THE SPECTRUM OF HEART DISEASE IN PREGNANCY AND ITS OUTCOME IN PATIENTS VISITING A TERTIARY CARE CENTRE

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This is to certify that this dissertation entitled **"THE SPECTRUM OF HEART DISEASE IN PREGNANCY AND ITS OUTCOME IN PATIENTS VISITING A TERTIARY CARE CENTRE",** is the bonafide work done by **Dr.K.SATHYAPRIYA,** Post Graduate in the Department of Obstetrics and Gynecology, K.A.P. Viswanatham Government Medical College, Tiruchirappalli, towards partial fulfillment of the requirements of The Tamil Nadu Dr.M.G.R University for the award of M.S. Degree in Obstetrics and Gynaecology, under our guidance and supervision, during the academic period from the year of may 2019 to April 2022.

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DECLARATION

I, **Dr.K.SATHYAPRIYA** solemnly declare that this dissertation titled **"THE SPECTRUM OF HEART DISEASE IN PREGNANCY AND ITS OUTCOME IN PATIENTS VISITING A TERTIARY CARE CENTRE",** is a bonafide work done by me at K.A.P. Viswanatham Government Medical College ,Trichy, during November 2020 to October 2021 under the guidance and supervision of Head of the Department, Department of Obstetrics and Gynaecology **Prof. Dr. UMA MOHANRAJ M.D Paed, DNB(O&G).** The dissertation is submitted to the Tamilnadu Dr.M.G.R. Medical University, toward the partial fulfilment of university rules and regulations for the award of M.S.Degree (BRANCH-VI) In Obstetrics and Gynaecology.

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INTRODUCTION

Due to an increase in the incidence of diabetes, hypertension, and obesity, as well as significant improvements in the treatment of congenital heart disease, there has been a rise in the prevalence of heart disease in pregnant women[1]. The prevalence of cardiac disease in pregnancy ranges from 0.3 to 3.5 percent. Indirect maternal fatalities are now the largest cause of mortality, accounting for 20.5 percent of all cases[2,3].

Congenital heart disease is the most frequent kind of congenital heart disease in the Western world (75–82%), with shunt lesions accounting for 20–65% of cases[3]. Rheumatoid heart diseases (RHDs) still account for the bulk of such instances in underdeveloped nations like India, accounting for 56 percent to 89 percent of all cardiovascular disease in pregnancy[4]. Congenital heart disease used to affect just 5% of pregnant women with heart illness, but today the majority of pregnant women with heart disease in the developed world have congenital heart disease[5].

Maternal and perinatal mortality and morbidity in pregnancies complicated by cardiac problems varies according to the kind of condition, the patient's functional level, and the pregnancy's difficulties. Cardiac failure, pulmonary oedema, shock (cardiogenic), arrhythmia, thromboembolism, and even maternal death are all possible maternal

morbidities[6]. Low birth weight, intrauterine growth retardation, preterm delivery, and foetal congenital heart disease are all examples of perinatal outcomes[7].

India is classified as a lower-middle-income nation with agriculture as its primary source of revenue. Maternal mortality was 54 per 100,000 live births in 2015, while neonatal fatalities were on the order of 8,000. In comparison to affluent countries, caring for Indian children and mothers with heart illness is far more difficult. The specific issues are connected to late diagnosis, as well as insufficient infrastructure and medicine availability[8].As a result, it's critical to thoroughly analyse pregnant moms with heart illness to support the establishment of optimum prenatal care that becomes a critical component of the overall outcome[9]. However, there is no official published information on the maternal outcomes of pregnant women with heart illness[10]. Fetal growth restriction affects 3%–7% of all babies, and it is linked to a variety of negative consequences, including stillbirth[11], neonatal death[12], hypoxic-ischaemic encephalopathy[13], special educational requirements, and a variety of other health issues in adulthood[14]. As a result, the data concerning the hazards of foetal growth limitation must be examined. The goal of this study is to look at the maternal outcomes of pregnant Indian women who have heart illness and have a live delivery, as well as the risk factors for foetal growth restriction.

There are not many studies done in south India on pregnancy associated with cardiac disease, in spite of the increasing number of the same. Hence the current study is designed to provide an insight into the changing patterns and outcomes of this ever-increasing and life-threatening condition at a tertiary care centre of south India with an aim to find out prevalence, the spectrum of disorder and outcome in pregnancy with heart disease.

REVIEW OF LITERATURE

Pregnant women have a higher risk of heart disease than non-pregnant women. Many pregnant women who have cardiac problems have uneventful pregnancies. However, a significant number of these women have pregnancy problems such as heart failure, arrhythmias, thrombo-embolic events, or aortic dissection. In women with known or suspected heart disease, risk screening and counselling prior to pregnancy are critical.[15] The prevalence of diabetes, hypertension, and obesity has grown as a result of the increase in age at first pregnancy. [16] Despite a modest prevalence rate, heart disease is becoming the major cause of indirect maternal fatalities in a large percentage of cases. [17]

Pregnancies with hypertensive problems account for 6–8% of all pregnancies. Patients with congenital heart disease have a better chance of living to adulthood in Western countries, whereas the prevalence of rheumatic heart disease has reduced.[18] Congenital heart disease is now the most common cardiovascular condition in pregnant women. Furthermore, while the incidence of ischemic heart disease is currently low, it is rising as a result of rising maternal age and a larger frequency of risk factors. Cardiomyopathies and valvular heart disease have a greater mortality rate than congenital heart disorders. Rheumatic heart disease is still the leading cause of cardiac illness during pregnancy in underdeveloped nations.[16]

Maternal and perinatal mortality and morbidity in pregnancies complicated by cardiac problems vary depending on the kind of disorder, the patient's functional level, and the pregnancy's difficulties. Cardiac failure, pulmonary oedema, shock (cardiogenic), arrhythmia, thromboembolism, and even maternal fatality are all possible outcomes of maternal morbidity .[19] Low birth weight babies, intrauterine growth retardation, preterm birth, and foetal congenital heart disease are all perinatal outcomes.[20] Because of the changes in the cardiocirculatory system that occur during pregnancy, women with heart disease might have significant clinical worsening.[21] The kind of heart disease, myocardial dysfunction, arrhythmias, and previous cardiac events all influence the fate of the mother. Fetomaternal morbidity and mortality are influenced by the existence of basic cardiac disease, left and right heart function, valve function, NYHA class, cyanosis and pulmonary arterial hypertension, among other variables. A number of risk stratification scores have been created for individuals with heart illness who are expecting a child. Scores from CAPREG and ZAHARA are examples of this.[20]

Progressive heart failure, shock, different arrhythmias, placental abruption, and maternal mortality are all possible issues for pregnant women. Preterm delivery, intrauterine growth restriction, low birth weight, congenital heart disease, and foetal mortality are all examples of

perinatal outcomes that can occur. Improved awareness of the hazards associated with cardiac problems in pregnancy, as well as their appropriate management, is critical for enhancing patient care, as previously stated.[22] Women with known or undiagnosed heart illness face unique challenges as a result of the physiological demands of pregnancy. Although optimal care and preconception counselling are readily available in all centres throughout industrialised countries, women in need of such services are not always able to receive them. When it comes to women with cardiac disease, just a minority of them are evaluated and given adequate counselling prior to conception in poor nations. Not unexpectedly, this may have a significant negative impact on the outcome of the pregnancy.[15]

Treating clinicians face challenges due to a lack of evidence-based data on the spectrum of cardiovascular disease (CVD) in pregnancy or the postpartum period, as well as mother and foetal outcome, especially in low-resource settings. Our hospital serves as the primary cardiac referral facility for the district, and it is here that the majority of high-risk cardiac pregnancies are directed. The study was designed in order to gain a better understanding of the spectrum and feto-maternal outcome of cardiac disease in pregnancy and the local population, which would ultimately lead to better management of this high-risk group of pregnant women. The goal of this study was to look at the disease spectrum, manner of

presentation, and maternal and foetal outcomes of patients who were referred to a Cardiac Disease and Maternity Clinic (CDM).

Pregnancy and delivery were extremely risky for both the mother and the kid for the majority of our history. Several physiological changes occur in the body of a woman during pregnancy (Figure 1). Consider the long-term trend in maternal mortality — the risk that a woman will die as a result of her pregnancy-related complications.

Figure 1. Key physiological change observed in various body systems during pregnancy.

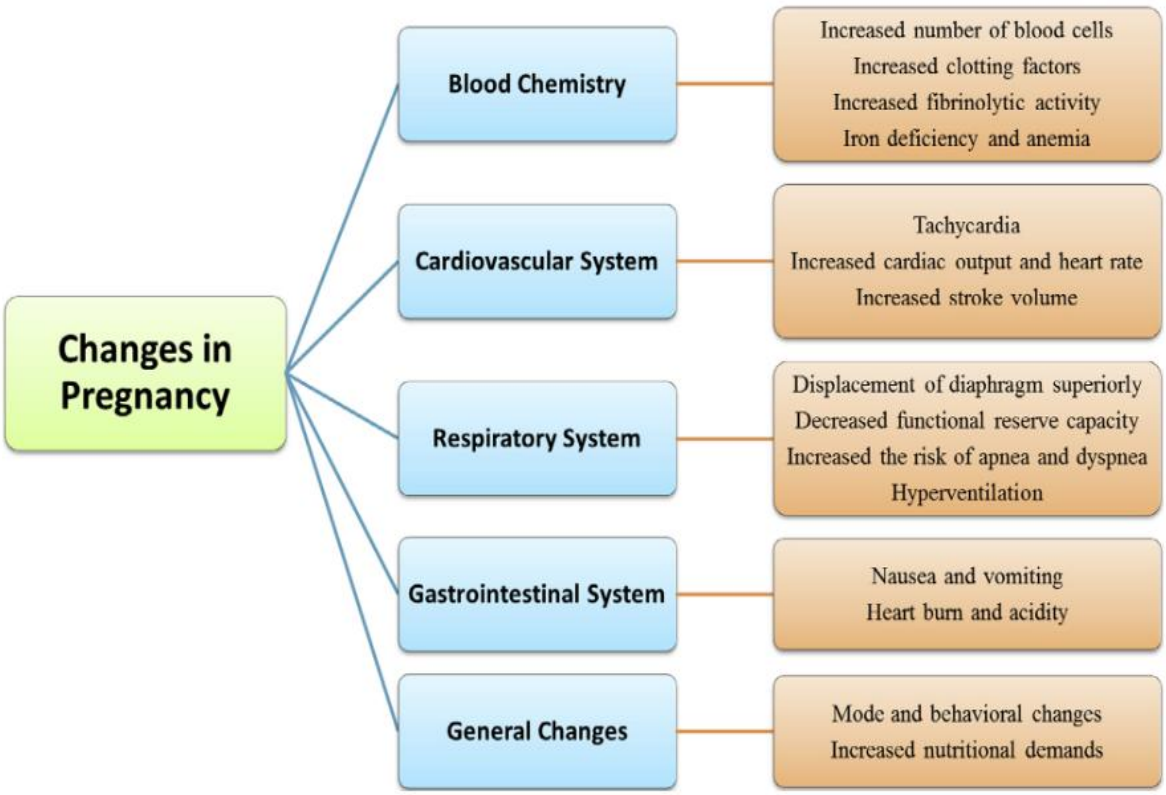
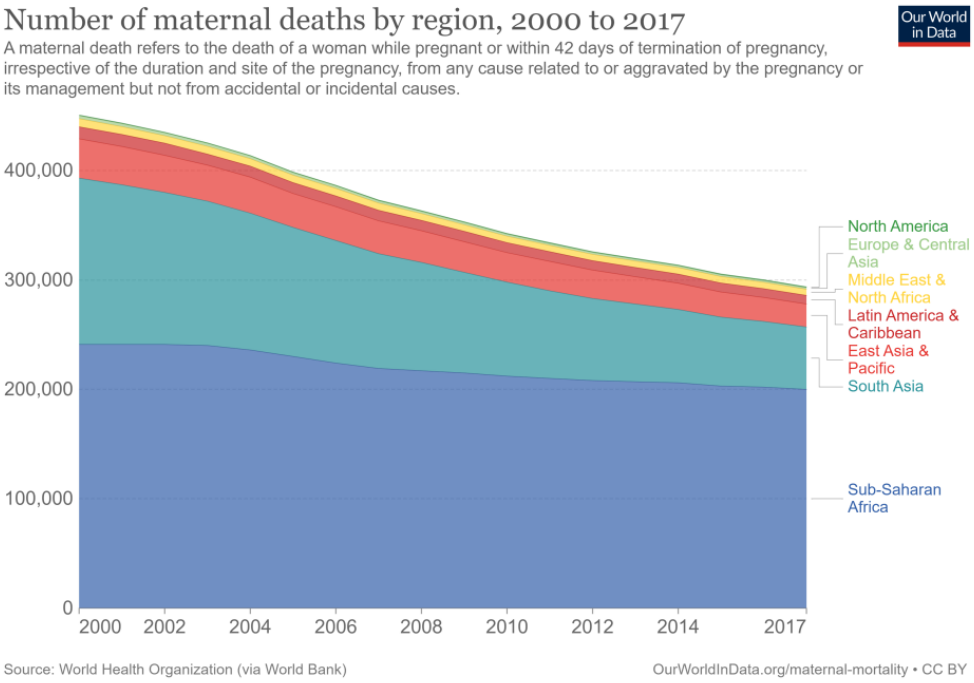


Figure 2. Maternal deaths by region (2000-2017) (Our world in data[9]).



MATERNAL MORTALITY

Every 100th to 200th birth resulted in the death of the mother. Maternal deaths have become far less common as a result of advancements in healthcare, nutrition, and hygiene. Women are still dying from pregnancy-related causes, many of which are preventable, despite this (Figure 2). When a woman dies while pregnant or within 42 days after the termination of her pregnancy, it is considered a maternal death. This can occur for any reason related to or aggravated by the pregnancy or its management, but it does not include accidental or incidental causes such as a car accident or a fall.[23]

Figure 3. Major causes of maternal mortality worldwide

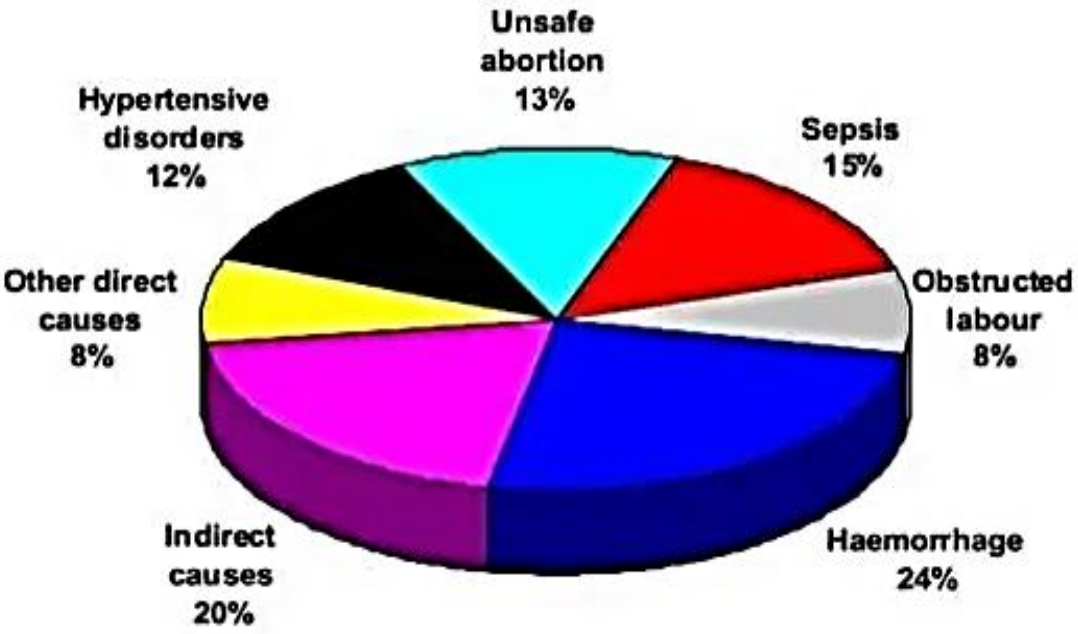


Table 1. Leading Causes of Maternity Mortalities

S.No	Causes of Maternity Mortalities	
	Pregnancy-Related	Medical
1.	Unsafe Abortion(Septic Abortion)	Anemia
2.	Severe Antepartum and Postpartum Haemorrhage	Thrombosis
3.	Puerperal Sepsis	Jaundice
4.	Early pregnancy	Diabetes
5.	Pregnancy Induced Hypertension	Hepatic failure
6.	Delayed and Obstructed labour	Renal failure
7.	Placenta Previa	Cardiac disease
8.	Uterine Rupture	Severe anaesthesia Complications

The number of pregnancy-related deaths and problems per 100,000 live births is calculated using the pregnancy-related mortality and morbidity ratio. This ratio is frequently used to assess the health of a country. Maternal deaths are caused by primarily two sorts of factors. There are two kinds of causes: pregnancy-related and medical (Figure 3, Table 1).

HEART DISEASE AND PREGNANCY

Along with various other physiological changes, the cardiovascular system also undergoes several changes during pregnancy (Table 2).

Table 2. Cardiovascular changes during pregnancy

INCREASE	DECREASE	UNCHANGED
Heart rate	Systemic vascular resistance	Central venous pressure
Stroke volume	Systolic, diastolic, and mean arterial pressure	Pulmonary capillary wedge pressure
Cardiac output		Left ventricular ejection fraction
Blood, red blood cell, and plasma volume		Left ventricular diastolic function
		Troponin I
		Brain natriuretic peptide

Cardiovascular disease (CVD) is the main cause of maternal morbidity and mortality, accounting for almost a third of all pregnancy-related deaths.[24] Acquired heart disease is thought to be the cause of rising cardiovascular mortality in women, with an increasing number of mothers entering pregnancy with a greater burden of common CVD risk factors such as age, obesity, diabetes, and hypertension.[25] Pregnancy-induced hypertension was formerly assumed to be a short-lived illness in otherwise healthy young women. Recent research shows that preeclampsia survivors have endothelial dysfunction, which raises their chance of acquiring CVD. Endothelial dysfunction is associated with increased coronary calcium content, which predicts acute coronary events.[26] Hypertension and preeclampsia during pregnancy were linked to coronary calcium level changes that were caused by the events related to adjusting for body size, blood pressure, but not serum creatinine. [27]

There is an increase in cardiac output due to the physiological demands of the uteroplacental circulation and the developing foetus, with the largest rise of up to 45 percent from baseline happening during the first trimester. Late in the second trimester, the rise in cardiac output slows and reduces slightly in the third trimester (but remains above pre-pregnancy values).[28] Table 3 summarises the major changes in cardiovascular physiology during pregnancy by trimester, while Figure 4

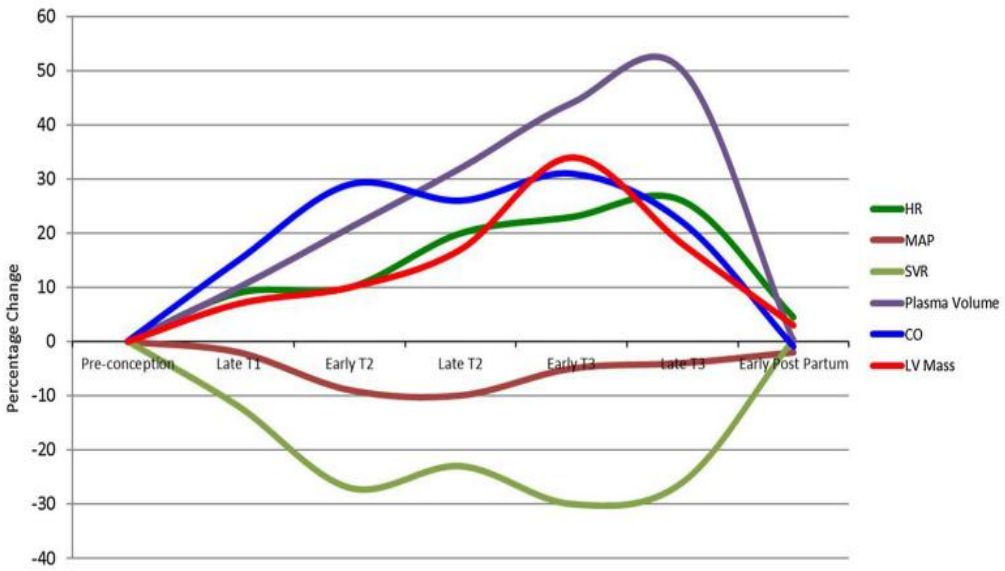
summarises the major changes in cardiovascular physiology during pregnancy by trimester and percentage change.

