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EVALUATION OF RISK SCORES FOR PREDICTING MATERNAL COMPLICATIONS IN PREGNANT CARDIAC PATIENTS IN AFIC-NIHD.WHO VS CARPREG SCORE

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ABSTRACT

Objective: To report cardiac complications during pregnancy in pregnant patients with cardiac disease and to evaluate suitability and validity of risk scores to predict maternal complications.

Study design: Prospective cohort study

Place and Duration of Study: This study was conducted at obstetrics and gynecology ward of Armed Forces Institute of Cardiology and National Institute of Heart Disease (AFIC-NIHD) from Jan 2015 Dec 2015.

Material and Methods: All consecutive cardiac patients becoming pregnant were enrolled. Risk scoring was done on first visit according to CARPREG scoring and WHO scoring. Patients were followed up for the duration of pregnancy and purperieum. Primary outcome was maternal mortality and morbidity due to cardiac complications. Validity of risk scores was assessed by sensitivity and specificity in predicting complications

Results: A total of 170 patients were enrolled. Mean age was 28.9±4.9 yrs. There were 157(92%) completed pregnancies and 13(8%) miscarriages. Cardiac events complicated 66 (38.8%) of pregnancies and there were 11 (6.4%) obstetric and 63(37%) neonatal complications. Cardiac maternal deaths were 04(2.4%) and there were no obstetric deaths. Prediction of cardiac complications by both the scoring systems was significant. The discriminatory power of each risk score was assessed by the area under the receiver-operating characteristics curve (ROC). AUC 0.746 to WHO modified and AUC 0.651 to CARPREG score.

Conclusion: The modified WHO risks score is better adjusted to predict cardiac complications than CARPREG risk score in our population of pregnant patients with heart disease.

Keywords: Cardiac disease, Cardiac risk scoring, Pregnancy.

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INTRODUCTION

The prevalence of heart disease during pregnancy is estimated to be 1-3%[1]. Rheumatic heart disease is most prevalent in developing countries and in the Western world congenital heart disease constitutes 80% of maternal heart disease[2,3]. Pregnancy leads to hemodynamic changes like increased intravascular volume and cardiac output, decreased systemic vascular resistance and hypercoagulable state which increases risk for mother and fetus when maternal heart disease is present[4]. The most prevalent maternal cardiovascular complications that occur during pregnancy are heart failure, arrhythmias, thromboembolic events, and aortic dissection[5]. In women with a known history of heart disease in order to reduce these risks full pre-pregnancy or early pregnancy risk assessment and counselling are important. This prevents women from becoming pregnant when the risks are high. Interventions can be carried out before pregnancy if necessary, and a management plan can be timely made. Progress in the fields of diagnostic techniques and surgical intervention has dramatically improved long-term outcome in patients with congenital heart disease (CHD). In these patients pregnancy burden may have harmful effects on the health of both the mother and her offspring as according to many studies pregnancy in these patients can lead to cardiac, obstetric, and neonatal complications[6].

Many cardiac risk scoring systems have been established for pregnant patients to predict adverse outcome including CARPREG[7] ZAHARA[8] and WHO scoring system[9]. The 'CARdiac disease in PREGnancy' (CARPREG)

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investigators were first to identify predictors of the adverse pregnancy outcome in women with established heart disease. The investigators also were the first to design a risk score in 2001 which is now commonly used .But it has its limitations as many complex diseases and risk scores should be a part of pre-pregnancy risk assessment[10].

A system that integrates all available knowledge was proposed by an English group of experts. They adapted the World Health

Table-1: Risk scores and complications.

Clinical Variables (N=170)	N (%)
Age (Mean ± S.D)	28.9 ± 4.9
WHO score:	
1	46 (27.1%)
2	74 (43.5%)
3	33 (19.4%)
4	17 (10%)
Carpreg score:	
0	122 (71.8%)
1	35 (20.6%)
>1	13 (7.6%)
Neonatal complications	
Healthy	107 (64.5%)
Low birth weight	48(28.9%)
Preterm	01(0.6%)
IUD / NND	10(6%)
Cardiac complications	66 (38.8%)
Pulmonary Edema	21(31.8 %)
Arrhythmia	09(13.6%)
Medical Rx	01(1.5%)
Cardioversion	02 (3.0%)
Infective endocarditis	02 (3.0%)
Heart failure	18 (27%)
thromboembolism	08 (12.1%)
Intervention during pregnancy:	05(7.5%)
PTMC	04 (2.5%)
Cardiac surgery	01(0.5%)
Obstetric complications:	11(6.4%)
Pre-Eclampsia / pregnancy induced hypertension	04 (36.3%)
Preterm labor	01 (9.0%)
Postpartum hemorrhage	02 (18.1%)
Placenta previa	02 (18.1%)
Twins	02 (18.1%)
Mortality	04 (2.4%)
Infective endocarditis	02(1.17)
Heart failure	01(0.58)
Embolism	01(0.58%)
Non cardiac mortality	0(0%)

situations are not included. Maternal and offspring events and risks appeared to be highly related also in the ZAHARA scoring to maternal cardiovascular events. Therefore, it is important to understand that the calculation of

