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ORIGINAL ARTICLE

Pregnancy in Adult with Repaired or Unrepaired Congenital Heart Disease – A Hospital Based Observational Study

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Abstract

Background: *Congenital heart disease (CHD) represents a diverse group of structural cardiac abnormalities present from birth and is increasingly encountered in women of reproductive age. Maternal and neonatal outcomes during pregnancy vary widely according to lesion complexity, ventricular function, pulmonary pressures, and prior repair status, highlighting the need for careful risk assessment and multidisciplinary care.*

Objectives: *To evaluate maternal and neonatal outcomes in pregnant women with CHD and compare outcomes between repaired and unrepaired lesions, and between simple and complex defects.*

Methods: *This prospective observational study was conducted at Bangladesh Medical University from January 2024 to December 2025. Thirty-three pregnant women with confirmed CHD and singleton viable pregnancies were enrolled. Lesions were categorized as simple acyanotic, acyanotic with additional lesions, combined septal defects, or complex CHD, and stratified as repaired or unrepaired. Maternal outcomes included cardiac complications and death. Neonatal outcomes included birth weight, fetal growth restriction (FGR), NICU admission, and early neonatal death. Data were analyzed descriptively.*

Results: *Simple acyanotic CHD predominated (63.6%); 33.3% had repaired and 66.7% had unrepaired lesions. Among 33 births, 42.4% were normal birth weight, 27.3% low birth weight, and 15.2% very low birth weight (all in the unrepaired group). Two maternal (6.1%) and two neonatal deaths (6.1%) occurred, exclusively in women with unrepaired CHD. FGR (12.1%) and NICU admissions (12.1%) were observed only among unrepaired cases.*

Conclusions: *Pregnancy outcomes were more favorable in women with repaired, simple CHD. Unrepaired disease was associated with higher maternal and neonatal morbidity and mortality, highlighting the importance of pre-pregnancy counseling, timely intervention, and multidisciplinary care.*

Keywords: *congenital heart disease; pregnancy; maternal outcome; neonatal outcome; ventricular septal defect; atrial septal defect; repaired lesions; unrepaired lesions; fetal growth restriction; low birth weight.*

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Introduction:

Congenital heart disease (CHD) comprises a wide spectrum of structural abnormalities of the heart and great vessels present from birth, ranging from simple left to right shunt lesions such as atrial and ventricular septal defects to complex cyanotic and obstructive malformations.[1,2] Over recent decades, advances in pediatric cardiology, cardiac surgery, and long term follow up have resulted in the survival of most children with CHD into adulthood, so that an increasing number of women with CHD now reach reproductive age and present for pre pregnancy counselling and antenatal care.[1,3,4] Consequently, CHD has become one of the most frequent forms of pre existing cardiovascular disease encountered during pregnancy in developed and many developing health care settings.[2,3]

Pregnancy is associated with profound cardiovascular and hemostatic adaptations, including a 30–50% increase in plasma volume and cardiac output, a reduction in systemic

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vascular resistance, and the development of a hypercoagulable state, which peak in the second and third trimesters and persist into the early puerperium [2,5]. These physiological changes are usually well tolerated in women with preserved ventricular function and mild hemodynamic lesions but can unmask previously silent disease or precipitate decompensation in those with limited cardiac reserve, significant valvular lesions, pulmonary hypertension, or a substrate for arrhythmias [2,5,6]. As a result, women with CHD are at increased risk of maternal complications such as heart failure, atrial and ventricular arrhythmias, thromboembolism, and—in selected high risk subgroups—maternal death, while their offspring face higher rates of miscarriage, preterm delivery, fetal growth restriction, low birth weight, and perinatal morbidity and mortality.[1,3,6]

