

An Observational Study Of Electrocardiographic Findings In Third Trimester Of Pregnancy With Anaemia, In A Tertiary Care Centre Of North East India

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Abstract:

Introduction: pregnancy is a physiological condition rather than an illness, but the number of difficulties related with pregnancy is significant. Anaemia in pregnancy is one of the most common and widespread public health problems. Anaemia affects various organs in body including the heart. It affects the heart by impairing the O₂ supply of myocardium, thus supply – demand myocardial mismatch causing myocardial ischemia or infarction. Electrocardiography is one of basic tools in the investigation of cardiovascular diseases. Hence, the present study is taken up to assess the changes in electrocardiographic parameters in pregnant women with anaemia in third trimesters of pregnancy.

Objectives:

1. To assess the changes in ecg in pregnant women with anaemia in third trimester.
2. To determine the proportion of pregnant women with anaemia having ecg changes in third trimesters of pregnancy.

Materials and method: a hospital based cross sectional study was taken up among pregnant women with anaemia in their third trimester. Written informed consent was obtained from all the participants. All the study participants were personally subjected to detailed history and clinical examination. Hb% and rbc count were recorded from current medical documents. 12 – lead standard, resting ecg were recorded from the study participants. The data were analyzed using spss 21.

Results: a total of 25 pregnant women with anaemia in their third trimester had participated in the study. Mean age of the study participants were (25.50±5.23) years. Mean hemoglobin level were (9.08±0.65) gm%. Mean pr interval, qt interval & rr interval were (0.13±0.02) sec, (0.37±0.04) sec & (0.62±0.12) sec respectively. T wave was inverted in 90% of the participants. T wave was inverted in lead iii & v1 in 65.4% of the participants, only in lead v1 26.9% and only in lead iii in 7.7% of the participants.

Conclusion: presence of t wave inversion in ecg in most of the participants is associated with increased risk of coronary heart disease. Therefore pregnant women with anemia should be closely monitored for development of cardiovascular diseases to prevent any complications.

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I. Introduction:

Pregnancy is a physiological condition rather than an illness, but the number of difficulties related with pregnancy is significant. It is a biological process that utilizes several resources of the mother to nurture & accommodate the developing fetus. These result in widespread physiological changes on the body of the pregnant women¹.

Anaemia in pregnancy is one of the most common and widespread public health problems. The overall prevalence of anaemia among pregnant women is 36.8% worldwide and the highest of this prevalence is mild anaemia. The prevalence of anaemia in the third trimester is higher than in the first and second trimesters. Anaemia in pregnant women in developing countries is significantly higher than in developed countries². The risk factors that are involved are young age, educational status and socioeconomic status, poor birth spacing, grand multiparity and lack of compliance to iron and folic acid supplementation³.

The maternal blood volume increases markedly during pregnancy. Blood volume increases progressively from 6-8 weeks of gestation & reaches maximum at approximately 32-34 weeks. The increase in

plasma volume (40%-50%) is relatively greater than that of RBC mass (20%-30%), which results in hemodilution and decrease in haemoglobin concentration⁴.

During pregnancy the mother is under risk of developing nutritional deficiency anaemia because of increased body demands of the nutrients. The degree of iron requirement depends on iron stores and the amount of dietary iron that can be absorbed⁵. Anaemia is a condition in which the number & size of red blood cells or the hemoglobin concentration falls below an established cut-off value, consequently impairing the capacity of the blood to transport oxygen around the body⁶.

The major consequences of anaemia in pregnancy are increased maternal mortality and morbidity as well as low birth weight leading to increased infant mortality. Anaemia affects various organs in body including the heart. It affects the heart by impairing the O₂ supply of myocardium, thus supply – demand myocardial mismatch causing myocardial ischemia or infarction⁷.

In pregnancy, there is a significant increase in heart rate as early as 5th week of pregnancy and this contributes to an increase in cardiac output. Presence of anaemia in pregnant women further increases the workload on the heart and thereby increases the oxygen demand leading to demand and supply mismatch for oxygen. All these can contribute to the abnormality in cardiac performance. Cardiovascular abnormality in pregnant women with anaemia further increases the complication leading to increased morbidity and mortality. Electrocardiography is one of basic noninvasive tools in the investigation of cardiovascular diseases.

