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Original Research Article.

Assessment of Impact of Cold Stress on Heart Rate and Blood Pressure in Healthy Offspring with and without Parental History of Type 2 Diabetes Mellitus: A Comparative Study

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ABSTRACT

Background: Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The cold pressor test in healthy subjects triggers a vascular sympathetic activation and an increase in blood pressure. Hence; the present study was undertaken for assessing the Impact of Cold Stress on Heart Rate and Blood Pressure in Healthy Offspring with and without Parental History of Type 2 Diabetes Mellitus.

Materials & Methods: 200 participants were enrolled in the present study and were divided into two study groups with 100 patients in each group as follows: Group A- 100 healthy and non-diabetic patients without parental history of type 2 diabetes mellitus; and Group B- 100 healthy and non-diabetic patients with atleast of one parent with history of type 2 diabetes mellitus. Instructions were given to all the participants for immersing their hands in cold water till their wrist portion for a time period of two minutes (or until toleration; whichever is earlier). Special care was taken for ensuring that all the participants avoided any form of isometric contractions, breath holding or performance of Valsalva maneuver. Continuous monitoring of heart rate (HR), Systolic blood pressure (SBP) and diastolic blood pressure (DBP) with the help of cardiac monitor from the other arm at 60 seconds interval till time period of two minutes.

Results: While comparing the mean heart rate and blood pressure in between the two study groups at different time intervals, it was observed that heart rate and blood pressure after CPT were significantly lower in study group patients (group B) in comparison to control group subjects (Group A).

Conclusion: Heart rate and blood pressure show abrupt changes after CPT in subjects with atleast of one parent with history of type 2 diabetes mellitus.

Key words: Diabetes, Cold Stress, Heart Rate.

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INTRODUCTION

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels.[1, 2] Several pathogenic processes are involved in the development of diabetes. Autonomic nervous system (ANS) dysfunction at the subclinical level seems to be the predisposing condition that occurs far earlier before developing an overt diabetic condition.[3-5] Among the different non-invasive techniques available for assessing the autonomic cardiovascular status, the cold pressor test is considered to be a sympatho-excitatory manoeuvre. It is a simple, non - invasive and validated test of sympathetic activation. The cold pressor test in healthy subjects triggers a vascular sympathetic activation and an increase in blood pressure.[6] Hence, the blood pressure responses to environmental stressors as acute exposure to cold could be used as indicators of global sympathetic activation, and thus of cardiac status.[7] Hence; the present study was undertaken for assessing the Impact of Cold Stress on Heart Rate and Blood Pressure in Healthy Offspring with and without Parental History of Type 2 Diabetes Mellitus.

MATERIALS & METHODS

The present study was conducted in the department of Physiology of S. P. Medical College, Bikaner and it included evaluation of

Impact of Cold Stress on Heart Rate and Blood Pressure in Healthy Offspring with and without Parental History of Type 2 Diabetes Mellitus. Ethical approval was obtained from institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol. 200 participants were enrolled in the present study and were divided into two study groups with 100 patients in each group as follows:

Group A: 100 healthy and non-diabetic patients without parental history of type 2 diabetes mellitus; and

Group B: 100 healthy and non-diabetic patients with atleast of one parent with history of type 2 diabetes mellitus

Inclusion Criteria

- Patients with negative history of any other systemic illness, Patients with negative history of any cardiac or pulmonary illness,
- Patients with negative history of smoking and alcohol consumption

Cold Pressor Test

Instructions were given to all the participants for immersing their hands in cold water till their wrist portion for a time period of two minutes (or until toleration; whichever is earlier). Special care was taken for ensuring that all the participants avoided any form of isometric contractions, breath holding or performance of Valsalva maneuver. Continuous monitoring of heart rate (HR), Systolic blood pressure (SBP) and diastolic blood pressure (DBP) with the help of cardiac monitor from the other arm at 60 seconds interval till time period of two minutes. All the results were recorded in Microsoft excel sheet and were analysed with SPSS software. Chi- square test and student t test were used for assessing level of significance. P- value of less than 0.05 was taken as significant.

