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STUDY OF R AND S WAVE VOLTAGES OF ELECTROCARDIOGRAM (ECG) IN SMOKERS AND ALCOHOLICS

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ABSTRACT

The Electrocardiogram (ECG or EKG) is a simple and noninvasive, inexpensive test helps in assessing the cardiovascular status. Chronic smoking and chronic consumption of alcohol induce changes in various components of the ECG and are established. R voltage and S voltage represent the early and late depolarization of the ventricles and these are less addressed in the literature with respect to smoking and alcoholism. Hence we intended to study the same. Age, height and weight matched smokers, alcoholics and non alcoholic non smoking group were selected from the population constituting 50 adult men in each group. The ECG was recorded; R voltage, S voltage and Ventricular activation time (VAT) were analyzed. Heart rate was significantly increased in both alcoholics and smokers. R and S voltages were decreased both in smokers and alcoholics. VAT was increased. This study showed that smokers and alcoholics are at risk for conduction problems also.

KEY WORDS: Electrocardiogram, Alcoholism, Smokers, R wave, S wave

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INTRODUCTION

The electrocardiogram (ECG) is the graphical recording of the electrical activity of the heart using the electrodes positioned on the body surface to reflect the activity from variety of spatial perspectives. It is a simple, noninvasive and inexpensive. It is useful in detecting various conduction disturbances, myocardial ischemia and metabolic disturbances[1, 2]. Cigarette smoking is one of the most harmful and addictive habits which is widespread all over the world. Cigarette smokers are likely to develop IHD at a younger age and having it are most likely to die suddenly compared to non-smokers[3]. Alcohol consumption one of the old habit and its effect and consequences are very well documented in the history[4]. Alcohol consumption is associated with variety of factors such as political liberalization, marketing and demographics. World Health Organization (WHO) estimates that there are about 2 billion people worldwide consuming alcohol beverages and 76.3 million with diagnosed alcoholic disorders[5]. Studies have shown that consumption of ethanol causes depression of myocardial contractility, adverse effects on ventricular function, dilated cardiomyopathy, systemic hypertension and cardiac arrythmia[6]. In milder cases abstinence from alcohol can revert back some of the cardiovascular changes to nearly normal or in more severe cases to recovery with little residual damage to heart[6]. Diastolic function is impaired during acute exposure to cigarette smoke[8] and in one third of alcoholics[9]. ECG changes associated with diastolic dysfunction (DD) in smokers and an alcoholic is poorly defined. Prolongation of the Ventricular Activation Time (VAT) has been found to be associated with diastolic dysfunction[10]. Hence this study intended to assess the VAT in smokers and alcoholics. Smoking and alcohol abuse are the frequently associated with cardiac disorders resulting in morbidity and mortality. This study was taken up to detect the electrocardiographic changes in apparently healthy smokers and alcoholics so that at risk individuals can be identified and counseled to quit the habit and prevent them entering a disastrous phase. Extending the study of Electrocardiogram (ECG) changes in chronic smokers and alcoholics, now we intended to study the R wave, S wave and Ventricular activation time (VAT) as these are associated with the action potentials of the heart[11].

MATERIALS AND METHODS

This case control study was undertaken in the Department of Physiology JJMMC, Davangere. Age, height and weight matched smokers, alcoholics and non alcoholic non smoking group were selected from the population constituting 50 adult men in each group. Smokers selected based on WHO's ICD-10 criteria[12]. Alcoholics were selected as per Fourth Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) [13] Smokers selected were non alcoholic and Alcoholics were non smokers to avoid the interference. Subjects with Hypertension, Diabetes mellitus and cardiovascular disorders were excluded. Each subject's detailed history was taken followed by physical and systemic examination. Height, weight, blood pressure, respiratory rate was measured prior to ECG recording. Body Mass Index (BMI) was also calculated. Mean and standard deviation of various parameters of the ECG were recorded and compared between the groups. Friedman rank sum test was used to test the significance of difference between the groups. Spearman's rank correlation was used to test the significance of changes present.

