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A Study of Maternal and Neonatal Outcome in Pregnant Women with Cardiac Disease

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Abstract:-

- ***Objective:***

To analyze the maternal and fetal outcome of pregnant women with cardiac disease in tertiary care centre.

- ***Methods:***

A retrospective study was conducted over a period of 5 years and 2 months wherein 101 cases delivering at our centre were studied thoroughly.

- ***Results:***

As per the present study, the incidence of rheumatic heart disease was more than congenital heart disease, with mitral stenosis being the most common rheumatic heart disease lesion and atrial septal defect being the most common congenital heart lesion encountered. The most common obstetric complication noted was oligohydramnios in the antenatal period and postpartum hemorrhage. Common cardiac complications include cardiac failure and arrhythmias. The mode of delivery for 51.48% cases was cesarean section. Majority of the neonates, 73.26%, were of term maturity.

- ***Conclusion:***

Heart disease in pregnancy poses a significant challenge to the obstetrician to ensure positive maternal and fetal well-being. This necessitates appropriate care and a multidisciplinary forethought in the antenatal, intrapartum and postpartum period.

Keywords: *- Cardiac disease in Pregnancy, Maternal Outcome, Neonatal Outcome, High Risk Pregnancy.*

I. INTRODUCTION

Cardiac disease, in an antenatal patient, is a high risk pregnancy and is one of the leading indirect causes of maternal mortality and morbidity. Indirect cause implies a condition existing before the pregnancy or a disease which has recently developed, unrelated to the pregnancy.

With a prevalence of 1-4% of all pregnancies, cardiac diseases pose a significant challenge to the obstetrician to have a positive maternal and fetal outcome [1, 2]. Despite the low prevalence rate, there is significantly higher risk of adverse perinatal events. The physiological changes in pregnancy may unmask a previously unknown cardiac lesion causing them to be detected during the antenatal check-ups [3]. The cardiac diseases in pregnancy can be classified as congenital heart disease and acquired, which comprises rheumatic heart disease, cardiomyopathies, and ischaemic heart disease. Rheumatic heart disease is known as the most common type encountered in developing countries, like India.

Advancement in diagnostic and surgical techniques has led to an apparent increase in the incidence of congenital heart disease. The advent of newer antibiotics and surgical intervention modalities have lead to decrease in the maternal mortality and morbidity rates associated with rheumatic heart disease.

The presence of maternal heart disease increase the risk of neonatal complications in a number of ways, majorly leading to preterm delivery and fetal growth restriction, and predisposing the infant to have a congenital heart disease[4]. Cardiac disease in the mother may compromise the cardiac output, thereby, affecting the uteroplacental blood supply and thus, leading to fetal growth restriction.

II. METHOD

This was a retrospective study executed in the Department of Obstetrics and Gynecology at MGM Medical College and Hospital, Aurangabad over a period of 5 years and 2 months starting from October, 2014 till December, 2019.

The study population included 101 pregnant women with heart disease admitted during the study period. The details of the enrolled patients including demographic information, diagnosis, course in the hospital, management, maternal and fetal outcome was obtained from the medical records. This study did not contain any interference to the patients.

- *Inclusion Criteria*

All pregnant women with newly or previously diagnosed heart disease delivering at MGM Medical College and Hospital, Aurangabad

- *Exclusion Criteria*

The conditions mimicking heart disease were excluded.

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III. RESULTS

Age (in years)	Number of Patients (n=101)
<=19	9 (8.91%)
20-29	82 (81.18%)
30-34	8 (7.92%)
>=35	2 (1.98%)

Table – 1: Maternal age-wise distribution

Among the 101 pregnant women, majority were in child-bearing age group of 20-29 years (81.18%). There are a growing number of women with corrected congenital heart disease reaching adulthood. In the patients belonging to the <19 age group, 3 were known cases and 6 were newly diagnosed. Most were acquired heart disease.

