Original Research Article

The Effect of Ischemic Heart Diseases in Maternal Outcome- A Retrospective Cohort Study

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Abstract: *Introduction:* In women with heart disease, maternal mortality is reported to be much higher than average and the risk appears to be increasing. In western countries heart disease is the major cause of maternal death. The full spectrum of structural heart disease including congenital heart disease (CHD), valvular heart disease (VHD), and cardiomyopathy (CMP), and also ischemic heart disease (IHD) may be encountered in pregnant women. *Aim of the study:* The aim of this study was to determine the impact of ischemic heart diseases on maternal adverse outcome during pregnancy. *Methods:* This was a retrospective cohort study and was conducted in the Department of Gynaecology and Obstetrics of Kushtia General Hospital, Kushtia, Bangladesh during the period from January, 2021 to January, 2022. There was total 100 women in our study. This study was conducted among pregnant women with ischemic heart disease. The study population was categorized into two; namely, Group A -women with IHD(n=50) and Group B - women without IHD (n=50). *Result:* In total 100 patients from both the groups completed the study. In our study we found the mean ± SD age of pregnant mothers in Group A was (30.01 ± 5.00) and in Group B (27.05 ± 5.04) respectively. The mean± SD of BMI for women in Group A was (27.47 ± 4.40) and in Group B (28.34 ± 5.67) respectively. The prevalence of Hypertension was found in 41(82%) & 21 (42%) and DM was 68% & 36%among Group A & B respectively. Transient Ischemic Attack & Stroke was found 46% & 16 % in Group A respectively. Arrythmia was only found in Group A by 36% & 28%. *Conclusion:* In our study, we found that the incidence of adverse maternal outcomes was higher among women with IHD. Pregnant women with IHD have a higher risk of maternal and fetal complications compared with women without HD. Cardiomyopathy, hypertension, and arrhythmias were independently associated with higher rates of major adverse maternal events was found in our study.
Keywords: Congenital heart disease, Cardiomyopathy, Ischemic heart disease, Maternal Outcome.

INTRODUCTION

In women with heart disease, maternal mortality is reported to be much higher than average and the risk appears to be increasing. In western countries heart disease is the major cause of maternal death [1-3]. However, we do not fully understand what the impact of pregnancy is on the progression of heart disease or how heart disease affects the outcome of pregnancy. The full spectrum of structural heart disease including congenital heart disease (CHD), valvular heart disease (VHD), and cardiomyopathy (CMP), and also ischemic heart disease (IHD) may be encountered in pregnant women. In developing countries that still struggle with a high prevalence of rheumatic fever, acquired VHD dominates, whereas in developed countries,

