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A Study of the Electrocardiographic Changes in Normal Pregnant Women.

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ABSTRACT

There are significant cardio respiratory changes in pregnancy and labour. ECG examination is not a routine during antenatal period. In this background, we tried to find out the incidence of any abnormal ECG findings during pregnancy. Two hundred pregnant women, aged 18 to 38, across all stages of gestation from 20 to 34 weeks from a single hospital were recruited for this study. Singleton pregnancies without any previous cardiac illness, hypertension or a metabolic illness possibly affecting ECG were taken for the study. The ECG was reported both by software and a physician well versed in reading ECGs. In case of any doubt, a second physician opinion was sought. Any abnormality was recorded. Parturients with doubtful ischemic change were subjected to Echo evaluation. The mean and standard deviation of the age of the patient is 24.19 ± 4.0 years with an average gestational age of 29.11 weeks. The incidence of abnormal ECG was 27%, the commonest change was short PR interval (13.5%) which can be taken as benign. The respective incidence of sinus tachycardia and WPW syndrome were 5 and 4.5%. Dextrocardia was observed in one patient and nonspecific ST-T changes were observed in three patients who were subjected to echocardiogram which established the diagnosis of dextrocardia and found normal in the other three patients. As the incidence of ECG changes are high (27%) with some specific changes prone for tachyarrhythmias, we conclude that ECG examination may be part of the investigation armamentarium of parturients.

Key words: ECG, pregnancy, PR interval.

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INTRODUCTION

The electrocardiogram (ECG) is a graphic representation of the electrical activity of the heart recorded from the surface. ECG is the technique of choice in the study of patients with chest pain, syncope, palpitations and acute dyspnea, and is crucial for the diagnosis of cardiac arrhythmias, conduction disturbances, pre-excitation syndromes and channelopathies. It is also very important for assessing the evolution and response to treatment of all types of heart diseases and other diseases, and different situations such as electrolytic disorders, drug administration, athletes, surgical evaluation, etc [1]. Obstetrics is the dynamic medical specialty dealing with the care of all women's reproductive tracts and their children during pregnancy (prenatal period), childbirth and the postnatal period. Obstetric care focuses on labor and delivery and continues to the end of the postpartum period. During this time, there are profound changes in maternal physiology. In addition, disorders may develop that are unique to pregnancy e.g. pre-eclampsia. An understanding of the changes in obstetric physiology and the pathophysiology of pregnancy-related disorders is essential to provide safe, effective obstetric care[2].

By 5 weeks of gestation, there is a significant increase in cardiac output. Cardiac output increases by 40% of non-pregnant values by the end of the first trimester, and 50% by the end of the second trimester. In labor, cardiac output increases by an additional 40% in the second stage. An additional 20% increase in cardiac output is seen during uterine contractions. Immediately post-partum, cardiac output can be as high as 75% above pre labor values. These changes can be significant for the patient with preexisting cardiovascular disease.[3] There are a lot of described ECG changes during pregnancy[4]. Whether these ECG changes become relevant during labour and delivery is not known. Hence in this study we tried to find out the incidence of changes in ECG and a clinical correlation of the same.

Aims and objectives:

- To study the ECG changes in normal pregnancy.
- To study the incidence of any abnormal changes.
- To find out the common abnormal changes.
- To correlate the ECG changes if any with further investigations.

MATERIALS AND METHODS

A sample survey of the number of hospitals doing a routine antenatal ECG was done. Two hundred pregnant women, aged 18 to 38, across all stages of gestation from 20 to 34 weeks from a single hospital were recruited for this study. All patients were enrolled for antenatal checkup in an obstetric hospital near puducherry. The gravida was noted but insignificant. Only singleton pregnancies were eligible. Women with cardiovascular disease, metabolic disease, hypertension (essential or pregnancy-induced), preeclampsia or any cardiovascular illness which the patient already knows and likely to affect the cardiovascular system, hence the ECG were specifically excluded. Women were also excluded if they were in labor or in any form of distress. Patients with fever or not willing to take ECG were excluded. The study included a period of six months. The patients were assigned computer generated random numbers and parturients with odd numbers were taken up for this study. The sample size was determined by previous studies and an alpha power of 0.08 and possible abnormalities in 20 % of individuals.

