

Prevalence of hypertension in school going children of Surat city, Western India

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ABSTRACT

Background: Early diagnosis of hypertension (HT) is an important strategy in its control. Previous studies have documented that hypertension may begin in adolescence, perhaps even in childhood. The purpose of this study was to determine the prevalence of hypertension and risk factors among school going children in Surat city, south Gujarat, India. **Materials and Methods:** School going children aged between 6 to 18 years, of two schools were selected by purposive sampling method and blood pressure measurements were taken by mercury sphygmomanometer as per recommendation of American heart association. Hypertension is considered when blood pressure is more than 95th percentile according to update on task force report (2004) and children having hypertension in first and second recording repeat measurement was done to confirm hypertension after a week. **Results:** Total prevalence of hypertension in our study was 6.48%. Hypertension in males was 6.74% (<10 yrs 5.88%, 10-13yrs 6.04%, >13yrs 9.19%) and in females was 6.13% (<10yrs 0.62%, 10-13yrs 8.67%, 13yrs 8.48%). Prevalence of obesity in hypertension was 8.7% against normotensive 1.1% ($P<0.05$). Prevalence of hypertension in family members of hypertensive was 18.6% and in normotensive 13.1% ($P=0.1$). Prevalence of diabetes mellitus in family members of hypertensive was 23.4% and 13.7% in normotensive ($P<0.05$); while prevalence of ischemic heart disease in family members was 12.34% in hypertensive and 8.3% in normotensive ($P<0.05$). **Conclusion:** Prevalence of hypertension was 6.48% in the study subjects. We identified obesity, family history of diabetes mellitus, ischemic heart disease was found to be significant association for childhood hypertension.

Key words: Children, hypertension, India, risk factors

INTRODUCTION

Systemic hypertension is an important condition in childhood, with estimated population prevalence of 1-2% in the developed countries. Nutritional surveys, in the USA show a significant secular increase in systolic and diastolic blood pressures.^[1] The causes

for increase in blood pressure are attributed to obesity, change in dietary habits, decreased physical activity and increasing stress. Similar data is lacking from India; small surveys in school children suggest a prevalence ranging from 2-5 %.^[2]

Elevated blood pressure, systolic or diastolic at any age, in either sex is a contributor for all forms of cardiovascular disease.^[3] Identifying and modifying risk factors reduces the incidence and complications in adolescents and adult. Prevalence of hypertension varies across countries and states. It is multifactorial disease, influenced by genetic, racial, geographic, cultural and dietary patterns. This study was conducted to observe the prevalence and risk factors for hypertension in children from Surat city.

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MATERIALS AND METHODS

The study was a prospective cross sectional study conducted in two schools from Surat city (one government and one private). The schools were selected by using purposive sampling method keeping in view operational feasibility.

The sample size was calculated keeping in view expected prevalence of hypertension in children as 6%. The study subjects were children aged between 6 to 18 years of age, in the city of Surat in south Gujarat, India which is an important industrial centre and well known for diamond industry and textile industries. The following subjects were eliminated from the study, those who (1) had been advised bed rest for more than 15 days during the last 6 months, due to any sickness (2) had any chronic systemic disease (3) were absent during the time of conduction of the study due to any reason (4) unwilling for study.

The study protocol was approved by ethical committee of Govt. Medical College, Surat. A prior consent for the study was taken from school administration and from the parents. At the time of the initiating the study each participant were informed about the study protocol and written consent was obtained. Study could be conducted properly only from June to February as academic calendar existing for these books was the same and their exam months and vacations were to be excluded. As far as possible, the free time or physical activity periods were used for this study, so that their routine classes were unaffected.

The exact age of children was verified from school records. Children were explained about study in their local language (Gujarati). A semi-structured pre-tested questionnaire was administered to each student by first author with the help of class representative and asked to get filled by parents at home, unsatisfactory or incomplete answer confirmed by telephonic contact or repeating questionnaire. Questionnaire included information regarding demographic details (name, age sex, address, religion) and family history of hypertension, diabetes mellitus, ischemic heart disease (IHD) in father and mother. Children those who were having positive family history, findings were reconfirmed by telephonic interview of parents asking about current medications and doctor visited.

