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Research Article

The Normative Value for Heart Rate Variability for the Assessment of Sympatho-vagal Balance in Healthy Adult Population of Bihar

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Abstract

Recording of HRV will help us to identify cardiovascular autonomic derangement earlier. However, to be used clinically, normative data has to be established. In this study, HRV analysis of 111 young healthy subjects aged 18 to 30 yrs is done who are divided on the basis of gender. In time domain parameters, values are slightly higher for males for RR interval and slightly higher for females for RMSSD and PRR50%. In frequency domain parameters, higher values are found for VLF for males and LF and HF for females. Total power is higher for females and LF/HF ratio is higher for males. However, no comprehensive investigations of all HRV indices in large normal populations have yet been performed.

Keywords: Tumefactive VR Spaces; Virchow-Robin Spaces; Neuroradiology; Periventricular Cysts

Introduction

Heart rate variability (HRV) refers to the beat-to-beat fluctuations in the cardiac rhythm occurring due to modulation of the pacemaker (sinoatrial node) activity of the heart by the sympathetic and parasympathetic branches of the autonomic nervous system. Nowadays, cardiovascular diseases and their risk factors are increasingly occurring at a younger age (children and adolescents) and recording of HRV in them will help us to identify cardiovascular autonomic derangement earlier. However, to be used clinically, normative data has to be established in this age group considering other major factors that can influence HRV such as sex, physical activity, and BMI [1].

Significant relations were found between cardiovascular mortality and autonomic nervous system over last few years. That lead to efforts to develop measures to monitor autonomic activity [2-5].

HRV is the most effective marker of autonomic activity. Heart rate variability is an universally accepted method for assessing the heart autonomic balance. At the same time HRV is a highly specific method, but with a low sensitivity to the cardiovascular diseases [6].

The clinical relevance of HRV was first appreciated in 1965 when Hon and Leef [7] noted that fetal distress was preceded by alterations in interbeat intervals before any appreciable change occurred in heart rate itself [8]. The clinical importance of HRV became appreciated in the late 1980s, when it was confirmed that HRV was a strong and independent predictor of mortality after an acute myocardial infarction [9-11]. With the availability of new, digital, high-frequency, 24-hour, multichannel ECG recorders, HRV has the potential to provide additional valuable insight into physiological and pathological conditions and to enhance risk stratification. With this insight, this study aims at preparing normative data of HRV for the young population of Bihar.

Aim of the Study

Aim of the study is to provide normal physiological data for HRV in carefully screened normal young healthy subjects.

Objectives of the Study

Objectives of the study are to provide normative HRV data in young population of Bihar and to compare HRV normative data of males and females.

Material and Methods

This Study was performed in department of physiology, All India Institute of Medical Sciences, Patna after obtaining ethical clearance from ethical committee. Normal healthy subjects (including patient attendants, employee of AIIMS Patna) both male and females aged 18 to 30 years visiting AIIMS Patna OPD and giving written consent were enrolled in this study. Detailed history and directed physical examination was performed.

Inclusion criteria

Healthy young adults, both male and female, aged 18-30 years were recruited in the study.

Exclusion criteria

Any patient with hypertensive or any cardio respiratory disorder, Endocrine disorders (thyroid, adrenal etc.), those with injuries and painful condition, Epileptic patients, patients with Psychiatric disorders (depression, manic depressive illness etc.), Smokers and/alcoholics and those undergoing treatment with drugs like antidepressants, thyroid stimulants, anti thyroid drugs were excluded from the study.

Steps to perform study

Measurements of HRV was performed on the short term recording basis for periods of 6 to 10 minutes. The HRV of the subjects was assessed, 2 hours after food and without any caffeinated drinks or strenuous exercise. Subject was instructed that any drug that may affect autonomic function should be withdrawn at least 48 hr before the test unless it is very necessary or life saving drug. Anthropometric measurements such as height (m), weight (kg) were recorded. BMI was calculated from height and weight measurements. Resting blood pressure was measured in supine position and using a digital sphygmomanometer. Resting heart rate was recorded. The tests were performed using 8 channel Power Lab System (AD Instrument ltd) in an equable environment. The lab was made sound proof and air conditioned to provide comfort while performing tests. HRV values were derived by the LAB Chart Pro software.

The main steps of HRV analysis are Detection of heart beats from ECG, Computation of time domain tachogram and Computation of frequency domain.

The resting ECG of 10 minutes was recorded in supine posture for all subjects, in lead II of ECG, in a state of physical and mental rest, to find HRV.

