

Original research article

Clinical and Echocardiographic Assessment of all Cases of Valvular Heart Disease During Pregnancy in a Urban South Indian Population Between 2020-2021 and the Effect of Valvular Heart Disease on Maternal and Fetal Outcome of Pregnancy

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Abstract

Background: Pregnancy adaptations are well tolerated in healthy women but it rapidly decompensate in pregnant with valvular heart disease resulting in maternal and perinatal morbidity². Multidisciplinary approach and proper guideline is a necessity to reduce the adverse outcome.

Aims and Objectives: Clinical and echocardiographic assessment of valvular heart disease during pregnancy, in south Indian population and its effect on maternal and fetal outcome. Thereby provide local layout of disease burden and help develop patient centric management plan.

Materials and Methods: 77 pregnant women admitted with valvular heart disease in Coimbatore Medical College Hospital were recruited during period of 2020-2021. Clinical and Echocardiographic correlation with Maternal and fetal outcome were studied.

Results: In our study, 70.1% of pregnant had Rheumatic heart disease and 23.4% had Congenital heart disease, with ratio of 3:1; 70.3% were diagnosed during index pregnancy.

Mitral valve was the most common valve involved (84.4%) with Mitral Regurgitation being the predominant lesion (62.3%); Aortic valve involvement (14.3%); Both Aortic and Mitral valve involvement (3.9%). Functional class deterioration were seen in pregnant with critical stenotic lesions and severe insufficiency. Increase in valvular gradient in stenotic lesions is associated with congestive failure. Maternal outcome: 63.6% had caesarean section; 31.7% had cardiac indications; 7.8% had instrumental delivery; 1 maternal death; 23.4% had Congestive Cardiac Failure. Fetal outcome: 71% had term delivery; 28.6% had preterm delivery; 11(14.3%) had fetal loss; 48% low birth weight; 5.2% Intrauterine growth retardation; Perinatal mortality was 7.5% in NYHA class I, II and 42.1% in class III, IV.

Conclusion: High transvalvular gradient, Depressed LV function and increased LV volume, especially in patients with stenotic lesion is associated with life threatening complications in the course of pregnancy. Regurgitant lesion have better tolerability and outcome as compared

to obstructive lesion. There was close association of NYHA class and maternal and fetal outcome, with higher risk in NYHA class III and IV.

Keyword: Valvular heart disease, Maternal outcome, Fetal outcome, Echocardiographic correlation.

Introduction

Heart disease and pregnancy carries grave prognosis and its incidence remain unchanged since decades. Study done by Walther et al¹ in 2005 report incidence of 0.1 to 4%. Cardiovascular haemodynamic changes like increase in volume and tachycardia occur during pregnancy. These pregnancy adaptations are well tolerated in healthy women but in pregnant with heart disease, it can decompensate ultimately resulting in significant Maternal and fetal morbidity and mortality². Rheumatic heart disease (RHD) still accounts for majority of the cases and mitral stenosis being the most encountered valvular lesion in India⁴. In most developing countries, Valvular heart disease are 1st recognised only during pregnancy, when there is pregnancy related cardiovascular hemodynamic changes increasing demands on the already diseased heart, hence presenting with symptoms like Breathlessness, palpitations, chest pain, fatigue, syncope and hemoptysis in certain valvular lesion.

There are numerous improvements in cardiac diagnostic techniques, however echocardiography still stands out as the corner stone for assessing the physiological cardiac changes of pregnancy with respect to valve patency or valvular flow pattern⁵. Further important practical strategies need to be identified to reduce maternal deaths due to cardiac disease in pregnant women⁶. With regards to fetal wellbeing, valvular heart disease in pregnancy pose a risk factor. In many studies, they have been shown to develop more intrauterine growth retardation, more premature births and more mortality and morbidity⁷ and hence there is a need for multidisciplinary approach involving participation from both obstetrician and cardiologist. Families must be counselled before conception itself regarding the various risk and outcome⁸ and whenever possible to undergo valve intervention before conception or to avoid pregnancy for untreated severe valvular lesions. Various data supporting medical and balloon valvuloplasty have been reported which improve the maternal outcome and now term gestation has become a possibility⁴. Predictors of adverse Maternal and fetal outcome has to be identified to avoid complications⁹. Hence our study aims to not only evaluate, the occurrence of maternal and fetal outcome in pregnant with Valvular Heart Disease but also to identify the echocardiographic risk factors or predictors of adverse outcome. Our study done from prominent tertiary centre in the south will provide a local data and give layout of disease burden of disease and thereby helps develop a patient centric management plan.