CHD is the main diagnostic group [4-6]. In addition, over the last few years, the incidence of an acute coronary event during pregnancy has increased, due to older child-bearing age, and changes in lifestyle with more hypertension, smoking, and obesity in women.[7-9] CMP is uncommon during pregnancy, but it is difficult to manage a pregnancy in the context of left ventricular dysfunction or peripartum cardiomyopathy (PPCM) with a high risk of an adverse outcome for both the mother and the baby [10, 11]. In developed countries, optimal care and preconception counselling are available in all centers, although quite often not accessed by the women concerned. In developing countries, only a minority of women with heart disease are assessed and appropriately counselled prior to conception. Not surprisingly, this may have a major adverse influence on pregnancy outcome [12]. Heart disease is now the leading cause of maternal mortality in the UK with a mortality rate of 2.27 per 100,000 maternities; double that reported in 1990 [13]. However, the incidence of heart disease during pregnancy has remained constant at 0.9% over several decades implying that the severity of heart disease and/or the risk it poses during pregnancy is increasing [14]. In the developed world, congenital heart disease is now more common in the pregnant population than acquired heart disease. This reflects the fact that with advances in cardiac surgery and medication, 85% of infants with congenital heart disease now survive into adult life [15, 16]. By contrast, the rates of maternal death related to structural congenital heart disease have declined progressively, suggesting that the level of awareness may have increased and, thus, may have led to improved management of pregnant women with various congenital heart defects [17, 18]. Acute myocardial infarction accounts for the majority of deaths and is most commonly due to coronary atherosclerosis, although coronary artery dissection and consequent occlusion is also relatively frequent [19]. The risk of an acute myocardial infarction during pregnancy is small but increasing, with an estimated incidence of one in 35,700 deliveries between 1991 and 2000 [20] and one in 16,100 deliveries between 2000 and 2002 [21]. Pregnancy-induced cardiomyopathy is a disorder in which left ventricular systolic dysfunction and heart failure present in the last month of pregnancy and the first 5 months postdelivery, in the absence of all other causes of dilated cardiomyopathy with heart failure. It is a rare condition with an estimated incidence of 1 case per 5000–10,000 live births [22]. Cardiac arrhythmias are also an important cause of maternal morbidity. The main cause of this appears to be an increased incidence in previously undiagnosed ischemic heart disease. This is due to lifestyle changes, with increasing numbers of pregnancies in women with risk factors such as obesity, diabetes and smoking, and also pregnancies in older women. In addition, women with complex pre-existing heart disease are surviving into adulthood and considering pregnancy. Pregnancy in women with heart disease not only poses a risk of maternal death but also of serious morbidity such as heart failure, stroke and cardiac arrhythmia. In this study we aimed to examine the impact of ischemic heart disease on the risk of maternal adverse outcome among women with pregnancy and newborn mothers.

Objectives of the study
a) General objective:
- To determine the impact of ischemic heart disease on maternal adverse outcome in pregnant women with underlying HD.

b) Specific Objectives:
- To examine the adverse maternal cardiac events in women with significant HD and without any HD

Methodology & Materials
This was a retrospective cohort study and was conducted in the Department of Gynaecology and Obstetrics of Kushtia General Hospital, Kushtia, Bangladesh during the period from January, 2021 to January, 2022. There was total 100 women in our study. This study was conducted among pregnant women with ischemic heart disease. The study population was categorized into two; namely, Group A -women with IHD (n=50) and Group B -women without IHD (n=50). These are the following criteria to be eligible for the enrollment as our study participants: a) Women who were aged >= 18 aged years old; b)Women with multiple pregnancies; c) Women with congenital, acquired, or arrhythmic diseases ; d) Women with previous corrective cardiac surgery and pulmonary hypertension; e) Women with valvular stenoses; f) Women with a history of cardiomyopathy or dilated cardiomyopathy And a) Women with isolated mitral valve prolapse without significant (3þ) regurgitation, b)Women with isolated patent foramen ovale ; c) Women with isolated tricuspid regurgitation or; d) Women with any previous surgical history excluding cardiac surgery; e) Women with illness other than IHD (i.e. renal or pancreatic diseases, malaria, medical emergency) were excluded from our study. Baseline data were collected through chart review, including maternal age, body mass index, gravida and parity status, hypertension, history of transient ischemic attack or cerebrovascular event and diabetes mellitus. Baseline echocardiographic data included left ventricular ejection fraction and cavity size, left

atrial diameter and volume, valvular stenosis and regurgitation grade, and right ventricular systolic pressure. Chamber quantification and valvular assessment were performed according to the American Society of Echocardiography guidelines. [23-25]. The biplane method of discs (modified Simpson's rule) was used to estimate left ventricular ejection fraction; visual estimation was used if endocardial definition was suboptimal. For patients with multiple echocardiograms during their pregnancy, an antepartum echocardiogram performed closest to the date of delivery was used for analysis.

