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Comparison Of Left Ventricular Performance During Pregnancy With Anaemia.

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ABSTRACT

To study the effect of iron deficiency anaemia on left ventricular function by ECG during second trimester of pregnancy & to compare ECG changes with normal pregnant women in second trimester. The study was conducted at antenatal OPD between Nov 2014 to Aug2015.Sixtypregnant women were selected & divided in to 2 groups.30 normal pregnant women (control group)in 2nd trimester (20-24 weeks of gestation) were compared with equal number of pregnant women with anaemia(study group) in 2nd trimester, aged between 20-30 years. Electrocardiogram was recorded using Philips twelve channel ECG machine model TC20 in both control & study groups to evaluate myocardial performance. Haematological parameters were analysed by SYSMEX auto analyser.Analysis of Variance (One way ANOVA) was used for comparison between study and control groups and the data was analysed by t tests. In our study we observed a significant decrease in QRS duration , increase in QTc in study group ($p<0.05$). 90% of subjects in study group have tachycardia and ECG abnormalities. There was a negative correlation between Hb level, serum ferritin and tachycardia, ECG abnormalities. Pregnancy with Iron deficiency anaemia brings about various changes in ECG ,suggesting that anaemia and volume overload in pregnancy is a risk factor that may lead to cardiac hypertrophy.

Keywords: Anaemia; Pregnancy; Electrocardiographic changes.

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INTRODUCTION

Anaemia is the most common disease and in developing country like India iron deficiency anaemia predominates. Although, the prevalence of anaemia in countries with high development is estimated at 9%, in countries with low development the prevalence is 43%[1].Anaemiaaffects various organs in body including the heart.True congestive heart failure rarely results from the anaemic state[2]. Similarly maternal heart disease is the most important non obstetric cause of death in pregnant women[3].

Pregnancy usually causes dramatic reversible changes in a woman's cardiovascular system. These remarkable changes begin soon after fertilization & continue throughout gestation to maintain healthy environment for the fetus& mother. The first hemodynamic change during pregnancy seems to be a rise in heart rate[4].In anaemia oxygen carrying capacity of blood decreases. The following mechanisms operate in anaemia to maintain a normal or near normal oxygen supply to the tissues[2].Hemodynamic mechanism includes increase cardiac output ; Blood flow and its distribution; the oxygen-carrying capacity of the blood, i.e. haemoglobin concentration; and oxygen extraction. Among all these the iron requirement also increases during pregnancy for fetal blood formation & iron is required for mothers own blood and cell mass. The degree of iron requirement depends on iron stores & the amount of dietary iron that can be absorbed during pregnancy. Iron depletion & the amount of stored iron is reduced in iron deficiency anaemia which limits reduced red cell production[5]. Stored iron can be estimated by serum ferritin in iron deficiency anaemia [6]. Electrocardiography is used to detect ischemic heart diseases, hypertensive heart diseases &asymptomatic arrhythmias[7].

Earlier studies have reported diversed changes on reports of ECG in anaemia [8,9]. Few studies have shown a decrease in QRS amplitude, T wave flattening and minor degrees of atrioventricular (AV) conduction disturbances [10], but these have not been observed in more recent studies[8]. Later studies have reported frequent non-specific ST-T wave changes [11]. However, the studies which show the effect of iron deficiency anaemia on myocardial function during pregnancy are few in India.

Hence, the present study is taken up to know the effect of iron deficiency anaemia on electrocardiography during second trimester of pregnancy & to compare the ECG changes with normal pregnant women in second trimester.

MATERIALS AND METHOD

The study was conducted at antenatal OPD, departments of Physiology and Cardiology ofPrathima Institute of Medical sciences hospital between Oct 2014 to July 2015.Sixty pregnant women were selected for this study & divided in to 2 groups. Group Iincluded 30 normal pregnant women (control group)in 2nd trimester (20-24 weeks of gestation) with normal clinical cardiovascular history and normal physical findings. Group II included equal number of pregnant women with iron deficiency anaemia(Haemoglobin% is 7-9.9gm%, serum ferritin <4.6ng/ml), in 2ndtrimester,aged between 20-30 years. Selected pregnant women were informed about the course and aim of the study and signed consent was obtained.

