SHORT COMMUNICATION

Prevalence of hypertension and variation of blood pressure with age among adolescents in Chetla, India

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Abstract: This community-based cross-sectional study was carried out to determine the prevalence of hypertension and variation of blood pressure with age among adolescents in an urban slum of Chetla, Kolkata, India. A total of 1081 adolescents aged 10-19 years were involved in the study. The prevalence of hypertension was 2.9% (31) and highest prevalence (5.6%) was observed in the age group of 18-19 years. The mean systolic and diastolic blood pressure was higher in males than females. Among males and females, average increase of mean systolic blood pressure was found to be 2.26mmHg and 1.95mmHg per year respectively. The mean diastolic blood pressure increased by 1.55 mmHg and 1.42mmHg per year, respectively. The age spurt of rise in mean systolic blood pressure in males was found at 10-11, 13-14, and 16-17 years age groups, whereas in females it was observed in 12-13, and 17-18 years age groups. The age spurt of rise in mean diastolic blood pressure in males was observed in the age group 16-17 years and in females it was noted in the age group 11-12, and 17-18 years. In conclusion**,** blood pressure measurement should be done routinely during health check up of adolescents to initiate secondary level of prevention at the earliest.

Key words: adolescents, hypertension, India

In any country in the world including India, with gradual socioeconomic development, control of communicable diseases and increased expectation of life, non-communicable life style related diseases are becoming important. Hypertension is becoming the commonest cardiovascular disorder posing a challenge to the societies in socioeconomic and epidemiological transition, contributing a lot to the morbidity and mortality (WHO, 1996). The Global Burden of Disease study, initiated in 1992, calculated the disability adjusted life years (DALYs) attributable to hypertension as 19.1 (Murray & Lopez, 1997).

The detection of hypertension during childhood is of potential value in identifying those, who are at increased risk of primary hypertension as adults, and, who might benefit from earlier intervention and follow-up, since the roots of hypertension grow in childhood. Different Indian studies revealed magnitude of hypertension ranging from 0.41 – 2.93% among adolescents (Laroia *et al.,* 1989; Anand & Tandon, 1996; Gupta & Ahmad, 1990). Prospective cohort studies have shown that children with high blood pressure are more likely than other children to suffer from hypertension as adults, known as "tracking". This knowledge can be applied in identifying children and adolescents "at risk" of developing hypertension at a future date. The objective of the present study was to determine the prevalence of hypertension among adolescents (10 -19 years) as well as the variation of blood pressure with age.

This community based cross-sectional study was done in Chetla, the urban field practice area of All India Institute of Hygiene and Public Health, Kolkata, India from June 2003 - May 2004. Out of four sectors under Urban Health Centre-Chetla, one sector was chosen by simple random sampling, in which the total population was 25000 (Source: Statistical department Urban Health Centre, Chetla). The adolescent population in the urban areas of West Bengal comprised of 5.71% of the total population as was estimated on 2001-02 (10–14 years = 3.02 % of population and 15–19 years = 2.69 % of population) (Government of West Bengal, 2001-2002). Accordingly estimated number of the total adolescents was 1428 (5.71% of 25000). Sample size was calculated using the formula,

$$n = \frac{N \cdot p\,q\,Z^2}{N \cdot L^2 + pq\,Z^2}$$

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Where, p = prevalence of hypertension = 2.93 % (Laroia *et al.,* 1989), q = 100 – p = 97.07, N = population size = 1428, Z = Standard normal deviate 1.96 (95% confidence limit), L= allowable error (15% of p). Thus, the sample size came as 1140. 10% allowance was taken for nonresponse and final sample size was 1254.

Initially a sampling frame of adolescent population was constructed from the family folders of that sector and the required number of study subjects was selected by simple random sampling, without replacement. Data recording was done in a pre-designed, pretested schedule, by home visits, after taking consent and their blood pressure was examined using standard technique and tools (WHO, 1996). Readings were taken in morning hours (2–3 hours after breakfast). In order to allay the anxiety and fear of the children, the nature of the procedure was explained in depth. Children were encouraged to void urine and take rest for 10–15 minutes prior to the procedure. Blood pressure was recorded in a relaxed and unhurried manner in a quiet room at the end of the interview, on the right arm of the seated child with his / her legs uncrossed and the arms extended over a table at the level of the heart. Three measurements were taken at the interval of five minutes each and mean of these three readings were taken as systolic and diastolic blood pressure respectively using the same mercury sphygmomanometer throughout the study. The instrument was standardized comparing with results obtained by a similar instrument used in Urban Health Centre.

