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Maternal arrhythmias detected with electrocardiography during labour: Are they significant clinically?

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Summary
This study examines the maternal and fetal effects of arrhythmias detected by electrocardiographic (ECG) monitoring during labour in parturients at term, with no cardiovascular pathology. Pregnant cases were classified into three groups based on determined stages of labour and a standard 12-lead surface electrocardiogram and long-lead 2 rhythm strips were recorded during the labour. Cardiac arrhythmia of any kind was detected in 82.3% of patients in all stages of labour. Sinus tachycardia was the most commonly observed arrhythmia. Arrhythmias in the form of supraventricular tachycardia, T-wave inversion and ventricular extrasystole were also detected. The highest rate of arrhythmia was recorded for the active phase and 2nd phase of labour. Arrhythmias that are detected by ECG during or after the labour in patients with no cardiovascular pathology display a benign nature and do not create any clinical risk for the mother and the baby.

Keywords: *Arrhythmia, electrocardiography, labour, pregnancy*

Introduction

Cardiac arrhythmias are quite prevalent during pregnancy. They can be observed in pregnant women without a history of cardiovascular disorder. However, it is important to identify arrhythmias during pregnancy in order to be able to detect any underlying cardiovascular disease. Arrhythmias concurrent with an existing cardiac disorder increase maternal and fetal morbidity. Detecting arrhythmia in advance can reduce existing risks (Berlinerblau 2004; Elkayam and Gleicher 1998).

Pregnancy brings about a hyperdynamic circulation in the form of increased cardiac output, heart rate and blood volume, and decreased vascular resistance and average arterial pressure. Changes in these parameters balance each other out and these parameters revert back to normal levels after labour. However, severe arrhythmia arising during pregnancy or labour can adversely affect this natural balance (Elkayam and Gleicher 1998).

This study examines the maternal and fetal effects of arrhythmias detected by electrocardiographic (ECG) monitoring during labour in parturients at term, without any known cardiovascular pathology.

Materials and methods

The study group included 38 patients with vertex presentation who were followed-up in our obstetrics clinic. The ages, parities, gestational weeks, blood pressure and weight gains of patients were monitored on a regular basis. Patients with a medical disorder; smoking and coffee addiction; constant medicine use; anaemia; electrolyte imbalance; hyperthyroidism; high blood pressure; morbid obesity, and patients under oxytocin treatment were excluded from the study. All of the patients initially entered into the study had echocardiography in order to determine if there was normal cardiac structure and function, and patients with cardiac pathology detected by echocardiography were excluded from the study. Informed consent was taken from all selected subjects. Approval for the study was obtained from Fatih University, Institutional Review Board.

Subsequently, all patients were classified into three groups, based on determined stages of labour and all cases were followed from the beginning to the end of the delivery. They were classified into three groups based on determined stages of labour:

- Group 1: Patients who were at stage 1, latent phase (cervical dilation <4 cm, effacement $<30\%$) of delivery
- Group 2: Patients who were at stage 1, active phase ($\leq$cervical dilation between 4–$\leq$10 cm, $\leq$ effacement between 40%–$\leq$100%) and stage 2 of delivery
- Group 3: Patients during the first 6 hours after giving birth.

Long-lead 2 rhythm strips and a standard 12-lead surface electrocardiogram recorded for all patients in all three stages by a Hewlett Packard Page Writer, which records 12 derivations simultaneously at a paper speed of 50 mm/s, with a calibration of 0.5 mV/cm. Based on ECG traces, heart rates <60 b.p.m. and >100 b.p.m. were classified as bradycardia and tachycardia, respectively. Patients who had undergone a caesarean section due to an obstetric reason, were excluded

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from the study group. Changes in ECG traces in all three stages were recorded. Arrhythmias developed in different stages of labour and their maternal and fetal effects were examined.

The statistical analyses were carried out using the SPSS 15.0 statistical software package. Following the entering of patiet data into the computer, all the necessary diagnostic checks and corrections were performed. Conformity of the measured values to normal distribution was examined graphically and using Shapiro–Wilks test. Test results failed to detect a normal distribution pattern for the groups. In presenting descriptive statistics, numbers and percentages were used for categorical variables, and median (Interquartile range, IQR) values were used for the data. The Friedman's Test was used for group comparisons. When a difference was detected, Modified Bonferroni Wilcoxon Test was used to determine which stage that difference belonged to. Significance level (alpha) was set to 0.05.