Parity	Number of Patients (n=101)
Primigravida	32 (31.68%)
Multigravida	69 (68.31%)

Table – 2: Parity and Cardiovascular Risk

Physiological changes of pregnancy parallel established risk factors for heart disease like hormonal fluctuations during gestation, delivery, and lactation. Increase in BMI, waist-to-hip ratio and metabolic changes with progressive pregnancies predispose the women to developing acquired heart disease like ischemic heart disease. 68.31% of the patients in the study were multipara.

Time of Diagnosis	Number of Patients (n=101)	Operated Cases
Prior to Pregnancy	77 (76.23%)	18
In Present Pregnancy	24 (23.76%)	3

Table – 3: Time of Diagnosis of Heart Disease

Most of the patients were diagnosed prior to pregnancy (76.23%). Total number of patients who had undergone surgical intervention was 21 (20.79%). Most common surgery was Mitral Valve Replacement followed by ASD closure. Active intervention during antenatal period included bi-ventricular pacing, percutaneous balloon mitral valvoplasty (second trimester) and thrombolysis (with streptokinase) done in a case of double valve replacement.

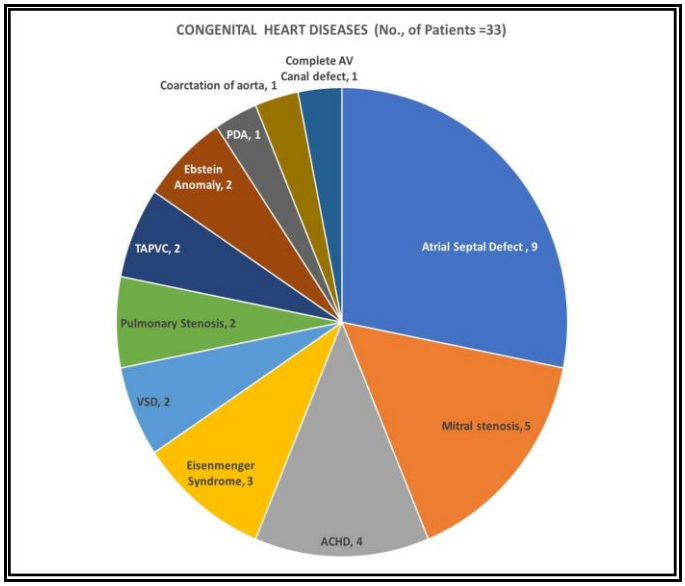

Fig 1 - Congenital heart disease

The most common lesion was atrial septal defect seen in 27.27% of the cases with congenital heart disease followed by mitral stenosis and acyanotic congenital heart disease. Amongst cases classified as – i) **Moderate risk**: All 5 were previously diagnosed patients and 4 were multipara and had not undergone pre-conceptional counseling; ii) **High Risk**: Both patients were multipara and one of them had undergone pre-conceptional counselling and was advised against conception

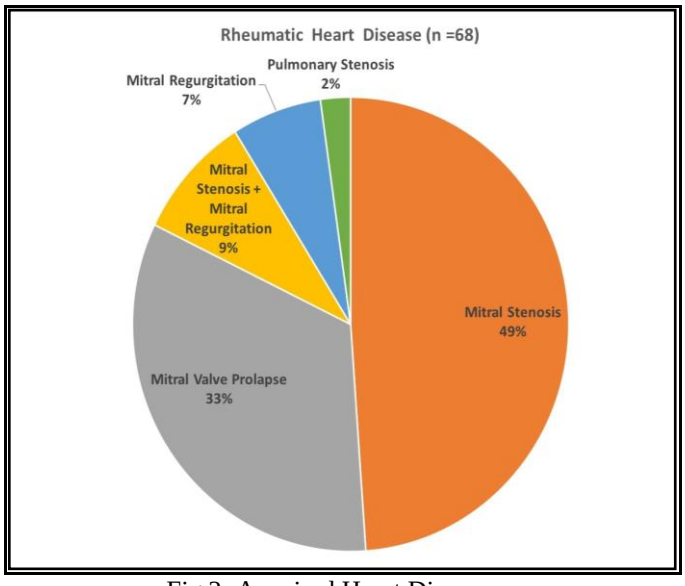

Fig 2: Acquired Heart Disease

The most common lesion was mitral stenosis, contributing to 49% of the cases with acquired heart disease, followed by mitral valve prolapse seen in 33% of the cases. Mitral regurgitation and pulmonary stenosis, at 7% and 2% respectively, were the least common lesions.