All anthropometric measurements were taken by trained investigators. Height and weight were measured, using "Seca" stadiometer (UNICEF) with beam balance, with sensitivity of 0.1 cm and 0.1 kg, respectively. Zero error was set after every 10 measurements. Height was measured without any footwear. The student stood straight with

heels, buttocks, back touching the vertical limb of the instruments and stretching upwards to the fullest extent with arms hanging on the side. The head was aligned so that the lower rim of the orbit and the auditory canal were in the horizontal plane (Frankfurt plane). Mild upward pressure was exerted on the mastoid region bilaterally. Weight was measured without any footwear with minimal clothing (school uniform). BMI was calculated and children are identified as overweight if BMI was more than 85th percentile and obese if BMI was more than 95th percentile (IAP Growth Monitoring Guidelines for Children from Birth to 18 Year).^[4]

Children made comfortable and explained about procedure to alleviate anxiety. BP was recorded by mercury sphygmomanometer using standardized method.^[5,6] For each student, the blood pressure was measured thrice in the same visit with a minimum of 30 minutes rest between each determination and mean blood pressure was calculated. The systolic blood pressure was determined by the onset of the "tapping" Korotkoff-1 sound and the diastolic at its disappearance (Korotkoff-5). The children were considered hypertensive if the systolic or diastolic blood pressure or both were equal to or more than the 95th percentile for height for age and sex.^[5] Students found to have hypertension on first visit were contacted to undergo a second set of blood pressure measurements at least four weeks later. Three further sets of reading were taken on second contact, 4 weeks or later after the first measurement. The pre stated norms were then used to conclude the presence or absence of hypertension. Blood pressure measurements were made by a single observer.

Statistical analysis

Data was recorded on a pre-designed Performa and managed on Excel spread sheet. All the entries were double checked for any possible key-board error. Association of each of the categorical with hypertension (outcome variable) is assessed with chi-square test. Variables showing statistically significant association with the outcome variables ($P < 0.05$) were considered as statistically significant. Data analysis was performed using Epi Info 6 program (CDC Atlanta). In this study P value less than 0.05 was considered as statistically significant.

RESULTS

Out of 1350 children 101 excluded in study as parents were uncooperative and repeated absenteeism of children. Study included 1249 children which included 727 males (58.2%)

and 522 females (41.8%). Total prevalence of hypertension in our study was 6.48%. Out of total 1249 children 461 children were from private school and 788 children were from government school. Prevalence of hypertension was 8.24% in private school children while it was 5.4% in children from government school. Overall prevalence of obesity was 1.6%. Prevalence of obesity was 3.03% in private school children while it was 0.7% in children from government school. This explain the relative low prevalence of obesity in our study as children from government school is from low socio-economic status where malnutrition was still the significant problem but it was not the aim of our study to measure the malnutrition.

Prevalence of hypertension in males was 6.74% and in females was 6.13%. We observed that prevalence of hypertension increases with age [Table 1], among girls prevalence increases after 10 years (<10 yrs 0.62%, 10-13yrs 8.67 %, >13 yrs 8.48%) and in boys prevalence increases after 13yrs (<10 yrs 5.88%, 10-13 yrs 6.04 %, > 13yrs 9.19%).

In our study we also observed significant high prevalence of hypertension in obese children or in other words 1/3rd of obese in our study were hypertensive. The prevalence of obesity in hypertensive was 8.7% against normotensive 1.1 %. ($P < 0.05$) [Table 2].

We observed that prevalence of familial hypertension in children with hypertension was 18.6% and in normotensive

was 13.1($P = 0.1$). The prevalence of diabetes mellitus in family members of hypertensive children was 23.47% and in normotensive children was 13.7% ($P < 0.05$). The prevalence of IHD in family members of hypertensive children was 12.3% and in normotensive children was 8.3% ($P < 0.05$) [Table 2].

DISCUSSION

We determined the prevalence and risk factors for hypertension among school going children in a prospective cross sectional study in Surat city. We concluded that prevalence of childhood hypertension increase with age, among girls it increases after 10 years and in boys it increases after 13yrs. Family history of diabetes mellitus, IHD was found to be significant association for childhood hypertension.

The unique feature about Surat is that it is cosmopolitan and fastest developing economic city in India. The prevalence rates of hypertension have been so variable among different studies from different countries^[7,8] and from India also.^[9-12] A previous study from Surat by HG Thakor *et al* found low (2.3%) prevalence of hypertension in children as compared to our study. The difference may be because of using different criteria as they used Second Task Force recommendation and all schools in their study were government school run by Surat Municipal Corporation while we used Fourth Task Force recommendation and one of the selected schools in our study was private school. A fall in prevalence on repeated evaluation has been noticed by Gupta and Ahmed^[9] and Verma *et al*^[10] so we did BP measurement on different occasion to reduce false positives. Burke *et al*^[13] also have recommended serial measurement to reduce the effect of regression to mean and increase predictive values.