The following data were charted in the proforma

Age, height, weight, (body mass index) BMI, gestational age, gravida and any other medical history were recorded. The routine cardiorespiratory examination was made on all patients. An ECG was taken by the same staff nurse who is well educated and trained in taking the same. The ECG was reported both by software and a physician well versed in reading ECGs. In case of any doubt, a second physician opinion was sought. Any abnormality was recorded. A few patients with possible ischemic changes were subjected to echocardiogram. In all patients, the contact phone number was noted down to access them in case of any necessity. Any significant correlation in the abnormal changes with clinical signs was noted. PR interval measured with the three-channel device. The exact PR interval measurement is the longest distance from the earliest onset of the P wave in the given lead to the earliest onset of the QRS complex in the same lead. Normal PR interval values in adults range from 0.12 to 0.20 seconds (up to 0.22 seconds in the elderly and even under 0.12 seconds in

the newborn) Any PR interval less than 110 ms was taken as short PR interval. A short PR interval followed by certain specific QRS changes which are described below constitute WPW syndrome (Wolff–Parkinson–White). QRS complexes show an abnormal morphology with a width greater than that of the baseline QRS complex (often >0.11 seconds) and characteristic initial slurring (delta wave), which are secondary to the initial activation through the contractile myocardium where there are few Purkinje fibres. Different degrees of pre-excitation (of delta wave) may be observed.

Under normal conditions, the ST segment is isoelectric. Certain normal variants were described. The ST T changes which do not conform to any specific disease pattern were described as nonspecific changes. Even though there are various criteria to define LVH (left ventricular hypertrophy) $SV1 + RV5-V6 \geq 35$ mm (Sokolow–Lyon) was used in this study. In all suspected cases, echocardiography of the heart was done to recognize any other disease. In case of any doubt, a repeat ECG was advised and opinion was obtained. The patients were sent home and asked to follow up with their obstetrician for their antenatal examination. All data were fed into the computer and using SPSS 16 software, the data were analyzed for the incidence of abnormal findings with the commonest one. All other demographic data were analyzed with descriptive methods and a mean and standard deviation was utilized. All these data were not to be compared with the similar age group non pregnant individuals as they don't form part of the study protocol. The other data including gravida were descriptively explained.

RESULTS

A total of 200 pregnant mothers were enrolled for the study. Out of the twenty obstetric hospitals, only two prefer to take antenatal ECGs. In our study all cases were done in only one hospital, near puducherry. All the patients completed the protocol and there were no omissions. There were no significant events during the study period. All data were spread over excel spread sheet. The data were subjected to simple descriptive analysis and reporting. The mean and standard deviation of the age of the patient is 24.19 ± 4.0 years. The study was done in pregnant patients and hence the question of sex does not arise. Regarding the gravida, the primigravida was one hundred and forty five patients (145), second gravida was forty seven (47) and the third was eight (8). The mean gestational age was 29.11 ± 3.0 weeks. The body mass index was 22.93 ± 2.966 . The minimum BMI was 18 with a maximum of 31 which varied among our 200 patients. The mean heart rate was 78.125 ± 11.41 / minute in our patients. Out of the 200 patients, three complained of dyspnea and in all these patients the clinical examination and ECG were normal. This was other than the two patients who had clinical history of bronchial asthma and dyspnea. These patients with bronchial asthma were clinically symptom free with inhaled drugs. There was one patient with controlled epilepsy. Two of our patients had chest pain and the clinical examination and the ECG were normal in both these cases. Three patients had clinical hypothyroidism which was corrected with drugs and in all these hypothyroid patients the ECG was normal. One had dextrocardia, not known to the patient earlier, but revealed by the ECG. A heart rate of more than 100 was taken as sinus tachycardia and when it was associated with other abnormalities, it was considered in the disease status than in the sinus tachycardia section. (e.g. inhaled beta agonists and heart rate) The incidence of abnormal ECG was 27%, the commonest change was short PR interval (13.5%) which can be taken as benign. The respective incidence of sinus tachycardia and WPW syndrome were 5 and 4.5%. The demographic data (fig 1), systemic illness, the ECG abnormalities found in this study are depicted in dedicated figures and tables. (table 1)

Table 1: Showing the ECG changes

ECG changes	Number of parturients
Normal	146
Short PR interval	27
WPW syndrome	9
Sinus tachycardia	10
Nonspecific ST T changes	3
Dextrocardia	1
LVH	4

