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Assessment of sympathetic reactivity by isometric handgrip test among young adult students with parental history of hypertension: A cross sectional study

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Abstract

The modern world with rapid urbanization and globalization has changed the face of world economy that has imposed an excessive stress on working population in the form of altered work pattern have forced us to adapt to sedentary lifestyle. One of the lifestyle related disease is hypertension which is a leading cause of death due to CVD and neurocognitive complications. Further familial history of genetic susceptibility makes them more vulnerable to acquire the disease. The present study was carried out to assess the sympathetic reactivity by isometric handgrip test among young adults with parental history of hypertension. The present cross sectional study was undertaken among students of first year MBBS between age group of 18-24 years during January 2017 to December 2017. 200 students were screened with parental history of hypertension. Sixty students were found to be having parental history of hypertension which was taken as study group and another 60 students without parental history of hypertension were included in control group using simple random sampling technique. Hence a total of 120 students were recruited in the study. All the tests were carried out on the subjects using standardized instruments & methodologies. The results were analyzed using student t-test and p value < 0.05 was taken as statistically significant. The sympathetic reactivity was higher among the children with parental history of hypertension as compared to those students with parental history of normotension. The present study stands relevant as there is very rare availability of information indicative of changes in cognition and anxiety levels in normotensive subjects who are at risk of developing hypertension. The periodic evaluation for early risk detection & lifestyle modification measures shall be of significant value in reducing the morbidity and mortality associated with the disease.

Keywords: Sympathetic reactivity, isometric handgrip test, young adults, hypertension

Introduction

Hamilton Anxiety Rating Scale is a subjective assessment scale (HAM-A) that is validated as a reliable Questionnaire to assess anxiety levels in many studies. The student phase in life is found to be associated with unhealthy risk behavior in the form of insufficient sleep, sedentary life, unhealthy eating habits, alcohol consumption and smoking etc. [1, 2] Professional courses are more stressful and challenge both physical and mental health. Mental stress is inevitable risk factor in the modern world. Along with genetic predisposition, stress acts as a strong predictor of future hypertension and its associated complications among these children. Sympathetic dominance with flight /fight response to any mental stress causes high arousal, that in long run leads to early mental fatigue [3, 4, 5].

Stress and anxiety act as important risk factors in pathogenesis and progression of the disease outcome and the same is confirmed by many studies. The studies on children with family history of hypertension also highlighted upon the importance of periodic evaluation of high risk groups, early diagnosis and lifestyle modification in them, so as to halt the progress of the disease and reduce the disability adjusted life years associated with high blood pressure [4, 6, 7].

Many researches in the past have been undertaken and have documented presence of sympathetic over-activity in normotensive children with parental history of hypertension, neuro-cognitive complications in middle aged hypertensive patients using non invasive

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techniques [8, 9, 10]. There is meager literature available on sympathetic reactivity, assessment of sensory motor response and cognition using Isometric hand grip test among the young students with parental history of hypertension. Present study was an attempt to fill this gap in literature and add newer information. Hence the present study was undertaken to assess the sympathetic reactivity by isometric handgrip test among young adult students with parental history of hypertension.

Methodology

The present study was undertaken in the Department of Physiology, Jawaharlal Nehru Medical College, Belagavi. Students of first year MBBS between age group of 18-24 years of Jawaharlal Nehru Medical College, Belagavi were included in this study. The present study was a cross sectional study carried out from January 2017 to December 2017.

A census of all 200 students was carried out to screen the children with parental history of hypertension. Sixty students were found to be having parental history of hypertension which was taken as study group and another 60 students without parental history of hypertension were included in control group using simple random sampling technique. Total 120 students were recruited in the study.

Students with any congenital heart disease and history of drug intake for chronic illnesses, history of any illness or chronic disease that needs long term medication, history of chronic Alcohol intake and Smoking were excluded from the study. Instruments used in this study were Krup's weighing scale, Stadiometer, Standardized mercury sphygmomanometer, Stethoscope, Handgrip Dynamometer—using Jamar hand grip dynamometer inc. USA manufactured by INCO Ambala. Ethical clearance was obtained from Institutional Human Ethical Clearance Committee of Jawaharlal Nehru Medical College, BELAGAVI, as per the declaration of Helsinki of 1975 and revised in 2000 before initiating the study. Written informed consent was obtained from the participants and they were briefed about the study procedure. Socio-demographic data in the form of personal information/details of the participants, parental and family history of hypertension was taken using self-administered questionnaire. The participants were asked to report to the laboratory by 9:30 am & they were advised to have light breakfast at least 2 hours before the test. They were also advised to have adequate sleep in the night, a day before the test.

Parameters

Height was measured using a stadiometer to the nearest of 0.5cm. Weight was measured Using Krups Weighing Scale, weight of the students were recorded with near accuracy of ± 0.5 Kg. Body Mass Index (BMI) was determined using Quetlet's equation $^{63}[\text{Weight (kg)} / \text{Height (m}^2\text{)}]$. Pulse rate was measured by palpating the radial pulse following 10 minutes of rest in the seated position. Blood pressure was recorded using standardized mercury sphygmomanometer. BP response to sustained handgrip that is Handgrip Dynamometer Test (IHG) was done using Jamar hand grip dynamometer with values of 0-60 kgs was used to measure sympathetic response. Subjects were briefed about the instrument before conducting the test. Baseline BP was recorded from non-dominant hand. The hand dynamometer is spring type with two needles, one remains at zero mark and the other needle depicts the maximal voluntary contraction. The subjects were advised to compress the handle of dynamometer with maximum effort using dominant hand for one minute. 3 such

readings were recorded with 30 sec gap in between to prevent fatigue. Mean of the three readings was calculated and T max was obtained. Thirty percent of the T max was calculated. Now the subjects were asked to maintain the same i.e., 30% of the T max for a period of 2 minutes. During these 2 minutes the BP was recorded from non-dominant hand. One reading was taken during 2 min exercise and second reading was taken following rest of 5 min after exercise.

