Original article

A prospective observational study of age and gender dependency of Cardio Vagal Baroreflex Sensitivity

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Abstract:

Introduction: Age & gender related changes in cardiovagalbaroreflex sensitivity (BRS) in humans are less investigated. Here an attempt was made to assess the effect age and sex on cardiovascular parasympathetic functions.

Methods: This was a prospective observational study with the Primary Data. Total 80 completely healthy subjects were selected and divided into three groups according to their age. CardiovascularParasympathetic functions were assessed and compared by using CANWIN, a windows based cardiac autonomic neuropathy analysis system with interpretation.

Observations and results: Descriptive statistics was done using "unpaired t" test. Comparison of outcome parameterswere calculated with significance test which suggested impairment of cardio vagalBRS with aging.

Conclusion: Decline in cardio vascular parasympathetic functions in females as compare to males of same age group indicating age and sex as the important determinants of cardio vagalBRS and so the autonomic functions.

Keywords: Baroreflex sensitivity

Introduction

Every human being feels never grow old and wish to live long. This fear of the aging is mainly due to the illness and disability generally associated with it. Aging is a physiological phenomenon leading to impaired ability to maintain homeostasis during external as well as internal stresses leading to deteriorated quality of life (1, 2). Aging is the process of merely growing order in a temporal sense. Aging or senescence is the sum total loss of functions and structures when a person grows older(3). Overall the age related changes in both parasympathetic and sympathetic nervous system of human body are less investigated(2, 4). The cardio vagalbaroreflex sensitivity (BRS) declines with advancing age in humans, but the underlying mechanism has not been established (5).Some of the commonly employed tests for early detection of autonomic dysfunction are classified into parasympathetic function tests (e.g. Resting heart rate / min, Heart rate response to deep

breathing i.e. E: I ratio, Immediate heart rate response to standing i.e. 30:15 ratios, Valsalva ratio.Standing to lying ratio i.e. S/L ratio, Heart rate variability etc.)andSympathetic function tests(e.g. Orthostatic variation in arterial B.P., Isometric hand grip test, Cold pressor test, Sympathetic skin response etc.) (6, 7). There is evidence for impairment of both parasympathetic and sympathetic nervous system functions with aging (8, 9). It gives us an indication of effect of ageing on the cardio vagal functions, so a formal study was planned to be carried out which involved an assessment of cardiovascular parasympathetic functions in males and females of different age groups in order to determine the cardio vagal BRS . The changes were noticed in some parameter of parasympathetic function tests during comparison between different age group and amongst males and females of same age group.

Material and methods

The present study of assessment of cardiovagal BRS in different age group was conducted in Dept. of Physiology, RMC Loni.

Inclusion criteria - Totally, 80 (40 males and 40 females) healthy volunteer subjects (not having any major illness or chronic addiction) were selected for the study from among those visiting the OPD of Pravara Rural Hospital, Loni, Maharashtra, India. According to the age they were divided into three groups, as follows: Group I - Age 31 – 40 yrs as elders, comprising of 10 males(Group I A) and 10 females (Group I B). Group II - Age 41 – 60 yrs as young old comprising of 15 males(Group II A) and 15 females (Group II B). Group III - Age 61 yrs and onwards as old old comprising of 15 males(Group III A) and 15 females (Group III B) (10).

Exclusion criteria - Subjects less than 30 years of age, suffering from any major illness and with chronic addiction were excluded from the study. The tests were performed at the same time of the day in all the subjects and at a comfortable environment. The four tests included in this study were carried out using CANWIN.

CANWIN is the state of the art PC, windows based cardiac autonomic neuropathy analysis system manufactured by GENESIS MEDICAL SYSTEMS PVT. LTD.HYDERABAD, with interpretation. It has an extensive data base to keep tract of subjects‟ history and for archive test retrieval and comparisons being fully autonomic. The need of manual recordings, readings and calculation is eliminated. Inbuilt time domain waveform analysis (i.e. recording of ECG in Lead II for one minute) make the task of conducting all the tests very easy.

Various tests carried out to assess parasympathetic activity are as follows:

1. Resting heart rate / min
2. heart rate response to deep breathing (E: I ratio)
3. Immediate heart rate response to standing (30 : 15 ratio)
4. Valsalva ratio.

1. Heart rate - resting: -The subject was asked to lie down comfortably and the heart rate/ minute was recorded in resting lying down position.

2. Heart rate response to deep breathing (Expiratory: Inspiratory ratio)The subject was asked to lie down comfortably and was asked to take deep breaths slowly in and out as per the directions displayed in CANWIN

3. Heart rate response to standing (30:15 ratio):-

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The subject was asked to lie down comfortably and the heart rate was recorded. Then the subject was asked to stand up and immediately the heart rate was recorded.

4. Heart rate response to Valsalva maneuver:-

The test was conducted with subject in sitting position. When the ECG wave forms appear stabilized on the computer screen and the GREEN light turns on, the subject was asked to blow air into the mouthpiece (closing the nose) till the reading on the meter reaches 40 mmhg and hold it in the same position. And when the RED light glows the pressure was released.

Observations and results

The statistical analysis for parasympathetic tests was carried out separately for males and females in all the three groups in order to compare the cardiovascular parasympathetic functions between the 3 study groups by applying "unpaired t test".

Sex wise comparison in Group – I, resting heart rate, expiratory to inspiratory ratio and valsalva ratio were not statistically significant($p > 0.05$) and 30:15 ratiowas statistically significant($p < 0.05$) - Table No.1.

In Group- II,Resting heart rate, 30:15 ratio and valsalva Ratio were notstatistically significant ($P> 0.05$) and expiratory to inspiratory ratio was statistically significant ($P < 0.05$) - Table No.2.