Within this broad group, pregnancy outcomes vary markedly according to lesion complexity, ventricular function, pulmonary artery pressures, cyanosis, and prior repair status.[1,3] Simple acyanotic defects such as small or successfully repaired atrial and ventricular septal defects are generally associated with good maternal tolerance of pregnancy and favorable perinatal outcomes when ventricular systolic function is normal and pulmonary hypertension is absent.[1,3] In contrast, more complex or residually hemodynamically significant lesions—including those with pulmonary vascular disease or Eisenmenger physiology, residual problems after repair of Tetralogy of Fallot, or coexisting cardiomyopathy—are associated with substantially higher rates of cardiac events and adverse neonatal outcomes, particularly when cyanosis, ventricular dysfunction, or significant valvular regurgitation or stenosis are present.[3,6] Current recommendations therefore highlight the importance of early pre pregnancy counselling, lesion specific risk stratification (such as the modified World Health Organization classification), and coordinated multidisciplinary management involving cardiology, maternal–fetal medicine, anesthesia, and neonatology for women with both repaired and unrepaired CHD who are planning or continuing a pregnancy.[2,4,5]

Materials and Methods

Study design and setting

This prospective observational study was conducted in the Department of Fetomaternal Medicine at Bangladesh Medical University (BMU), Dhaka, Bangladesh, from January 2024 to December 2025. The primary objective was to evaluate maternal and neonatal outcomes among pregnant women with congenital heart disease (CHD), with particular emphasis on differences between repaired and unrepaired lesions and between simple and complex defects. The study was conducted in accordance with the ethical principles outlined in the World Medical Association Declaration of Helsinki.[7]

Study population

The study population comprised 33 consecutive pregnant women with underlying CHD and a viable singleton pregnancy who were managed at BMU during the study period. CHD was defined as a structural abnormality of the heart or great vessels present from birth, confirmed by echocardiography and/or existing cardiology records. Cardiac lesions were categorized as simple acyanotic (e.g., isolated atrial septal defect, ventricular septal defect), acyanotic CHD with associated valvular or additional shunt lesions, combined septal defects, and complex CHD (including Eisenmenger syndrome, Tetralogy of Fallot, and hypertrophic obstructive cardiomyopathy). Cases were identified and classified according to the International Classification of Diseases, 10th Revision (ICD 10) [8].

Inclusion criteria were:

1. Pregnant women with a confirmed diagnosis of CHD.
2. Singleton, viable pregnancy at any gestational age.
3. Antenatal care and/or delivery completed at BMU during the study period.

Exclusion criteria were:

1. Multiple gestations.
2. Women with only acquired heart disease (e.g., isolated rheumatic or ischemic heart disease) without congenital lesions.
3. Incomplete medical records that did not allow assessment of key maternal or neonatal outcomes.
4. Patients transferred to other facilities before delivery or whose final pregnancy outcome could not be ascertained.

Data collection

Data was collected prospectively using a structured proforma by trained research personnel. At enrolment, each woman underwent detailed obstetric and medical history taking (including gravidity, parity, history of abortion, and trimester at presentation), general and obstetric examination, and review of available cardiology documentation (previous diagnoses, echocardiography reports, and surgical history).

For demographic characterization, only maternal name (for internal hospital identification) and age were systematically recorded, with age categorized into three groups (18–23, 24–29, and 30–35 years) for analysis. Clinical variables included gravidity category (primigravida, multigravida, grand multigravida), gestational age and trimester at first presentation, type of CHD, lesion complexity (simple vs complex), and repair status (repaired vs unrepaired). Maternal outcomes recorded were occurrence of heart failure or arrhythmias (when documented), need for higher level of care, and maternal death. Fetal and neonatal outcomes included gestational age at delivery, birth weight and birth weight category [normal birth weight (NBW ≥2500 g), low birth weight (LBW 1500–2499 g), very low birth weight (VLBW 1000–1499 g)], fetal growth restriction, NICU admission, and early neonatal death. To ensure data quality, 10% of the records were randomly selected and independently reviewed by a second researcher, with any discrepancies resolved by consensus.[9]

Study groups

For analysis, women were primarily categorized into two groups based on cardiac surgical status:

1. Repaired CHD group: women with documented prior corrective or palliative cardiac surgery before the index pregnancy.
2. Unrepaired CHD group: women with persistent native lesions and no history of cardiac surgery.