According to National Family Health Survey-4, the prevalence of anaemia among pregnant women in Tripura was 54.4%⁸. Very few studies had been conducted in this part of India to assess the cardiac performance in pregnant women with anaemia. Hence, the present study is taken up assess the changes in electrocardiographic parameters in pregnant women with anaemia in third trimesters of pregnancy.

II. Materials And Method:

Study design: Hospital based Cross-sectional study

Type of study: Observational study

Study duration: 6 months; August 2023 to January 2024

Study area/location: Department of Physiology in collaboration with Department of Obstetrics & Gynaecology, Agartala Govt. Medical College (AGMC), Agartala.

Study population: 25 pregnant women with anaemia in their third trimester attending the antenatal clinic of Agartala Govt. Medical College (AGMC), Agartala were included in the study.

Sampling procedure: Convenient sampling Convenience type of sampling (non-probability) was used to select the participants for the study among the study population who suitably fulfill the selection criteria. Written informed consent was obtained from all the participants.

Inclusion criteria:

1. Pregnant women in third trimester of gestation with anaemia⁶.

[WHO classification of anaemia for pregnant women i.e. Hb% below 11gm/dl. Mild anaemia was classified as hemoglobin concentration of 9.0 to 10.9gm/dl, moderate anaemia as 7 to 8.9 gm/dl and severe anaemia as hemoglobin below 7 gm/dl.]

2. Co-operative and willing to participate in the study.

Exclusion criteria:

All pregnant women with the following characteristics

1. Any known cardiac diseases or hypertensive disorders of pregnancy.
2. Diagnosed renal disease.
3. Uncontrolled thyroid disorders.
4. Those who are not willing to participate in the study.

Study tools:

- Electrocardiograph (Model No. CARDIART 6108T) available in the department of Physiology, AGMC and GBP Hospital.
- Sphygmomanometer – Mercury Deluxe BP apparatus (diamond allied products)
- Stethoscope
- Height measuring stand – Bioplus; height 200cm

- Weighing machine – Victoria Dx
- Case study format

Data collection:

All the study subjects were selected consecutively during the study period following the inclusion and exclusion criteria.

All the participants were personally subjected to detailed history regarding name, age, sex, occupation, socioeconomic status, educational status, medical history and clinical features etc. These findings were recorded in a predesigned and pretested standard questionnaire. Hb% and RBC count were recorded from current medical documents. Written informed consent was obtained from all the participants.

Complete physical and obstetric examination was performed. Gestation was confirmed by last menstrual period and ultra sound measurement of the fetal crown-rump-length in selected pregnant women.

Measurement of height and weight:

Height of the subjects was measured barefooted in centimeters to the nearest 0.1cm. The subjects were asked to stand straight with the head in the Frankfurt horizontal plane. Two readings were taken. The average of both was recorded as the height of the subject. Weight of the subject was recorded to the nearest 0.1kg. The subjects were asked to stand on the weighing machine without shoes and while wearing only light clothes. Two readings were taken and their mean were recorded as the weight of subject.

Measurement of Blood Pressure:

BP (mmHg) was recorded as per the guidelines of the American Heart Association (2009) with the participant in a seated position and at least two measurements made with cuff at the level of the heart, 2 minutes apart and their average value recorded as the BP of the participant.

Recording of ECG:

A 12-lead standard, resulting ECG was recorded from the study participants. The recording, measurements and interpretations was done as per the standard guidelines ⁹.

The following ECG parameters were assessed by using Standardization (Calibration): 10mm=1mv, ECG paper speed 25mm/sec.

- P-wave duration (0.08-0.10sec)
- PR interval (0.12-0.2sec)
- QRS duration (0.05-0.11sec)
- QT interval (0.26-0.45sec)
- QTC interval (0.39±0.04sec): Bazett’s formula: QT/\sqrt{RR}
- Mean QRS electrical axis (-30° to +110°)
- Heart Rate (60-100/min): 1500 divided by the no. of small boxes between two successive ‘R’ waves.

