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CARPREG score as predictor of maternal and fetal outcomes in pregnancies complicated by cardiac disease: A prospective observational study

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***Abstract*---**Background: Co-existing cardiac diseases in pregnancy poses unique challenges to anaesthesiologists and obstetricians. Heart diseases are estimated to complicate 1-3% of all pregnancies. It is a major contributing cause of maternal mortality and fetal complications. This study was designed to predict maternal and fetal outcomes in pregnancies complicated by cardiac diseases using Cardiac disease in Pregnancy (CARPREG) score. Aims and Objectives: 1.Predicting maternal mortality and adverse cardiac events during peripartum period using CARPREG score. 2.Evaluating neonatal outcomes in the pregnancies complicated by cardiac diseases. 3.To assess various cardiac conditions complicating pregnancies. Materials and Methods: A prospective observational study was designed to assess maternal and fetal outcomes using CARPREG score in 60 pregnancies complicated by cardiac diseases in the obstetric department of a tertiary care centre in South India between 2019-2021. CARPREG score includes New York Heart Association (NYHA) class, systolic ejection fraction, left ventricular obstruction and history of cardiac events assigning one point for each parameter; maximum being four. CARPREG score is validated for scores 0, 1 and 2 or more than 2 to be associated with cardiac event rates of 5%, 27% and 75%

respectively. Results: Rheumatic heart disease (46.66%) followed by congenital heart diseases (31.66%) were the predominant cardiac diseases. The overall incidence of maternal cardiac events was 28.33%. CARPREG score was 0 in 54 pregnancies (90%) and 1 in 3 pregnancies (5%) and two or more than two in 3 pregnancies (5%). In 3 pregnancies with CARPREG score two or more than two, there was one maternal death and the other two resulted in low neonatal birth weight. The mean neonatal birth weight was 2.8690 ± 0.4992 kg (Mean ± S.D) while it was <2.5 kg for neonates with maternal CARPREG score >1. Maternal congenital heart disease was found to be an independent risk factor for neonatal malformations (1.66%). Perinatal complications were observed in 17% of pregnancies. Conclusion: CARPREG scoring is a reliable tool to predict adverse maternal and fetal outcomes in pregnancies complicated by cardiac diseases. RHD continues to be the commonest cardiac problem among South Indian population.

***Keywords*---**CARPREG score, cardiac disease, maternal outcome, perinatal outcome.

Introduction

Cardiac disease in developing countries remains an important cause of maternal mortality and morbidity. Heart disease is estimated to complicate approximately 1% of all pregnancies[1], and the management of these cases can challenge the entire team providing care to the mother and fetus. As the management and treatment of patients with Congenital Heart Disease (CHD) have improved, there are growing number of women with palliated or corrected CHD surviving into adulthood who may become pregnant. Advanced maternal age along with other risk factors such as obesity had lead to an increase in women presenting with Ischemic Heart Disease (IHD). Cardiomyopathy presenting during pregnancy or in the first few months after delivery is uncommon but accounts for approximately 10% of maternal deaths[2]. Management of pregnancies complicated by heart diseases requires a multidisciplinary team approach, and it should be tailored to the specific needs of the patient. Predicting mortality and morbidity associated with maternal cardiac disease during pregnancy is essential to provide quality medical care. Several risk assessments tools have been proposed to stratify cardiac risks during pregnancy, the most common tools being Cardiac disease in Pregnancy (CARPREG), ZAHARA (Zwangerschap bij vrouwen met een Angeboren HARtAfwikking-II) and Modified World Health Organization Cardiac Risk Assessment Classification[2].

Aim

The aim of this study was to find out the effectiveness of CARPREG score in predicting the cardiac, obstetric and neonatal outcome in pregnancies complicated by cardiac diseases in a tertiary care centre in South India. Maternal heart disease characteristics, peripartum cardiac complications, maternal and fetal outcomes were also studied.

Materials & Methods

A Prospective Observational study was conducted in the Department of Obstetrics and Gynecology, in a tertiary care hospital in South India .In the present study 60 pregnant women with a period of gestation more than 28 weeks who fulfilled the inclusion criteria of age above 18 years with a diagnosed Cardiac Disease like Congenital, Rheumatic, Cardiomyopathies, Ischemic or Others (Table: 5) and a Hemoglobin level of more than 8gm/dL were studied during the period of 2019-2022. Parturients with history of any pre-existing severe comorbid conditions, or major congenital abnormality in the fetus diagnosed during antenatal scan were excluded from the study. Informed consent was obtained and data was collected in a predesigned proforma. Ethical clearance was obtained from the ethical committee of our institution to carry out the present study.

