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ORIGINAL ARTICLE

Pregnancy Outcomes in Uncorrected Ventricular Septal Defect in Tertiary Care Hospital

TANZILA HALIM[1], UMME KULSUM[2], MD. SAIFUL ISLAM[3], MD. KIBRIYA SHAMEEM[4], MOSTOFA MIDHAT PASHA[4], AHMED SAIFUL BARI[4], KHONDOKER QUMRUZZAMAN[4]

[1]Department of Obstetrics and Gynaecology, Bangladesh Medical University, Dhaka, Bangladesh, [2]Department of Fetomaternal Medicine, Bangladesh Medical University, Dhaka, Bangladesh, [3]Department of Opthalmology, Bangladesh Medical University, Dhaka, Bangladesh, [4]Department of Cardiology, Bangladesh Medical University, Dhaka, Bangladesh

Address of Correspondence: Dr. Tanzila Halim, Associate Professor, Department of Obstetrics and Gynaecology, Bangladesh Medical University, Dhaka, Bangladesh, E-mail: thbsmmu@gmail.com, Orcid id: 0009-0008-7885-2656

Abstract

Background: Pregnancy in women with uncorrected ventricular septal defect (VSD) poses significant maternal and fetal risks, yet data from low-resource settings remain limited.

Aim of the study: To evaluate maternal, obstetric, and neonatal outcomes in pregnancies complicated by uncorrected VSD at a tertiary care hospital.

Methods: A retrospective observational study was conducted at Bangladesh Medical University, Dhaka, Bangladesh over a period of July 2022 to June 2024 on 50 pregnant women with echocardiographically confirmed uncorrected VSD. Maternal cardiac status, obstetric complications, and neonatal outcomes were extracted from medical records. VSDs were classified by size and type. Quantitative data were analyzed using SPSS v26, with continuous variables expressed as mean ± SD and categorical variables as frequencies and percentages. Independent t-tests and Chi-square or Fisher's exact tests were used for comparisons, with $p<0.05$ considered significant.

Result: Small VSDs predominated (56%), with perimembranous defects most common (74%). Cardiac complications occurred in 7% of small versus 32% of moderate/large VSDs ($p<0.01$). Preterm delivery (14% vs. 32%, $p=0.04$) and low birth weight (18% vs. 45%, $p=0.02$) were higher in moderate/large defects. Cesarean delivery was more frequent in larger defects (55% vs. 36%). Overall, maternal and neonatal outcomes were favorable in small VSDs.

Conclusion: Pregnancy in women with uncorrected VSD is generally well tolerated in small defects but carries substantial maternal and fetal risks in moderate to large VSDs. Individualized risk assessment and multidisciplinary care are essential.

Keywords: Ventricular septal defect, congenital heart disease, pregnancy outcomes, maternal morbidity, neonatal outcomes

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Introduction

Congenital heart disease (CHD) encompasses a broad spectrum of structural cardiac abnormalities that originate during fetal development and are present at birth. It represents the most common congenital malformation worldwide and contributes substantially to maternal and neonatal morbidity when affected women enter pregnancy.[1,2] Globally, the prevalence of CHD is estimated at approximately 8–10 per 1000 live births, although reported rates vary depending on diagnostic methods and population characteristics.[3] In Bangladesh, recent epidemiological data indicate a substantially higher burden, with an overall CHD prevalence of 18.9 per 1000 live births among children. Ventricular septal defect (VSD) has been consistently identified as the most common congenital cardiac lesion in this setting.[4] Advances in

