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Maternal and Fetal Outcomes in Pregnant Women with Prior Cardiac Surgery: A Valve Surgery Classification Versus Non-Valve Surgery Classification

Geçirilmiş Kalp Cerrahisi Olan Gebelerde Maternal ve Fetal Sonuçlar: Valvüler cerrahi ve Non-Valvüler Cerrahi Sınıflandırması ile

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Abstract: This retrospective study aimed to compare maternal and fetal outcomes in pregnant women with a history of cardiac surgery—classified into valvular and non-valvular groups—and healthy controls. The findings showed that women with prior cardiac surgery had higher maternal intensive care needs and worse neonatal outcomes, including lower birth weights, higher Neonatal Intensive Care Unıte NICU admission rates, and increased fetal cardiac anomalies. The non-valvular group exhibited more adverse neonatal results. These results highlight the increased risks associated with pregnancy in women with a cardiac surgical history and underscore the importance of multidisciplinary follow-up to optimize outcomes.

Keywords: Cardiac Surgery, Pregnancy, Neonatal Outcome

Özet: Bu retrospektif çalışma, kapak cerrahisi öyküsü olan ve kapak dışı kalp cerrahisi geçiren hamile kadınlarda maternal ve fetal sonuçları sağlıklı kontrollerle karşılaştırmayı amaçlamıştır. Bulgular, daha önce kalp ameliyatı geçirmiş kadınların daha yüksek maternal yoğun bakım ihtiyaçları ve daha düşük doğum ağırlıkları, daha yüksek yoğun bakım ünitesi (YYBÜ) nekabul oranları ve artan fetal kardiyak anomaliler dahil olmak üzere daha kötü neonatal sonuçları olduğunu göstermiştir. Valvüler olmayan grup daha olumsuz neonatal sonuçlar sergilemiştir. Bu sonuçlar, kardiyak cerrahi öyküsü olan kadınlarda gebelikle ilişkili risklerin arttığını vurgulamakta ve sonuçları optimize etmek için multidisipliner takibin öneminin altını çizmektedir.

Anahtar Kelimeler: Kardiyak cerrahi, gebelik, yenidoğan sonuçları

Ethics Committee Approval: The study was carried out after the approval of the Health Sciences University Ankara Bilkent City Hospital Ethics Committee with the registration number TABED 1-25-1233 dated 07.05.2025

Informed Consent: The authors declared that it was not considered necessary to get consent from the patients because the study was a retrospective data analysis.

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1. Introduction

The most common non-obstetric cause of maternal death is cardiac disease. The rate of cardiac disease is approximately 1-4% and the most common cardiac disease is mitral valve disease (1).

As pregnancy progresses, numerous physiological adaptations occur in the maternal body to meet the increasing demands of both the mother and the developing fetus. These changes typically begin immediately after conception and continue throughout the latter stages of pregnancy. Notably, there is an increase in cardiac output and heart rate, while systemic vascular resistance and blood pressure tend to decrease. Meanwhile, central venous pressure generally remains stable during this period (1-4). These changes in the pregnant woman affect the interpretation of the cardiovascular status of the pregnant woman.

The hemodynamic changes that occur during pregnancy can lead to worsening of previously stable heart disease. The risk of cardiac event is 6 times higher in patients with a history of prior cardiac event, New York Heart Association (NYHA)>II or left heart obstruction compared to pregnant women without these factors) (5).

Both maternal and fetal effects of heart disease have been shown in studies.(6-8). In pregnant women with heart disease, fetal mortality and prematurity have been associated with a modified World Health Organization (WHO) classification (9).

The aim of this study was to compare maternal and fetal outcomes in pregnant women with a history of valvular and non-valvular cardiac surgery.

