Assessment of Parasympathetic Autonomic Function In Stage 1 Essential Hypertension By 30:15 ratio test

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Abstract: **There is more incidence of resting tachycardia and arrhythmias in essential hypertension. Resting heart rate is the index of vagal tone. This suggests some derangement of parasympathetic autonomic functions in essential hypertension. In essential hypertension autonomic nerves supplying the heart may also be affected leading to cardiac autonomic neuropathy. The 30:15 ratio is a measure of parasympathetic function.Parasympathetic autonomic functions are less studied in stage 1 essential hypertension. So the present study was aimed to measure 30:15 ratio in stage 1 essential hypertensive subjects. Study designed as analytical, cross-sectional, comparative study in the Department of Physiology B J medical college and hospital, Pune. Newly diagnosed 50 essential hypertensive male subjects in the age group of 35 -50 years having stage 1 hypertension according to JNC 7 criteria were selected in study group. In control group healthy age and gender matched, 50 normotensive subjects were selected. After informed consent, 30:15 ratio was measured in the study and control group. Comparisons were performed using 'z-test' in the two groups. 30:15 ratio was significantly decreased in stage 1 essential hypertensive subjects as compared to normotensive subjects. (p <0.0001**) Conclusion: The parasympathetic autonomic function is decreased in stage 1essential hypertensive subjects as compared to normotensive subjects.**

*Keywords***: Hypertension, parasympathetic autonomic functions, 30:15 ratio.**

Introduction:

Worldwide prevalence of hypertension is approximately 26%. About 80- 90 % of hypertensive subjects have essential hypertension.[1]Essential hypertension is having more incidence of resting tachycardia and arrhythmias. Tachycardia may be occurring either due to increased sympathetic or a decreased parasympathetic tone. At restvagal tone in human beings brings firing rate of SA node from its intrinsic rate of 90 -120 beats/min to the actual heart rate of about 72 beats/min.[2]At rest the vagal i.e. parasympathetic influence on SA node predominates over sympathetic influence.[3] This suggests there is abnormally decreased parasympathetic tone in essential hypertensive subjects.

Essential hypertension may be associated with peripheral neuropathy, sensory neuropathy[4], ischemic optic neuropathy[5].Autonomic nerves supplying the heart may also be affected in hypertension causing cardiac autonomic neuropathy (CAN).[4,6]In most autonomic disorders, parasympathetic function is affected before sympathetic function[7].The 30:15 ratio is a measure of parasympathetic function.[8] The ratio of R-R intervals corresponding to the 30th and 15th heart beatis called the 30:15 ratio. This30:15 ratio test evaluatescardiovagal function. It has a high sensitivity and specificity and is safe, valuable, and cost-effective. The test is well standardized.

Parasympathetic autonomic functions are less studied in stage 1 essential hypertension. With this background present study was aimed to assess parasympathetic autonomic functions in stage 1 essential hypertension.

Aim and Objectives:

To measure parasympathetic autonomic function in newly diagnosed stage 1 essential hypertensive subjects using 30:15 ratio tests and compare the same in age and gender matched normotensive controls.

Materials and Method:

The study was designed as analytical, cross-sectional, comparative study in the Department of Physiology of BJGMC medical college, Pune. The synopsis of study protocol was submitted to the institutional ethics committee and approval was obtained. Study was conducted from December 2013 to September 2015. First screening was done according to inclusion-exclusion criteria.

Inclusion criteria:

For study group newly diagnosed essential hypertensive male subjects in the age group between 35 - 50 years having stage 1hypertension as per JNC 7 criteria with systolic blood pressure upto159 mm of Hg, diastolic blood pressure up to 99 mm of

Hg were included. For control group healthy normotensive age, gender and body mass index (BMI) matched 50 subjects with sinus rhythm on ECG were selected.

Exclusion criteria:

For both study group and control groupobese person having BMI ≥ 30 were excluded. Subjects having history of cardiac diseases, renal or endocrinal diseases, peripheral nervous system diseases, peripheral vascular disorder like Reynaud's disease, diabetes mellitus, bronchial asthma, alcohol abuse and tobacco chewing or smoking, those who regularly practice yoga or exercise training, secondary hypertension, subjects on drugs like β2 agonist, antagonist were excluded.