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Antenatal Complications	Number of Patients (n=95)
Oligohydramnios	25 (24.75%)
Anemia	24 (23.76%)
Preterm Delivery	22 (21.78%)
Fetal Growth Restriction	17 (16.83%)
Premature Rupture of Membranes	5 (4.95%)
Pre-eclampsia	2 (2%)

Table 4:- Antenatal Complications in Heart Disease

Oligohydramnios was seen in 24.75% of the cases as an antenatal complication followed by anemia, seen in 23.76% of women. Pre-eclampsia, in 2% cases, was the least encountered complication.

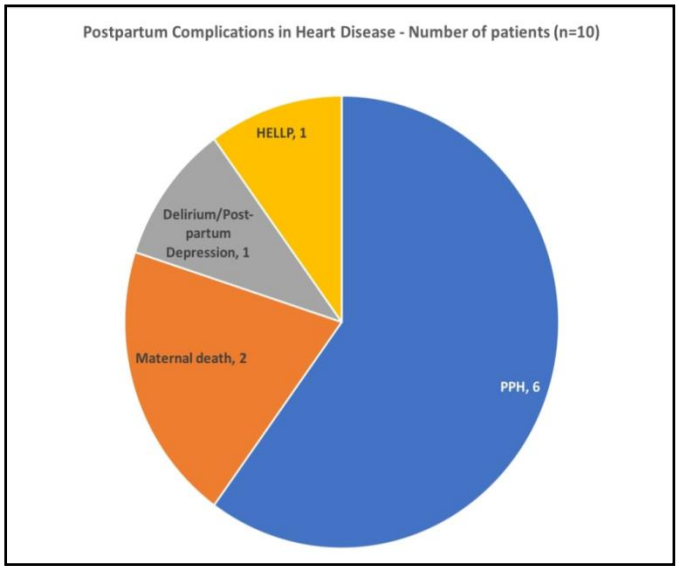

Fig 3:- Postpartum Complications in Heart Disease

Postpartum hemorrhage, with an incidence of 6%, was the most common postpartum complication. The cause of the 2 maternal mortalities was severe mitral stenosis with mitral regurgitation with cardiac failure (referred case, irregularly booked) and Eisenmenger syndrome (known case, was advised against conception). Both the deaths were before the year 2017 and no maternal deaths due to a cardiac condition were encountered thereafter.

Complications during Antepartum Period	No. of Patients (n=9)	Complications during Postpartum Period	No. of Patients (n=10)
Cardiac Failure	5 (4.95%)	**Arrhythmias**	5 (4.95%)
Pulmonary Hypertension	2 (1.98%)	**Cardiac failure**	2 (1.98%)
Infective Endocarditis	1 (0.99%)	**Pulmonary Edema**	3 (2.97%)
Thrombosis	1 (0.99%)		

Table – 5: Cardiac Complications

Cardiac failure was seen in 4.95% cases in antenatal period and 1 patient developed infective endocarditis. In the postpartum period, arrhythmias were noted in 4.95% of the cases.

Co-Morbidities	Number of patients (n=82)
ICU Admission	43
Prolonged Antibiotic Cover	27
Blood Transfusion	9
Prolonged Hospital Stay	3

Table – 6: Other Co-morbidities in Heart Disease

Majority of the ICU admissions had undergone LSCS in view of cardiac disease and as sequelae, required prolonged care. Two cases had non-cardiac indication of ICU stay: HELLP syndrome, post-partum hemorrhage.

Mode of delivery	Number of patients (n=101)
Vaginal	**49 (48.51%)**
LSCS	**52 (51.48%)**
• Obstetric Indication	33
• Cardiac Indication	19

Table – 7: Mode of Delivery

48.51% of the patients had vaginal delivery. Almost an equal number of patients, 51.48% patients underwent lower segment cesarean section, but 63% cases had an obstetric indication for operative intervention. Cardiac indication was noted in 27% of the cases.