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prenatal diagnosis, pediatric cardiology, interventional techniques, and cardiac surgery have markedly improved survival, allowing an increasing proportion of children with CHD particularly females to reach adulthood and reproductive age.[3] As a result, CHD has emerged as an important contributor to cardiac disease complicating pregnancy, especially in low and middle-income countries where early corrective care remains limited.[3,4] Delayed diagnosis, inadequate screening programs, limited access to specialized cardiac services, and socioeconomic barriers result in a significant proportion of patients entering adolescence and adulthood with uncorrected septal defects.[5] Consequently, women with uncorrected VSD represent a clinically important subgroup within the pregnant population. The etiology of VSD is multifactorial, reflecting complex interactions between genetic predisposition and environmental exposures during early embryonic cardiac development.[6,7] Several non-inherited maternal risk factors have been implicated, including pre-gestational diabetes mellitus, viral infections during pregnancy, micronutrient deficiencies, exposure to teratogenic drugs or environmental toxins, and advanced maternal age.[8,9] These factors may disrupt normal septation of the ventricular chambers, leading to persistent structural defects.[9] Pregnancy induces profound physiological cardiovascular adaptations, including increased plasma volume, heart rate, and cardiac output, which may exacerbate left-to-right shunting in women with uncorrected VSD.[10,11] These hemodynamic changes can precipitate clinical deterioration, particularly in those with large defects or established pulmonary vascular disease.[11] Accordingly, pregnant women with CHD face a higher risk of cardiac complications such as arrhythmias, heart failure, thromboembolism, and pulmonary hypertension compared with the general obstetric population.[12] In addition to maternal risks, adverse fetal outcomes including preterm birth, low birth weight, intrauterine growth restriction, and increased need for neonatal intensive care have been reported more frequently in pregnancies complicated by maternal CHD.[13] Despite the high burden of VSD in Bangladesh and data on pregnancy outcomes among women with uncorrected VSD remain limited. Evaluating maternal and fetal outcomes in a tertiary care setting is essential to improve risk stratification, antenatal surveillance, and multidisciplinary management. The aim of this study is to assess maternal and fetal outcomes of pregnancy in women with uncorrected ventricular septal defect at a tertiary care hospital.

Methodology & Materials

This retrospective observational study was conducted at Bangladesh Medical University, Dhaka, Bangladesh over a period of July 2022 to June 2024. A total of 50 pregnant women with echocardiographically confirmed uncorrected VSD who received antenatal care and delivered at the study hospital were included. Participants were enrolled based on the availability of complete maternal, cardiac, obstetric, and neonatal records.

Inclusion criteria

- Pregnant women with a confirmed diagnosis of uncorrected ventricular septal defect
- Singleton pregnancy
- Delivery at the study hospital
- Availability of complete maternal, cardiac, obstetric, and neonatal data

Exclusion criteria

- Prior surgical or device closure of VSD
- Presence of complex or cyanotic congenital heart disease
- Significant associated valvular heart disease or cardiomyopathy
- Multiple pregnancy
- Incomplete or missing medical records

Data Collection

Baseline maternal characteristics including age, gravidity, gestational age at booking, smoking history, and prior cardiac or medical events (arrhythmia, thromboembolism, infective endocarditis) were extracted from hospital records. Functional cardiac status was assessed using the New York Heart Association (NYHA) classification at the first antenatal visit. Transthoracic echocardiography was performed by experienced cardiologists. VSDs were classified according to anatomical type (perimembranous, muscular, or double committed subarterial) and measured in millimeters. Based on defect size, VSDs were categorized as small (<5 mm), moderate (5–10 mm), or large (>10 mm). For analytical purposes, participants were grouped into small VSD and moderate/large VSD categories. Obstetric data included pregnancy-related complications such as hypertensive disorders of pregnancy, gestational diabetes mellitus, infections, premature rupture of membranes, preterm labor, postpartum hemorrhage, and placental abnormalities. Mode of delivery (vaginal or cesarean section) was recorded for all cases. Maternal

cardiac outcomes during pregnancy and the peripartum period were documented, including arrhythmias, syncope, infective endocarditis, and thromboembolic events. Fetal and neonatal outcomes assessed included gestational age at delivery, preterm birth (<37 weeks), birth weight, low birth weight (<2.5 kg), intrauterine growth restriction (IUGR), 5-minute Apgar score, need for neonatal intensive care unit (NICU) admission, stillbirth, and early neonatal death.