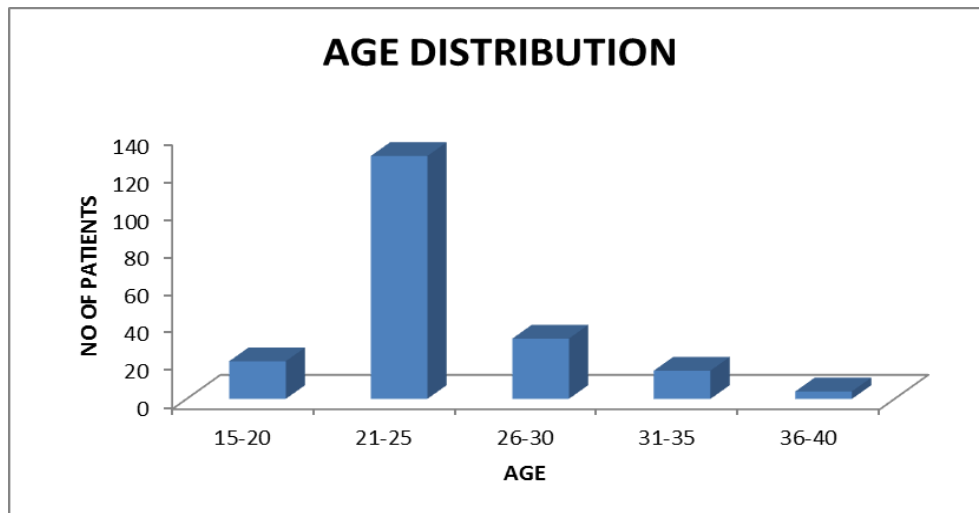


Figure 1: Showing age distribution

DISCUSSION

The average age of our pregnant women is 22.19 where it is 25.1 in USA and 28.1 in Australia. Hence it is clear from our study that our patients get pregnant earlier than the counterparts of many developed countries [5]. Excessive prenatal weight gain in overweight and obese women increases the risk of maternal hypertension, postpartum weight retention and macrosomia in the infant and may necessitate caesarean delivery and perinatal complications. In our study, the mean BMI is well under normal limits[6]. There is a clear suggestion that pregnancy affects the ECG at some time point and that there is restoration of the normal axis late in pregnancy or following delivery. We found out an incidence of 2% of left ventricular hypertrophy in our study according to ECG criteria. In all these patients, we found that the echo heart to be normal. [7]

The commonest ECG change was a short PR interval which was observed in 27 cases and it is more than the previously reported data. In our cases of short PR interval, patients were asymptomatic. We had not taken ECGs in a serial fashion to document any changes with gestational age. Studies indicate that shortening of PR interval during pregnancy does not need any treatment[8].

Still it should be borne in mind that the incidence of WPW syndrome is very high and around 4.5% of individuals suffer and in our study whether these changes revert after the cardiovascular changes associated with pregnancy is not known [9]. Still in tachyarrhythmia of unproven and unknown cause in pregnancy, the knowledge of the possibility of WPW syndrome is to be there. Sinus bradycardia, ectopic beats observed in earlier studies were not found in our study. Nonspecific ST T changes observed in a few cases, later on the echo heart was normal [10].

The prevalence of asthma is 12% among pregnant women in Australia. In our cases, we had two cases of known bronchial asthma which was well controlled inhalational steroids[11]. The incidence in our study is 1 % only. This is less than the expected prevalence of comorbid conditions like asthma in pregnancy. Even though the incidence of hypothyroidism is only 3/200, and all these patients are clinically euthyroid as well as biochemically normal, we did not expect any abnormality in ECG[12]. This was manifest in our findings. Estimates suggest that between 0.2 and 0.5% of pregnancies that occur involve a woman with active epilepsy[13]. This earlier finding goes along with our study which denotes one patient in 200 cases.

CONCLUSION

ECG examination is not a routine in many of the hospitals for routine obstetric patients out of the total 200 pregnant mothers who completed the study, the incidence of abnormal ECG was 27%, the commonest change was short PR interval which can be taken as benign. The incidence of WPW syndrome 4.5%, which itself was higher than earlier reports. All patients with significant abnormal ECGs were subjected to echocardiogram which was normal. It is to be noted that the incidence of undiagnosed tachyarrhythmia is

high among pregnant women with WPW syndrome. Hence to identify such cases prior is essential. We conclude with a note that the possibility of a routine antenatal ECG should be encouraged to identify rare causes of cardiac illness and avoid any potential catastrophic journey of motherhood.

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