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Variability of Blood Pressure in Progeny of Hypertensives

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Abstract

This study was designed to examine normotensive subjects with and without history of parental hypertension (PHH) by ambulatory blood pressure monitoring (ABPM) to detect abnormalities of blood pressure (BP) curve that may identify individuals at risk before the development of established hypertension. We studied 40 young healthy individuals with 24 hour noninvasive ABPM and echocardiography. 20 individuals had positive PHH (group A, mean age 26 ± 3 yrs) and 20 had negative PHH (group B, mean age 27 ± 2 yrs). All subjects were junior doctors attending their training programs at Cairo University Hospitals. In all subjects, familial hypertension or normotension was established by measurement of the parent's BP at home; recorded values greater than 160/95 mmHg on more than three occasions in one or both parents indicated a family history of hypertension. Results showed no difference between the two groups (+ ve & - ve PHH).

Introduction

SUBJECTS with a family history of parental hypertension are reported to have a slightly higher office blood pressure in the prehypertensive stage [1, 2, 3, 4]. In a recent report by Ravogli et al [5] such phenomenon is believed to represent an early permanent blood pressure elevation rather than a hyperreactivity to stress. In This report it was concluded that subjects with a strong genetic predisposition to hypertension, the prehypertensive stage is characterized by elevation in prolonged resting and 24 hour blood pressure monitoring records [5]. Although these individuals escape recognition until blood pressure values at which the diagnosis is made are reached, this elevation in blood pressure is related to cardiovascular disease even within the normotensive range [6].

Failure of arterial blood pressure (BP) to decrease by > 10% during sleep in hypertensives (nondippers) could identify certain subsets of patients and those with

increased risk of cardiovascular complications. The presence of this phenomenon in normotensives with positive parental history of hypertension (PHH) has not been adequately examined. Ravogli et al [5] reported that in subjects with hypertensive parents, the blood pressure was higher over a prolonged period of rest and showed slightly but significantly elevated values during 24 hours monitoring period. Interestingly, even during sleep, systolic blood pressure was higher in subjects with parental as compared to those with no parental hypertension.

This study was therefore designed to examine normotensive subjects with and without parental hypertension by ambulatory blood pressure monitoring to detect abnormalities of blood pressure curve that may identify individuals at risk before the development of established hypertension.

Patients and Methods

The material of this work was collected from 40 young healthy normotensive adults. All subjects were junior doctors attending their training programs at Cairo University Hospitals. In all subjects, familial hypertension or normotension was established by measurement of the parents' blood pressure at home; recorded values greater than 160/95 mmHg on more than three occasions in the parents indicated a family history of hypertension. Parental hypertension was also inferred from a history of antihypertensive treatment. Subjects were then divided into two groups:

Group (A): 20 subjects with one or both hypertensive parents; they included 17 males and 3 females with a mean age of 27 ± 2 years.

Group (B): 20 subjects with normotensive parents; they included 17 males and 3 females with a mean age of 26 ± 3 years.

Criteria for exclusion from the study :

* Athletes and athletic conditions.
* Patients with valvular heart disease.
* Diabetic patients and patients with other medical disorders that might affect the heart.

All subjects were properly interrogated and clinically examined for evidence of frank or incipient cardiac or medical disorder which, if present, mandates exclusion from the study.

Office blood pressure was measured in the morning by a sphygmomanometer, using the first and the fifth Korotkoff sounds to identify systolic and diastolic blood pressure, respectively. Measurements were made in the sitting position at the beginning and at 5 and 10 minutes of the doctor's visit. Subjects were then hooked to 24 hour ambulatory blood pressure monitoring (ABPM) using a non-invasive automatic portable monitoring device (Sandoz Pressure System). The recording was starterd in the morning, and the automatic measurements were taken at 30 min-

utes intervals in both day and night for equal sampling. During the recording, the research subjects were allowed to return to their usual daily life. Data obtained by 24 hours ambulatory BP recording were analyzed by connecting the recorder to a decoder and a printer and the average systolic BP, diastolic BP, mean BP, and the heart rate were calculated for the 24 hours period. The system is also capable of giving information about the day-time and night-time blood pressure recording. In each individual we got 3 reports about the 24 hours, the awake, and the sleeping measurements.

Echocardiography with Doppler studies were obtained in all subjects after ABPA. The height and weight for all subjects were documented and body surface area was calculated. Echocardiographic equipment consisted of a Hewlett Packard machine 77020A phased array sector scanner. Ultrasound transducers ranging from 2.5 to 5 MHz were used for examinations which were conducted with the subject in the left lateral position. Recordings were videotaped and hard copies were obtained at a paper speed of 50 and 100 cm/sec. Electrocardiographic lead II was recorded simultaneously for measurement timing purposes.

