

# Detection of individuals prone to develop hypertension in their future life

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## ABSTRACT

Hypertension is a global burning health problem. Early detection of proneness to hypertension may help an individual to lead a healthy life by altering the life style (by diet restriction, exercise etc.). Subjects at high risk of future hypertension e.g. the persons of hypertensive family and / or having high resting heart rate etc. show blood pressure hyper-responsiveness to stress. Elevated blood pressure due to sympathetic stimulation prevailed longer time in susceptible persons. In the present study sympathetic stimulation exerted through cold pressor test (hand immersion up to the wrist in 4<sup>o</sup> C water) resulted in elevation of blood pressure and heart rate in all young male normotensive individuals (age 18-35 years, n=72). Nevertheless, blood pressure and heart rate returned to baseline, following 5 minutes of withdrawal of the stressor, in case of volunteers from normotensive families. On the other hand, the subjects whose parents, either or both were reported to be hypertensive showed elevated diastolic blood pressure even after 5 minutes of withdrawal of the said stressor— indicating that the autonomic nervous system in them was not competent enough for lowering the diastolic pressure quickly to baseline as observed in the volunteers from the normotensive families. The present study revealed that the young subjects who showed greater and prolonged responsiveness to diastolic blood pressure due to sympathetic stimulation through cold pressor test are prone to develop hypertension in future.

**Keywords:** Normotensive, hypertension.

## INTRODUCTION

Hypertension is a burning health problem in the modern world, full of worries and anxieties. Most of the hypertensive patients (88.0%) suffer from essential hypertension.<sup>1</sup> Early detection of proneness to hypertension may help an individual to lead a healthy life by altering the lifestyle (eg, avoidance of alcoholic drink, smoking, excessive fatty food intake etc. and adoption of the practice of yogic exercise,<sup>2</sup> moderate aerobic exercise,<sup>3</sup> mental relaxation<sup>4</sup> etc.). Therefore, if a person can be informed that he may suffer from hypertension well ahead the hypertension sets in, it will be obviously beneficial.

Cardio-vascular reactivity to stress may have a pathological role in neurogenic hypertension. People who are at high risk for elevated blood pressure might have an exaggerated stress induced cardiovascular response at a younger age.<sup>5</sup>

Studies indicate that sympathetic nervous system might play a pivotal role in the pathogenesis of essential hypertension. Subjects at high risk of future hypertension— such as those with a positive history of familial hypertension, high resting heart rate or transient increase in arterial hypertension revealed blood pressure hyper-responsiveness to stress stimuli mediated by an over-activity of the sympathetic nervous system.<sup>6</sup>

Once stimulated by a stressor (immersion of a hand up to the wrist in 4<sup>o</sup> C cold water), sympathetic system

causes rise in heart rate and blood pressure but usually heart rate and blood pressure returns to normal level within a very short period of time after the withdrawal of the stressor.<sup>7</sup> Elevated blood pressure and heart rate prevail for a longer time in the susceptible individual. Naturally, the persons who show higher cardiovascular reactivity to a stressor and slower rate of recovery after the withdrawal of the stressor which caused sympathetic stimulation are at high risk for developing hypertension in their future life. This ignited the thought to explore the cardiovascular reactivity to stress (cold stress) and the recovery time after the withdrawal of the stressor in normotensive young adults.

## SUBJECTS AND METHODS

Normotensive, non-smoker sedentary male subjects (n =72) of age group 18-35 years participated in the study as volunteers. Blood pressure of each subject was recorded using a mercury sphygmomanometer. The casual blood pressure and heart rate of the normotensive subjects were recorded after allowing the subject to take rest in an easy-chair for five minutes. Systolic pressure was determined at the point when the Korotkoff sound became audible and diastolic pressure was measured at the point at which the sound disappeared.<sup>8,9</sup> Pulse pressure was determined by subtracting diastolic pressure from systolic pressure. Blood pressure was measured between 10:00 and 11:00 AM in the month of October when the room temperature was 16– 18<sup>o</sup> C.