Results

The initial sample size for this study was 38. After excluding the four caesarean section cases due to obstetric reasons, the final sample consisted of 34 patients. The mean age, gravidity and parity, gestational weeks and birth weights are listed in Table I. Gravidity and parity of the women are given below:

- Gravida 1: 35.3%; Parity 0: 44.1%
- Gravida 2: 47.1%; Parity 1: 41.2%
- Gravida 3: 17.6%; Parity 2: 14.7%.

As a total of 47 cardiac arrhythmias of any kind were detected in 82.3% of patients (28 of 34) in any given stage of labour. Sinus tachycardia was the most commonly observed cardiac rhythm disturbance, with a frequency of 70.6% (24 of 34). Other cardiac arrhythmias in the form of supraventricular tachycardia (three cases), T-wave inversion (two cases) and ventricular extrasystole (one case) were also detected. Among the three groups, the highest rate of arrhythmia was recorded for the active phase group (29 of 47 arrhythmias), with sinus tachycardia being the most common type (10 cases). This group also had three patients with supraventricular tachycardia (8.8%) and two patients with T-negativity (5.8%). Similarly, sinus tachycardia was the most frequently observed arrhythmia in the latent phase group (five cases). The distribution of the frequency of arrhythmias across three groups is presented in Table II.

The pairwise comparison tests yielded significant differences in arrhythmia frequencies between patients in the latent phase vs active phase ($p < 0.001$), and patients in the latent phase vs postpartum period ($p < 0.001$), based on ECG monitoring. The active phase group experienced higher incidences of arrhythmia than the postpartum group. But the tests failed to detect any significant difference between the active phase group and postpartum group ($p = 1.000$).

When the groups are compared in terms of arrhythmia types, there were statistically significant differences in sinus tachycardia frequencies ($p < 0.001$). Active phase group patients experienced significantly higher sinus tachycardia incidence compared with other groups ($p < 0.001$). There was no statistically difference between latent phase and postpartum group ($p = 0.025$). Incidence of supraventricular tachycardia, ventricular extrasystole and T-negativity rates were not significantly different between groups ($p = 0.050$; $p = 0.368$; $p = 0.135$).

None of the cases had severe arrhythmia. Patients did not show serious symptoms, except tachycardia during these arrhythmias. None of the patients who experienced arrhythmia developed maternal and fetal mortality or morbidity. None of the mothers or neonates needed intensive care. Apgar scores of newborns at 1 and 5 min after birth were 9 (1) and 10 (0), respectively.

Table I. Demographic characteristics of cases.

	Mean ± SD; Median (IQR)
Age (year)	29.7 ± 6.6
Gravida (*n*)	2 (1)
Parity (*n*)	1 (1)
Gestational age (week)	38.6 ± 7.2
Birth weight (g)	3,309 ± 421.3

Discussion

Earlier studies report a cardiac arrhythmia incidence rate of 1.9–3.6% in women (Niwa et al. 2004). Arrhythmias are very common during pregnancy and labour and their true incidence are not known. Although a previous study reports that 95% of the pregnant women experience supraventricular or ventricular extrasystoles, complex arrhythmias in pregnancy are very rare (Tateno et al. 2003). In a study conducted by Ovando et al. (1983), an arrhythmia frequency of 72% was found during labour while Upshaw et al. (1970) detected at least one arrhythmia incidence per patient in their study. The current study reveals an arrhythmia rate of 82.3%. None of the patients experienced serious arrhythmia; sinus tachycardia was noted in 24 patients (70.5%) and supraventricular tachycardia in three (8.8%).

Pregnancy can cause the development of cardiac arrhythmia, regardless of the existence of prior organic heart disease, creating clinical risk for the mother and the baby (Flores and Márquez 2007; Erdoğan and Aksu 2005). Whether the incidence rates increase with pregnancy or the detection of higher frequency, is the result of closer monitoring during pregnancy is the subject of further study.

Hormonal, haemodynamic and autonomic changes are the underlying mechanisms causing arrhythmias in pregnancy. During pregnancy, oestrogen and hCG levels dramatically rise, intravascular volume increases and cardiac output doubles, resulting in myocardial stress and end-diastolic

Table II. Types of arrhythmias and detection rates according to groups.