We observed in our study that prevalence of hypertension increase with age. Studies in the past have demonstrated that age appropriate blood pressure values tend to be

Table 1: Age and sex wise distribution

	Hypertensive	Normotensive	Total
Males	49	678	727
< 10 year	15 (5.88)	240	255
10-12 years	16 (9.19)	158	174
Female	32	490	522
< 10 years	1 (0.62)	160	161
10-13 Years	17 (8.67)	179	196
<13 years	14 (8.48)	151	165

Values in parenthesis denotes percentages

Table 2: Relationship between different variables and childhood hypertension

Variables	Status	Hypertensive	Normotensive	Total	P value
Obesity	Present	7 (8.6)	74 (93.4)	81	0.0002
	Absent	13 (1.1)	1155 (98.6)	1168	
Family H/O hypertension	Present	16 (19.75)	155(13.27)	171	0.1007
	Absent	65 (80.25)	1013 (86.73)	1078	
Family H/O diabetes mellitus	Present	19 (23.45)	155 (13.27)	174	0.0104
	Absent	62 (76.54)	1013 (86.72)	1075	
Family H/O IHD	Present	10 (12.34)	60 (5.13)	70	0.0063
	Absent	71 (87.65)	1108 (94.86)	1179	

Values in parenthesis denotes percentages

more among boys than girls throughout childhood and adolescence.^[5,14] Studies from Turkey^[15] and Zambia^[16] on school children showed rise of BP with age. Soundarssanane MB *et al* from India also gives same opinion of increase in hypertension with increase in age.^[17] In their study on adolescent and young adults, they found a significant increasing trend of BP was seen only among males. In a recent study from India,^[18] there was a relative increase in mean systolic and diastolic blood pressures in girls by the age of 9 years. By the age of 16 years, both genders have similar systolic blood pressure values. By the age of 16 years there appears to be minimal differences in diastolic blood pressure between both genders. We found almost similar observation.

The present study found significant rise of hypertension with obesity in both sex groups, around 30% of obese children in our study had hypertension. This association also demonstrated in many studies like Norwegian study^[19] and Taiwan study.^[20] The Framingham study^[21] also showed increased prevalence of obesity in subjects with hypertension as well increase in BP in established obesity. Many studies from India^[9,10,17] and also from Surat^[22] had similar observations. Similar observations were also reported among adolescent population in Hungary^[23] and France^[24] and such association in early childhood with SBP alone was reported by British cohort.^[25] Andriska *et al*^[26] found 41% of their hypertensive children were obese, so they concluded that obesity plays very important role in development of childhood hypertension.

Family history of hypertension was significant risk factor for hypertension as evident in many studies like Zambian study^[27] which showed that parental history before age of 60 was related to offspring hypertension. Studies from India like Verma *et al*,^[10] Soundarssanance *et al*^[17] and Gupta and Ahmed^[19] have also reported similar observations. But in our study we couldn't observe such relationship which might be due to inadequate screening of parents as hypertension is iceberg disease and is largely asymptomatic. The awareness that essential hypertension has its origin in childhood has resulted in increased emphasis on screening. The Indian Pediatric Nephrology Group recommends annual measurement of blood pressure in all children more than 3-year-old, who are seen in clinics or hospital setting.^[28]

In our study we also identified significant relationship of family history of diabetes mellitus and IHD for hypertension in children. There are studies like Gambian^[29] study which observed positive relationship between familial history of Diabetes mellitus and stroke with development

of Obesity and stroke in adolescents and adults. Though hypertension, diabetes and IHD are interrelated yet studies are lacking on relationship between familial history of Diabetes and IHD with childhood hypertension.

Our study has number of limitations. All BP measurement was taken by single observer, which may be a source of bias. We have not studied or adjusted for factors such physical activity, diets and salt intake. We also did not look at how many of children require antihypertensive medications, do they develop any cardiovascular disease or other morbidity. There areas are open for further research.

In conclusion, result of our study confirms that there is significant high prevalence of childhood hypertension. Obesity, family history of diabetes mellitus and IHD are risk factors for childhood hypertension. Findings of the our study suggest a need for larger population based studies to accurately estimate the prevalence and risk factors for hypertension among children in our country