Statistical Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) v26. Continuous variables were tested for normality and expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between small and moderate/large VSD groups were performed using the independent t-test for continuous variables and the Chi-square or Fisher's exact test for categorical variables. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Institutional Review Board of the study hospital. Patient anonymity and confidentiality were strictly maintained. As this was a retrospective, record-based study, informed consent was waived in accordance with institutional policy and the principles of the Declaration of Helsinki.

Result

The mean age at inclusion was 31.0±11.0 years, and the mean gestational age at booking was 13.32±6.43 weeks (Table I). Multigravida women constituted a slight majority of the study (54.00%), while 46.00% were primigravida. The majority were classified as New York Heart Association (NYHA) functional class I (66.00%), followed by class II (26.00%), and class III (8.00%). Thrombo-embolic complications and infective endocarditis before pregnancy were reported in 2.00% and 4.00% of women respectively. A history of smoking prior to pregnancy was present in 32.00% of participants, while 20.00% continued smoking during pregnancy. The mean infant birth weight was 3121±453 g. Table II shows that perimembranous VSD was the predominant anatomical subtype, observed in 37 women (74.00%). Muscular VSD was identified in 11 cases (22.00%). With respect to defect size, more than half of the participants had small VSDs measuring less than 5 mm (56.00%). Moderate-sized defects (5–10 mm) were present in (34.00%) of women. Most women had a planned vaginal delivery (98%), with planned caesarean section in only 2% (Figure 1). Intrapartum interventions were common: labor induction was performed in 40% of cases, and artificial rupture of membranes and episiotomy were each used in 34%. Emergency caesarean delivery occurred in 6% of women, while operative vaginal delivery was infrequent, with vacuum extraction in 6% and forceps in 4%. Table III presents thatcardiac complications were

Table-I

Baseline characteristics of study population (n = 50)

Variables	Frequency (n)	Percentage (%)
Age at inclusion (years), Mean±SD	31.0±11.0	
Mean gestational age at booking (weeks), Mean±SD	13.32 ± 6.43	
Gravida		
Primi	23	46.00
Multi	27	54.00
NYHA functional class		
Class I	33	66.00
Class II	13	26.00
Class III	4	8.00
Medical history		
Arrhythmia before pregnancy	0	0.00
Thrombo-embolic complication before pregnancy	1	2.00
Endocarditis before pregnancy	2	4.00
Smoking before pregnancy	16	32.00
Smoking during pregnancy	10	20.00
Infant weight (g)	3121 ± 453	

Table-II

VSD related characteristics (n=50)

Variables	Frequency (n)	Percentage (%)
	Type of VSD	
Perimembranous VSD	37	74.00
Muscular VSD	11	22.00
Double committed subarterial VSD	2	4.00
	Size of VSD	
Small (<5 mm)	28	56.00
Moderate (5–10 mm)	17	34.00
Large (>10 mm)	5	10.00