Types of arrhythmias	Latent phase		Active phase		Postpartum		*p* value
	n	(%)	*n*	(%)	*n*	(%)	
Sinus tachycardia	5	14.7	24	70.5	10	29.4	<0.001*
Supraventricular tachycardia	0	0	3	8.8	0	0	0.050
Ventricular extrasystole	0	0	0	0	1	2.9	0.368
T-wave inversion negativity	0	0	2	5.8	2	5.8	0.135

*Statistically difference between latent phase group vs active phase and active phase group vs postpartum group.

volume increase. Sympathetic system activity also increases in parallel with the higher catecholamine levels and adrenergic receptor sensitivity (Braverman et al. 1991; Brodsky et al. 1992; Doig et al. 1992). All these hormonal changes make pregnant women more susceptible to arrhythmias.

A change in the position and orientation of the heart inside the thorax can lead to alterations in some ECG readings during pregnancy (Nihoyannopoulos 1997). QRS changes with small Q waves in Lead III and inverted T-waves are detected. Right axis deviation symptoms can be observed more frequently than left axis deviation symptoms (Kron and Conti 2007; Schwartz and Schamroth 1979). Nonspecific ST- and T-wave abnormalities can emerge at a rate of 4–14%. PR and QT interval can be shortened (Boyle and Lloyd-Jones 1966; Oram and Holt 1961).

Arrhythmia types during pregnancy include a broad spectrum. The most noted arrhythmias are ventricular and atrial ectopic beats (50–60%) (Shotan et al. 1997). On the other hand Sobotka et al. (1981) report no significant differences between pregnant and non-pregnant women in the prevalence of arrhythmias of any kind, including tachycardia and bradycardia, other than Atrial Premature Beats (APBs). Further, a study by Shotan et al. (1997) revealed no difference in APB rates between pregnant and non-pregnant women.

Sinus tachycardias and supraventricular tachycardias are very frequently observed cardiac rhythm abnormalities during pregnancy (Ferrero et al. 2004). Excluding sinus rhythm disturbances, paroxysmal supraventricular tachycardia (PSVT) is the most prevalent arrhythmia type during pregnancy (Hösl et al. 1996). Bradyarrhythmias during pregnancy and labour are very rare (Devendra et al. 2006). They are mostly observed in the fourth phase of labour where there is a decline in anxiety and pain and there is no need for treatment if it is asymptomatic. Nevertheless, symptomatic bradycardia requires treatment – sometimes placement of a permanent pacemaker in the case of heart block (Dalvi et al. 1992).

Ventricular arrhythmias, atrial fibrillation and flutter are extremely rare in pregnancy and when detected, the patient must be examined for presence of unrecognized congenital heart disease, rheumatic valve diseases and hyperthyroidism (Oakley et al. 2003).

In a study by Perrotta et al. (1999), the authors examined the ST changes by ECG monitoring in 46 pregnant women during and after labour and reported changes (flat ST or fluctuating T-wave) in three patients (7%) before labour and in 27 patients (59%) during labour. T-wave inversion in 16 patients (59%), nonspecific changes in 23 patients (85%) and ST segment shortening in eight patients (30%) were also observed. While ST changes continued after labour in seven (15%) cases, they disappeared in most of the cases. Although ST changes were more frequent during labour, no difference was detected in ST patterns between labour phases. This study reports ST changes in 82.3% of the patients, mostly observed in the second and third phases of labour, without creating any serious symptoms.

Most of the studies on pregnant women revealed that sinus tachycardia is the most frequent rhythm abnormality in women. Arrhythmia types other than sinus tachycardia are summarised in Table III. Romem et al. (2004) found, in their Holter study, that 93% of patients experience an arrhythmia of some kind during labour. In the same study, 90% of the reported arrhythmias were isolated atrial premature beats (APB) and the most frequently observed ventricular arrhythmias were isolated ventricular premature beats (VPB). The majority of the arrhythmias were short-lived. While APBs were observed more frequently during the first and fourth phases of labour, bradycardia was especially more prevalent during the fourth phase. Other arrhythmia types do not yield any significant differences in terms of various phases of labour (Romem et al. 2004).

Berlinerblau et al. (2001) studied the arrhythmias developed before, during and 1-hour after the labour and they find that although sinus rhythm disturbance is observed frequently, serious arrhythmias are detected in only two patients, without any need for further treatment. The same study reported that the frequency of arrhythmia development in pregnant women before, during and after labour is not significantly different than those in non-pregnant women (Berlinerblau et al. 2001). The current study detects no APB case and only one VPB. These rates are very low compared with the above studies. The differences may stem from the different methodology employed.

