

# Prediction of individuals prone to suffer from early onset of hypertension

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## ABSTRACT

The present study was undertaken to predict the persons prone to suffer from early onset of hypertension. Healthy sedentary volunteers (age 18-25 years) having normal blood pressure were asked about their history of familial hypertension, smoking-habit, alcohol consumption, existing worries/anxieties; these being the predisposing factors of hypertension. The blood pressure of them was recorded (casual baseline blood pressure). Maximum voluntary contraction (MVC) was noted as maximum pressure (in Kg) sustained during 3 sec of handgrip using a handgrip dynamometer. Thereafter, the participant was asked to sustain isometric handgrip at one third of MVC for one minute with the same instrument (isometric handgrip-test). Then, blood pressure was measured and the subject was allowed to rest. Three minutes after the handgrip test, the blood pressure was noted again (recovery blood pressure). Handgrip-test produced a rise in systolic blood pressure in all male volunteers. Amongst them, with predisposing factors of hypertension, diastolic blood pressure remained significantly higher than casual baseline diastolic blood pressure even after 3 minutes of withdrawal of stressor. Whereas, in males with no predisposing factors of hypertension, the diastolic blood pressure approached almost the baseline casual blood pressure. In all female participants, no significant difference was noted between the casual baseline blood pressure and blood pressure after recovery. Results indicated that the young men who presented prolonged elevated diastolic blood pressure, in response to handgrip test would be at high risk of early onset of hypertension, as sympathetic over-activity prevails in them for longer time.

**Keywords:** Blood pressure, handgrip dynamometer, hypertension.

## INTRODUCTION

Hypertension is one of the burning health problems in the modern world. Essential hypertension is most common (88%) among the hypertensive patients.<sup>1</sup> Early detection of proneness to hypertension may help an individual to lead a healthy life by altering his/her lifestyle (e.g. 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 is warned about 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 disclosed that sympathetic nervous system might play a pivotal role in the pathogenesis of essential hypertension. Subjects at high risk of early onset of 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>6,7</sup>

Sympathetic system when stimulated by a stressor, leads to rise in blood pressure which usually returns to normal level within a very short period of time after the withdrawal of the stressor.<sup>8</sup> Slow recovery from sympathetic stimulation shows elevated blood pressure for a longer time in an individual denoting the person prone to be a victim of early onset of hypertension.

The present study was designed to explore the vascular reactivity to stress (through isometric exercise, using handgrip dynamometer) and the recovery time after the withdrawal of the stressor in normal healthy young adults (age 18-25 years).

## MATERIALS AND METHODS

Healthy young subjects, who were not accustomed to take regular exercise, led a sedentary lifestyle, although had a normal blood pressure (n = 70; 40 males, 30 females, age: 18-25 years) were chosen randomly as volunteers to participate in the study. None of them was taking any medication and none had a significant medical history. The participant was asked about his /her history of familial hypertension; habit of smoking, alcohol consumption, existing worries/anxieties; these being

the most common predisposing factors of hypertension. Volunteer having any of the aforesaid factors was considered as subject with risk factor of hypertension. The casual blood pressure of the participants was recorded using a mercury sphygmomanometer after allowing the subject to take rest in an easy-chair quietly and comfortably 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>9,10</sup> Blood pressure was measured between 10:00 – 11:00 AM in the month of July when the temperature was 20-25°C.

At first, blood pressure was recorded from the left hand (casual baseline blood pressure). Sphygmomanometer cuff was kept tied for next measurement of blood pressure. Maximum voluntary contraction (MVC) was noted as maximum pressure (in Kg) sustained during 3sec of handgrip using a handgrip dynamometer. The participant was asked to sustain isometric handgrip at one third of MVC for one minute with the same instrument (isometric handgrip test). At the completion of one minute, blood pressure was measured and the subject was allowed to relax. Three minutes after the isometric handgrip test, the blood pressure was noted again (recovery blood pressure).<sup>11</sup> Results were analyzed by Student's t test.

**RESULTS**

It is evident from the results that in male volunteers having no predisposing factors of hypertension, a slight

rise in systolic blood pressure occurred as a result of isometric exercise through hand grip test. In male volunteers with predisposing factors of hypertension the rise in systolic blood pressure was significant (Table -1).