2.Material and Method

2.1. Study Population

This study included patients who were followed up in the Perinatology Department of Ankara City Hospital between January-2021 and May-2025 with a diagnosis of cardiac surgery. The names and diagnoses of the patients who underwent cardiac surgery before pregnancy were scanned and recorded with the words “heart disease” from a Microsoft Excel program kept by our clinic. Other information about the patients was recorded from the hospital database.

Signature on the informed consent form was obtained from each patient included in the study. Approval for this study was obtained from the Ethics Committee of Ankara Bilkent City Hospital (1-25-1233). The rules of the Declaration of Helsinki were followed at every stage of the study.

For each patient included in this study, clinicodemographic information, age, parity, gravida, type of maternal cardiac surgery, maternal warfarin use, maternal hemoglobin levels, the type of delivery of patients and the type of anesthesia used , maternal need for intensive care, newborn's birth week, birth weight, 1st and 5th minute APGAR scores, neonatal cord artery PH and whether the newborn went to the neonatal intensive care unit (NICU) ,fetal cardiac anomaly were recorded.

In this study, the patients included in the control group were randomly selected from healthy pregnant women. Each patient in the study group was assigned a control patient in return.

Patients with incomplete data were excluded from the study.

2.2. Statistical Analysis

Data analysis was performed using SPSS v. 22.0 (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess normality. Descriptive analyses were presented as mean ± standard deviation values for normally distributed data. A one-way analysis of variance was conducted to compare categorical variables, and Tukey’s test was used as a post hoc analysis.

3.Results

In this study, a total of 110 patients including 23 patients with non-valve repair, 32 patients with valve surgery and 55 healthy patients were included. Thirteen (23.6%) of 55 pregnant women who underwent cardiac surgery were using warfarin.

In the group of patients with cardiac surgery, 11 patients delivered vaginally, and 44 patients delivered by cesarean section. 32 of the patients who delivered by cesarean section underwent spinal/epidural anesthesia and 11 underwent general anesthesia.

The types of surgery performed in patients who underwent cardiac surgery before pregnancy is shown in Table 1. The most common opere atrial septal defect (ASD) (%21.8) and mitral valve replacement (MVP)%21.8 surgery was detected in

the patient group who had undergone cardiac surgery.

The clinicodemographic data, maternal hemogram values and maternal intensive care needs of these patients are given in Table 2. There was no difference between the three groups in age, gravida, parity, number of abortions, maternal blood values (p>0.05) There was a difference in the need for postop maternal intensive care between the three groups (p<0.001).

In the posthoc Tukey test, there was no difference in the need for postop maternal intensive care between patients who underwent valve repair operation and patients who underwent non-valve repair, whereas there was a difference in the need for postop maternal intensive care between healthy pregnant women and the other two groups (p<0.000; p=0.058).

The neonatal outcomes of all three groups; birth week, birth weight, APGAR and PH values at 1st and 5th minute, NICU needs and fetal cardiac anomaly rates in the newborns are given in Table 3. There was no difference in birth week,birth weight and 1st minute Apgar score of the newborn between the three groups(p>0.05).

Among the groups, APGAR score at 5 minutes, PH, NICU requirement and rate of neonatal cardiac anomaly in the newborn were statistically different (p=0.048, p<0.001; p<0.001; p=0.012).

Posthoc tukey test showed a significant difference in APGAR score at 5 min in the group of patients with non-valvular cardiac surgery compared to healthy pregnant women(p=0.045).

In the post hoc Tukey test, there was a difference in cord artery PH between healthy pregnant women and pregnant women who underwent valvular and non-valvular cardiac surgery (p<0.000; p<0.000).

In the post hoc Tukey test, there was a difference in terms of NICU requirement between the healthy pregnant women and the group undergoing non-valvular cardiac surgery (p<0.000), while there was no difference between the group undergoing valve surgery and the healthy pregnant women group. There was also a difference between the group undergoing valve surgery and the group undergoing non-valve surgery (p=0.008).