Table 3. Major changes in CV physiology trimester wise[29]

	Variables	Trimester			
		I	II	III	Early post-partum
1.	SVR	↓	↓	↓- late rise	↑
2.	Heart rate	↑	↑	↑	↓
3.	LVEDD	↑	↑	↑	↓
4.	LV Mass	↑	↑	↑ -late drop	↓
5.	Cardiac output	↑	↑	↑ -late drop	↓
6.	LV longitudinal strain	No change	No change	↓	↑

"LV Left ventricular, LVEDD LV end-diastolic diameter, SVR systemic vascular resistance"

Figure 4. Pregnancy associated physiological changes in CV system.[29]



There are other adaptive changes in the great veins and blood that are significant to women with heart disease, in addition to the circulatory alterations discussed above. Oestrogen receptor expression in the aorta induces reticulin fibre breakage, a reduction in acid mucopolysaccharides, and a disruption of the usual arrangement of elastin fibres, predisposing women to aortic dissection, especially if they have an aortopathy. Pregnancy is also a hypercoagulable state, which helps to minimise the risk of postpartum haemorrhage.[30] This increases the risk of clotting, most often venous thromboembolism, but it also puts women on anticoagulants for heart disease at risk. Pregnancy is a high-risk endeavour for persons who have mechanical heart valves.

ETYMOLOGY

Between 1921 and 1938, Hamilton and Thompson conducted the first investigation on heart disease and pregnancy. Sudhir Bose of Calcutta and Masoni of Bombay conducted the first studies in India in the 1950s. Several studies followed, both in India and abroad. The incidence of cardiac disease in pregnancy ranges from 0.2 to 0.97 percent based on these researches. Szekely and Snaith conducted the first large-scale study on heart disease and pregnancy between 1942 and 1971.[31] This study looked at over a thousand individuals at New Castle General Hospital who had varied heart conditions.The study found a significant drop in

rheumatic heart disease incidence during the last three decades. Mitral stenosis was the most common lesion in this study, occurring in 90% of patients. 15.4% of the patients experienced lung congestion and 1.6% developed pulmonary oedema. Heart failure afflicted 1.8% of patients. Acute pulmonary oedema was the leading cause of maternal death (1.6%).

PREVALENCE OF CVDs IN PREGNANT WOMEN

According to Siu et al., 2021,[32] CV complications in pregnant women with heart disease are common. Today's prenatal cardiovascular risk assessment technologies can detect high-risk pregnant mothers.They came to this conclusion by comparing long-term CV outcomes following pregnancy in women with and without heart disease.The need for continued surveillance and risk factor management in these young women after pregnancy is highlighted by their findings. The same techniques that are used to assess CV risk during pregnancy can also be used to risk-stratify for long-term cardiovascular risk after delivery.

For the first time, a study conducted by Farhan et al. 2019[33] revealed the clinical pattern and prevalence of heart disease in pregnancy among Iraqi patients presenting to the country's first cardio-maternal unit. Valvular heart disease was shown to be the most common kind of heart illness in the cohort, followed by congenital heart disease and

cardiomyopathy, particularly peripartum cardiomyopathy. Because current data on cardiac illness during pregnancy is scarce, precise data collection is critical for future prevention and therapy of those patients, as well as for improving their outcomes by a multidisciplinary team in a specialist unit.

The mechanism underlying the putative link between maternal cardiac output and neonatal problems in pregnant women with heart disease is not well understood. Wald et al. (2015)[34] used maternal echocardiography and obstetrical ultrasound scans to track pregnant women with cardiac disease and healthy pregnant women (controls) at baseline, third trimester, and postpartum. They discovered that a decrease in maternal cardiac output during pregnancy and aberrant umbilical artery Doppler flows both predict neonatal problems independently. They also claim that their findings would help identify high-risk pregnancies that would benefit from close antenatal monitoring.

Pregnant women with heart disease have a higher risk of maternal and newborn complications. Pregnancy in women with heart disease remains a difficult situation, with increased maternal and foetal morbidity and mortality. Defining low and high-risk groups can help in cardiac risk assessment. Stangl et al. (2008)[35] investigated pregnancy risks in both low and high-risk women with CVD. Pregnancy outcomes were studied in a cohort of women with cardiac disease who were followed in a single

location. According to their research, low-risk women who do not fit one of these requirements often tolerate pregnancy well. High-risk patients, on the other hand, have significantly higher risks of maternal and neonatal events. Successful management of high-risk pregnancies with maternal heart disease requires a coordinated interdisciplinary approach that includes specialised cardiologic care, high-risk obstetric assistance, and neonatologic expertise with close patient monitoring.

Bhatla et al. (2003) conducted research in a poor nation to assess the mother and foetal outcomes of pregnancies complicated by heart illness. A retrospective examination of 207 pregnancies in women with a heart illness who delivered at a tertiary care centre at 28 weeks of pregnancy was conducted. They discovered that the most common cardiac condition was rheumatic heart disease with isolated mitral stenosis. The most frequent type of congenital cardiac disease was septal abnormalities. The diagnosis of heart illness was made during pregnancy in some women. Cardiac and foetal problems were both reported. Patients in NYHA classes I/II had fewer maternal problems and their babies were heavier at birth than those in NYHA classes III/IV. Patients who had prosthetic valves had a better maternal and foetal outcomes. As a result, the study reveals that rheumatic heart disease was the most common. NYHA class I/II patients had a better maternal and foetal prognosis than NYHA class III/IV patients. Prior to pregnancy, surgical repair of the

heart lesion was linked to a better pregnancy result. Pregnant ladies with prosthetic valves fared well during their pregnancy.

Breastfeeding has been linked to a lower risk of maternal cardiovascular diseases (CVDs) later in life, as well as other health benefits for children. However, the research on the effects of CVD is still mixed, particularly among East Asians, whose breastfeeding frequency and duration differ greatly from those in the West. Breastfeeding and the risk of various main CVDs were investigated by Peters et al. in 2017.[37] Breastfeeding is related with a 10% decreased risk of multiple main CVDs in later life among Chinese women, according to their large prospective study, and the size of the inverse connection was larger among those who breastfed for longer periods. If these findings are causative, they suggest that initiatives to increase the probability and length of breastfeeding could have long-term cardiovascular advantages for mothers.

In a study of middle-aged UK women, Canoy et al.[38] looked at the relationship between a history of hypertension during pregnancy and coronary heart disease (CHD) and stroke. Hypertension during pregnancy was linked to an elevated risk of coronary heart disease and stroke in their large sample of middle-aged women. The risk of vascular disease linked with hypertension in middle age, on the other hand, was higher than the risk associated with a history of hypertension during pregnancy alone.

Because many of the women who had hypertension during pregnancy were also hypertensive in their later period of life, the link between hypertensive pregnancy and coronary heart disease and stroke is most likely explained by increasing blood pressure in middle age. Controlling hypertension, especially hypertension during pregnancy, is likely to be advantageous to middle-aged women. However, measures to prevent hypertensive women from developing hypertension by middle age may be just as essential in lowering their long-term risk of developing vascular disease.

Magnussen et al.[39] looked at the link between hypertensive pregnancy problems and modifiable risk factors for cardiovascular and metabolic illnesses to see if early detection and prevention were possible. Women who had preeclampsia or gestational hypertension during pregnancy had a higher BMI, higher blood pressure, and unfavourable total cholesterol, low-density lipoprotein cholesterol, and triglyceride values. Preeclampsia was linked to a much higher risk of diabetes, and the relationships with later cardiovascular risk factors were much stronger if the hypertensive illness occurred in more than one pregnancy or at a reasonably late stage of pregnancy. When compared to women without a history of hypertensive disorders, women with two episodes of preeclampsia were nearly 10 times more likely to require blood pressure medication at follow-up, as were those with gestational hypertension in

three consecutive pregnancies. Adjusting for current BMI decreased these correlations to some extent, implying that BMI may play a key mediating function. Women who have had hypertension problems during pregnancy in the past, especially those who have had recurrent pregnancy disorders, should be considered for intervention to prevent premature CVD.

Brahmam et al [40] conducted a study to look at preeclampsia recurrence rates and newborn outcomes in mothers who had preeclampsia and had to deliver their babies early. The findings confirmed preeclampsia recurrence, with ethnicity, enrollment of higher systolic blood pressure, current antihypertensive treatment, and proteinuria of 2+ on enrolment urinalysis being prognostic factors. Women who had previously delivered at 34 weeks' gestation were more likely than those who had previously delivered between 34 and 37 weeks' gestation to deliver preterm again. Although this study confirms that women who have had previous preeclampsia that necessitated an early delivery are at a higher risk of developing the condition again, it also identifies risk factors for recurrence and shows that women who have had previous preeclampsia are more likely to have a negative neonatal outcome.

Reduced maternal mortality is a worldwide health target set by the World Health Organization (WHO). Although maternal deaths from bleeding and infection are on the decline, those from heart disease are on the rise and are now the leading cause of death in Western countries. The

goal is to determine current diagnosis-specific outcomes in heart disease-affected pregnant women. Pregnant women with cardiac disease were prospectively enrolled in the Registry, according to Roos-Hesselink et al.[41] Maternal mortality or heart failure was the primary endpoint, with various cardiac, obstetric, and foetal problems as secondary outcomes. Congenital and valvular heart disease were the most common diagnosis. The group with pulmonary arterial hypertension (PAH) had the highest mortality rate. Arrhythmias and heart failure occurred. A significant number of babies were delivered via Caesarean section. There were obstetric and foetal difficulties. Over the years, the number of high-risk pregnancies (mWHO Class IV) has risen dramatically. Pre-pregnancy cardiac failure and systemic ejection fraction were factors in maternal problems. Women with cardiac disease had higher rates of maternal death or heart failure. Despite the inclusion of more high-risk pregnancies, these rates began to fall in 2010. Women with PAH had the highest complication rates.

In India, heart illness complicates one to four percent of pregnancies. Rheumatic heart disease still predominates in developing nations like India, This is due to inadequate hygienic conditions in rural locations, which result in recurring childhood streptococcal infection. Rheumatic heart disease is responsible for around 69 percent of cardiac problems seen in pregnancy in India. The goal of Laxmikantha and his

colleagues,[42] prospective study was to see how heart disease affected pregnancy and feto-maternal outcomes. The findings may also be useful in raising patient awareness of heart disease and other medical conditions during standard prenatal care. The current data shows that the prognosis for pregnant women with cardiac disease has improved, with a high rate of success. According to the findings of this study, pre-pregnancy diagnostic,Counselling, appropriate referral, normal prenatal observation, and delivery in a well-equipped facility all help to enhance the outcome.Both the mother and the infant suffer from heart disease throughout pregnancy. Cardiac failure is a potentially fatal consequence.This frequently results in the death of the mother. As a result, we emphasise the importance of monitoring cardiac patients for early detection and treatment.During pregnancy, childbirth, and puerperium, care of heart failure is necessary.

Pregnancy complications due to heart disease are considered a high-risk circumstance. Increased cardiac demands during pregnancy may increase morbidity and death in women who already have a heart condition. The risk of a negative outcome is higher in the rural population than in the urban population. Bangal et al.[43] conducted a prospective clinical analysis of 35 instances of pregnancy complicated by heart disease that presented to a tertiary care hospital for delivery to determine the incidence and mother and foetal outcomes. In the current study, the

incidence of cardiac disease in pregnancy was 1.3 percent. The majority of the women in the rural population were from low socioeconomic status. The majority of the cases involved rheumatic heart lesions. The most prevalent lesion was mitral stenosis. Despite the fact that the majority of women birth on time, a significant number of women deliver preterm. Forceps delivery was used as a preventative measure in some circumstances. In addition, a caesarean section was performed. There was no death of the mother. The maternal and perinatal mortality and morbidity associated with heart disease can be reduced by early detection of heart disease, regular prenatal checkups, institutional delivery, and restricting family size.

Introduction- Pregnancy complications due to heart disease are considered a high-risk circumstance. Increased cardiac demands during pregnancy may increase morbidity and death in women who already have a heart condition. Garg et al.30 conducted a study to investigate maternal and foetal outcomes in pregnant women with heart disease. The goal of this prospective clinical study was to determine the incidence and mother and foetal outcomes in select cases of pregnancy complicated by heart disease that were referred to a tertiary care hospital for delivery. RHD is the most frequent heart condition in pregnancy, they find. In NYHA grades III and IV, foetal mortality and morbidity are high. Early booking minimises and reduces maternal and foetal morbidity and death when

heart disease complicates pregnancy, which is a high-risk circumstance that requires specific monitoring throughout the pregnancy. The best maternal and perinatal outcomes are achieved with skilled monitoring and management by the obstetrician and physician, as well as the patient's full cooperation throughout the antenatal, intranatal, and post-natal periods. The necessity of regular prenatal checkups and hospital delivery must be communicated to the rural community.

Establishing low-cost cardiac surgical facilities in rural areas will undoubtedly help to reduce the mortality and morbidity associated with heart disease complicating pregnancy. Peripartum cardiomyopathy has to be made more widely known. This study emphasises the significance of the alarm signals[32] for pregnancy prognosis, which includes cyanosis, NYHA class, and poor LVEF. A multidisciplinary approach comprising obstetricians and cardiologists should be used to ensure that the patient has been thoroughly evaluated and is in good health for the anticipated pregnancy. Genetic counselling is indicated for patients with congenital heart disease, either before or early in pregnancy, to determine the risk to their offspring. It is necessary to identify predictors of a poor mother and foetal outcomes. Previously, the high maternal mortality rate among pregnant cardiac patients led to the claim that women with defective hearts should not get pregnant. This long-held belief needs to be updated today.

Pregnancy in women with heart disease remains a difficult situation due to the increased maternal and foetal morbidity and death. In the clinical setting, determining an accurate individual risk assessment is critical. Taha et al.[45] conducted the current research. 150 pregnant women with structural heart disease were polled. They were followed up for 6 weeks after the birth. The most prevalent cardiac lesion in pregnant women is RHD. Peripartum cardiomyopathy was the first cause of heart failure in our study, but it had a good prognosis. Therefore, determining the pre-conceptional functional class of women with structural heart disease is critical because it has a clear impact on maternal and foetal morbidity and mortality, as well as the decision to continue or terminate the pregnancy.

In India, cardiac disorders account for around 4% of all pregnancies. Pregnant women with both congenital and acquired cardiac disorders are at risk for a number of foeto-maternal adverse events, which can jeopardise both mother and baby's health. Dasgupta et al.[46] conducted a study to identify pregnancies with congenital and acquired heart illnesses, as well as to analyse the impact of heart disease on maternal, foetal, and neonatal health. All patients had a thorough medical history is taken, as well as a clinical examination and investigations. The manner of delivery, gestational age, prenatal, intranatal, and postnatal problems, as well as the baby's entire delivery history and neonatal metrics like birth

weight and APGAR score, were all calculated. Multidisciplinary teams in tertiary centres should take care of pregnant women with pre-existing heart issues. If a woman has pre-existing cardiac disease and wants to carry her baby to term, her cardiac state must be improved before birth, and an elective delivery should be scheduled if possible. The current study concludes that among pregnant women with cardiac disease, a high index of suspicion and a cautious interdisciplinary approach can improve the foetomaternal prognosis.

Cardiovascular disorders are the leading non-obstetric cause of morbidity and mortality. The fundamental goal of Kothapalli et al.33's study is to determine the impact of heart disease on pregnancy and its outcome. In the majority of cases, if diagnosed early and managed properly with a multidisciplinary team approach involving a qualified obstetrician, cardiologist, anaesthetist, paediatrician, and nurse, the mother and child will have a favourable outcome. The main goal of this study is to determine the impact of heart disease on pregnancy and its outcome. The study included all antenatal patients with cardiac diseases, either previously diagnosed or diagnosed during antenatal visits, early postnatal patients with scheduled antenatal visits, cardiac disease referrals, emergency admissions, and patients who developed cardiac complications during the peripartum period. In all of the pregnancies, RHD was the leading cause of heart disease. Congenital cardiac disorders

are the second most common cause. Twenty-six percent of them had to have heart surgery. In 6% of individuals, peripartum cardiomyopathy was discovered. This study found that prenatal diagnosis, counselling, appropriate referral, routine antenatal observation, and delivery in a well-equipped facility increase the foetomaternal outcome in heart disease pregnancy.

Pregnant women with cardiac problems are more vulnerable. Studies of these patients' risk variables are critical for improving maternal and foetal outcomes. We hope to explore the major risk factors for cardiac events in pregnant women with heart disease and develop a risk assessment method in this research. Hua et al.[49] conducted a retrospective investigation of pregnancies in Shanghai delivered by women with heart disease. In pregnant women with heart disease, a logistic regression model was utilised to identify independent risk factors for cardiac events and generate the risk score. Prenatal consultation and assessment for pregnant women with cardiac disease should include a risk score, according to the researchers. Clinics for pregnant women with cardiac disease, in particular, should be open, where obstetricians and cardiologists collaborate to do physical examinations of patients before and during pregnancy, as well as to monitor laboratory tests, EKGs, and ECGs on a continuous basis. Heart illness during pregnancy can contribute to unfavourable pregnancy outcomes. A risk index could be

used to assess the risk of cardiac events in pregnant women with heart disease.

Koregol et al.[50] looked analysed the mother and foetal outcomes of pregnancies in a developing nation that were complicated by heart disease. A retrospective investigation of 110 pregnancies in women with heart illness was conducted. They came to the conclusion that RHD is the most common cardiac condition among pregnant women. Patients with NYHA class III and IV have a high rate of foetal morbidity and mortality. People are less aware of heart abnormalities and its implications during pregnancy, which needs to be remedied.

Puri et al.[51] conducted a study to analyse the presence of various forms of heart problems in pregnant women admitted to a Punjabi tertiary care hospital. 97 women with heart disease who were pregnant were evaluated for varied etiologies, cardiac lesions, maternal and perinatal outcomes. The most prevalent acquired lesion was rheumatic heart disease (RHD) with isolated mitral stenosis, while mitral valve prolapse was the most common congenital heart disease lesion. Cardiomyopathy was the major cause of death in the miscellaneous group. In 36 women, several heart lesions were discovered. The majority of the babies were born by caesarean section, with some having spontaneous vaginal births. Only a few needed induction of labour. There were cardiac problems in 19 of the women. There were three deaths among the mothers. This study

found that rheumatic heart disease is still the most common cause of cardiac lesions in pregnancy, despite the fact that acquired cardiac lesions are on the rise. Maternal and foetal outcomes can be improved with attentive observation and management during pregnancy.

