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THE STUDY OF ECG CHANGES IN PEOPLE PRONE FOR HYPERTENSION

Cardiology

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ABSTRACT

BACKGROUND: Health vitality and long life are desirable goals of every individual. But many of habits of modern life style and sedentary living have become a serious threat to our health by significantly increasing the incidence.

AIMS AND OBJECTIVE: 1) To study the variation of blood pressure among people prone for hypertension and controls. 2) To study the variation of ECG wave forms among people prone for hypertension and controls.

METHODS AND MATERIALS: The study of ECG changes in people prone for Hypertension was conducted in the department of cardiology, IGIMS, Patna, Bihar, for a period of 12 months from April 2016 to March 2017 and are grouped into two controls and study groups who are prone for hypertension. Physical examination, recording resting pulse rate by palpating radial artery and blood pressure recording with a mercury sphygmomanometer and clinical examination of cardio vascular and respiratory systems was done in detail.

RESULT: Total study subjects participated in the study was 100 and out of them 50% was study group and 50% were control. Among study group Smokers, highest percentage of study subjects were in the age group of 30-34 years. Height (mean) was more among smokers (1.63mts), weight (mean) was more among diabetics (62.76kgs), BMI (mean) was comparatively more among diabetics (24.69kg/m2) and smokers (20.14kg/m2). Height (mean) was more among smokers (1.63mts), controls 1.61mts) compared to diabetics (1.60mts). There was no much difference in duration (mean) of P wave between smokers (0.08 sec) and diabetic (0.07 sec). Systolic BP (mean) was more among smokers (123.36 mmHg), diabetics (123.12 mmHg).

CONCLUSION: There was significant increase in heart rate in study group (smokers, diabetic) when compared to controls, significant increase in systolic blood pressure as well as diastolic blood pressure in study group (smokers, diabetics) when compared to controls, decrease in PR interval in smokers when compared to controls, decrease in QT and QTc interval in smokers when compared to controls.

KEYWORDS

Hypertension, electrocardiogram, diabetes and smoker

INTRODUCTION:

Health vitality and long life are desirable goals of every individual. But many of habits of modern life style and sedentary living have become a serious threat to our health by significantly increasing the incidence [1]. Hypertension is the commonest cardiovascular disorder posing a challenge to the societies in socioeconomic and epidemiologic transition [2]. Hypertension affects nearly 26 per cent of the adult population worldwide [3]. Hypertension as a most important risk factor for death in industrialized countries [4]. India, the world's largest democracy, is undergoing a rapid economic growth. This growth has been accompanied by demographic, lifestyle and cultural changes which have had a large impact on the health profile of India's citizens and placed a significant strain on the country's healthcare system [5-7]. Whilst such changes may be most obvious in major cities, such as Delhi and Mumbai, they are also likely to impact those living in the rural areas. Over 70% of India's population live in rural areas, yet access to government healthcare is much poorer than in urban areas, with twice the number of hospital beds available to urban dwellers per head of population [8]. In India, cardiovascular diseases (CVDs) are estimated to be responsible for 1.5 million deaths annually [9]. Indeed, it is estimated that by 2020, CVDs will be the largest cause of mortality and morbidity in India [10]. Hypertension is a major risk factor for CVDs, including stroke and myocardial infarction, and its burden is 2 increasing disproportionately in developing countries as they undergo demographic transition [11-14].

The prevalence of hypertension depends on both the racial composition of the population studied and the criteria used to define the condition. The prevalence of isolated systolic hypertension (ISH) is considerable in elderly population. ISH is strongly age dependent. The Framingham Heart Study and the NHANES III (National Health and Nutrition Examination Survey) study showed that similar patterns of progressively increasing SBP occur throughout adult life in untreated individuals [15, 16]. Data from Systolic Hypertension in Elderly Program (SHEP) showed 8% of those aged 60-70 years, 11% aged 70-79 years and 22% of those over 80 years had ISH.53 In American population ISH is present in 1% by the age of 55 years, 5% by the age of 60 years, 12.5% by the age of 70 years and 23.6% by the age of 75 to 80 years [17].

AIMS AND OBJECTIVE:

1) To study the variation of blood pressure among people prone for hypertension and controls.
2) To study the variation of ECG wave forms among people prone for hypertension and controls.

METHODS AND MATERIALS:

The study of titled “The study of ECG changes in people prone for Hypertension” was conducted in the department of cardiology, Indira Gandhi institute of Medical Sciences, Patna, Bihar. Duration of the study was 12 months from April 2016 to March 2017.