Graph 1: Demographic data

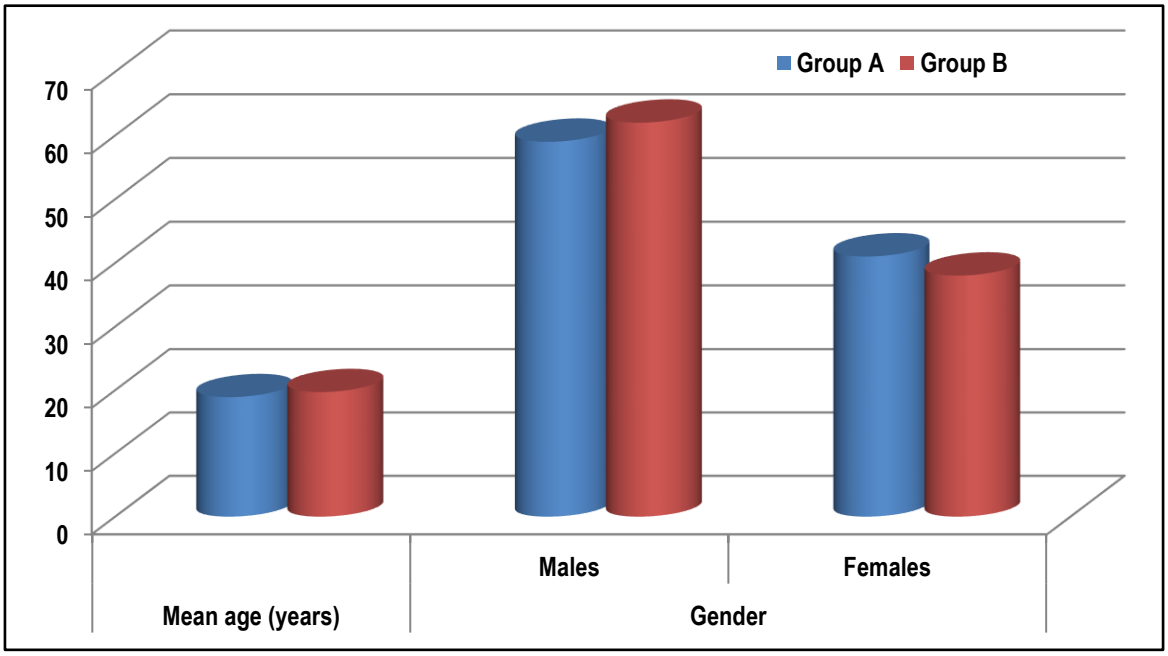

Table 1: Comparison of heart rate

Heart rate (bpm)		Group A	Group B	p- value
Before CPT		75.1	74.5	0.26
During CPT	**60 seconds**	79.4	80.3	0.42
	120 seconds	80.2	81.9	0.36
After CPT	**180 seconds**	75.6	73.6	0.02 (S)
	240 seconds	74.8	71.8	0.01 (S)

S: Significant

Table 2: Comparison of DBP

DBP (mm of Hg)		Group A	Group B	p- value
Before CPT		79.4	80.2	0.68
During CPT	**60 seconds**	80.2	81.4	0.28
	120 seconds	84.6	85.8	0.77
After CPT	**180 seconds**	81.6	78.4	0.01 (S)
	240 seconds	80.8	77.6	0.00 (S)

S: Significant

Table 3: Comparison of SBP

SBP (mm of Hg)		Group A	Group B	p- value
Before CPT		119.6	118.2	0.82
During CPT	**60 seconds**	120.4	121.6	0.35
	120 seconds	126.8	125.8	0.74
After CPT	**180 seconds**	120.4	116.2	0.03 (S)
	240 seconds	118.9	115.4	0.04 (S)

S: Significant

RESULTS

In the present study, a total of 200 participants were enrolled in the present study and were divided into two study groups with 100 patients in each group as follows: Group A- 100 healthy and non-diabetic patients without parental history of type 2 diabetes mellitus; and Group B- 100 healthy and non-diabetic patients with atleast of one parent with history of type 2 diabetes mellitus. Mean age of the patients of Group A and Group B was 18.9 years and 19.7 years respectively. There were 59 males and 41 females in Group A while there were 62 males and 38 females in Group B respectively.

In the present study, while comparing the mean heart rate and blood pressure in between the two study groups at different time intervals, it was observed that heart rate and blood pressure after CPT were significantly lower in study group patients (group B) in comparison to control group subjects (Group A).

DISCUSSION

Temperature and other environmental stressors are known to affect HR and BP. For example, sudden and increasingly painful cold stress causes massive discharge of the sympathetic nervous system and release of norepinephrine. This sympathetic discharge triggers responses in the cardiovascular (CV) system that include arteriolar constriction, increased HR, and increased cardiac contractility. These responses combine to increase BP. 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 ventricular function.[8-10] Hence; the present study was undertaken for assessing the Impact of Cold Stress on Heart Rate and Blood Pressure in Healthy Offspring with and without Parental History of Type 2 Diabetes Mellitus.

