



ECG Changes in Obese Individuals

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ABSTRACT

The electrocardiogram in 100 subjects was correlated with the severity of obesity. QRS vector shifted to the left with increasing obesity in 42% of people which indicates left ventricular hypertrophy. These changes were independent of age, sex and blood pressure. Interventricular conduction defect was present in 21% of patients, but t wave inversion was in 14% only. 17% of people had normal ECG, whereas 3% of have showed sinus bradycardia & arrhythmia. The shift of QRS vector to the left and the conduction abnormalities are increasing with increase in obesity. Since the left ventricular hypertrophy is an important risk factor for sudden cardiac arrest, this non-invasive procedure may be utilized as a routine screening test for obese people for better medical care. Thus, obesity is associated with a wide variety of ECG abnormalities, many of which are corrected by weight loss.

Keywords: *Electrocardiogram, Obesity, Left ventricular hypertrophy, QRS vector.*

INTRODUCTION

Obesity is a chronic medical condition characterized by excessive accumulation of fat on human body that cause a generalized increase in body mass. Overweight and obesity has become a worldwide health concern. The prevalence of excess weight gain within populations forecasts an increase burden from several diseases, most notably cardiovascular, diabetes mellitus and cancer. The environmental factors such as lifestyle preferences and cultural practices playing pivotal roles in the rising prevalence of obesity, India has now become the third most common country in the world as per the study conducted by Lancet.

It is a major risk factor for many acute and chronic disorders, including cardiovascular, cerebrovascular disease and diabetes. It affects the respiratory system as well. It is associated with

additional health conditions including carpal tunnel syndrome, deep vein thrombosis and poor wound healing.⁽⁷⁾

Obesity is a serious health condition which can cause increase in stroke volume, cardiac output, left ventricular end-systolic pressure and pulmonary artery pressure. The hypervolemic and hyperdynamic status increase left ventricular work and lead to an increase in cardiac mass that is proportional to degree of obesity and increased cardiac mass is due to increased muscle mass of left ventricle and not due to epicardial or myocardial fat infiltration.^(11,12)

Obesity is associated with increase in LV wall thickness, LV mass and prevalence of echocardiographic LVH, independent of impact of blood pressure. Conversely, obesity has been shown to decrease sensitivity of precordial leads,

ECG criteria for LVH, presumably because of attenuating effects increased distance of exploring electrodes from LV and attenuation of QRS amplitudes by interposed tissues.^(8,11,12)

BMI (Body mass index) is an attempt to quantify the amount of tissue mass in an individual and it is calculated as weight in kilogram divided by square of height in metres.

WHO Classification	WHO BMI cut-off points for definition (kg/m ²)
Underweight	<18.5
Normal range	18.5-24.9
Overweight	>=25.0
Pre-Obese	25.0 – 29.9
Obese class I	30.0 - 34.9
Obese class II	35.0 – 39.9
Obese class III	>=40.0

OBJECTIVES

1. To analyze the electrocardiogram changes in obese individuals.
2. To determine the effect of severity of obesity on cardiovascular system.

MATERIALS AND METHODS

SELECTION OF THE SUBJECTS

Obese individuals of about 100 people with BMI >30 of both sexes of age group between 30 -45 years were included in this study. The healthy volunteers, visitors or relatives of patients visiting Government Thiruvapur Medical College Hospital, Thiruvapur were taken as subjects and the study was conducted in department of Physiology, Government Thiruvapur Medical College, Thiruvapur after getting the Ethical committee approval. The subjects were informed about the study and written consent was obtained from them. The selection of obese individual is based on WHO BMI cutoff points. Study group consists of obese subjects with BMI >30kg/m² without any confounding factors like age, sex and blood pressure and also without any comorbidities like hypertension, diabetes mellitus etc,^(1,2,9,10) ECG was taken in all participants.

METHOD

An electrocardiogram is simple, non-invasive test that measures electrical activity of heart. During the test the subject was asked to lie on table in supine position. 12 to 15 soft electrodes with gel were attached to chest, arms and legs. These electrodes were attached to electrical leads (wires), which will be attached to the ECG machine. The machine will record the electrical activity of heart. After the procedure the electrodes were removed. The following parameters were recorded. P Wave, PR Interval, QRS Complex, ST Segment, T Wave and QT Interval

STATISTICAL ANALYSIS

The data will be subjected to basic statistical analysis (SPSS 2016) and appropriate interpretations will be drawn.

