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Original Article

A prospective observational study of correlation between age and the parasympathetic nervous system

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ABSTRACT:
Aging is associated with changes in the cardiovascular autonomic regulation both under resting and stimulated conditions. Autonomic nervous system functions are altered with aging even in healthy subjects.So present study is conducted to observe correlation between age and parasympathetic nervous system on 125 healthy subjects.3 parasympathetic tests –heart rate response to standing (30:15 ratio), heart rate response to deep breathing (E:I ratio) and valsalva maneuver were performed. In this study ,E:I ratio,30:15 ratio and Valsalva maneuver were negatively correlated with age .But relationships of E:I ratio and 30:15 ratio with age were statistically significant ($P<0.05$).So from this study it may concluded that parasympathetic function declines linearly with advancement of age .
Keywords: Ageing , parasympathetic nervous system, heart rate response to standing (30:15 ratio), heart rate response to deep breathing (E:I ratio) and valsalva maneuver.

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INTRODUCTION

In India 7.1% of the people are over 65 years as against 12% in U.S.A and Britain (as per 2001census). Also in India although the percentage of aged persons to total population is low in comparison to developed countries, nevertheless, the absolute size of aged population is considerable. Thus number of aged persons is continually on the increase in India and worldwide. The autonomic nervous system is divided into sympathetic and parasympathetic nervous systems. The parasympathetic division is primarily involved in relaxation, preparing the body to rest and recover. An increase in parasympathetic activity constricts the pupils, decreases the heart rate and intensifies digestion. Parasympathetic regulation also quickly changes the psychophysical mode of the human body. In old age though both sympathetic and parasympathetic systems are affected but parasympathetic involvement appears to be more frequent than sympathetic.[1]

As age advances, the parasympathetic tone and baroreflex sensitivity are gradually reduced [2].Thus blood-pressure regulations which ultimately may lead to the development of many cardiovascular diseases.[3]

There are many evidences indicating relationship between aging and parasympathetic functions from various parts of the world. But there are few works involving this subject with conventional methods for assessing the parasympathetic functions of Indian origin in this field. The aim of the present study is to therefore observe correlation of parasympathetic function tests with age.

MATERIAL AND METHODS

The present study was carried out in the Department of Physiology in collaboration with Department of Medicine, Dr. S.N. Medical College on 125 healthy individuals of western Rajasthan between the age group of 20-70 years. A informed consent was obtained from patients after explaining the procedure in detail. The procedure was in accordance with the ethical standards of the committee of the institute.

Subjects were checked for symptoms and signs of possible autonomic dysfunctions including orthostatic hypotension (light headedness, blurred vision, sensation of weakness and unsteadiness, fainting or syncope on standing), perspiration, palpitations.

Inclusion criteria

Only healthy subjects of age group of 20 to 70 years and average body mass index of Indian origin will be included in the study.

Exclusion criteria

- Subjects not giving consent for participation.
- History of alcohol intake.
- History of smoking, tobacco consumption.
- History of hypertension or any other clinical signs of cardiovascular diseases.
- Subjects receiving drugs known to affect autonomic function, for example: Adrenergic drugs, Adrenergic blocking drugs, Cholinergic agents, Diuretics, Antihypertensive drugs etc.
- Females with irregular menstrual cycle.

METHOD-CAN *Win* METHOD - following non-invasive cardiovascular autonomic parasympathetic function tests were performed:-

1. Heart Rate variation during deep breathing (Expiration/Inspiration ratio):

While recording ECG, the subject was asked to inhale deeply for 5 seconds followed by exhalation for 5 seconds at a rate of 6 breaths per minute. The ratio between longest R-R interval during expiration and shortest R-R interval during inspiration (E/I ratio) in each respiratory cycle is calculated for evaluation. A value of 1.20 or higher was taken as normal.[4]

