Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

A comparative study of heart rate variability in hypertensive and normal subjects

[1]Dr Jayanti Singh, [2]Dr Sanjay Kumar Agarwala

[1]Associate Professor, Department of Physiology, Major S D Singh Medical College, Farrukhabad, Uttar Pradesh, India;
[2]Assistant Professor, Department of Biochemistry, Major S D Singh Medical College, Farrukhabad, Uttar Pradesh, India

ABSTRACT:
Background: Chronic imbalance of the autonomic nervous system is prevalent and potent risk factor for adverse cardiovascular events including mortality. The present study was conducted to assess heart rate variability in hypertensive and normotensive subjects. **Materials & Methods:** 60 hypertensive and 60 normotensive subjects was included. Total power (TP), normalized low frequency power (LFnu), normalized high frequency power (HFnu), ratio of low frequency power to high frequency power (LF-HF ratio), standard deviation of normal-to-normal RR intervals (SDNN), root mean square successive difference (rMSSD) and the proportion of NN50 to the total number of NN intervals (pNN50) were assessed. **Results:** SDNN (ms) was 156.2 in group I and 142.6 in group II, pNN50 was 14.5 in group I and 11.7 in group II, rMSSD (ms) was 42.6 in group I and 39.0 in group II. LFnu was 74.0 in group I and 84.5 in group II, HFnu was 56.2 in group I and 34.9 in group II and LF/HF ration was 2.7 in group I and 3.6 in group II. The difference was significant ($P< 0.05$). **Conclusion:** Hypertensive patients exhibited decreased heart rate variability and decreased parasympathetic modulation as compared to normotensive subjects.
Key words: Hypertensive, heart rate variability, Normotensive

Received: 17 January, 2018 Accepted: 2 February, 2018

Corresponding Author: Dr Sanjay Kumar Agarwala, Assistant Professor, Department of Biochemistry, Major S D Singh Medical College, Farrukhabad, Uttar Pradesh, India

This article may be cited as: Singh J, Agarwala SK. A comparative study of heart rate variability in hypertensive and normal subjects. J Adv Med Dent Scie Res 2018;6(2):133-135.

INTRODUCTION

Chronic imbalance of the autonomic nervous system is prevalent and potent risk factor for adverse cardiovascular events including mortality.[1] Any factor that leads to inappropriate activation of the sympathetic nervous system can be expected to have an adverse effect on these measures. Any factor that augments vagal tone tends to improve outcome.[2] The autonomic nervous system (ANS) plays a fundamental role in the control of arterial blood pressure and heart rate, and, therefore, may be considered an important pathophysiologic factor in the development of arterial hypertension. Currently, the status of autonomic action of the heart may be known through the study of heart rate variability.[3] Heart rate varies per beat as a consequence of the constant adaptations promoted by the ANS to maintain cardiovascular system balance. These alterations may be assessed through the variations in R-R intervals, therefore, constituting the heart rate variability. The integration between the sympathetic and parasympathetic modulations determines heart rate variability.[4]

Obesity, diabetes mellitus, hypertension, hyperlipidemia, coronary artery diseases and cancers are the leading causes of death worldwide. The burden of cardiovascular diseases and diabetes mellitus is very high in developing countries.[5] Among the various risk factors, physical inactivity is an important risk factor for cardiovascular diseases and for increased cardiovascular mortality. Worldwide, physical inactivity is estimated to be the primary cause of approximately 21-25% of breast and colon cancers, 27% of diabetes and approximately 30% of ischemic heart disease.[6] The present study was conducted to assess heart rate variability in hypertensive and normotensive subjects.

MATERIALS & METHODS

The present study was conducted among 60 hypertensive patients of both genders. Equal number of normotensive subjects was also included as control. The criteria for diagnosing hypertension were BP ≥140/90 mmHg based on the average of 3 consecutive readings at an interval of 3 weeks. Subjects with blood pressure values of 100-119/60-79 mm Hg were recruited as normotensive. All subjects were informed and their written consent was obtained.

