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AGE AND SEX RELATED CHANGES ON RR INTERVAL AND ST HEIGHT IN ELECTROCARDIOGRAM (ECG) OF HEALTHY INDIVIDUALS

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ABSTRACT: BACKGROUND AND OBJECTIVES: With advancing age, degenerative changes occur in heart muscle and its conduction system. This study was undertaken to see the ECG changes in different age groups of healthy adults. **MATERIALS & METHODS:** A cross sectional study was conducted in a group consisting of 150 (75 male and 75 female) Healthy adults in the age group 21 to 80 years. All the subjects were divided into different subgroups according to their sex and age. Lead II ECG was recorded on all subjects in supine position in an ambient temperature for 3 minutes by using Power lab. And the analysis of the ECG was done by the software in the same instrument. RR interval, Heart rate and ST height were used for analysis. **RESULTS:** There was prolongation of R-R interval and decrease in heart rate and ST height with increasing age in both males and females. **CONCLUSION:** In this study we saw changes in different ECG parameters in both males and females of different age groups. There were changes in some of the ECG parameters between males and females of different age groups. But all these changes were within physiological limits.
KEYWORDS: Electrocardiogram, Aging.

INTRODUCTION: The electrocardiogram (ECG or EKG) is a graphic recording of electric potentials generated by the heart. The signals are detected by means of metal electrodes attached to the extremities and chest wall and are then amplified and recorded by the electrocardiograph. ECG leads actually display the instantaneous differences in potential between these electrodes. The process of normal aging in the absence of disease is accompanied by a myriad of changes in body systems. Health and lifestyle factors together with the genetic make-up of an individual determine the response to these changes. With advancing age, degenerative changes occur in heart muscle and its conduction system. Some of the pathways of pacemaker system may develop fibrous tissue and fat deposits. Functionally, there is a prolongation of myocardial contraction and relaxation time and decrease in ventricular compliance. The number of pacemaker cells in the SA node is reduced which is possibly related to reduce heart rate to both sympathetic and parasympathetic stimuli.[1] It is necessary at intervals to revise our standards of the normal in all sciences. This is particularly desirable in electrocardiography, where important advances are made yearly in its application to the diagnosis of cardiac disease. A critical analysis of the literature in the field of electrophysiological pattern in normal population reveals that though during last century a sizable amount of literature has been generated in this field, still there is a wide gap in differentiation between a 'normal" and 'abnormal' electrocardiogram for a particular population. The differentiation between various abnormal ECG pattern and their

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correlation with specific pathology requires further and definite knowledge about the normal ECG pattern in a wide range of population. Moreover, most of data on normal electrocardiographic patterns are obtained from western population and very few of Indian studies tried to see the effect of aging on ECG. Therefore in this study we tried to see the effect of aging on different parameters of ECG.

MATERIALS & METHODS: A cross sectional study was conducted in a group consisting of 150 (75 male and 75 female) Healthy adults in the age group 21 to 80 years. All the male and female subjects were divided into 3 subgroups according to their age. Group I (21-40 years), Group II (41-60 years) and Group III (61-80 years) respectively. The study protocol was approved by the Institute's Ethical Committee and each subject signed an informed consent statement prior to participation and could withdraw without prejudice at any time. Subjects with a history of systemic diseases like hypertension, heart diseases, diabetes mellitus, smoking, alcohol consumption and medication were excluded from the study. After explaining the procedure the subjects were asked to take rest for 10 minutes. Then Lead II ECG was recorded on all subjects in supine position in an ambient temperature for 3 minutes by using Power lab 8/30 series with dual bio amplifier (Manufactured by AD instruments, Australia with model no ML870). And the analysis of the ECG was done by the software in the same instrument. Blood pressure, Body Mass Index (BMI) and Waist/Hip ratio were also measured in all the subjects. RR interval, Heart rate and ST height were used for analysis.

One way ANOVA test followed by post-hoc Turkey-Kramer Multiple Comparisons Test and students 't' test for parametric and Mann-Whitney Test for non-parametric data were used for comparison between groups. Pearson's correlation coefficient 'r' was used to examine relationship between RR interval and ST segment changes with different age groups. A two tailed p-value less than 0.05 will be considered as significant.

RESULTS: There was prolongation of R-R interval and decrease in heart rate and ST height with increasing age in both males and females. Compared between males and females in different age groups, there was statistically significant difference in ST height in all the age groups and only in heart rate and RR interval in group II (Tables 2 to 6).

