JOURNAL OF AMERICAN MEDICAL SCIENCE & RESEARCH

Original Research Article
ISSN: 3041-5578
Journal homepage: https://medical.researchfloor.org/

The Impact of Heart Disease on Maternal and Fetal Outcomes in Pregnancy

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ABSTRACT

Background: *Heart disease in pregnancy is a leading cause of non-obstetric maternal and neonatal morbidity. Physiological changes during gestation can exacerbate existing cardiac conditions. A multidisciplinary approach involving obstetricians, cardiologists, and anesthesiologists is essential for managing these patients from preconception through the postpartum period. Therefore, the aim of the current study is to evaluate the impact of heart disease on maternal and fetal pregnancy outcomes.*

Methods: *This prospective, cross-sectional study was conducted at Baghdad Teaching Hospital from May 2023 to May 2024, involving 81 pregnant women with heart disease. Baseline data, maternal complications (cardiac and obstetrical), and fetal outcomes were recorded.*

Results: *Valvular heart disease, particularly mitral valve disease, was predominant. Most patients had mild disease severity. Maternal outcomes showed increased rates of congestive heart failure and arrhythmia. Fetal outcomes revealed higher incidences of preterm delivery and low birth weight.*

Conclusion: *Pregnant women with heart disease face high risks for both maternal and fetal complications, with outcomes closely related to the type and severity of the cardiac condition.*

Citation: Asmaa Fadhil Nassar, Zainab Hazim Abdul Karim, and Arij Sabah Abdulla (2026). The Impact of Heart Disease on Maternal and Fetal Outcomes in Pregnancy.
Journal of American Medical Science and Research.
DOI: https://doi.org/10.51470/AMSR.2026.05.01.42

Revised 18 January 2026
Received 17 February 2026
Accepted 08 March 2026

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Keywords: *Heart disease in pregnancy, valvular heart disease, maternal outcomes, fetal outcomes, congestive heart failure, preterm delivery, low birth weight, multidisciplinary care.*

Introduction

Cardiovascular disease (CVD) complicates 1% to 4% of pregnancies and remains a leading cause of non-obstetric maternal morbidity and mortality worldwide [1]. Its incidence is rising due to increasing maternal age, cardiovascular risk factors (obesity, diabetes, hypertension), and improved survival of women with congenital heart disease (CHD) [1]. Congenital heart disease is the most common cardiac condition in pregnancy in developed countries, while rheumatic heart disease predominates in developing nations [2,6].

The spectrum of heart disease in pregnancy includes valvular lesions (rheumatic and non-rheumatic), congenital malformations (acyanotic: ASD, VSD, PDA, coarctation, pulmonary stenosis; cyanotic: TOF, Eisenmenger syndrome), cardiomyopathies (dilated, hypertrophic, peripartum), arrhythmias, coronary artery disease, and others [3–5]. Risk stratification using the New York Heart Association (NYHA) classification is essential; classes III and IV carry high maternal morbidity and mortality, whereas classes I and II indicate lower risk [3].

Valvular heart disease is often rheumatic, accounting for >90% of cardiac disease in pregnancy globally [6]. Mitral stenosis is particularly critical: severe stenosis (valve area <1 cm^2) predisposes to pulmonary oedema and right heart failure; tachycardia is poorly tolerated, requiring rate control with beta-blockers or digoxin, and balloon valvuloplasty may be needed for refractory symptoms [7]. Regurgitant lesions (mitral regurgitation, aortic regurgitation) are usually well tolerated due to physiological vasodilation, and ACE inhibitors are contraindicated [8].

Women with mechanical prosthetic valves require meticulous anticoagulation; warfarin is effective but carries risks of embryopathy and fetal haemorrhage, while heparin regimens have higher thrombotic risk (up to 25%) [9–12]. Multidisciplinary care is mandatory [11].

Congenital heart disease is increasingly encountered; many women have residual sequelae after surgery [13,14]. Bicuspid aortic stenosis is well tolerated if left ventricular function is preserved and gradients are moderate [15]. Aortic coarctation requires preconception hemodynamic assessment [16]. In Marfan syndrome, aortic dissection risk (~1%) is increased with an aortic root >4 cm; beta-blockers and often cesarean delivery are recommended [17]. Fontan patients have low cardiac output and risk of failure/arrhythmias [18]. Isolated pulmonary stenosis is generally well tolerated [19]. ASD and VSD are usually well tolerated unless large or with pulmonary hypertension [20].

Cyanotic lesions carry higher risks. Eisenmenger syndrome has >50% maternal mortality and is an absolute contraindication to pregnancy [21]. Pulmonary hypertension (mean PAP ≥25 mmHg) is associated with high mortality, especially postpartum, and requires management in expert centres [22,23]. Repaired Tetralogy of Fallot carries a 7% risk of cardiovascular complications and potential worsening of right ventricular function [24].

