A Comparative Study of Electrocardiographic Changes between Non smokers and Smokers

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Abstract— **cardiovascular diseases were on the constant rise in developing countries. Cigarette smoking is a major risk factor for cardiovascular disease. In this study changes in ECG were evaluated in healthy adult male smokers and non smokers to identify the possible high risk factor for cardiovascular diseases. ECG was recorded in smokers and non smokers. Subjects age ranged from 22 to 30 years were selected. After taking consent and a detailed history from subjects, electrocardiogram was recorded during resting supine position. The ECG results are evaluated for different parameters like heart rate, P-wave, P-R interval, QRS complex, QT interval, and T-wave. Probability (p) values of 0.05 are less (p < 0.05) was considered for statistical significance. There is statistically significant increase in the heart rate and decrease in QRS complex and T-P interval in smokers compared to non-smokers. P-wave, P-R interval, QT interval, QRS complex, ST segment and T-wave does not show statistically significant results. Probability (p) value is calculated with the help of mean, standard deviation (SD), number of observation (N). Results showed that smoking potentially increase the risk of cardiovascular disease.**

Keywords— **Electrocardiogram, Heart rate, QRS complex, T-P interval, Probability (p)**

I. INTRODUCTION

Cigarette smoking is one of the strongest contributors to the risks of cardiovascular diseases, including coronary heart disease, stroke, sudden death, peripheral artery disease, and aortic aneurysm. [1] Recording of ECG is one of the easiest methods of assessing cardiovascular dysfunction. An Electrocardiogram is simply a representation of the electrical activity of the heart muscle as it changes with time. Smoking is a well established risk factor for ischemic stroke and myocardial infarction (MI) [2]. Smoking has varied effects on the cardiovascular system. The quality, quantity, duration and frequency of smoking play an important role in determining how much smoking is harmful to the cardiovascular system. Smoking substantially increases the risk of stroke and coronary heart disease, and quitting smoking is an important step toward preventing cardiovascular disease. Studies have shown that smoking habit induces changes in the normal ECG pattern, but the results are not consistent. The mean QT and QTc dispersion before and after smoking in different age groups in non-smoker and smokers with different backgrounds of smoking habits was compared and a significant rise in QTd was consistent in all age groups of non-smokers and smokers with different smoking back-grounds.[8] ECG

changes in healthy adult male smokers and their findings showed that smoking causes no change in ECG wave forms except P-R interval.[9] The prevalence of cigarette smoking has peaked among the adult. The present study has been undertaken to see ECG changes in healthy adult male smokers.

II. MATERIAL & METHOD

In this study included male subjects 22-30 years of age selected. After taking consent and a detailed history from subjects, electrocardiogram was recorded during resting supine position. They were divided into two groups, smokers and non smokers. Each group contained 4 subjects. A detailed assessment was done and various parameters were recorded which includes personal details like name, age, occupation, address, smoking history, personal history, family history and past history. Subjects with systemic illness like diabetes mellitus, hypertension, and bronchial asthma were excluded. After taking consent and a detailed history from subjects, Lead II ECG was recorded using BIOPAC Inc. USA. The BIOPAC system comprised an MP150 data acquisition unit and ECG signals were stored and analyzed using acqknowledge software version 4.1.

III. SIGNAL ACQUISITION

Lead II ECG was recorded using electrocardiogram amplifier module (ECG 100C) in BIOPAC. Three AgCl electrodes are used to record Lead II ECG signal. Two electrodes are affixed on right arm (RA) and left leg (LL). Ground electrode is placed on right leg (RL) of subject. The electrode are connected to ECG amplifier (ECG 100C) using three leads. The following hardware setting of ECG 100C are used to record ECG II of subject: Amplifier Gain: 1000, Mode: Normal, Low pass filter: 35 Hz, High pass filter: 0.5 Hz.

IV. STATISTICAL ANALYSIS

Probability (p) value is calculated with the help of mean, standard deviation (SD), number of observation (N).

- p < 0.001 : Highly significant
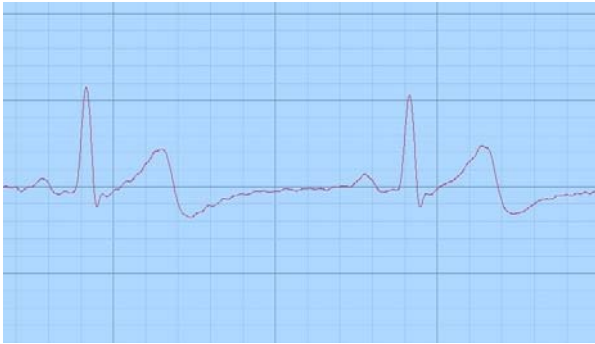- p < 0.05, p < 0.01: Significant
- p>0.05: Not significant
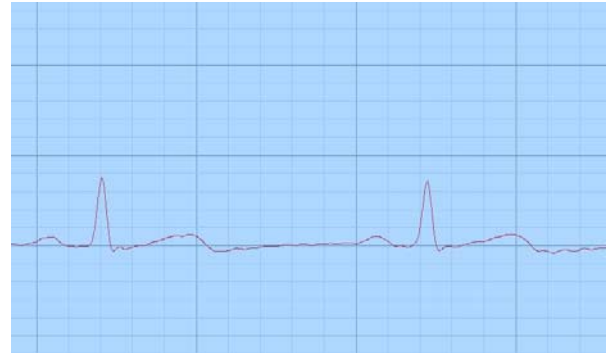
Fig1- Recorded ECG signal for non-smoker subject