Source of data: They are grouped into two controls and study groups who are prone for hypertension. Each group consists of 50 subjects between ages 30-40 years were selected from general population, Cardiology department, IGIMS, Patna. Following a description of the nature and purpose of the study, those subjects who were willing to participate in the study were included after obtaining informed consent. A detailed history was taken from the subjects who were followed by a detailed physical examination. A pre-tested structured proforma was used to record relevant information from each individual. Physical examination included measuring height in centimeters, weight in kilograms, recording resting pulse rate by palpating radial artery and blood pressure recording with a mercury sphygmomanometer. Clinical examination of cardio vascular and respiratory systems was done in detail. The subjects were screened using the inclusion and exclusion criteria and taken up for the study.

INCLUSION CRITERIA

1) Male Individuals age group 30-40 years of people prone for hypertension like a) Smoker b) Diabetic (FBS ≥ 126mg/dl, RBS ≥ 200mg/dl.84)

EXCLUSION CRITERIA 1) The male individuals aged 40yrs, 2) Patients on Anti-hypertensive medications 3) Patients with coronary artery disease 4) Females 5) Acute illness

Following detailed assessment of the subject, a 12 lead electrocardiogram was recorded during the resting state. The subjects were made to lie in supine position. The subject's chest, forearms and legs were uncovered. Objects such as electronic gadgets, metallic ornaments etc. were removed to avoid interference. In order to avoid interference from AC operated machines, the subject was kept away from current carrying conductors. Subject was made to relax. Location for placing electrodes on arms and legs was selected by choosing a place where there was minimum movement. The electrode area was cleaned and surface hair was removed. The skin was rubbed with spirit until lightly red and was allowed to dry. Sufficient quantity of ECG gel was applied approximately 2cm on the skin at the chosen location to ensure good electrical contacts. Limb electrodes were clipped to subject's skin to give proper contact. Chest leads were placed over six different locations. Care was taken so that gel does not smear between the chest electrode sites. The ECG was recorded and was evaluated for different parameters like heart rate, P wave, PR interval, QRS Complex, QRS axis, QT interval, QTc interval, ST segment and T wave and results were drawn.

STATISTICALANALYSIS:
Descriptive and inferential statistical analysis has been carried out in the present study. The statistically software namely SPSS 15.0 were used for analysis of the data and Microsoft word and Excel have been used.

RESULT: Total study subjects participated in the study was 100 and out of them 50% was study group and 50% were control. Among study group Smokers, highest percentage of study subjects were in the age group of 30-34 years and whereas among Diabetics and controls subjects were in 30-34, 35-39 and 40-44 yrs. There is a difference in age distribution between study group and controls and it was statistically significant in Diabetics (p-value 0.001).

Table – 1: Age wise distribution of study subject

Age in years	Smokers		Diabetics		Controls	
	No	%	No	%	No	%
30-34	18	72.0	3	12.0	22	44.0
35-39	7	28.0	10	40.0	16	32.0
40-44	0	0.0	12	48.0	12	24.0
Total	25	100.0	25	100.0	50	100.0
Mean ± SD	32.80 ± 3.32		37.80 ± 3.32		35.24 ± 3.76	

Diabetic patients had higher mean age with p<0.001*

Table -2: Comparison of Anthropometric measurements b/w study group and controls

	Smokers	Diabetics	Controls	P value
Height (cm)	1.63±0.05	1.60±0.09	1.61±0.07	0.358
Weight (kg)	53.16±4.09	62.76±6.66	57.98±5.66	<0.001*
BMI(kg/m^2)	20.14±1.01	24.69±1.74	22.22±2.07	<0.001*

Height (mean) was more among smokers (1.63mts), controls (1.61mts) compared to diabetics (1.60mts) and this difference was statistically not significant. Weight (mean) was more among diabetics (62.76kgs), controls (57.98kgs) compared to smokers (53.16kgs) and this difference was statistically significant. BMI (mean) was comparatively more among diabetics (24.69kg/m^2) and smokers (20.14kg/m^2), controls (22.22kg/m^2) and this difference was found statistically significant.

