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BLOOD PRESSURE RESPONSE TO COLD PRESSOR TEST IN SIBLINGS OF HYPERTENSIVES

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Abstract : One hundred and five female and thirty-four male student volunteers were divided into three groups. Each group was again divided into siblings of hypertensives (SH) and siblings of normotensives (C). SH group had higher basal seated and supine Systolic and Diastolic Blood Pressures (SBPs and DBPs, respectively). During cold pressor test (CPT), the SH group showed higher rise of SBPs and DBPs. All the volunteers were again regrouped as hyperreactors (HR) (the criteria of a rise of more than 22 mmHg systolic and 18 mmHg diastolic blood pressure during (CPT) and normoreactors (NR). HR showed higher resting seated SBPs and DBPs, and higher rise of SBPs & DBPs during CPT as compared to control groups. The rise in SBPs and DBPs in hyperreactors was significantly higher than SH groups only in 16–19 years female group. The rise of SBPs and DBPs during CPT were also higher in HR as compared to NR of all age groups. The rise of SBPs and DBPs during CPT was significantly higher in controls than in NR in the two female groups. The study suggests that identification of hyperreactors in population gives a better indication of potential hypertensives of future than the children of hypertensives.

Key words : hypertension systolic blood pressure hyperreactor normoreactor cold pressor test

INTRODUCTION

Hypertension has been reported to be generally associated with sympathetic overactivity (1, 2, 3). But the sympathetic response of certain individuals from both normotensive and hypertensive population have been reported to be more pronounced (4). Again there is a dilemma who amongst the mild hypertensives eventually develop significant and established hypertension (5).

Therefore, an attempt was made in the present study to compare the blood pressures of siblings of hypertensives in young adults (between 16 and 24 years of age) with that of the age matched controls. The aim was to identify those who may ultimately suffer from hypertension when they grow older.

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METHODS

In the present study, one hundred and thirty-nine students volunteered. They were divided into three groups. 16–19 years male group consisted of 20 siblings of hypertensives and 14 controls. The 16–19 years and 20–24 years female groups consisted of 33 and 12 siblings of hypertensive and 33 and 27 controls respectively. Classifying the subjects in three groups were to separate adolescent and adult groups.

All the subjects filled up consent forms giving details regarding the family history of hypertension. Ethical committee approval was obtained. In order to avoid biases, the person recording the blood pressure was not aware whether the subjects were siblings of hypertensives (SH) or siblings of normotensives (C). Grouping as siblings of hypertensives and siblings of normotensives were done after all the parameters were recorded. The subgroups of SH and C were chosen to examine the contribution of heredity.

Blood pressures of the subjects were recorded thrice, after 10 minutes of rest while in supine and seated position.

In cold pressor test, systolic and diastolic blood pressures were recorded twice in sitting position after resting for ten minutes. The volunteer immersed the left hand upto the elbow in a bucket of ice cold water (between 3°C and 4°C). Blood pressures were noted from the right hand at 30, 60, and 90 seconds after immersion.

Individuals were categorized into two groups depending on their reactivity to cold pressor test (6) as normoreactors (NR) and hyperreactors (HR). The classification of HR and NR is a well-accepted criterion based on the work of Edgar A Hines Jr (6). Several authors have adopted this criterion as guideline (14, 15). The subjects who registered a rise of more than 22 mmHg of systolic blood pressure and 18 mmHg of diastolic blood pressure were grouped as hyperreactors. Those, whose both systolic and diastolic blood pressures did not raise more than 22 mmHg and 18 mmHg respectively were grouped as normoreactors (4, 11, 12). Also those who satisfied only criterion were classified as NR. Statistics-Student ‘t’ test was used.

RESULTS

The supine and seated systolic and diastolic blood pressures (SBPs and DBPs, respectively) were significantly higher in siblings of hypertensives (SH) than their corresponding controls in all the groups (Table I).

The maximum SBPs and DBPs and the maximum rise of SBPs and DBPs during Cold pressor test were significantly higher in siblings of hypertensives when compared to their age matched controls in all groups (Table II). Both SH and control groups registered significantly higher SBPs and DBPs during cold pressor test than their resting SBPs and DBPs, respectively. The maximum rise of SBP and DBP was higher in SH groups as compared to their control groups. After segregating the hyperreactors from control and SH groups based on cold pressor test and regrouping all the subjects as hyperreactors (HR) and normoreactors (NR) instead of siblings of hypertensives and siblings of normotensives, the SBPs and

TABLE I: Supine and seated systolic and diastolic blood pressures (Mean±SEM, mmHg).