Where numbers were allowed, descriptive subgroup analyses were also performed according to lesion complexity (simple vs complex CHD).

Outcome measures

Primary maternal outcomes were maternal death during pregnancy or within 42 days postpartum and clinically significant cardiac complications (such as heart failure or arrhythmias) when documented. Key fetal and neonatal outcomes included gestational age at delivery, birth weight category (NBW, LBW, VLBW), fetal growth restriction, NICU admission, and early neonatal death. Attention was paid to patterns of birth weight, fetal growth restriction, NICU admission, and mortality in relation to repaired versus unrepaired CHD.

Statistical analysis

Data was entered into a spreadsheet and analyzed using STATA (Stata Corp LLC, College Station, TX, USA). Continuous variables (such as maternal age and birth weight) were summarized as means with standard deviations or as medians with interquartile ranges, according to data distribution. Categorical variables (such as gravidity category, trimester at presentation, type of lesion, repair status, birth weight category, fetal growth restriction, NICU admission, and maternal and neonatal death) were expressed as frequencies and percentages. Analyses were primarily descriptive for the overall cohort (n = 33) and for subgroups defined by repair status (repaired vs unrepaired CHD). Given the small sample size, no multivariable modelling was performed; differences between groups were described by comparing the distribution of key maternal and neonatal outcomes.

Results

Study Setting and Population

This study was conducted in the Fetomaternal Medicine Department of Bangladesh Medical University between 2024 and 2025. A total of 33 pregnant women with underlying cardiac disease were included in the analysis.

Baseline Maternal Characteristics

Maternal age ranged from 18 to 35 years. Nearly half of the participants (48.5%, n=16) were aged 24–29 years, followed by 30.3% (n=10) aged 18–23 years and 21.2% (n=7) aged 30–35 years.

Table-I

Age distribution of the participants

Age Group (years)	Frequency	Percentage
18–23	10	30.3%
24–29	16	48.5%
30–35	7	21.2%
Total	33	100%

Table 1 shows that nearly half of the participants (48.5%) were between 24–29 years of age, while 30.3% were 18–23 years and 21.2% were 30–35 years, demonstrating that the majority were within the 24–29-year age group.

Regarding obstetric status, 45.5% (n=15) were primigravida, 39.4% (n=13) were multigravida, and 15.2% (n=5) were grand multigravida. A history of abortion was reported in 33.3% (n=11) of women, including one patient with a history of four abortions.

Table-II

Distribution of the Participants According to Gravidity

Gravidity	Frequency	Percentage
Primigravida	15	45.5%
Multigravida	13	39.4%
Grand Multigravida	5	15.2%
Total	33	100%

Table II shows most participants were primigravida (45.5%), followed by multigravida (39.4%), while grand multigravida constituted a smaller proportion (15.2%) of the study population.

At presentation, most women were in the third trimester (e”28 weeks), accounting for 90.9% (n=30), while 6.1% (n=2) were in the second trimester and 3.0% (n=1) in the first trimester.

Table-III

Distribution of the Participants According to Gestational Age Category

GA Category	Frequency	Percentage
d”13 weeks	1	3.0%
14–27 weeks	2	6.1%
≥28 weeks	30	90.9%
Total	33	100%

Table III demonstrates that most participants presented at or beyond 28 weeks of gestation (90.9%), while very few were in the first (3.0%) or second trimester (6.1%).

Spectrum of Cardiac Disease

Among the 33 cases, 21 (63.6%) had simple acyanotic congenital heart disease, predominantly atrial septal defect (n=13) and ventricular septal defect (n=7). Six women (18.2%) had acyanotic congenital heart disease with associated valvular or shunt lesions. Combined septal defects were identified in 5 (15.2%) cases, while 3 (9.1%) had complex cardiac conditions, including Eisenmenger syndrome, Tetralogy of Fallot, and hypertrophic obstructive cardiomyopathy.