Left ventricular dimensions and wall thickness were determined according to the recommendations of The American Society of Echocardiography [7]. In each subject, three to five consecutive cardiac cycles were chosen for analysis. Left ventricular dimensions and Doppler diastolic flow velocity waveforms for these cycles were measured and the values averaged. Left ventricular mass index was calculated from the wall thickness and the left ventricular diameters according to the formula of the Penn Convention [8]. The following Doppler indices of diastolic filling were obtained in each subject: Peak LV early diastolic inflow velocity (E), peak LV late diastolic inflow velocity (A) and their ratio (A/E). All Echocardiographic-Doppler examinations were made by the same operator who was unaware of both the family history and the blood pressure values of the subjects examined.

Results

Clinical characteristics of research subjects are summarized in table (1). There was no difference between subjects of either group in relation to age, body surface area, causal systolic (SBP) or diastolic (DBP) blood pressure readings.

Ambulatory blood pressure readings are summarized in table (2). There was no difference between subjects in either group in relation to mean 24 hour SBP, mean 24 hour DBP, mean day-time SBP, mean day-time DBP, mean night SBP or mean night DBP.

Table (3) summarizes percentage of abnormal blood pressure readings in both groups (SBP > 140 mmHg or DBP > 90 mmHg). Among subjects in group (A) the percentage of these abnormal readings

Table (1) Clinical Characteristics of Study Subjects.

Paramenter	Group A	Group B	*P* Value
Age	26.3 ± 3	27.3 ± 2.5	NS
BSA	1.91 ± 0.22	1.94 ± 0.18	NS
Causal SBP	118 ± 12	117 ± 12	NS
Causal DBP	78 ± 7	76 ± 6	NS

* Age : Age in years.
* BSA : Body Surface Area in m^2.
* SBP : Systolic Blood pressure in mmHg.
* DBP : Diastolic Blood Pressure in mmHg.

Table (2) Ambulatory Blood Pressure Readings Among Study Subjects.

Paramenter	Group A	Group B	*P* Value
M2 4h - SBP	122 ± 15	117 ± 12	NS
M2 4h - DBP	77 ± 8	78 ± 12	NS
MDT - SBP	126 ± 15	122 ± 12	NS
MDT - DBP	81 ± 8	82 ± 7	NS
MN - SBP	103 ± 16	98 ± 10	NS
MN - DBP	63 ± 9	65 ± 7	NS
MX - 24h - SBP	155 ± 21	153 ± 18	NS
MX - 24h - DBP	100 ± 13	97 ± 11	NS
Mn - 24h - SBP	89 ±8	88 ± 7	NS
Mn - 24h - DBP	52 ± 6	51 ± 6	NS
M - 24h - HR	78 ± 8	78 ± 6	NS
MDT - HR	83 ± 6	81 ± 8	NS
MNT - HR	66 ±6	68 ± 5	NS

* SBP : Systolic Blood pressure.
* DBP : Diastolic Blood Pressure.
* HR : Heart Rate.
* M - 24h: Mean 24 hours.
* MDT : Mean Day - Time.
* MN : Mean Night.
* MX : Maximum.
* NS : Not Significant.

ranged between 0-76% for SBP (mean 19 ± 24%) and from 0-65% for DBP (mean= 19 ± 22%); while in group (B) the percentage of abnormal readings ranged from 0-20% for SBP (mean 9 ± 10%) and 0-48%). The percentage of abnormal readings were higher in group (A) but this was not significant probably due to the large standard deviation due to a relatively small number of subjects studied. Moreover, the percentage of SBP > 160 mmHg and DBP > 110 mmHg were more prevalent in group (A) than group (B) (7 ± 15% versus 2 ± 2%, $p < 0.05$ for SBP and 15 ± 18 versus 6 ± 19%, for DBP, respectively). The non-dipping phenomenon (failure of blood pressure reduction during sleep by at least 10% of its day value) was found in 5 subjects (25%) in group (A) and was totally absent among subjects of group (B) ($p < 0.01$).

Table (2) summarizes the values of heart rate recordings in both groups. There was no significant differece between subjects in either group in relation to heart rate variability over 24 hours period of recording.

Table (4) summarizes the echocardiographic-Doppler measurements in both groups. There was no significant difference between subjects in either group in relation to posterior wall thickness, left ventricular end diastolic and end systolic dimensions, percent LV fractional shortening or left ventricular late to early peak inflow filling velocity ratio. Left ventricular diastolic septal wall thickness was higher in group (A) than in group (B) ($p < 0.02$). The left ventricular mass and mass index are higher in subjects of group (A) than subjects of group (B), however, this did not reach statistical significance probably due to the small sample size and a large standard deviation.

Table (3) : Percentage of Abnormal BP Readings Among Study Subjects.