Parameters	*Category*	*Groups*		
		16–19 yr; Females n-SH-33 C-33	*20–24 yr; Females SH-12 C-27*	*16–19 yr; Males SH-20 C-14*
Supine SBP	Controls	109.33±1.29	114.44±1.82	116.0±1.80
	SH	113.88±1.72*	122.17±1.51**	122.0±1.90*
Supine DBP	Controls	70.48±0.56	72.67±0.45	71.57±0.73
	SH	73.09±0.44**	75.17±0.63**	74.0±0.58*
Seated SBP	Controls	105.33±1.01	111.11±1.64	109.29±2.14
	SH	109.88±1.62*	120.5±2.49**	115.5±2.04*
Seated DBP	Controls	69.03±0.75	69.93±0.67	68.29±0.72
	SH	71.82±0.71*	73.17±0.63**	71.40±0.67**

SH – Siblings of hypertensives, C – Controls, n – number of volunteers.
SBP – Systolic blood pressure, DBP – Diastolic blood pressure.
*Means comparison are between SH groups and their corresponding control groups.
*P<0.05, **P<0.01, ***P<0.001.

TABLE II: Systolic and diastolic blood pressure of siblings of hypertensives (SH) and controls (C) during cold pressor test (Mean±SEM, mmHg).

Parameters	*Category*	*Groups*		
		16–19 yr; Females n-SH-33 C-33	*20–24 yr; Females SH-12 C-27*	*16–19 yr; Males SH-20 C-14*
Maximum SBP	Controls	127.05±1.23	134.89±3.42	128.29±2.20
	SH	136.79±2.03***	150.33±3.65***	142.1±2.47***
Maximum DBP	Controls	86.73±1.18	88.96±1.55	84.14±0.92
	SH	94.48±1.32***	97.67±1.43***	92.0±1.32**
Maximum rise in SBP	Controls	21.76±0.98	23.78±2.08	19.0±1.27
	SH	26.79±1.61*	29.83±2.07*	26.6±2.13**
Maximum rise in DBP	Controls	17.94±0.74	19.04±1.02	15.86±0.75
	SH	22.67±0.91***	24.50±1.23**	20.60±0.87***

SBP – Systolic blood pressure, DBP – Diastolic blood pressure.
*P<0.05, **P<0.01, ***P<0.001.
n–number of volunteers

DBPs recorded during rest and CPT is shown in Table III.

The resting seated SBPs and DBPs of hyperreactors were significantly higher than that of the normoreactors only in 20–24 years female group. The maximum SBPs and DBPs recorded in HR during CPT were higher than that in NR in all age groups.

TABLE III: Systolic and diastolic blood pressures (SBP and DBP, respectively) of hyperreactors and normoreactors at rest and during cold pressor test (CPT) (Mean±SEM, mmHg).

Groups Parameters	*Category*	*16–19 yr; Females n-HR-34 NR-32*	*20–24 yr; Females n-HR-22 NR-17*	*16–19 yr; Males n-HR-16 NR-18*
Resting seated	NR	107.62±1.22	110.47±2.23	112.33±2.22
SBP	HR	107.65±1.92	116.73±1.93*	113.62±2.24
Resting seated	NR	69.88±0.69	68.94±0.86	69.22±0.59
DBP	HR	70.94±0.83	72.45±0.54**	71.12±0.93
Maximum rise	NR	18.06±0.77	17.88±0.12	16.78±0.44
in SBP during	HR	31.71±1.17***	31.64±0.94***	31.0±1.63***
CPT	SH	26.79±1.61	29.83±2.07	26.60±2.13
	HR	31.71±1.17†	31.64±0.94	31.0±1.63
	Controls	21.76±0.93	23.78±2.08	19.0±1.27
	NR	18.06±0.77•	17.88±0.12•••	16.78±0.44
Maximum rise	NR	15.25±0.27	14.71±0.34	15.22±0.29
in DBP during	HR	25.06±0.39***	25.36±0.36***	25.50±0.59***
CPT	SH	22.67±0.91	24.50±1.23	20.60±0.87
	HR	25.06±0.39††	25.36±0.36	22.50±0.59
	Controls	17.94±0.74	19.04±1.02	15.86±0.75
	NR	15.25±0.27••	14.71±0.34•••	15.22±0.29

*P<0.05, **P<0.01, ***P<0.001, HR – Hyperreactors, NR – Normoreactors.
*refers to comparison between hyperreactors (HR) and normoreactors (NR).
†refers to comparison between SH (siblings of hypertensives) and hyperreactors (HR).
•refers to comparison between NR (normoreactors) and controls.

TABLE IV: Incidence of hyperreactors (HR) and normoreactors (NR) among siblings of hypertensives (SH) and siblings of normotensives (C).

