ORIGINAL RESEARCH

A Study of Blood Pressure and Electrocardiography Changes among Smokers and Non Smokers

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ABSTRACT

Introduction: Tobacco smoking is one of the common cause of the preventable deaths globally. It contains nicotine which causes physical and psychological dependencies increases the blood coagulability and causes conduction block, re-entry and ventricular fibrillation. Cigarette components causing cardiovascular abnormalities assessed by doing cheapest method ECG.

Material and Methods: A prospective case control study was done on 100 smokers and 100 non smokers. Detailed clinical examination was done to rule out any other physical illness. BP and 12 lead ECG were done in all participants.Systolic blood pressure, diastolic blood pressure, Resting heart rate, the p wave, the PR interval,the QRS complex,QTc(corrected QT interval),ST segment,T wave abnormalities were assesed in both group and statstical analysis was done by unpaired T test.

Result: Prevalence of hypertension was higher in smoker's.A significant correlation with elevated systolic blood pressure,diastolic blood pressure and mean arterial blood pressure was noted.(p ≤ 0.01).The heart rate was increased in smokers which was statstically significant.The RR interval,The analysis showed that QTc interval was shortened and that the QRS complex duration was widened the QT interval and the ST segment were shortened as compared to those in the non smokers which was highly significant statstically.QTc interval was shortened and that the QRS complex duration was widened in the smokers, although the values did not show any statistical significance.

Conclusion: ECG is an important tool in predicting cardiovascular morbidity in smokers.Not only the ST-T changes or chamber hypertrophy but also resting heart rate, PR inerval and QT interval should be measured in smokers periodically to predict cardiovascular involvement early.

Keywords: Blood Pressure, Electrocardiography, Smokers and Non Smokers

INTRODUCTION

Smoking is important and independent risk factor for coronary heart disease. Men younger than 65 years with smoking 25 cigarettes per day had increased risk of coronary artery disease than that of non-smoker. Effects of smoking on cardiovascular system are varied[1]. The frequency and duration of smoking plays an important role in determining the extent of harm caused to cardiovascular system[2]. Binding of nicotine to nicotine cholinergic gate on cation channel receptor throughout body especially heart, pancreas, spleen, caecum, testis and eyes.[3] It is facilitated by increase oxidative stress by direct effect of nicotine on conduction and re-entry pathway and also increase vulnerability to ventricular

arrhythmias.[3] An Electrocardiogram is a graphic recording of electric potentials generated by the heart.Recording of ECG is one of the easiest, cheap and reliable methods of assessing cardiovascular function. Various Studies have shown that smoking habit induces changes in the normal ECG pattern like increase in heart rate short PR interval, QTc interval shortening but the results have been inconsistent. This study was conducted with aim to observe changes in blood pressure, resting heart rate various ECG parameters amongst smokers and non-smokers.

MATERIAL AND METHODS

This was a prospective case control study conducted at a tertiary care teaching hospital from October 2015-September 2016. Cases were apparently healthy male smokers between age ≥18 years, selected from among students and staff of the institute, and attendants of patients visiting outpatient departments at the hospital. Age and Sex matched controls(non-smokers) were also considered for study. The research procedure followed was in accordance with the approved ethical standards and study was approved by Institutional Ethics Committee (Human).

A written consent was taken from all potentially eligible subjects. Detailed history was taken and physical examination was performed and recorded on predesigned proforma from each patient and informed consent was obtained from those willing to participate in the study.

The smoking history and their past medical history were also obtained in case if they are suffering from chronic diseases Smokers were divided into the following categories[4] Mild smokers (1-10 cigarettes or 1-15 bidis per day), Moderate smokers (11-20 cigarettes or 16-30 bidis per day), Heavy smokers (21 or more cigarettes or 31 bidis per day). Blood pressure (BP) measurements were taken from each patient's right arm in the seated position by using mercury sphygmanometer and recording resting radial pulse rate. The final study group consisted of 100 smokers and 100 non-smokers.