Organization (WHO) classification for use of contraceptive methods to classify the maternal risk of pregnancy associated with specific cardiovascular conditions. Pregnancies are classified into four categories (WHO class I-IV): low, medium and high risk of pregnancy as

well as contraindication for pregnancy. This classification combines the knowledge of disease specific literature with the predictors of pregnancy outcome. The adapted WHO classification was the most accurate system for risk evaluation in prospective evaluation of several risk estimation models[9]. It is advocated in the new ESC guidelines for the management of cardiovascular diseases during pregnancy as the risk estimation system of choice[11].

This study was done to observe the frequency of cardiac, obstetric and neonatal complications in study cohort and classify patients according to Carpreg (fig-2) and WHO risk scores (fig-3) .

Table-2: Validation of the risk scores.

ROC Curve table				
Test variables		**Area under the curve**		***p*-value**
WHO score		0.746		0.001
Carpreg score		0.651		0.001
Cardiac complications		**Yes**	**No**	***p*-value**
WHO Score	1	4 (8.7%)	42(91.3%)	0.001
	2	31(41.9%)	43(58.1%)	
	3	15(45.5%)	18(54.5%)	
	4	16(94.1%)	1(5.9%)	
Carpreg Score	0	36(29.5%)	86(70.5%)	0.001
	1	19(54.3%)	16(45.7%)	
	>1	11(84.6%)	02(15.4%)	

MATERIAL AND METHODS

This was a prospective cohort study done in Armed Forces Institute of Cardiology National Institute of Heart Disease (AFIC-NIHD), Pakistan from january 2015 to dec 2015. Aproval for conducting the study was taken from Institutional Review Board and 170 patients were recruited in this study by purposive non probabiliy sampling technique. To assess outcomes comprehensively in a contemporary cohort, the frequency and predictors of pregnancy-related complications were examined. All consecutive cardiac patients during pregnancy and peurpureim were included. Patients having structural and congenital lesions, rhythm disorders, cardiomyopathy and ischemic heart disease were included. The exclusion criteria included miscarriages and termination of pregnancy.

Written Informed consent for data collection was taken as per IERB requirement. As per protocol all pregnant women with cardiac lesions or those with cardiac arrhythmias referred to this tertiary cardiac care center were eligible for enrollment. Age at conception, parity,gestational age at entry into study, mode of delivery, New York Heart Association (NYHA) functional class, peripartum cyanosis (oxygen saturation ≤ 90%), prior cardiac events, cardiac lesions and prior surgery / interventions were noted[12] -lead ECG, transthoracic echocardiographic assessment of cardiac status was done. Follow-up data was obtained from clinical visits during the second trimester (28 weeks), third trimester and peripartum period (onset of labor until hospital discharge), and at 6 weeks postpartum. Prepartum, peripartum, and postpartum complications were grouped into cardiac, obstetric, and neonatal events. Primary cardiac events were defined as pulmonary edema (documented on chest radiograph or by crackles heard over more than one-third of posterior lung fields), sustained symptomatic tachyarrhythmia or bradyarrhythmia requiring treatment, heart failure requiring treatment, endocarditis identified by standard criteria, thromboembolic phenomenon (stroke, pulmonary embolism, deep venous thrombosis, valve thrombosis), acute coronary syndrome, need for urgent invasive cardiac procedures

during pregnancy or within 6 weeks after delivery, cardiac arrest or cardiac death.

Neonatal events were defined as premature birth (≤37weeks gestation), fetal growth restriction (<10th percentile), fetal death (>26 weeks gestation) or neonatal death (within 28 days after birth). Obstetric events included non cardiac death, pregnancy induced hypertension (PIH), and postpartum hemorrhage (PPH). PIH was defined as an increase of systolic (≥30 mm Hg) and diastolic (≥15 mm Hg) blood pressure. PPH was defined as blood loss ≥500mL (vaginal delivery) or ≥1000 mL (Caesarean section), which required transfusion or was accompanied by a drop in hemoglobin ≥ 2.0 g/L. Estimation of maternal risk associated with pregnancy was done by classifying the patients according to the modified World Health Organization (WHO) categories, and also according to Carpreg scoring.