In a study on 20 parturients during labour, Palmer (1994) reported sinus tachycardia in all patients, premature ventricular contractions or supraventricular tachycardia in eight patients, and non-symptomatic ST segment depression in three patients in the postpartum period.

Detecting arrhythmia in advance can prevent maternal and fetal adverse effects during pregnancy and labour. Spritzer et al. (1970) did not detect any serious arrhythmia during labour. Jung et al. (1983) reported one case of serious SVT that required treatment, while Eckstein and Marx (1973) observed

Table III. Most common types of arrhythmias in women except sinus tachycardia.

Study	Study population	Types of arrhythmias	%
Sobotka et al. 1981	50 non-pregnant	APB+VPB	88.0
Ovando et al. 1983	47 in labour	Arrhythmia, most of them atrial origin	72.3
		Ventricular arrhythmia	41.1
Palmer 1994	20 in labour	SVT or VPB	40.0
	ST depression	15.0%	
Shotan et al. 1997	110 pregnant	APB	58.0
		VPB	40.0
Perrotta et al. 1999	46 in labour	ST changes	82.3
Berlinerblau et al. 2001	100 in labour	APB	71.9
		VPB	28.1
Romem et al. 2004	30 in labour	Bradycardia	50.0
		Isolated APB	90.0
		Isolated VPB	50.0

one case of bi- and trigeminy, which could be treated with oxygen. Similarly, in a sample of 92,135 parturients, Mendelson (1956) found that arrhythmias during labour do not adversely affect the course of labour and health of the newborn.

The arrhythmia rates reported in the current study are similar to those reported in the previous literature. However, in terms of arrhythmia types, the results of this study differs from that of Romem et al. (2004) and Berlinerblau et al. (2001). This difference stems from the different methodology employed. The current study is based on a 12-lead ECG and long-D2 rhythm monitoring, while other studies are based on longer observations by the Holter system.

Although the rate of sinus tachycardia in the current study is consistent with that reported in earlier studies, Romem et al. (2004) reported a higher rate of atrial and ventricular premature beats; their bradycardia rate was especially high after labour. However, the authors attributed this result to the fact that the observations were made during periods when the majority of the patients were sleeping. The current study does not report any bradycardia cases and this is consistent with the study by Palmer (1994). Similar to the earlier studies, no serious maternal arrhythmia was observed in our study. There was no need for any medical treatment.

In conclusion, arrhythmia frequency was higher during and after labour. Sinus tachycardia was the most frequently detected arrhythmia by ECG. These arrhythmias did not create any adverse maternal and fetal effects, thus arrhythmias detected by ECG during or after labour on our patients with no cardiovascular pathology, displayed a benign nature and did not create any clinical risk for the mother and the baby.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

Berlinerblau R. 2004. Maternal cardiac arrhythmias during labor. American Journal of Cardiology 93:931–933.

Berlinerblau R, Yessian A, Lichstein E, Haberman S, Oruci E, Jewelewicz R. 2001. Maternal arrhythmias of normal labor and delivery. Gynecologic and Obstetric Investigation 52:128–131.

Braverman AC, Bromley BS, Rutherford JD. 1991. New onset ventricular tachycardia during pregnancy. International Journal of Cardiology 33:409–412.

Boyle DM, Lloyd-Jones RL. 1966. The electrocardiographic ST segment in pregnancy. Journal of Obstetrics and Gynaecology of the British Commonwealth 73:986–987.

Brodsky M, Doria R, Allen B, Sato D, Thomas G, Sada M. 1992. New-onset ventricular tachycardia during pregnancy. American Heart Journal 123:933–941.

Dalvi BV, Chaudhuri A, Kulkarni HL, Purushottam KA. 1992. Therapeutic guidelines for congenital heart block presenting in pregnancy. Obstetrics and Gynecology 79:802–804.

Devendra K, Ching CK, Tan LK, Tan HK, Yu SL. 2006. Intrapartum maternal sinus bradycardia with spontaneous resolution following delivery. Singapore Medical Journal 47:971–974.

Doig JC, McComb JM, Reid DS. 1992. Incessant atrial tachycardia accelerated by pregnancy. British Heart Journal 67:266–268.

Eckstein KL, Marx GF. 1973. Cardiac arrhythmias during delivery (in German). Der Anaesthesist 22:413–414.