Subjects were asked to abstrain from smoking and caffeine beverages, 2 hours prior to the taking of the ECG recording

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International Journal of Contemporary Medical Research
Volume 5 | Issue 1 | January 2018 | ICV: 77.83 | ISSN (Online): 2393-915X; (Print): 2454-7379

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and blood pressure measurment. A 12 lead electrocardiogram was recorded in each subject in lying down.The ECGs were evaluated for any cardiac abnormality in terms of rate, frontal axis deviation, conduction defect, arrhythmia, chamber hypertrophy or any change suggestive of ischemia With special emphasis on the resting Heart rate, P wave, PR interval, QRS duration, QTC interval, ST segment, T wave, TP interval and frontal axis

STATISTICAL ANALYSIS

Data was analyzed using Statistical Package for Social Sciences, version 20
(SPSS Inc., Chicago, IL). Results for continuous variables are presented as mean ±standard deviation, whereas results for categorical variables are presented as number
(percentage). Student t-test was used for comparison between smoker and non-smokers groups. The level $P < 0.05$ was considered as the cutoff value or significance.[81]

RESULTS

There is statistically significant difference in both groups. (p<0.001); the people in non smoker group were younger as compared to smokers.Gender distribution pattern amongst male and female is also statistically significant in both groups (p<0.05), the nonsmoker group has more females as compared to smoker group.(table 1)

The pulse rate, systolic blood pressure, diastolic blood pressure is significantly high among smokers as compared to non smokers (P<0.001)(figure1)

Smokers have significantly higher p wave voltage, short QRS and QT intervals (p<0.05) and short PR interval (p<0.001) as compared to non smokers (table 2). None of the nonsmoker had any ST elevation or depression as compared to smokers where 23% had such changes (table 3). None

Age group (years)		Smoker* (N=100)	Non-smoker* (N=100)	P value
≤ 30 year		15 (15.0%)	37 (37.0%)	<0.001
31 to 40 year		16 (16.0%)	23 (23.0%)	
41to 50 year		20 (20.0%)	20 (20.0%)	
51 to 60 year		29 (29.0%)	14 (14.0%)	
>60 year		20 (20.0%)	6 (6.0%)	
Mean Age(Mean ±SD)		49.14±14.12	37.93±13.23	<0.001
Gender	Male	74 (74.0%)	57 (57.0%)	
	Female	26 (26.0%)	43 (43.0%)	0.0170
*= frequency (%)				

Table-1: Demographic profile age wise and sex wise distribution in both groups

	Smoker (Mean ±SD) (N=100)	Non-smoker (Mean ±SD) (N=100)	P value
P wave voltage	1.53±0.51	1.35±0.70	0.040
P wave duration (seconds)	0.082±0.03	0.081±0.03	0.846
PR interval (seconds)	0.16±0.04	0.18±0.04	<0.001
QRS duration (seconds)	0.040±0.0	0.044±0.02	0.059
QT interval (milliseconds)	361.2±25.4	376.8±51.27	0.007

Table-2: Comparison of ECG parameters between smokers and non-smokers

ST segment	Smoker (Number of patients (%) (N=100)	No Smoker (Number of patients (%) (N=100)
No elevation or depression	77 (77.0%)	100 (100.0%)
Elevation or depression	23 (23.0%)	0 (0.0%)

Table-3: ST segment changes in smokers and non-smokers

T wave morphology	Smoker (Number of patients (%) (N=100)	Non Smoker (Number of patients (%) (N=100)
Normal	78 (78.0%)	100
Abnormal	22 (22.0%)	0

Table-4: T wave morphology in smoker and nonsmoker group

Block		Smokers (Number of patients (%) (N=100)	Non-Smokers (Number of patients (%) (N=100)
No Changes		90 (90.0%)	100
Change		10 (10.0%)	0
Change	Right bundle branch block	6 (6.0%)	0
	Left bundle branch block	3 (3.0%)	0
	Bifasicular block	1 (1.0%)	0

Table-5: Bundle branch block observed in smokers and non smokers

International Journal of Contemporary Medical Research
ISSN (Online): 2393-915X; (Print): 2454-7379 | ICV: 77.83 | Volume 5 | Issue 1 | January 2018

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Ventricular Hypertrophy	Smoker (Number of patients (%)) (N=100)	No Smoker (Number of patients (%)) (N=100)
No	89 (89.0%)	100 (100.0%)
LVH	10	0
RVH	1	0

