Fetal Arrhythmias and Related Fetal and Neonatal Outcomes

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Abstract

Objectives: Fetal cardiac arrhythmia has good prognosis. However, some can lead to hydrops fetalis and perinatal mortality. There are not sufficient studies on the prevalence and complications of fetal arrhythmias in Iran, thus, making parents anxious. Therefore, we performed this study to determine its proper management and to prevent its complications during pregnancy. Then we can help parents by giving them sufficient information about their fetal problem.

Materials and Methods: This descriptive-analytic study included 81 pregnant women with fetal arrhythmia detected in routine monitoring. For cases, we performed fetal echocardiography. Data was analyzed by SPSS 20 (P<0.05).

Results: This study assessed the fetal period until 28 days after labor. Fetal arrhythmia was confirmed in 37 cases through echocardiography. The most prevalent arrhythmia was extrasystole with 27 cases (72.97%). Two cases with congenital heart disease experienced heart failure and hydrops fetalis and died in neonatal period and 25 cases survived. Eight cases had bradycardia including 5 with sinus bradycardia and 3 with atrioventricular block. Seven cases had congenital heart problems and 4 of them led to heart failure. Perinatal mortality was seen in six cases. Tachycardia was seen in two cases (5.4%) with no heart failure or hydrops fetalis. One case died of preterm delivery.

Conclusion: Congenital heart disease is considered as an important risk, affecting fetal and neonatal outcome in fetuses with arrhythmias. As pregnancy advances, the frequency of arrhythmias decreased and converted to sinus rhythm.

Keywords: Arrhythmia, Echocardiography, Fetal monitoring, Hydrops fetalis, Perinatal mortality

Introduction

Studies on fetal cardiac arrhythmia have been increasing during the recent three decades. These arrhythmias are diagnosed during prenatal care through routine fetal cardiac monitoring or routine ultrasound tests carried out during pregnancy. It is confirmed by M-Mod and two-dimensional Doppler echocardiography (1-3). Although most types of the arrhythmias have good prognosis but they can cause problems like hydrops fetalis, congenital heart failure and fetal and neonatal mortality in 1% to 2% of cases (2,4).

Fetal arrhythmia is an irregularity in heart rhythm or rate. It can be classified into regular and irregular arrhythmias based on its rhythm and into tachycardia and bradycardia based on its rate. They are detected in about 1% of pregnancies (3-5). The most common type of irregularity in rhythm is extrasystole arrhythmia resulting from cardiac ectopic beat (6).

Tachycardia and bradycardia are two other types of fetal arrhythmia. Tachycardia in which the heart rate exceeds 160 bpm, is divided to sinus tachycardia, supraventricular tachycardia (SVT), atrial flutter, atrial fibrillation and others (6). Most cases of tachyarrhythmia occur during the third trimester of pregnancy (7,8). Bradycardia in which the heart rate is below 110 bpm, is divided to atrial-ventricular block (AV-block), sinus bradycardia and long QT syndrome. Most of these disorders are associated with structural disorders of the heart or maternal connective tissue disease (6). Isolated complete heart block (CHB) in neonates is rare (1/15 000 to 1/20 000) (9). However, the risk increases to 2% of pregnancies in women with anti-Ro and anti-La autoantibodies without considering maternal symptoms (10,11). Importantly, the risk of CHB recurrence increases by up to 10-fold in subsequent pregnancies (12,13).

There are not sufficient studies on the prevalence and complications of fetal arrhythmias in Iran and fetal arrhythmia makes parents anxious. Therefore, we performed this study to investigate the outcome of fetal arrhythmia during pregnancy and neonatal periods in order to determine its proper management and to prevent its complications during pregnancy. Then we can assure parents by giving them sufficient information about their fetal problem.