Fig2- Recorded ECG signal for smoker subject

V. RESULT

TABLE I

Subject	P wave (sec)	P-R Interval (sec)	R-R Inter-val (sec)	QRS Complex (sec)	QTc Interval (sec)	ST segment (sec)	T-P interval (sec)	T wave (sec)
1	0.1	0.15	0.78	0.07	0.3	0.05	0.28	0.14
2	0.1	0.18	0.85	0.07	0.35	0.08	0.22	0.15
3	0.1	0.13	0.76	0.08	0.33	0.06	0.30	0.20
4	0.02	0.13	0.88	0.05	0.34	0.03	0.20	0.19
5	0.04	0.14	0.77	0.07	0.33	0.07	0.32	0.18
6	0.1	0.12	0.86	0.06	0.43	0.07	0.24	0.20
7	0.07	0.13	0.75	0.08	0.33	0.04	0.30	0.10
8	0.1	0.15	0.87	0.07	0.32	0.03	0.20	0.24

TABLE II

Variable	Particular	Non Smoker	Smoker	P value
P wave	Mean ± SD	0.078 ± 0.025	0.08 ± 0.035	0.9289
P-R interval	Mean ± SD	0.138±0.0083	0.145±0.023	0.5877
R-R interval	Mean ± SD	0.7125±0.02	0.83±0.03	0.001
QRS interval	Mean ± SD	0.075±0.005	0.0625±0.0083	0.0418
QTc interval	Mean ± SD	0.32±0.013	0.36±0.042	0.1187
S-T segment	Mean ± SD	0.055±0.011	0.053±0.023	0.8805
T-P interval	Mean ± SD	0.3±0.014	0.22±0.0165	0.0418
T wave	Mean ± SD	0.155±00384	0.195±0.032	0.1606

Heart rates were 74 ± 2 and 83 ± 3 among nonsmokers and smokers respectively. Heart rate showed a statistically significant increase in smokers groups compared to nonsmokers. In smokers four subjects showed decrease in P-R interval but have no statistical significance. In smokers group two subjects showed elevated ST segment and one subject with depressed ST segment, but no statistical significance. QRS complex measurements (in seconds) were 0.075±0.005, 0.0625±0.0083 in nonsmokers and smokers respectively. There is statistically significant decrease in smokers compared to nonsmokers group. T-P interval values (in sec) were 0.3±0.014, 0.22±0.0165 among nonsmoker's and smoker's respectively. There is statistically significant decrease seen in smokers compared with nonsmokers.

VI. DISCUSSION

Smoking has various kinds of effects on the cardiovascular system. The quantity, duration and frequency of smoking play an important role in cardiovascular disease determination. In available literatures, it has been seen that smoking increased the heart rate. It was found that in smokers there was a little decrease in the duration of P-R interval and QRS duration. But it was not statistically significant. [4] In this study P-wave and P-R interval were within normal range and was not statistically significant. QRS complex measurements in this study showed decrease in smokers. Cigarette smoking increases the velocity of conduction and shortens the effective refractory period at the AV node [5]. Smoking was associated with shorter QT_C than non smokers. [6] QT_C interval in this study does not show any statistical significance. Smoking causes down sloping of ST segment in the subject, which predicts any kind of future coronary events. [7] In this study 2 subjects showed non-specific ST changes in smokers group of no significance. T-P interval in this study showed statistically significant decrease in smokers compared to nonsmokers.

VII.   CONCLUSION

The present study was conducted to assess the electrocardiographic changes in the cardiovascular system. The electrocardiographic results were evaluated for different parameters like heart rate, P-wave, P-R interval, QRS complex, QTC interval, ST segment and T-wave. Heart rate shows a significant change for smokers. There is no significant change seen in P-wave, P-R interval and QTC interval among both groups. QRS complex is decreased significantly in smokers compared to non smokers. T-P interval reduction is seen in smokers, which may alter the heart rate.

The result from this study among non-smokers and smokers shows that smoking of even a single cigarette can potentially increase the risk of sudden cardiac death in all individuals. So it is the responsibility of ours and physicians to discourage smoking of even a single cigarette, in the whole community.

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