CARDIAC DISEASE – DIAGNOSIS

History and examination

Although a clinical examination and patient history can identify many diseases, an echocardiography is essential to validate clinical suspicions. Congenital and acquired heart abnormalities can manifest during pregnancy. In many cases, the background is obscure, and prior surgical procedures are undocumented CD can also develop during pregnancy or postpartum, as in peripartum cardiomyopathy. Detailed family history is vital in all situations, since it may reveal a congenital lesion or potentially lethal disorders including arrhythmias and sudden death syndromes.Symptoms of CD include increasing shortness of breath, decreased effort tolerance, orthopnoea, PND, syncope, palpitations, and chest pain.Symptoms like shortness of breath, exhaustion, and lower effort tolerance may be difficult to discern in pregnant women. A healthy pregnant woman's cardiovascular examination may also demonstrate peripheral oedema, elevated PR, and a physiological murmur. The doctor can separate disease from normal physiological changes by evaluating the symptoms stated in the history. A woman who is unable to do daily duties

due to worsening shortness of breath may be classified as an NYHA class III or IV patient, and her inability to sleep may be cause for alarm. A woman, who maintains her normal functional level when pregnant, with mild physiological dyspnea at rest and reducing with effort, is unlikely to have cardiovascular pathology.A resting tachycardia, a pathological murmur, or symptoms of heart failure necessitate immediate attention.[52]

Electrocardiograms, Holter ECGs, and echocardiograms are technically more difficult to do in advanced pregnancy but should be done if needed. Table 2 summarises the usual adaptations detected on a pregnant 12-lead ECG.

Transthoracic echocardiography is the primary screening and diagnostic method for structural and functional heart abnormalities. It also does not expose the patient to radiation and can be repeated as needed. The gravid belly, breast engorgement, and heart rotation make an echocardiography challenging to perform in a pregnant woman.A 24-hour Holter ECG should be used if severe arrhythmias are suspected or if the patient has symptoms such as persistent palpitations or syncope. Loop recorders have been implanted in a restricted group of individuals at high risk of deadly arrhythmias.[52]

Risk assessment

This condition's influence on pregnancy should be documented once a diagnosis has been made.Arrangements should be made for delivery and postpartum care. These measures should be executed before pregnancy to allow for a baseline examination of heart function and appropriate counselling. Prenatal interventions can avoid foetal radiation exposure and procedure hazards. A medical geneticist may be consulted if the patient has a familial ailment or if there is a risk of inheritance (congenital heart defect). When a patient expresses a desire to conceive, the proper functioning of the heart should be examined. Medications are to be adjusted if necessary.[53] Various risk rating methods are available to help counsel CD patients in their reproductive years. Because risk scores are population-dependent, any study assessing risk must have sufficient prevalence of a certain lesion or clinical event in the sample population to assess risk meaningfully.The WHO's risk assessment classification (Figure 5) is the most accurate to date, with four severity levels.[15]

Several factors may raise maternal and foetal risk in pregnant women with heart disease, which could be utilised in conjunction with the Hagen et al.[54] risk chart (Figure 6).

Figure 5. WHO risk assessmentclassification of cardiac disease in pregnancy.

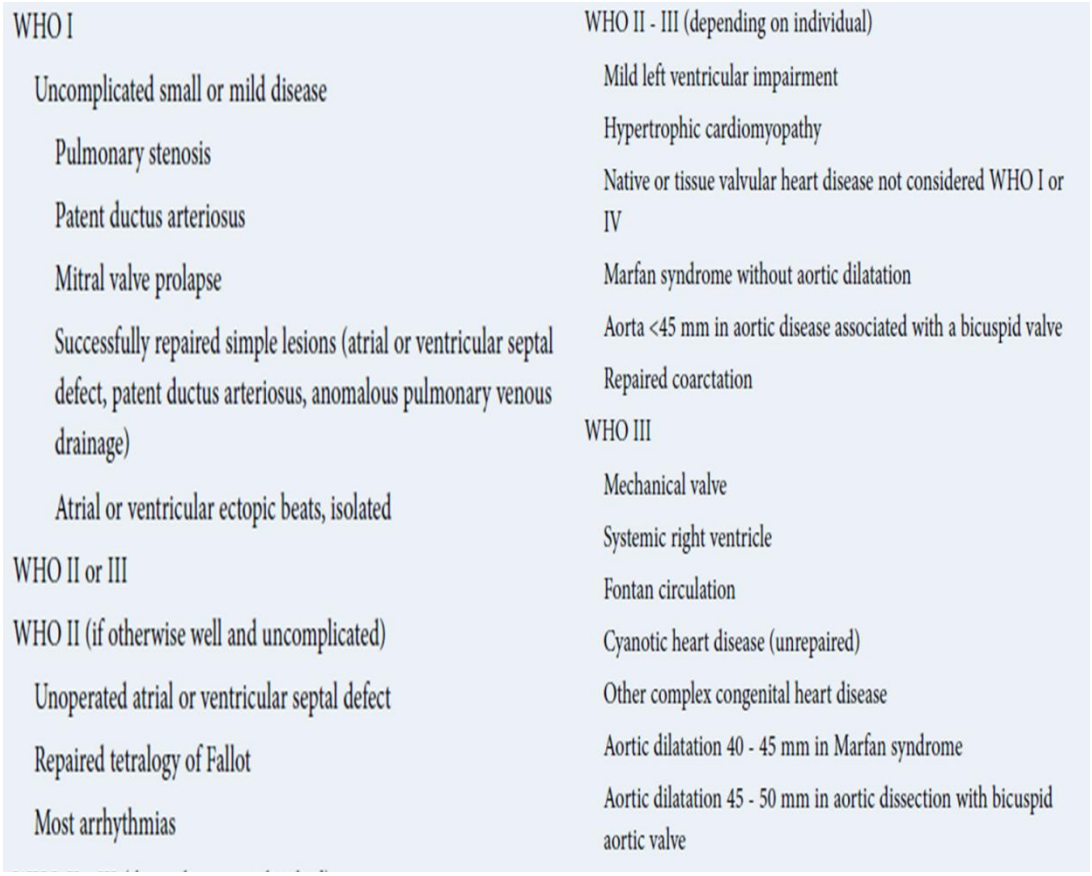
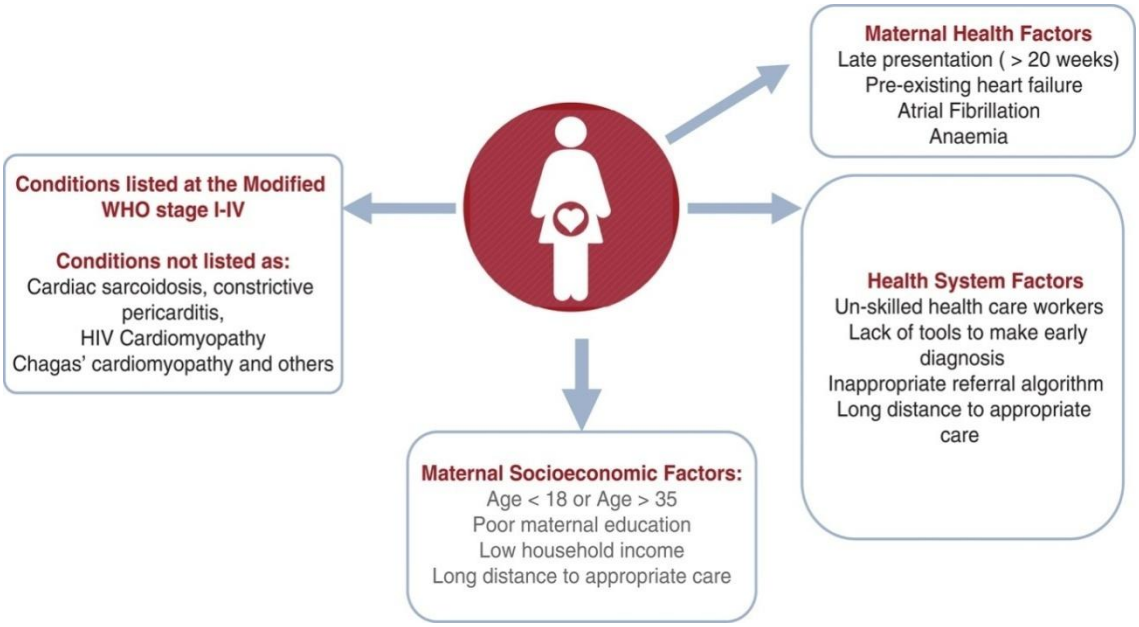


Figure 6. Factors contributing to increased maternal and foetal risk in pregnant women with CHD.

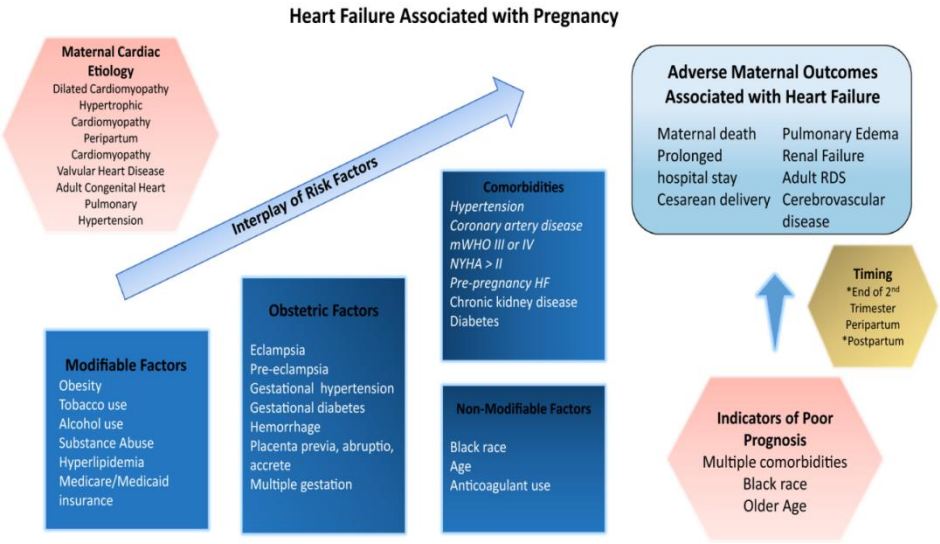


Predicting risk for heart disease in pregnant women in LMICs should take into account the disease's distinctive nature and many risk factors. A combination of disease-specific risk, individual variability related to biological susceptibility, and co-morbid disorders combined with environmental circumstances are recognised as part of medical care. All of these components are challenging to combine into a single risk assessment that patients can use.[55]

Numerous studies have linked maternal HF risk factors to race, age, cigarette, alcohol, and drug usage, as well as Medicare or Medicaid coverage. Because patients are not isolated, a mother may have cardiomyopathy, mitral stenosis, and PH, increasing her cardiac risk. Medical and obstetric risk factors influence the outcome. Among other

MACE, prepregnancy HF, ejection fraction 40%, prepregnancy NYHA class >II or mWHO class IV, cardiomyopathy, and PH are risk factors for developing HF.[56] An cumulative effect of multiple modifiable and non-modifiable risk factors is seen in risk indices like CARPREG II (Cardiac Disease in Pregnancy Study) pertaining to maternal cardiac problems (Figure 7). The ROPAC results demonstrate that mWHO risk classification is less successful in emerging/developing countries than advanced countries (Registry on Pregnancy and Cardiac Disease). [54]

Figure 7. Heart failure associated with pregnancy



Multiple gestations, gestational or chronic hypertension, preeclampsia/eclampsia, postpartum haemorrhage, placenta accreta/abruption/previa, and gestational diabetes mellitus are all obstetric risk factors for HF. 5, ten Hyperlipidemia, diabetes mellitus, obesity, chronic renal disease, and the use of anticoagulants all raise the chance of developing HF.[57]

Adverse Maternal Outcomes associated with CVD in pregnancy

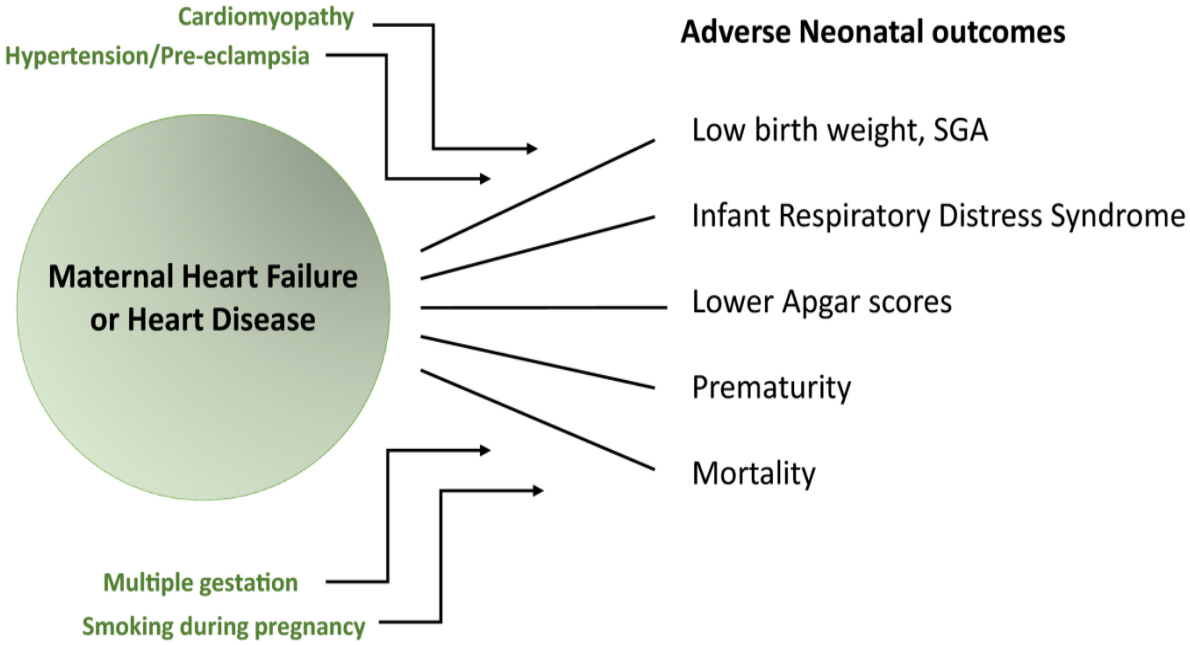
Mothers who have been diagnosed with HF have a 7-fold increased risk of dying. 10 In the ROPAC study, maternal mortality was greater in patients with HF (4.8%) than in those who did not (0.5 percent). 6 Because of the data collection used or the time period analysed, much of the information on maternal outcomes is skewed. Some studies exclusively look at in-hospital deaths that are ascribed to admission-related or inpatient issues, leaving out patients who are managed in an outpatient setting and deaths that occur outside of the hospital late after pregnancy that aren't attributed to pregnancy. Mothers who are diagnosed with HF at any point during their pregnancy are more likely to have negative outcomes, including pulmonary edoema, renal failure, cerebrovascular disease, and adult respiratory distress syndrome, as well as requiring mechanical ventilation, delivering by caesarean section, and staying in the hospital for an extended period of time. Despite the fact that death among moms with HF is infrequent, it is between 4 to 35 times higher than that of healthy women giving birth, a huge discrepancy. Certain characteristics have been linked to poorer outcomes in moms with HF; those who died from HF complications were more likely to be Black, older, and have numerous comorbidities.[58]

Adverse neonatal outcomes associated with maternal heart failure

Due to a lack of data on prenatal and neonatal outcomes, determining the exact impact of maternal HF on the kids born to affected moms is difficult. Recent research has found that having HF during pregnancy, especially if the mother has a known heart condition, puts the foetus at risk for perinatal mortality and morbidity.

Neonates born to afflicted moms have a lower birth weight, are more likely to be tiny for gestational age, have worse Apgar scores, and are more likely to be born prematurely than babies born to healthy mothers. Although these types of heart disease are collectively more common, the overwhelming majority of data in the arena of foetal or neonatal outcomes in women with heart disease is centred on the outcomes of women with ACHD and infrequently on those with acquired heart diseases such as cardiomyopathy, valvular heart disease, or PH.[59] Among the more reliably proven risk factors for neonatal unfavourable clinical outcomes are smoking during pregnancy, multiple gestation pregnancies, cardiomyopathy, and hypertension (Figure 8).

Figure 8. Adverse neonatal outcomes associated with maternal heart failure



The risk to the mother and foetus grows exponentially as the underlying condition becomes more complex. Our unit created a referral algorithm (Figure 9) based on the risk categories indicated above, which serves as a guideline for referring pregnant patients with suspected or confirmed CD to multidisciplinary combined cardiology and obstetric clinic.[52]

PREGNANCY AND DELIVERY IN WOMEN WITH MANY CHDS, INCLUDING PREGNANCY AT HIGH RISK

It is preferable to avoid or terminate pregnancy in women with Eisenmenger syndrome, severe LV outflow tract stenosis (mean pressure gradient >50 mmHg), cardiac failure (>NYHA III with LV ejection

fraction 35 percent), aortic root dilatation (Marfan with aortic root size >45 mm, bicuspid aortic valve (BAV) with aortic root size >50 mm, or become pregnant after surgical repair (Figure 10).

Clinical classification

The New York Heart Association recommends classification of functional capability (used to classify dyspnoea caused by heart failure). The New York Heart Association produced the first-ever classification for assessing functional capacity in 1928, and it was amended for the eighth time in 1979. After all of the data had been examined, one significant change was the addition of a heart state assessment. As a result, the classification is no longer solely dependent on symptoms (Figure 11).

Figure 9. Referral algorithm for suspected and previously known cardiovascular disease in maternity.

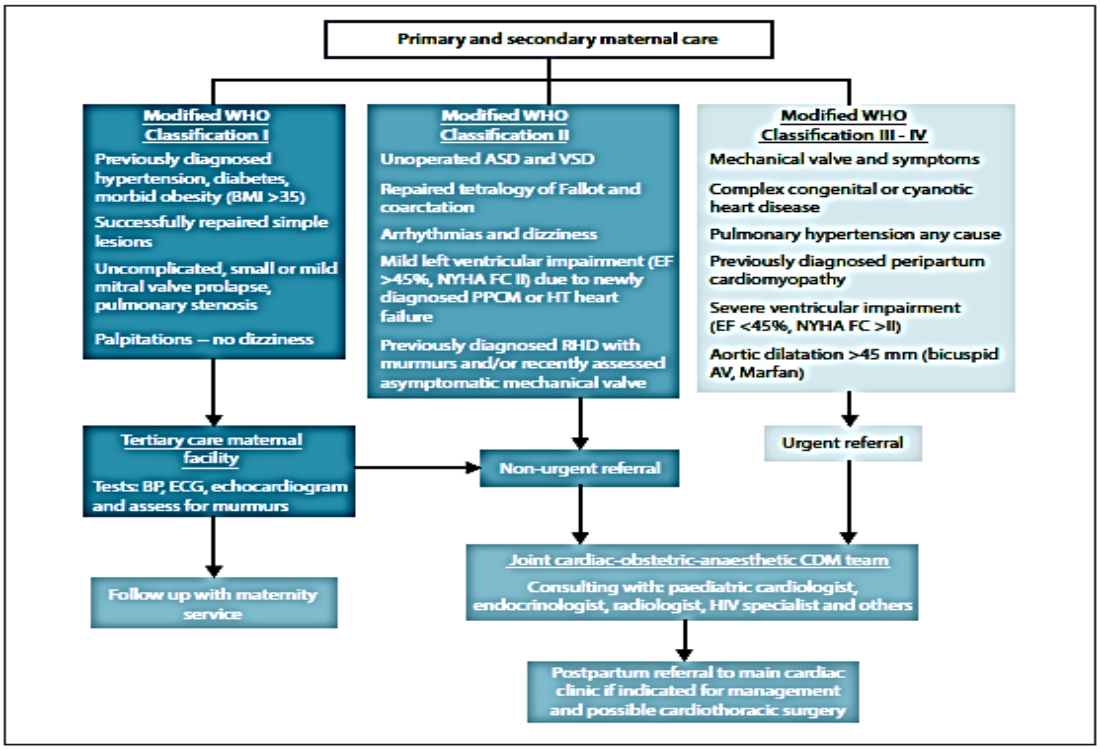


Fig. 2. Referral algorithm for suspected and previously known cardiovascular disease in maternity (BP = blood pressure; BMI = body mass index; ECG = electrocardiogram; ASD = atrial septal defect; VSD = ventricular septal defect; EF = ejection fraction; NYHA FC = New York Heart Association Functional Class; PPCM = peripartum cardiomyopathy; HT = hypertension; RHD = rheumatic heart disease; AV = aortic valve; CDM = cardiovascular disease in maternity).