The study protocol was approved by ethical committees of B.L.D.E.U Shri BM Patil Medical College, Bijapur, Karnataka(IEC/29/2012) &Prathima institute of medical sciences(Ref number: IEC/PIMS/2013/001. Predetermined exclusion criteria for the selection of the study population were pregnant women with diabetes, maternal cardiovascular disease and preeclampsia.

Complete physical and obstetric examination was performed after taking detailed history from the selected subjects at the time of recruitment. Gestation was confirmed by last menstrual period and ultra sound measurement of the fetal crown-rump-length in selected pregnant women.

Electrocardiogram was recorded using Philips ECG machine model TC20 in both control & study groups to evaluate left ventricular performance. The instrument used to record electrocardiogram was the twelve channel electrocardiograph HEWLETT PACKARD page writer manufactured by Philips electronic Ltd.

Haematological parameters were analysed using SYSMEX auto analyser. Serum Ferritin was quantitatively determined by ChemiluminscenceMicroparticulateImmuno Assay (CMIA).

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Statistical Analysis

Data was expressed as Mean±SD. Analysis of Variance (One way ANOVA) was used for comparison between anaemic pregnant women and normal pregnant women. The data was analysed by t test (MINITAB 14 SOFTWARE). $p< 0.05$, $p < 0.01$ was considered statistically significant, $p< 0.001$ was considered Highly Significant(HS) and $p> 0.05$ was considered as not Significant.

RESULTS

Table 1: The anthropometric data in second trimester pregnant women of control & study groups.

Parameter	Group –I Control (n=30)	Group-II Study (n=30)	P Value.
Maternal age (years)	23±2	22±3	0.17 (NS)
Gestational age at the Time of echo (week)	20 ±2	21 ±2	0.65 (NS)
Weight (kg)	47.40±4.43	50.32±6.28	0.09 (NS)
Height (cm)	140.3±3.5	141.2±4.0	0.2 (NS)
Body surface area	27.33±0.14	29.35±0.16	0.5 (NS)
SBP(millimitres of mercury)	101.6±6.62	102.3± 5.19	0.06 (NS)
DBP(millimitres of mercury)	68.8± 7.25	64.6±7.48	0.09 (NS)

p>0.05: Not Significant (NS), *p: <0.05: Significant,** p: <0.01: Highly significant, *** p: <0.001: Very highly significant.

Table 1 shows demographic characteristic of the study population. Age and body surface area (BSA) were almost similar in the two groups. This observation was not statistically significant(p>0.05). SBP showed an increase in study group when compared to control group. This observation was not statistically significant between control & study groups(p>0.05). DBP showed an decrease in study group when compared to control group. This observation was not statistically significant between control & study groups(p>0.05).

Table 2: Comparison of haematological parameters between two groups

Parameter	Group –I Control (n=30)	Group-II Study (n=30)	P Value.
Hb%	11.57±1.19	8.49±0.75	0.000 (HS)
RBC	4.16±0.41 (millons/cumm)	3.89±0.40	0.6 (NS)
Serum ferritin	41.76±52.25	4.89±1.21	0.002 (HS)

p>0.05: Not Significant (NS), *p: <0.05: Significant,
** p: <0.01: Highly significant, *** p: <0.001: Very highly significant.

Table 2 shows comparison of haemoglobin concentration,RBC count between control & study groups. Hb% showed a statisticaliysignificant decrease in study group when compared to control group ($p<0.001$). RBC wasnot statisticaliy significant decrease in study group when compared to control group .Serum ferritin showed a statistically significant decrease in study group when compared to control group($p<0.01$).

Table 3 shows Comparison of Mean±SD , significance & range of QRS duration, QT interval, QTc interval & QRS axis between control & study groups of 2nd trimesters pregnant women.

QRSD in sec in control 2nd trimester pregnant women without anaemia & in study group 2nd trimester pregnant women with anaemia were 83.04±8.79 & 76.52±10.76 respectively. This observation showed a statistically significant decrease in study group when compared to control group ($p<0.02$)

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Table 3: Comparison of Mean±SD ,significance& range of QRS duration,QTinterval,QTc interval & QRS axis between control & study groups .