Results

The present cross sectional study was conducted to assess sympathetic reactivity in first year medical students between 18 to 24 years of age group with parental history of hypertension and compared it with students of non-hypertensive parents. Sympathetic reactivity was assessed by blood pressure response to isometric hand grip test.

The study group comprised of students with parental history of hypertension and control group with no parental history of hypertension & each group comprised of 60 students with total study population of 120 students out of which 56 were male & 64 females. Our results showed that 49 (81.67%) students had parental history of hypertension in either of a parent. Out of 49 students 35 had a history of hypertension in father, 14 had a history of hypertension in mother and 11 (18.33%) students had a history of hypertension in both the parents.

Our results demonstrated that the two groups do not differ much on demographic and anthropometric scale. The mean age of population was between 18-19 years, mean height was between 164-166 centimeters & BMI score ranged between 22-24 & did not differ in two groups. The Baseline PR, SBP & DBP were more among study group compared to control group which was not statistically significant. Showed that in the Study group rise in DBP during IHG-exercise ($p=0.0001^*$) which was statistically significant. The DBP was higher than the baseline value in the study group compared to control group after 5 minutes of IHG exercise. Our results showed rise of SBP in study group compared to control group during IHG test which was statistically significant ($p=0.0001^*$). Following 5 minutes of rest SBP nearly reached to the baseline value in both the groups.

Discussion

The present study was conducted to assess the sympathetic reactivity by blood pressure response to static exercise among the medical students with parental history of hypertension. In the present study it was observed that 81.67% students had a history of hypertension in either parent, out of whom 58.4% students had a history of hypertension in father and 23.3% students had a history of hypertension in mother & 18.33% students had history of hypertension in both the parents. The strength of hereditary risk in causation of diseases doubles with single first degree hypertensive relative & quadruples with two such relatives [11]. Some studies in the past have reported the probability of developing hypertension in the offspring's of hypertensive parents in future to be 25%, if the children had history of hypertension in either of the parent & 50%, if children had history of hypertension in both the parents [12]. This indicates major role of genetics in acquiring the disease even though many confounding factors such as age, gender, lifestyle, stress & environmental factors also play an important role in causation of disease [13]. John Hopkins Precursors Study reported a strong incidence of acquiring hypertension in adult life with history of hypertension in both parents [14].

In the present study BMI score, resting PR and BP was higher among children of hypertensive parents. Many studies have found significant rise in BMI & SBP in the genetically susceptible individuals who inherit these traits as recessive inheritance from either or both parents suffering from hypertension [15, 16]. Many other studies observed that the offspring's of hypertensive parents showed altered lipid profile along with elevated PR, DBP & mean arterial blood pressure (MABP) levels which was found to be more pronounced in consanguineous population. The underlying mechanism was explained on the basis of increased sympathetic activity in these children with high plasma catecholamine levels before exercise [17, 18, 19].

Sympathetic over activity & high BMI mutually influence the ongoing pathophysiological processes & the latter act as an additional triggering factor to already existing vasoconstriction & retention of sodium due to increased renal sympathetic activity. High level of insulin with increased resistance, raised level of leptin along with free fatty acids & endothelial dysfunction further accelerate the damage associated with sympathetic over activity [20, 21]. The elevated

BP & BMI was also attributed to multiple gene variation & their interactions that regulate BP in response to mental and physical stress. Earlier study reported no change in resting DBP in offspring's of hypertensive parents in contrast to other study which observed high resting DBP in these children [22].

In the present study there was statistically significant increase in DBP & SBP during isometric handgrip test. Rise in systolic & diastolic blood pressure with hand grip dynamometer is an indicator of increased sympathetic activity [23]. The increased afterload to the heart due to constriction of blood vessels in exercising muscles and increased peripheral vasoconstriction mediated through adrenergic receptors of sympathetic nervous system is responsible for rise in DBP during IHG exercise. Further the metabolites that accumulate in the exercising muscle like lactic acid and adenosine are sensed by metabosensitive nerve endings in the interstitium of skeletal muscle cause release of afferent discharge of group IV nerves, thus increase the sympathetic reflex activity. Similar observation was reported in few studies earlier, along with high resting PR and BP in children of hypertensive parents [24].

Table 1: Association of factors influencing study and control group

Parameters	Study group (n=60)	Control group (n=60)	p-value
Age	18.95 ± 1.13	18.83±0.87	0.5261
Height (cm)	164.12 ± 8.38	166.38 ± 8.99	0.156
Weight(kg)	64.60 ± 13.10	63.13 ± 13.41	0.546
BMI	24.03 ± 4.17	22.75 ± 3.80	0.081
Age	18.95 ± 1.13	18.83±0.87	0.5261
PR	82.50±8.90	79.07±8.45	0.032
DBP	74.65±5.86	74.33±7.80	0.802
SBP	111.10±10.50	109.80±11.23	0.514
DBP Baseline	74.65±5.86	74.33±7.80	0.802
DBP During IHG	98.90±11.26	89.52±9.88	0.0001*
DBP After 5 Minutes	75.40±6.95	73.20±5.52	0.058
SBP Baseline	111.10±10.50	109.80±11.23	0.514
SBP During IHG	142.73±17.40	129.37±12.73	0.0001*
SBP After 5 Minutes	110.17±9.31	108.60±11.03	0.402

* = Statistically Significant

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