Table 1. Information regarding two types heart surgery

Variable	Frequency	Percentage (%)
Opere ASD	12	21.8
MVR	12	21.8
AVR	6	10.9
Opere VSD	4	7.27
Opere ASD VSD	2	3.63
MV balon	2	3.63
MV valvuloplasti	2	3.63
Bypass	1	1.81
Fallot PVR	1	1.81
Opere Fallot	1	1.81
TGA Corrected	1	1.81
TGA VSD opere	1	1.81
PV valvuloplasti	1	1.81
PV valvulotomi	1	1.81
Others	8	14.5
Total	55	100

AVR: Aortic Valve Replacement,ASD:Atrial Septal Defect,MV:Mitral Valve,MVR:Mitral Valve Replacement,PV:Pulmoner Valve,PVR:Pulmoner Valve Replacement,TGA: Transposition of the Great Artery

Table 2. Clinico-demographic information of patients

Variable	**Group 1 N:55**	**Group 2 N:32**	**Group3 N:23**	**P value**
Age	30(28-34)	32(23-45)	28(25-35)	0.324
Gravida	1.5(1.0-2.0)	2.0(1.0-5.0)	2.0(1.0-5.0)	0.726
Parity	0.5(0.0-1.0)	1.0(0.0-3.0)	1.0(0.0-1.0)	0.926
Miscarriage	0.0(0.0-0.0)	1.0(0.0-1.0)	0.0(0.0-3.0)	0.795
Maternal hemoglobin(g/dl)	11.2(11.0-13.1)	11.4(10.4-12.0)	11.2(9.4-12.1)	0.251
Maternal intensive care	0(%0)	9(8.18)	4(%3.63)	**<0.001***

Group 1: Healty pregnancy group, Group 2: Valve operation positive group, Group 3: Non-valve cardiac operation pozitif group
∗Posthoc test valve operations vs healthy pregnant women p:0.000; non-valve operations vs healthy pregnant women p:0.058

Descriptive analyses were presented as mean ± standard deviation values for normally distributed data. A one-way analysis of variance was conducted to compare categorical variables, and Tukey's test was used as a post hoc analysis. $p<0.05$ statistically significant

Table 3. Neonatal outcomes of patients

Variable	Group 1 N:55	Group 2 N:32	Group 3 N:23	P value
Gestational week at birth	39.0(38.0-40.0)	38.0(33.0-40.0)	38.0(27.0-41.0)	0.473
Birth weight (g)	3015(2960-3570)	3054(1890-3585)	3180(1140-3700)	0.456
First-minute Apgar score	8.0(8.0-8.0)	7.0(5.0-8.0)	8(2.0-8.0)	0.253
Fifth-minute Apgar score	9.0(9.0-9.0)	9.0(7.0-9.0)	9.0(3.0-10.0)	**0.048$^{\alpha}$**
Cord pH	7.3(7.26-7.34)	7.38(7.30-7.47)	7.35(6.9-7.48)	**<0.001$^{\beta}$**
NICU	0(%0)	2(%1.81)	4(%3.63)	**<0.001$^{\delta}$**
Fetal cardiac abnormally	0(%0)	4 (%3.63)	4(%3.63)	**0.012**

Group 1: Healty pregnancy group, Group 2: Valve operation positive group, Group 3: Non-valve cardiac operation pozitif group
NICU: neonatal intensive care unit $p<0.05$ statistically significant.
α Post hoc Tukey test non-valvular cardiac surgery vs. healthy pregnant women(p:0.045)
β Post hoc Tukey test healthy pregnant women vs. Valvular and non-valvular cardiac surgery ($p<0.001$; $p<0.000$).
δ In the post hoc Tukey test, healthy pregnant women vs. non-valvular cardiac surgery ($p<0.001$); valve surgery vs. non-valve surgery (p:0.008).