Table-6: Showing Ventricular Hypertrophy findings in both groups
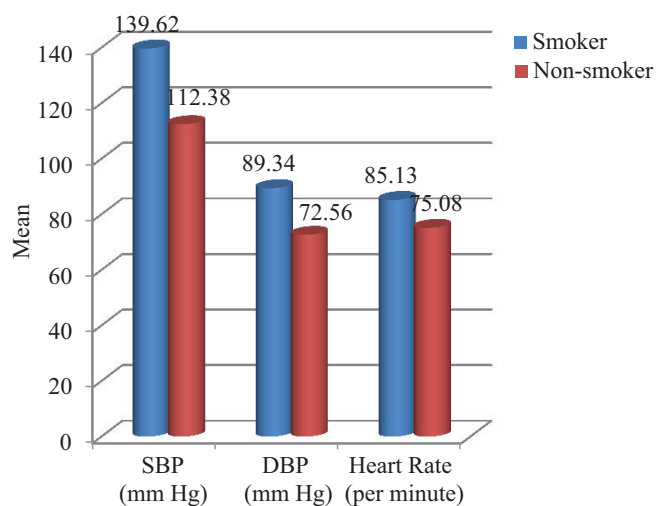

Figure-1: Mean SBP DBP and Pulse in smokers and nonsmoker groups

of the non smoker had T wave abnormality as compared to smoker group; wherein 22% had such abnormalities (table 4). 10 percent of smokers had bundle branch block. Right bundle branch block was most common occurrence. None of the nonsmoker had such ECG changes (table 5,6).

10% of smokers had Left ventricular hypertrophy and 1% had right ventricular hypertrophy. No such changes were observed in nonsmokers.

DISCUSSION

In this prospective case control study done at a tertiary care teaching hospital,total 200 people were enrolled for study; who were asymptomatic for cardiovascular illness. Their average age was 43.54±14.7 years and 139 (65.5%) were male and remaining 69 (34.5%) were females, then divided according to their smoking status.The subjects included in this study were mostly from the middle or poor socio-economic strata and most of them belonged to rural background.In smoker groups, mostly 49% patients were in age between 41 to 60 years and mean age of smokers (both male and female included) was 49.14±14.12 years as against that mean age of non-smokers was 37.93±13.23 years. There is statistically significant difference in both groups. (p<0.001); the people in non-smoker group were younger as compared to smokers. Gender distribution pattern amongst male and female is also statistically significant in both groups (p<0.05). Hence the nonsmoker group has more females as compared to smoker group. (Table 1) As this hospital based study group is not representative of the entire population the demographic

profile cannot be compared with other population based studies. Global adult tobacco survey conducted in 2010 shows the prevalence of smoking in males is variable from 9% to 37.4% in males and 3-9% in females. In males, maximum number of smokers were observed in age group 45-65 years and in females in a more than 50 years age; this difference could be attributed to socio cultural reasons. In western studies and according to WHO fact sheet this more incidence of smoking is reported at a younger age group in western world, where youth are much more independent at a younger age.

The present study shows that pulse rate, systolic blood pressure,diastolic blood pressure is significantly high among smokers as compared to non-smokers (P<0.001) (fig.1) In the year 5 of CARDIA study on 3366 young smoker heart rate at rest was significantly higher in smokers by 1.5 to 5 beats/min in all race/gender groups except black. However, this study did not show any significant difference in systolic BP of smokers as compared to nonsmokers.[5] A significant increase in resting heart is observed by other Indian authors also.[6]