Baseline clinical, electrocardiographic and echocardiographic data were collected in the first antenatal visit which also included demographic data such as maternal age, gestational age, parity and New York Heart Association (NYHA) functional class (Table:1). Any comorbid conditions that could be accounted as potential confounders like Obesity, tobacco use, history of any arrhythmias, heart failure, endocarditis, stroke or transient ischemic attack, mechanical valve, pacemaker or defibrillator, pulmonary hypertension, venous thromboembolism, cyanosis (oxygen saturation<90%) were excluded from the study. Pregnant women with cardiac diseases were followed up during antenatal period, evaluated and the maternal and fetal outcome such as mode of delivery, any cardiac complication during delivery, intra uterine death (IUD), fetal anomalies and any intensive care unit (ICU) admission of mother and the fetus were recorded.

CARPREG score and NYHA classification were used to assess the severity of cardiac disease among subjects. CARPREG score included 4 parameters such as any prior cardiac event, NYHA Class, Left heart obstruction (Mitral valve area <2 cm^2 and Aortic valve area< 1.5cm^2, Left ventricular outflow tract gradient >30mm Hg) and Left Ventricular Ejection Fraction < 40%, one point assigned for each variable[3] (Table 2). The sum of the predictor points (maximum score of 4) was used to predict maternal and neonatal outcomes. The NYHA Classification is a simple method of classifying the extend of heart failure, by categorizing the patient to any of the four groups, based on their limitations in doing physical activity.

Statistical methods

The sample size for the study was arrived at 60 using Cochrans formula. Appropriate statistical methods were employed to tabulate the results. Statistical Package for the Social Sciences (version 21.0) (IBM SPSS Statistics V21.0 NEW YORK, USA) was used for analyzing the data. Descriptive statistics such as mean, standard deviation (SD), frequency, and percentages and inferential statistics such as Chi-square test and independent t-test were used. Data were presented as mean ± SD, and P = 0.05 was considered statistically significant.

Results

This study was carried between May 2019 to June 2021 with 60 parturients and their demographic data for quantitative and qualitative data is presented in Table:1. There was no significant association between maternal age and cardiac outcomes. Majority of the women belonged to age group between 21 to 30 years (78.33%), 11.66% were below 20 years while 10% of them were aged more than 30 years and were from lower middle and middle socio-economic status. Among study participants 72.28% were primipara and 27.72% mothers were multipara. The overall incidence of cardiac complications was 28.33% in this study, Congestive cardiac failure (CCF)/Pulmonary edema was seen in (8.33%) of cases, arrhythmias in 5(10%), Transient ischemic attack in 2 (3.33%) and thromboembolism was noted in 1.66% of cases. There were two cases of peripartum cardiomyopathy (3.33%) and one maternal death (1.66%) was documented. The mean duration of stay in the hospital was 8 ± 3.97 days. Rheumatic heart disease (RHD) (46.66%) followed by congenital heart diseases (31.66%) were the predominant cardiac diseases. The overall incidence of maternal cardiac events was 28.33%.

CARPREG score was 0 in 54 pregnancies (90%) and 1 in 3 pregnancies (5%) and 2 or more than 2 in 3 pregnancies (5%). CARPREG score predicts adverse cardiac outcomes in pregnancies complicated with cardiac disease which is 5%, 27% and 75% in parturients with CARPREG score of zero, one and two or more than two respectively. The observations of maternal cardiac outcomes from our study was documented and was compared (Fig:1 and Fig:2) Among 60 pregnancies 57 pregnancies were live term deliveries (95%), one intra uterine death and two abortions were recorded. One of the neonate had congenital heart disease and ten neonates required neonatal intensive care unit (NICU) admissions. The mean birth weight of the babies was 2.8690 Kg ± 0.4992 (mean ± SD). Maternal congenital heart disease was found as an independent risk factor for neonatal malformations. Perinatal complications were observed in 17% of pregnancies.

Table 1: Demographic characteristics

Characteristics	Observation	
Age (in years)	Number of Parturients (n=60)	Percentage
• <20	7	11.66
• 21-30	47	78.33
• >31	6	10.00
Mean Weight (kg)	59.24	
Mean Height (cm)	157.46	
Parity (%)		
▪ Primipara	72.28	
▪ Multipara	27.72	

Table 2: CARPREG Scoring for Predicting Maternal Cardiovascular Events

1	Prior Cardiac event • Heart Failure • Transient Ischemic Attack • Cerebrovascular accident • Arrhythmia	1 Point
2	Left Heart Obstruction • Mitral Valve Area < 2cm^2 • Aortic Valve Area <1.5cm^2 • Left Ventricular Outflow Tract Gradient >30 mm Hg	1 Point
3	Ejection Fraction < 40%	1 Point
4	NYHA Class > II or Cyanosis	1 Point

Table 3: Maternal CARPREG and NYHA Scoring (Observed values)

