

EMBRYONIC HEART RATE: A PROGNOSTIC FACTOR OF FIRST TRIMESTER PREGNANCY OUTCOME

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Article Info: Received 09 January 2021; Accepted 15 February 2021

DOI: <https://doi.org/10.32553/ijmbs.v5i2.1758>

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Conflict of interest: No conflict of interest.

Abstract

Introduction: The earliest proof of a viable pregnancy is obtained when cardiac activity of the embryo can be observed. Transvaginal sonography can accurately demonstrate embryonic heart rate at 6 weeks of gestational age by using M-mode transvaginal sonography. Slow embryonic heart rate at 6-7 weeks of gestational age is associated with high rate of first trimester pregnancy loss.

AIM: The study was aimed to evaluate the role of embryonic heart rate (EHR) of early pregnancies as predictive factor of adverse outcome at end of first trimester of pregnancy.

Methods: This observational study was conducted in the Department of Obstetrics and Gynecology Zenana Hospital, SMS Medical College, Jaipur. It included 300 pregnant women between 6 weeks to 9 weeks of gestational age attending antenatal OPD. Embryonic heart rate was measured by transvaginal sonography. Embryonic heart rate was classified as slow, if it was fewer than 110 beats/minute or outcome was measured as occurrence of spontaneous pregnancy loss prior to 12 weeks.

Results: Out of 300 cases, 290 (96.67%) had embryonic heart rate ≥ 100 beats per minutes and 10 (3.33%) had embryonic heart rate < 100 beats per minutes. Out of these 290, (Embryonic heart rate ≥ 100 beats per minutes), 284 (97.93%) had good prognosis and 6 (2.07%) had abortion. In 10 women (Embryonic heart rate < 100 beats per minutes), 3 (30.00%) had good prognosis and 7 (70.00%) had abortion. This observation was statistically significant.

Conclusion: Slow embryonic heart rate on ultrasonography reduced the success of pregnancy and may lead to abortion.

Keywords: Embryonic heart rate, Ultrasonography, Early pregnancy loss

Introduction

It is estimated that approximately 30-40 % of human pregnancies result in spontaneous abortion during the first trimester after implantation. Significant number of losses predominantly occurs very early in gestation, but once the embryonic heart activity appears the rate of spontaneous abortion gradually decreases to 2-5 %.¹ However intrauterine gestational sac is first to appear sonographically, followed by the yolk sac and the foetal pole with cardiac activity.²

Within the gestational sac, yolk sac is the first evident embryonic structure. It is usually visible between the fifth and twelfth week of pregnancy as a round anechoic area; after which it undergoes degeneration.^{3,4}

Many investigators have studied the mean and distribution of EHRs as a function of gestational age as a possible predictor of fetal viability. Most studies of early EHR in fertile women have examined and assessed the prognostic significance of slow or fast early EHRs.⁵

Material & methods

This observational study was conducted in the Department of Obstetrics and Gynecology, Zenana Hospital, SMS Medical College, Jaipur from May 2019 to August 2020. It

included 300 pregnant women with gestational age ranging from 6 weeks to 9 weeks, who were attending antenatal clinic in obstetrics and gynaecology department. A written and informed consent was taken. Women with symptomatology of threatened abortion, chronic illness like diabetes mellitus, hypertension and autoimmune diseases or women with drug abuse and smoking were excluded from the study. All pregnant women had ultrasonography evaluation using M-mode scanning. The intrauterine gestational sac and embryo were identified, crown-rump-length was measured to confirm the gestational age and cardiac activity was noted. After embryo heart activity was confirmed, calculation of embryonic heart rate was done by measuring the time interval for at least three waves, which provided the number of heart beats per minutes. Outcome was measured as spontaneous pregnancy loss. Women with slow heart rate less than 110 beats/minute had adverse outcome.

Statistical analysis

Linear variables were summarised as mean and standard deviation and were analysed using unpaired 't' test. Nominal/categorical variables were described as proportional and were analysed using chi-square test / fisher's exact test.

p-value <0.05 was taken as significant (MEDCALC 16.4 version software was used for all statistical analysis).

