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A Study of Cold Pressor Test on Young Healthy Subjects

Dr. Ajay Kumar Mishra	Assistant Professor Department of Physiology, N.S.C.B Medical College Jabalpur MP
Dr. Prabhat Kumar Budholia	Associate Professor- Department of Physiology, N.S.C.B. Medical College Jabalpur MP

ABSTRACT

In this study, we perform the cold pressor test to demonstrate the changes in blood pressure that follow cold stress. For cold stress, the subject immerses one hand into ice water for 1–2min while we monitor changes in the subject's blood pressure from baseline to recovery. Sudden and increasingly painful cold stress causes massive discharge of the sympathetic nervous system and release of catecholamine. This sympathetic discharge triggers responses in the cardiovascular system that include arteriolar constriction, increased heart rate, and increased cardiac contractility. These responses combine to increase 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. The subjects comprised of both male and female 120 young health medical students of age group 18 to 21 years, selected randomly, studying in first M.B.B.S. classes. Based upon the recordings of blood pressure. of subjects, they were differentiated into two groups using the criteria for Hyperreactors and Normoreactors to cold presser test according to Hines and Brown. In cold presser test, systolic rise in blood pressure, diastolic rise in blood pressure, and number of hyper-reactors; all these are significantly higher in males as compared to females.

KEYWORDS: Cold pressor test, Hyperreactors, Normoreactors

Introduction-

Reactivity of blood pressure to cold stress has been used as a measure of existing autonomic nervous system activity level by many authors. Temperature and other environmental stressors are known to affect blood pressure and heart rate. In this study, we perform the cold pressor test to demonstrate the changes in blood pressure that follow cold stress. For cold stress, the subject immerses one hand into ice water for 1–2min while we monitor changes in the subject's BP from baseline to recovery.

Temperature and other environmental stressors are known to affect heart rate and blood pressor. For example, sudden and increasingly painful cold stress causes massive discharge of the sympathetic nervous system and release of catecholamine. This sympathetic discharge triggers responses in the cardio vascular system that include arteriolar constriction, increased heart rate, and increased cardiac contractility. These respons es combine to increase 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. The cold pressor test has been used clinically as a stress test to assess left ventricu lar function . The test is also used to evaluate cardiac auto nomic function and as an experimental pain stimulus.

The test was once suggested as an index for screening subjects for hypertension. Several studies have indicated that the cardio vascular response to the cold pressor test can predict the future development of hypertension. The cold pressor test has been shown to dilate the coronary arteries of normal subjects but constrict the coronary arteries of hypertensive subjects.

Objective of Study -

To observe effect of cold stress on blood pressure of young healthy subject.

Material and Method-

The present work was undertaken in department of physi ology, N.S.C.B. Medical College, Jabalpur, M.P. The subjects comprised of both male and female 120 young health medi cal students of age group 18 to 21 years, selected randomly, studying in first M.B.B.S. classes.

Cold pressor test:

Cold Pressor status of all the cases was determined by doing the coldpresser test, described by Hines and Brown (1933) in the following manner. Every subject was allowed to rest in a calm, quiet and comfortable room in supine position, for a pe riod of 30 minutes. Prior to the rest period, nature of the test was explained to the subjects, so as to allay any undue appre hension in the students. Then by Auscultatory method, blood pressure was recorded by mercury sphygmomanometer every 10 minutes until last two consecutive readings were identical. With the subject still in supine position cuff of the sphygmo manometer tied in right arm, the left hand was immersed in ice cold water (at 4 deg C) upto just above wrist level. The hand was kept immersed in ice cold water for 60 seconds i.e. one minute. Immediately after 60 seconds, blood pressure reading was taken, and hand was withdrawn from ice cold water. Another blood pressure reading was taken 60 seconds after the removal of hand from ice cold water.

Based upon the recordings of blood pressure. of subjects, they were differentiated into two groups using the criteria for Hy perreactors and Normoreactors to cold presser test according to Hines and Brown (1933 & 1936).

Hyperreactors-

Those subjects in whom systolic B.P. increased by 20 or more mm of Hg and/or diastolic B.P. increased by 15 or more mm of Hg.

Normoreactors–

Those subjects inwhom rise in systolic B.P. was less than 20 mm of Hg and/or rise in diastolic B.P. was less than 15 mm of Hg.