Parameter	2nd trimester		2nd trimester	P value
	Control Group I		Study Group II	
	Mean±SD	Range	Mean±SD	
QRSduration	83.04±8.79	80-100ms	76.52±10.76	0.02 (S)
QT interval	365.04±24.89	320-360ms	350.32±17.44	0.06 (NS)
QTc interval	431.44±23.75	350-420ms	449.46±17.33	0.003 (HS)
QRS axis (in degrees)	46.44±16.24	22-82	44.36±21.21	0.7 (NS)
T axis(in degrees)	19.84±20.57	-33-54	21.40±18.20	0.78 (NS)
p>0.05: Not Significant(NS), *p: <0.05: Significant, ** p: <0.01: Highly significant, *** p: <0.001: Very highly significant.				

QT interval was decreased in study group when compared to control group. This observation was not statistically significant between control & study groups (p<0.06)

QTc interval showed statistically significant increase in study group when compared to control group (p<0.01)

QRS axis showed decrease in study groups. This observation was statistically not significant (p>0.05). T axis showed an increase in study group when compared to control group. There was no statistically significant decrease between control & study groups (p>0.05)

Pregnant women with anaemia in 2nd trimester (study group) showed sinus tachycardia and was statistically significant p>0.01.

There was negative correlation between Hb% , serum ferritin and tachycardia, ECG changes i.e. as the Hb& serum ferritin levels decrease, there was an increase in occurrence of tachycardia & ECG abnormalities.

DISCUSSION

Electrocardiography is one of basic tools in the investigation of cardiovascular diseases [12]. Serum ferritin can be used to estimate the amount of stored iron & is conventional test for the diagnosis of iron deficiency anaemia. The sensitivities of the other iron status markers(serum trasferrin,serum iron) were too low and the false positive rates too high to be of clinical value in the diagnosis of iron depletion. Despite physiologic variations due to haemodilution, the serum ferritin concentration is currently the most reliable non-invasive marker of iron status in pregnancy [6,13].The electrocardiogram during normal pregnancy may show wide variation from the normal non pregnant women. These variations may be due to the changed spatial arrangement of the chest organs as well as changed electrical properties of the myocardium due to low serum ferritin & haemoglobin levels. ECG recordings show changes with anaemia in pregnancy. In the current study tachycardia was observed in anaemic pregnant women, it could be due to increase in heart rate which is due to physiological adjustments in circulation during anaemia. To compensate anaemia cardiac output increases in order to maintain adequate oxygen supply. Cardiac output increases due to increase in blood volume, preload, heart rate, stroke volume along with a decrease in after load [14](Ref.no changed from 13to 14). Similar reports were given by Roy SB, Bhatia ML et al.,[15]ref no from 14 to 15)

But according to Gv S et al.,[16], Lokhotia M et al.,[17] ,tachycardia observed in their study seems to be is due to low basal parasympathetic outflow.

In addition the other changes seen in our study were T wave flattening & inversion.

QRSD: In present study QRSD showed statistically significant decrease in study group when compared to control group. Altered circulatory dynamics during pregnancy might have some effect on its duration. Similar reports were given byLechmanova et al [18].

QT interval:In current study there was no statistically significant decrease in QT interval when compared between the control & study groups.

QTcinterval:QTc interval in ECG reflects the time taken for depolarization& repolarization in the ventricular myocardium. In our study an increase in QTc interval may be due to tachycardia & complex consequence with changes in regulatory mechanisms during pregnancy.Also supported bySunitha M et al [19],OzmenN et al [20],Carruth JE et al [21],OramS et al [22], B.N.Nandini et al[23] in their studies. In current study prolongationof QTc interval may be due to low serum ferritin because prolongation of QTc is predominately dependent on K+ rectifier current. It is possible that low levels of ferritin might affect the ferritin dependent K+ current, both the outward & the inward rectifier current & that it may affect the QTc interval which was supported by Aerssens J et al.,[24,25].

QRS axis:It is a measure of overall direction of depolarization of the ventricles. In current study QRS axis showed no statistically significant decrease in control & study groups.

T axis:In present study there was no statistically significant increase in T axis when compared between the control & study groups.

CONCLUSION

Pregnancy with iron deficiency anaemia brings about various changes like QRS duration QTcinterval & tachycardia in ECG. There was a negative correlation between Hb level, serum ferritin and ECG abnormalities. If anaemia persists for longer time it may lead to cardiac hypertrophy. This study clinically helps the condition of the heart for early diagnosis.

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