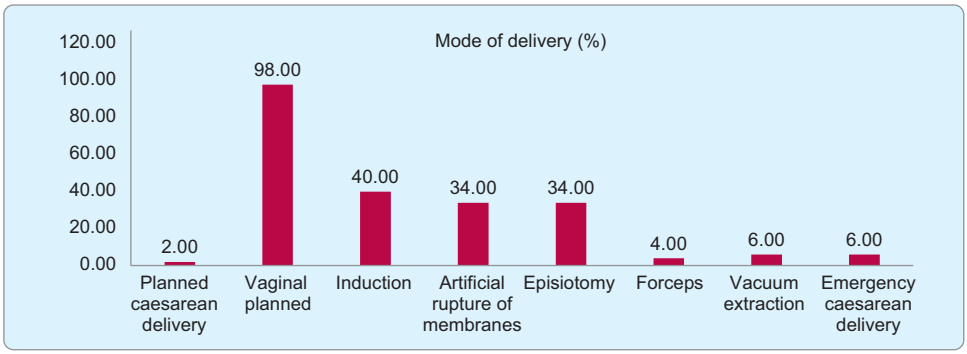

Figure 1: *Mode of delivery among participants (n=50)*

Table-III

Maternal, fetal and neonatal outcomes

Variables	Frequency (n)	Percentage (%)
Cardiac complications		
Arrhythmias	1	2.00
Syncope	1	2.00
Endocarditis	1	2.00
Obstetric complications		
Pre-eclampsia	4	8.00
Pregnancy-induced hypertension	3	6.00
Infection	2	4.00
Postpartum haemorrhage	5	10.00
Premature rupture of membranes	2	4.00
Premature labour	2	4.00
Gestational diabetes	3	6.00
Thromboembolic event	0	0.00
Placental abruption	0	0.00
Fetal and Neonatal Outcomes		
Mean gestational age at delivery (weeks)	38.53 ± 1.76	
Preterm birth (<37 weeks)	12	24.00
Mean birth weight (kg)	2.76 ± 0.56	
Low birth weight (<2.5 kg)	15	30.00
Intrauterine growth restriction (IUGR)	10	20.00
APGAR <7 at 5 minutes	5	10.00
NICU admission	12	24.00
Stillbirth	2	4.00
Early neonatal death	1	2.00

Table-IV

Pregnancy outcome according to VSD Size

Outcome	Small VSD (n=28)		Moderate/Large VSD (n=22)		p-value
	n	%	n	%	
Cardiac complications	2	7.14	7	31.82	<0.01
Preterm delivery	4	14.29	7	31.82	0.04
Low birth weight	5	17.86	10	45.45	0.02
Cesarean delivery	10	35.71	12	54.55	0.18

rare, with arrhythmia, syncope, and infective endocarditis each occurring in 2% of women. Obstetric complications included postpartum haemorrhage (10%), pre-eclampsia (8%). Infective complications, premature rupture of membranes, and preterm labour were reported in 4% of cases each. Fetal and neonatal outcomes showed a mean gestational age of 38.53±1.76 weeks. Preterm birth (<37 weeks) occurred in 24% of pregnancies. Mean birth weight was 2.76±0.56 kg, with 30% of neonates classified as low birth weight and 20% with intrauterine growth restriction. Five neonates (10%) had a 5-minute Apgar score <7, and 24% required NICU admission. There were 2 stillbirths (4%) and 1 early neonatal death (2%). Women with moderate or large VSDs experienced significantly higher rates of cardiac complications compared with those with small defects (31.82% vs. 7.14%, p<0.01) (Table 4). Preterm delivery was more frequent in the moderate/large VSD group (31.82% vs. 14.29%, p=0.04), as was low birth weight (45.45% vs. 17.86%, p=0.02). Cesarean delivery was more common among women with moderate/large VSDs (54.55% vs. 35.71%).