CARPREG SCORE		NYHA SCORE	
Zero	54	Class I	52
One	3	Class II	7
Two / > Two	3	Class III	1
		Class IV	0

Table 4: Maternal cardiac outcome ; predicted vs observed

CARPREG Score	CARPREG Cardiac Complication Rates (%)	Observed Cardiac Complication Rates (%)
0	5	5.8
1	27	23.5
2 or >2	75	70.5

Table 5: Maternal Cardiac Disease Characteristics

Cardiac Lesions	Number	Percentage
RHD with valvular Lesions	28	46.66
CHD	19	31.66
RHD with CHD	2	3.33
Cardiomyopathy	2	3.33
Myocarditis	2	3.33
MVP	7	11.66

RHD: Rheumatic Heart Disease
CHD: Congenital Heart Disease

MVP: Mitral Valve Prolapse

Figure 1: Maternal Outcome

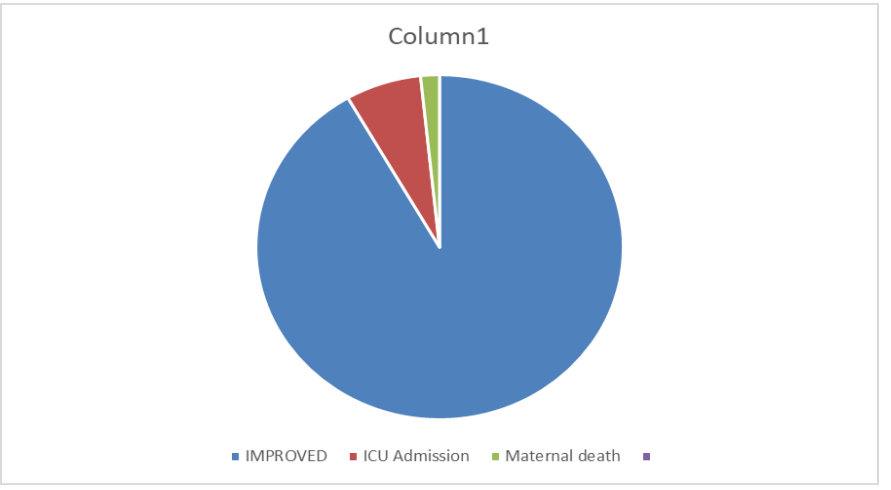
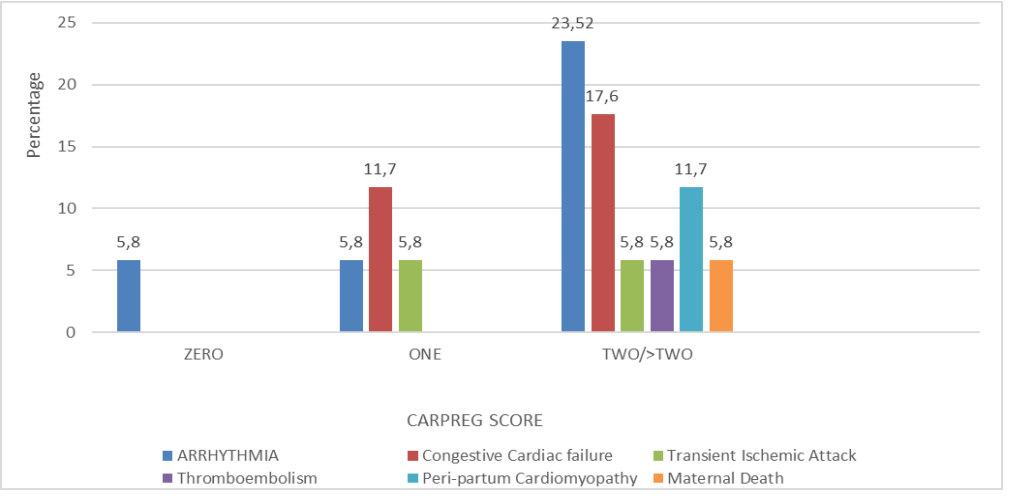


Figure 2: CARPREG score and maternal cardiac outcome



Discussion

The prevalence of Cardiac diseases in pregnancy ranges from 1-3%[4]. The total number of childbirths in the hospital during the study period (2019-2021) was 3652, out of which prevalence of maternal cardiac diseases was found to be 1.69% (62 pregnancies), comparable to the studies by Burlew BS et al[5] (1%) and Datta Ray et al[6] (3.764%). Majority of the women belonged to the age group of 21-30 years, with the mean gestational age during delivery being 38.23 +/- 3.24 weeks comparable to the demographic distribution by Datta Ray et al[6]. Rheumatic heart disease is the predominant cardiac disease in developing countries while congenital heart disease is the most common cause in developed countries[4].