This increase in resting heart rate is an indicator of high sympathetic tone. Increase in heart rate could be due to stimulation of sympathetic ganglia and discharge of catecholamines from adrenal medulla. It has since long been known that blood pressure and heart rate increase during smoking[7]. These effects are specifically associated with nicotine while the other components of smoke seem to be of minor importance. The rise in blood pressure is due both to an increase in cardiac output and total peripheral vascular resistance. The blood pressure rise appears immediately and occurs before any increase in circulating catecholamines[8]. Many studies show that BP gets paradoxically reduced while smoking but long-term use causes hypertension[9] It is also found in many studies that risk of development of cardiovascular disease is related to number of cigarettes smoked[10]. Smokers have significantly higher p wave voltage, short QRS and QT intervals (p<0.05) and short PR interval (p<0.001) as compared to non-smokers. (Table 2) None of the nonsmoker had any ST elevation or depression as compared to smokers where 23% had such changes (Table 3). None of the non-smoker had T wave abnormality as compared to smoker group; wherein 22% had such abnormalities (Table 4).10 percent of smokers had bundle branch block out of which Right bundle branch block was major finding(Table 5).10% of smokers had Left ventricular hypertrophy and 1% had right ventricular hypertrophy. (Table 6) In this case-control study, abnormal ECG parameters were prevalent in smokers as compared to non-smokers and findings corresponds with Sharma et al study who also commented increased heart rate and QTc-interval with increase in pack years of smoking more commonly in female. Increase P-wave amplitude found in males with increase in the number of pack years. Along with that P-wave duration, PR-interval, QRS-duration and RR-interval tended to decrease more in females with increase pack year as compared to males with similar number of pack years and QT-interval and ST-segment duration tended to

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decrease in males with increase pack years.[11]

Increase in P-wave amplitude noted in present study was in accordance with that reported by Sharma etal[11]. This might be due to the reduced right ventricular compliance and subsequent right atrial hypertrophy due to chronic smoking.[11]

CONCLUSION

ECG is an important tool in predicting cardiovascular morbidity in smokers. Not only the ST-T changes or chamber hypertrophy but also resting heart rate PR interval and QT intervals should be measured in smokers periodically to predict cardiovascular involvement early.

REFERENCES

1. Singh A, Ladusingh L. Prevalence and Determinants of Tobacco Use in India: Evidence from Recent Global Adult Tobacco Survey Data. PLoS ONE. 2014; 9:114073
2. Sugiishi M, Takatsu F. Cigarette smoking is a major risk factor for coronary spasm. Circulation 1993;87:76–9
3. Chevalier HJ, Kuhnigk C, Bandilla B, Dontenwill W, Hänel J. Effect of high doses of nicotine in pigs. Basic research in cardiology. 1976;71:68-75.
4. Rastogi R, Shrivastava SS, Mehrotra TN, Singh VS, Gupta MK. Lipid profile in smokers. J Assoc Physicians India 1989; 37: 764-6.
5. Gidding SS, Xie X, Liu K, Manolio T, Flack JM, Gardin JM. Cardiac function in smokers and nonsmokers: the CARDIA study. The Coronary Artery Risk Development in Young Adults Study. J Am CollCardiol. 1995;26:211-6.
6. Motilal C. Tayade, Nandkumar, B. Kulkarni. A comparative study of resting heart rate in smokers and nonsmokers. IJCRR 2012;4: 59-62
7. Dhanalakshmi, John Nitin Ashok, Vasudevan Kavita, Maheswari K Uma, Niraimathi D, Devi S V Uma, Velkumary S, Karthik S. Hand Grip Strength, Endurance Time, Heart Rate and Blood Pressure Changes in Smokers. International Journal of Physiology 2015; 3:72-77.
8. Primatesta P, Falaschetti E, Gupta S, Marmot MG, Poulter NR. Association between smoking and blood pressure: Evidence from the health survey for England. Hypertension. 2001;37:187–93.
9. Omvik P. How smoking affects blood pressure. Blood Press. 1996;5:71-7.
10. Burns DM. Epidemiology of smoking-induced cardiovascular disease. Progress in cardiovascular diseases 2003; 46: 11-29.
11. Sharma NK, Jaiswal KK, Meena SR, Chandel R, Chittora S, Goga PS, Harish HB, Sagar R. ECG Changes in Young Healthy Smokers: A Simple and Cost- Effective Method to Assess Cardiovascular Risk According to Pack-Years of Smoking. J Assoc Physicians India. 2017;65:26-30.

International Journal of Contemporary Medical Research
ISSN (Online): 2393-915X; (Print): 2454-7379 | ICV: 77.83 | Volume 5 | Issue 1 | January 2018

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