

A Comparative Study of Electrocardiographic Changes In Pregnant And Non-Pregnant Women

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Abstract: Pregnancy is the unique physiological condition that differs from non-pregnant state. Cardiovascular changes are significant and occur by sixth to eighth week of gestation. The aim of the present study is to know the nature and frequency of ECG changes in pregnant women compared to non-pregnant women of the same race and age group. Study of variations in ECG in normal pregnant women serves as a basis to detect Pathological changes in ECG in normal pregnant women. A cross sectional prospective study was carried in 90 subjects of which 30 (Group-I) were non pregnant. 60 were pregnant, 30 (Group-II) were in early pregnancy between 10-20 weeks of gestation and 30 (Group-III) were in late pregnancy between 24-40 weeks of gestation. A 12 lead electrocardiogram was recorded by using ECG machine in all the participants in supine position. Minor ECG changes including left axis deviation and increased incidence of inverted T-waves in V2 and lead III, aVF have been described in pregnancy. Data was analyzed by analysis of variance for repeated measures and contingency tables were used to compare findings at rest. A P-value of < 0.05 was considered significant. The present study results suggest that at rest, minor ECG changes like axis deviation, T-wave inversion in lead V2, lead III and increase in QTc interval were more frequently present in healthy pregnant than non-pregnant subjects. We recommend that there is need for systemic evaluation of hemodynamic and ECG changes during pregnancy.

Keywords: Pregnancy, Electrocardiogram (ECG), T-wave, QTc interval, QRS axis.

I. Introduction

Pregnancy is unique physiological condition that differs from non-pregnant state [1]. Pregnancy, although a physiological phenomenon affects all the functions of the maternal body [2]. Various physiological changes, especially changes in the cardiovascular system do occur during normal pregnancy [3]. Cardiovascular changes are significant and occur by sixth to eighth week of gestation [1]. In order to detect pathological changes in Electrocardiogram of pregnant women, one has to know about physiological changes in Electrocardiogram during pregnancy [4]. The Cardiovascular changes which occur normally during pregnancy sometimes simulates heart diseases [2]. In addition, many of the physiological adaptations of normal pregnancy alter the physical findings, thus misleading the diagnosis of heart disease [5]. Pregnancy also bring about various changes in ECG. Most common reason for referral of pregnant subject from the Obstetrician to Cardiologist is evaluation of systolic murmur heard over the precordium [6]. The present study was carried out to determine Electrocardiographic changes in normal pregnancy as the Electrocardiogram reflects the condition of the heart which in turn is regulated by hemodynamic alterations during normal pregnancy [2,7]. Electrocardiogram (ECG) is the graphical record of summated action potentials generated in cardiac muscle, by means of metal electrodes placed on the surface of the body on a moving strip of paper [8]. The Electrocardiographic changes in normal pregnancy at rest are considered normal unless associated with significant symptoms [9]. Hemodynamic changes during pregnancy play a major role in the induction of arrhythmias [10]. The present study is designed to know the incidence of physiological variations in Electrocardiogram in pregnant Indian women compared with non-pregnant women of the same race and age group.

II. Materials And Methods

30 apparently healthy pregnant women in early pregnancy (10-24 weeks of gestation) and late pregnancy (24-40 weeks gestation) each between 20-30 years of age were selected. 30 healthy non-pregnant women of the same age group were selected. Women associated with anemia, medical disorders, pregnancy induced hypertension, pre-eclamptic toxemia, heart disease complicating pregnancy, patients under cardiac medication were excluded from the study. This study is a case control study and the subjects were out patients attending to antenatal clinics and non-pregnant women attending to Gynecology OP department in the age group of 20-30 years. The study was carried after obtaining permission by the institutional ethics committee.

The procedure was explained and all the subjects underwent detailed clinical examination. The study included ECG recording and Blood Pressure Measurement, Pulse rate determination. Resting pulse rate was expressed as bpm Blood pressure (in mmHg) was measured by Sphygmomanometer by palpatory and auscultatory method. A 12 lead electrocardiogram was recorded by ECG machine in all the participants during resting state in supine position [11]. The instrument used to record electrocardiograph is CARDIART 108T DIGI manufactured by BPL electronics limited. The ECG was evaluated for axis deviation (QRS axis), T wave, Q wave, QTc interval and results were drawn. The results were analyzed by analysis of variance for repeated measures and contingency tables were used to compare findings at rest. A P-value of < 0.05 was considered as statistically significant.

III. Results

For the purpose of analysis of data, the results were tabulated

Table 1: T-wave Inversion in V₂ among the study groups.

S.No	Group	No. of subjects	T-wave inversion in V ₂	
			Yes (%)	No (%)
1	Non-pregnant	30	1 (3.3)	29 (96.7)
2	Early pregnant	30	8 (26.7)	22 (73.3)
3	Late pregnant	30	16 (53.3)	14 (46.7)
	Total	90	25 (27.8)	65 (62.2)
	Statistical significance	$\chi^2=18.72$; df=2; P=0.001; S		

Our study showed a statistically significant increase in inverted T-waves in lead V₂ in pregnant women (Group II and III) than in non-pregnant women (Group -I).

Table 2: T-Wave Inversion in LIII among the study groups.

S.No	Group	No. of subjects	T-wave inversion in L _{III}	
			Yes (%)	No (%)
1	Non-pregnant	30	0 (0.0)	30 (100.0)
2	Early pregnant	30	9 (30.0)	21 (70.0)
3	Late pregnant	30	9 (30.0)	21 (70.0)
	Total	90	18 (20.0)	72 (80.0)
	Statistical significance	$\chi^2=11.25$; df=2; P=0.0036; S		

In this study, inverted T-waves in lead III were significantly more frequent in the pregnant women than in the non-pregnant women (Group I).