Data analysis:

The data were analyzed using SPSS 21. All the quantitative variables in the present study such as age, height, weight, Hb%, and ECG parameters was analyzed and expressed in terms of descriptive statistics such as mean and standard deviation. A probability value less than 0.05 was considered as statistically significant.

III. Results:

A total of 25 pregnant women with anaemia in their third trimester had participated in the study. Mean age of the study participants were (25.50±5.23) years. Mean hemoglobin level were (9.08±0.65) gm%. Mean PR interval, QT interval & RR interval were (0.13±0.02) sec, (0.37±0.04) sec & (0.62±0.12) sec respectively. T wave was inverted in 90% of the participants. T wave was inverted in Lead III & V1 in 65.4% of the participants, only in Lead V1 26.9% and only in Lead III in 7.7% of the participants.

PARAMETERS	MEAN	STD. DEVIATION
Age (Years)	25.5	± 5.23
Height (cm)	150	± 6.88
Weight (kg)	54.02	± 10.68
POG (wks)	34.65	± 3.32
SBP (mmHg)	116.08	± 10.74
DBP (mmHg)	75	± 7.49
HB%	9.08	± 0.65

Table 1: Variables among the study participants

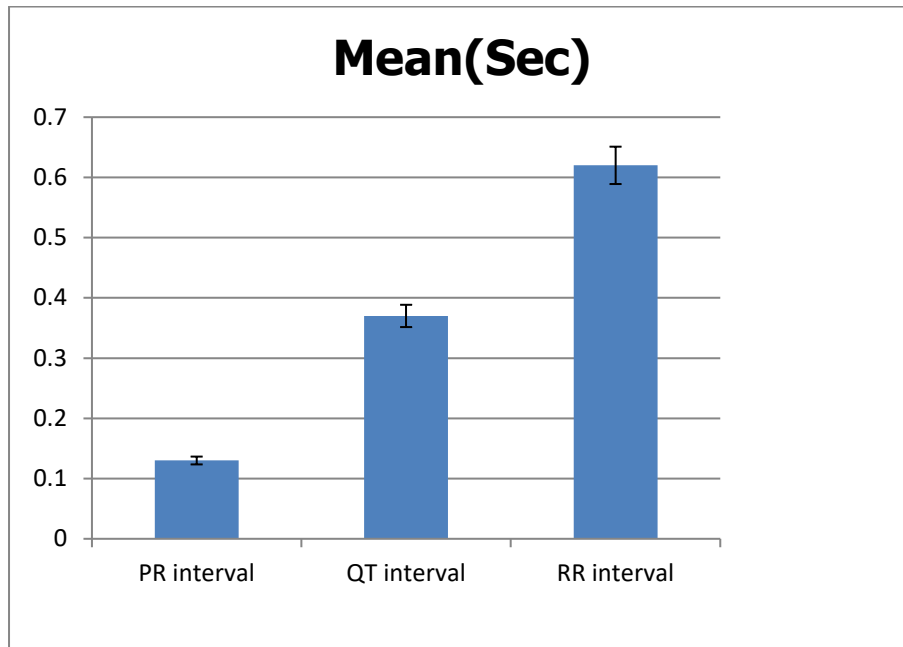


Fig.1: Mean values of ECG parameters

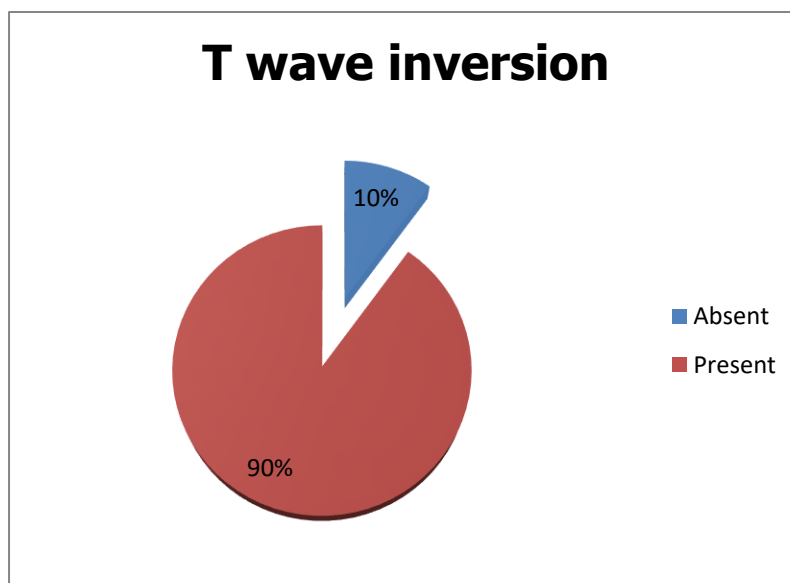


Fig.2: Pie chart showing the T wave inversion in study participants

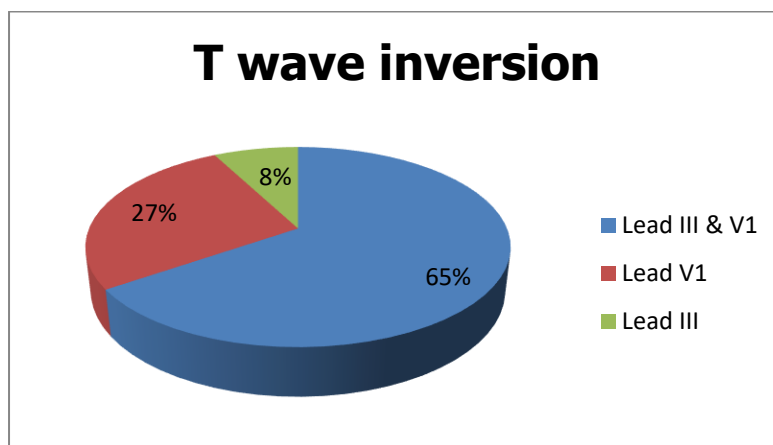


Fig.3: Pie chart showing the T wave inversion in different leads

IV. Discussion:

In developing countries like India anaemia is very common during pregnancy. Anaemia in pregnancy brings about various changes in ECG, suggesting that anaemia and volume overload in pregnancy is a risk factor that may lead to cardiac abnormality.

In the present study there was T wave inversion in the ECG of 90% of the study participants. In a study conducted by Vimlesh P et al. it was found that patients with iron deficiency anaemia had significant ST depression (80.2%) and T wave inversion (94.1%)¹⁰.