4.Discussion

In this study, pregnant women who underwent valvular surgery and non-valvular surgery were compared among themselves and with healthy pregnant women. Patients who underwent cardiac surgery had lower neonatal birth weight, Apgar score at the fifth minute, cord PH, but higher maternal intensive care needs, NICU needs and cardiac anomaly rates in the newborn compared to normal healthy pregnant women. Between those who underwent valvular surgery and those who underwent non-valvular surgery, the need for NICU was higher in those who underwent non-valvular surgery.

Heart disease in pregnancy is among the causes of maternal death not directly related to pregnancy. Pregnancy after previous cardiac surgery is now more common (10). With advances in cardiac surgery, acquired or congenital heart diseases have better outcomes (11).

Follow-up of pregnant women undergoing cardiac surgery is difficult due to maternal and fetal effects. The incidence of maternal mortality, thromboembolic events and maternal heart failure, fetal anomalies due to anticoagulant use and intrauterine growth retardation is high in these pregnancies (12). Considering these difficulties, we analyzed the patients who underwent cardiac surgery in our clinic. This idea formed the basis of our study. In this study, maternal mortality was not observed but maternal and fetal intensive care needs were significantly higher.

Overall fetal outcomes in mothers with congenital heart disease have been evaluated in several studies.

Studies have found that pregnant women with heart disease are more likely to have premature birth, miscarriage and intrauterine growth retardation(13-15).

The need for NICU was significantly higher in patients undergoing non-valvular cardiac surgery than in patients undergoing valve surgery. In the literature, no article was found to classify pregnant women with previous cardiac surgery into valvular and non-valvular surgery.

The mode of delivery in pregnant women who have undergone cardiac surgery can be either cesarean section or normal delivery. Cesarean section should be performed if there is a possible fetal indication. In our clinic, pregnant women who have undergone cardiac surgery have mostly undergone cesarean section (16). Since our hospital is a multidisciplinary hospital, these patients are managed in conjunction with cardiology and cardiovascular surgery. Based on their recommendation, patients undergo cesarean sections.

Low molecular weight heparin (LMWH) treatment during the first trimester decreases the likelihood of fetal anomalies. The anticoagulants used decrease the likelihood of thromboembolism but increase the likelihood of preterm delivery and intrauterine growth retardation (17,18). Pregnant women who have undergone cardiac surgery are given anticoagulants to prevent thromboembolic events. Warfarin is the drug that prevents thrombosis the best among anticoagulants and has the highest rate of fetal side effects (12). In our clinic, warfarin was used as anticoagulant and no fetal anomaly developed.

Fetal echocardiography should be recommended for women with congenital heart disease between 19 and 22 weeks of gestation for possible fetal cardiac pathology (13-19). In this study, fetal cardiac anomalies were more common in pregnant women with previous cardiac surgery.

This study offers a novel classification of pregnant women with prior cardiac surgery into valvular and non-valvular groups, providing valuable insights into their maternal and fetal outcomes. The retrospective analysis encompasses a relatively large sample size and includes comprehensive maternal and neonatal data, facilitating meaningful comparisons. The multidisciplinary approach and detailed evaluation of pregnancy outcomes contribute to clinical understanding.

The retrospective, single-center design limits the generalizability of the findings and introduces potential biases. The sample size, particularly within subgroups, is relatively small, restricting the statistical power.

İn conclusion pregnant women with a history of cardiac surgery, whether valvular or non-valvular, are at increased risk for adverse maternal and fetal outcomes. These patients require careful, multidisciplinary management to optimize both maternal and neonatal health. Our findings highlight that non-valvular cardiac surgeries may be associated with higher neonatal intensive care needs and fetal complications compared to valvular surgeries. Further prospective studies are needed to develop tailored strategies for this high-risk group to improve pregnancy outcomes.