Arrhythmias in pregnancy are linked to adverse fetal outcomes; atrial fibrillation may precipitate pulmonary oedema [25,26]. In dilated cardiomyopathy, pregnancy is poorly tolerated, with maternal mortality up to ≥7% in NYHA III–IV and fetal mortality up to 30% in class IV; ACE inhibitors are ge.

nerally avoided [27]. Peripartum cardiomyopathy occurs in ~1/2,289 live births; about 50% recover within six months [28,29]. Hypertrophic cardiomyopathy requires avoidance of volume depletion and tachycardia; beta-blockers are beneficial in obstructive forms [30].

Aim of the study:
The object of this study is to evaluate the effect of heart disease on the maternal and fetal outcomes of pregnancy.

Patients and Methods

Study Design, Setting, and Period
This prospective cross-sectional study was conducted at Baghdad Teaching Hospital from May 2023 to May 2024. A total of 8,521 deliveries occurred during the study period.

Study Population:
The study included 81 pregnant women with confirmed heart disease, all at a gestational age of>28 weeks. Maternal age ranged from 16 to 45 years. Parity distribution included 9 nulliparous and 72 multiparous women. Delivery modes comprised 31 vaginal deliveries and 50 cesarean sections.

Inclusion and Exclusion Criteria:
Inclusion required echocardiographically confirmed heart disease. Exclusion criteria included pregnancies ending before 28 weeks due to miscarriage, termination, or fetal death, as well as pregnancies occurring within six months of a previous delivery.

Diagnosis and Risk Stratification:
Heart disease severity was classified according to the New York Heart Association (NYHA) functional classification: classes I and II were designated as low risk, while classes III and IV were considered high risk. Patients were further categorised by diagnosis into valvular heart disease, congenital heart disease, cardiomyopathy, arrhythmias, and ischemic heart disease.

Data Collection:
Baseline data recorded included age, gestational age, parity, comorbid conditions (diabetes mellitus, hypertension, thyroid disease), antenatal care attendance, symptoms during pregnancy, and use of cardiac medications and anticoagulants. Follow-up data were obtained during delivery and the postpartum hospitalisation period through collaborative management by obstetricians and cardiologists.

Delivery and Intrapartum Management:
Mode of delivery was determined, with cesarean sections performed primarily for obstetric indications; only two cases were performed for cardiac indications. Intrapartum management emphasised avoidance of fluid overload, use of oxytocin with fluid restriction, contraindication of ergometrine, and administration of endocarditis prophylaxis postpartum.

Maternal Outcomes:
Maternal complications were classified as:

- **Cardiac complications:** admission to cardiac care unit, heart failure, arrhythmia, pulmonary embolism, or maternal mortality.
- **Obstetric complications:** postpartum haemorrhage, placenta previa, infections, hypertension, and diabetes mellitus.

Fetal and Neonatal Outcomes: Neonatal outcomes assessed included stillbirth, preterm delivery, intrauterine growth restriction, and admission to the neonatal intensive care unit.

Ethical Considerations: The study protocol was approved by the Arab Board of Health Specialisation, and institutional approval was obtained from the hospital administration and the Department of Obstetrics and Gynaecology. Verbal informed consent was obtained from all participants.

Statistical Analysis: Data were analysed using SPSS version 21. Descriptive statistics were presented as mean ± standard deviation, frequencies, and percentages. Comparisons between groups were performed using the chi-square test for categorical variables and Student's t-test for continuous variables. A p-value ≤0.05 was considered statistically significant. Multiple logistic regression analysis was used to identify predictors and risk factors for adverse neonatal outcomes, with odds ratios calculated to estimate risk (odds ratios>1 indicating a risk factor, <1 indicating a protective effect). Results were presented in tables and figures with accompanying explanations.

Results

Demographic-Characteristics:
A total of 81 pregnant women with heart disease were included. Mean maternal age was 30.8 ± 6.2 years, with 58% aged 26–35 years. Nulliparous women accounted for 11.1%, while 56.8% had a parity of 1–3. Only 27.2% were registered for antenatal care. Cesarean section was performed in 61.7% of cases; among these, 96% were for obstetrical indications and 4% for cardiac indications (both due to pulmonary hypertension). Vaginal delivery occurred in 38.3%, of which 77.4% were induced. Smoking during pregnancy was reported in 4.9% of women.