PRECONCEPTIONAL COUNSELLING

When a patient with a highly impaired or high-risk heart disease wishes to conceive, pre-conceptional counselling becomes important. Pre-conception counselling is the most critical element of assessing reproductive-age women with heart illness (Figure 12). Any evaluation must take into account the dangers of pregnancy to both the mother and the foetus. The mother's risks include her ability to handle the predicted haemodynamic changes that occur during pregnancy, the necessity for highly medicalised antenatal care and delivery, possibly a premature delivery distant from home, and the long-term implications of a

pregnancy on her heart disease. The effects of drugs that may need to be continued, as well as the chance of problems, are all risks to the foetus and mother that must be discussed.[29]

Figure 10. Principal heart diseases are classified into low, moderate, and high risk.

- High risk
  - Pulmonary arterial hypertension
  - Eisenmenger syndrome
  - Secondary pulmonary hypertension
  - Primary pulmonary hypertension
  - Marfan syndrome with aortic root dilatation
  - AMI during pregnancy
  - Severe aortic stenosis
  - Severe ventricular dysfunction
  - Dilated cardiomyopathy
  - Previous peripartum cardiomyopathy
  - Right systemic ventricle with severe dysfunction
  - Univentricular physiology with or without Fontan with severe ventricular dysfunction
  - Severe mitral stenosis
- Intermediate risk: 1%-5% mortality
  - Mechanical prosthesis
  - Univentricular physiology (with or without Fontan) with preserved systolic function
  - Unrepaired cyanotic heart disease without pulmonary hypertension
  - Unrepaired aortic coarctation
  - Non-severe aortic stenosis
  - Severe pulmonary stenosis
  - Marfan syndrome without aortic root dilatation
  - Mitral stenosis
- Low risk: the risk of maternal mortality is higher than that estimated in the general population (1:1000) but lower than 1%
  - Repaired congenital heart disease without defect or residual dysfunction
  - Left-to-right shunt without pulmonary hypertension
  - Asymptomatic moderate-to-severe mitral or aortic regurgitation without left ventricular dysfunction
  - Moderate pulmonary stenosis
  - Biological prostheses without residual dysfunction
  - Bicuspid aortic valve

Figure 11.The New York Heart Association functional capacityand objective assessment

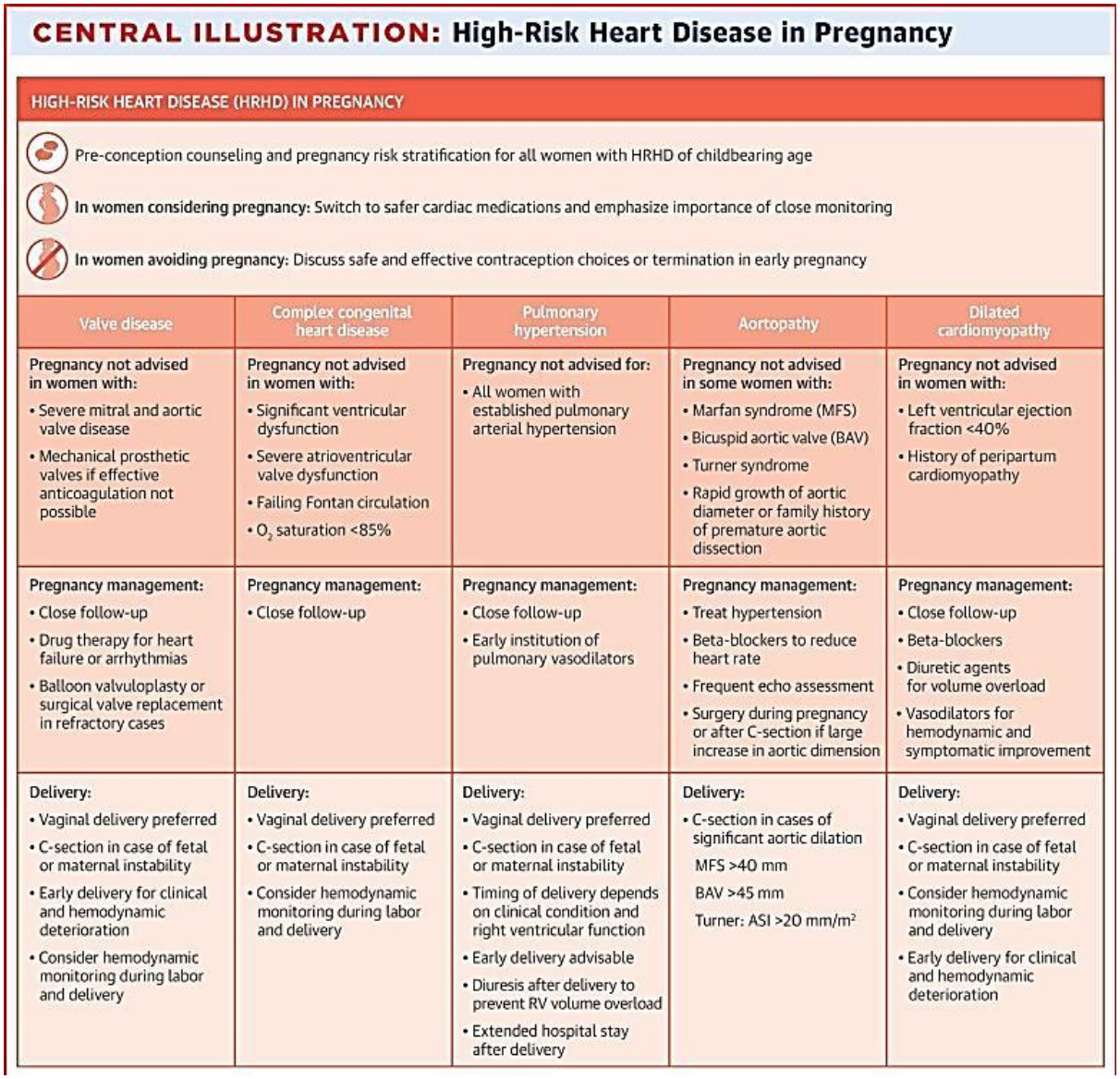
Functional capacity	Objective assessment
Class I	
Patient with cardiac disease but without limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or angina	No objective evidence of cardiovascular disease
Class II	
Patient with cardiac disease resulting in slight limitation of physical activity. Comfortable at rest but ordinary activity results in fatigue, palpitation, dyspnea, or angina	Objective evidence of minimal cardiovascular disease
Class III	
Patient with cardiac disease resulting in marked limitation of physical activity. Comfortable at rest but less than ordinary activity results in fatigue, palpitation, dyspnea, or angina	Objective evidence of moderately severe cardiovascular disease
Class IV	
Patient with cardiac disease resulting in an inability to carry on any physical activity. Symptoms of heart failure or anginal syndrome may be present even at rest	Objective evidence of severe cardiovascular disease

Figure 12. Issues to Discuss With the Patient during Pre-Conception Counselling

Pregnancy risk stratification • Maternal cardiac risk • Maternal obstetric risk • Fetal and neonatal risks
Long-term effects of pregnancy on the heart
Maternal life expectancy
Genetic consultation
Contraception safety and efficacy
Modification of cardiac medications
Optimization of cardiac status
Planning for pregnancy*

Several management strategies for pregnant women who have high risk heart disease (HHRDP) have been proposed (Figure 13).[60]

Figure 13.Management strategies forwomen with HHRDP



CENTRAL ILLUSTRATION: High-Risk Heart Disease in Pregnancy

HIGH-RISK HEART DISEASE (HRHD) IN PREGNANCY

Pre-conception counseling and pregnancy risk stratification for all women with HRHD of childbearing age

In women considering pregnancy: Switch to safer cardiac medications and emphasize importance of close monitoring

In women avoiding pregnancy: Discuss safe and effective contraception choices or termination in early pregnancy

Valve disease	Complex congenital heart disease	Pulmonary hypertension	Aortopathy	Dilated cardiomyopathy
Pregnancy not advised in women with: • Severe mitral and aortic valve disease • Mechanical prosthetic valves if effective anticoagulation not possible	**Pregnancy not advised in women with:** • Significant ventricular dysfunction • Severe atrioventricular valve dysfunction • Failing Fontan circulation • O_2 saturation <85%	**Pregnancy not advised for:** • All women with established pulmonary arterial hypertension	**Pregnancy not advised in some women with:** • Marfan syndrome (MFS) • Bicuspid aortic valve (BAV) • Turner syndrome • Rapid growth of aortic diameter or family history of premature aortic dissection	**Pregnancy not advised in women with:** • Left ventricular ejection fraction <40% • History of peripartum cardiomyopathy
Pregnancy management: • Close follow-up • Drug therapy for heart failure or arrhythmias • Balloon valvuloplasty or surgical valve replacement in refractory cases	**Pregnancy management:** • Close follow-up	**Pregnancy management:** • Close follow-up • Early institution of pulmonary vasodilators	**Pregnancy management:** • Treat hypertension • Beta-blockers to reduce heart rate • Frequent echo assessment • Surgery during pregnancy or after C-section if large increase in aortic dimension	**Pregnancy management:** • Close follow-up • Beta-blockers • Diuretic agents for volume overload • Vasodilators for hemodynamic and symptomatic improvement
Delivery: • Vaginal delivery preferred • C-section in case of fetal or maternal instability • Early delivery for clinical and hemodynamic deterioration • Consider hemodynamic monitoring during labor and delivery	**Delivery:** • Vaginal delivery preferred • C-section in case of fetal or maternal instability • Consider hemodynamic monitoring during labor and delivery	**Delivery:** • Vaginal delivery preferred • C-section in case of fetal or maternal instability • Timing of delivery depends on clinical condition and right ventricular function • Early delivery advisable • Diuresis after delivery to prevent RV volume overload • Extended hospital stay after delivery	**Delivery:** • C-section in cases of significant aortic dilation MFS >40 mm BAV >45 mm Turner: ASI >20 mm/m²	**Delivery:** • Vaginal delivery preferred • C-section in case of fetal or maternal instability • Consider hemodynamic monitoring during labor and delivery • Early delivery for clinical and hemodynamic deterioration

Peripartum cardiomyopathy

Peripartum cardiomyopathy (PPCM) is an uncommon cardiac condition that strikes previously healthy women near the end of pregnancy or shortly after delivery. The disease's prevalence varies

greatly by location and has been increasing, either to increased awareness or socioeconomic changes. PPCM has a complex aetiology and pathophysiology that is poorly understood. Myocarditis, oxidised prolactin, autoimmune, starvation, genetic predisposition, and apoptosis have all been offered as possibilities over the years. PPCM is still an excluding diagnosis. Biomarkers with solely pregnancy-related kinetics are not currently available in clinical practice, and their relevance is unknown. Globally, the prognosis has improved marginally in recent years. The clinical state of some patients recovers fast and sometimes returns to normal. In others, clinical circumstances rapidly deteriorate and become resistant to medical treatment, resulting in chronic heart failure (HF) caused by persistent left ventricular dysfunction (LVD). Intravenous vasodilators, inotropes, and levosimendan, as well as intra-aortic balloon pumps, ventricular assist devices, and heart transplantation, may be used in acute care treatment. In PPCM patients, beta-1-adrenergic agonists may accelerate myocyte loss and HF, cause irreversible damage, and hinder recovery. Targeting 16 kDa prolactin and its downstream mediator miR-146a, as well as the vascular endothelial growth factor (VEGF) system, may enhance healing. In individuals with acute onset of PPCM, bromocriptine, a dopamine 2D agonist that suppresses prolactin, may be a disease-specific medication in addition to normal therapy. PPCM survivors frequently recover from LVD; nevertheless, in subsequent

pregnancies, they may be at risk for HF recurrence and mortality. Following international guidelines, women with chronic LVD should be handled and additional pregnancies should be avoided. Women who have recovered from PPCM and require counselling for future pregnancies must have close follow-up and appropriate risk categorization.[61]

Congenital Heart Disease

Because over 90% of women with congenital heart disease (CHD) have reached adulthood, the number of women at risk of pregnancy is increasing. Most of them have a satisfactory pregnancy and delivery outcome if their functional class and systemic ventricular function are good. Women with CHD have a higher risk of developing pulmonary hypertension (Eisenmenger syndrome), severe left ventricular outflow stenosis, cyanotic CHD, aortopathy, Fontan procedure, and systemic right ventricle (complete transposition of the great arteries [TGA] after the atrial switch, congenitally corrected TGA). Heart failure, arrhythmias, bleeding or thrombosis, and maternal death are the most common problems during pregnancy and delivery. Prematurity, low birth weight, abortion, and stillbirth are among foetal complications. Pregnancy and delivery risk stratification is based on the patient's functional status and is lesion-specific. The use of medication during pregnancy and after delivery (breastfeeding) is a major source of worry. Prescriptions with teratogenicity, in particular, should be avoided. A multidisciplinary team

approach comprising cardiologists, obstetricians, anesthesiologists, neonatologists, nurses, and other associated disciplines is required for adequate treatment during pregnancy, delivery, and the postpartum period. Because of the temporary heart dysfunction caused by pregnancy, caring for a baby is a major concern, and family support is essential, especially during peripartum and after delivery. To eliminate preventable pregnancy-related risks, all women with CHD should get timely pre-pregnancy counselling. When adequate counselling and optimal care are provided, most women with CHD at low risk can have a successful pregnancy.[62]

AIM AND OBJECTIVES

1. To analyze the impacts of heart disease on pregnancy
2. To find out the prevalence, spectrum of various heart diseases and their outcome in pregnancy
3. To study maternal and perinatal outcome
4. To reduce maternal mortality through early diagnosis and treatment, effective antenatal follow-up and safe delivery practices

MATERIALS AND METHODS

DESIGN OF STUDY: Prospective observational study

PLACE OF STUDY: Department of Obstetrics & Gynaecology, K.A.P.V Government Medical College & MGMGH, Trichy

PERIOD OF STUDY: 12 Months (November 2021- October 2021)

SAMPLE SIZE: 100

STUDY POPULATION: Pregnant women with heart disease

INCLUSION CRITERIA: All pregnant women have various heart diseases (Rheumatic, Congenital, Vascular, Ischemic etc.) enrolled in AN OPD/Labour ward. All pregnant women with heart disease are admitted for safe confinement.

EXCLUSION CRITERIA: Pregnant women without heart disease but presenting with symptoms and signs suggestive of heart disease, cardiac failure (non-cardiac cause) were subjected to meticulous history taking, detailed examination and if not diagnosed with heart disease were excluded.

METHODOLOGY

Detailed antenatal, obstetric and cardiac history was obtainedfrom all of them. Women were assessed for their functional cardiacstatus as per the New York Heart Association (NYHA) classification.A cardiologist opinion was obtained. ECG was taken and 2D Echo wasdone to confirm structural heart diseases. Routine lab investigations andnecessary special investigations were done. Age, parity, gestational age, NYHA classification, cardiaclesion (congenital, rheumatic, miscellaneous), medications, whethersurgically corrected or not, mode of delivery, maternal and perinatal outcome, birth weight of babies, need for NICU admission for theneonate, maternal and neonatal complications if any were recorded.

STATISTICAL ANALYSIS

Data are presented as percentages and the number of cases.Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Science Inc., Chicago, IL).

RESULTS

Total 100 women were enrolled for the present study and maximum women were found in the age group of 26 to 30 years and 21 to 25 years each with 35 (35%), followed by an age group of 31 to 35 years with 14 (14%) women. The minimum subjects were observed in the age group of below 20 years with 7 (75) women (Table 1, Fig 1).

Table 1: Age group distribution participating women

AGE GROUP	Frequency	Percent
<20	7	7.0%
21-25	35	35.0%
26-30	35	35.0%
31-35	14	14.0%
>36	9	9.0%
Total	100	100.0%

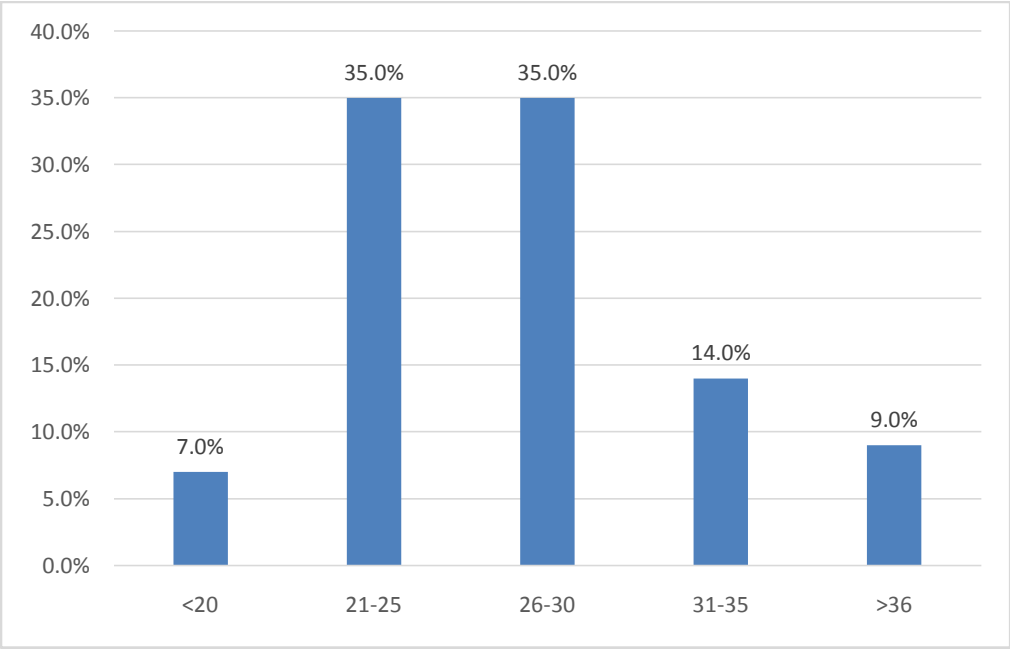


Fig 1: Age group distribution participating women

The qualifications of all volunteers were evaluated, it was found that maximum women were high school passed 49 (49%), followed by middle school and postgraduate passed each with 13 (13%) women. Only 1% of women were found uneducated in the present study (Table 2, Fig 2).