In male volunteers with predisposing factors of hypertension (n = 20) the diastolic blood pressure even after 3 minutes of withdrawal of stressor was seen to be significantly higher than casual baseline diastolic blood pressure recorded before the isometric handgrip test [80 mm Hg vs. 74 mm Hg]. Whereas, in male volunteers with no predisposing factors of hypertension (n = 20) the diastolic blood pressure after 3 minutes of withdrawal of stressor was seen to approach almost the same casual blood pressure (71 mm Hg vs. 70 mm Hg). In other words, there was no significant difference between basal casual blood pressure and recovery blood pressure in the later group (Table- 1, Fig. 1).

In female participants, both with and without predisposing factors of hypertension no significant difference between the casual baseline blood pressure (systolic and diastolic) and blood pressure after recovery was noted (Table-1 and Fig. 1).

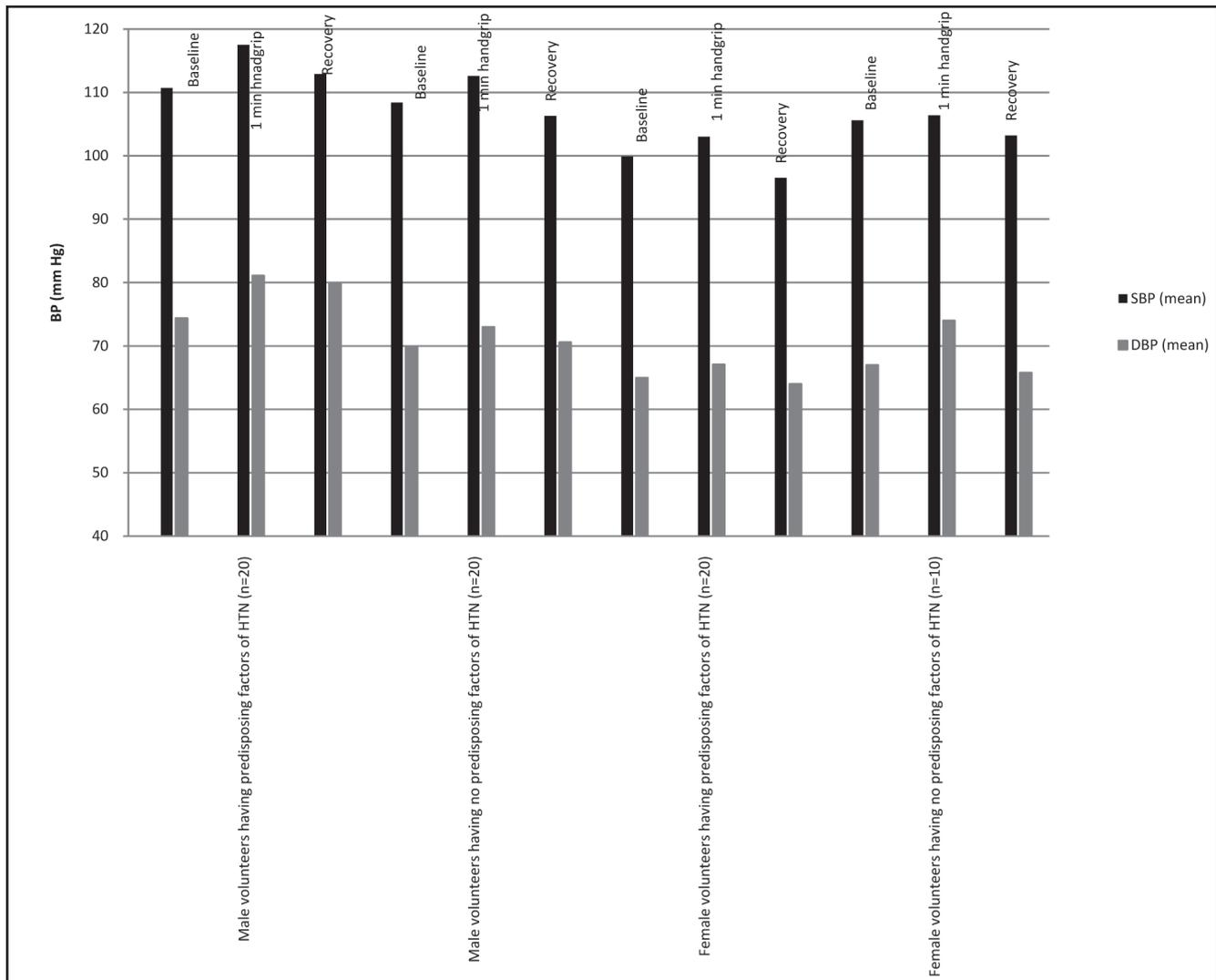
**DISCUSSION**

The sympathetic noradrenergic fibers are vasoconstrictors in function. The noradrenergic post-ganglionic sympathetic nerves contain neuropeptide Y, also a vasoconstrictor. When vasoconstrictor discharge