Recording of ECG

The subjects were made to rest for 5 minutes in the supine position. All the electronic gadgets were taken away. A 12 lead electrocardiogram (Cardiant 108-T-MK-VI manufactured by BPL Electronics Ltd.) was recorded at 25mm/sec and labeled with subjects name and age. It was later analyzed for Heart rate, voltages of R and S wave and Ventricular activation time (VAT).

RESULTS

Mean and standard deviation of age, height and weight of the controls, smokers and

alcoholics were calculated and tested for the difference [Table 1]. It was found that there was no significant difference in them. Also, R and S voltages were significantly decreased in both alcoholics and smokers. ($p < 0.01$). VAT was found to be increased in both alcoholics and smokers.

Table 1
Comparision of various factors between control, smokers and alcoholic subjects

	Controls Mean ± SD	Smokers Mean ± SD	Alcoholics Mean ± SD	Friedman rank sum test
Age (yrs)	38.36±8.48	39.28± 10.02	40.84±10.92	p = 0.46 NS
Height (cm)	169.30±8.50	167.00±9.90	168.92±5.70	p = 0.95 NS
Weight (kg)	58.32±7.34	59.68±8.81	58.32±9.06	p = 0.60 NS
Voltage of R-wave (in mm)	17.44±3.49	14.08±4.32	14.26±4.08	**p < 0.01 HS**
Voltage of S-wave (in mm)	15.26±3.97	11.60±3.59	11.32±4.30	**p < 0.01 HS**
VAT (in sec)	0.02±0.00	0.03±0.01	0.03±0.00	**p < 0.01 HS**

Students't' test; HS = Highly significant; NS = Not significant

Spearman's rank correlation showed that there is significant correlation between R and S wave and also between S wave and VAT ($p < 0.01$). [Table 2].

Table 2
Spearman's rank correlation between the R wave, S wave and VAT

		Controls	Smokers	Alcoholics
R vs S	**r value**	-0.17	0.14	0.61
	P value	0.21	0.32	**<0.01**
R vs VAT	**r value**	-0.21	0.10	0.15
	P value	0.13	0.45	0.27
S vs VAT	**r value**	-0.06	0.11	0.38
	P value	0.64	0.42	**<0.01**

r value = Correlation co-efficient; Highly significant (p < 0.01); Significant (p < 0.05); Not significant (p > 0.05)

DISCUSSION

Smoking and alcoholism are the frequently seen adverse habits spread across all socio economic strata. In our study we noted; R voltage and S voltages were decreased both in smokers and alcoholics and VAT was increased. R wave voltage is attributed to early ventricular depolarization[14]. Variety of factors affects the R wave. Increase in the R wave aptitude is seen in conditions like anterior wall myocardial infarction, ventricular hypertrophy and decreased central blood volume. But, decrease in R voltage is non-specific and seen in conditions like obesity. This study has shown that the decrease in R voltage in both smokers and alcoholics. S voltage represents the late ventricular depolarization, decreased S voltage is less reported[15]. Myopathic changes like dilation and thinning of ventricular walls are found in chronic alcoholism and may have the role in affecting the depolarization and may be responsible for the changes in R & S voltages. Hence, these changes indicate that the conduction system and cardiac musculature are affected[16]. Further studies at the molecular level may be needed to prove the specific changes in cardiac tissue or its conduction system due to smoking and alcohol. Though the R wave and S wave changes are non specific in smokers and alcoholics, they should be used to warn the patient of probable adverse cardiac events. Ventricular activation time is the time taken for the impulse to traverse the myocardium from

the endocardial to the epicardial surface. Hence, prolonged VAT denotes the diastolic dysfunction. In this study VAT was found to be increased in the study groups, indicating the presence of diastolic dysfunction in asymptomatic alcoholics and smokers.

CONCLUSION

This showed that both smokers and alcoholics were associated with R and S voltage changes in the ECG. Though they were of non specific nature still they imply the presence of damage to either the myocardial tissue or the conduction system. Therefore, performing ECG in smokers and alcoholics is of important to sensitize the individuals to quit the habit as well as for categorizing them as at risk and monitor them to prevent the cardiovascular risk.

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