Table 2: Qualification of all participants

QUALIFICATION	Frequency	Percent
Uneducated	1	1.0%
Primary School	21	21.0%
Middle School	13	13.0%
High School	49	49.0%
Undergraduate	3	3.0%
Postgraduate	13	13.0%
Total	100	100.0

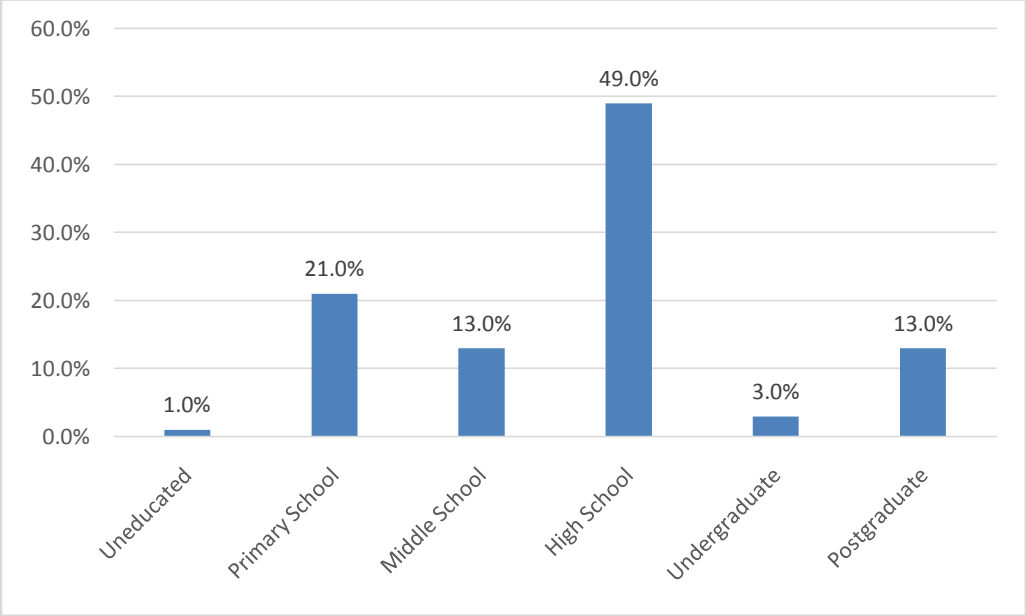


Fig 2: Qualification of all participants

The occupation of all volunteers was recorded and it was found that 91 (91%) women were house wife, followed by 4 (4%) women were coolie and remaining occupations were observed only 1 (1%) in participants (Table 3, Fig 3).

Table 3: Occupation distribution among participating women

OCCUPATION	Frequency	Percent
Coolie	4	4.0%
Housewife	91	91.0%
Lab technician	1	1.0%
lecturer	1	1.0%
Staff nurse	1	1.0%
Tailor	1	1.0%
Teacher	1	1.0%
Total	100	100.0%

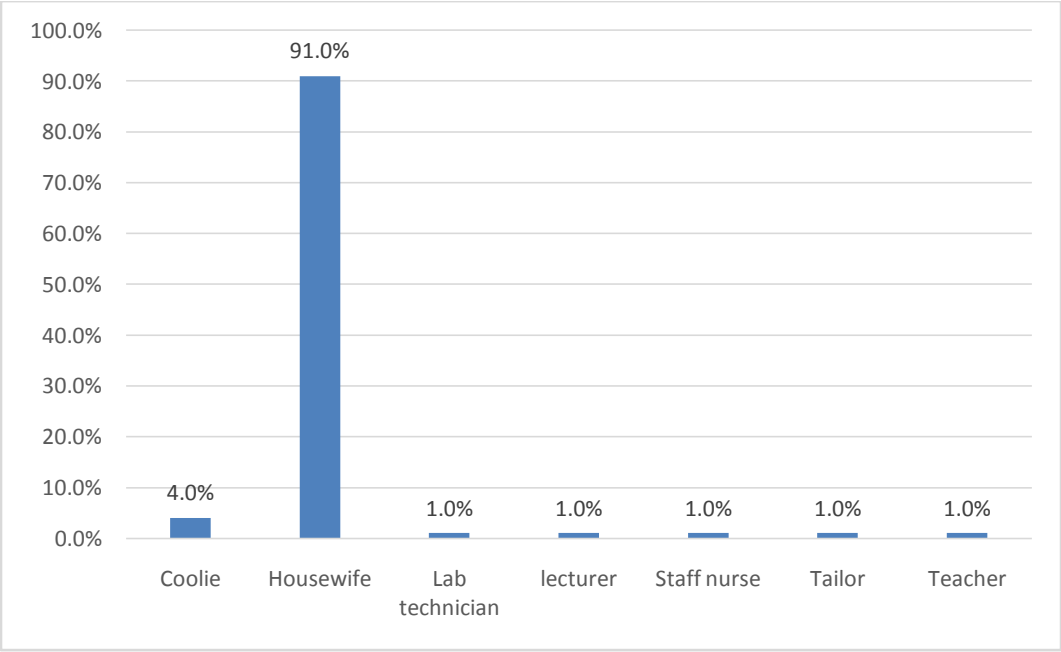


Fig 3: Occupation distribution among participating women

The socio-economical statuses of all patients were recorded and 74 (74%) women were found below the poverty line and only 26 % of women were surviving above the poverty line (Table 4, Fig 4).

Table 4: Socio-economical status of all participants

SOCIO-ECONOMIC	Frequency	Percent
Above Poverty Line	26	26.0%
Below Poverty Line	74	74.0%
Total	100	100.0%

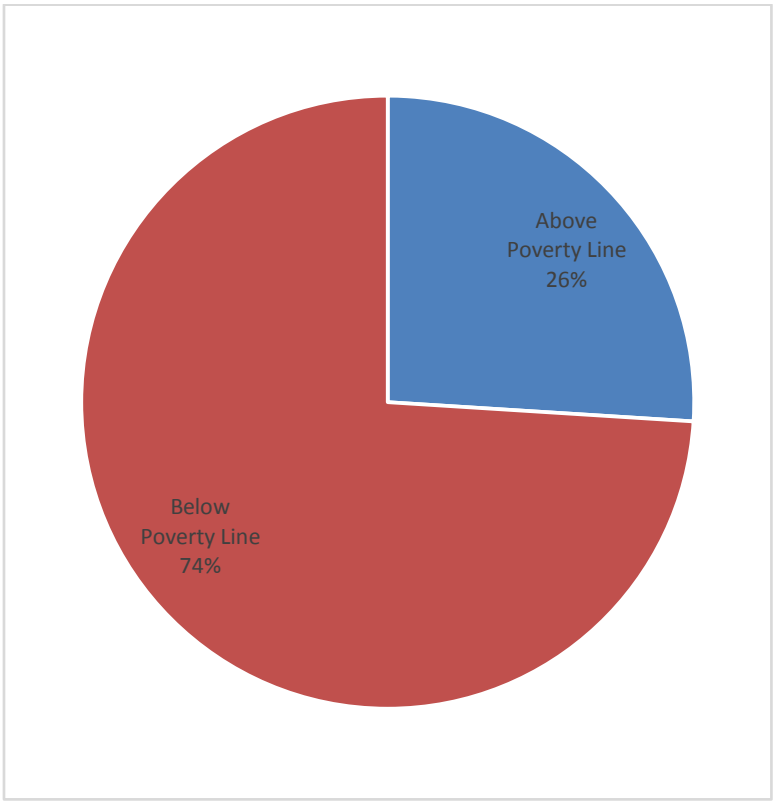


Fig 4: Socio-economical status of all participants

The obstetric score of all 100 women was carried out and it was observed that 65 (65%) women were multi-gravida whereas only 35 (35%) were reported to be primi (Table 5, Fig 5)

Table 5: Obstetrics score of all participants

OBSTETRIC SCORE	Frequency	Percent
Multi	65	65.0%
Primi	35	35.0%
Total	100	100.0%

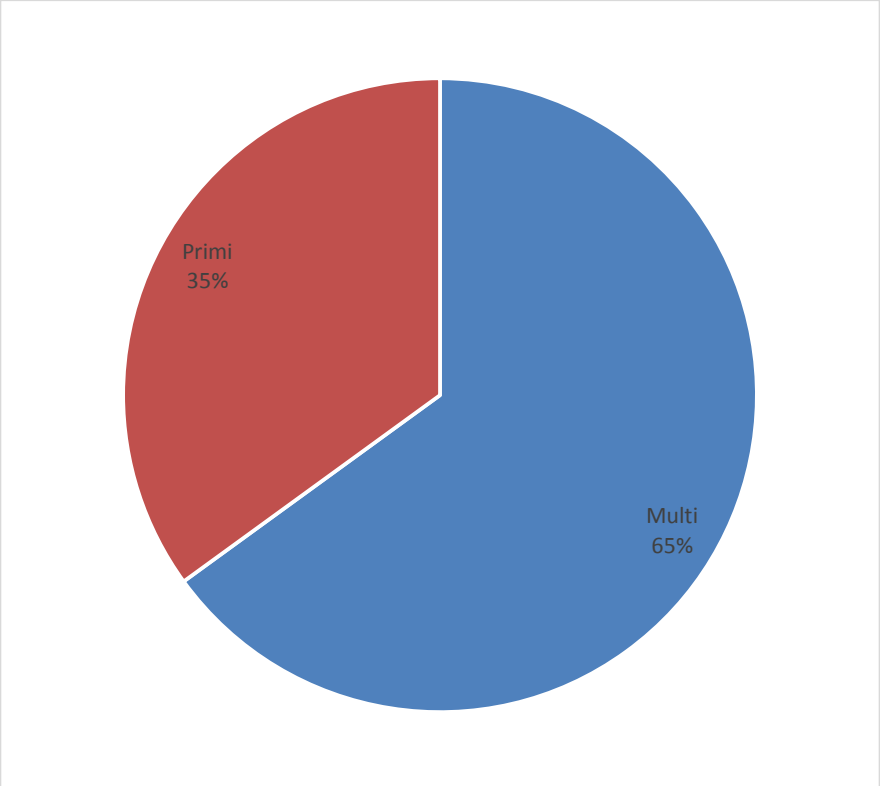


Fig 5: Obstetrics score of all participants

The participating women were categorised based on NYHA class, it was observed that maximum women were in class I category 52(52%), followed by class II 41 (41%) and minimum patients were reported in class III 3 (3%) (Table 6, Fig 6)

Table 6: NYHA classification of all participants

NYHA CLASS	Frequency	Percent
Class I	52	52.0%
Class II	41	41.0%
Class III	3	3.0%
Class IV	4	4.0%
Total	100	100.0%

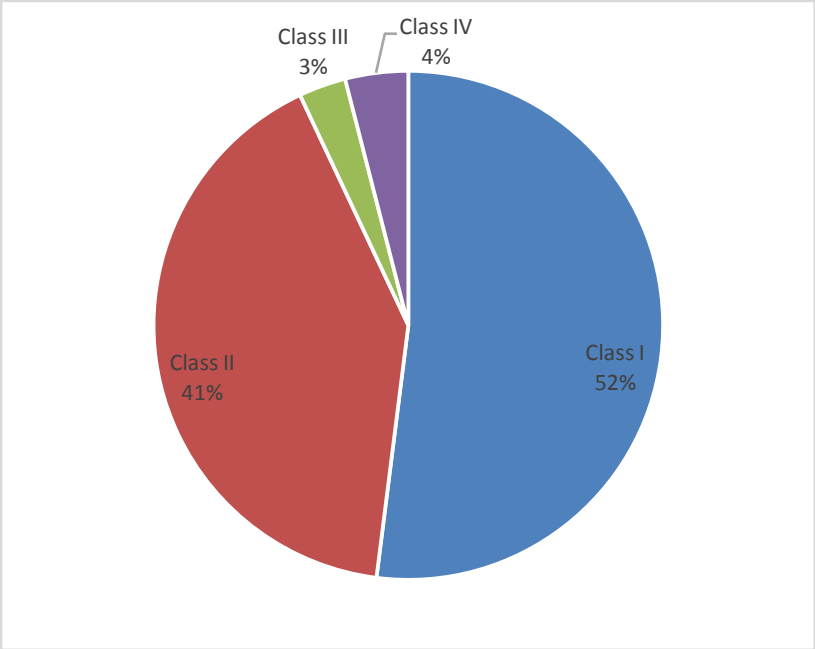


Fig 6: NYHA classification of all participants

The heart disease of all patients was examined, the maximum patients were observed with Rheumatic heart disease 55 (55%), followed by congenital heart disease 26 (26%) and least subjects2 (2%) were observed with a complete heart attack (Table 7, Fig 7).

Table 7: Distribution of observed heart disease among participating women.

HEART DISEASE	Frequency	Percent
Complete heart block	2	2.0%
Congenital heart diseases	26	26.0%
Mitral valve prolapse	13	13.0%
Peripartum cardiomyopathy	4	4.0%
Rheumatic heart disease	55	55.0%
Total	100	100.0%

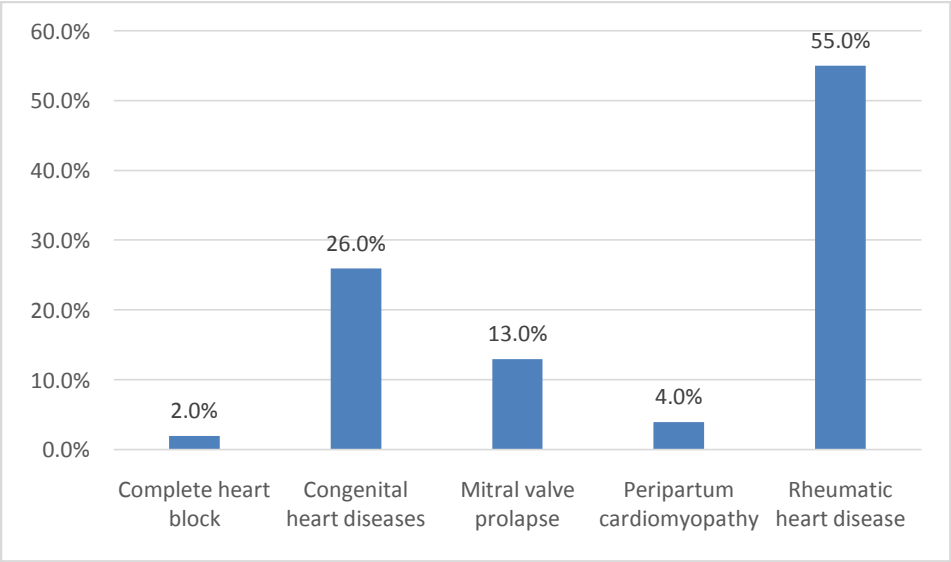


Fig 7: Distribution of observed heart disease among participating women.

The RHD lesion among patients observed with RHD was also examined, it was found that maximum patients 21 (38.2%) were reported with MS/MR RHD lesion, followed by isolated MS with 12 (21.8%) women and minimum patients 5 (12.7%) were observed with MS/MR/AR RHD lesion (Table 8, Fig 8)

Table 8: Observation of RHD lesion in all participants.

RHD Lesion	Number	Percentage
Isolated MS	12	21.8%
Isolated MR	10	18.2%
MS/MR	21	38.2%
MS/MR/AR	5	9.1%
Other combined lesions	7	12.7%
Total	55	100.0%

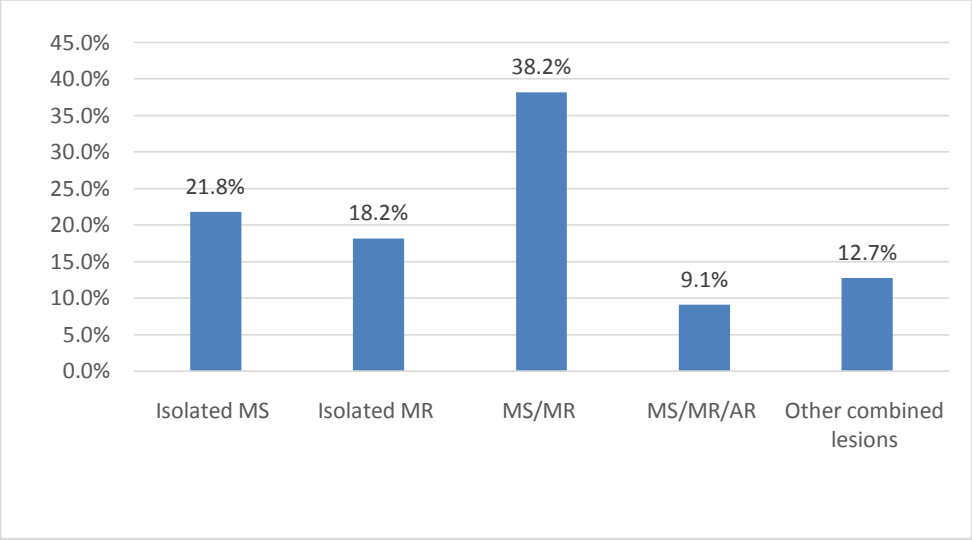


Fig 8: Observation of RHD lesion in all participants.

The type of CHD disease among participants was examined in our study. The 69 (69%) patients were observed with ASD, followed by pulmonary valve stenosis and Bicuspid Aortic Valve Disease each with 4 (15.4%) patients (Table 9, Fig 9).

Table 9: Type of CHD observed in all patients

Type of CHD	Number	Percentage(%)
ASD	18	69.2%
Pulmonary valve stenosis	4	15.4%
Bicuspid Aortic Valve Disease	4	15.4%
Ventricular septal defect	1	3.8%
Ebstein's Anomaly	1	3.8%
Total	26	100.0%

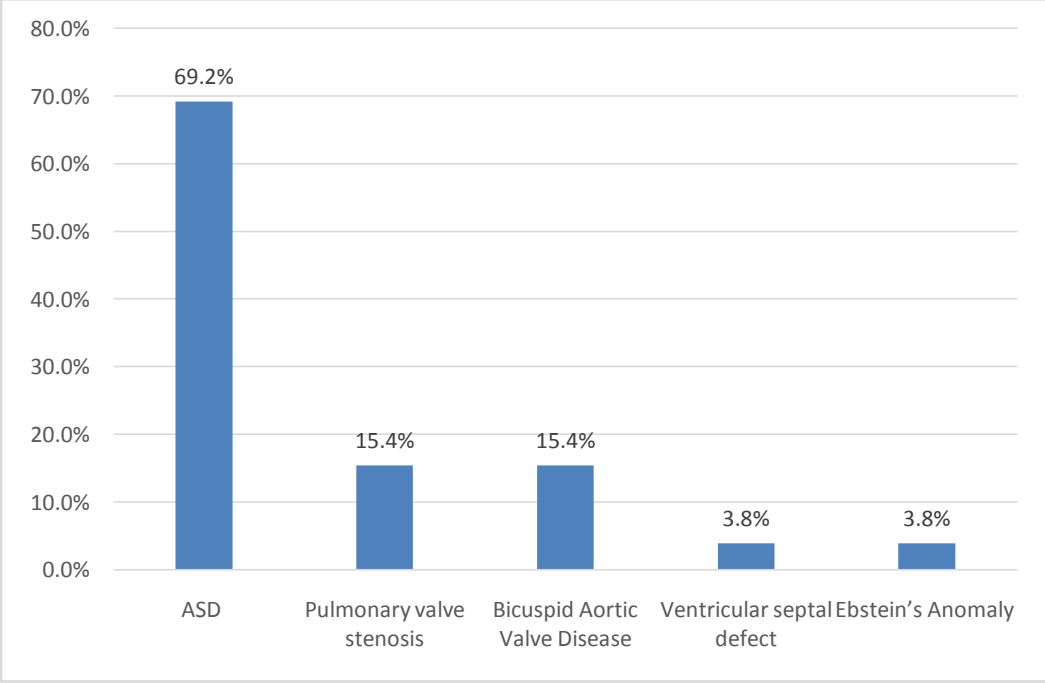


Fig 9: Type of CHD observed in all patients

Mode of delivery whether LSCS or normal vaginal delivery was recorded in all participating women. In present study 73 (73%) women were observed with normal vaginal delivery whereas 27 (17%) women were reported with caesarean delivery (Table 10, Fig 10).