RESULTS

Particulars	No.of respondents (n=100)	Percentage (100%)
30 to 35yrs	21	21.0
36 to 40yrs	47	47.0
41 to 45yrs	26	26.0
46yrs & above	6	6.0

ECG

Particulars	No.of respondents (n=100)	Percentage (100%)
LVH	42	42.0
IV CON DEFECTS	21	21.0
Normal ECG	17	17.0
t wave inversion	14	14.0
Sinus arrhythmia	3	3.0
Sinus bradycardia	3	3.0

Descriptive statistics

Variables	Age	BMI
Mean	38.81	33.80
Median	38.50	34.00
S. D	4.057	2.441
Min.	30	30
Max.	49	40
N	100	100

Chi-square test :

ECG	Age					Statistical inference
	30 to 35yrs	36 to 40yrs	41 to 45yrs	46yrs & above	Total	
LVH	5	19	15	3	42	$\chi^2=27.423$ $Df=15$ $.025<0.05$ Significant**
IV CON DEFECTS	4	12	5	0	21	
NI ECG	9	7	1		17	
t wave ^	2	6	3	3	14	
Sinus arrhythmia	0	1	2	0	3	
Sinus bradycardia	1	2	0	0	3	
Total	21	47	26	6	100	

**Highly significant

The ECG waves had shown left axis deviation which is in favour of left ventricular hypertrophy. This changes in the obese individuals were statistically proved significant ($P<0.025$).

Regression Coefficients(a)						
		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	6.215	2.327		2.671	.009
	Age	-4.854E-02	.034	-.144	-1.445	.152
	BMI	-6.187E-02	.056	-.111	-1.108	.271
a Dependent Variable: ECG						

Regression coefficient: not significant

DISCUSSION

All the obese people included in the present study had not have the ECG changes, some had normal ECG(17%). The mean age of obese individuals included in the study was 38.81 years who ranged from 30 to 46 years. But, the earlier studies were carried out only in the older patients (with the mean age of 64 and above who might have had the age-related ECG changes which was not, hitherto, ruled out. ⁽⁶⁾ Therefore, it could be stated from this study that the obesity is more prevalent in the individuals of middle age groups and the ECG changes noticed in these people are obesity-driven rather than age-related. Since normal ECG values have already been very well established, there was no normal or control population for comparison. Our aim of the study is to evaluate ECG abnormalities with varying degrees of obesity. The mean BMI was 33.80 with the range of 30-40.

Considering the ECG changes normal sinus rhythm was present in 17%, but, 42% people had left ventricular hypertrophy, 21% had interventricular conduction defects, 14% had t

wave inversion, 3% had sinus arrhythmia and another 3% had sinus bradycardia. Of these changes, left ventricular hypertrophy was predominant and statistically significant ($p<0.025$), which is the important risk factor for sudden cardiac arrest. These changes were independent of age, sex and blood pressure. Conduction is slowed, and the QRS vector shifts toward the left as percent overweight increases. ⁽⁴⁾ These changes must be considered when evaluating both baseline electrocardiographic studies in obese patients and the changes seen during weight reduction.

Alterations in the signal-averaged ECG and in heart rate variability may be arrhythmogenic. Cardiac arrhythmias have been described in obese subjects, but are often accompanied by left ventricular hypertrophy or the sleep apnea syndrome. ⁽⁵⁾ Many of these ECG abnormalities are reversible with substantial weight loss. Thus, obesity is associated with a wide variety of ECG abnormalities, many of which are corrected by weight loss. ⁽³⁾

CONCLUSION

The influence of obesity causing the cardiac abnormalities is proved beyond doubt, from the significant ECG changes, especially left ventricular hypertrophy which is an important risk factor for sudden cardiac arrest. So, this non-invasive procedure may be utilized as a routine screening test for obese people for better medical care. In addition, the results necessitate further study to evaluate this medical condition thoroughly as a potential risk factor for cardiac dysfunction.

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