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Physiology

"CROSS-SECTIONAL STUDY OF COLD PRESSOR TEST RESPONSE IN ADULTS IN NAGPUR"

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ABSTRACT

Background: Cold Pressor Test is used in many studies around the world and there is a need to know if the responses are generalized geographically.

Aim & objectives: To study Cold Pressor Test Response in adult population in Nagpur region.

Methodology: 320 consenting adults residing in Nagpur fulfilling the eligibility criteria were administered the Cold Pressor Test for one minute. Pre and post test Systolic and Diastolic Blood pressure were analyzed statistically.

Conclusion: The result of the present study suggests that there is statistically significant increase in both Systolic Blood Pressure and Diastolic Blood Pressure after Cold Pressor Test.

KEYWORDS : Cold Pressor Test, Blood Pressor.

INTRODUCTION

Cardiovascular hyper-reactivity to stress has been hypothesized to be an important risk factor for the development of hypertension and cardiovascular disease[1,2]. Temperature and other environmental stressors are also known to affect Blood pressure and Heart Rate (HR). For example, sudden and increasingly painful cold stress causes massive discharge of the sympathetic nervous system and release of nor-epinephrine. This sympathetic discharge triggers responses in the cardiovascular system that includes arteriolar constriction, increased HR, and increased cardiac contractility. These responses combine to increase the Blood Pressure. This is known as the pressor response, and testing a subject with cold stress in this fashion is known as the Cold Pressor Test[3] (CPT).

The Cold Pressor Test was first used by Hines and Brown in 1932[4]. The cold pressor test measures blood pressure (BP) response to the stimulus of external cold and has been commonly used for the evaluation of cardiovascular reactivity to stress, in normotensive and hypertensive subjects. Increased BP response to CPT has been associated with greater risk of hypertension in previous studies[5].

In 1936, Hines and Brown proposed that a period of vascular hyper-reactivity preceded the development of sustained hypertension. They further suggested that vascular hyper-reactivity manifested by an excessive pressor response to an external cold stimulus was a potential predictor of hypertension[6]. The increased activity of the sympathetic nervous system during CPT is considered one of the major mechanisms mediating the cardiovascular response to the Cold Pressor Test[7,8]. Since the first report by Hines and Brown in 1932, CPT has been evaluated in several physiologic, pharmacologic, and clinical studies as a powerful stimulus of sympathetic activity, and has been used to examine the sympathetic neural influence on peripheral and coronary circulation[3].

Till date, a few factors have been identified to be associated with the pressor effect of the cold stimulus, such as age, sex, baseline BP level, and physical activity[9,10,11]. Blacks exhibited greater BP response to cold stimulation than whites[9,12,13].

AIM AND OBJECTIVE:

To study Cold Pressor Test Response in adult population in Nagpur region.

METHODOLOGY:

- **Study Design:** A Cross-sectional Study.
- **Study Setting:** A tertiary care hospital and teaching institute.
- **Study Participants:** Adults residing in Nagpur
- **Sample Size:** 320 subjects
- Inclusion Criteria were consenting normotensive adults between age 20 to 60 years, residing in Nagpur
- Exclusion criteria were obese smokers on any antihypertensive, cardiac, bronchodilator, analgesic or antihistaminic drugs with history of any autonomic or genetic disorders.

Data was collected from consenting students fulfilling criteria (as determined by a questionnaire and physical examination). It involved personal information, anthropometric measurements, general examination and systemic examination. The subjects were then administered the Cold Pressor Test for one minute. The data obtained was analysed statistically. Continuous variables like age, BMI, Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were presented as Mean ± Standard Deviation (S.D.). Pre and post Cold Pressor Test Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were compared by applying paired t-test. Data obtained was analyzed statistically by the 'p' value; p-value<0.05 was considered as significant, p-value < 0.001 were taken as highly significant and p-value > 0.05 considered as non-significant.

RESULTS

Table 1:
Mean±SEM of Baseline Assessment and Characteristics of Subjects

	Total	Male	Female	P value
Mean Age (years)	39.39 ± 11.31	39.47 ± 11.05	39.31 ± 11.60	0.9019
Mean BMI (kg/m2)	21.75 ± 2.52	21.50 ± 2.75	21.99 ± 2.26	0.0813

Table 1 shows that when compared, there was no statistically significant difference (p>0.05) in all base line assessment and characteristics between the males and females.

Table 2: Comparison of pre-CPT and post-CPT Blood Pressure in mmHg among study groups

	Pre CPT*	Post CPT*	% change*	p-value
Systolic Blood Pressure	124.88 ± 6.19	136.28 ± 6.57	9.71± 2.96	<0.0001**
Diastolic Blood Pressure	80.53 ± 4.13	91.93 ± 5.98	14.04 ± 5.81	<0.0001**

(*Mean ± SD; ** P <0.05 significant)

Table 2 shows that there was statistically significant difference ($p>0.05$) in both Systolic and Diastolic Blood Pressure between pre and post CPT response

DISCUSSION

In the present study, the pre-test SBP was compared with the SBP after 1minute of hand immersion in cold water i.e. post-test SBP. It was observed that there was significant ($p<0.0001$) increase in post-test SBP as compared to the pre-test SBP (Table 2). The total mean of pre-test SBP was 124.88 ± 6.19, while total mean of post-test SBP was 136.28 ±6.57. These findings are consistent with several of the previous studies including those of Mourot L (2007)[14], Mishra S et al. (2012)[15] and Qi Zhao et al. (2012)[16].

Similarly, post-test DBP is increased significantly when compared with pre-test DBP (Table 2). The total mean of pre-test DBP was 124.88 ± 6.19, while post-test DBP was 136.28 ± 6.57. Similar findings were observed in previous studies conducted by Mourot L (2007)[14], Mishra S et al. (2012)[15] and Qi Zhao et al. (2012)[16].

Explanation for these findings can be given by the fact that stress causes a variety of physiological changes in the body. These include increased cortisol levels, increased anaerobic cellular activity, increased heart rate and blood pressure. Stress affects physiological equilibrium, probably through disturbance in autonomic balance of sympathetic and parasympathetic activity[17]. Immersion of hand in cold water is also a stressful condition. It globally activates sympathetic system and also elicits significant α-adrenergic vasoconstriction, thus imposing resistance to the ejection of blood from the left ventricle into systemic circulation and thereby increasing the after-load. This subsequently leads to rise in blood pressure[18].

CONCLUSION

The result of this present study suggests that there is significant increase in both Systolic Blood Pressure and Diastolic Blood Pressure after Cold Pressor Test.

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