After explaining study and taking written informed consent, E:I ratio was measured and compared in both the groups during deep breathing test. All the subjects were called in the morning hours between 10 am to 12 noon to avoid diurnal variations in autonomic functions. The subjects were instructed to avoid drinking tea and caffeine containing beverages for minimum 8 hours prior to testing. Subjects were examined in quiet room at room temperature. E:I ratio was measured after a mandatory 30 minutes rest period.

Sample size:

In the present study after screening according to inclusion and exclusion criteria, 50 newly diagnosed essential hypertensive male subjects in the age group of 35 -50 years having stage 1 hypertension according to JNC 7 criteria were selected in study group. Healthy age and gender matched, 50 normotensive subjects were included in control group.

Procedure:[9]

30: 15 ratio: Each subject was asked to lie quietly for 3 minutes. He was then askedto stand up and remain motionless. A continuous ECG was recorded and apoint was marked on ECG paper to identify the point of standing. The 30:15ratio was calculated by measuring the R-R interval at 30th beat and at 15[th]beat after standing.

Calculations:[9]

30:15 ratio = (RR interval at the 30th beat/RR interval at the 15th beat)

Interpretation:[8] (Normal = > 1.04, Borderline= 1.01-1.03, Abnormal = <1.01)

Statistical Analysis:

The results were given as Mean ± Standard Deviation. Comparisons were performed using z-test in the two groups. A p-value of less than 0.05 was considered as statistically significant. Statistical software SPSS (Statistical Package for the Social Science) version 20 was used for the analysis of data. Microsoft word and Microsoft excel have been used to create text documents, graphs and tables etc

Table no. 5: Comparison of 30: 15 ratio between hypertensive and normotensive groups.

Parameters	Hypertensive (n=50)		Normotensive (n=50)		z value	p value
	Mean	SD	Mean	SD		
30:15 ratio	1.00	0.072	1.10	0.052	7.36	<0.0001**
p values <0.05 : statistically significant*, p values <0.0001: statistically highly significant**, p values >0.05 : not significant						

Discussion:

Essential hypertension is most prevalent cardiovascular disorder. It may be associated with peripheral neuropathy, sensory neuropathy,[4] ischemic optic neuropathy[5]. Autonomic nerves supplying the heart may also be affected in hypertension causing cardiac autonomic neuropathy (CAN).[4,6]

Wu JSet al (2008) also found that hypertensive subjects manifest a significantlyimpaired parasympathetic activity and impairment of the cardiacparasympathetic drive in hypertension.[9]

When normal healthy subject assumes an erect posture from supineposition, gravity causes pooling of blood in the lower limbs. As a result venousreturn, cardiac output and arterial blood pressure decreases. This leads todecreased stretch of baroreceptors causing activation of vasomotor center,which leads to increased sympathetic discharge, decreased vagal tone andan instantaneous increase in heart rate. On standing the heart rate increasesuntil it reaches a maximum at about the 15th beat, after which it slows downto a stable state at about 30th beat due to baroreflex.[10]

This reflex phenomenon to standing is due to unloading of thebaroreceptors. This decreased blood pressure decreases the firing ofbaroreceptor impulses to nucleus tractus solitarius unloading it from inhibitoryinfluence of baroreceptors on nucleus tractus solitarius.[11]

In the present study hypertensive subjects had decreased 30:15 ratio.Hypertensive subjects showed no significant increase in heart rateimmediately after standing may be due to decreased baroreceptor sensitivity.
Causes for decreased baroreceptor sensitivity may be –[12].
1. Decreased vascular elasticity and endothelial damage because of atherosclerosis and aging.

2. Alterations in the release of various factors from endothelium.

3. Enhanced circulating renin, angiotensin II and action of circulating angiotensin II on brain (area postrema and nucleus tractus solitarius).

In the present study the mean value of 30:15 ratio was statistically significantly lower in hypertensive group as compared to normotensive group (p< 0.0001**). So we conclude that there is decreased parasympathetic activity in stage 1 essential hypertensive subjects.

Application of the study:

1. It will also help clinically treating the hypertensive patients.

2. If any abnormality is detected in parasympathetic autonomic functions in early stage of hypertension, future complications can be prevented.

3. People with cardiac autonomic neuropathy can undergo yoga and lifestyle modification to prevent further damage and complications.

There was no any conflict of interest.

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