

Cold Pressor Test as A Predictor of Hypertension in Normotensive Medical Students

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Received: 20-04-2023 / Revised: 22-05-2023 / Accepted: 25-06-2023

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Conflict of interest: Nil

Abstract:

Introduction: Early diagnosis of hypertension risk may enable an individual to live a healthier lifestyle. Subjects with hypertension predisposing variables have a higher and longer reaction to blood pressure after stress. The current study was carried out to assess cardiovascular response, such as blood pressure and heart rate changes during a cold pressor test, as a prospective future risk factor for hypertension in normotensive Medical students.

Materials and Methods: Normotensive, non-smoking healthy 60 first MBBS students of either sex of Mamata Medical College of age group 18-22 years participated in the study. This study was conducted between February 2023 and March 2023. The cold pressor test was carried out. The changes in blood pressure and heart rate among the students of hyper responsive group and normo responsive group were compared using Student's t-test.

Result: In the present study, 30% of total subjects were hyper reactors. Average SBP in the hyper response group during CPT and recovery were 132.56 mm Hg & 128.75 mm Hg. Average DBP in the hyper response group during CPT and recovery were 84.28 mm Hg & 79.42 mm Hg which was statistically significant

Conclusion: The current study demonstrates that hyperresponsiveness may precede essential hypertension and that the cold pressor test may be effective as a predictor of future hypertension in a young study population. Early intervention in their lifestyle change can help them avoid acquiring hypertension later in life.

Keywords: Blood pressure, Cold pressor test, Hypertension.

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Introduction

Blood pressure is defined as the "lateral pressure exerted by the column of flowing blood on the blood vessel wall". Blood pressure that rises to 140/90 mm Hg or higher on three separate occasions is considered to be hypertension. [1] Hypertension is classified into two types: main and secondary. Primary hypertension accounts for more than 90% of all cases. Genetic and environmental factors are the pathophysiological determinants of primary hypertension. Family history, insufficient physical fitness, uncontrolled weight, and bad food choices are all factors that contribute to hypertension. Interventions such as early detection, awareness, and lifestyle changes can play a critical role in the control of high blood pressure and the enhancement of an individual's quality of life [2].

Early detection of hypertension risk may allow an individual to live a healthier lifestyle (e.g., avoidance of alcoholic beverages, smoking, excessive fatty food intake, etc. and adoption of the practise of yogic exercise,[3] moderate aerobic

exercise,[4] mental relaxation,[5] and so on). As a result, it is plainly advantageous if a person is warned that he may suffer from hypertension well in advance of the onset of hypertension.

Cardiovascular response to stress may play a detrimental role in neurogenic hypertension. According to reports, people at high risk of hypertension may have an increased stress-induced cardiovascular response at a younger age[6]. The sympathetic nervous system is crucial in the development of essential hypertension. Subjects with a positive history of familial hypertension, a high resting heart rate, or a transitory increase in arterial hypertension have been found to exhibit hyperresponsive blood pressure to stress stimuli mediated by sympathetic nervous system overactivity.[7] When activated by a stressor, the sympathetic nervous system increases heart rate and blood pressure; however, heart rate and blood pressure normally return to normal levels within a short amount of time when the stressor is

removed.[8] Elevated blood pressure and heart rate persist for a longer period of time in the vulnerable individual. Naturally, people who have a higher cardiovascular reactivity to a stressor and a longer rate of recovery following the stressor that caused the sympathetic activation are at a higher risk of developing hypertension in the future. The current study was carried out to assess cardiovascular response, such as blood pressure and heart rate changes during a cold pressor test, as a prospective future risk factor for hypertension in normotensive Medical students.

Materials and Methods

After receiving approval from the institutional review board, this cross-sectional study was carried out in the Department of Physiology at Mamata Medical College in Khammam, Telangana. The study lasted from February 2023 to March 2023 . After receiving approval from the relevant ethical review board and obtaining informed written consent, 60 healthy first-year MBBS students of both genders (30 males and 30 females) with ages ranging from 18 to 22 years were included. Furthermore, the participants were informed about the study's design and methodology. Students with a history of cardiovascular or neurological diseases, as well as smokers, were excluded from the study.