Observations-

Table- 1

Table showing mean age of the students

Cases	Number	Mean Age (in years)	F-value	p-value
Total	120	18.90±0.95	1.94	>.05
Male	62	19.01±1.0		
Female	58	18.78±0.88		

Table-2
Cold Pressor test:- systolic elevation in whole study sample, male and female groups

Cases	No	Mean rise in Systolic B.P.(in mm of Hg)	t value	P value
Total	120	13.11 ± 6.27	10.85	<.001
Male	68	14.87±6.59		
Female	52	11.24±5.36		

As is evident from the above, a very highly significant difference exists between male and female group in mean systolic rise in B.P. in Cold Pressor Test.

Table-3
Cold Pressor Test :- Diastolic Elevation in Whole Study sample, Male Female groups

Cases	No	Mean rise in Diastolic B.P.(in mmof Hg)	t value	P value
Total	120	8.60±4.10	5.74	<.05
Male	62	9.54±4.30		
Female	58	7.69±3.70		

As is evident from the above, there is significant difference exists between male and female group in mean Diastolic rise in B.P. in Cold Pressor Test

Table-4
Showing cold Pressor Status of Whole study group, Male and Female group

Cases	No	Normo-reactor		Hyper-reactor	
		No	%	No	%
Total	120	86	71.7%	34	28.3%
Male	62	39	45.3%	23	67.6%
Female	58	47	54.7%	11	32.4%

Chi-square 4.85 and P =0.027

Result-
1-The subjects chosen for this study (n= 120) were young medical students having a mean age of 18.90±0.95 years. Males (n= 62) among them were averaging 19.01±1 years and females (n= 58) averaged 18.78±0.88 years. There was no statistically significant age difference between male and female groups; and they formed a single age group [Table 1].

2- In cold Pressor test, the mean rise in systolic B.P. of whole group was 13.11±6.27 mm of Hg whereas that of males and females was 14.87±6.59 and 11.24±5.36 mm of Hg, respectively. Because P value was less than 0.001, hence it is evident that a very highly significant difference exists between male and female groups; systolic rise being higher in males as compared to females [Table 2].

3- In cold Pressor test, rise in diastolic B.P. of whole group was 8.60±4.10 mm of Hg. Diastolic elevation was significantly higher [P less than 0.05] in case of males [mean diastolic elevation 9.45±4.30 mm of Hg] as compared to females [mean diastolic elevation 7.69±3.70 mm of Hg] [Table 3].

4- 71.70% of the subjects were normo-reactors to cold stress, whereas 28.3% were hyper-reactors. 45.3% of normo-reactors were males while females constituted 54.7% of this group. Among Hyper-reactors 67.6% were males while females were only 32.4%. When tested by Pearson Chi-square test, using null-hypothesis, that reactor status to cold stress is independent of sex difference, the hypothesis was rejected [Chi-square 4.85 and P value 0.027]. Thus males tend to be hyper-reactors in higher proportion as compared to females [Table 4]

Discussion-
Cold perssor test is a basically physiological cold stress test and it directly influence to autonomic nervous system. Painful cold stress causes massive discharge of the sympathetic nervous system and release of catecholamine, this sympathetic discharge stimulates responses in the cardiovascular system that include arteriolar constriction, increased hear rate, and increased cardiac contractility, all these responses combine to increase blood pressure. Sensory afferent nerves trigger a systemic sympathetic activation leading to marked vasoconstriction, this result is an elevation of pulse pressure, due to catecholamine release. This increased pulse pressure fills the ventricle to a greater extent, but stroke volume decreases due to an increase in afterload. In healthy human subjects, Cold Pressor Test triggers an increase in blood pressure, this may be due to an increased cardiac output during the initial period of the test with little increase in vascular smooth muscle sympathetic nerve activity, while an increase in muscle sympathetic nerve activity elevates peripheral resistances in the later period. Pulse pressure also increases, mainly at the end of the test. Temperature and other environmental stressors are known to affect blood pressure.

Conclusion-
In cold Pressor test, systolic rise in blood pressure., diastolic rise in blood pressure, and number of hyper-reactors; all these are significantly higher in males as compared to females.

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