Journal of Obstetrics, Gynecology and Cancer Research | ISSN: 2476-5848

Reviewing the Anxiety in Pregnant Mothers with Fetuses Having Positive Cardiac Anomaly and Its Relation with Birth Outcomes

Mohammad Nasir Hematian[1], Mahnaz Ghiasi[2], Somayeh Baharian[3], Sedigheh Safaie[4*], Mojgan Rahmanian[5], Shirin Torabi[6], Samaneh Vahdatnia[7]

1. *Department of Pediatric Cardiology, Yas Hospital Complex, Tehran University of Medical Sciences, Tehan, Iran*
2. *Department of Psychology, School of Educational Sciences and Psychology, Alzahra University, Tehran, Iran*
3. *Department of Psychology, Science and Research Branch of Tehran, Islamic Azad University, Tehran, Iran*
4. *Department of Psychology, School of Economics and Social Sciences, Bu Ali Sina University, Hamadan, Iran*
5. *Department of Obstetrics and Gynecologist, Semnan University of Medical Sciences, Tehran, Iran*
6. *Department of Pathology, School of Medicine, Tehran University of Medical Sciences, Tehran, Iran*
7. *Semnan University of Medical Sciences, Semnan, Iran*

Article Info

10.30699/jogcr.7.1.7

Received: 2021/04/09;
Accepted: 2021/06/28;
Published Online: 09 Sep 2021;

Use your device to scan and read the article online

Corresponding Information:
Safaie Sedigheh,
Department of Psychology, School of Economics and Social Sciences, Bu Ali Sina University, Hamadan, Iran
Email: safaie.s@hotmail.com

ABSTRACT

Background & Objective: Concerns about adaptation to a new situation can cause anxiousness in pregnant women, which could lead to dangerous consequences. The aim of this study was to evaluate the severity of pregnancy anxiety in mothers with fetuses having cardiac anomalies and their association with birth outcomes.

Materials & Methods: A number of 50 pregnant women were enrolled as the accessible sampling. The diagnosis of congenital heart anomaly was considered in prenatal ultrasound screening (NT ultrasound and anomaly scan). The General Health Questionnaire (GHQ-28), Spielberger State-Trait Anxiety Inventory (STAI), Cambridge Worry Scale (CWS), and Pregnancy Concern Questionnaire (PCQ) were used to evaluate fear, concern and anxiety. Data were analyzed using Wilcoxon statistical test.

Results: Six infants had fetal outcomes including low birth weight (IUGR). Fetal prematurity was observed in only one infant. The highest and the lowest levels of anxiety were reported before the echocardiography and within one week after the echocardiography. There was a significant difference between maternal general health score before and 5 days after echocardiography as well as 5 days after echo and 35th week of pregnancy (P<0.05). A significant difference between maternal general health score was observed before fetal echocardiography and at 35th week of pregnancy (P<0.05).

Conclusion: The results showed that mothers' anxiety increased significantly after the diagnosis of fetal cardiac anomaly. However, after fetal echocardiography and in the late pregnancy period, the anxiety level reduced in both stages. It was clear that receiving information about unhealthy fetus can cause significant anxiety in mothers.

Keywords: Anxiety, Cardiac Anomaly, Nuchal Translucency, Pregnancy

Introduction

Pregnancy is a unique experience for a woman and her family. Although pregnancy-related changes occur progressively and sequentially, psychological changes do not follow this pattern. This period demands many psychological and social adjustments that considering them can lead to the improved mental health in the pregnant woman and prevent future social problems in the family **(1)**. Pregnant women's fear and stress about adaptation to a new situation can make them anxious and put them at some risks **(2)**.