Materials and Methods

This study assessed 81 pregnant women who referred to our high-risk pregnancy clinic or to neonatal cardiac specialists because of suspected fetal arrhythmia during routine prenatal care, by auscultation of the fetal heart or
by ultrasound. Among the cases, 27 were inpatients and 54 cases were outpatients, which were referred to pedi-
atrie cardiology clinics by obstetricians. To confirm and
investigate fetal arrhythmia, fetal echocardiography was
conducted on all 81 cases. Those who needed medical in-
tervention received drugs (digoxin, dexamethasone or sal-
butamol based on the fetal problems) and their response
to treatment was studied during pregnancy and neonatal
periods. Echocardiographic findings in terms of cardiac
anomalies, signs of fetal heart failure and hydrops fetalis
were recorded. In addition, fetal and neonatal mortalities
(after 28 days from delivery) were investigated. Cases with
confirmed fetal arrhythmia were subjected to echocar-
diography on weeks 34 and 38 of pregnancy and after deliv-
ery up to the end of neonatal period and results were re-
corded in questionnaire. Among the referred cases, those
mothers whose fetal arrhythmia was because of maternal
fever, labour pain, maternal anemia or chorioamnionitis
were excluded.

Collected data was analyzed by SPSS 20. Chi-square test
was used; Fischer test was used in lower number of case.
P < 0.05 was significant. Kappa coefficient was used to de-
terminate agreement percentage.

Results

Eighty-one pregnant women with fetal arrhythmia were
enrolled in the study. The average maternal age was
28.13 ± 5.73. The average gestational age when fetal ar-
rhythmia was diagnosed, was 29.43 ± 5.73 weeks. The av-
 erage gestational age in delivery was 37.79 ± 2.5. Newborn
babies had an average weight of 3079.25 ± 583.92 grams.

Among 81 cases, one woman (1.2%) had a history of car-
diac anomaly.

Among 81 pregnant women referring because of arrhyth-
 mia, arrhythmia was confirmed in 37 cases (45.67%) by
echocardiography. Table 1 shows the frequency of differ-
ton causes of arrhythmias when referred to pediatric car-
diologist by obstetricians.

From 37 cases with fetal arrhythmia confirmed by echo-
cardiography, the most frequent arrhythmia was extrasys-
tole seen in 27 cases (72.97%). Other types were sinus bra-
dycardia in five cases (13.51%), AV-block in 3 cases (8.1%)
and tachycardia in 2 cases (5.4%).

Among cases whom arrhythmia was confirmed by echo-
cardiography, 12 cases needed medical therapy during
pregnancy, 8 of which (66.7%) responded to the treatment,
while 4 cases (33.33%) did not respond, which in-
cluded one extrasystole, one tachycardia (SVT type) and
2 cases were CHB who required pace-maker after birth.

By ultrasound examination, six cases (7.4%) were diag-
nosed as fetal anomaly, five of which had hydrops feta-
lis. However, ultrasound was normal in 75 cases (92.6%).

Echocardiographic findings of 15 cases (18.51%) out of 81
cases were abnormal.

About the fetal and neonatal outcomes, the frequency of
perinatal mortality of different fetal arrhythmias was nine
(24.32%). Among the dead neonates, 8 (88.88%) had heart
anomaly of which two had extrasystole (one case had hy-
 poplastic left heart problem and the other case had ven-
tricular septal defect plus pericardial effusion and hydrops
fetalis), three had sinus bradycardia and all of them had
heart anomaly. One had AV-channel defect, one had hy-
poplastic left heart syndrome with hydrops fetalis and the
last case had atrial septal defect with cardiomegaly and
heart failure. Two of the dead neonates had AV-block ar-
rhythmia and both had pleural effusion and heart failure.

One of the dead neonates had sinus tachycardia that died
at the 30th week of pregnancy due to preterm birth and
respiratory distress with no heart anomaly.

About the fetal and neonatal complications in extrasystole
cases: Among 27 cases with extrasystole, arrhythmia re-
solved in 24 cases (88.88%). Two cases (7.4%) with extras-
systole arrhythmia had hydrops fetalis and heart failure.