Table 10: Mode of delivery in all patients

MODE OF DELIVERY	Frequency	Percent
LSCS	27	27.0%
Vaginal delivery	73	73.0%
Total	100	100.0%

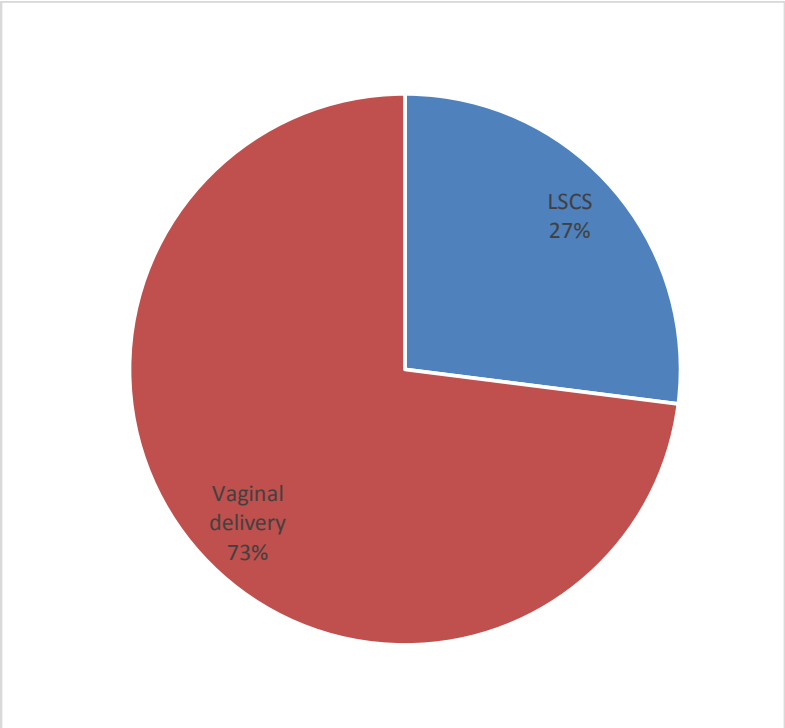


Fig 10: Mode of delivery in all patients

Of all 100 subjects, 49 (49%) were observed with Outlet forceps delivery, followed by emergency delivery with 20 (20%) subjects and natural delivery in 18 (18%) participants. In our study, only 2(2%) women were observed with assisted beech type of delivery (Table 11, Fig 11).

Table 11: Observation of type of delivery among all subjects.

TYPE OF DELIVERY	Frequency	Percent
Elective	7	7.0%
Emergency	20	20.0%
Labour natural	18	18.0%
Assisted breech	2	2.0%
Outlet forceps	49	49.0%
Spontaneous expulsion	4	4.0%
Total	100	100.0%

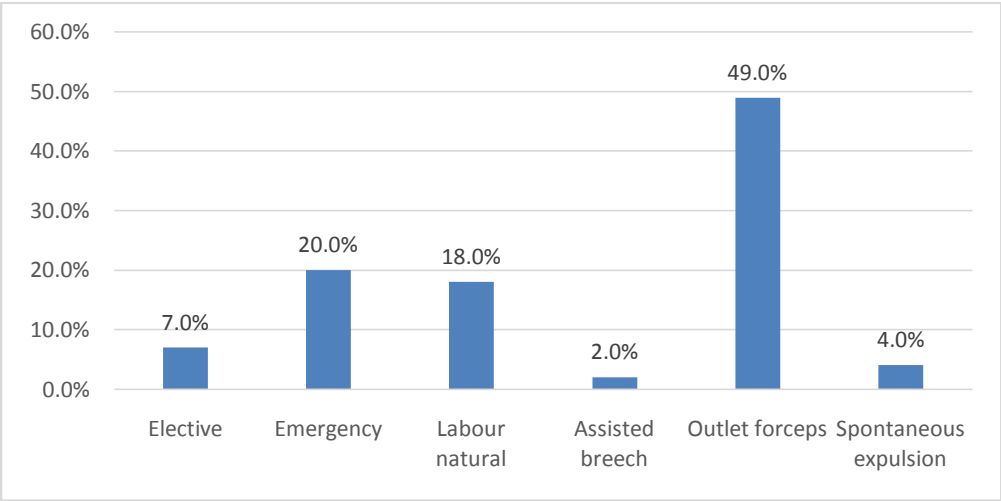


Fig 11: Observation of type of delivery among all subjects.

Indication for LSCS delivery among subjects with LSCS delivery was examined and it was found that previous LSCS delivery as major indicator 9 (33.3%) for present LSCS delivery, followed by Cephalopelvic Disproportion i 6 (22.2%) patients and Oligohydramnios in 5 (18.5%) patients. AS as an indicator for LSCS delivery was observed in only 1 (3.7%) patients (Table 12, Fig 12).

Table 12: Observed indicator for LSCS delivery in all volunteers

INDICATION FOR LSCS	Frequency	Percent
Cephalopelvic Disproportion	6	22.2%
Failed induction	2	7.4%
Fetal distress	2	7.4%
Oligohydramnios	5	18.5%
Previous LSCS	9	33.3%
AS	1	3.7%
Multiple valvular lesions	2	7.4%
Total	27	100.0%

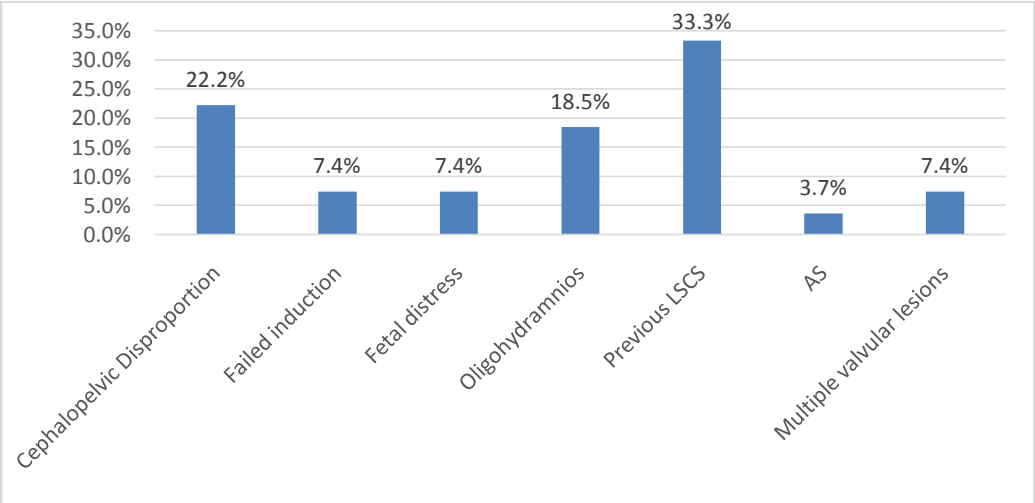


Fig 12: Observed indicator for LSCS delivery in all volunteers

Birth weight of all neonates was recorded in the study, maximum neonates 53 (53%) were observed in the range of 2.6 to 3 kg, followed by 2.1 to 2.5 kg in 40 (40%) and more than 3.1 kg with 5 (5%) patients. Only 2 (2%) patients were observed with weight less than 2 kg (Table 13, Fig 13).

Table 12: Birth weight distribution of all neonates.

BIRTH WEIGHT	Frequency	Percent
<2	2	2.0%
2.1-2.5	40	40.0%
2.6-3	53	53.0%
>3.1	5	5.0%
Total	100	100.0%

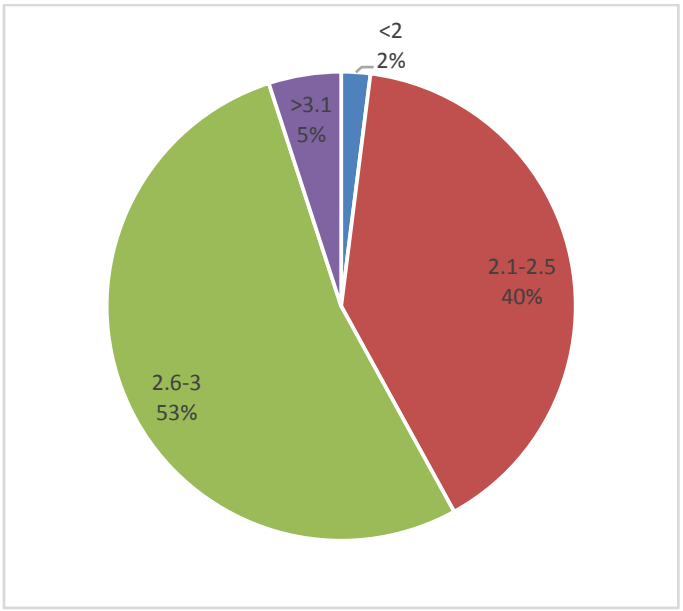


Fig 12: Birth weight distribution of all neonates.

Associated co-morbidities in all participating subjected were notified, it was found most of the participants 83 (83%) did not have any co-morbidities. The pre-term labour with 7 (7%) patients followed by Pre-eclampsia in 4 (4%) patients was recorded in the study (Table 13, Fig 13).

Table 13: Observed co-morbidities in all participants

ASSOCIATED CO-MORBIDITY	Frequency	Percent
Cardiogenic Shock	1	1.0%
HELPP Syndrome	1	1.0%
Postpartum hemorrhage	1	1.0%
Pre-eclampsia	4	4.0%
Pre-term labour	7	7.0%
Pulmonary edema	2	2.0%
Tachyarrhythmia	1	1.0%
Nil	83	83.0%
Total	100	100.0%

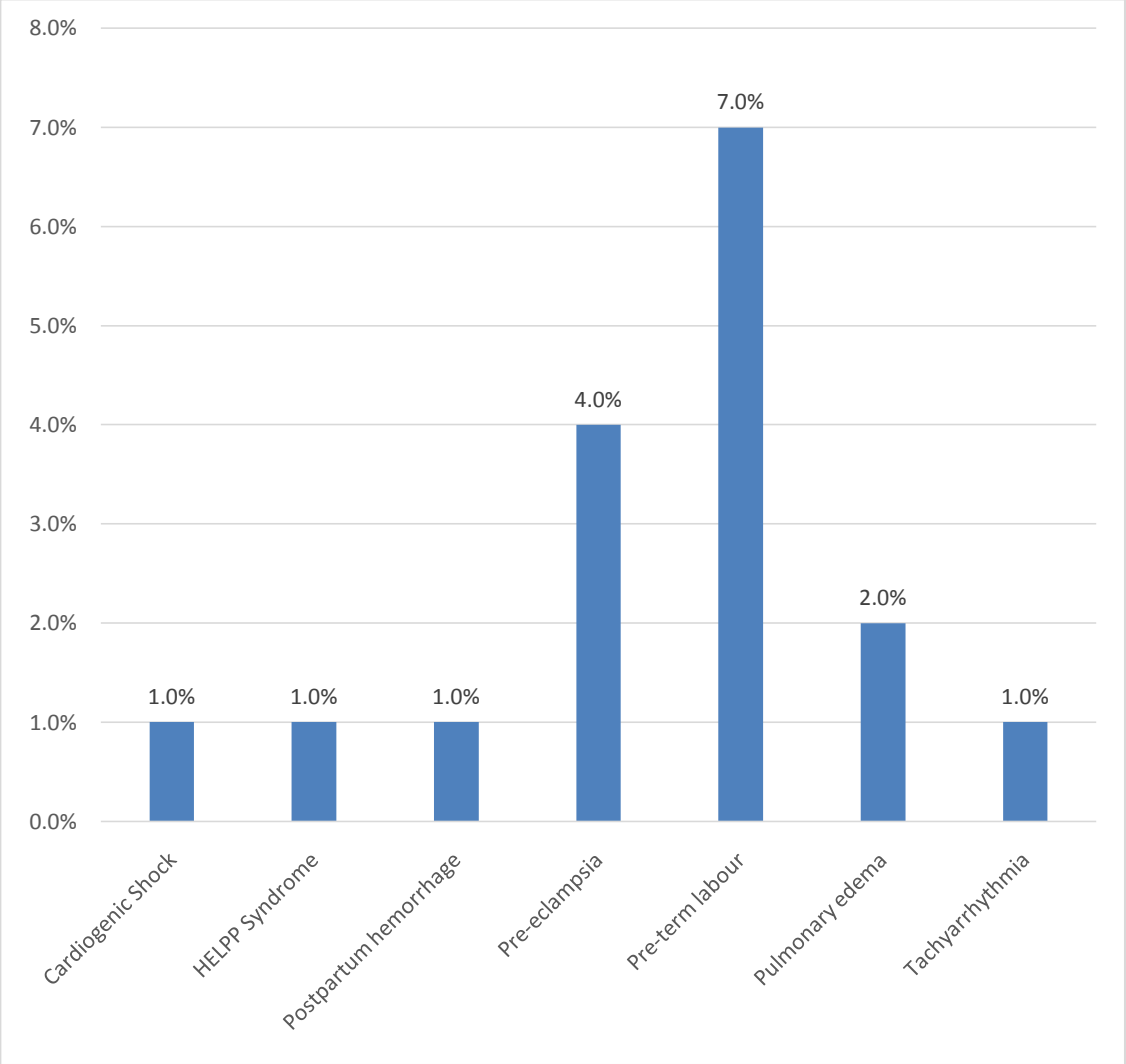


Fig 13: Observed co-morbidities in all participants

Requirement of NICU admission was also recorded among all neonates, in the current study 18 (18%) required NICU admission whereas 82 (82%) did not require NICU admission (Table 14, Fig 14)

Table 14: Observation of NICU admission

NICU ADMISSION	Frequency	Percent
No	82	82.0%
Yes	18	18.0%
Total	100	100.0%

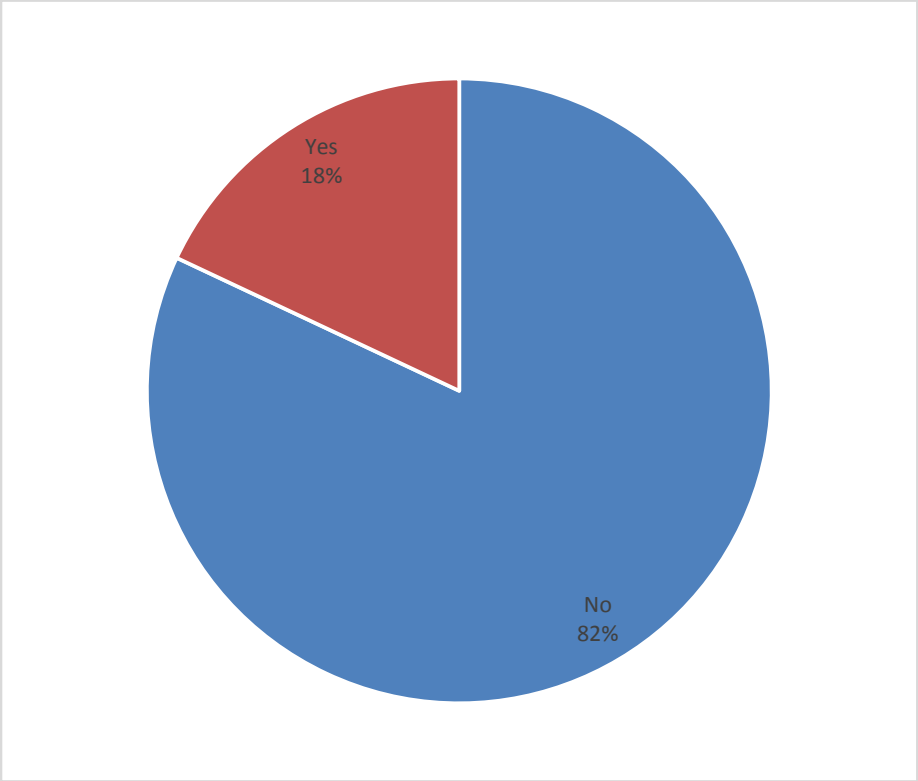


Fig 14: Observation of NICU admission

The foetal outcome was evaluated in all cases in our study. A good foetal outcome was observed in 74 (74%) followed by birth asphyxia was observed in 9 (9%) patients and Preterm in 7 (7%) patients (Table 15, Fig 15).

Table 15: Observation of foetal outcome in cases

FETAL OUTCOME	Frequency	Percent
Birth asphyxia	9	9.0%
Good fetal/neonatal outcome	74	74.0%
Meconium aspiration	2	2.0%
Preterm	7	7.0%
Respiratory distress syndrome	5	5.0%
Small for gestational age	3	3.0%
Total	100	100.0%

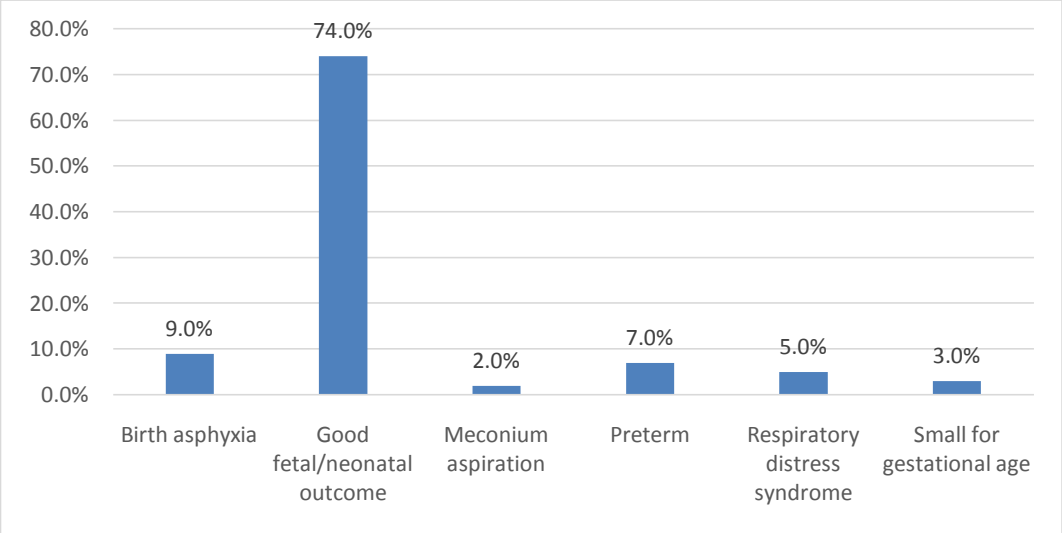


Fig 15: Observation of foetal outcome in cases

In the present study 4(4%) neonates were observed with congenital heart disease whereas 96 (96%) were found without congenital heart disease (Table 16, Fig 16)

Table 16: Observation of Congenital heart disease in Neonates

Neonates with congenital heart disease	Frequency	Percent
Yes	4	4.0%
No	96	96.0%

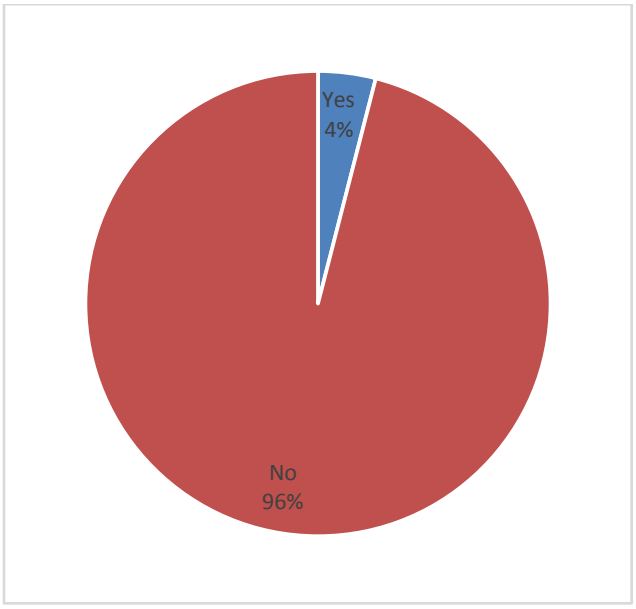


Fig 16: Observation of Congenital heart disease in Neonates

All maternal outcomes were recorded in the present study, it was found that 76 (76%) subjects with safe delivery followed by accidentally diagnosed heart disease during pregnancy in 14 (14%) patients and PPCM recovered in 12 (12%) patients. No mortality and Infective endocarditis were reported in the present study (Table 17, Fig 17).