High anxiety and stress during pregnancy can have long-term consequences for the mother and the fetus. Anxiety affects the fetus by a particular mechanism. Stress hormones (catecholamines, corticotrophin-releasing hormones and adrenal steroids) which are released due to the mother's anxiety and stress, cross the placenta and affect fetal brain development at the 12-22 weeks of pregnancy by constricting the placental artery and limiting oxygen supply and nutrition of the fetus. This is one of the reasons of the limitation of the

fetal growth and fetal asphyxia, which can lead to medical interventions, such as cesarean section. Furthermore, stress hormones stop the immune system. Therefore, anxious mothers are more likely to have infants with infections including respiratory infections **(3)**.

The prevalence of anxiety disorders during pregnancy is high **(4)**. In Iran, the prevalence of these disorders during pregnancy has been reported to be 64% **(5)**. Dunkel Schetter **(6)** also found that anxiety, depression, and stress during pregnancy were associated with side effects for the mother and the fetus, which can lead to low birth weight and negative effects on fetal and child nervous development.

The most common and important stresses experienced by pregnant women include anxiety and stress about fetal health, communication problem with the spouse, anxiety about the experience of childbirth and motherhood **(7)**. This can have reverse effects on fetal and neonatal outcomes **(4)**. For example, anxiety during this period may have consequences such as low birth weight and low Apgar score **(8)**.

In another study by Ost, Nisell, Frenckner, Burgos and Ojmyr-Joelsson **(9)**, 34 pregnant women with diaphragmatic herniated fetuses were assessed by an anxiety questionnaire over four years. They revealed that mothers were more anxious than fathers and the prenatal diaphragmatic hernia diagnosis and the low parental literacy were two factors that were associated with higher levels of parental anxiety. In a study, Bazrafshan and Mahmoudi Rad **(10)** assessed the anxiety of pregnant women, their Apgar score and the infant weight. A number of 150 pregnant mothers were enrolled in the study and they completed the Spielberger State-Trait Anxiety Inventory. Findings showed that there was a significant relationship between low birth weight and the hidden anxiety of mothers. Also, there was a significant relationship between Apgar scores at first and fifth minutes after birth and the mother's overt anxiety. In another study by Bazrafshan and Mahmoudi Rad **(11)**, findings indicated that there was a significant relationship between previous abortions and the overt and covert anxiety history, between history of difficult childbirth and covert anxiety and finally between low birth weight and covert anxiety history. In another study, Shayeghian, Rasoulzadeh Tabatabaei and Sedighey Loyeh **(12)** investigated the effect of maternal anxiety on infant's mental health. The results showed that growth indices in infants of mothers with high anxiety were significantly lower than the control group.

On the other hand, the diagnosis of diseases or abnormalities during pregnancy, for example, fetal cardiac anomaly, can be one of the main reasons of the anxiety or exacerbation of anxiety in mothers. A congenital heart defect (CHD) is the most common congenital anomaly in the fetus. Its incidence rate is from0.08 to 0.10 per thousand live births. According to the World Health Organization report, from 1950 to 1994, 42% of infant deaths were due to heart problems. One of the most difficult prenatal diagnoses is screening for fetal cardiac defect **(13)**. The presence of known and unknown teratogens and the increased gestational age can be considered as the reasons. On the other hand, despite the development of modern diagnostic methods during pregnancy, the diagnosis, treatment and identification of patients with these abnormalities remain a serious problem in the fetal and maternal medicine **(14)**.

Although our knowledge of CHDs is high, studies on the role of parental psychological effects on fetuses with congenital heart diseases and birth outcomes are limited **(7)**. Parental awareness of the fetal cardiac anomaly puts them in sudden physiological stress. Severe stress can be related to adrenal-pituitary-hypothalamic axis and sympathetic nervous system function. In this way, cortisol and adrenocorticotropic secretion are affected by stress plasma cortisol level is increased **(15)**. Finally, they are exposed to preterm labor, intrauterine growth restriction (IUGR), or small for gestateonal age (SGA) and this may even disrupt the child's neurological development.