REFERENCES

1. Mahli A, Izdes S, Coskun D. Cardiac operations during pregnancy: review of factors influencing fetal outcome. Ann Thorac Surg. 2000;69(5):1622-6.
2. Green LJ, Kennedy SH, Mackillop L, et al. International gestational age-specific centiles for blood pressure in pregnancy from the INTERGROWTH-21st Project in 8 countries: A longitudinal cohort study. PLoS Med. 2021;18(4):e1003611.
3. Clapp JF, 3rd, Capeless E. Cardiovascular function before, during, and after the first and subsequent pregnancies. Am J Cardiol. 1997;80(11):1469-73.
4. Duvekot JJ, Cheriex EC, Pieters FA, et al. Early pregnancy changes in hemodynamics and volume homeostasis are consecutive adjustments triggered by a primary fall in systemic vascular tone. Am J Obstet Gynecol. 1993;169(6):1382-92.
5. John AS, Connolly HM, Schaff HV, et al. Management of cardiac myxoma during pregnancy: a case series and review of the literature. Int J Cardiol. 2012;155(2):177-80.
6. Siu SC, Sermer M, Harrison DA, et al. Risk and predictors for pregnancy-related complications in women with heart disease. Circulation. 1997;96(9):2789-94.
7. DAVUTOĞLU E, YÜKSEL MA, ÖNCÜL M, et al. Kalp Hastalığı ve Gebelik: Maternal ve Fetal Sonuçlar. Journal Of Clinical Obstetrics & Gynecology. 2015;25(2):103-110.
8. Köşüş A, Köşüş N, Açıkgöz N, et al. Kalp hastalığı olan ve olmayan gebelerde maternal ve fetal sonuçlar açisindan bir fark var mı? Journal of General Medicine/Genel Tıp Dergisi. 2008;18(2).
9. Roos-Hesselink J, Baris L, Johnson M, et al. Pregnancy outcomes in women with cardiovascular disease: evolving trends over 10

years in the ESC Registry Of Pregnancy And Cardiac disease (ROPAC). Eur Heart J. 2019;40(47):3848-3855.
10. Kanhere AV, Kanhere VM. Pregnancy After Cardiac Surgery. J Obstet Gynaecol India. 2016;66(1):10-5.
11. into Maternal CE. Why Mothers Die (2000-2002). http://www cemach org uk/Publications/CEMACH-Publications/Maternal-and-Perinatal-Health aspx. 2005.
12. Anthony J, Osman A, Sani MU. Valvular heart disease in pregnancy. Cardiovasc J Afr. 2016;27(2):111-8.
13. Regitz-Zagrosek V, Blomstrom Lundqvist C, Borghi C, et al. ESC Guidelines on the management of cardiovascular diseases during pregnancy: the Task Force on the Management of Cardiovascular Diseases during Pregnancy of the European Society of Cardiology (ESC). Eur Heart J. 2011;32(24):3147-97.
14. Siu SC, Sermer M, Colman JM, et al. Prospective multicenter study of pregnancy outcomes in women with heart disease. Circulation. 2001;104(5):515-21.
15. Khairy P, Ouyang DW, Fernandes SM, et al. Pregnancy outcomes in women with congenital heart disease. Circulation. 2006;113(4):517-24.
16. Srivastava AR, Modi P, Sahi S, et al. Anticoagulation for pregnant patients with mechanical heart valves. Ann Card Anaesth. 2007;10(2):95-107.
17. Born D, Martinez EE, Almeida PA, et al. Pregnancy in patients with prosthetic heart valves: the effects of anticoagulation on mother, fetus, and neonate. Am Heart J. 1992;124(2):413-7.
18. Marcus-Braun N, Segal D, Merkin M, et al. [Anticoagulation in pregnant women with prosthetic heart valve--a new approach for therapy]. Harefuah. 2003;142(7):508-11, 567.
19. Ayad SW, Hassanein MM, Mohamed EA, et al. Maternal and Fetal Outcomes in Pregnant Women with a Prosthetic Mechanical Heart Valve. Clin Med Insights Cardiol. 2016;10:11-7.