Padmaja R.T et al. showed in their study that pregnant women in 2nd trimester of gestation with anaemia had sinus tachycardia and was statistically significant at $p > 0.01$. There was negative correlation between Hb%, serum ferritin and tachycardia, ECG changes i.e. as the Hb and serum ferritin levels decrease, there was an increase in occurrence of tachycardia and ECG abnormalities. Tachycardia 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. They also showed that incidence of T-wave abnormalities like flat and negative or inverted T-waves in lead II, III, avF and also in V2-V4 were statistically more in study group when compared to control group. These findings are consistent with our study⁵.

Renuka B.G et al concluded in their study that anaemic patients are at risk of developing cardiac function abnormality as indicated by ST depression, T inversion and attenuation of QRS complex and ECG changes seemed to be closely related to the severity of anaemia¹¹.

Naito Y et al concluded in their study that in ongoing IDA, the patient develops cardiac hypertrophy and cardiac chamber enlargement, eventually leading to heart failure¹².

T-wave abnormalities in anaemic pregnant women may be due to disturbances in myocardium resulting from oxygen deficiency caused by diminution of oxygen carrying power of the blood and due to increased workload on heart due represented by T-wave inversion.

V. Conclusion:

Presence of T wave inversion in ECG in most of the participants is associated with increased risk of coronary heart disease. Therefore pregnant women with anemia should be closely monitored for development of cardiovascular diseases to prevent any future complications.

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Conflict Of Interest: Nil

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