood pressure have been established for the children of different ages, in both sex, black and white race, in their countries. At the same time Western standards cannot be applied to Indian children, because of differences in factors such as ethnic, socio-economic, dietetic, environmental and emotional factors between Indian and Western countries. Hence there is strong need to establish the normal blood pressure standards for Indian children and find out the prevalence of hypertension among them.

Many studies in India have been done to know the blood pressure profile in children in varying age groups (varies from 3 to 17 years) and urban affluent children and not in rural areas. Therefore, the present study was undertaken to determine the blood pressure levels in apparently healthy, asymptomatic school children in the age range of 6 to 16 years in karad taluka and to determine the influence of contributory factors like, age, sex, body mass index (BMI) and parental blood pressure status. So that this can be a reference and guidance for the management of hypertension.

Materials & Methods

Source of Data

It is a cross sectional study done between time period from October 2015 and November 2017 in the age group of 6 to 16 years. Children were selected from Rural schools in Karad

taluka. Two schools one was Nagar Parishad School, and other was private trust school, childrens were selected based on simple random sampling method. Study was approved and ethical clearance was obtained from ethical committee of Krishna institute of Medical sciences deemed university, Karad.

Method of Collection of Data

Sample size

1000 children in the age group of 6-16 years.

Inclusion Criteria

- Apparently healthy rural School children aged between 6 to 16 years of karad taluka

Exclusion Criteria

- Children below 6 years and above 16 years.
- Children with known cardiovascular, renal and endocrine diseases.

Data was collected in a pre-tested Performa meeting the objective of the study. Informed consent was obtained from the parents of all children before measuring blood pressure. Blood pressure was measured in all 6-16 years school children in sitting position after 10 minutes of rest. BP was measured after applying an appropriate sized cuff on the right arm encircling 2/3rd circumference of the arm with lower edge 2.5 cm above the cubital fossa, as per guidelines suggested by WHO guidelines. The age of the school children was obtained from the school records. The name and other particulars were entered in a pretested Performa. Height was measured by making the child to stand upright barefoot, on the ground with heels, buttocks and shoulder touching the wall and head in Frankfurt plane. The height was measured using a sliding stadiometer with an accuracy of 0.1 mm. Weight was recorded using a spring balance (bathroom scale) calibrated to 0.5 Kg accuracy.

Systolic blood pressure was determined as appearance of lst Korotkoff sounds and diastolic blood pressure was taken at the point of muffling of heart sounds (4th Korotkoff sounds). Three measurements were taken at an interval of ten minutes each and mean of these readings were taken as average systolic blood pressure and average diastolic blood pressure.

Blood pressure values were compared to the values given by the update of fourth task force report of the National high blood pressure Education Programme Co- coordinating committee [7].

Children were classified into 3 groups as per guidelines of the above committee

- If BP > 95th percentile - Hypertension (HTN)
- 90 – 95th percentile - Pre hypertension (PHTN)
- < 90th percentile - Normal (N)

Blood pressure was compared in relation to age, sex and height percentile in each age group. In those children whose systolic and diastolic Blood Pressure values was found to be more than 95th percentile for age, sex and height were diagnosed as hypertensive.

After recording weight and height of the school children, Body mass index (BMI) was also calculated and based on these values children were classified as follows.

- If BMI > 95th percentile — Obese (OB)
- 85-95th percentile — Over weight (OW)
- <85th percentile — Normal (N)

Statistical Method

Quantitative data was presented with the help of Mean and Standard deviation. Comparison among the study groups was done with the help of paired t test as per results of normality test. Qualitative data was presented with the help of frequency and percentage table. Association among the study groups was assessed with the help of chi-Square test.

'p' value less than 0.05 is taken as significant.

Pearson's chi-squared test

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where,

X2 = Pearson's cumulative test statistic.

Oi = an observed frequency;

Ei = an expected frequency, asserted by the null hypothesis;

n = the number of cells in the table.

Results were graphically represented where deemed necessary. Appropriate statistical software, including but not restricted to MS Excel, SPSS ver. 20 was used for statistical analysis. Graphical representation was be done in MS Excel 2010.