Results:

Total 300 cases were enrolled in this study, 151 women (50.33%) were from 20-25 yrs age group and 149 (49.67%)

were from 26-30 yrs age group. Mean age of cases was 25.40 ± 3.04 years. 250 women (83.33%) were hindu and 50 (16.67%) were muslim ,187 (62.33%) were primigravida and 113 (37.67%) were multigravida.

Table 1: Distribution of Cases According to Embryonic Heart Rate (EHR)

Embryonic Heart Rate (EHR)	No.	%
<100	10	3.33
≥100	290	96.67
Total	300	100.00

Table 2: Distribution of Cases According to Pregnancy Outcome in Correlation with Embryonic Heart Rate (EHR)

Embryonic Heart Rate (EHR)	Survival		Abortion		Total	
	No.	%	No.	%	No.	%
<100	3	30.00	7	70.00	10	3.33
≥100	284	97.93	6	2.07	290	96.67
Total	287	95.67	13	4.33	300	100.00

p-value = 0.001

This study showed that embryonic heart rate more than 100 beats/min had a sensitivity of 98.95%, specificity of 53.85%, positive predictive value of 97.93% and a negative predictive value of 70.00% in predicting the first trimester outcome. According to these four parameters diagnostic accuracy of embryonic heart rate was 93.00% for successful pregnancy outcome.

Discussion:

Embryonic heart rate develop during embryonic development between 6 weeks to 9 weeks of gestational age. The development in the obstetric ultrasound 50 years ago mainly focussed on documentation of embryonic heart rate in the first trimester scan to confirm viability.^{6,7} Subsequently it was realized that slow embryonic heart rate was associated with increased rate of spontaneous abortions. Now it is universally known that embryonic heart rate serves as one of the important predictors of imminent fetal demise.⁸ Transvaginal ultrasonography has higher resolution and hence it can be used for visualization of the embryonic heart beat in M mode. The embryonic heart rate can be visualized as early as 5 - 6 weeks of gestation and it is known that the mean heart rate progressively increases from 6 weeks (120 to 140 bpm) to 9 weeks (145 to 170 bpm) after which it slowly stabilizes to lesser heart rate for rest of the pregnancy.⁹ It has been observed that embryonic heart rate less than 100 bpm (beats per minute) is associated with higher risk of miscarriage and the risk of embryonic demise almost touches 100 % when the rate is less than 80 bpm.¹⁰ The rate of chromosomal abnormalities and structural abnormalities are significantly higher in surviving fetuses when they have slow heart beats.¹¹

Several studies have examined the relation between slow embryonic heart rate and rate of first trimester pregnancy loss . In this study we found that women with normal heart

rate (above 110 beats/mint) had 97.93% of positive pregnancy outcome while 70% of those with embryonic heart rate less than 110 beats/ mint had abortion.

Similar results was seen in Adiga P et al¹² who found that ten abortions occurred when heart rate was abnormal (10/12, 83.3%), whereas, those with normal embryonic heart rate, 2 women (2/268, 0.7%) had abortion. These observations were highly significant.

Kurtz AB et al¹³ found that association between embryonic heart rate and maternal outcome was statistically significant.

In this study we found sensitivity, specificity, positive predictive value, negative predictive respectively 98.95%, 53.85 ,97.93% ,70.00, of embryonic heart rate equal or more than 110 beats/ mint and diagnostic accuracy was 93.00%

The sensitivity, specificity and PPV of predicting an abnormal outcome was 26.9%, 92.7% and 51.1% respectively as reported by Lindsay DJ et al¹⁴. The results of our study are comparable to the results of this study.

Conclusion

The finding of this study showed that embryonic heart rate can be an important predictor for predicting pregnancy outcome. It has been observed that slow embryonic heart rate on ultrasonography reduced the success of pregnancy and may lead to abortion

Thus assessing embryonic heart rate by ultrasonography in first trimester of pregnancy helps in predicting pregnancy loss at the earliest and thus patients may be closely follow up.

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