Groups	*Category*	*HR%*	*NR%*
16-19 yrs. Females	SH	66.67	33.33
	C	36.36	63.64
20-24 yrs. Females	SH	83.0	17.0
	C	44.44	55.56
16-19 yrs. Males	SH	65.0	35.0
	C	21.43	78.57

Hyperreactors also showed a significantly higher rise of SBPs and DBPs during CPT than normoreactors. The rise in SBPs and DBPs in hyperreactors were significantly higher than SH groups only in 16 to 19 years female group. The rise of SBPs and DBPs were significantly higher in controls than in NR in the two female groups.

DISCUSSION

Our study shows that siblings of hypertensives had a higher basal SBP and DBP. The higher SBP and DBP in the siblings of hypertensives appear to be due to hereditary influence. The importance of parental history in essential hypertension was studied by Thomas (7). He showed that the incidence of hypertension in Doctors of hypertensive family was greater when one or both parents were hypertensive compared to that in Doctors of normotensive family; the incidence was 41.4% and 60.5% when either Doctor's mother or father was found

hypertensive, whereas the incidence of hypertension was only 38.9% in Doctors of normotensive family. Hypertension before age 55 occurs 3.8 times more than in persons with positive family history of hypertension and both genetic predisposition and environmental factors together produced hypertension in most persons (8, 9). Similarly, the influence of parental history of hypertension studied on normotensive persons showed that the resting mean blood pressure and diastolic blood pressure were significantly higher in normotensive offspring of hypertensive parents compared to that in normotensive siblings with no family history of hypertension (8). Moreover, systolic blood pressure and mean blood pressure during 24 hr. ABPM (ambulatory blood pressure measurement) were significantly higher in normotensives of hypertensive parents than that of controls (10). Similarly, significantly higher levels of systolic blood pressures and diastolic blood pressures were noted in school children (early and late adolescence) of hypertensive parents compared to siblings of normotensive parents (11).

In the present study, the siblings of hypertensives (SH) responded more profoundly to cold pressor test (CPT).

Many earlier investigators also reported a greater rise of blood pressure, both systolic and diastolic, during CPT, in patients of essential hypertension as compared to normotensive subjects (12, 13). Barnett and his associates (14) restudied cold pressure test in 207 subjects after 27 yrs. They concluded that children of parents with hypertension are four times more likely to show increased vascular reactivity (increased blood pressure) than the children of normotensive parents; which underlined the concept of inherited vascular reactivity. This was supported by Busjan et al (9) and McIlhany et al (15) who studied the heritability of blood pressure of 200 pairs of twins (15). This inheritance is a mendelian dominant triat (16).

When the subjects were categorized as hyperreactors and normoreactors, the greater percentage of HR among siblings of hypertensives (Table IV) in our study, explains the statistically significant increase in maximum SBP and DBP in SH group during CPT. The hyperreactors showed a significantly greater rise of SBP and DBP during cold pressor test compared to normoreactors in all three groups. This response is probably due to sympathetic overactivity in hyperreactors.

When the seated SBPs and DBPs from hyperreactors and normoreactors were compared, our investigation showed an age-related trend. While in younger age groups (16–19 yr. females and 16–19 yr. males) the SBP and DBP were similar in normo and hyperreactors; in older age group (20–24 yr. females) the hyperreactors showed higher resting (seated) SBP and DBP than their age matched controls. This indicates the basal autonomic activity may remain masked in young adults but with advent of age the higher level of response might be exposed. Barnett et al (1963) reported 10% of hyperreactors in 1934 had become hypertensive when examined in 1961.

We observed a higher rise of SBP and DBP in siblings of hypertensives during CPT (Table II). Again after rearranging the groups as hyperreactors and normoreactors,

a higher rise of SBP and DBP was noted in hyperreactors (Table III). To examine whether the response to CPT was of same degree among the offspring of hypertensives and the hyperreactors, their maximum rise of SBPs and DBPs were compared (Table III). Both HR and NR groups comprises of subjects taken from controls and SH depending upon their response to CPT. The rationale behind comparing SH and HR was to point-out that sympathetic response to cold could be within normal range in certain SH, while others were more sensitive than average.

The comparison showed that the maximum rise of SBPs and DBPs during CPT was significantly higher in hyperreactors than the siblings of hypertensives in 16–19 yr. age female group. Similarly maximum rise of SBPs and DBPs were significantly less in normoreactor groups than the siblings of normotensives except in 16–19 yrs male group where there was no difference though it showed a similar trend. The reason for comparing controls with NR was to establish the fact that all the siblings of normotensives are not necessarily NR. The above observation suggests that vascular autonomic responses among the siblings of hypertensives can vary and this is also true for the siblings of normotensive parents. Therefore our study suggests that it might be more logical to identify the hyperreactors in the population for the early detection of future hypertensives.

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