Parameters measured

Time domain parameters

In the time domain some of the measures measured are

- Heart Rate and RR interval
- RMSSD(ms) – the square root of the mean of the sum of the square of the differences between adjacent RR intervals
- RR50(count) – number of pairs of adjacent RR intervals differing by more than 50ms in the entire recording. Three variants are possible: counting all such NN intervals pairs, counting only pairs in which the first interval is longer, and counting only pairs in which the second interval is longer
- pRR50% – percentage of adjacent NN differing by more than 50ms over an entire 24 hour ECG recording.

Frequency domain parameters

Following parameters are measured:

- Total power (variance of R-R intervals over temporal segment)
- VLF (Power in very low frequency range)
- LF (Power in low frequency range)
- HF (Power in high frequency range)
- LF/HF ratio.

Statistical analysis

Data obtained was analysed using excel software and SPSS version 22 to find mean and standard deviation of HRV in all subjects and males and females separately.

Results

This study was conducted in department of physiology AIIMS Patna. Total 111 subjects students participated and completed the study. 74 were male and 37 were female.

	Total (111)	Blood group				
		B+	O+	A+	AB+	Rh-
Male	74	22	21	24	5	2
Female	37	11	10	10	4	2

Table 1: Demographic profile of subjects.

Autonomic function of all the subject were analyze using HRV analysis.

	Total (n)	Height (cm)	Weight (kg)	Systolic	Diastolic	Pulse per minute
Male	74	172.19 ± 7.03	66.65 ± 12.52	122.10 ± 8.79	72.97 ± 6.96	79.25 ± 14.88
Female	37	158.19 ± 4.67	52.22 ± 8.84	108.61 ± 11.51	71.14 ± 7.61	86.11 ± 9.74

Table 2: Demographic profile of subject.

	Average (male)	Average (female)
R.R intervals (ms)	773.11 ± 153.57	753.14 ± 99.82
RMSSD (ms)	42.93 ± 23.76	47.68 ± 24.65
pRR50%	21.78 ± 17.71	30.74 ± 20.62

Table 3: Time domain parameter of subject.

	Average (male)	Average (female)
Total POWER	2364.57 ± 1960.69	2377.95 ± 2023.51
VLF	832.96 ± 753.97	600.16 ± 576.28
LF	619.48 ± 562.73	630.44 ± 515.97
HF	963.34 ± 1037.25	1130.58 ± 1033.60
LF/HF	.92 ± .78	.82 ± .71

Table 4: Frequency domain parameters of the subjects.

Discussion and Conclusion

HRV analysis of 111 young healthy subjects aged 18 to 30 yrs is done who are divided on the basis of gender. Demographic profile of the subjects is mentioned in table 1. 74 are males and 37 are females. Table 2 shows anthropometric measurements (the differences are statistically significant in males and females) and blood pressure and pulse (the differences are not statistically significant).

Table 3 and table 4 mention the time domain and frequency domain parameters of the subjects. In time domain parameters, values are slightly higher for males for RR interval and slightly higher for females for RMSSD and PRR50%. In frequency domain parameters, higher values are found for VLF for males and LF and HF for females. Total power is higher for females and LF/HF ratio is higher for males.

A study [12] shows that in both men and women, the LLN of SDNNc and RMSSDc decreases continuously from birth to old age, whereas the ULN decreases at the same rate until the age of 50-60 and then starts to rise again. The differences in SDNNc and RMSSDc between men and women are small, with men generally having slightly lower LLN and median values than women in the age groups of 20-70. Several studies calculated uncorrected normal values for HRV from 5-min or 24-h ECG signals (Umetani., *et al*. 1998 [13]; Nunan., *et al*. 2010 [14]; Kim and Woo, 2011 [15]; Seppala., *et al*. 2014 [16]). Nunan., *et al*. (2010) [14] published normal values for middle-aged and elderly people in a systematic review of 5-min SDNN and RMSSD using 44 studies containing 21,438 participants. Seppala., *et al*. (2014) [16] reported normal HRV values but only for children aged 6-8 years. Kim and Woo (2011) [15] found that 5-min SDNN and RMSSD decreased between the age of 18 and 50 in both men and women. Umetani., *et al*. (1998) [13] also found that 24-h SDNN decreases in adults, as recorded in 260 healthy participants aged 10–99 years. There is another study that calculated normal values of uncorrected 10-s HRV, for middle-aged and elderly participants (O'Neal., *et al*. 2016) [17].

Large prospective population studies with longitudinal follow-up are needed to establish normal HRV standards for various age and sex subsets [18]. Framingham Heart Study reported on the time and frequency domain measures of HRV in 736 elderly subjects and the relationship of these HRV measures with all-cause mortality during 4 years of follow-up [19]. These investigators concluded that HRV provides prognostic information. Additional HRV studies involving the full age spectrum in male and female subjects need to be performed.