Table 1: Demographic characteristics of the study group (N = 81)

Characteristic	Category	No.	%
Age (years)	16–20	1	1.2
	21–25	7	8.6
	26–30	13	16
	31–35	20	24.7
	36–45	27	33.3
	Mean ± SD	*30.8 ± 6.2*	*Range*
			16–45
Parity	Nulliparous	9	11.1
	1	10	12.3
	2	16	19.8
	3	20	24.7
	4	11	13.6
	5	8	9.9
	>5	7	8.6
Antenatal care registration	Yes	22	27.2
	No	59	72.8
Mode of delivery	Cesarean section	50	61.7
	Obstetrical indication	48	96.0*
	Cardiac indication	2	4.0*
	Vaginal delivery	31	38.3
	Induced	24	77.4†
	Spontaneous	7	22.6†
Smoking during pregnancy	Yes	4	4.9
	No	77	95.1

**Percentage calculated among cesarean deliveries (n = 50);†Percentage calculated among vaginal deliveries (n = 31).*

DOI: https://doi.org/10.51470/AMSR.2026.05.01.42

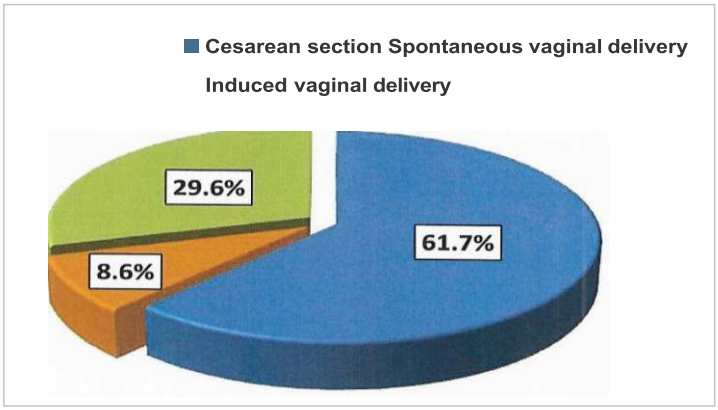

Figure 1: Distribution of the mode of delivery of the studied group

Medical and Cardiac Surgical History:

Pregnancy-induced hypertension was present in 19.8%, chronic hypertension in 8.6%, diabetes mellitus in 3.7%, and other medical conditions (e.g., Raynaud's phenomenon, thyroid disease) in 3.7%. A history of cardiac surgery included catheterisation (9.9%), correction of atrial septal defect or patent ductus arteriosus (7.4%), and valve replacement (4.9%).

Table 2: Maternal medical and cardiac surgery history (N=81)

History	No.	%
Medical history		
PIH	16	19.8
Chronic hypertension	7	8.6
Diabetes mellitus	3	3.7
Others*	3	3.7
History of cardiac surgery		
Catheterization	8	9.9
Corrected ASD,PDA	6	7.4
Valve replacement	4	4.9

**Others: Raynaud's phenomena, thyroid disease*

Types of Heart Disease

Valvular heart disease was the most common, affecting 59.3% of patients; of these, 60.4% were rheumatic and 39.6% non-rheumatic. Congenital heart disease was present in 28.4%, arrhythmias in 3.7%, and other conditions (ischemic heart disease, cardiomyopathy) in 22.2% (some patients had more than one lesion).

Table 3: Distribution of maternal heart diseases (N = 81)

Type of Heart Disease	Subtype	No.	% *
Valvular heart disease	Rheumatic	29	35.8
	Non-rheumatic	19	23.5
	MVP (mitral valve prolapse)	19	39.6†
	MVR (mitral valve regurgitation)	17	35.4†
	MVS (mitral valve stenosis)	8	16.7†
	Other (TR, AR)	4	8.3†
	Total	**48**	**59.3**
Congenital heart disease	ASD	6	26.1‡
	PS	6	26.1‡
	VSD	5	21.7‡
	PDA	3	13.0‡
	PHT	2	8.7‡
	TOF	1	4.3‡
	Total	**23**	**28.4**
Arrhythmia	SVT	2	66.7§
	AF	1	33.3§
	Total	**3**	**3.7**
Other heart diseases	IHD	12	66.7¶
	Cardiomyopathy	6	33.3¶
	Total	**18**	**22.2**

**Percentages calculated based on total patients (N = 81);†Percentages calculated among valvular heart disease cases (n = 48); ‡Percentages calculated among congenital heart disease cases (n = 23);§Percentages calculated among arrhythmia cases (n = 3); Percentages calculated among other heart disease cases (n = 18). Some patients had more than one type of heart disease simultaneously; therefore, the sum of percentages exceeds 100%.*