Table -3: Comparison of heart rate b/w study group and controls

HR (bpm)	Smokers		Diabetics		Controls	
	No	%	No	%	No	%
<70	0	0.0	3	12.0	16	32.0
71-80	3	12.0	12	48.0	32	64.0
81-90	16	64.0	6	24.0	1	2.0
>90	6	24.0	4	16.0	1	2.0
Total	25	100.0	25	100.0	50	100.0

Table -4: Comparison of SBP b/w study group and controls

SBP (mm HG)	Smokers		Diabetics		Controls	
	No	%	No	%	No	%
<120	1	4.0	4	16.0	43	86.0
>120	24	96.0	21	84.0	7	14.0
Total	25	100.0	25	100.0	50	100.0

Table -5: Comparison of DBP b/w study group and controls

DBP (mm HG)	Smokers		Diabetics		Controls	
	No	%	No	%	No	%
<80	0	0.0	5	20.0	42	84.0
>80	25	100.0	20	80.0	8	16.0
Total	25	100.0	25	100.0	50	100.0

Table -6: Comparison of vitals (BP, HR) b/w study group and controls

Vitals parameters	Smokers	Diabetics	Controls	P value
HR (bpm)	87.76±4.56	79.40±9.39	73.48±4.19	<0.001*
SBP (mm Hg)	123.36±2.75	123.12±4.73	117.95±2.98	<0.001*
DBP (mm Hg)	81.20±1.53	80.08±3.81	79.52±2.57	0.040*

Heart rate (mean) was high among smokers (87.76 bpm), diabetics (79.40 bpm) compared to controls (73.48 bpm) and this difference was found to be statistically significant. Systolic BP (mean) was more among smokers (123.36 mmHg), diabetics (123.12 mmHg) Compared to controls (117.95 mmHg) and this difference was statistically significant.

Table -7: Comparison of P wave b/w study group and controls

Measurements (P wave)	Smokers	Diabetics	Controls	Significance		
				Smokers-Diabetics -	Smokers - Controls -	Diabetics-Controls-
Duration (S)	0.08±0.01	0.07±0.01	0.075±0.009	0.177	0.271	0.863
Amplitude (mm)	1.02±0.07	0.92±0.31	0.96±0.134	0.124	0.344	0.656

There was no much difference in duration (mean) of P wave between smokers (0.08 sec), diabetic (0.07 sec) and controls (0.075 sec) and it was statistically not significant. And amplitude (mean) was slightly high among smokers (1.02), controls (0.96) compared to diabetics (0.92) which was statistically not significant.

Table -8: Comparison of ECG parameters b/w study group and controls

Measurements	Smokers	Diabetics	Controls	Significance		
				Smokers - Diabetics -	Smokers-Controls-	Diabetics-Controls-
PR interval	0.14±0.02	0.15±0.02	0.155±0.013	0.790	0.020*	0.122
QRS interval	0.08±0.02	0.08±0.02	0.077±0.011	0.806	0.999	0.732
QT interval	0.35±0.04	0.40±0.03	0.39±0.023	<0.001*	<0.001*	0.505
QT$_c$ interval	0.38±0.06	0.44±0.04	0.43±0.039	<0.001*	<0.001*	0.464
QRS Axis	41.32±13.93	52.68±10.73	55.80±10.51	0.002*	<0.002*	0.512

PR interval (mean) was shortened among smokers. PR interval (mean) was no much difference among diabetics compared to controls but there was no statistical significance in QRS complex between smokers (0.08sec), diabetics (0.08sec) and controls (0.077sec). QT interval (mean) was less among smokers (0.35sec). QTc interval was less among smokers (0.38sec) QTc interval no much difference between diabetics (0.44sec) and controls. QRS axis (mean) was very high among controls (55.800) compared to smokers (41.320) and it was statistically significant. But QRS axis in diabetics compared to controls no much difference and statistically not significant.

Table -9: Comparison of T wave parameters b/w study group and controls

T wave	Smokers		Diabetics		Controls	
	No	%	No	%	No	%
Normal	25	100.0	25	100.0	50	100.0
Abnormal	0	0.0	0	0.0	0	0.0
Total	25	100.0	25	100.0	50	100.0

DISCUSSION:

Hypertension is estimated to cause 4.5% of current global disease burden and is as prevalent in many developing countries, as in the developed world. Blood pressure induced cardiovascular risk rises continuously across the whole blood pressure range. In this study Blood pressure and ECG changes compared between people prone for hypertension and age matched controls.

Heart rate: In this study Heart rate (mean) was more among smokers (87.76bpm) compared to controls (73.48bpm) and it was statistically significant (p value <0.001). Ramon C. Hermida et al [18] found statistically significant increased heart rate among smokers (p <0.001), Zahi Khoury et al [19] found smokers had (74bpm) whereas controls (71.3bpm). The increased in heart rate could be due to stimulation of sympathetic ganglia and discharge of catecholamine's from adrenal medulla. [20].