Age was recorded in completed years and was ascertained by birth certificate (963 subjects) and in times of confusion, correlation of birth dates with important local and national events was done. The subjects found to be hypertensive was advised lifestyle modification and oral antihypertensive drugs were prescribed in appropriate cases. Advice was given for regular follow up of blood pressure in Urban Health Centre. WHO criteria for hypertension for 10–18 years age group has been adapted from Task Force on Blood Pressure Control in Children which was generated from mean systolic/ diastolic blood pressure equal to or greater than 95th percentile for age. For persons aged 18 years and above, hypertension is defined as systolic blood pressure of ≥140mmHg or a level of diastolic blood pressure of ≥90mmHg (WHO, 1996). Statistical evaluation was done by mean, standard deviation, z test for proportion, confidence interval and correlation coefficient, by using Excel and Epicalc 2000 statistical package.

A total of 1081 subjects were interviewed (response rate 94.8%). Among them 53.3% were males and 46.7% were females. Overall prevalence of hypertension was 2.9% (3.3% in males and 2.4% in females). No statistical significant difference was observed between male and female hypertension (z = 0.70, P >0.05). Overall, majority of the hypertensive (5.6%) were in the age group of 18-19 years. In all the different age groups, prevalence of hypertension was more in males than females, except in the age group 12-13 years (female=3.5%, male=2.4%) (Table 1).

Overall mean systolic blood pressure (MSBP) and mean diastolic pressure (MDBP) of males were higher than that of females (110.05 vs. 107.51mmHg for MSBP and 73.37 vs. 72.08 mm Hg for MDBP) and these differences were found to be statistically significant (z = 3.73; P < 0.01 for MSBP and z = 2.87; P <0.01 for MDBP). In individual age group also, MSBP and MDBP was found to be high in males compared to females, excepting in the age of 13 years and 16 years. MSBP in males increased from 99.27mmHg at 10 years to 121.86mmHg at 19 years of age (an average increase of 2.26mmHg per year). The MDBP in males increased from 64.68 mm Hg at 10 years to 80.17 mm Hg at 19 years (an average increase of 1.55mmHg per year). In females, the MSBP increased

Table 1: Prevalence of hypertension among adolescent by age and sex (n = 1081)

Age (years)	Male		Female		Total	
	No. hypertensive	% Hypertensive	No. hypertensive	% Hypertensive	No. hypertensive	% Hypertensive
10 – 11	2	1.9	1	1.0	3	1.5
12 – 13	3	2.4	3	3.5	6	2.8
14 – 15	2	1.9	1	1.0	3	1.4
16 – 17	3	2.5	2	1.9	5	2.2
18 – 19	9	6.9	5	4.2	14	5.6
Total	19	3.3	12	2.4	31	2.9

from 98.12mmHg at 10 years to 117.56mmHg at 19 years (an average increase of 1.95mmHg per year). The MDBP in females increased from 63.73mmHg at 10 years to 78mmHg at 19 years (an average increase of 1.42mmHg per year).

Statistical evaluation revealed a significant positive correlation between systolic blood pressure (SBP) and diastolic blood pressure (DBP) with age. The correlation coefficient of males for SBP and DBP were same r = 0.63 ($p < 0.001$). The correlation coefficient (r) of females for SBP and DBP were 0.54 (P<0.001) and 0.53 (P<0.001) respectively. The age spurt of MSBP in males was found at 10-11, 13-14, and 16-17 years age group with an average of approximately 5mmHg. Similarly, in females MSBP spurt was noted in 12-13, and 17-18 years age group with an average of approximately 5mmHg. The age spurt of MDBP in males was seen in the age group 16-17 years with an average of (4mmHg), and in females spurt of MDBP was noted in the age group 11-12, and 17-18 years (4mmHg) (Table 2, 3).

In most of the studies prevalence of adolescent hypertension ranged from 0.41% to 3.6%. The diversity in prevalence is due to varying age groups taken for different studies, different criteria and methodologies adopted for defining hypertension, differences between racial subgroups related to geographic, dietary, and cultural factors. Prevalence of hypertension was more in males as also reported by Laroia *et al.* (1989), but in contrast Singh *et al.* (1993) did not find any sex difference in prevalence. Anand & Tandon (1996) also noted higher MSBP and MDBP in males which were similar with the observations of the present study. Laroia *et al.* (1989) also found higher MSBP among males but in contrast MDBP was higher among females. On the contrary, Singh *et al* (1993)

Table 2: Relationship of systolic blood pressure with age in both sexes (n =1081)