DISCUSSION: In our study it was observed that the R-R interval and the heart rate were within normal range in all the age groups of both the sexes. There was highly significant prolongation of R-R interval and decrease in heart rate with increase in age in males and females. On comparison between males and females there was higher value of heart rate in females in all age groups with a significant rise in age group 21 – 40 years. These finding are similar to the previous studies.[2,3] The probable explanation for these findings can be as age increases, vagal tone increases and heart rate decreases. The SA node loses some of its cells. These changes may result in a slightly slower heart rate. The heart rate is slightly higher in females as compared to males due to lower systemic blood pressure and more resting sympathetic tone.

High sympathetic activity can lead to myocardial membrane properties that give rise to early after depolarizations and dispersion of repolarization.[4-5] Furthermore, noradrenaline levels

have been reported to increase with age.[6] Some of the increased sympathetic activity can be explained by loss of arteriolar compliance with age as well as by deteriorating function of the sinus node compensated by excess sympathetic activity.[7]

The values of ST height in our study decreased in both males and females as the age advanced. When compared between gender in all the age groups, females had significant decrease in ST height. Recent studies revealed that ST segment depression is a more important criterion in evolving inferior wall acute myocardial infarction,[8] and there is definite gender difference in value of ST-segment depression.[9] ST segment abnormalities indicate subclinical myocardial damage from coronary atherosclerosis that later may be clinically manifested as sudden death. These abnormalities in the electrocardiogram can reflect inequalities in ventricular recovery, and disparity in recovery of excitability in cardiac muscle is related to increased vulnerability to arrhythmias. Thus, the electrocardiographic signal permits detection of cardiac status at high risk of ventricular arrhythmias.

CONCLUSION: In conclusion, we saw changes in different ECG parameters in both males and females of different age groups. There were changes in some of the ECG parameters between males and females of different age groups. But all these changes were within physiological limits.

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Parameters	Group I	Group II	Group III	Post hoc multiple Comparison
BMI (kg/m^2)	24.02±2.66	23.16±1.10	22±2.73	Gr I vs II, p>0.05 Gr I vs III, p<0.01* Gr II vs III, p>0.05
W/H ratio	0.91±0.04	0.94±0.03	0.91±0.03	Gr I vs II, p<0.05* Gr I vs III, p>0.05 Gr II vs III, p>0.05
Table 1: Comparison of Anthropometric parameters between males of different age groups					

* Statistically significant.

Parameters	Group I	Group II	Group III	Post hoc multiple Comparison
RR Interval (s)	0.73±0.09	0.79±0.09	0.82±0.13	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05
HR (bpm)	81.92±7.39	76.31±10.39	75.9±7.24	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05
ST height (mV)	0.16±0.1	0.11±0.1	0.09±0.06	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05
Table 2: Comparison of ECG Parameters between males of different age groups					

* Statistically significant.

Parameters	Group I	Group II	Group III	Post hoc multiple Comparison
RR Interval (s)	0.68±0.18	0.69±0.06	0.76±0.07	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05
HR (bpm)	85.52±11.3	83.26±12.3	77.33±10.1	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05
ST height (mv)	0.052±0.06	0.011±0.01	0.03±0.018	Gr I vs II, p<0.01* Gr I vs III, p>0.05 Gr II vs III, p>0.05
Table 3: Comparison of ECG Parameters between females of different age groups					

* Statistically significant.

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Parameters	Male	Female	p-value
RR Interval (s)	0.73±0.09	0.68±0.18	P=0.25
HR (bpm)	81.92±7.4	85.5±11.3	P=0.19
ST height (mv)	0.16±0.1	0.05±0.06	P=0.001*
Table 4: Comparison of ECG Parameters between males & females of age group-I			

* Statistically significant.

Parameters	Male	Female	p-value
RR Interval (s)	0.79±0.10	0.69±0.06	P=0.0003*
HR (bpm)	76.3±10.4	83.26±12.3	P=0.04*
ST height (mv)	0.12±0.1	0.011±0.01	P=0.001*
Table 5: Comparison of ECG Parameters between males & females of age group-II			

* Statistically significant.

Parameters	Male	Female	p-value
RR Interval (s)	0.82 ± 0.13	0.76 ± 0.07	P=0.08
HR (bpm)	75.98 ± 7.24	77.3 ± 10.16	P=0.59
ST height (mv)	0.09 ± 0.06	0.03 ± 0.018	P=0.001*
Table 6: Comparison of ECG Parameters between males & females of age group-III			

* Statistically significant.

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