**Table-1:** Baseline, stress and recovery heart rate and blood pressure in normotensives from normotensive and hypertensive families

Volunteers	Conditions	HR	SBP	DBP	PP
From normotensive family (n=42)	Baseline	74.35 ± 9.82	112.66 ± 8.78	69.85 ± 8.43	42.95 ± 7.46
	4 <sup>o</sup> C exposure	76.28 ± 10.07	120.23 ± 10.12*	74.16 ± 9.43*	46.07 ± 7.65
	Recovery	74.71 ± 9.74	113.52 ± 8.50	70.33 ± 8.29	43.19 ± 7.04
From hypertensive family (n=30)	Baseline	74.40 ± 14.37	113.83 ± 10.38	69.33 ± 9.47	44.56 ± 7.96
	4 <sup>o</sup> C exposure	75.30 ± 12.61	122.00 ± 10.33*	79.40 ± 11.48*	42.46 ± 10.84
	Recovery	74.93 ± 11.92	113.93 ± 10.10	74.73 ± 10.93*	39.26 ± 7.56*

\*  $p < 0.05$ , HR = Heart rate, SBP = Systolic blood pressure, DBP = Diastolic blood pressure, PP = Pulse pressure

At first, heart rate and blood pressure were recorded from the left hand. Sphygmomanometer cuff was kept *in situ* for next measurement of blood pressure. Right hand of the subject was immersed in the mixture of ice and water (4<sup>o</sup> C) for 1 minute. At the completion of one minute, blood pressure and heart rate were measured and the subject was asked to take out his hand from the cold water (Cold pressor test).<sup>10</sup> Then the subject's hand was wrapped up by a warm towel for 3 minutes and he was allowed to rest. Five minutes following the cold pressor test, the heart rate and blood pressure were noted again.

## RESULTS

The Result has been presented in table 1. From the table it is evident that cold pressor test for a minute elevated both systolic and diastolic pressure. Although following 5 minutes of withdrawal of the stimulus, the blood pressure, both systolic and diastolic, came near baseline ie, as it was before the test, in volunteers from non hypertensive family (n=42). On the other hand, in case of the normotensive volunteers from hypertensive family (n=30), the diastolic blood pressure remained elevated ( $p < 0.05$ ) and did not return to baseline following the aforesaid experimental condition.

## DISCUSSION

The sympathetic noradrenergic fibres are vasoconstrictor in function. The noradrenergic post-ganglionic sympathetic nerves also contain neuropeptide Y, a vasoconstrictor. Vasoconstrictor discharge is associated with increased arteriolar constriction and a rise of blood pressure. Impulses in nor-adrenergic sympathetic nerves cause an increase in heart rate and force of cardiac contraction.<sup>1,11</sup>

Once stimulated by a stressor, sympathetic system causes rise in heart rate and blood pressure but usually these parameters return to normal level within a very short period of time (5 min.) after the withdrawal of the

stressor. The persons who show higher cardiovascular reactivity to a stressor and slower rate of recovery after the withdrawal of the stressor that caused sympathetic stimulation, indicate that their autonomic control system is not competent enough to bring down the blood pressure to baseline quickly. Naturally, they are at high risk for developing hypertension in their future life.

Stress exerted through cold pressor test stimulated the sympathetic nervous system and produced acceleration of heart rate and rise of blood pressure, both systolic and diastolic; in comparison to those recorded before the cold pressor test in all the normotensive volunteers. After 5 minutes of removal of hand from cold water the sympathetic stimulation through cold and pain was withdrawn and blood pressure and heart rate came to basal level. Nevertheless, in almost all the volunteers whose either or both the parents were reported to be hypertensive; the diastolic blood pressure did not return to normal level even after 5 minutes of the withdrawal of the stimulus. On the other hand, the same came to near baseline level in all the volunteers from non-hypertensive family. Hypertension has familial disposition. Person, from hypertensive family (based on the information from the volunteer that either his father or mother or both of them were hypertensive) showed greater and prolonged responsiveness to sympathetic stimulation in comparison to the subjects from non-hypertensive family. Results of this study give an indication that the person who showed greater and specially prolonged responsiveness to diastolic blood pressure due to sympathetic stimulation through cold pressor test is prone to develop hypertension in his future life.

## ACKNOWLEDGEMENTS

Authors are grateful to Professor PR Chowdhury, HOD, Dept. of Physiology, Dr. S Shakya, HOD, Dept. of Ophthalmology and Dr. SB Rizyal, Principal, Nepal Medical College for their co-

operation and support. We are also thankful to Nepal Medical College Research Committee (NMCRC) for the financial support.

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