Statistical analysis

The results obtained were statistically analyzed and compared between the two groups of the study. Baseline characteristics of the study participants were expressed in mean ± standard deviation. Comparison of mean was done by unpaired t test. The statistical analysis was performed using SPSS version 25 computer software for windows 10. Statistical significance was considered at P< 0.05. All clinical and biochemical data of study subjects were expressed as means ± standard deviations. Independent sample t- tests were conducted to assess the relationship between the studied variables.
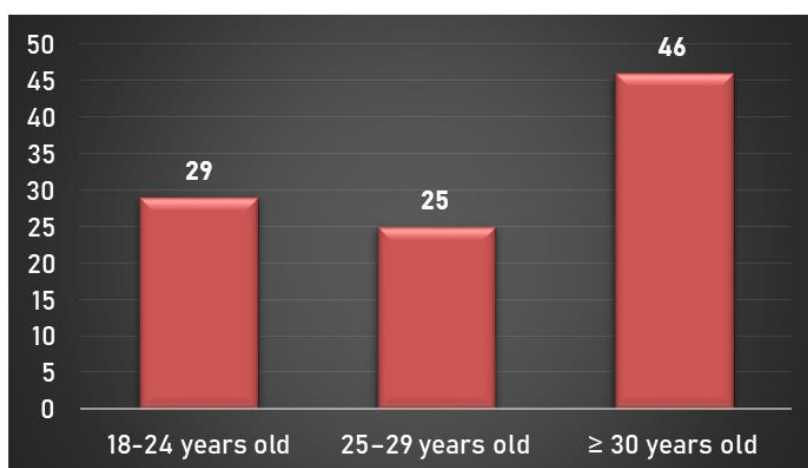
RESULT

Figure-1: Age distribution among our study people

Table-1: Maternal, socio-demographic and life style characteristics women who gave birth with ischemic heart disease (n = 100)

Variables	Overall		Group A		Group B		P-Value
	N=100	%	(n=50)	%	(n=50)	%	
Maternal age (years)	27.73 ± 5.25		30.01 ± 5.00		27.05 ± 5.04		0.001
18-24	29	29%	7	14%	22	44%	0.001
25–29	25	25%	11	22%	14	28%	0.001
≥ 30	46	31%	32	64%	14	28%	0.001
Weight (kg)	82.03 ± 21.03		86.05 ± 24.02		78.02 ± 18.04		0.102
Height (m)	156.32 ± 4.42		156.11 ± 4.66		156.46 ± 4.34		0.002
Body Mass Index (kg/m^2)	28.14 ± 4.87		28.34 ± 5.67		27.47 ± 4.40		0.002
Educational level							
Not formal education	17	17%	9	18%	8	16%	0.001
Primary education	53	53%	21	42%	22	44%	0.001
Secondary education and above	40	40%	20	40%	20	40%	0.001
Hemoglobin (g/dl) ∗∗	12.67 ±1.75		12.39 ±1.77		12.73 ±1.75		0.054
Anemic status							
Normal	65	65%	29	58%	36	72%	0.107
Anemia	35	35%	21	42%	14	28%	0.107
Dietary diversity status							
Adequate	54	54%	19	38%	35	70%	0.001
Inadequate	46	46%	31	62%	15	30%	0.001
Level of physical activity							

Variables	Overall		Group A		Group B		P-Value
	N=100	%	(n=50)	%	(n=50)	%	
High	42	42%	20	40	22	44	0.001
Moderate	35	35%	17	34%	18	36%	0.001
Low	23	23%	13	26%	10	20%	0.001
Antenatal depression							
Yes	45	45%	30	60%	15	30%	0.001
No	55	55%	20	40%	35	70%	0.001

Table-2: Baseline Characteristics and medical history among our study people

Baseline Characteristics	Group A		Group B		P-Value
	N=50	%	N=50	%	
Gravida	3.01 ± 1.90		2.81 ± 2.02		0.014
Para	1.22± 1.32		1.09± 1.31		0.012
Hypertension (baseline or gestational)	41	82%	21	42%	
Transient Ischemic Attack	23	46%	0		0.002
Stroke	8	16%	0		0.001
Diabetes Mellitus (baseline or gestational)	34	68%	18	36%	0.001
History of Arrhythmia					
Ventricular Tachycardia	18	36%	0		0.001
Supraventricular Tachycardia	14	28%	0		0.001