Table 17: Observation of maternal outcomes in volunteers

MATERNAL OUTCOME	Frequency	Percent
Safe delivery	76	76.0%
Procedure for MVR/AVB	8	8.0%
Treatment for embolic complication	6	6.0%
PPCM recovered	12	12.0%
Accidentally diagnosed heart disease during pregnancy	14	14.0%
Mortality due to cardiac failure	5	5.0%
Infective endocarditis	0	0.0%
Mechanical ventilation	9	9.0%
Arrhythmia/Pulmonary edema	4	4.0%

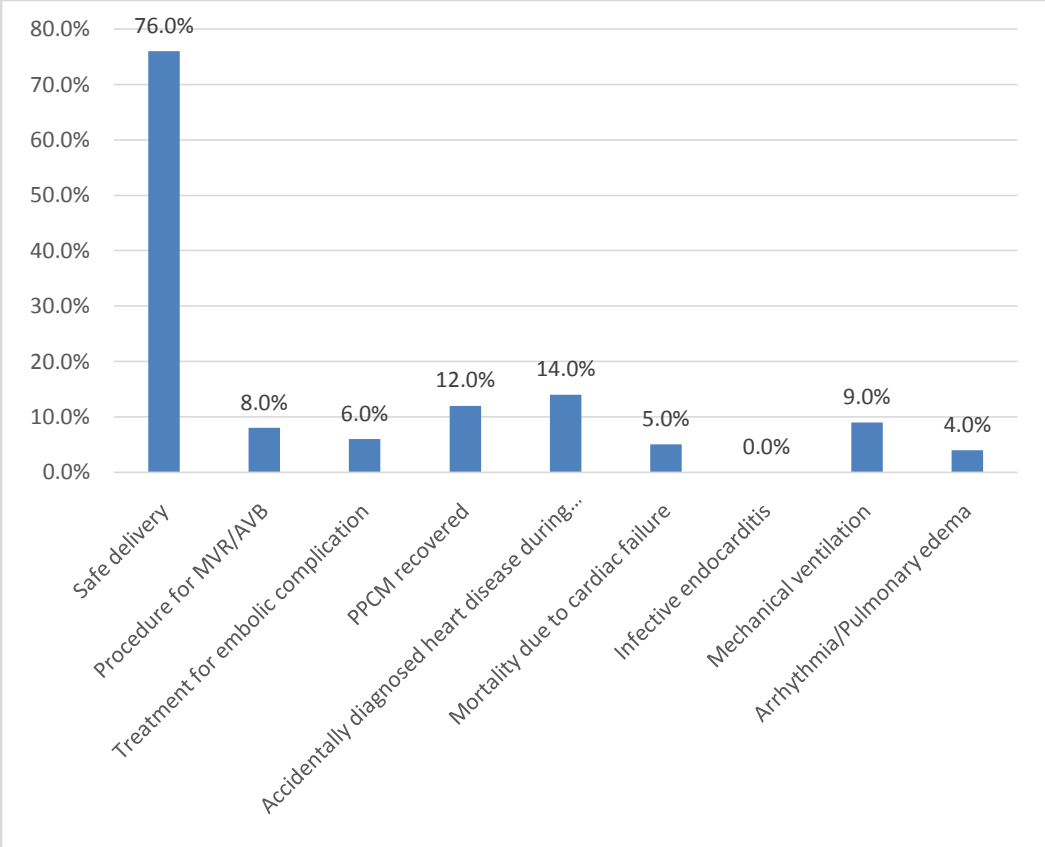


Fig 17: Observation of maternal outcomes in volunteers

DISCUSSION

There is an increased prevalence of heart disease has been found in pregnant women, due to increase age at first pregnancy, increasing the prevalence of diabetes, hypertension, obesity and also due to marked improvement in the treatment of congenital heart disease.[63] Prevalence of heart disease in pregnancy is found to vary between 0.3-3.5%.[64] Heart diseases are now the leading cause of indirect maternal deaths accounting for 20.5% of all cases.[65] Hence the current study is designed to provide an insight into the changing patterns and outcomes of this ever-increasing and life-threatening condition at a tertiary care centre of South India to find out prevalence, the spectrum of disorder and outcome in pregnancy with heart disease.

In the present study total, 100 pregnant women participated, and a maximum number of women were observed in the age group of 21 to 25 years and 26 to 30 years each with 35 (35%), followed by an age group of 31 to 35 years with 14 (14%) patients. The minimum number of women were observed in the age group of fewer than 20 years, 7 (7%). In the present study, 77% of patients were below the age of 31 years. **Regitz-Zagrosek[63] et al.** also reported similar findings in their study.

All the participants were classified based on their qualifications, it was found that the maximum number of patients were high school pass 49 (49%), followed by primary educated 21 (21%) and 13 (13%) patients were found to be middle school and postgraduate each. Only 1(1%) patients were reported uneducated in the current study. A similar observation has also been reported by earlier studies.[66]

In the present study 91 (91%) were found to house wives and only 4 (4%) were reported to be coolie. These findings in present is been reported by the number of other studies where the majority of the mothers were found to be housewives.[67] Of 100 participating women 74 (74%) women were reported to be living below the poverty line whereas 26 (26%) of women were found to be surviving above the poverty line. These findings are comparable to other reported studies.[68]

In the present study, multi-term delivery was observed significantly higher 65 (65%) than primi 35 (35%). **Stangl[69] et al** also reported the predominance of multi-term delivery women in their study.

All patients were categorised based on their NYHA class, it was observed that a maximum number of patients 52 (52%) were found in class I, followed by class II 41 (41%) and at least 3 (3%) patients were

observed in class III. **Bhatia[70] et al** also reported a similar finding in their study.

In the present study, all the participating women were further observed for different heart diseases. The most common heart disease was reported to be rheumatoid heart disease 55 (55%), followed by congenital heart disease 26 (26%) and only 2 (2%) patients were found with complete heart block. **Nqayana[71] et al** in their study also found maximum patients with rheumatoid heart disease in their study.

RHD lesions were observed in all patients, it was found that MS/MR lesion shown by maximum patients 21 (38.2%), followed by isolated MS 12 (21.8%), and isolated MR 10 (18.2%). **Arnoni[72]**et al in their study reported Mitral stenosis as a major (40%) RHD lesion.

In the present study incidences of congenital heart disease (CHD) was examined in all patients. The ASD was observed in a maximum number of patients 18 (69.2%) followed by Pulmonary valve stenosis and Bicuspid Aortic Valve Disease each with 4 (15.4%). In another study, a total of 1321 cases were studied and 65.85% of the patients, had surgical intervention done 579 for congenital lesion and 291 valvular interventions.[73]

The mode of delivery was also evaluated in all participating women, it was observed that 73 (73%) delivery were normal vaginal deliveries whereas only 27 (27%) deliveries were LSCS. The percentage of instrumental vaginal deliveries (23.06%) was higher among cases that are fairly justified in an attempt to cut short the second stage of labour. Though some studies showed a lower rate of vaginal delivery in 45.2% cases and caesarean delivery in 54.8%[74]two other studies mentioned a higher rate of vaginal delivery (53% and 46.6%). The Previous LSCS was reported to be the major indicator 9 (33.3%) for LSCS delivery in the present study.[69] **IE Prophylaxis given to all mothers with heart valve disease, previous valvular surgery, congenital heart disease, intravenous drug users and previous history of IE.**

Drug	Dose	Duration	Notes
1st choice options			
Amoxicillin	***Adults:*** 2g oral or IV ***Children:*** 50mg/kg oral or IV (max. 2g)	Single dose, 30-60minutes pre-procedure	• Avoid in penicillin allergy. • Oral suspension available as 250mg/5ml (2g=40mls)
2nd choice options (for penicillin allergy)			
Clindamycin	***Adults:*** 600mg oral or IV ***Children:*** 20mg/kg oral or IV (max. 600mg)	Single dose, 30-60minutes pre-procedure	

Type of delivery among patients was also evaluated, the Outlet forceps was found in maximum patients 49 (49%), followed by emergency delivery 20 (20%) and labour natural in 18 (18%) patients. These findings in the present study are in agreement with earlier reported studies.[75]

In the current study, most of the neonates 53 (53%) were found to have a birth weight between 2.6 to 3 kg followed by 2.1 to 2.6 kg in 40 (40%) neonates. Only 2% of neonates were found to have a birth weight of less than 2 kg. **Stangl[76] et al** in their study reported birth weight of less than 2.5 kg in 16.7% of cases.

The associated co-morbidity among participating patients were examined and it was found that 83 (83%) of patients did not have any associated co-morbidity. Pre-term labour was observed in 7 (7%) of patients and Pre-eclampsia was reported in 4 (4%) of patients. These findings in the present study are comparable to other reported studies.[77]

In the present study, only 18 (18%) neonates required NICU admission whereas most of 82 (82%) neonates did not need NICU admission. This finding in the present study is similar to earlier reported study.[78]

The fetal outcome in all participating women was evaluated in the present study. It was observed that the maximum neonates 74 (74%) were born well without any complications. However 9 (9%) neonates were born with birth asphyxia and 7 (7%) were born pre-term. There is no neonatal death observed in the present study. **Puri[79] et al**., in their study, reported 86% neonates with live birth and 14% stillbirth.

The present study reported 4 (4%), neonates, with congenital heart disease, whereas **Khurseed[77]et al** recorded 13% inheritance of congenital heart disease in the newborn in their study.

The maternal outcome was finally evaluated in all subjects, and 76 (76%) women reported safe delivery, followed by accidentally diagnosed heart disease during pregnancy in 14 (14%) women, PPCM recovered in 12 (12%) subjects. No subjects were observed with Infective endocarditis in our study. Further, no maternal death was reported in our study. However, with the increase in the prevalence of heart diseases in pregnant women, it has emerged as an important cause of maternal mortality, especially in developing countries. **Konar[80] et al.** stated that heart diseases associated with pregnancy accounted for 15% of pregnancy-related mortality.

SUMMARY

- Total 100 women were enrolled for the present study and maximum women were found in the age group of 26 to 30 years and 21 to 25 years each with 35 (35%)
- The obstetric score of all 100 women was carried out and it was observed that 65 (65%) women were multi-gravida whereas only 35 (35%) were reported to be primi
- NYHA class, it was observed that maximum women were in class I category 52(52%), followed by class II 41 (41%) and minimum patients were reported in class III 3 (3%)
- The maximum patients were observed with Rheumatic heart disease 55 (55%), followed by congenital heart disease 26 (26%) and least subjects2 (2%) were observed with a complete heart attack
- RHD lesion, it was found that maximum patients 21 (38.2%) were reported with MS/MR RHD lesion,
- CHD, 69 (69%) patients were observed with ASD, followed by pulmonary valve stenosis and Bicuspid Aortic Valve Disease each with 4 (15.4%) patients

- In the present study 73 (73%) women were observed with normal vaginal delivery whereas 27 (17%) women were reported with caesarean delivery
- Of all 100 subjects, 49 (49%) were observed with Outlet forceps delivery, followed by emergency delivery with 20 (20%) subjects and natural delivery in 18 (18%) participants
- Maximum neonates 53 (53%) were observed in the range of 2.6 to 3 kg, followed by 2.1 to 2.5 kg in 40 (40%)
- A good foetal outcome was observed in 74 (74%) followed by birth asphyxia was observed in 9 (9%) patients and Preterm in 7 (7%) patients
- 4(4%) neonates were observed with congenital heart disease
- 76 (76%) subjects with safe delivery followed by accidentally diagnosed heart disease during pregnancy in 14 (14%) patients and PPCM recovered in 12 (12%) patients.

CONCLUSION

Rheumatic heart disease is the predominant lesion followed by congenital heart disease. The incidence of RHD for years has continued to be higher, as most of the patients belonged to low socioeconomic class where poverty, poor nutrition, low level of sanitation and hygiene and inaccessibility to health services are common. In pregnancies complicated with cardiac disorders, maternal and perinatal mortality and morbidity depends on the type of disorder, the functional status of the patient and the complications associated with the pregnancy. Hence multidisciplinary approach has been done with the obstetricians, cardiologists, anaesthetist and neonatologists and early diagnosis, treatment and proper follow up is done and mortality has been reduced.

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IP NO.	Name	Age (year)		Qualification	Occupation	Socio-Economic	Height	Weight	Heart Rate	Blood Pressure	Respiratory Rate	Obstetric Score	D1 PATIENT SYMPTOMS - N	HEART DISEASE
1	Mala	29	3	HigherSecondary	Housewife	Above Poverty Line	156	72	80	110/80	16	Multi	Class I	Mitral valve prolapse
2	Mariyam vinothin	23	2	Primary School	Housewife	Below Poverty Line	152	56	89	100/60	18	Multi	Class II	Rheumatic heart disease
3	Sneha	19	1	Primary School	Housewife	Below Poverty Line	159	52	86	110/60	16	Primi	Class III	Rheumatic heart disease
4	Revathy	31	4	Primary School	Housewife	Below Poverty Line	159	52	86	110/60	16	Multi	Class II	Congenital heart diseases
5	Abhirami	26	3	Primary School	Housewife	Below Poverty Line	158	46	86	110/78	16	Multi	Class I	Congenital heart diseases
6	Shanmugapriya	33	4	Primary School	Housewife	Below Poverty Line	156	67	88	120/80	16	Multi	Class I	Rheumatic heart disease
7	Rukumani	37	5	Primary School	Housewife	Below Poverty Line	149	41	142	100/69	36	Multi	Class I	Complete heart block
8	Gowri	25	2	HigherSecondary	Housewife	Below Poverty Line	156	64	86	110/80	16	Multi	Class II	Rheumatic heart disease
9	Malliga	41	5	Primary School	Housewife	Below Poverty Line	161	54	92	117/80	16	Multi	Class II	Rheumatic heart disease
10	Santhanamalar	23	2	Primary School	Housewife	Below Poverty Line	150	53	92	100/60	20	Primi	Class I	Congenital heart diseases
11	Ganga	27	3	Middle School	Housewife	Below Poverty Line	163	58	80	110/80	16	Multi	Class I	Rheumatic heart disease
12	Ishwarya	25	2	HighSchool	Housewife	Below Poverty Line	151	48	80	110/80	16	Multi	Class I	Rheumatic heart disease
13	Saranya	27	3	Undergraduate	Housewife	Above Poverty Line	158	56	80	110/80	16	Multi	Class II	Rheumatic heart disease
14	Selvalakshmi	26	3	HigherSecondary	Housewife	Below Poverty Line	165	52	98	110/60	16	Multi	Class I	Congenital heart diseases
33	Nandhini	25	2	HigherSecondary	Housewife	Above Poverty Line	153	58	98	110/80	16	Multi	Class I	Congenital heart diseases
16	Sudha	28	3	Undergraduate	Housewife	Above Poverty Line	162	54	88	110/60	16	Multi	Class II	Mitral valve prolapse
17	Kalpana	29	3	HigherSecondary	Housewife	Below Poverty Line	149	46	88	110/60	16	Multi	Class II	Rheumatic heart disease
18	Yogalakshmi	27	3	Middle School	Housewife	Below Poverty Line	158	46	98	110/80	16	Multi	Class I	Rheumatic heart disease
19	Tamilarasi	37	5	Primary School	Housewife	Below Poverty Line	160	58	96	110/6	16	Multi	Class I	Rheumatic heart disease
20	Rosy	22	2	Primary School	Housewife	Below Poverty Line	150	58	86	110/80	16	Primi	Class I	Rheumatic heart disease
21	Revathy	31	4	HighSchool	Housewife	Below Poverty Line	150	63	80	110/80	16	Multi	Class I	Rheumatic heart disease
35	Menaga	27	3	Postgraduate	Housewife	Above Poverty Line	148	62	84	100/60	16	Multi	Class I	Congenital heart diseases
23	KaliYammal	29	3	HigherSecondary	Housewife	Below Poverty Line	156	58	86	100/70	16	Multi	Class II	Rheumatic heart disease
24	Poongodi	32	4	HigherSecondary	Housewife	Below Poverty Line	158	50	80	100/80	16	Multi	Class I	Mitral valve prolapse
36	Jeyalakshmi	32	4	Primary School	Housewife	Below Poverty Line	156	46	124	100/80	16	Primi	Class II	Congenital heart diseases
26	Priyanka	27	3	Postgraduate	Teacher	Above Poverty Line	152	47	86	110/60	16	Multi	Class II	Rheumatic heart disease
27	Thenmozhi	35	4	Primary School	Housewife	Below Poverty Line	136	33	84	100/60	20	Multi	Class I	Rheumatic heart disease
28	KEERTHANA	24	2	HigherSecondary	Housewife	Above Poverty Line	156	56	80	110/60	16	Primi	Class II	Rheumatic heart disease
29	Jeyalakshmi	21	2	HighSchool	Housewife	Below Poverty Line	155	62	60	100/60	16	Primi	Class II	Rheumatic heart disease
30	LAKSHMI	30	3	Primary School	Housewife	Below Poverty Line	156	50	86	100/60	16	Multi	Class IV	Peripartum cardiomyopathy
31	Indumathi	27	3	Middle School	Housewife	Below Poverty Line	143	50	88	110/80	16	Multi	Class II	Rheumatic heart disease
32	Santhiya	29	3	HigherSecondary	Housewife	Above Poverty Line	152	59	80	150/90	16	Multi	Class II	Mitral valve prolapse
37	Senthamil selvi	29	3	Primary School	Housewife	Below Poverty Line	146	52	80	100/80	16	Primi	Class I	Congenital heart diseases
38	Maheswari	39	5	Middle School	Housewife	Below Poverty Line	168	90	86	100/80	16	Multi	Class I	Congenital heart diseases
44	Sivakalai	32	4	HigherSecondary	Housewife	Below Poverty Line	155	50	128	100/80	16	Multi	Class I	Congenital heart diseases
48	Jannathul firthose	21	2	HigherSecondary	Housewife	Below Poverty Line	151	40	88	110/70	16	Primi	Class I	Congenital heart diseases
52	Anjalai	32	4	Primary School	Housewife	Below Poverty Line	160	61	88	110/70	16	Multi	Class I	Congenital heart diseases
60	Dharanya	20	1	HigherSecondary	Housewife	Below Poverty Line	157	50	82	100/60	16	Primi	Class I	Congenital heart diseases
39	Ramya	26	3	HigherSecondary	Housewife	Below Poverty Line	163	69	88	100/80	16	Multi	Class I	Rheumatic heart disease
40	Kokila	21	2	HighSchool	Housewife	Below Poverty Line	162	49	86	100/70	16	Primi	Class II	Mitral valve prolapse
41	Thavamani	25	2	HigherSecondary	Housewife	Below Poverty Line	150	40	90	120/70	24	Primi	Class I	Rheumatic heart disease
42	Sangeetha	20	1	HigherSecondary	Housewife	Above Poverty Line	142	44	86	100/70	19	Primi	Class II	Mitral valve prolapse
43	Nagamani	23	2	HigherSecondary	Housewife	Below Poverty Line	150	50	86	100/70	18	Multi	Class I	Rheumatic heart disease
70	Kanagavalli	26	3	HigherSecondary	Housewife	Below Poverty Line	146	50	104	110/70	18	Primi	Class I	Congenital heart diseases
45	Muthamil selvi	32	4	Undergraduate	Housewife	Above Poverty Line	158	60	68	120/70	16	Multi	Class I	Mitral valve prolapse
46	Pushpa	19	1	HigherSecondary	Housewife	Below Poverty Line	150	56	80	110/70	16	Primi	Class I	Rheumatic heart disease
47	Ruthra	26	3	Middle School	Housewife	Below Poverty Line	148	68	86	110/80	16	Multi	Class II	Rheumatic heart disease