Methodology

All pregnant women with valvular heart disease were recruited; Preformed Performa was made and regular followed-up was done in both Antenatal clinic (ANC) and a cardiology outpatient clinic. Patients were informed about the study and consents taken. Proper history including age, parity, chief complaints like breathlessness, palpitations, syncope, NYHA class assessed. During the course of pregnancy all women underwent basic physical examination, Electrocardiogram (ECG) and echocardiography (ECHO). Any obstetric related or cardiac complications were recorded. Maternal outcome like Mode of delivery (whether vaginal delivery - instrumental or medically assisted or cesarian delivery), NYHA functional class, Hospitalizations, arrhythmias, maternal death, Congestive cardiac failure (CCF) noted. Fetal outcome included Low birth weight, Preterm delivery, Fetal loss, Intra Uterine Growth

Retardation (IUGR), Anomalous fetus were noted. Newborn < 2.5 kg were defined as low birth weight (LBW) and preterm deliveries- between 28 and 37 weeks.

Echocardiographic evaluation using adult probe included various parameters like Left ventricular Internal Diameter in Diastole (LVIDD), Left Ventricular Internal Diameter in Systole (LVIDS), Left Atrium Diameter (LAD), Peak and Mean mitral and aortic gradients, Ejection fraction (EF), Mitral valve area (MVA), Aortic valve area (AVA) and Vena Contracta.

Any abnormal echocardiographic findings were recorded and correlated with the outcome.

Results:

1. Table 1 shows that out of 77 pregnant women, 5(6.5%) were in the age group of 10-20 years, 52(67.5%) in the age group 20-30 years and 20(26%) in 30-40 age group.
2. Table 2 shows parity distribution in the study group. 30(38.96%) were primigravidae and 47(61%) were multigravidae.
3. Table 3 shows maternal outcome in the group. It shows the mode of delivery among the study group. 49(63.6%) had caesarean section, indication being obstetric and heart disease complicating pregnancy; 9(11.7%) had spontaneous vaginal delivery; 6(7.8%) had instrumental delivery and 4(5.2%) had medically induced vaginal delivery.
4. Among the study group, 1 patient had spontaneous abortion, 5 women underwent medical abortion, 2 women had hysterectomy and 1 maternal death due to cardiogenic shock in severe MS with severe Pulmonary hypertension; 18(23.4%) had Congestive Cardiac Failure (CCF); 8(10.3%) had moderate to severe Pulmonary Hypertension(PHTN).
5. Table 4 shows Fetal outcome in the group. 55(71%) out of 77 pregnant women had full term delivery; 22(28.6%) had preterm delivery; 66(85.7%) had live birth; 11(14.3%) had fetal loss; 37(48%) had low birth weight; 4(5.2%) had Intrauterine growth retardation (IUGR); 2 had Anomalous baby; 16(20.8%) had Cephalo-pelvic disproportion (CPD).
6. Table 5 shows spectrum of valvular heart disease involved and New York Heart Association (NYHA) class. Out of 77 pregnant women with valvular heart disease, Rheumatic Heart Disease (RHD) accounts for almost 54(70.1%); Mitral Valve Prolapse (MVP) accounts for 16(20.8%); Bicuspid Aortic valve 2% and functional mitral regurgitation due to Peripartum Cardiomyopathy accounts for 5(6.5%). 66(85.7%) of pregnant women had isolated Mitral valve involvement; 8(10.4%) had Isolated Aortic valve involvement; 3(3.9%) had both Mitral and Aortic valve involvement; 3(3.9%) had history of Balloon Mitral Valvotomy (BMV) done prior to current pregnancy. 40(51.9%) pregnant women were in NYHA functional class I and II and 19(24.7%) had NYHA class III and IV.
7. Table 6 shows Echocardiographic data of pregnant women with Mitral Stenosis (MS).