BLOOD PRESSURE: In this study Systolic BP (mean) was more among smokers (123.36mmHg) compared to controls (117.95mmHg) and this difference was statistically significant. Similarly Diastolic BP (mean) was more among smokers (81.20mmHg) compared to controls (79.52mmHg) and this difference was statistically significant. Ramon C. Hermida et al [21] found statistically significant increased diastolic pressure in smokers (p<0.001), Zahi Khoury et al [22] found increased systolic as well as diastolic blood pressure in smokers. Nicotine stimulates production of catecholamine from adrenal medulla which causes constriction of peripheral blood vessels which leads to increase in blood pressure. Increase in systolic blood pressure is due to increased contractility of the heart caused by increased sympathetic discharge in smokers. The increased contractility causes an increased in the volume of blood pumped by the heart and hence causes an increased in cardiac output. This increased cardiac output causes an increase in blood pressure. The increase in diastolic blood pressure in smokers is due to the increase in peripheral resistance caused by an increase in sympathetic stimulation [23]. It was also found that, there was increase in Systolic BP (mean) in diabetics (123.12mmHg) compared to controls (117.95mmHg) and this difference was statistically significant. Similarly Diastolic BP (mean) was more among diabetics (80.08mmHg) compared to controls (79.52mmHg) and this difference was statistically significant. This is similar to observation in Zaria [24]. Famingham study group has shown that mean systolic BP are higher in diabetics then in age, sex, control.

P wave:
There was no much difference in duration (mean) of P wave between smokers (0.08sec) and controls (0.075sec. Amplitude (mean) was slightly high among smokers (1.02mm) compared to controls (0.96mm). S B Sharma et al [25] and Khan IS et al [26] also found amplitude was slightly high among smokers compared to controls. But P wave duration and amplitude measurements did not show any statistical significant difference in diabetics when compared to controls. Webster A et al [27] also reported that decrease in P wave amplitude in diabetics is due to effect of serum potassium levels.

PR interval:
In this study PR interval (mean) was shortened among smokers compared to controls. This results finding was in agreement with Baden L et al [28] and Khan IS et al.[29] Cigarette smoking increases the velocity of conduction and shortens the effective refractory period at the AV node. In some cases of postural hypertension PR interval is decreased. Also no much difference in PR interval was seen among diabetics compared to controls. Montague BT et al also observed decreased PR interval in their study.

QRS complex:
In this study there was no statistical difference in duration of QRS complex (mean) between smokers (0.08sec) and controls (0.077sec). Similar findings noted in Khan IS et al [29]and Chatterjee S et al [30]. Increased duration of QRS complex noted. It may be because aging affects electrocardiographic wave patterns and aging effect is modified by long term smoking. There was no significant difference in duration of QRS complex (mean) between diabetics (0.08sec) and controls (0.077sec). Krahulec B et al found that prolongation of QRS complex was feature of cardiomyopathy in diabetics [32].

QRS axis:
In this study, QRS axis (mean) showed statistically highly significant decrease in smokers (41.320) when compared to controls(55.800). Venkatesh G and Swamy RM [20] found decreased QRS axis in smokers (42.00) when compared to controls (510) but was not significant. So these results indicate that aging affects electrocardiographic wave patterns. Also there was no significant difference in QRS axis in diabetics (52.680) when compared to controls (55.800).

QT interval:
QT interval (mean) was less among smokers (0.35sec) compared to controls (0.39sec). Similar findings was reported by Dilaveris P et al. [31] Also there was slight increase in QT interval was noticed in diabetics (0.40sec) when compared to controls (0.39sec). Increased QT interval reported in earlier studies done by Krahulec B et al. [32]

QTc interval:
QTc interval was decreased in smokers (0.38sec) compared to controls (0.43sec). The ventricular repolarisation is altered in young male smokers. The differences in the heterogeneity of ventricular repolarisation between smokers and controls are mainly due to heart rate differences between the 2 study groups. [31]. There was no significant difference in QTc interval among diabetics (0.44sec) and controls (0.43sec). Studies done by Palova S. et al [33] and Zdarska D et al [34] showed that the QTc interval was not significant difference in diabetics when compared to controls due to small number of patients.

T wave:
In this study, we noticed normal T waves was seen in study group compared to controls

CONCLUSION:
The following conclusions can be drawn from results of this study: There was significant increase in heart rate in study group (smokers, diabetic) when compared to controls, significant increase in systolic blood pressure as well as diastolic blood pressure in study group (smokers, diabetics) when compared to controls, decrease in PR interval in smokers when compared to controls, decrease in QT and QTc interval in smokers when compared to controls, decrease in QRS axis in smokers when compared to controls. Though our study is by no means exhaustive, it does provide a glimpse into variety of ECG changes and increased systolic as well as diastolic blood pressure in absence of any cardiac disease in people prone for hypertension. Although to some extent these changes and few studies have been done on this aspect.

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