Demographic parameters of all enrolled subjects were recorded. A thorough clinical examination was done. Blood pressure measurement was done (SBP and DBP). Group I comprised of hypertensive patients and group II had normotensive subjects. HRV such as total power (TP), normalized low frequency power (LFnu), normalized high frequency power (HFnu), ratio of low frequency power to high frequency power (LF-HF ratio), standard deviation of normal-to-normal RR intervals (SDNN), root mean square successive difference (rMSSD) and the proportion of NN50 to the total number of NN intervals (pNN50) were assessed. Results of the study was recorded and subjected to statistical analysis P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Group I	Group II
Status	Hypertensive	Normotensive (Control)
M:F	35:25	35:25

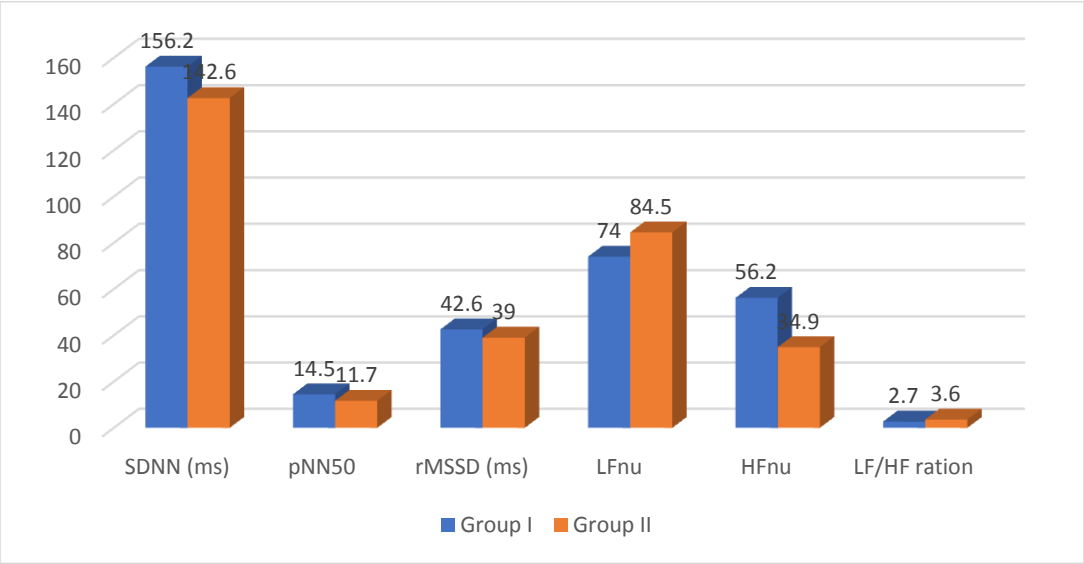
Table I shows that both groups had 35 males and 25 females.

Table II Assessment of domain

Parameters	Group I	Group II	P value
SDNN (ms)	156.2	142.6	0.05
pNN50	14.5	11.7	0.01
rMSSD (ms)	42.6	39.0	0.04
LFnu	74.0	84.5	0.01
HFnu	56.2	34.9	0.02
LF/HF ration	2.7	3.6	0.05

Table II, graph I shows that SDNN (ms) was 156.2 in group I and 142.6 in group II, pNN50 was 14.5 in group I and 11.7 in group II, rMSSD (ms) was 42.6 in group I and 39.0 in group II. LFnu was 74.0 in group I and 84.5 in group II, HFnu was 56.2 in group I and 34.9 in group II and LF/HF ration was 2.7 in group I and 3.6 in group II. The difference was significant (P< 0.05).

Graph I Assessment of domain



DISCUSSION

Several population-based studies show that incremental levels of regular physical activity are inversely proportional to long-term cardiovascular mortality when controlled for the presence of other risk factors in both men and women.[7] In studies of male college alumni, the risk of death became progressively lower as physical activity dose levels

increased from an expenditure of 2.1 to 14.7 MJ/wk, 500 to 3500 kcal/wk. There was a 24% reduction in cardiovascular mortality in subjects whose energy expenditure was 0.8.4 MJ/wk, 2000 kcal/wk.[8] Alumni who were initially inactive and later increased their activity levels demonstrated significantly reduced cardiovascular risk compared with those who remained inactive. The present study was conducted to assess heart rate variability in hypertensive and normotensive subjects.[9] Heart rate variability (HRV) has emerged as a practical, non-invasive tool to quantitatively investigate cardiac autonomic dysregulation in hypertension. Studies have reported decreased HRV among hypertensives and that the relation between blood pressure and HRV is present across a wide range of blood pressures.[10] The present study was conducted to assess heart rate variability in hypertensive and normotensive subjects.

In present study we enrolled 60 hypertensive and 60 normal subjects. Menezes et al[11] conducted a study comprised 286 patients diagnosed with arterial hypertension (AH) for the first time and divided into 4 groups according to diastolic blood pressure (DBP) levels: group A - DBP110 mmHg. Group A (110 healthy individuals) and group C (79 patients with moderate AH) underwent 24-hour Holter ECG with analysis of heart rate variability in time domain (TD) and frequency domain (FD). The group C patients were treated with ACE inhibitors for 3 months, and, after this period, they underwent a new 24-hour Holter- ECG study for assessing heart rate variability, the values being compared with those of normotensive individuals. The SDNN and PNN50 parameters (TD), and the LF spectrum (FD) were significantly different in the 2 groups, with clearly reduced values in hypertensive individuals.