Table-3: The effects of ischemic heart disease on the risk of adverse maternal outcomes

Maternal outcomes	Group A		Group B		P-value
	N=50	%	N=50	%	
Heart Failure	11	22%	2	4%	0.001
Transient ischemic attack or stroke	18	36%	8	16%	0.157
Congenital heart disease	16	32%	4	8%	0.010
Arrhythmia	11	22%	3	9%	0.002
Cyanosis	21	42%	7	14%	0.001
Pulmonary hypertension	18	36%	3	9%	0.001
Cardiomyopathy	14	32%	2	4%	0.001
Left heart obstruction					
Mitral valve area <2 cm^2	31	62%	19	38%	0.004
Aortic valve area <1.5 cm^2	28	56%	13	26%	0.003
Peak ventricular outflow tract gradient >30 mmHg	42	84%	38	76%	0.001
Reduced systemic left-ventricular function					
Ejection fraction <40%	24	48%	12	24%	0.001
Preterm birth (< 37 weeks)	21	42%	9	18%	0.001
Composite maternal adverse outcome	38	76%	23	56%	0.001

In this study Figure 1 shows the age distribution of our study people. The highest prevalence 46% was seen among women aged between >= 30 years old and the lowest prevalence was 25% aged between 25-29 years old. Followed by 29% was seen aged between 18-24 years. In table 1 we showed the maternal, socio-demographic and life style characteristics women who gave birth with IHD. We found the mean ± SD age of pregnant mothers in Group A was (30.01 ± 5.00) and in Group B (27.05 ± 5.04) respectively. The mean± SD of BMI for women in Group A was (27.47 ± 4.40) and in Group B (28.34 ± 5.67) respectively. The mean± SD of hemoglobin was (12.39 ±1.77) and (12.73 ±1.75) in Group A & B respectively which is significantly higher in Group B compared to Group A. Moreover,

higher proportion of women with IHD had low level of physical activity, inadequate dietary diversity, and antenatal depression and the numbers are 26%,62% & 40% respectively. In table 2 we showed the baseline characteristics and medical history among our study people. We found the mean of Gravida was (3.01 ± 1.90) & (2.81 ± 2.02); Para was (1.22± 1.32) & (1.09± 1.31) among Group A & B respectively. The prevalence of Hypertension (baseline or gestational) was found in 41(82%) & 21 (42%) among Group A & B respectively. Transient Ischemic Attack & Stroke was found 46% & 16% in Group A respectively. The prevalence of DM was 68% & 36% in Group A & B respectively. Arrhythmia was only found in Group A by 36% & 28%. In table 3 we showed the effects of ischemic heart disease on the risk of adverse

maternal outcomes. We found heart failure in 22% & 4%; transient ischemic attack or stroke was found 36% & 16%; congenital heart disease was found 32% & 8% among Group A & B respectively. The highest prevalence of arrhythmia, cyanosis & pulmonary hypertension was present in Group A by 22%, 42% & 36% respectively. The prevalence of preterm birth was 42% & 18% in women with IHD & without IHD respectively. Overall, the risk of composite maternal adverse outcome was 76% higher among newborns from women with IHD compared to women without IHD (56%).