Results

Study group consists of 1000 rural school children from Karad taluka between 6-16 years, 455 were males and 545 were females. In these children, prevalence of systolic hypertension in males is 2.7% compared to 1.5% in females with over all prevalence of 2%. Prevalence of systolic Pre-hypertension in males is 5.9%compared to 0.6%in females with overall prevalence of 3%. Prevalence of Diastolic hypertension in males is 0.9% compared 1.6% in females with overall 1.3%, where as prevalence of diastolic Pre-hypertension is more in males (4.8%) compared to females(2.9%) with overall 3.8%.

Table 1: Prevalence of systolic prehypertension and hypertension (SBP) in children according to gender

Prevalence	Male		Female		Total		p Value
	N	%	N	%	N	%	
Normal	416	91.4%	534	97.9%	950	95%	<0.001
Prehypertension	27	5.9%	3	0.6%	30	3%	

Hypertension	12	2.7%	8	1.5%	20	2%	
Total	455	100%	545	100%	1000	100%	

Table 2: Prevalence of diastolic prehypertension and hypertension (DBP) in children according to gender

Prevalence	Male		Female		Total		p Value
	N	%	N	%	N	%	
Normal	429	94.3%	520	95.5%	949	94.9%	<0.001
Prehypertension	22	4.8%	16	2.9%	38	3.8%	
Hypertension	4	0.9%	9	1.6%	13	1.3%	
Total	455	100%	545	100%	1000	100%	

Prevalence of obesity is 2.4% in male and 0.7 % in female with over all prevalence of 1.5%. Prevalence of over weight is 7.5% in male compared to 4.8 in female with overall prevalence of 6%.

Systolic hypertension seen in 13.3% of overweight and 6.7% of obese children. Systolic prehypertension seen in 11.7% overweight and 13.3 % obese children. Only2.3% are prehypertensive and 1.1% is hypertensive with normal BMI. (Table3)

Diastolic hypertension seen in 16.7% of overweight and 6.7% obese children. Diastolic pre hypertension seen in 18.3% overweight and 20 % obese children. Only 1.7% are pre hypertensive and 0.9% are hypertensive with normal BMI (Table 4).

Out of 20 children with systolic hypertension 14 children gave definite family history of hypertension in one of the family members. Out of 14 children with diastolic hypertension only 11 gave definite history of hypertension in one of the family members (Table 5-6)

Discussion

The present study is a cross sectional study done in rural schools of Karad taluka, maharashtra consists of 1000 children in the age group of 6-16 years.

Prevalence of Systolic hypertension in the present study is 2.7% in males and 1.5% in females with overall prevalence of 2%.

A wide range of prevalence of hypertension has been recorded in different studies ranging from 1 to 16.2%. This diversity of prevalence of hypertension is mainly due to varying age groups taken for study and different criteria adopted for defining hypertension, basic differences between racial sub groups related to geographic, dietary and cultural factors.[7]

Table 3: Prevalence of systolic prehypertension and hypertension (SBP) in children according to BMI

BMI	Total	Normal	Pre HTN	HTN	p Value
Normal	925	893 (96.5%)	21 (2.3%)	11 (1.2%)	<0.001
Overweight	60	45 (75%)	7 (11.7%)	8 (13.3%)	
Obese	15	12 (80%)	2 (13.3%)	1 (6.7%)	
Total	1000	950 (95%)	30 (3%)	20 (2%)	

Table 4: Prevalence of diastolic prehypertension and hypertension (DBP) in children according to BMI

BMI	Total	Normal	Pre HTN	HTN	p Value
Normal	925	900 (97.4%)	16 (1.7%)	9 (0.9%)	<0.001
Overweight	60	39 (65%)	11 (18.3%)	10 (16.7%)	
Obese	15	11 (73.3%)	3 (20%)	1 (6.7%)	
Total	1000	950 (95%)	30 (3%)	20 (2%)	

Table 5: Prevalence of systolic hypertension and prehypertension (SBP) according to family history and gender