Table IV

Classification of Cardiac Conditions Among the Study Participants (n = 33)

Category	Diagnosis	Number
Simple acyanotic CHD	ASD	13
	VSD	7
	PDA	1
Subtotal		21
Acyanotic CHD with associated lesions	VSD with MR	3
	ASD with TR	1
	VSD with bidirectional shunt	2
Subtotal		6
Combined septal defects	ASD + VSD	4
	Ebstein anomaly with ASD closure	1
Subtotal		5
Complex/cyanotic disease	Eisenmenger syndrome	1
	TOF	1
	HOCM	1
Subtotal		3
Total		33

The findings in Table IV indicate that simple acyanotic lesions constituted the majority of cases, whereas complex or cyanotic conditions accounted for a smaller but clinically significant proportion of the study population.

With respect to surgical status, 33.3% (n=11) had undergone corrective cardiac surgery prior to pregnancy, whereas 66.7% (n=22) had unrepaired lesions.

Table-V

Distribution of Participants According to Repair Status of Cardiac Lesions (n = 33)

Cardiac Status	Frequency	Percentage
Repaired	11	33.3%
Unrepaired	22	66.7%
Total	33	100%

The data demonstrate that two-thirds of the women had unrepaired cardiac defects, highlighting the continued burden of uncorrected CHD in this cohort.

Birth Weight Distribution

Birth weight data were available for 28 neonates. Of these, 15 (53.6%) had normal birth weight (NBW, e”2500 g), 8 (28.6%) had low birth weight (LBW, 1500–2499 g), and 5 (17.9%) had very low birth weight (VLBW, 1000–1499 g).

Table-VI

Distribution of Neonates According to Birth Weight Category (n = 28)

Birth-weight Category	Birth weight	Number of Babies
VLBW (Very Low Birth Weight)	1000–1499 g	5
LBW (Low Birth Weight)	1500–2499 g	8
NBW (Normal Birth Weight)	≥2500 g	15
Total		28

Table VI shows the majority of neonates (53.6%) had normal birth weight, while 28.6% and 17.8% were LBW and VLBW,

When analyzed1 across the full cohort (n=33), 14 mothers (42.4%) delivered NBW infants, 9 (27.3%) delivered LBW infants, and 5 (15.2%) delivered VLBW infants.

Within the NBW group, 7 of 14 (50.0%) mothers had previously repaired congenital heart disease. In the LBW group, 2 of 9 (22.2%) mothers had repaired lesions, while the remainder were unrepaired. All VLBW infants (5/5, 100%) were born to mothers with unrepaired cardiac disease.

Maternal Outcomes

Two maternal deaths occurred, corresponding to a maternal mortality rate of 6.1% (2/33). Both deaths were observed among mothers with unrepaired cardiac lesions—one following delivery of an LBW infant and the other associated with a VLBW infant.

Fetal Growth Restriction

Fetal growth restriction was observed in 12.1% (n=4) of pregnancies. Among these, one case occurred in a mother with repaired cardiac disease and three in mothers with unrepaired lesions.

Neonatal Outcomes

NICU admission was required in 12.1% (n=4) of neonates. There were two neonatal deaths (6.1%), both occurring among VLBW infants born to mothers with unrepaired cardiac disease, representing 40.0% (2/5) of the VLBW group.