**Table-1:** Baseline stress and recovery blood pressure in young sedentary normotensive population with and without predisposing factors of hypertension

Volunteers	Conditions	SBP in mm (mean ± SD)	DBP in mm (mean ± SD)
Male volunteers having predisposing factors of hypertension (n = 20)	Baseline	110.70 ± 9.45	74.40 ± 6.44
	1 minute handgrip exercise	117.50 ± 9.31*	81.10 ± 7.38*
	Recovery	112.90 ± 9.36	79.90 ± 6.47*
Male volunteers having no predisposing factors of hypertension (n = 20)	Baseline	108.40 ± 8.54	69.80 ± 7.19
	1 minute handgrip exercise	112.60 ± 8.56	73.00 ± 6.66
	Recovery	106.30 ± 9.25	70.60 ± 6.71
Female volunteers having predisposing factors of hypertension (n = 20)	Baseline	99.90 ± 9.45	65.00 ± 7.03
	1 minute handgrip exercise	103.00 ± 8.83	67.10 ± 5.96
	Recovery	96.50 ± 7.04	64.00 ± 5.65
Female volunteers having no predisposing factors of hypertension (n = 10)	Baseline	105.60 ± 11.99	67.00 ± 9.48
	1 minute handgrip exercise	106.40 ± 12.71	74.00 ± 10.24
	Recovery	103.20 ± 10.59	65.80 ± 9.21

\* = p < 0.05, SBP = Systolic blood pressure, DBP = Diastolic blood pressure.



**Fig. 1.** Baseline stress and recovery blood pressure in young sedentary normotensive population with and without predisposing factors of hypertension

is increased, there occurs an increase in arteriolar constriction and a rise of blood pressure. Moreover, impulses in nor-adrenergic sympathetic nerves also cause an increase in the force of cardiac contraction.<sup>11</sup>

Once stimulated by a stressor, sympathetic system causes rise in blood pressure that usually returns to normal level within a very short period of time after the withdrawal of the stressor. The persons who show higher cardiovascular reactivity to a stressor but slower rate of recovery after the withdrawal of the stressor 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 early onset of hypertension in future.

Previous studies also support the fact that even in the absence of hypertension, its development, ie, excess rise of blood pressure during stress could be considered a predictive marker for the future development of early onset of hypertension, and can be a potential tool for identifying individuals at high risk having apparently

normal blood pressure at present. These individuals should be followed up and their blood pressure controlled for a long time.<sup>12</sup>

Stress exerted through handgrip test (isometric exercise) stimulated the sympathetic nervous system and caused rise in both systolic and diastolic pressure in all volunteers. After 3 minutes of relaxation, systolic blood pressure gradually re-stabilized near to the casual baseline level; as it was before the test (Table-1). In all female volunteers, modulation of blood pressure in response to exercise was nominal and recovery of blood pressure after exercise was also quick in both the groups – with and without predisposition factors of hypertension. It might be due to high elasticity of blood vessel, as all of them were young with high level of female sex hormone estrogen in them.<sup>13, 14</sup> Among the female volunteers the baseline casual systolic blood pressure was found to be little higher than recovery systolic blood pressure which might be due to anticipatory feed forward mechanism of transient rise of systolic blood pressure.<sup>15</sup>

In male volunteers who had predisposition factor of hypertension; blood pressure, especially the diastolic blood pressure did not return to casual baseline level even after 3 minutes of the withdrawal of the stimulus (80 mm Hg vs. 74 mm Hg). On the other hand, the same came to near baseline level (71 mm Hg vs. 70 mm Hg) in the male volunteers having no predisposition factors of hypertension.

Results of this study gives an indication that the young men who will show greater and specially prolonged responsiveness to diastolic blood pressure, due to sympathetic stimulation through handgrip test (isometric exercise) [i.e. whose diastolic blood pressure did not come to near baseline level even after 3 minutes of withdrawal of stimulus] will be at high risk for early onset of hypertension.

#### ACKNOWLEDGEMENTS

Authors are thankful to Prof. Dr. Paresh Roychowdhury, Head, Department of Physiology, Prof. Dr. Ramesh Prasad Singh, Principal and Dr. Shekhar Babu Rizyal, Director, Medical Education, Nepal Medical College for their active help and support. We are also thankful to Binaya Tara Foundation for financial support.

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