Table 3: Q -Wave in LIII & aVF among the study groups.

S.No	Group	No. of subjects	T-wave inversion in L _{III}	
			Yes (%)	No (%)
1	Non-pregnant	30	3 (10.0)	27 (90.0)
2	Early pregnant	30	0 (0.0)	30 (100.0)
3	Late pregnant	30	4 (13.3)	26 (86.7)
	Total	90	18 (20.0)	72 (80.0)
	Statistical significance	$\chi^2=4.02$; df=2; P=0.13; NS		

Our study showed no statistical significance regarding the presence of Q- wave in these leads.

Table 4: Mean QRS of the study groups.

S.No	Group	No. of subjects	Mean	SD	Statistical significance
1	Non-pregnant	30	0.11	0.13	1 vs 2: t = 0.29.; P=0.77; NS
2	Early pregnant	30	0.10	0.13	
3	Late pregnant	30	0.07	0.007	
	Total	90	0.09	0.10	2 vs 3: t = 1.26; P=0.21; NS
	Statistical significance	F ratio = 0. 74; P = 0.47; NS			1 vs 3 : t = 1.68; P = 0.09; NS

QRS axis showed a statistically significant decrease in pregnant women (Group II and Group III) when compared to non-pregnant women (Group I).

Table 5: Mean QTc of the study groups.

S.No	Group	No. of subjects	Mean	SD	Statistical significance
1	Non-pregnant	30	0.41	0.01	1 vs 2: t = 1.73; P=0.08; NS 2 vs 3: t = 0.00; P=1.00; NS
2	Early pregnant	30	0.42	0.03	
3	Late pregnant	30	0.42	0.02	
	Total	90	0.41	0.02	1 vs 3 : t = 2.44; P = 0.01; S
	Statistical significance	F ratio = 3. 10; P = 0.04; S			

Increase in QTc interval was observed in pregnant women (Group II and Group III) than non-pregnant women (Group I).

IV. Discussion

Studies on ECG in pregnant women have been used as a basis to detect pathological changes in ECGs of pregnant women. The present study was designed to know the incidence of physiological variations in the Electrocardiogram of normal pregnant women, especially of south Indian women, compared with non-pregnant women of the same race and age group. Most of the ECG changes that occur during pregnancy can be explained by the physiological adaptations in response to normal pregnancy. The Electrocardiographic changes during pregnancy may be due to changed spatial arrangement of the Chest organs, changed electrical properties of the myocardium due to sympathetic and hormonal modulations. Pregnancy may be associated with concentric enlargement of the left ventricle in response to hemodynamic requirements which explains these ECG changes [12]. Minor ECG changes including left axis deviation and increased incidence of inverted T-waves in V2 and lead III and aVF have been described in pregnancy [13].

The ECG changes are analyzed as follows:

T-wave: The results showed an increase in incidence of T-wave inversion in lead V2 and LIII. Our study showed a statistically significant increase in inverted T-waves in lead V2 in Groups II and III. T-wave inversion observed in 26.7% and 53.3% of subjects in Group II and III and 3.3% in Group I (controls) with a P-value of 0.001. These results correlate with the study of Jean Claude *et al* 1996 [14]. T-wave inversion in LIII were present 30% of subjects in Group II and Group III compared to Group I which showed no T-wave inversion in LIII, with a P-value of 0.0036 which is statistically significant which correlates the study of Scott Moses M D *et al* 2008 [15]. These changes may be due to increased work load on heart due to temporary increased blood volume during pregnancy which may cause temporary ischemia represented by T-wave inversion. [2]

Q-wave: Q waves in LIII and aVF were present in 10% (3 subjects) in Group-I and 13.3.% (4 subjects) in Group-III. No Q waves were present in Group II. Our study showed no statistical significance regarding the presence of Q wave in these inferior leads.

QRS Axis: Our results showed that QRS axis significantly decreased. i.e., left axis deviation in pregnant women when compared to non-pregnant women. In our study left axis deviation was observed in 3.3% i.e., one subject each; in Group II and III. No deviation in axis from normal (0-90°) was observed in Group I (non-pregnant).

The determination of QRS axis showed -15° left axis deviation in one subject in Group II (Early pregnant) and -30° left axis deviation in one subject in Group III (late pregnant) with a P-value of 0.0051 which is statistically significant which correlate with the study of Joseph E-Carruth *et al* 1981 [16].

The change in electrical axis can be attributable to the diaphragm raising as pregnancy advances [17]. Changes in the left ventricular size, mass with associated increase in volume may cause the displacement of apical impulse towards left. Elevation and rotation of the heart resulting from the enlarging uterus, also contributes to displacement [18].

In early pregnancy, the left axis deviation can be explained from the fact that there is increased blood volume which causes left ventricular load [2].

QTc Interval

Our results showed that a statistically significant increase in mean QTc interval in pregnant women when compared to non-pregnant women. The mean QTc interval in Group II and Group III was 0.42sec and in Group I it was 0.41sec. 5 subjects in Group II and 6 subjects in Group III had QTc > 0.44 sec.

QTc interval in electrocardiogram reflects the depolarization and repolarization in the ventricular myocardium. The QT interval when corrected for heart rate is QTc. An increase in QTc interval may be due to tachycardia. They must be considered as a complex consequence with changes in regulatory mechanism during normal pregnancy [12]. Which correlates with the study of Leishmanova M *et al* 2002.

V. Conclusion

We conclude that ECG changes like left axis deviation, inverted T-waves in V 2 and LIII, increase in QT interval were more frequent in pregnant women than in non-pregnant women. There is alteration in circulatory dynamics during pregnancy which leads to significant variations in ECG from the average normal. There is need for systemic evaluation of hemodynamic and ECG changes during pregnancy.

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