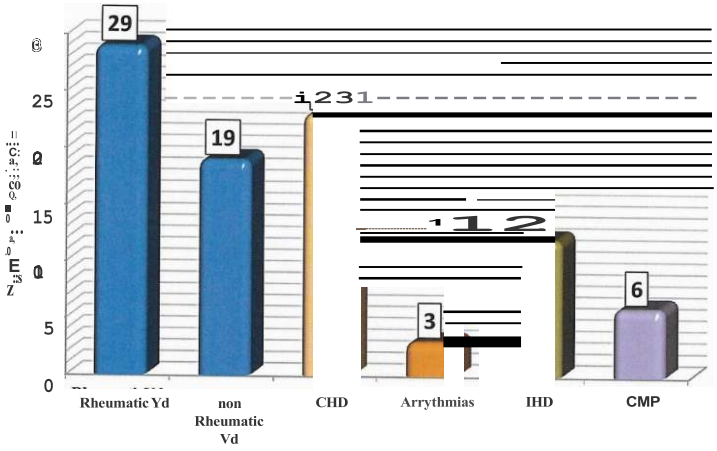

Figure 2: Distribution of main types of maternal heart disease (N=81)

New York Heart Association (NYHA) Classification

Of the 81 women, 33 (40.7%) were in NYHA class I, 26 (32.1%) in class II, 12 (14.8%) in class III, and 10 (12.4%) in class IV. No significant association was found between the type of maternal heart disease and NYHA class ($p > 0.05$ for all comparisons), as detailed in Table 5.

Table 4: Distribution of NYHA classification among the study group (N = 81)

NYHA Class	Number (n)	Percentage (%)
I	33	40.7
II	26	32.1
III	12	14.8
IV	10	12.4
Total	**81**	**100**

Table 5: Distribution of maternal heart diseases according to NYHA clas

Maternal Heart Disease	NYHA I (n=33)	NYHA II (n=26)	NYHA III (n=12)	NYHA IV (n=10)	p-value
Valvular disease	22 (66.7%)	16 (61.5%)	4 (33.3%)	4 (40.0%)	0.27
Congenital heart disease	11 (33.3%)	5 (19.2%)	3 (25.0%)	3 (30.0%)	0.59
Arrhythmia	2 (6.1%)	1 (3.8%)	0 (0.0%)	0 (0.0%)	1.00
Other heart diseases*	6 (18.2%)	4 (15.4%)	5 (41.7%)	3 (30.0%)	0.26

**Other heart diseases include ischemic heart disease and cardiomyopathy; Some patients had more than one type of heart disease simultaneously.*

DOI: https://doi.org/10.51470/AMSR.2026.05.01.42

Discussion

Pregnancy in women with heart disease is associated with increased maternal and fetal complications. A multidisciplinary approach involving obstetricians, cardiologists, anesthesiologists, and neonatologists is essential to optimise outcomes from the antenatal through the postpartum period [1,13].

Incidence and Demographics:

Among 8,521 deliveries at Baghdad Teaching Hospital over one year, 81 pregnant women had heart disease, yielding an incidence of 0.95%. This finding aligns with Asghar et al. [31] in Pakistan (0.98%). The mean maternal age was 30.8 ± 6.2 years, with the majority being parous (89.9%). Only 27.2% were registered for antenatal care. Cesarean section was performed in 61.7% of cases, predominantly for obstetric indications (96%), with only 4% for cardiac indications (both pulmonary hypertension). This contrasts with Pratibha D et al. [32] in India, who reported vaginal delivery in 73.5% and cesarean section in 26.5%, a difference attributed to a higher rate of previous cesarean sections in the present study.

Types of Heart Disease

Valvular heart disease was the most common (59.3%), of which 60.4% were rheumatic, reflecting the pattern in developing countries where poor socioeconomic conditions, overcrowding, and limited healthcare access prevail [6]. Mitral valve involvement was predominant (54.4% of valvular cases), consistent with Pratibha D et al. [32] who reported mitral valve involvement in 80.5%. Congenital heart disease accounted for 28.4% of cases, a lower proportion than reported by Roos-Hesselink et al. [33] (66%), likely due to differences in pre-pregnancy diagnosis and counselling practices. Peripartum cardiomyopathy was diagnosed by exclusion based on clinical presentation and echocardiography, consistent with Mishra et al. [34].

Risk Stratification

According to the NYHA classification, 46.9% were class I and 25.9% class II, similar to Roos-Hesselink et al. [33] who reported 72% in class I. The lower proportion of high-risk patients (classes III and IV) may reflect pre-conception counselling advising against pregnancy in women with severe cardiac disease.

Conclusion

Pre-pregnancy maternal characteristics help identify women at increased risk for adverse cardiac events during pregnancy. The incidence of maternal and fetal complications is closely related to the type and severity of heart disease.

Recommendations

1. All women with heart disease should be referred to a tertiary care centre from the first trimester for comprehensive pregnancy management.
2. Antenatal care should be expanded to include the preconception period.
3. Intensive care during pregnancy and delivery should be provided by a multidisciplinary team comprising experienced obstetricians, cardiologists, obstetric anesthesiologists, and neonatologists.

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