There was not any Intrauterine Fetal Death (IUFD) in the
extrasystole cases. Neonatal death was seen in two cases
(7.4%), both of which had heart anomaly and heart failure.

Among cases (22.2%) with extrasystole, cardiac anomaly
was seen in six cases by echocardiography. 25 (92.59%) of
extrasystole cases survived.

About the fetal and neonatal complications in cases with
sinus bradycardia: Among five sinus bradycardia cases,
the problem resolved in one case (20%). Two cases (40%)
had heart failure, one of which was associated with hy-
drops fetalis. One case (20%) had hydrops fetalis. One
case died during fetal period and perinatal mortality was
seen in four cases (80%); all of them had heart anomaly.

Only one case (20%) survived.

About the fetal and neonatal complications in cases with
tachycardia: As mentioned there were only 2 cases with
tachycardia; one resolved during pregnancy and one had
preterm birth and died because of it. Thus, it was not pos-
 sible to evaluate the fetal and neonatal outcome of this ar-
rhythmia.

About the fetal and neonatal complications in cases with
AV-block arrhythmia: There were three cases with this

Table 1. Fetal Arrhythmia Detected in Routine Examination Versus Verified Heart Arrhythmia by Echocardiography

<table>
<thead>
<tr>
<th>Verified Heart Arrhythmia by Echocardiography, n=37</th>
<th>Fetal Arrhythmia Detected In Routine Examination, n = 81</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extrasystole (n = 27)</td>
<td>Extrasystole, n = 58</td>
</tr>
<tr>
<td>Tachycardia (n = 2)</td>
<td>-</td>
</tr>
<tr>
<td>Bradycardia (n = 5)</td>
<td>-</td>
</tr>
<tr>
<td>Atrialventricular block (n = 3)</td>
<td>-</td>
</tr>
<tr>
<td>Normal sinus rhythm (n = 44)</td>
<td>31</td>
</tr>
</tbody>
</table>
problem; hydrops fetalis and heart failure were seen in two cases (66.66%). Neonatal mortality was seen in two cases (66.66%); both of them had cardiac anomaly and one case with complete cardiac block was candidate for embedding a pacemaker but died before the operation. The other case had second degree heart block. The survived case had CHB without cardiac anomaly. Her mother suffered from lupus. After birth, a pacemaker was embedded and the neonate is being treated with dexamethasone and salbutamol since the fetal period. Table 2 summarizes the obtained results.

As pregnancy progresses, the vast majority of fetal cardiac arrhythmias turn to sinusoidal rhythm; thus in this study the number of arrhythmia cases reduced to 12 (14.81%) with 69 cases (85.18%) having normal sinus rhythm. Figures 1 and 2 show the frequency of arrhythmias at the time of diagnosis, late pregnancy and neonatal period.

Discussion

In Vergani et al study, the prevalence of extrasystole arrhythmia was 88 cases (77%); 88% of which turned to normal sinusoidal rhythm. None of the cases had heart anomaly and heart failure. However, no mortality was seen during fetal and neonatal periods. In this study, 100% of cases survived (5). In our study the prevalence of extrasystole was the same as Vergani et al study; however the number of survived cases was higher and no mortality and heart failure was seen in that study which could be because that none of their fetuses had cardiac anomaly. In Rasiah et al study, sinusoidal bradycardia was seen 15 cases (8.24%); 10 of them (66.66%) had congenital heart problem. Survival rate in cases with no heart problem and in cases with heart problem was 73% and 20%, respectively (2). Our study similar to Rasiah et al study showed the important role of contemporary fetal cardiac anomalies in causing fetal and neonatal complications in sinus bradycardia.

In Vergani et al study, AV-block was observed in four cases. In one case (25%) AV-block turned to sinus rhythm. Three cases had heart failure; two of them died (5). The prevalence of AV-block in our study was nearly similar to Vergani et al study, but with more serious complications and arrhythmia related mortality increased in the presence of congenital heart disease and heart failure.