We found that SDNN (ms) was 156.2 in group I and 142.6 in group II, pNN50 was 14.5 in group I and 11.7 in group II, rMSSD (ms) was 42.6 in group I and 39.0 in group II. LFnu was 74.0 in group I and 84.5 in group II, HFnu was 56.2 in group I and 34.9 in group II and LF/HF ration was 2.7 in group I and 3.6 in group II. Goldstein et al[12] conducted a study in which a total of fifty-nine apparently healthy male (M) and female (F) individuals (M/F = 15/44) were included in the trial. HRV data for analysis was derived from 5 minutes of baseline recordings, while the subject was sitting on a comfortable chair. Subject body measures (weight and height) were taken and BMI was obtained according to common calculation (kg/m²). BMI was inversely related to pNN50 and RMSSD components of HRV. Statistically significant differences between stratified groups (BMI25) only occurred for analysis of pNN50 components. The pNN50 components and RMSSD are strongly associated with cardiac vagal influence, and thus represents parasympathetic activity. The present data supports previous findings, that sympatho-vagal balance is related to BMI in non-obese, healthy individuals, providing evidence for a prominent role of the vagus nerve in the modulation of the energy expenditure of the human organism. Furthermore, this relation can be observed in short term recordings of HRV of 5 minutes in length.

CONCLUSION

Authors found that hypertensive patients exhibited decreased heart rate variability and decreased parasympathetic modulation as compared to normotensive subjects.

REFERENCES

1. Jagmeet P, Martin G Larson, Hisako Tsuji, Jane C Evans, Christopher JO Donnell, Daniel Levy. Reduced Heart rate variability and new-onset Hypertension. Hypertension 1998; 32: 293-297.
2. Virtanen R, Jula RA, Kuusela T, Helenius H, Voipio Pulkki LM. Reduced Heart rate variability in Hypertension. Journal of Human Hypertension 2003; 17: 171-179.
3. Xie Gui-Ling, Wang Jing-hua, Zhou Yan, Xu Hui, Sun Jing-Hui, Yang Si-Rui. Association of High Blood Pressure with Heart Rate Variability in Children. Iran J Paediatr 2013; 23: 37-44.
4. Mohd Urooj, Pillai KK, Monika Tandon, Venkateshan SP, Nilanjan Saha. Reference ranges for time domain parameters of Heart rate variability in Indian population and validation in hypertensive subjects and smokers. Int J Pharm Pharm Sci; 2011;3(1): 36-39.
5. Martini G, Riva P, Rabbia F, Molini V, Ferrero GB, Cerutti F, et al. Heart rate variability in childhood obesity. Clin Auton Res 2001;11:87-91 2. Kim JA, Park YG, Cho KH, Hong M
6. Han HC, Choi YS, et al. Heart rate variability and obesity indices: emphasis on the response to noise and standing. J Am Board Fam Pract 2005;18:97-103.
7. Molfino A, Fiorentini A, Tubani L, Martuscelli M, Rossi Fanelli F, Laviano A. Body mass index is related to autonomic nervous system activity as measured by heart rate variability. Eur J Clin Nutr 2009;63:1263-1265.
8. Tarvainen MP, Niskanen JP, Lipponen JA, Ranta-aho PO, Karjalainen PA. Kubios HRV – A Software for Advanced Heart Rate Variability Analysis. IFMBE Proceedings 2009;22:1022–1025.
9. Casadei B, Cochrane S, Johnston J, Conway J, Sleight P. Pitfalls in the interpretation of spectral analysis of the heart rate variability during exercise in humans. Acta Physiol Scand 1995;153:125-131.
10. Moak JP, Goldstein DS, Eldadah BA, Saleem A, Holmes C, Pechnik S, et al. Supine low frequency power of heart rate variability reflects baroreflex function, not cardiac sympathetic innervation. Cleve Clin J Med 2009;76:51-59.
11. Menezes JR, Oliveira LLM, Melo CSN, Freitas JR. Heart rate variability and Autonomic nervous system response in Hypertensive patients with and without ACE inhibitors. Progress in Biomedical research 2000; 1: 385-388.
12. Goldstein DS, Bentho O, Park MY, Sharabi Y. Low-frequency power of heart rate variability is not a measure of cardiac sympathetic tone but may be a measure of modulation of cardiac autonomic outflows by baroreflexes. Exp Physiol 2011;96:1255-1261.