In Group –III, Resting heart rate, Expiratory to inspiratory ratio and 30:15 ratio were not statistically significant($p > 0.05$) result in and Valsalva ratio was statistically significant ($P < 0.05$) - Table No.3.

In age wise comparison in all the three groups, Expiratory to inspiratory ratio and Valsalva ratio were statistically significant ($P < 0.05$) and 30:15 ratio was highly significant ($p<0.001$) - Table No.4.

These results indicated the involvement of parasympathetic activity with ageing.The parasympathetic activity is lower in females while sympathetic activity is higher in males. So mainly the age to a lesser gender are important factors affecting the cardiovagal BRS, hence the Autonomic Nervous System.

Table No.1: Sex wise comparison of mean values of Parasympathetic tests in Group I:

Para-sympathetic tests	***Group I A(10)***	***Group I B(10)***	***'t' value***	***'p' value***	***Result***
	Mean ± SD	***Mean ± SD***			
RHR	74.06±8.078	72.1 ± 6.41	0.74	p>0.05	Not significant
E : I Ratio	1.13±0.23	1.16 ± 0.124	0.70	p>0.05	Not significant
30 : 15 Ratio	1.92±3.40	1.165 ± 0.135	2.31	p<0.05	Significant
Valsalva Ratio	4.09±4.98	1.675 ± 0.36	1.19	p>0.05	Not significant

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Table No.2: Sex wise comparison of mean values of Parasympathetic tests in Group II:

Para-sympathetic tests	*Group II A(15)*	*Group II B(15)*	*'t' value*	*'p' value*	*Result*
	Mean ± SD	***Mean ± SD***			
RHR	73.27±8.12	77.29±6.64	1.46	p>0.05	Not significant
E : I Ratio	1.23±0.094	1.17±0.13	2.50	p<0.05	Significant
30 : 15 Ratio	0.99±0.30	1.13±0.168	1.57	p>0.05	Not significant
Valsalva Ratio	4.93±8.25	50.60±166.60	1.02	p>0.05	Not significant

Table No.3: Sex wise comparison of mean values of Parasympathetic tests in Group III:

Para-sympathetic tests	*Group III A(15)*	*Group III B(15)*	*'t' value*	*'p' value*	*Result*
	Mean ± SD	***Mean ± SD***			
RHR	74.06±8.078	77.81±7.89	1.31	p>0.05	Not significant
E : I Ratio	1.13±0.23	1.08±0.155	0.63	p>0.05	Not significant
30 : 15 Ratio	1.92±3.40	1.11±0.27	0.92	p>0.05	Not significant
Valsalva Ratio	4.09±4.98	1.52±1.16	2.15	p<0.05	Significant

Table No.4: Comparative study of parasympathetic function tests in different age groups

	RHR	**E : I Ratio**	**30 : 15 Ratio**	**Valsalva Ratio**
Group	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
I	73.08±7.24	1.14±0.17	1.54±1.77	2.88±2.67
II	75.28±7.38	1.2±0.11	1.06±0.23	27.76±87.43
III	75.94±7.98	1.11±0.89	2.66±1.84	4.54±3.07
'P' Value	p>0.05	p<0.05	p<0.001	p<0.05
Result	Not significant	Significant	Highly significant	Significant

Discussion

Many of the previous studies have already suggested that age and sex of the individual influences the cardiovagal BRS in humans, but the experimental evidence is controversial & confusing. Therefore in the present study it was planned to assess the cardiovagal BRS in males and females of different age groups with the cardiovascular parasympathetic function tests.In the present study, it was noticed that decline in parasympathetic activity occurs as the age

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advances and this effect of aging on the parasympathetic activity was much pronounced in females as compared to the males of the same age group.These findings are consistent with the study(KuoT et al) where in a population of normal subjects, using short-term and long-term recordings, it was found predominance of parasympathetic over sympathetic tone in women and vice versa in men.It was also demonstrated that the gender-related difference in parasympathetic regulation diminishes after the age of 50, while sympathetic dominance in men disappears significantly later (11). It was also consistent with the studies carried out by Storm et al., (1989) who studied blood pressure and heart rate responses to the valsalvamaneuver (12).Frey Tomaselli (1994) studied and showed the cardiovascular responses to standing differ, in some respects between the sexes and with age (13).Cowan et al., (1994) observed the effect of gender and age on heart rate variability (HRV) in healthy individuals and in persons after sudden cardiac arrest (14). The sympathetic and parasympathetic nervous system and the baroreflex are the important tools by which Central Nervous System uses the Autonomic Nervous System to maintain homeostasis (15). Sympathetic nervous system activation, diminished cardiovagal functions, peripheral adrenergic functions and decreased baroreflex circulatory control are fundamental features of number of cardiovascular disorders (16).Thus, there was evidence of an age related increase of cardiovascular sympathetic nervous system activity. These findings are consistent with the hypothesis that there is sympathetic nervous system and parasympathetic nervous system compensation of cardiovascular functions in response to an age related decrease in baroreceptor sensitivity (16). The cardiovascular responses of blood pressure, cardiac output, heart rate and other variables to change in posture differ between the sexes. The differences are related to greater decrease of thoracic blood volume with standing in women than the men (17).

Conclusion

There occurs decline in Parasympathetic activity as the age advances, thus the aging has inhibitory influence on the cardio vagal BRS. Also this decline in Parasympathetic activity is much lower in females as compare to males of the same age group. So, aging and to some extent sex of an individual are the significant determinants affecting the cardio vagal BRS and hence thecardiovascular autonomic functions.

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