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

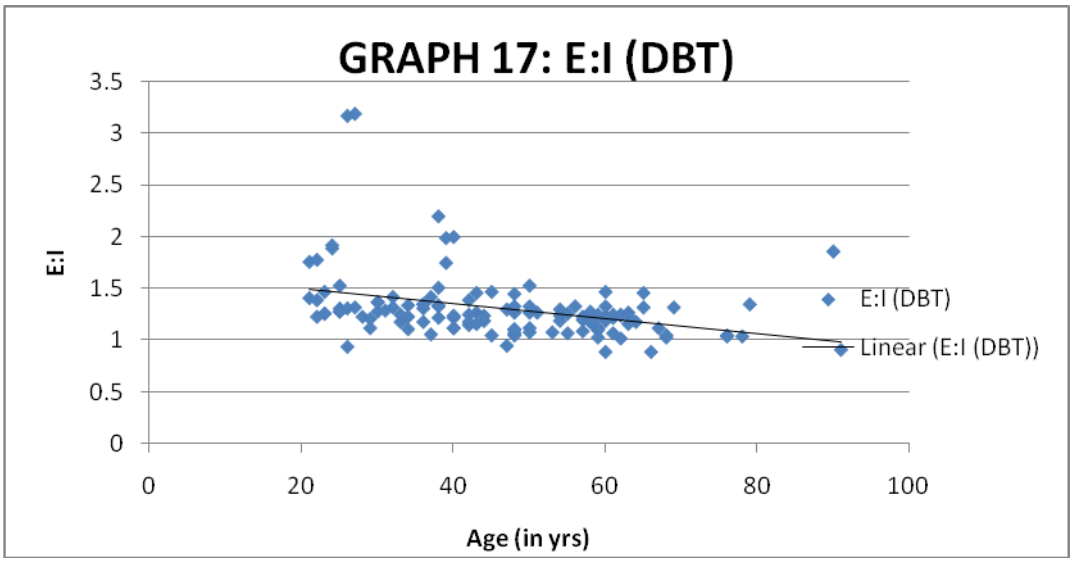
The subject was instructed to lie down comfortably and ECG was recorded to calculate the heart rate. Then the subject was instructed to stand up within 3-4 seconds and remained motionless thereafter. The 30:15 is the ratio of the longest R-R interval at beat 30 during the inspiration/expiration cycle and the shortest R-R interval at beat 15 after standing. It examines the integrity of the efferent parasympathetic branch. The 30:15 ratio of ≥1.04 is taken as normal and value of <1.04 is considered abnormal.[5]

3. Heart-rate response to Valsalva maneuver (VM ratio)

The subject was asked to blow out or to expire forcefully through a mouthpiece attached to the sphygmomanometer to maintain the pressure at about 40mm Hg for 15 seconds. The ECG is recorded simultaneously during this maneuver and 15 seconds afterwards to see the RR interval changes. The valsalva ratio = Longest R-R interval after maneuver (after the strain)/ Shortest R-R interval during maneuver (during the strain). The normal valsalva ratio is >1.21 and in autonomic dysfunction this ratio is <1.21.[5]

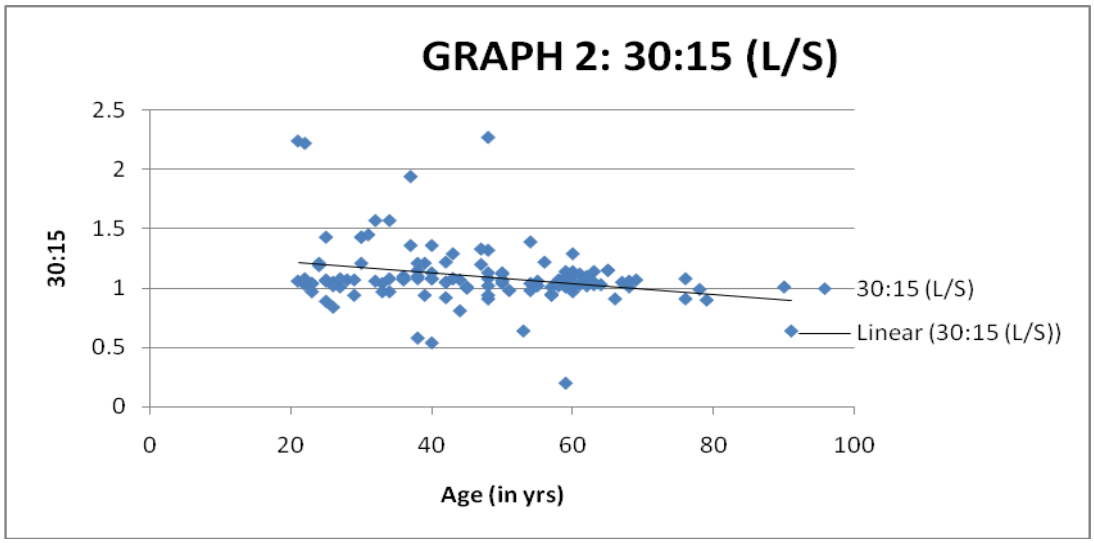
RESULTS

Graph 1 :Relation of AGE with E:I ratio.