No comprehensive investigations of all HRV indices in large normal populations have yet been performed. Normal values listed in the tables were obtained in this study involving small numbers of subjects. The values should therefore be considered as approximate and no definite clinical conclusions should be based on them. The adjustment of normal limits for age, and environment, which is also needed, has been omitted here because of the limited sources of data.

HRV has considerable potential to assess the role of autonomic nervous system fluctuations in normal healthy individuals and in patients with various cardiovascular and noncardiovascular disorders. HRV studies should also increase our understanding of physiological phenomena. Large prospective longitudinal studies are needed to determine the predictive value of HRV in the identification of individuals at risk for morbid and mortal events.

Bibliography

1. Sharma VK., *et al*. "Heart Rate Variability in Adolescents - Normative Data Stratified by Sex and Physical Activity". *Journal of Clinical and Diagnostic Research* 9.10 (2015): CC08-13.

2. Lown B and Verrier RL. "Neural activity and ventricular fibrillation". *The New England Journal of Medicine* 294 (1976): 1165-1170.

3. Corr PB., *et al*. "Mechanisms controlling cardiac autonomic function and their relation to arrhythmogenesis". In: Fozzard HA, Haber E, Jennings RB, Katz AN, Morgan HE, eds. The Heart and Cardiovascular System. New York, NY: Raven Press; (1986): 1343-1403.

4. Schwartz PJ and Priori SG. "Sympathetic nervous system and cardiac arrhythmias". In: Zipes DP, Jalife J, eds. Cardiac Electrophysiology: From Cell to Bedside. Philadelphia, Pa: WB Saunders Co (1990): 330-343.

5. Levy MN., *et al*. "Vagal Control of the Heart: Experimental Basis and Clinical Implications". Armonk, NY: Futura (1994).

6. Matveev M and Prokopova R. "Normal and abnormal circadian profiles of heart autonomic balance, evaluated by time-related common indicator of heart rate variability". *Anadolu Kardiyoloji Dergisi* 7 (2007): 125-129.

7. Hon EH and Lee ST. "Electronic evaluations of the fetal heart rate patterns preceding fetal death: further observations". *American Journal of Obstetrics and Gynecology* 87 (1965): 814-826.

8. Pagani M., *et al*. "Power spectral analysis of heart rate and arterial pressure variabilities as a marker of sympathovagal interaction in man and conscious dog". *Circulation Research* 59 (1986): 178-193.

9. Kleiger RE., *et al*. "Decreased heart rate variability and its association with increased mortality after acute myocardial infarction". *American Journal of Cardiology* 59 (1987): 256-262.

10. Malik M., *et al*. "Heart rate variability in relation to prognosis after myocardial infarction: selection of optimal processing techniques". *European Heart Journal* 10 (1989): 1060-1074.

11. Bigger JT., *et al*. "Frequency domain measures of heart period variability and mortality after myocardial infarction". *Circulation* 85 (1992): 164-171.

12. Marten E., *et al*. "Normal Values of Corrected Heart-Rate Variability in 10-Second Electrocardiograms for All Ages". *Frontiers in Physiology* 9 (2018): 424.

13. Umetani K., *et al*. "Twenty-four hour time domain heart rate variability and heart rate: relations to age and gender over nine decades". *Journal of the American College of Cardiology* 31 (1998): 593-601.

14. Nunan D., *et al*. "A quantitative systematic review of normal values for short-term heart rate variability in healthy adults". *Pacing and Clinical Electrophysiology* 33 (2010): 1407-1417.

15. Kim G M and Woo J M. "Determinants for heart rate variability in a normal Korean population". *Journal of Korean Medical Science* 26 (2010): 1293-1298.

16. Seppala S., *et al*. "Normal values for heart rate variability parameters in children 6-8 years of age: the PANIC Study". *Clinical Physiology and Functional Imaging* 34 (2013): 290-296.

17. O'Neal W T., *et al*. "Reference ranges for short-term heart rate variability measures in individuals free of cardiovascular disease: the Multi-Ethnic Study of Atherosclerosis". *Journal of Electrocardiology* 49.5 (2016): 686-690.

18. Algra A., *et al*. "Heart rate variability from 24-hour electrocardiography and the 2-year risk for sudden death". *Circulation* 88 (1993): 180-185.

19. Tsuji H., *et al*. "Reduced heart rate variability and mortality risk in an elderly cohort: the Framingham Heart Study". *Circulation* 90 (1994): 878-883.

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