A deep water pan filled with ice was utilised in the cold pressor test to maintain a temperature of 4°C utilising a mercury-in-glass thermometer, radial arm electronic sphygmomanometer, pulse oximeter, and a timer. Each participant was instructed to lie down for five minutes. Before and during immersion, BP and HR were measured three times each. Three blood pressure readings were

taken before to immersion, and their average was calculated. The wrist was then left with a deflated blood pressure cuff. The right hand was soaked in icy water without the cuff for 2 minutes. After measuring blood pressure and heart rate every thirty seconds for two minutes, the participant was advised to remove his or her hand from the chilly water.[9] The subject's hand was then wrapped in a warm towel for 3 minutes before being permitted to rest. Heart rate and blood pressure were measured again five minutes after the cold pressor test (recovery). The changes in blood pressure were measured. Individuals with a Systolic BP difference of 25 mmHg (post immersion BP-pre immersion BP) and a Diastolic BP difference of 10 mmHg were classified as normal response groups, while those whose BP differed from a rise of systolic BP 25 mmHg or diastolic BP 10 mmHg were classified as hyper response groups [13].

SPSS 21 was used for statistical analysis. The mean blood pressure and heart rate of each participant were determined on the datasheet, and students were separated into two groups based on their values: normal reaction and hyper-response. An independent sample t-test was used to determine whether there was a significant difference in the mean blood pressures and heart rates of the two groups. Statistical significance was accepted at the $p < 0.05$ level.

Results

A total of sixty healthy medical students of both genders were included in the study. The mean age group in both male and female students was 20 ± 0.254 years and 20 ± 0.568 years as shown in Table 1.

Table 1: Comparison of characteristics between normal response and hyper response group

Variable	Normal Response Group (N=42)	Hyper Response Group (N=18)	P-Value
Age (Years)	20 ± 0.254	20 ± 0.568	0.523
Gender			
Male, N (%)	22 (55%)	8 (44%)	0.734
Female, N (%)	20 (45%)	10 (56%)	

Average SBP in the hyper response group during CPT and recovery were 132.56 mm Hg & 128.75 mm Hg. Average DBP in the hyper response group during CPT and recovery were 84.28 mm Hg & 79.42 mm Hg which was statistically significant as shown in Table 2

Table 2: Comparison of PR, SBP, and DBP of basal blood pressure among normal response and hyper response group

Subjects	Condition	PR Beats/Minute	SBP (Mm Hg)	DBP (Mm Hg)
Normal Response Group	Baseline	73.42 ± 9.48	113.67 ± 11.42	72.12 ± 10.97
	During CPT	73.86 ± 9.45	$119.56 \pm 11.42^*$	$76.23 \pm 10.23^*$
	Recovery	72.86 ± 9.65	$113.85 \pm 10.42^*$	$72.48 \pm 9.89^*$
Hyper Response Group	Baseline	74.34 ± 11.43	118.42 ± 11.42	73.25 ± 9.67
	During CPT	75.96 ± 11.43	$132.56 \pm 11.75^*$	$84.28 \pm 10.23^*$
	Recovery	74.68 ± 10.84	128.75 ± 10.68	$79.42 \pm 9.87^*$

* significant

Discussion

In this study, 30% of the students were classified as the hyper-responsive group because they had mean systolic blood pressure differences of more than 25 mmHg and mean diastolic blood pressure differences of more than 10 mmHg. These results were in line with those of the Mathews et al. study. His subsequent investigation found that normotensive subjects who displayed strong reactions to stress (cold employed as a stressful stimuli) had a higher probability of developing hypertension [10]. Mythri et al. reported the cardiovascular response to the cold pressor test in a different study and discovered that 36.7% of the study participants were hyperreactors [11]. In contrast to Banoo et al.'s findings, our investigation found a significant rise in systolic blood pressure in the hyper reaction group. Systolic or diastolic blood pressure in none of the research subjects increased significantly [12].

The normal response and hyper response groups had a substantial mean difference in diastolic blood pressure, according to our findings. These results contrasted with those of Hada et al. who found that pre-hypertensive individuals experienced a substantial increase in diastolic blood pressure during the cold pressor test compared to normotensive pupils [13]. The results of our investigation showed that there was no statistically significant difference between male and female reactions to the cold pressor test. However, Laura Mitchell's erratic research in Glasgow found variations between the sexes, with males tolerating the stimulus for noticeably longer than women [14].

Conclusion

It can be concluded that Individuals who show increased and notably prolonged reactivity to diastolic blood pressure due to sympathetic stimulation via the cold pressor test are at a significant risk of developing hypertension early in life. Future lifestyle change recommendations for these students may help them avoid acquiring hypertension.

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