Primary outcome was frequency of cardiac complications. Secondary outcomes were obstetric and fetal complications and number of patients identified by both risk scoring systems and validity of the scoring systems. Data was collected and analyzed using SPSS version 20.Descriptive statistics were used to describe the data. Frequency and percentage were calculated. The validity of both risk scores in our population was tested. The discriminatory power of each risk score was assessed by the area under the receiver-operating characteristics curve (ROC).

RESULTS

A total of 170 patients were recruited to be followed prospectively in this study. Mean age was 28.9 ± 4.9 yrs and 13.3% were primigravida .The aetiology of maternal cardiac lesions was 96 (57%) acquired, 40 (23%), congenital 25 (15%), arrhythmias and 9 (5%) cardiomyopathy in study population. Cardiac events complicated 66 (38.8%) of pregnancies,11 (6.4%) obstetric and 63 (37%) neonatal complications .There were 04 (2.4%) cardiac maternal deaths and no obstetric deaths as shown by table 1.out of all patients 80 (47%) delivered by spontaneous vaginal delivery, 25 (15%) by instrumental delivery and 65 (38%) by cesarean section. Most cesarean sections were for obstetric indications 61 (94%) and cardiac disease was indication in 4 (6 %) patients.

Risk scoring by WHO identified majority of patients to be in WHO 2 whereas 122 (71.8%) were in Carpreg 0. prediction of cardiac complications by both the scoring systems was significant as shown in Table 2.The

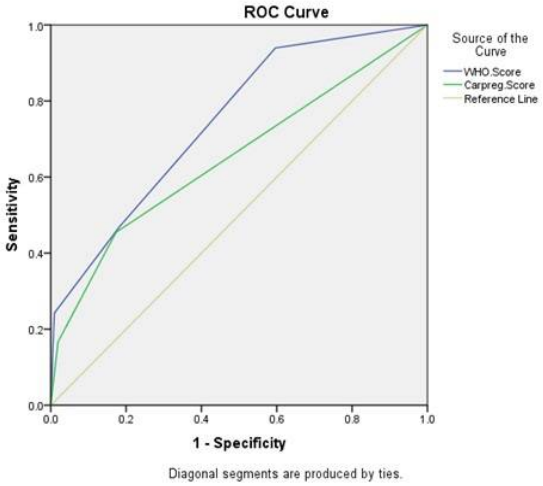

Figure-1: ROC WHO and carpreg score.

discriminatory power of each risk score was assessed by the area under the receiver-operating characteristics curve (ROC). AUC 0.746 to WHO modified and AUC 0.651 to CARPREG score as depicted in fig-1. The modified WHO risk score is better adjusted to predict cardiac complications than CARPREG risk score in our population of pregnant patients with heart disease.

DISCUSSION

Cardiovascular disease is responsible for 10% to 15% of all maternal mortality[12]. Because more women with congenital or acquired heart disease are reaching childbearing age due to improved medical and surgical care, and desire children, the incidence of cardiovascular disease in pregnancy is increasing. Pregnancy in patients with heart disease results in a maternal mortality which is a hundred times higher than in normal pregnant patients. In developing countries that still struggle with a high prevalence of rheumatic fever, acquired valvular heart disease dominates, whereas in developed countries, congenital heart disease is

the main diagnostic group. In addition, over the last few years, the incidence of an acute coronary event during pregnancy has increased, due to older child-bearing age, and changes in lifestyle with more hypertension, smoking, and obesity[13]. Mean age of our study population was 28 ± 4.9 yrs which was similar to other studies[7,14,15].Cardiac lesions were predominantly valvular, followed by

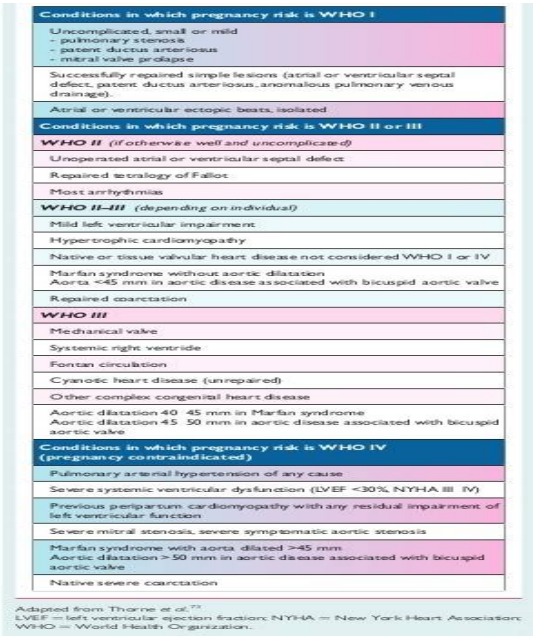

Figure-2: Modified WHO classification maternal cardio vascular risk[11].