DISCUSSION
In this study we found the highest prevalence 46% was seen among women aged between >= 30 years old and the lowest prevalence was 25% aged between 25-29 years old. Followed by 29% was seen aged between 18-24 years (Figure 1). In other study (Muche *et al*.,) found < 25 12.7% & 31.3% aged under 25 years old; 25.4% & 36.9 % aged between 25–29 years old; 33.9% & 21% aged between 30–34 years old and 28% & 61% aged above 35 years old among women respectively [26]. In our study we found the mean ± SD age of pregnant mothers in Group A was (30.01 ± 5.00) and in Group B (27.05 ± 5.04) respectively. The mean± SD of BMI for women in Group A was (27.47 ± 4.40) and in Group B (28.34 ± 5.67) respectively. The mean± SD of hemoglobin was (12.39 ±1.77) and (12.73 ±1.75) in Group A & B respectively which is significantly higher in Group B compared to Group A. Moreover, higher proportion of women with IHD had low level of physical activity, inadequate dietary diversity, and antenatal depression and the numbers are 26%,62% & 40% respectively (Table 1). In other study (Sotiropoulou *et al*.,) found the mean age of pregnant mothers with IHD was 30 (SD ± 5) and without IHD 29 (SD ± 6) years. The mean± SD of BMI for women with IHD was (30.1 ± 6.1) and without IHD was (31.9 ± 8.9) respectively [27]. In our study we found the mean of Gravida was (3.01 ± 1.90) & (2.81 ± 2.02); Para was (1.22± 1.32) & (1.09± 1.31) among Group A & B respectively. The prevalence of Hypertension (baseline or gestational) was found in 41(82%) & 21 (42%) among Group A & B respectively. Transient Ischemic Attack & Stroke was found 46% & 16 % in Group A respectively. The prevalence of DM was 68% & 36% in Group A & B respectively. Arrhythmia was only found in Group A by 36% & 28% (Table 2). In other study (Sotiropoulou *et al*.,) found that among their participants 37 (21%) had cardiomyopathy, 65 (38%) other HD, and 68 (40%) had no HD. Forty-three percent of the other HD group had history of congenital HD and 38% had previous corrective cardiac surgery; 26% had a history of arrhythmias, 6% had pulmonary hypertension, and 18% had a history of valvular HD. Of the cardiomyopathy group, 30% had history of dilated cardiomyopathy, 8% had a history of peripartum cardiomyopathy, 5% had hypertrophic cardiomyopathy, and 3% had restrictive cardiomyopathy [27]. In this study as an effect of ischemic heart disease on the risk of adverse maternal outcomes we found heart failure in 22% & 4%; transient ischemic attack or stroke was found 36% & 16%; congenital heart disease was found 32% & 8% among Group A & B respectively. The highest prevalence of arrhythmia, cyanosis, cardiomyopathy & pulmonary hypertension was present in Group A by 22%, 42%, 32% & 36% respectively. The prevalence of preterm birth was 42% & 18% in women with IHD & without IHD respectively. Overall, the risk of composite maternal adverse outcome was 76% higher among newborns from women with IHD compared to women without IHD (56%) (Table 3). In other study (Sotiropoulou *et al*.,) found that compared with women with other HD and no HD, women with HD had significantly higher rates of maternal adverse clinical events, including preterm labor, preterm delivery, and admission to an intensive care unit. MACE rates were higher in women with HD compared with women with no HD, driven primarily by higher rates of heart failure [27].

Limitations of the study
We could only study the women who visited at the outpatient departments Kushtia General hospital within a short study period. In our study we only investigated the maternal adverse outcomes and did not investigate information about the obstetric characteristics and neonatal, perinatal outcomes of women who gave birth and newborns of mothers stratified with IHD. After evaluating once those women we could not follow-up them for a long period and have not known other possible interference that may happen in the long term with these women.

CONCLUSION AND RECOMMENDATIONS
In our study, we found that the incidence of adverse maternal outcomes was higher among women with IHD. Pregnant women with IHD have a higher risk of maternal and fetal complications compared with women without HD. Cardiomyopathy, hypertension, and arrhythmias were independently associated with higher rates of major adverse maternal events was found in our study. Women with IHD have a significantly higher risk of preterm labor and delivery and admission to an intensive care unit. The fetuses of women with IHD were more likely to experience adverse events including death compared to women without IHD. The presence of cardiomyopathy was independently predictive of adverse maternal and fetal events.

Therefore, pre-pregnancy counseling should inform patients with known HD of these maternal and fetal risks. Hence, a further study with a prospective and longitudinal study design needs to be done on these populations to improve the maternal adverse outcome.

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