In Mild to Moderate MS(n=11), Mean and Peak Mitral gradient showed no significant variation during consecutive trimester and after delivery as compared with the 3rd trimester values. LVIDD (Left ventricle Internal Diameter at End Diastole) and LVIDS (Left Ventricle Internal Diameter at End Systole) shows no significant increase or decrease during pregnancy and after delivery respectively as compare with the 3rd Trimester values. LAD (Left Atrium Diameter) on the other hand, significantly increased during consecutive trimesters with p value of < 0.005. No significant change in Ejection Fraction (EF) noted during pregnancy and after delivery.

9(81.8%) out of 11 women with Mild to Moderate MS had NYHA class I and II while only 2(18.2%) had NYHA class III dyspnea. No deterioration in NYHA functional class noted in

consecutive trimester. 7(63.6%) out of 11 patient patients in the group underwent Cesarean section, mostly performed due to Obstetric indication while only 2 patients had cardiac indication due to CCF. 1 patient underwent emergency hysterectomy following detection of anomalous fetus. 7(63.6%) newborns in the group had low birthweight, 4 preterm deliveries; 2 patients had Congestive Cardiac Failure (CCF); 3 fetal deaths, mostly due to obstetrics complications.

In pregnant women with Severe MS(n=9), Mean and Peak gradient increased significantly (p value<0.005) during consecutive trimester and significant decrease post-delivery as compared with 3rd trimester values with p value of < 0.001. Mean pressure gradient was 18 mmHg. LVIDD and LVIDS remained in normal range and no significant change noted during pregnancy and post-delivery. LAD significantly increased with p value of < 0.003 between 1st and last trimester. No significant change in Ejection Fraction (EF) noted during pregnancy and after delivery.

Out of 9 patients with severe MS, 4(44.4%) patients were in NYHA class I and II while 5(55.6%) patients had NYHA class III and IV dyspnea. Deterioration and shift of NYHA functional class was observed in all of them with consecutive trimester. 5(55.6%) patients had acute pulmonary edema, most of them observed in the 2nd and 3rd trimester and observed gradient to be above 20 mmHg. 1 patient had Atrial fibrillation but no Left Atrial (LA) clot or stroke noted and managed medically. 7(77.8%) patients underwent Cesarean section, 4(44.4%) performed due to cardiac indication due to CCF; 4(44.4%) of new born had low birthweight; 6(66.7%) had preterm delivery; 4(44.4%) patients had Congestive Cardiac Failure (CCF); 3 fetal deaths, due to cardiac complications due to CCF with severe PHTN. 1 Maternal death noted in the group due to CCF with severe PHTN.

8. Table 7 shows Echocardiographic data of Pregnant women with Mitral regurgitation(n=48)
In Mild MR(n=33), there was no significant increase in LVIDD and LVIDS during consecutive Trimester. LAD remains within normal limit during pregnancy and post-delivery. No significant change in EF noted. 5(15.1%) patients in the group had peripartum cardiomyopathy with mildly reduced EF; 16(48.5%) patients had Mitral Valve Prolapse (MVP), mostly asymptomatic; 9(27.3%) patients were in NYHA class I and II while 5(15.1%) patients had NYHA class III and IV dyspnea. Deterioration and shift of NYHA functional class was observed in 5 patients with peripartum cardiomyopathy. 5(15.1%) patients had acute pulmonary edema, observed in the 2nd and 3rd trimester. 17(51.5%) women underwent Cesarean section performed almost due to obstetric indication; 10 (30.3%) new born in the group had low birthweight; 4(12.1%) had preterm delivery.

In pregnant women with Moderate to severe MR(n=15), there was non-significant increase in LVIDD and LVIDS during consecutive trimester. LAD on the other hand, increased significantly with p value of < 0.01. Also Following delivery, there was a significant decrease in LVIDD and LAD as compared to 3rd trimester values with p value of <0.01. No significant change in EF noted during pregnancy and after delivery.