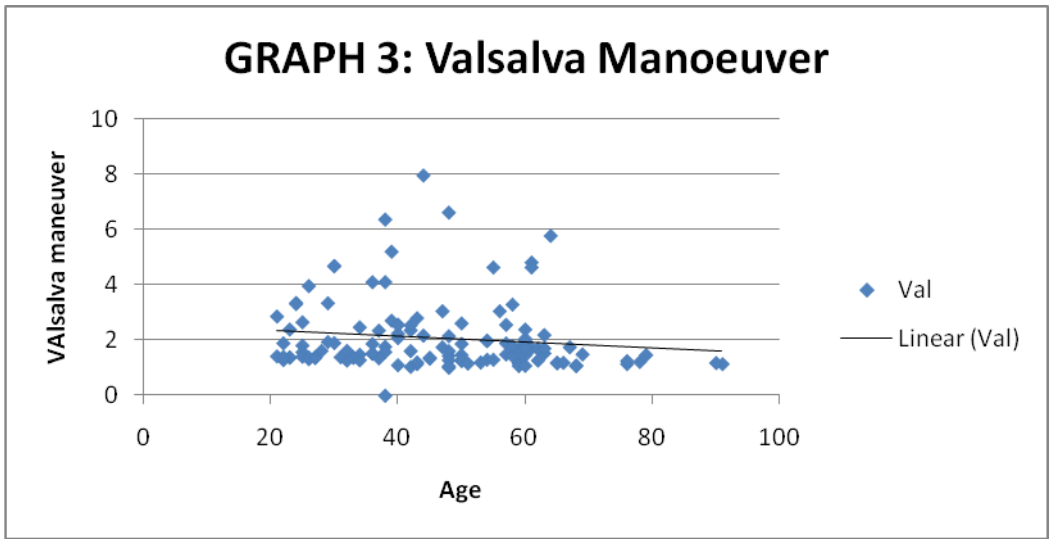
Graph No.1 shows Pearson's correlation between age with E:I ratio. Graph shows that there was negative correlation between age and E:I ratio.On statistical analysis result was highly significant (p-value 0.00)

Graph 2 Relation of AGE with 30:15 ratio



Graph No.2 shows Pearson's correlation between age with 30:15 ratio. Graph shows that there was negative correlation between age and 30:15 ratio.On statistical analysis result was highly significant (p-value 0.00).

Graph 3 : Relation of AGE with VALSALVA MANOEUVER.



Graph No.3 shows Pearson's correlation between age with Valsalva Maneuver ratio. Graph shows that there was negative correlation between age and VM ratio. On statistical analysis result was non significant (p-value< 0.07).

Table 1: Pearson Co-relation table(relation of different test with age).

Test	r value	P value
E:I	-0.34	<0.00
30:15 RATIO	-0.27	<0.00
VALSALVA MANEUVER	-0.13	0.07

Table no. 1 shows comparison of Pearson's co relation between different cardiovascular parameters with age. On comparison Pearson's co relation between different cardiovascular parameters with age ,we found that Pearson negative correlation with age was present between E:I ratio,30:15 ratio and Valsalva maneuver. On statistical data analysis of E:I and 30:15 ratio shows significant results (P<0.05).

DISCUSSION

The present study was carried out in 125 healthy subjects within the age range of 21-70 years. In this study, correlation (by Pearson correlation) of different parasympathetic nerve function parameters was analyzed. Here E:I ratio,30:15 ratio and Valsalva maneuver were negatively correlated with age .Only E:I ratio and 30:15 ratio relationships with age were statistically significant ($P<0.05$).

Our results are in agreement with the study done by Islam T et al [6], Chu TS et al[7], Ian A D O Brien et al [2] ,who also found that age is correlated negatively with heart rate response to standing, deep breathing and valsalva ratio.In a study Ziegler et al [8] found decline in valsalva maneuver,30:15 ratio and E:I ratio with increase in age.In another study done by Gautshy et al[9] found decline in valsalva maneuver and 30:15 with increasing age.Low P A et al[10] found decline in both valsalva maneuver and E:I ratio in his study.

Heart rate response to deep breathing is very sensitive & detects the parasympathetic dysfunction at the earliest. Different researchers suggested that the vagal tone is reduced or loss of vagal tone occurs gradually as age advances [6].Again vagal damage causes reduction of heart rate to various stimuli [11]. Due to this, baroreflex activity may be decreased with increase in age .The cause for the decline in autonomic control of the heart is thought to be a result deterioration of cardiovagal baroreflex sensitivity [12]. One of the primary mechanisms believed to be responsible for such change is decline in arterial compliance (i.e. in carotid artery and aorta) which determines the amount of stretch to which baroreceptors are exposed for any change in intravascular pressure [13]. Similarly, impaired transmission of impulse through both afferent and efferent pathway as well as reduced central integration of afferent inputs may be the contributory factors for this lower baroreflex activity in elderly subjects.[6]

All these factors may be responsible for decline in parasympathetic activity in elderly.

CONCLUSION

Hence based on the results of above study it is concluded that increasing age has an important role in declining parasympathetic functions. So in multiple of chronic diseases and in managing geriatric problems, the autonomic status of the subject and rate of its decline should be considered.

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