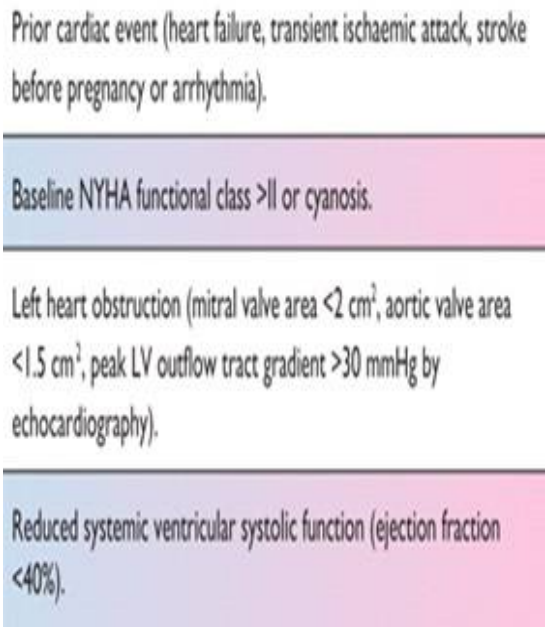

Figure-3: Predictors of maternal cardio vascular evens and risk score from CARPE[6] study.

congenital, cardiomyopathy and rhythm disorders. These results are similar to other studies done here in Pakistan but congenital lesions were predominant in studies done in western world with frequency of 74% and 66% congenital lesions followed by 22% and 28% acquired lesions[16,17]. Frequency of cardiac complications was 38%, obstetric 6.4% and 37% neonatal complications which were higher than a study done by sameul et al which reported complications as 17% cardiac, 20% neonatal and 2% obstetric[18,19]. Adverse cardiac and neonatal outcome are more common in these patients as was demonstrated by a study which had normal pregnant patients as control. In this study 17% had cardiac complications and 18% neonatal complications compared to 0% amongst controls[20]. Cesarean section was mode of delivery in 38% patients, 5.8% for cardiac indication whereas another study reported 27% cesarean section and 4% only for cardiac indication[7]. In ROPAC study cesarean section rate was 41%. Maternal mortality was 1% and highest was in patients with cardiomyopathy like in this study[21]. Nature of cardiac, obstetric and perinatal complications was similar. Commonest cardiac complications were cardiac failure and arrhythmias. Obstetric complications studied were pregnancy induced hypertension , postpartum hemorrhage and preterm labor. Neonatal complications were predominantly fetal growth restriction and prematurity[8,22].

Studies done on validity of different scores for picking up patients at high risk of developing complications used carpreg scoring initially but it performs inadequately and overestimates risk[20,21].Zaharas investigators proposed a new scoring system but it was more valid for patients having congenital heart disease. European Society for Cardiology guide lines and some new studies demonstrate WHO score as the more valid score in comparison to Carpreg and Zahara which have limitations like both fail to identify pulmonary

hypertension[22,23]. Even in our population which constitutes predominantly of rheumatic heart disease patients in contrast to majority congenital lesions in western studies it fared well. Highest AUC for maternal cardiovascular risk was by WHO score followed by Zahara and Carpreg score,0.77,0.71,0.57 just like our study[14,24].

Limitation of this study is that it is a single centre study hence cannot be generalized to population as predictors and risk scores are highly population dependent.

Major contribution of our study is gaining confidence in using WHO modified score in our population just like in developing countries inspite of study population being slightly different as this a tertiary care cardiac centre catering to all kinds of cardiac patients.

CONCLUSION

In conclusion, many women with heart disease can go through pregnancy with few or no complications. The safety of pregnancy for women with heart disease can be enhanced by adequate risk assessment and counselling. We advocate a pre-pregnancy evaluation in an outpatient setting, including physical examination, laboratory evaluation, and an echocardiography according to a predefined protocol by an expert in the field to identify high risk patients and make individual management plan to minimize risks.

AUTHORS CONTRIBUTION

Asma Ansari, design and interpretation, Imran Fazal, coordination and data conception, Hafsa Khalil, data analysis and write up.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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