Discussion:

Maternal and newborn outcomes among pregnant women with congenital heart disease (CHD) were assessed in this prospective analysis, which showed distinct disparities based on lesion complexity and repair status, with poor outcomes mostly clustered among women with unrepaired disease.[10,11] The prevalence of simple acyanotic lesions, especially ventricular and atrial septal defects, is consistent with data from large registries that indicate more women with CHD are reaching reproductive age and seeking prenatal care because of improved survival.[12,13]

Women with unrepaired lesions were the only ones who experienced maternal death, highlighting their susceptibility throughout pregnancy and the early postpartum period.[10] Significant hemodynamic stress during pregnancy, such as increased cardiac output and blood volume, can cause decompensation in women with persistent lesions or low cardiovascular reserve.[11,14] Women who have unrepaired or complicated CHD are more likely to experience heart failure, arrhythmia, and major cardiac events, especially if they also have pulmonary hypertension or cyanosis, according to prior research.[12,15] The importance of lesion severity and baseline cardiac condition in determining maternal outcomes is further supported by risk prediction models like CARPREG II.[16]

This cohort's birth weight distribution pattern demonstrates how maternal cardiovascular health affects fetal development. Mothers with unrepaired congenital heart disease gave birth to all extremely low birth weight babies, indicating impaired uteroplacental perfusion linked to decreased maternal cardiac output.[12] Research has shown that women with congenital heart disease (CHD) have higher rates of low birth weight and small-for-gestational-age babies, particularly when maternal oxygen supply or placental perfusion is compromised.[10,17]

Most women with unrepaired illness experienced fetal development limitation, which is in line with the known link between placental insufficiency and maternal hemodynamic impairment.[12] Growth limitation may result from impaired nutrition and oxygen transport across the placenta caused by reduced maternal cardiac output and persistent hypoxemia.[14]

The study's neonatal outcomes, such as NICU hospitalization and neonatal mortality that exclusively happened to babies whose moms had unrepaired lesions, show how the severity of the mother's illness affects the neonatal morbidity.[10] According to earlier cohort studies, preterm, growth restriction, and medically recommended early delivery brought on by maternal decline are frequently linked to newborn problems.[15,17]

In this cohort, the results for women with corrected CHD were more favorable, with a greater percentage of normal birth weight babies and no maternal fatalities. This is consistent with data showing that when there are few remaining hemodynamic problems, women with corrected uncomplicated lesions and retained ventricular function typically handle pregnancy successfully.[11,12] Both maternal cardiac events and unfavorable perinatal outcomes have been demonstrated to decrease by surgical repair before pregnancy.[11,15]

One noteworthy result was that most women showed up in the third trimester, indicating a lack of access to early specialized care and preconception consultation. In order to maximize results, current international recommendations stress the significance of multidisciplinary planning, risk stratification using the updated World Health Organization classification, and pre-pregnancy evaluation.[11] Barriers including poor knowledge, delayed diagnosis, or limited access to cardiology services—problems commonly reported in low- and middle-income settings—may be the cause of delayed presentation.[18]

Disparities in availability to prompt corrective surgery and early detection are further highlighted by the cohort's comparatively high percentage of unrepaired lesions. While unrepaired abnormalities are more prevalent in resource-constrained situations, increasing maternal and

newborn risk, most women with CHD in high-income nations get their problems fixed before they reach reproductive age.[12,18]

Limitations:

This study has limitations, including small sample size and single-center design, which limit statistical power and generalizability. Nevertheless, the prospective design and detailed outcome assessment provide valuable insight into real-world patterns and reinforce the importance of early counselling, appropriate risk assessment, and coordinated multidisciplinary care to improve outcomes for women with CHD and their infants.[10,11]

Conclusion:

According to this prospective study, women with treated, minor congenital cardiac defects often handle pregnancy better than those with unrepaired or more complicated conditions. The significance of ongoing hemodynamic impairment on both mother and fetus is shown by the clustering of adverse outcomes, including extremely low birth weight, neonatal death, and maternal mortality, among women with unrepaired heart abnormalities. These results highlight the significance of planned pregnancy treatment in a multidisciplinary, tertiary environment, optimization or repair of heart defects where practical, and pre-pregnancy counselling. Enhancing referral channels and combining cardiology with fetomaternal services are crucial for enhancing fetomaternal outcomes in settings where unrepaired CHD is still prevalent.

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