Discussion

This study assessed maternal and neonatal outcomes in pregnancies complicated by uncorrected ventricular septal defects, focusing on the influence of defect size and maternal functional status.14]. In this study, the mean age was 31.00/ ±/ 11.00 years, with booking at 13.32/ ±/ 6.43 weeks. Multigravida accounted for 54.00% and primigravida 46.00%. Most were NYHA class I (66.00%), followed by II (26.00%) and III (8.00%). Pre-pregnancy thromboembolism and infective endocarditis occurred in 2.00% and 4.00%, respectively. Prior and ongoing smoking were 32.00% and 20.00%. Mean birth weight was 3121/ ±/ 453/ g. Choi et al. reported a maternal mean age of 31.65 years (range 17–42), with most women in NYHA class I (89.32%), followed by class II (9.71%) and class III (0.97%); no participants were class IV,[15] whereas Bansal et al. reported that heart disease was more common in primigravida (58.33%) than in multigravida (41.67%).[16] Rahnama et al. reported arrhythmia in 9.90%, endocarditis in 2.20%, and a history of smoking in 31.80% of participants.[17] In another study by Sweety et al. reported a mean neonatal birth weight of 2978/ ±/ 466/ g.[18] Perimembranous VSD was the most common subtype (37 women, 74.00%), followed by muscular VSD (11 women, 22.00%). Small defects (<5/ mm) were present in 56.00%, and moderate defects (5–10/ mm) in 34.00% of participants. Moniruzzaman et al. reported that most participants had perimembranous VSD (67.39%), followed by muscular (17.39%), inlet (8.70%), and outlet VSD (6.52%). Small defects (<5/ mm) accounted for 58.70%, moderate (5–10/ mm) for 32.61%, and large (>10/ mm) for 8.70% of cases.[19] Planned vaginal delivery was predominant (98%), with 2% scheduled for caesarean. Labor induction occurred in 40%, and both artificial rupture of membranes and episiotomy in 34%. Emergency caesarean was 6%, while vacuum and forceps deliveries were 6% and 4%, respectively. Easter et al. reported that 86% of women attempting vaginal delivery succeeded, mostly through spontaneous vaginal birth or VBAC, with a 9.50% rate of operative vaginal delivery among those planning vaginal delivery.[20] Cardiac complications were rare (2% each). Obstetric complications included postpartum haemorrhage (10%) and pre-eclampsia (8%); other complications occurred in 4% each. Mean gestational age was 38.53/ ±/ 1.76 weeks, with 24% preterm births. Mean birth weight was 2.76/ ±/ 0.56/ kg; 30% were low birth weight, 20% had IUGR. Five neonates (10%) had 5-min Apgar <7, 24% required NICU, with 2 stillbirths (4%) and 1 early neonatal death (2%). Bansal et al. reported significantly higher ICU admissions in one group (6 patients, 50%; p/ =/ 0.009). Maternal mortality was observed, and adverse neonatal outcomes, including prematurity (91.67%), low birth weight (66.67%), SGA (41.67%), and neonatal mortality (8.33%), were common in mothers with EF/ </ 30%. NICU admissions were 20.83% in neonates of mothers with EF/ ≥/ 30%.[16] Easter et al. reported preterm birth <37 weeks in 15.90% of cases, spontaneous conception in 89.50%, hysterectomy in 0.72%, and peripartum infection in 8.80%.[20] Moderate/ large VSDs were associated with more cardiac complications (31.82% vs. 7.14%, p<0.01), higher preterm birth (31.82% vs. 14.29%, p=0.04), low birth weight

(45.45% vs. 17.86%, p=0.02), and increased cesarean rates (54.55% vs. 35.71%). These findings align with previous studies indicating that larger VSDs increase maternal and fetal risk, likely due to greater hemodynamic stress causing maternal cardiac strain and reduced uteroplacental perfusion, leading to preterm birth and low birth weight.[21]

Limitations of the study: This single-center, retrospective study with a modest sample size may limit generalizability. Dependence on medical records risks incomplete or inconsistent data. Long-term maternal and neonatal outcomes were not evaluated, restricting insights into the extended impact of uncorrected VSD during and after pregnancy.

Conclusion

In this study of pregnant women with uncorrected ventricular septal defect, maternal outcomes were generally favorable, particularly among those with small defects, with low rates of severe cardiac complications. However, women with moderate or large VSDs demonstrated a significantly higher risk of cardiac events, preterm delivery, and low birth weight infants. Obstetric interventions, including cesarean delivery, were more frequent in this higher-risk group. Neonatal outcomes reflected the impact of defect size, with increased NICU admissions and perinatal complications observed in moderate or large VSDs.

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