9(60%) patients were in NYHA functional class I and II while 6(40%) patients had NYHA class III and IV dyspnea. Deterioration and shift of NYHA functional class was observed in 4(26.7%) patients with consecutive trimester. 4(26.7%) patients had acute pulmonary edema, observed in the 2nd and 3rd trimester, managed with diuretics; 9(60%) patients in the group underwent Cesarean section, performed almost due to obstetric complications; 8(53.3%) new born had low birthweight; 3(20%) had preterm delivery; 1 Intra Uterine Growth Retardation (IUGR) noted in the group but no fetal or maternal death were observed.

9. Table 8 shows echocardiographic data of pregnant women with Aortic Regurgitation(n=9). LVIDD, LVIDS and LAD increased significantly between 1st and 3rd trimester of pregnancy with p value of < 0.01. There is significant decrease of all these parameters post - delivery as

compared to the 3rd trimester values with a p value of < 0.004. No significant change in EF noted.

Out of 9 patients with AR, 5(55.6%) patients had NYHA class I and II, 4(44.4%) patients had NYHA class III and IV. Deterioration and shift of functional class seen in 4 patients with consecutive trimester; 4(44.4%) patients had CCF, observed in the 2nd and 3rd trimester, managed with diuretics; 7(77.8%) patients in the group underwent Cesarean section, 4 had obstetric indications and 3 patients had cardiac indications due to acute pulmonary edema; 4(44.4%) new born had low birthweight; 1(11.1%) had preterm delivery; 2(33.3%) fetal death. 1 patient had to undergo emergency hysterectomy due to obstetric indication.

10. Table 9 shows echocardiographic data of pregnant women with Aortic stenosis(n=2) Only 2 patients in our study group presented with severe AS. 1 patient has spontaneous abortion at 1st trimester. In other patient, there was no significant increase in LVIDD, LVIDS and LAD between consecutive trimester. Peak gradient ranged from 62 to 87 mm Hg with decrease in gradient by 25 mm Hg post-delivery. No change noted in EF during pregnancy and post-delivery; underwent Cesarean section, performed due to cardiac indications viz CCF, post-delivery newborn had low birthweight.

11. Mitral Stenosis with Mitral regurgitation: only 6 patients had both Mitral Stenosis and regurgitation. Out of 6 patients in the group, 3(50%) patients had dyspnea, NYHA functional class III and IV; 5(83.3%) new born has low birthweight; 2(33.3%) preterm delivery; 1 fetal death following hysterectomy done due to obstetric indication. 5(83.3%) patients in the group underwent Cesarean section, 3 patients had cardiac indication due to Acute pulmonary edema.

12. **Mitral stenosis + Mitral Regurgitation + Aortic Regurgitation:** Only 3 patients had multivalvular involvement - MS, MR and AR. Out of the 3 patient, 2 patient had CCF at 3rd trimester with NYHA functional class IV; all patient underwent cesarean delivery, performed almost due to cardiac indications following CCF; 1 had preterm delivery and all newborns were of low birth weight.

13. Out of 2 patients admitted with history of **Balloon Mitral Valvotomy (BMV)** done for severe MS, 1(50%) patient had severe mitral restenosis, and deterioration of NYHA class noted with consecutive trimester, had CCF at 6 months of pregnancy due to severe pulmonary hypertension. Non-viable Fetus delivered post emergency cesarian section.

Tables and Charts

Table 1: Age distribution

Age group	No of pregnant woman	%
10-20	5	6.5
20-30	52	67.5
30-40	20	26
Total	77	100

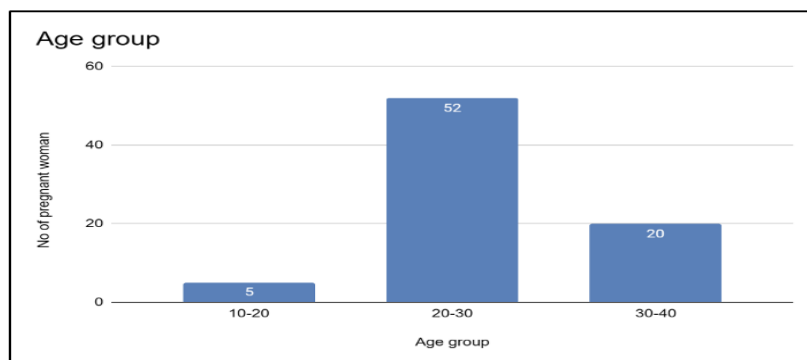


Figure 1: Age distribution of Pregnant women with Valvular Heart disease.