Maturity	Number of Neonates (n=100)
Pre-term	23 (22.77%)
Term	73 (73.26%)
Post-dated	4 (3.96%)

Table – 8: Neonatal Outcome

Birth Weight	Number of Neonates (n=101)
< 2.5	49 (48.51%)
≥ 2.5	52 (51.48%)

Table 9

Most neonates, 73.26%, were of term maturity. The number of neonatal deaths was 2 and the cause was an existing congenital anomaly (Patent Ductus Arteriosus with omphalocoele) and acute respiratory distress syndrome. One intrauterine death was noted. Patent Ductus Arteriosus was the congenital anomaly noted in one of the live neonates. 51.48% of the neonates had birth weight more than 2.5 kg which was an important factor in reducing the number of cases requiring NICU care.

Registrations	Number of patients
Booked in MGM	35 (34.65%)
Booked outside	51 (50.49%)
Irregularly Booked	15 (14.85%)

Table – 10: Number of ANC Visits

Majority of the complications were observed in women who were irregularly booked in hospitals (14.85%). Antenatal patients receiving adequate treatment at a tertiary care centre, like ours, had significantly less complications.

IV. TEST OF SIGNIFICANCE FOR CESAREAN OPERATIONS

This will be a significance test for proportions (and not means). Out of 13,937 patients sampled from the study period, 5609 undergo cesarean operations and out of 101 patients with cardiac disease, 52 undergo cesarean operations. A two proportion z-test allows us to compare two proportions to see if they are the same. The Steps for the Z-test are: 1. Decide the significance level, 2. Find out the pooled proportion, 3. Calculate the standard error, 4. Calculate the Z value, 5. From the Z-table, find out the P Value, 6. Compare the P value with Significance level and then decide whether or not accept the null hypothesis.

If P value is less than the significance level, then it indicates strong evidence against null hypothesis as there is less than 5% probability that the null hypothesis is correct. If P value is more than the significance level, then it indicates strong evidence to support null hypothesis as there is more than 5% probability that the null hypothesis is correct.

The data collected are presented below:

Total number of general pregnant patients	N1	13937
Total number of cesarean operations in general pregnant patients		5609
Proportion of cesarean operations among general pregnant patients	P1	0.402
Total number of cardiac disease patients among pregnant patients	N2	101
Total number of cesarean operations in cardiac disease patients		52
Proportion of cesarean operations among cardiac disease patients	P2	0.515

In this study, the null hypothesis is taken as “Cardiac disease in pregnancy does not lead to more number of cesarean operations than the normal cases (P1 ≥ P2)” and alternate hypothesis is proposed as “Cardiac disease in pregnancy does lead to more number of cesarean operations than the normal cases (P1 < P2)”.

Null Hypothesis (H_0) is P1 ≥ P2 and Alternate Hypothesis (Ha) is P1 < P2. This test is a right-tailed test and significance level is assumed as 5%. The calculations are worked out as follows:
Pooled proportion = P = ((P1*N1) + (P2*N2)) / (N1+N2) = 0.403
Standard Error =SQUARE ROOT OF (P*(1-P)*(1/N1 + 1/N2)) = 0.049
Z VALUE = (P1-P2) / (SE) = -2.294
P VALUE from the Z-table = 0.011

As the P value of 0.011 is less than the significance level of 0.05(as there is less than a 5% probability the null is correct), there is a strong evidence to reject the null hypothesis and the data presents strong evidence to accept the alternate hypothesis that pregnant patients with cardiac disease are likely to undergo more number of cesarean operations than the normal pregnant patients.