Family History of HTN	Male				Female			
	Total	Normal	Pre HTN	HTN	Total	Normal	Pre HTN	HTN
Present	133	105 (78.8%)	20 (15.1%)	8 (6.1%)	164	155 (94.6%)	3 (1.8%)	6 (3.6%)
Absent	322	311 (96.6%)	7 (2.2%)	4 (1.2%)	381	378 (99.1%)	1 (0.3%)	2 (0.6%)
Total	455	416 (91.4%)	27 (5.9%)	12 (2.7%)	545	533 (97.9%)	4 (0.7%)	8 (1.4%)

Table 6: Prevalence of diastolic hypertension and prehypertension (DBP) according to family history and gender

Family History of HTN	Male				Female			
	Total	Normal	Pre HTN	HTN	Total	Normal	Pre HTN	HTN
Present	133	110 (82.7%)	20 (15.1%)	3 (2.2%)	164	144 (87.8%)	12 (7.3%)	8 (4.9%)
Absent	322	319 (99.1%)	2 (0.6%)	1 (0.3%)	381	376 (98.7%)	3 (0.8%)	2 (0.5%)
Total	455	429 (94.3%)	22 (4.8%)	4 (0.9%)	545	520 (95.4%)	15 (2.7%)	10 (1.9%)

In our study prevalence of Systolic hypertension is correlating with the studies done by Kilcoyne *et al*, Londe and Laroia D *et al*. in which prevalence of Diastolic hypertension is 1.3% [8].

The hypertension in the present study is distributed over all adolescent age groups. The elevation of blood pressure in adolescents is also observed in various other studies, although exact reasons for the same are not clear.

Present study shows that prevalence of Systolic hypertensionis higher in males (2.7%) compared to females (1.5%), which is similar to studies done by Prazny Kardar *et al*. [10] and Laroia D *et al*. [8].

Prevalence of Diastolic hypertension is 0.9% in male compared to 1.6% in female whereas diastolic Pre-hypertension is 4.8% in male compared to 2.9% in female which is also nearer to the study done by Laroia D *et al*. [8].

Present study shows a Systolic HTN of 6.7% in obese school children which is similar to other studies by Jonathan M *et al.* [11] and J Chatwal *et al*. [12] Present study also shows Systolic HTN in 13.3% of overweight children whereas systolic Pre-Hypertension in 13.3% of obese and 11.7% of overweight children. It was evident that obesity in children is a risk factor for hypertension.

In the present study, there is significant association between parental hypertension and blood pressure in their children. Out of 20 children with systolic hypertension only 14 children gave family history of HTN in one of the parents. Similar observation was made by londe s *et al*. and chadha SL *et al*. [9, 10] who actually recorded blood pressure of both the parents and their children and compared them [13].

However, it is an established fact that familial aggregation of blood pressure occurs among adults and it extends through childhood down to the age of one year [2, 14].

In cases where any one of the parents was hypertensive but their children blood pressure was within normal limits, the possibilities

1. Parents are suffering from one of the secondary types of hypertension, which is unlikely to affect the off springs.
2. If only any one of the parents is suffering from essential hypertension the chances of affecting the off springs is only 28%, the particular child included in the study being unaffected.

Further detailed studies which include measurement of parental blood pressure are warranted.

Conclusion

HTN is a major risk factor for cardiovascular & cerebrovascular disease. In the present study prevalence of HTN was 2% with male preponderance (2.6:1.5). Obesity is an important risk factor for cardiovascular complications. In the present study prevalence of HTN was 6.7% in obese and 13.3% in over weight school children.

Limitations of the Study

No attempt was made to measure the blood pressure of the parents, whose children were labeled as hypertensive, due to lack of time, resources and personnel. Hence the true state of affairs regarding parental hypertension might have been missed

What is already known?

Blood pressure in children is a reliable predictor of adult blood pressure level who are at increased risk of developing essential hypertension as adults.

What this study adds to literature?

Hypertension is more prevalent in adolescent age group even in rural areas especially males with overweight and obesity being the significant risk factors with significant to family history.

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