In the present study, a total of 200 participants were enrolled in the present study and were divided into two study groups with 100 patients in each group. Mean age of the patients of Group A and Group B was 18.9 years and 19.7 years respectively. There were 59 males and 41 females in Group A while there were 62 males and 38 females in Group B respectively. Bansal S et al assessed the impact of cold stress on heart rate and blood pressure in healthy offspring with and without parental history of type II diabetes mellitus. A total of 50 subjects were selected for the study, 25 patients were healthy and non-diabetic without parental history of T2DM; and other 25 patients were healthy and non-diabetic subjects with at least one parent with T2DM. A written informed consent was obtained from each patient before the study after verbally explaining to them the procedure of the study. Mean age of study group was 20.20 years and control group were 19.80 years. Mean height in study group was 1.79 cm and in control group was 1.69 cm. Mean weight of study group was 63.28 kg and in control group was 65.87 kg. We observed that comparison of heart rate before CPT and during CPT at study group and control group was statistically non-significant. After CPT, the comparison of heart rate between study group and controls at various time intervals was statistically significant. The HR response to CPT was comparable, but after CPT the recovery of HR was smooth and gradual in the controls, whereas it was abrupt in cases.[11]

In the present study, while comparing the mean heart rate and blood pressure in between the two study groups at different time intervals, it was observed that heart rate and blood pressure after CPT were significantly lower in study group patients (group B) in comparison to control group subjects (Group A). Vivek P et al evaluated the cardiac autonomic status and its reactivity among healthy offspring with and without parental history of Type2 Diabetes Mellitus (T2DM). This study consists of 40 healthy male subjects with family history of T2DM (cases) and 40 healthy male subjects without family history of T2DM (controls) in the age group of 18-25 years. HR and BP during and after CPT were compared between cases and controls. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups. HR response to post CPT showed significant differences between two groups across all the time points. Controls showed higher HR than cases at all the time points. However, the reduction of HR with time was more gradual in controls. The graphical representation of SBP changes after CPT, shows fluctuation among cases before it reaches the stable value, whereas, in controls the decrease was at constant level. The results suggested there was altered autonomic reactivity to physical stress among the offspring with parental history of T2DM when compared to their counterparts and hence this points towards the fact that they are at a risk of developing future autonomic dysfunction and cardiovascular complications.[12]

CONCLUSION

From the above results, the authors concluded that heart rate and blood pressure show abrupt changes after CPT in subjects with atleast of one parent with history of type 2 diabetes mellitus. However; further studies are recommended.

REFERENCES

1. Valensi P, Bich Ngoc PT, Idriss S, Paries J, Cazes P, Lormeau B, et al. Haemodynamic response to an isometric exercise test in obese patients: Influence of autonomic dysfunction. International Journal of Obesity 1999;23:543–9.

2. Nonogaki K: New insights into sympathetic regulation of glucose and fat metabolism. Diabetologia, 2000;43:533– 49.

3. Grewal S, Sekhon T, Walia L, Gambhir R. Cardiovascular Response to Acute Cold Stress in Non-Obese and Obese Healthy Adults. Ethiopian Journal of Health Sciences. 2015;25(1):47-52.
4. Banoo H, Gangwar V, Nabi N. Effect of Cold Stress and the Cold Pressor Test on Blood Pressure and Heart Rate. Int Arch BioMedClin Res. 2016 June;2(2):65-8.
5. Straznicky NE, Lambert GW, Masuo K, Dawood T, Eikelis N, Nestel PJ, et al. Blunted sympathetic neural response to oral glucose in obese subjects with the insulin-resistant metabolic syndrome. Am J Clin Nutr. 2009;89:27–36.
6. Van Baak MA. The peripheral sympathetic nervous system in human obesity. Obes Rev. 2001;2:3–14.
7. Peterson HR, Rothschild M, Weinberg CR, Fell RD, McLeish KR, Pfeifer MA. Body fat and the activity of the autonomic nervous system. N Engl J Med. 1988;318:1077–83.
8. Spraul M, Ravussin E, Fontvieille AM, Rising R, Larson DE, Anderson EA. Reduced sympathetic nervous activity. A potential mechanism predisposing to body weight gain. J Clinical Invest. 1993;92:1730–5.
9. Diwan SK, Jaiswal N, Wanjari AK, Mahajan SN. Blood pressure response to Treadmill testing among Medical graduates: The Right time to Intervene. Indian Heart Journal 2005;57:237–40.
10. Victor RG, Leimbach WN, Seals DR, Wallin BG, Mark AL Effects of the cold Pressor test on muscle sympathetic nerve activity in humans. Hypertension 1987;9:429-36.
11. Bansal S, Agarwal M, Yadav K, Yadav Y, Choudhary R. Assessment of Impact of Cold Stress on Heart Rate and Blood Pressure in Healthy Offspring with and Without Parental History of Type II Diabetes Mellitus: A Comparative Study. J Adv Med Dent Scie Res 2018;6(7):65-8.
12. Vivek P, Arifuddin MK. Effect of cold stress on heart rate and blood pressure in healthy offspring with and without parental history of type2 diabetes mellitus. Indian Journal of Clinical Anatomy and Physiology, April-June, 2018;5(2);197-201.

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