V. TEST OF SIGNIFICANCE FOR LOW BIRTH WEIGHTS

This will be a significance test for proportions (and not means). Out of 13,937 normal pregnant patients, 2567 delivered low birth weight babies and out of 100 patients with cardiac disease, 23 delivered low birth weight babies. A two proportion z-test allows us to compare two proportions to see if they are the same. Following the same steps/procedure applied for caesarean significance test, the data collected are presented below:

Total number of general pregnant patients	N1	13937
Total number of general pregnant patients who delivered low birth weight babies		2567
Proportion of general pregnant patients who delivered low birth weight babies	P1	0.183
Total number of cardiac disease patients among pregnant patients	N2	100
Total number of cardiac disease pregnant patients who delivered low birth weight babies		23
Proportion of cardiac disease pregnant patients who delivered low birth weight babies	P2	0.23

In this test, the null hypothesis is taken as "Cardiac disease in pregnancy does not lead to more number of low birth weights than the normal cases (P1≥P2)" and alternate hypothesis is proposed as "Cardiac disease in pregnancy does lead to low birth weight babies compared to the normal cases (P1< P2)".

Null Hypothesis (H_0) is P1 >= P2 and Alternate Hypothesis (Ha) is P1 < P2. This test is a right-tailed test and significance level is assumed as 5%. The calculations are worked out as follows:
Pooled proportion = P = ((P1*N1) + (P2*N2)) / (N1+N2) = 0.183
Standard Error =SQUARE ROOT OF (P*(1-P)*(1/N1 + 1/N2)) = 0.039
Z VALUE = (P1-P2) / (SE) = -1.212
P VALUE from the Z-table = 0.113

As the P value of 0.113 is more than the significance level of 0.05(as there is more than a 5% probability the null is correct), there is a strong evidence to accept the null hypothesis and the data presents strong evidence against the alternate hypothesis that patients with heart disease are likely to deliver more number of low birth weight babies than the normal pregnant patients.

VI. DISCUSSION

Cardiac disease is a major factor affecting maternal and neonatal mortality and morbidity. As our centre is a tertiary care centre and a good percentage of the cases reported are referred cases, the actual prevalence of cardiac disease in pregnancy in the population may not be surmised. Of the 101 cases studied in this report, majority of them had an acquired heart disease. This particular trend is consistent with studies conducted in other developing countries, for instance, in a study by Manh TN et al[5] in Hanoi, Vietnam, rheumatic heart disease was the commoner variant of heart disease. At the domestic level, studies by Sheela et al [6](67%) and Joshi G et al [7] (40%) reflect at mitral stenosis being the predominant lesion and atrial septal defect being the most common congenital cardiac lesion.

The rate of operative intervention in pregnant women with cardiac intervention in the form of LSCS is 51.48% in our study. The higher rate of LSCS predisposes the patient to increased risk of co-morbidities including an extensive ICU stays.

Post partum complications most commonly included post partum hemorrhage. The 2 maternal deaths reported were due to the severe nature of the underlying cardiac condition, thereby, necessitating pre-natal counseling of women with known cardiac disease. The overall Maternal mortality rate has seen a declining trend over the past few decades in our country. From rates as high as 556 per 1,00,000 live births in 1990 to 374 in 2000, India has registered a 26.9% reduction in MMR since 2013, as of 2019. A 10 year audit of MMR holds cardiac disease responsible for 3.2% of maternal deaths [8].In our study, most neonates were of term maturity, but a significant percentage (48.51%) of the neonates weighed less than 2.5kg, thereby coming to the conclusion that pregnant women with heart disease are susceptible to various antenatal complications like oligohydramnios, anemia, preterm delivery, etc where the fetal well-being is noticeably compromised. These results are consistent with similar findings in studies conducted by Rampage K et al [9] and Silverside CK et al [10].

VII. CONCLUSION

Cardiac disease in pregnancy has an adverse effect on the maternal and neonatal outcome. Rheumatic heart disease continues to dominate the spectrum of cardiac disease even after a considerable proportion of patients having received adequate treatment prior to conception. Preconception counseling plays an important role in decreasing the maternal mortality and morbidity. Once diagnosed, patient should have regular antenatal visits and should deliver at a tertiary care centre. Antenatal counseling done in first trimester is very important as it directly has an effect on prognosis of pregnancy, maternal and neonatal alike.

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