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# INFLUENCE OF AGE ON COLD PRESSOR TEST RESPONSE IN INDIAN ADULTS: AN INTERVENTIONAL STUDY

Physiology

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## ABSTRACT

The present study is aimed to test the hypothesis that age influences Cold Pressor Test (CPT). For this, subjects were divided as, 20 years to 29 years (Group A), 30 years to 39 years (Group B), 40 years to 49 years (Group C) and >50 years (Group D), 80 subjects in each group. We studied absolute changes in Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) in Indian adults after CPT. We found significant positive linear correlation between age and post-CPT SBP ($p<0.0001$) as well as post-CPT DBP ($p=0.049$). Thus as age advances there is significant increase in post-CPT SBP and post-CPT DBP. Thus we concluded that age influences CPT response and should be taken into consideration while selecting study subjects undergoing the test.

## KEYWORDS

Cold Pressor Test, age.

## INTRODUCTION

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[1]. The test was once suggested as an index for screening subjects for hypertension[2,3]. Studies have indicated that the cardiovascular response to the cold pressor test can predict the future development of hypertension.

The determinants of Blood Pressure response to the CPT are still not fully understood. Physiological responses to moderate levels of cold stress may differ with age[4,5]. For instance, aging has been reported in some[6,7,8], but not all[9,10] studies. It is possible that age-associated increase in arterial stiffness may be a central factor in determining the magnitude of the cold-induced pressor response. The present interventional study was carried to find if there is a difference in the response to Cold Pressor Test with relation to age.

## METHODOLOGY

The present interventional study was carried out in a tertiary care hospital and teaching institute. 320 subjects were selected as per fulfillment of inclusion criteria of consenting normotensive adults between age 20 to 60 years. Exclusion criteria were obese smokers on any antihypertensive, cardiac, bronchodilator, analgesic or antihistaminic drugs with history of any autonomic or genetic disorders. They were then categorized in 4 age-groups. Group A included subjects aged 20 years to 29 years. Group B comprised of subjects aged 30 years to 39 years. Group C included subjects aged 40 years to 49 years. While Group D included subjects more than 50 years of age. A detailed history and thorough clinical examination of the subjects was done. The pre test SBP and DBP was noted. The cold pressor test was then performed on the subjects for 1 minute. The post test SBP and DBP was noted. The absolute rise in SBP and DBP was calculated. 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.). Influence of age on SBP and DBP was studied by applying ANOVA 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 Group-wise mean age distribution (in years),BMI, Pre-test and Post-test SBP and DBP**

| Group | | Group A (20-29 yrs) N=80 | Group B (30-39 yrs) N=80 | Group C (40-49 yrs) N=80 | Group D (>50 yrs) N=80 |
|---|---|---|---|---|---|
| Age* | | 24.24 ± 2.91 | 35.13 ± 2.71 | 44.51 ± 2.81 | 53.69 ± 2.91 |
| BMI* | | 20.78 ± 2.34 | 20.92 ± 2.24 | 22.47 ± 2.32 | 22.46 ± 2.97 |
| SBP | Pre-CPT SBP*z | 117.43 ± 7.76 | 120.65 ± 8.77 | 125.95 ± 7.31 | 128.18 ± 3.96 |
| | Post-CPT SBP* | 128.60 ± 8.18 | 133.18 ± 8.48 | 137.03 ± 7.72 | 140.95 ± 6.78 |
| | P value | <0.0001** | <0.0001** | <0.0001** | <0.0001** |
| DBP | Pre-CPT DBP* | 77.98 ± 4.90 | 79.20 ± 6.08 | 81.58 ± 3.22 | 80.68 ± 4.90 |
| | Post-CPT DBP* | 89.63 ± 6.84 | 90.98 ± 7.33 | 92.83 ± 3.83 | 90.73 ± 7.55 |
| | P value | <0.0001** | <0.0001** | <0.0001** | <0.0001** |

(*Mean ± SD; ** P <0.05 significant)

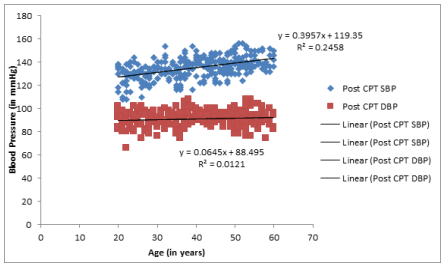
Table 1 shows that mean of post-CPT SBP and also DBP of study subjects is significantly higher when compared with the pre-CPT values in all 4 age-groups

**Table 2: Comparison of post-CPT Systolic Blood Pressure (SBP) in mmHg among the 4 age groups**

| Group | | Group A (20-29 yrs) N=80 | Group B (30-39 yrs) N=80 | Group C (40-49 yrs) N=80 | Group D (>50 yrs) N=80 |
|---|---|---|---|---|---|
| Post CPT SBP | Mean | 128.60 | 133.18 | 137.03 | 140.95 |
| | SD | 8.18 | 8.48 | 7.72 | 6.78 |
| | F-ratio | 35.55 | | | |
| | P value | <0.0001** | | | |
| Post-CPT DBP | Mean | 89.63 | 90.98 | 92.83 | 90.73 |
| | SD | 6.84 | 7.33 | 3.83 | 7.55 |
| | F-ratio | 3.277 | | | |
| | P value | 0.0213** | | | |

F ratio is obtained by applying ANNOVA test ** P <0.05 significant In Table 2 it is seen that the mean of post-CPT SBP and DBP is significantly increasing as age is advancing.

**Figure 1: Correlation between age and Post Cold Pressor Test (post-CPT) Systolic and Diastolic Blood Pressure.**



Post CPT SBP: r = 0.495, p-value<0.0001, N=320. Post CPT DBP: r = 0.109, p-value = 0.049,N=320.

Figure 1, a scatter diagram obtained by plotting age in years, of 320 study subjects. Significant positive linear correlation was found between age and post-CPT SBP (p<0.0001) as well as post-CPT DBP (p=0.049), with a higher r-value for SBP (0.495) than DBP (0.109).

## DISCUSSION

In the present study, there is a statistically significant correlation between age and CPT. It was observed that as age advances, there is a significant increase in the post-test SBP and DBP These results are consistent with study done by Deepinder Kaur Gandhi et al. (2012)[11]. They observed that cold presser test showed progressive increase from younger to older group. Mingizhi Zhang et al. (2013)[12] observed that BP response to the CPT was correspondingly higher with age.

Blood pressure reactivity to cold stimulus increases progressively from younger to older age group, suggesting significant increase in sympathetic activity in elderly. In healthy human subjects, an age-related increase in resting plasma nor-epinephrine levels is caused by an increase in nor-epinephrine spill-over at sympathetic nerve endings and by its decreased clearance[11]. With increasing age, there is a decrease in arterial compliance[13]

Structural changes in the aorta with age would be expected to reduce the ability of the vasculature to buffer pressure fluctuations across the cardiac cycle, resulting in increased SBP and widening of pulse pressure at rest and, possibly, in response to stress.[14] With ageing, the process of atherosclerosis may attenuate the production of endothelial derived releasing factor i.e. nitric oxide and vessels are likely to exhibit greater constrictor response even to the same levels of vasoconstrictors as in young. Ageing brings a decline in the sensory modalities including pain and touch, involving A and C fibres[11]. Also, the rise in blood pressure may represent the effect of environmental influences on blood pressure over time[15].

## CONCLUSION

As age advances, there is a significant increase in the post-test SBP as well as in post-test DBP. Thus age influences cold pressor test response.

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