Age	MALE			FEMALE		
(Yrs)	Mean	SD	C.I. *	Mean	SD	C.I.*
10	99.3	9.0	96.6 - 101.9	98.1	10.5	95.2 - 101.0
11	103.0	7.2	101.1 - 104.9	100.6	7.3	98.4 - 102.8
12	103.8	7.6	101.9 - 105.7	102.5	7.4	100.4 - 104.7
13	104.1	9.6	101.6 - 106.6	106.7	10.0	103.6 - 109.7
14	109.4	9.4	106.7 - 112.0	105.6	6.3	103.8 - 107.3
15	109.0	15.7	104.9 - 113.2	107.9	9.3	105.3 - 110.4
16	112.0	9.5	109.6 - 114.4	108.0	12.6	104.9 - 111.3
17	117.0	9.1	114.7 - 119.3	111.6	8.0	109.3 - 113.9
18	120.9	9.3	118.7 - 123.0	116.4	9.0	114.2 - 118.6
19	121.9	10.0	119.3 - 124.5	117.6	8.9	115.2 - 119.9
10-19	110.0	11.6	109.0 - 11.09	107.5	11.0	106.5 - 108.4

*C.I. = 95 % confidence interval

Table 3: Relationship of diastolic blood pressure with age in both sexes (n=1081)

Age	MALE			FEMALE		
(yrs)	Mean	SD	C.I.*	Mean	SD	C.I.*
10	64.7	5.7	62.9 - 66.3	63.7	6.0	62.0 - 65.4
11	67.0	6.5	65.3 - 68.6	65.0	6.2	63.2 - 66.9
12	70.9	4.6	69.8 - 71.9	70.3	5.7	68.6 - 71.9
13	72.2	4.9	70.9 - 73.5	71.4	7.0	69.3 - 73.6
14	74.0	4.1	72.9 - 75.2	73.6	5.0	72.2 - 75.0
15	74.3	4.9	73.0 - 75.6	73.4	6.1	71.7 - 75.0
16	73.8	6.1	72.3 - 75.4	74.3	5.7	72.9 - 75.8
17	77.4	5.0	76.0 - 78.7	73.7	11.0	70.5 - 76.9
18	79.0	5.8	77.7 - 80.4	77.1	5.5	75.8 - 78.5
19	80.2	5.7	78.7 - 81.6	78.0	5.2	76.6 - 79.4
10-19	73.4	7.0	72.8 - 73.9	72.0	7.8	71.3 - 72.6

*C.I. = 95 % confidence interval

and Gupta & Ahmad (1990) showed that both MSBP and MDBP were higher among females, compared to males. In contrast, Gupta & Ahmad (1990) found significantly higher MSBP and MDBP in females. However Laroia *et al* (1989) found only high MDBP in females compared to males at all the ages, which had not been recorded in other studies so far. These values as reported in different studies are not strictly comparable with each other because of the different methodology (cut-off points and age groups). Other researchers like Anand & Tandon (1996), Gupta & Ahmad (1990), Laroia *et al* (1989) and Singh *et al* (1993) also noted significant positive correlation between SBP and DBP with age, like our present study. The age spurt in MSBP and MDBP in both sexes has also been noted by others (Gupta & Ahmad, (1990; Laroia *et al.,* 1989; Anand & Tandon, 1996). Laroia *et al* (1989) observed a spurt in comparatively early age group in case of males. This spurt may possibly be due to certain hormonal and physical changes occurring in the body at adolescence.

In conclusion, the present study found out the trend of increase of blood pressure with age but it would have been better if the influence of other factors like physical activity, salt intake, obesity, juvenile diabetes, positive family history and renal diseases etc. affecting adolescent blood pressure could be explored. Nevertheless, if we can include routine blood pressure measurement during health check up of adolescents, then secondary level of prevention including prompt diagnosis and adequate treatment can be instituted at the earliest, to prevent further complications.

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References

Anand, N.K. & Tandon, L. (1996) Prevalence of hypertension in school going children. *Indian Pediatrics* 33, 377-381.

Gupta, A.K. & Ahmad, A.J. (1990) Normal blood pressures and the evaluation of sustained blood pressure elevation in childhood. *Indian Pediatrics* 27, 33-42.

Laroia, D., Sharma, M., Diwedi, V., Belapurkar, K.M. & Mathur, P.S. (1989) Profile of blood pressure in normal school children. *Indian Pediatrics* 26, 531-536.

Murray, C.J.L. & Lopez, A.D. (1997) The utility of DALYs for public health policy and research: a reply. *Bulletin of the World Health Organization* 75, 377-381.

Singh, B.M., Vashisht, S. & Bachani, D. (1993) Some observations on blood pressure of rural school going children. *Indian Journal of Preventive and Social Medicine* 24, 1-3.

WHO (1996) Hypertension control: report of a WHO Expert Committee. World Health Organization. *WHO Technical Report Series*. 862, 1-83.