REFERENCES

1. Munter P, He J, Cutler JA, Wildman RP, Whelton BK. Trends in blood pressure among children and adolescents. *JAMA* 2004;291:2107-13.
2. Mohan B, Kumar N, Aslam N, Rangbulla A, Kumbkarni S, Sood NK, *et al*. Prevalence of sustained hypertension and obesity in urban and rural school going children in Ludhiana. *Indian Heart J* 2004;56:310-4.
3. Kannel WB. Role of blood pressure in cardiovascular diseases – The Framingham study. *Angiology* 1975;26:1-14.
4. Khadilkar VV, Khadilkar AV, Choudhury P, Agrawal KN, Ugra D, Shah NK. IAP growth monitoring guidelines for children from birth to 18 years: *Indian Pediatr* 2007;44:187-97.
5. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The Fourth Report on the diagnosis, evaluation and treatment of highblood pressure in children and adolescents. *Pediatrics* 2004;114: 555-75.
6. Update on the 1987 Task Force Report on HighBlood Pressure in Children and Adolescents: A working group report from the National High Blood Pressure Education Program. National High Blood Pressure Education Program Working Group on Hypertension Control in Children and Adolescents. *Pediatrics* 1996;98:649-58.
7. Hahn L. The relation of blood pressure to weight, height and body surface area in school boys. *Arch Dis Child* 1952;27:43-53.
8. Orchard TP, Hedley AJ, Mitchell JR. The distribution and associations of blood pressure in an adolescent population. *J Epidemiol Community Health* 1982;36:35-42.
9. Gupta AK, Ahmed AJ. Normal blood pressure and evaluation of sustained blood pressure and evaluation of sustained blood pressure elevation in childhood. *Indian Pediatr* 1990;27:33-42.
10. Verma M, Chhatwal J, George SM. obesity and hypertension in children. *Indian Pediatr* 1994;1:1065-9.
11. Loria D, Sharma M, Diwedi V, Belapurkar KM, Mathur PS. Profile of blood Pressure in normal school children. *Indian Pediatr* 1989;26:531-6.
12. Aggarwal VK, Sharon R, Srivastava AK, Kumar P, Pandey CM. Blood Pressure profile in children of age 3-15 years. *Indian Pediatr* 1983;20:921-5.
13. Burke GL, Cresanta JL, Shear CL, Miner MH, Berenson GS. Cardiovascular risk factors and their modification in children. *Cardiol Clin* 1986;4:33-6.
14. Jackson LV, Thalange NK, Cole TJ. Blood pressure centiles for Great Britain. *Arch Dis Child* 2007;92:298-303.

15. Irgil E, Erkenci Y, Ayetekin N, Ayetekin H. prevalence of hypertension in School children aged 13-18 yrs in Gemlike, Turkey. *Euro J Public Health* 1998;40:176-8.
16. Ng'andu NH. Blood pressure levels of Zambian rural adolescents and their. Relationship to age, sex, weight, height and three weights for height indices. *Int J Epidemiol* 1992;21:246-52.
17. Soudarssanane M, Mathanraj S, Sumanth M, Sahai A, Karthigeyan M. Tracking of blood pressure among adolescents and young adults in an urban Slum of Puducherry. *Indian J Community Med* 2008;33:107-12.
18. Raj M, Sundaram R, Paul M, Kumar K. Blood pressure distribution in children. *Indian Pediatr* 2010;47:477-85.
19. Sandvik L, Eriksson J, Thaulow E, Eriksson G, Mundal R, Rodahl K. Physical fitness as predictor of mortality among healthy, middle-aged Norwegian men. *N Engl J Med* 1993;328:533-7.
20. Paffenbarger RS Jr, Hyde RT, Wing AL, Lee IM, Jung DL, Kampert JB. The association of physical activity level and other life style characteristics with mortality among men. *N Engl J Med* 1993;328:538-45.
21. Dannenberg AL, Garrison RJ, Kennel WB. Incidence of hypertension in the Framingham study. *Am J Public Health* 1998;78:676-9.
22. Thakor HG, Kumar P, Desai VK. An epidemiological study of hypertension amongst children from various primary schools of Surat city. *Indian J Community Med* 1998;23:110-5.
23. Torok E, Gyrafas I, Csukas M. Factors associated with stable high blood Pressure in adolescents. *J Hypertens* 1985;3 (Suppl 3):389-90.
24. Aullen JP. Obesity, hypertension and their relationship in children and adolescents. An epidemiological study in schools (Authors transl). *Sem Hop* 1978;54:637-43.
25. Hardy R, Wadsworth ME, Langenberg C, Kuh D. Birth weight, childhood growth and blood pressure at 43 yrs in a British birth cohort. *Int J Epidemiol* 2004;33:121-9.
26. Andriska J, Gombik M, Breyer H, Tarr A. Hypertension in children and adolescents. Results of a long term follow up study 1975-1985. *Clin Exp Hypertens A* 1986;8:567-9.
27. Lascaux-Lefebvre V, Ruidavets J, Arveiler D, Amouyel P, Haas B, Cottet D, et al. Influence of parental history of hypertension on blood pressure. *J Hum Hypertens* 1999;3:631-6.
28. Bagga A, Jain R, Vijaykumar M, Kanitkar M, Ali U. Evaluation and management of hypertension. *Indian Pediatr* 2007;44:103-21.
29. Mariane AB, Gijs EL, Paul JN, Winston AS, Sana M, Ousman A, et al. Family history: An opportunity for early interventions and improved control of Hypertension, obesity and diabetes. *Bull World Health Organ* 2001;79:321-8.

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