Accurate and rapid diagnosis of fetal cardiac anomaly can help to make the best decision in pregnancy management and it can result in increased survival and decreased postnatal mortality and morbidity. Studies have shown that infants with a prenatal diagnosis of CHDs have better hemodynamic status and outcomes than those who have not been diagnosed **(16)**. Given the importance of screening and evaluating fetal health in the current population in cases of high-risk pregnancies and indications of fetal heart echocardiography, fetal echocardiography is recommended and doing it quickly and on time will have benefits for the family including choosing the treatment and educating them on the disease. They can decide whether to continue or terminate the pregnancy or even make a decision about a legal abortion. In addition, it is possible to plan more appropriately by following the recommendations of a pediatric cardiologist and delivering a baby at a Level 3 center with the necessary preparations and, if necessary, considering prenatal and early postnatal treatment.

Very few studies have been conducted in this area. In particular, no internal research was found to investigate the relationship between maternal anxiety and fetal cardiac anomalies. This study was conducted to determine the anxiety levels during pregnancy in mothers whose fetuses were diagnosed with a cardiac anomaly. This helps to consider an appropriate intervention with the amount of anxiety at a particular stage of pregnancy. Therefore, the purpose of this study was to investigate the severity of changes in anxiety levels in different stages of pregnancy in mothers with a cardiac anomaly for their fetus.

Materials and Methods

In this causal-comparative study, the study population included mothers who went to the heart disease clinic of Amir al-Momenin Hospital in Semnan, Iran and suspected a cardiac anomaly in their fetuses. This study was performed on 80 pregnant women with the ges-tational age of 18-22 weeks, who were qualified for inclusion during a one year period in 2018-2019. In their screening ultrasound (NT ultrasound and scan anomaly), the possibility of a congenital heart problem was raised and they underwent fetal echocardiography by a pediatric cardiologist. Inclusion criteria were as follows: aging over 18 years old, having at least a middle school degree, lacking maternal systemic diseases (including diabetes, hypertension, collagen, and vascular diseases before and during pregnancy), not smoking, not using alcohol, not having drug abuse, not being addicted to drugs, not using any medication, lacking psychological problems, single pregnancy, consenting to the pregnancy continuation, consenting to participate in the research and a score lower than 23 on the General Health Questionnaire. Exclusion criteria included not having the inclusion criteria and the termination of pregnancy before 35th week. Accessible sampling was used in the study. Initially, informed consent was obtained and the demographic information questionnaire and general health questionnaire were administered to evaluate the inclusion criteria. Then, Spielberger State-Trait Anxiety Inventory (STAI) was completed half an hour before the first echocardiography. Of the total number, 10 embryos with a CHD or other extra cardiac major anomalies were excluded from the study. Also during the study, 20 mothers were excluded because of the exclusion criteria or the lack of co-operation and finally, 50 pregnant women whose fetuses had non-complex CHD were studied. After 5 days, the Cambridge Worry Scale (CWS) was performed. Finally, the Pregnancy Concerns Questionnaire (PCQ) was completed at 35th week.

Research Instrument

Demography Information Questionnaire: It includes questions about pregnancy age, BMI, smoking, and diet.

Maternal Outcome Questionnaire: It includes the age of delivery, type of delivery (normal spontaneous / cesarean followed by labor/ planned cesarean section) and Placental abruption.

Fetal Outcome Questionnaire: It includes low birth weight to gestational age, and perinatal mortality.

Neonatal Outcome Questionnaire: It Includes birth weight and Apgar score.

Congenital Heart Defect (CHD): CHD is considered to be a congenital anomaly of heart and in particular, the circulatory system. The disease, according to the 9th review of the International Division of Diseases, includes abnormalities of the atrium or ventricular walls, as well as anomalies in the aorta and pulmonary artery. The study was performed by a pediatric cardiologist for the fetus and once after the birth.