Elkayam U, Gleicher N. 1998. Hemodynamics and cardiac function during normal pregnancy and the puerperium. In: Elkayam U, Gleicher N, eds. Cardiac problems in pregnancy. 3rd Ed. New York: Wiley-Liss Inc; pp 3–19.

Erdoğan O, Aksu F. 2005. An approach to cardiac arrhythmias during pregnancy. Turkiye Klinikleri Journal of Medical Sciences 1:69–71.

Ferrero S, Colombo BM, Ragni N. 2004. Maternal arrhythmias during pregnancy. Archives of Gynecology and Obstetrics 269: 244–253.

Flores JR, Márquez MF. 2007. Arrhythmias in pregnancy. How and when to treat? Archivos de Cardiologia de Mexico 77:2–31.

Hösl P, Rust M, Johannigmann J, Schmidt G. 1996. Paroxysmal supraventricular tachycardia in pregnancy. Value of adenosine and other anti-arrhythmia agents. Geburtshilfe Frauenheilkd 56:313–316.

Junge WD, Morgenstern D, Friedrich I. 1983. Paroxysmal supraventricular tachycardia in the delivery room (in German). Zentralbl Gynäkol 105:1014–1019.

Kron J, Conti JB. 2007. Arrhythmias in the pregnant patient: Current concepts in evaluation and management. Journal of Interventional Cardiac Electrophysiology 19:95–107.

Mendelson CL. 1956. Disorders of the heart beat during pregnancy. American Journal of Obstetrics and Gynecology 72: 1268–1301.

Nihoyannopoulos P. 1997. Cardiovascular examination in pregnancy and the approach to diagnosis of cardiac disorder. In: Oakley C, editors. Heart disease in pregnancy London: British Medical Journal Publishing Group. p 52–62.

Niwa K, Warita N, Sunami Y, Shimura A, Tateno S, Sugita K. 2004. Prevalence of arrhythmias and conduction disturbance in large population-based samples of children. Cardiology in the Young 14:68–74.

Oakley C, Child A, Jung B, Presbitero P, Tornos P, Klein W, et al. 2003. Expert consensus document on management of cardiovascular diseases during pregnancy. European Heart Journal 24:761–781.

Oram S, Holt M. 1961. Innocent depression of the S-T segment and flattening of the T-wave during pregnancy. Journal of Obstetrics and Gynaecology of the British Empire 68:765–770.

Ovando LA, Jerminiani H, Miglino R, da Cunha GP. 1983. Estudo das arritmias cardiacas maternas durante o trabalho do parto e o parto. Arquivos Brasileiros de Cardiologia 40:171–176.

Palmer CM. 1994. Maternal electrocardiographic changes in the peripartum period. International Journal of Obstetric Anesthesia 3:63–66.

Perrotta E, Carillo C, Celli P. 1999. Electrocardiographic changes during at term labor. Giornale Italiano di Cardiologia (Roma) 29:48–53.

Romem A, Romem Y, Katz M, Battler A. 2004. Incidence and characteristics of maternal cardiac arrhythmias during labor. American Journal of Cardiology 93:931–933.

Schwartz DM, Schamroth L. 1979. The effect of pregnancy on the frontal plane QRS axis. Journal of Electrocardiology 12:279–281.

Shotan A, Ostrzega E, Mehra A, Johnson JV, Elkayam U. 1997. Incidence of arrhythmias in normal pregnancy and relation to palpitations, dizziness, and syncope. American Journal of Cardiology 79:1061–1064.

Sobotka PA, Mayer JH, Bauernfeind RA, Kankis C, Rosen K. 1981. Arrhythmias documented in 24 h continuous ambulatory electrocardiographic monitoring in young women without apparent heart disease. American Heart Journal 101:753–759.

Spritzer RC, Seldon M, Mattes LM, Donoso E, Friedberg CK. 1970. Serious arrhythmias during labor and delivery in women with heart disease. Journal of the American Medical Association 211:1005–1007.

Tateno S, Niwa K, Nakazawa M, Akagi T, Shinohara T, Yasuda T. 2003. Arrhythmia and conduction disturbances in patients with congenital heart disease during pregnancy: multicenter study. Circulation Journal 67:992–997.

Upshaw CB. 1970. A study of maternal electrocardiograms recorded during labor and delivery. American Journal of Obstetrics and Gynecology 107:17–27.