In Vergani et al study, tachycardia was observed in 17 cases (14.91%), 14 of which (82.35%) were treated. However, three SVT cases survived up to one year. They were treating by drug during this period. Heart failure, cardiac anomaly and fetal and neonatal mortality were seen in 5 (29.41%), 2 (11.76%), and 1 (5.88%) cases, respectively (5).

In our study, we had only 2 cases with tachycardia and among them there was no heart failure, hydrops fetalis and turning to sinus rhythm. The reason may be the smaller size of our study. Maybe the emergency termination of pregnancies complicated by this arrhythmia in our study was the reason, as there was no sufficient time for studying this arrhythmia. Mortality rate was higher in our study. The reason could be preterm birth and neonatal respiratory distress syndrome. Therefore, fetal arrhythmias

![Figure 1. Frequency of fetal arrhythmias in progress of gestational age and neonatal period.](image1)

![Figure 2. Frequency of Normal Sinus Rhythm in 81 Suspicious Fetal Arrhythmia Cases in Progressive Gestational Age and Neonatal Period.](image2)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Extrasystole</th>
<th>Sinus Bradycardia</th>
<th>Tachycardia</th>
<th>AV-Block</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal sinus rhythm</td>
<td>n = 24 (88.88%)</td>
<td>n = 1 (20%)</td>
<td>0%</td>
<td>0%</td>
<td>25</td>
</tr>
<tr>
<td>Hydrops fetalis</td>
<td>n = 2 (7.4%)</td>
<td>n = 1 (20%)</td>
<td>0%</td>
<td>n = 2 (66.66%)</td>
<td>5</td>
</tr>
<tr>
<td>IUFD</td>
<td>0%</td>
<td>n = 1 (20%)</td>
<td>0%</td>
<td>0%</td>
<td>1</td>
</tr>
<tr>
<td>Neonatal death</td>
<td>n = 2 (7.4%)</td>
<td>n = 3 (60%)</td>
<td>n = 1 (50%)</td>
<td>n = 2 (66.66%)</td>
<td>8</td>
</tr>
<tr>
<td>Abnormal findings in echocardiography</td>
<td>n = 6 (22.22%)</td>
<td>n = 5 (100%)</td>
<td>0%</td>
<td>n = 2 (66.66%)</td>
<td>13</td>
</tr>
<tr>
<td>Survivals</td>
<td>n = 25 (92.59%)</td>
<td>n = 1 (20%)</td>
<td>n = 1 (50%)</td>
<td>n = 1 (33.33%)</td>
<td>28</td>
</tr>
<tr>
<td>Heart failure</td>
<td>n = 2 (4.7%)</td>
<td>n = 2 (60%)</td>
<td>0%</td>
<td>n = 2 (66.66%)</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>37</td>
</tr>
</tbody>
</table>

Abbreviation: IUFD, Intrauterine Fetal Death.
could not be considered as the cause of mortality with high reliability. And it is better not to terminate these cases preterm only because of arrhythmia.

**Conclusion**

In our study, almost 50% of fetal arrhythmias discovered by routine fetal monitoring were confirmed by echocardiography; the vast majority of which had reached term pregnancy. Congenital heart diseases are considered as important risk factors of all arrhythmias resulting in fetal and neonatal complications and perinatal mortality. As pregnancy progresses, correction to sinusoidal rhythm increases with extrasystole which is the most correctable arrhythmia. It can be argued, therefore, that pregnant mothers with fetal cardiac arrhythmia of extrasystole type can be assured that the vast majority of cases will be corrected during fetal period and this problem has good prognosis. However, cases with bradycardia or with heart anomaly should be advised to refer to pediatric cardiologist for sufficient investigation and to deliver their baby at level 3 hospitals.

**Ethical Issues**

The Ethics Committee of Tabriz University of Medical Sciences approved this study.

**Conflict of Interests**

The authors declare no conflict of interests.

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Not applicable.

**Acknowledgments**

None to be declared.

**References**