Questionnaires to Assess the Anxiety of Pregnant Mothers

General Health Questionnaire (GHQ-28)

The questionnaire was developed by Goldberg and Hillier and is one of the most well-known screening tools in psychiatry **(17)** to distinguish health from mental illnesses. Questions on this questionnaire are scored on a Likert scale (0 to 3). Questions include the scale of physical complaints, anxiety, social dysfunctions, and depression. On each scale, separately, a score above 6 and overall, a score above 23 indicates symptoms. The validity of the questionnaire was obtained using test-re-test and Cronbach's alpha 0.70 and 0.90, respectively **(18)**. Individuals whose scores are above 23 in General Health Questionnaire are more likely to have a mental disorder.

Spielberger State-Trait Anxiety Inventory (STAI)

This inventory **(19)** consists of two separate 20-item scales measuring state anxiety (dependent on the state and the mood of the current anxiety) and trait (general anxiety of the individual). A 4-degree Likert scale (never-to-a lot) was used for scoring. Cronbach's alpha for this inventory was reported to be 0.91 **(20)**. In this study, state anxiety scale is one of the main tools for measuring the severity of anxiety in pregnancy.

Cambridge Worry Scale (CWS)

This scale, developed by Green *et al.* has 17 items **(21)**. The Cambridge Worry Scale measures pregnant women's anxiety about the infant health, the childbirth and the relationships with others and it is set on the 6-degree Likert scale. Following the evaluation of the psychometric properties of the Persian version, six items were added to Mortazavi and Akaberi's **(22)** research and finally, after the factor analysis, 22 items remained. Cronbach's alpha coefficient was obtained as 0.88. For the 17-item scale, the Cronbach's alpha coefficient was reported to be 0.76 **(21)**. In this study, an Iranian version of the questionnaire with 22 items was used.

Pregnancy Concerns Questionnaire (PCQ)

The questionnaire was developed by Alderidice and Lynn **(23)** and is used to measure specific pregnancy concerns. There are three sub-scales for it: concerns about the birth and the infant, concerns about the body weight and the body image and concerns about the emotions and the relationships. In Yousefi's study **(24)**, Cronbach's alpha coefficient for this questionnaire was 0.78 and its correlation with Spielberger State Anxiety Inventory was reported to be 0.53.

Echocardiography Device

Echocardiography is one of the imaging devices that are dedicated to image the cardiovascular system. The

basis of this device is imaging by ultrasound waves. In fact, echocardiography is an audio image of the heart. In this method, using ultrasound waves, one-dimensional, two-dimensional and three-dimensional images of the walls and valves of the heart are obtained simultaneously, which is used in the diagnosis of cardiovascular failure. The echocardiograph device displays images of different parts of the heart, vessels, and even the bloodstream into the veins. The echo unit has a high-resolution monitor. It displays 2D and 3D images based on the test results. This test does not require any preparation and it can be performed on the patient at any time. This test lasts from 15 to 20 minutes **(25)**.

Results

The mean and standard deviation of age were 28.28 and 5.33, respectively. The minimum age was 19 years and the maximum age was 41 years. 64% of pregnant women stated that they have no kinship with their spouses, while 22% had a close family kinship with their spouses. The history of heart diseases in relatives of pregnant women with fetal cardiac anomaly was 6% in the sample.

As you see in Table 1, the most frequent previous medical conditions in the sample were hypothyroidism and diabetes mellitus, respectively. Also, smoking and alcohol consumption were not observed in the sample.

Concerning maternal outcomes, the data in Table 2 indicates that the delivery in the majority of the sample was by cesarean. Also, placental disorder has the most frequency in pregnancy outcomes and the least frequency was related to poisoning.

Table 3 demonstrates that among the included patients, six infants had fetal outcomes. Most of these cases were associated with low birth weight (IUGR). Fetal prematurity was observed in only one infant.

Findings showed that there was a normal status in infants' Apgar score in 48 cases (96%). Moreover, infants' hospitalization occurred in 10 cases (20%). Heart diseases were not observed after echocardiography in infants.

Since there were non-linear and non-normal data distributions based on linearity and Kolmogorov-Smirnov tests, nonparametric tests were used to analyze the data at the inferential level. Therefore, data were analyzed using Wilcoxon statistical test to examine in pairs, which was an important goal in this study.