Parameter	Group A	Group B	*P* Value
% Systolic > 140 mmHg	19±24	9 ± 10	NS
% Diastolic > 90 mmHg	19 ± 22	13 ± 14	NS
% Systolic > 160 mmHg	7 ± 15	2 ± 2	< 0.05
% Diastolic > 110 mmHg	15 ±18	6 ± 10	< 0.05
% Non - Dipping	25	0	< 0.01

*NS : Not Significant.

Table (4) : Echo Doppler Measurements Among Study Subjects.

Parameter	Group A	Group B	*P* Value
LVEDD	5.1 ± 0.5	5 ± 0.34	NS
LVESD	3.2 ± 0.4	3.3 ± 0.4	NS
FS%	36 ± 4	34 ± 5	NS
LVMI	93 ± 30	89 ± 19	NS
PWT	0.86 ± 0.16	0.81 ± 0.12	NS
SWT	0.92 ± 0.14	0.77 ± 0.12	0.01
A / E RATIO	0.62 ± 0.28	0.63 ± 0.13	NS

*LVEDD : Left Ventricular End Diastolic Dimension in cm.
*LVESD : Left Ventricular End Diastolic Dimension in cm
*FS% : Percent Left Ventricular Fractional Shortening.
*LVMI : Left Ventricular Mass Index in gm / m^2.
*PWT : Diastolic Posterior wall Thickness in cm.
*SWT : Diastolic Septal Thickness in cm.
*A / E RATIO : Left Ventricular peak Late / Early Inflow velocity Ratio.
* NS : Not Significant.

Discussion

Development of hypertension has long been noted to be more common among relatives of hypertensive subjects. In this study, 20 normotensive young adults with one or both hypertensive parents (group A) were compared to 20 normotensive young adults with both normotensive parents (group B). The casual BP readings could not show a significant difference between the two groups which agrees with the previous findings [9, 10]. On the other hand, ABPM could show higher percentage of abnormally high readings (140 mmHg systolic or 90 mmHg diastolic BP) in group (A) than group (B). This difference was more significant, however, for the diastolic than the systolic readings (20 ± 24% versus 9 ± 11% for systolic and 20 ± 11% versus 13 ± 14% for systolic and 20±11% versus 13±14% for diastolic BP) in group (A) than group (B). This difference was more significant, however, for the diastolic than the systolic readings (20 ± 24% versus 9 ± 11% versus 13 ± 14% for diastolic BP, respectively). The incidence of abnormal systolic or diastolic BP readings among normotensive subjects

have been previously described [9, 11]. The results of the present study added to the previous findings that abnormal BP readings were higher among offsprings of hypertensive parents than in offsprings of normotensive parents.

Our results also agree with the previous findings that casual BP do not necessarily predict the level of BP recorded in a 24 hour period [9, 10]. However, the mean 24 hour BP in both groups showed insignificant difference for both systolic and diastolic BP. The mean day-time and night-time BP readings did not differ significantly in both groups for systolic or diastolic BP. Similar observations have been shown for the heart rate variation for the 24 hour period, day-time and night-time to be parallel to the previous studies. In those studies, the values of blood pressure and heart rate were lower at night by at least 10% of their day values [12,13]. This was true for group (B); but in group (A), 25% of subjects showed lack of this nocturnal drop of blood pressure by the normal 10% (nocturnal non-dipping phenomenon). The relation between this non-dipping phenomenon and the parental history of hypertension have not been previously reported. This phenomenon might implicate a disturbed neural control of BP in those at risk subjects. The only data available in this respect is what has been recently reported in a recent study done by Pickering [12] who stated that the incidence of non-dipping is commoner among blacks but no figures were reported. Verdecchia [13] raised the importance of the non-dipping in the clinical course of hypertensives but he stated that the prevalence of nondipping among hypertensives is not known. In this study, none of the offsprings of normotensive parents showed this phenomenon which adds to its importance. The parallelism between parental hypertension and non-dipping could be of great predictive value for the future development of hypertension.

In this study, the echocardiographic findings showed higher LV mass index in group (A) than in group (B). Although this difference was statistically insignificant, probably due to the small number of subjects, the increase in LV mass index in offsprings of hypertensives is parallel to what was found in previous studies [14, 15].

Doppler findings showed insignificant differences between both groups. Previous studies showed that diastolic dysfunction in normotensive adolescents with hypertensive parents have been observed in these subjects as young as 12 years old. In this study, none showed this abnormality.

Finally, this study showed certain pattern in BP profile in offsprings of hypertensives that differed from that in offsprings of normotensives. Studies conducted on a large number of subjects and longitudinal follow up studies are

needed to show if these subjects with abnormal BP profile will develop established hypertension in the future or not, and if they develop hypertension, will this profile carry a prognostic value or not.

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