Nevertheless, the incidence of congenital heart disease in developing countries is on the rise. Improving socioeconomic conditions and access to medical care has resulted in decreased incidence of rheumatic heart disease in developing countries. In the present study RHD was the predominant cardiac disease (46.66%), with more number of patients with noncorrected valvular lesion (21%), followed by CHD (31.66%), while 16.66% of cases were categorized as others which included mitral valve prolapse (MVP), Viral myocarditis, Cardiomyopathy etc (Table: 5) comparable to the studies by Walkiria et al[7] and Mc Faul et al[8]. Congenital heart disease (CHD) is the most prevalent chronic maternal heart disease in pregnancy in western society, accounting for 66% to 80% of cases. This is due to an increased number of patients with CHD living into their childbearing years because of advances in surgical repair and palliation procedures. Although many women with CHD tolerate the expected hemodynamic changes of pregnancy, maternal cardiovascular complications occur in approximately 5% to 25% of such pregnancies. The most common complications are congestive heart failure, thromboembolism, and arrhythmias. It was observed in the study that ASD was the most common congenital heart disease seen in 10 (52.63%) women followed by PDA with or without ASD/VSD in 3 (15.78%) women. 13 (68.42%) women with CHD had corrected lesions, while uncorrected lesions were found in 8 (31.57%) women.

Peripartum cardiomyopathy (PPCM) is defined as the development of idiopathic life-threatening cardiomyopathy with strict echocardiographic criteria including a left ventricular ejection fraction (LVEF) less than 45% or M-mode fractional shortening less than 30% (or both), and end-diastolic dimension greater than 2.7 cm in the last month of pregnancy or within the first 5 months postpartum in women; and without recognizable pre-existing heart disease[2]. In our study we had 2 patients (3.33%) with peripartum cardiomyopathy (Fig 2). There was one maternal death in our study. She was an un-booked case, presented at term, late in labour with signs of cardiac failure; she was diagnosed to have pulmonary thromboembolism due to mitral valvular lesion and later developed Congestive Cardiac Failure. Despite all measures she could not be saved.

Cardiac complications documented in the present study include CCF/Pulmonary edema seen in 8.33% of cases, arrhythmias in 10%, TIA and thromboembolism in 1.66% of cases each (Fig:2), comparable to the studies by Williem Drenthen et al[8], Julie A et al[4] and D Pratibha et al[9]. Ideally, a woman with known pre-existing cardiac disease should undergo a preconception evaluation and counselling with a rigorous, standardized risk assessment to make informed decisions regarding pregnancy, to adjust to the possibility of not having a pregnancy, and to address any correctable lesions before pregnancy. Evaluation should include a careful history, physical examination, assessment of New York Heart Association (NYHA) functional class, a 12-lead ECG, and Trans thoracic echocardiogram. A right heart catheterization may be necessary for women with CHD or pulmonary hypertension[2].

In the present study, majority of the parturients belonged to NYHA Class I and II (97.8%) (Table:3). We evaluated the parturients in our study and cardiac risk stratification was carried out employing CARPREG scoring. Study risk prediction scores were compared to standard prediction rates described in the CARPREG

scoring system to validate the CARPREG score (Table no 4). Cardiac complications in the peripartum period among study group was found to be 5.8%, 23.5% and 70.5% among parturients with CARPREG score of zero, one and two or more than two categories. This finding was statistically significant and consistent with CARPREG score. Similar findings were observed in earlier study by Deepika Gurnani et al[10].

Out of 60 pregnancies in this study, 48.33% women delivered vaginally which was predominant mode of delivery, while 43.33% underwent Caesarean section. Instrumental deliveries accounted for 5% of cases. Two abortions were documented (3.33%) among them one was spontaneous abortion and other being medical termination of pregnancy. Termination of pregnancy was carried out in view of fetal cardiac anomaly diagnosed by antenatal ultrasonogram, similar to the maternal outcome findings in the studies by D Pratibha et al[9], Siu C Samuel et al[11] and D K Desai et al.[12]

The overall perinatal outcome was good with live births of 95%. One case of IUD and one neonatal death was observed bringing the perinatal mortality to 3.33%. Congenital heart disease was diagnosed through antenatal USG in one pregnancy (Double outlet right ventricle). The pregnancy was promptly terminated. Mean birth weight was found to be 2.8690 +/- 0.4992 kg, similar to that of DK Desai et al[12].

Conclusion

The study concludes that CARPREG scoring is a reliable bedside tool to predict adverse maternal and fetal outcomes in pregnancies complicated by cardiac diseases. This scoring can be utilized routinely to provide improved maternal and fetal outcome among pregnancies complicated with cardiac diseases. RHD continues to be the commonest cardiac problem among South Indian population.

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Nil

Conflicts of Interest
There are no conflicts of interest

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