Table 1. Frequency distribution and percentage of disease history or smoking and alcohol consumption in mothers

Variant	Frequency	Percentage
Diabetes Mellitus	3	6
Blood Pressure	1	2
Smoking	0	0
Alcohol consumption	0	0
Thyroid		
Hyperthyroidism	1	2
Hypothyroidism	10	20
Colposcopy findings		

Table 2. Frequency distribution and percentage of pregnancy outcomes in women with fetal cardiac anomaly diagnosis

	Frequency	Percentage
Anemia	5	10
Pregnancy Infection	5	10
Placental disorder	12	24
Pregnancy Poisoning	1	2
Pregnancy Diabetes	6	12
Delivery type		
Normal	21	42
Cesarean	29	58

Table 3. Frequency distribution and percsentage of fetal outcomes with fetal cardiac anomalies in pregnancy

	Frequency	Percentage
Fetal Prematurity	1	2
Low Fetal Weight	5	10
Prenatal	0	0

The results demonstrated in Table 4 reveal that the highest level of anxiety was reported before the echocardiography and the lowest was within one week after the echocardiography. Also, in the 35th week of pregnancy, despite the moderate level of anxiety, the lowest standard deviation was observed, which means more similarity and uniformity of the sample in terms of the anxiety variable at this stage.

According to Table 5, there was a significant difference between STAI and CWS scores before and 5 days after echocardiography ($P<0.05$). There was a significant difference between CWS and PCQ scores 5 days after echo and during the 35th week of pregnancy ($P<0.05$). Furthermore, there was a significant difference between STAI and PCQ scores before fetal echocardiography and at 35th week of pregnancy ($P<0.05$). Overall, the mean of anxiety during pregnancy in the three stages of the study indicates a decrease in anxiety rate over time.

Table 4. Mean and standard deviation of anxiety measurement in three stages of pregnancy by diagnosing fetal cardiac anomaly

Measurement Stages	Mean	Standard Deviation
Before Doing Fetal Echocardiography	45.96	12.23
5 days After Fetal Echocardiography	16.08	13.43
35th week of pregnancy	20.62	5.98

Table 5. Checking the anxiety measurement in three stages of pregnancy by diagnosing fetal cardiac anomaly

Measurement Stages	Z	Sig.
Before Doing Fetal Echocardiography 5 Days After Echo	5.62	0.001*
5 Days After Echo 35thWeek of Pregnancy	5.91	0.001*
Before Doing Fetal Echocardiography 35thWeek of Pregnancy	2.86	0.004*

P <.05*

Discussion

The purpose of this study was to investigate anxiety rates in pregnant mothers with fetuses with fetal cardiac anomalies. Investigation of anxiety in three stages showed that there was a significant relationship between the fetal cardiac anomaly diagnosis and maternal anxiety.

Mother anxiety scores in the first stage were higher compared to the second stage. This finding was in agreement with the results of Sadeghi, Azizi and Molla-Nejad **(26)** and Sabote, Shahnazi, Sharifi Rad, and Hassanzadeh **(27)**. Anxiety is one of the most common symptoms in pregnant mothers. This process was not constant during pregnancy and it increases in the first three months.

One of the major contributing and aggravating factors of anxiety in pregnant mothers with cardiac anomalies in their fetuses is unawareness about events that occur during pregnancy and childbirth, especially if they are experiencing their first birth. They are exposed to lots of information from medical, health or family resources and those around them that can be at the same time contradictory. They also need to talk to someone they trust to be able to ask their questions easily and get enough information, since their anxiety and worry can be dangerous for themselves and the fetuses. The quality of social support can be considered as one of the most important causes of anxiety. In fact, social support means an individual's selective function for another person, and it can be obtained from such resources as family, friends, and spouses and it can lead to positive responses in the individual. Support can be physical, mental (caring, loving and sympathy), verbal and financial **(28)**. The decreased quality or lack of this component, especially when fetal cardiac anomaly is diagnosed, can aggravate anxiety of pregnant mothers. Other reasons to reduce mothers' anxiety after performing a fetal echo includes additional and clearer explanations for the therapist, and reduced concern about the consequences of the disease and whether it is treatable or not. Increased financial burden and unpredictability of the cost and its consequences, can lead to increased maternal anxiety at this stage. This explanation is inconsistent with the study of Zareipour, Sadeghianifar, Amirzahani, Parsnejad and Ayouki-Rahnama **(29)**.