75	Uma	35	4	Primary School	Housewife	Below Poverty Line	153	60	128	130/80	20	Multi	Class II	Congenital heart diseases
90	Kalaiarasi	21	2	Postgraduate	Housewife	Above Poverty Line	162	60	84	100/70	16	Primi	Class I	Congenital heart diseases
93	Chinammal	29	3	Primary School	Housewife	Below Poverty Line	162	58	80	110/80	16	Multi	Class I	Congenital heart diseases
51	Annakamatchi	30	3	HighSchool	Housewife	Below Poverty Line	160	60	88	100/80	16	Multi	Class I	Complete heart block
50	Anjalai devi	21	2	HigherSecondary	coolie	Below Poverty Line	155	60	88	110/80	16	Primi	Class II	Congenital heart diseases
53	Mitral regurgitation s ramya	19	1	HighSchool	Housewife	Below Poverty Line	157	62	88	110/70	16	Primi	Class II	Rheumatic heart disease
54	Vijayalakshmi	35	4	Primary School	Housewife	Below Poverty Line	165	70	88	110/70	19	Multi	Class II	Mitral valve prolapse
55	Dhanalakshmi	34	4	HigherSecondary	Housewife	Below Poverty Line	143	70	88	110/70	18	Multi	Class II	Rheumatic heart disease
56	Sangeetha	22	2	HigherSecondary	Housewife	Below Poverty Line	153	50	88	110/70	16	Primi	Class I	Rheumatic heart disease
57	Monisha	24	2	HigherSecondary	Housewife	Below Poverty Line	155	67	88	110/78	16	Multi	Class II	Rheumatic heart disease
58	Saraswathi	21	2	HighSchool	Housewife	Below Poverty Line	155	40	90	119/70	16	Primi	Class II	Rheumatic heart disease
59	Venilla	27	3	Primary School	Housewife	Below Poverty Line	155	62	78	110/70	18	Multi	Class II	Rheumatic heart disease
25	Vinodha	23	2	Postgraduate	lecturer	Above Poverty Line	158	53	80	100/80	16	Primi	Class I	Congenital heart diseases
34	Keethasree	21	2	HigherSecondary	Housewife	Above Poverty Line	154	63	106	110/80	16	Primi	Class II	Congenital heart diseases
62	Annaikodi	36	5	Middle School	Housewife	Below Poverty Line	140	56	78	110/70	16	Multi	Class II	Rheumatic heart disease
63	Kasturi	25	2	Middle School	Housewife	Below Poverty Line	150	57	88	110/79	16	Multi	Class I	Rheumatic heart disease
64	Anish raihana	25	2	Postgraduate	Housewife	Above Poverty Line	147	25	82	110/72	16	Primi	Class II	Rheumatic heart disease
65	PAPATHY	36	5	Uneducated	coolie	Below Poverty Line	153	58	86	110/70	16	Multi	Class II	Rheumatic heart disease
66	Maruthambal	40	5	HigherSecondary	coolie	Below Poverty Line	147	40	88	110/70	18	Multi	Class III	Peripartum cardiomyopathy
67	Periyammal	21	2	HigherSecondary	Housewife	Below Poverty Line	160	58	82	120/70	18	Primi	Class I	Mitral valve prolapse
68	Rasathi	27	3	HigherSecondary	Housewife	Above Poverty Line	150	58	92	110/70	18	Multi	Class I	Rheumatic heart disease
69	Chitra	42	5	Middle School	Housewife	Below Poverty Line	152	50	60	110/80	18	Multi	Class II	Rheumatic heart disease
61	SANTHIYA	22	2	Postgraduate	Housewife	Above Poverty Line	154	54	86	110/80	16	Primi	Class II	Congenital heart diseases
71	Saranya	28	3	Middle School	Housewife	Below Poverty Line	159	60	80	110/70	16	Multi	Class I	Mitral valve prolapse
72	Dhanapriya	25	2	Postgraduate	Housewife	Above Poverty Line	158	70	84	110/80	16	Multi	Class I	Rheumatic heart disease
73	Backialakshmi	27	3	Postgraduate	Housewife	Above Poverty Line	153	51	86	120/80	16	Multi	Class I	Mitral valve prolapse
74	Gangadevi	30	3	HighSchool	Housewife	Below Poverty Line	144	52	86	110/60	16	Multi	Class I	Rheumatic heart disease
22	Dhanalakshmi	20	1	Middle School	Housewife	Above Poverty Line	153	53	80	110/80	18	Primi	Class I	Congenital heart diseases
76	Mahalakshmi	29	3	HigherSecondary	Housewife	Below Poverty Line	149	60	68	110/70	16	Multi	Class I	Mitral valve prolapse
77	Ambika	22	2	HigherSecondary	Housewife	Below Poverty Line	146	50	80	110/80	16	Primi	Class IV	Rheumatic heart disease
78	Valarmathy	27	3	Primary School	Housewife	Below Poverty Line	150	60	76	110/80	16	Primi	Class II	Rheumatic heart disease
79	Vijayakumari	26	3	Postgraduate	Staff nurse	Above Poverty Line	153	65	96	110/70	16	Primi	Class I	Rheumatic heart disease
80	JELSIYA JOSEPHINE	24	2	HigherSecondary	Lab technician	Above Poverty Line	155	70	84	110/80	16	Primi	Class II	Rheumatic heart disease
81	Esther	27	3	HigherSecondary	Housewife	Below Poverty Line	151	84	74	130/80	16	Multi	Class II	Rheumatic heart disease
82	ANJALA MERCY	23	2	HigherSecondary	Housewife	Below Poverty Line	154	75	66	110/60	16	Primi	Class I	Rheumatic heart disease
83	Banupriya	28	3	Primary School	Housewife	Below Poverty Line	156	60	66	110/70	16	Multi	Class I	Rheumatic heart disease
84	Kamatchi	27	3	HigherSecondary	Housewife	Below Poverty Line	154	60	66	120/70	18	Multi	Class I	Rheumatic heart disease
85	Selvarani	28	3	HighSchool	Housewife	Below Poverty Line	145	58	60	110/80	16	Multi	Class II	Rheumatic heart disease
86	Nandhini	23	2	HigherSecondary	Housewife	Below Poverty Line	156	55	86	110/69	16	Primi	Class III	Rheumatic heart disease
87	Nathiya	27	3	HigherSecondary	coolie	Below Poverty Line	150	39	90	110/80	20	Multi	Class I	Rheumatic heart disease
88	Kalanjium	27	3	Middle School	Housewife	Below Poverty Line	144	55	86	110/70	16	Multi	Class IV	Rheumatic heart disease
89	Sharmiladevi	24	2	Postgraduate	Housewife	Above Poverty Line	162	65	98	150/100	45	Multi	Class II	Mitral valve prolapse
49	Rohini	27	3	Postgraduate	Housewife	Above Poverty Line	146	50	80	110/70	20	Primi	Class I	Congenital heart diseases
91	Latha	21	2	HighSchool	Housewife	Below Poverty Line	164	40	120	110/60	36	Primi	Class II	Peripartum cardiomyopathy
92	satheeshwari	31	4	Postgraduate	Housewife	Above Poverty Line	176	52	104	120/70	24	Multi	Class II	Peripartum cardiomyopathy
96	Punitha	25	2	HigherSecondary	Housewife	Below Poverty Line	146	45	80	110/70	16	Multi	Class II	Congenital heart diseases
94	Bhavadharini	18	1	HigherSecondary	Housewife	Below Poverty Line	145	48	88	110/70	16	Primi	Class II	Rheumatic heart disease
95	Jasmine sharmila	25	2	HigherSecondary	Housewife	Below Poverty Line	152	55	88	120/70	16	Multi	Class I	Rheumatic heart disease
15	Vijayalakshmi	24	2	HigherSecondary	Housewife	Below Poverty Line	150	47	80	120/80	16	Multi	Class I	Congenital heart diseases
97	Josephin sharmila	36	5	Middle School	Tailor	Above Poverty Line	156	58	88	100/60	16	Multi	Class I	Rheumatic heart disease
98	Anbarasi	23	2	HigherSecondary	Housewife	Below Poverty Line	154	60	86	90/60	16	Multi	Class II	Rheumatic heart disease
99	Anjana	34	4	Postgraduate	Housewife	Above Poverty Line	154	56	160	100/80	16	Multi	Class IV	Congenital heart diseases
100	Rampriya	25	2	Middle School	Housewife	Below Poverty Line	151	57	98	110/70	16	Primi	Class I	Rheumatic heart disease

LESION	MODE OF DELIVERY	TYPE	INDICATION FOR LSCS	BIRTH WEIGHT		OUTCOME	NICU ADMISSION	FETAL OUTCOME
Mitral regurgitation	Vaginal delivery	Labour natural		2.6	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	LSCS	Emergency	Cephalopelvic Disproportion	2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	LSCS	Elective	Cephalopelvic Disproportion	2.5	2.0	Postpartum hemorrhage	Yes	Birth asphyxia
Atrial septal defect	Vaginal delivery	Labour natural		2.6	**3.00**	NIL	No	Nil
Atrial septal defect	Vaginal delivery	Spontaneous expulsion		2.8	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	LSCS	Emergency	Previous LSCS	2.7/2.2	2	NIL	No	Good fetal/neonatal outcome
Mitral regurgitation	Vaginal delivery	Labour natural		2.7	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	Vaginal delivery	Outlet forceps		2.6	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.8	**3.00**	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Outlet forceps		2.8	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	LSCS	Emergency	Oligohydraminos	2.6	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	LSCS	Emergency	Cephalopelvic Disproportion	3.25	4.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosiss/Mitral regurgitation mi	Vaginal delivery	Outlet forceps		2.9	**3.00**	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	Yes	Small for gestational age
Atrial septal defect	Vaginal delivery	Outlet forceps		2.2	2.0	NIL	No	Nil
Mitral regurgitation	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.6	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation /Aortic regugitation/Tricuspid valve	LSCS	Emergency	Oligohydraminos	2.4	2.0	NIL	Yes	Birth asphyxia
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.75	**3.00**	NIL	No	Nil
Mitral regurgitation/cuspid Regurgitation	Vaginal delivery	Outlet forceps		2	1	NIL	No	Good fetal/neonatal outcome
Mitral regugitation /Aortic regugitation	LSCS	Emergency	Previous LSCS	2.5	2.0	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	LSCS	Elective	Oligohydraminos	3.3	4.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	LSCS	Emergency	Cephalopelvic Disproportion	2.6	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral regurgitation	Vaginal delivery	Outlet forceps		3	**3.00**	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Outlet forceps		**2.5**	2.0	HELPP Syndrome	**Yes**	Birth asphyxia
Mitral regugitation /cuspid Regurgitation	LSCS	Elective	Previous LSCS	**2.53**	**3.00**	NIL	No	Nil
Mitral regugitation /cuspid Regurgitation	LSCS	Emergency	Oligohydraminos	2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral regugitation /cuspid Regurgitation	Vaginal delivery	Outlet forceps		2.7	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral regurgitation / Pulmonary hypertension	Vaginal delivery	Outlet forceps		2.7	**3.00**	NIL	No	Good fetal/neonatal outcome
Peripartum cardiomyopathy	LSCS	Emergency	Previous LSCS	2.5	2.0	Pre-term labour	No	Preterm
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.6	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral valve prolapse	Vaginal delivery	Outlet forceps		2.8	**3.00**	Pre-eclampsia	Yes	Respiratory distress syndrome
Atrial septal defect	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Outlet forceps		**3**	**3.00**	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Labour natural		3	**3.00**	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Outlet forceps		2.25	2.0	NIL	Yes	Respiratory distress syndrome
Atrial septal defect	Vaginal delivery	Labour natural		2.6	**3.00**	NIL	No	Nil
Atrial septal defect	Vaginal delivery	Labour natural		2.8	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	Vaginal delivery	Outlet forceps		2.7	**3.00**	NIL	No	Nil
Mitral regurgitation	Vaginal delivery	Spontaneous expulsion		4	4.0	Pre-term labour	No	Preterm
Mitral regurgitation	Vaginal delivery	Outlet forceps		3	**3.00**	NIL	No	Nil
Mitral valve prolapse	Vaginal delivery	Outlet forceps		3	**3.00**	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Labour natural		2.3	2.0	NIL	No	Nil
Atrial septal defect	Vaginal delivery	Outlet forceps		2.4	2.0	NIL	No	Nil
Mitral valve prolapse	Vaginal delivery	Labour natural		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral regurgitation//Tricuspid valve	LSCS	Emergency	Fetal distress	2.5	2.0	NIL	No	Nil
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Labour natural		2.5	2.0	Pre-term labour	No	Preterm

Atrial septal defect	Vaginal delivery	Outlet forceps		3	3.00	Pre-eclampsia	Yes	Respiratory distress syndrome
Atrial septal defect	Vaginal delivery	Outlet forceps		2.6	3.00	NIL	No	Good fetal/neonatal outcome
Atrial septal defect	Vaginal delivery	Spontaneous expulsion		2.75	3.00	NIL	No	Nil
Mitral valve prolapse	LSCS	Emergency	Previous LSCS	2.3	2.0	NIL	No	Nil
Atrial septal defect/Mitral regurgitation	Vaginal delivery	Labour natural		2.8	3.00	Pulmonary edema	Yes	Respiratory distress syndrome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.3	2.0	NIL	Yes	Birth asphyxia
Mitral valve prolapse	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation Pulmonary hypertension	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	LSCS	Emergency	Previous LSCS	2.7	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	LSCS	Emergency	Fetal distress	2.8	3.00	Pre-term labour	No	Preterm
Atrial septal defect/Tricuspid valve/Pulmonary hypertension	Vaginal delivery	Outlet forceps		3	3.00	NIL	No	Good fetal/neonatal outcome
Bicuspid Aortic Valve Disease/Aortic stenosis	LSCS	Emergency	Failed induction	3	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation /Aortic regugitation/ Pulmonary hypertension	LSCS	Emergency	Previous LSCS	3	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Assisted breech		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/ Mitral regurgitation//Tricuspid valve / Pulmonary hypertension	Vaginal delivery	Outlet forceps		3	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Aortic regugitation Pulmonary hypertension	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Left ventricular dysfunction	LSCS	Emergency	Cephalopelvic Disproportion	2.3	2.0	NIL	Yes	Small for gestational age
Mitral valve prolapse	Vaginal delivery	Labour natural		3.2	4.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Tricuspid valve / Pulmonary hypertension	Vaginal delivery	Outlet forceps		2.7	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Labour natural		2.25	2.0	NIL	No	Good fetal/neonatal outcome
Bicuspid Aortic Valve Disease/Aortic stenosis	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral valve prolapse/Mitral regurgitation	Vaginal delivery	Outlet forceps		3	3.00	NIL	No	Good fetal/neonatal outcome
Mitral regurgitation	Vaginal delivery	Outlet forceps		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Mitral valve prolapse	Vaginal delivery	Labour natural		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	Vaginal delivery	Assisted breech		2.75	3.00	NIL	No	Nil
Bicuspid Aortic Valve Disease/Ventricular septal defect	LSCS	Emergency	Failed induction	2.2	2.0	NIL	Yes	Respiratory distress syndrome
Mitral valve prolapse/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.4	2.0	NIL	No	Nil
Mitral stenosis/Mitral regurgitation /Aortic regugitation/ Pulmonary hypertension	LSCS	Emergency	Oligohydraminos	2.8	3.00	Cardiogenic Shock	Yes	Birth asphyxia
Mitral stenosis	Vaginal delivery	Spontaneous expulsion		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.25	2.0	NIL	Yes	Birth asphyxia
Mitral valve regurgitation/Mitral regurgitation	LSCS	Elective	Cephalopelvic Disproportion	3	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Aortic regugitation	Vaginal delivery	Outlet forceps		2	1	Pre-eclampsia	Yes	Birth asphyxia
Mitral stenosis/Mitral regurgitation	Vaginal delivery	Labour natural		2.6	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis//Tricuspid valve	Vaginal delivery	Outlet forceps		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Mitral valve regurgitation/Mitral regurgitation	Vaginal delivery	Outlet forceps		2.75	3.00	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	LSCS	Elective	Previous LSCS	2.9	3.00	Pre-term labour	No	Preterm
Mitral stenosis/Mitral regurgitation / Pulmonary hypertension	Vaginal delivery	Outlet forceps		2.8	3.00	Pre-term labour	No	Preterm
Mitral regurgitation/Mitral stenosis//Tricuspid valve	Vaginal delivery	Outlet forceps		2.2/1.8	2	NIL	No	Nil
Mitral stenosis	Vaginal delivery	Labour natural		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral valve prolapse/Mitral regurgitation	LSCS	Emergency	Cephalopelvic Disproportion	2.1	2.0	Pre-eclampsia	Yes	Small for gestational age
Bicuspid Aortic Valve Disease/Ventricular septal defect	Vaginal delivery	Labour natural		2.25	2.0	NIL	Yes	Birth asphyxia
Peripartum cardiomyopathy	Vaginal delivery	Outlet forceps		2.2	2.0	NIL	Yes	Meconium aspiration
	LSCS	Elective	Cephalopelvic Disproportion	3	3.00	Pulmonary edema	No	Good fetal/neonatal outcome
Ebstein anomaly	Vaginal delivery	Outlet forceps		2.3	2.0	Pre-term labour	No	Preterm
Mitral regurgitation / Pulmonary hypertension	Vaginal delivery	Outlet forceps		3.6	4.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis	Vaginal delivery	Labour natural		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Pulmonary valve stenosis	LSCS	Emergency	Previous LSCS	2.5	2.0	NIL	No	Nil
Double-valve replacement	Vaginal delivery	Outlet forceps		2.5	2.0	NIL	No	Good fetal/neonatal outcome
Mitral stenosis/Mitral regurgitation//Tricuspid valve/Pulmonary hypertension	Vaginal delivery	Outlet forceps		2.8	3.00	NIL	No	Good fetal/neonatal outcome
Ventricular septal defect	Vaginal delivery	Labour natural		2.8	3.00	Tachyarrhythmia	No	Good fetal/neonatal outcome
Mitral stenosis	LSCS	Elective	Cephalopelvic Disproportion	2.5	2.0	NIL	Yes	Birth asphyxia