A study showed that anxiety and depression were common in pregnant women with fetuses who have cardiac disease (Nazar, Fonseca, and Canavarro) **(30)**. Also, in another study, it was found that after informing the mothers about the probability of fetal cardiac anomalies, their stress was increased and they had more anxiety than the control group. This anxiety in mothers was far greater than in fathers. It was also shown that the severity of anxiety was not significantly correlated with the time of the diagnosis i.e. before or after birth.

The findings also showed that the level of maternal anxiety decreased at the last measurement stage, at 35th week of pregnancy. This finding is in line with the results of Kaasen, Helbig, Malt, Skari and Haugen **(31)**. In their study, they evaluated the levels of anxiety in mothers who had a fetal structural anomaly in their ultrasound examinations compared to those who had a normal ultrasound. It was observed that maternal anxiety gradually decreased by the end of the pregnancy.

In Sadeghi, Azizi and Molanejad's **(25)** study, anxiety scores decreased at weeks 37 to 42. The results also agree with a study by Buss, Davis, Hobel and Sandman **(32)**. They showed that as the pregnancy progressed, the level of anxiety decreased. There are a number of possible reasons for this finding such as the process of pregnancy toward health and its completion. Spending several weeks and going through normal stages of fetal development evaluated by the medical team, assure the mother that the severity of the injury is less than what was estimated and it will not cause any problems at birth. On the other hand, the role of emotional support of mother's relatives or religious beliefs such as trusting in God may also be important.

On the other hand, due to the approaching time of delivery and progressive development of the fetus, the mother has a better understanding of the fetus and its movements, increasing the maternal relationship with the fetus and finds this process enjoyable. Therefore, one of the reasons that can be expressed in decreasing the mother's anxiety in the final weeks is her effort to enjoy all the moments of pregnancy being about to end **(33)**.

Due to limited access to the sample, it was not possible to compare maternal anxiety levels, fetal growth and postpartum outcomes with the sample without diagnosing fetal cardiac anomaly. As a suggestion, in future studies, considering this sample, the stages in this study can be compared in both samples. Also, conducting longitudinal studies of mothers with a history of pregnancy with fetal cardiac anomalies and the factors affecting it, especially psychological factors such as anxiety, can help to identify potential causes more efficiently.

Conclusion

Diagnosis of a fetal cardiac anomaly in pregnant women may lead to a higher anxiety rate in the mothers compared to the rates prior to diagnosis. This increased anxiety can be explained by receiving fetal illness news for the mother who is waiting for her fetal health news. However, over time, this anxiety did not disappear in the final weeks of pregnancy, but decreased compared to the time of diagnosis and prior to it. This may indicate the certainty of complete termination of pregnancy or the impact of the family and more specialized treatment groups who support pediatric and fetal echocardiography.

Acknowledgments

We appreciate the sincere cooperation of the Heart Diseases Clinic of Amir al-Momenin Hospital.

Conflict of Interest

Authors declared no conflict of interest.

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How to Cite This Article:

Hematian M N, Ghiasi M, Baharian S, Safaie S, Rahmanian M, Torabi Sh et al . Reviewing the Anxiety in Pregnant Mothers with Fetuses Having Positive Cardiac Anomaly and Its Relation with Birth Outcomes. J Obstet Gynecol Cancer Res. 2022; 7 (1) :7-14.

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