Table 2: Parity

Gravida	No of Pregnant woman	%
Primigravida	30	38.96
Multigravida	47	61.04
Total	77	100

Table 3: Perinatal and Maternal outcome

Perinatal and Maternal outcome		
Mode of delivery		
Cesarean	49	63.6%
Spontaneous vaginal delivery	9	11.7%
Instrumental	6	7.8%
Induced vaginal delivery	4	5.2%
Medical Abortion	5	6.5%
Spontaneous abortion	1	1.3%
Hysterectomy	2	2.6%
Maternal Death	1	1.3%
Congestive cardiac failure	18	23.4%
Cardiogenic shock	1	1.3%
Oligohydramnios	1	1.3%
Moderate to Severe Pulmonary Hypertension	8	10.3%

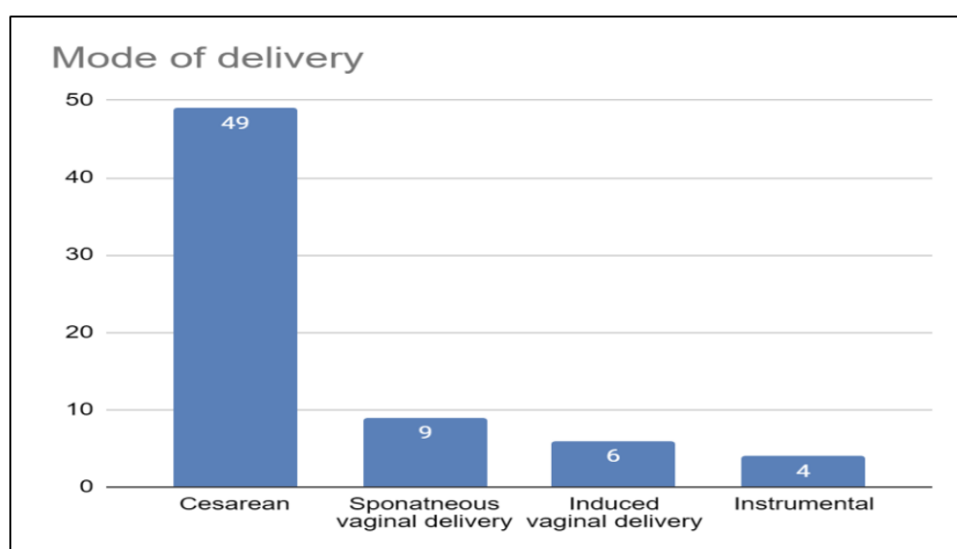
**Figure 2: Mode of delivery of pregnant with Valvular Heart Disease**

Table 4: Fetal outcome

Fetal outcome		
Term	55	71.4%
Preterm	22	28.6%
Live Birth	66	85.7%
Fetal Death	11	14.3%
Intra Uterine Growth Retardation	4	5.2%
Anomalous baby	2	2.6%
Cephalo-Pelvic Disproportion	16	20.8%
Meconium Stained Amniotic Fluid	1	1.3%
Low Birth Weight	37	48%

Table 5: Valvular Heart disease characteristics and NYHA class

Valvular lesion	No of Pregnant woman	%
RHD	54	70.1
MVP	16	20.8
PPCM	5	6.5
BAV	2	2.6
Isolated Mitral valve involvement	66	85.7
Isolated Aortic valve involvement	8	10.4
Both Mitral and Aortic valve involvement	3	3.9
MS+MR	6	7.8
MS+MR+AR	3	3.9
History of BMV	3	3.9
NYHA class		
I and II	40	51.9
III and IV	19	24.7

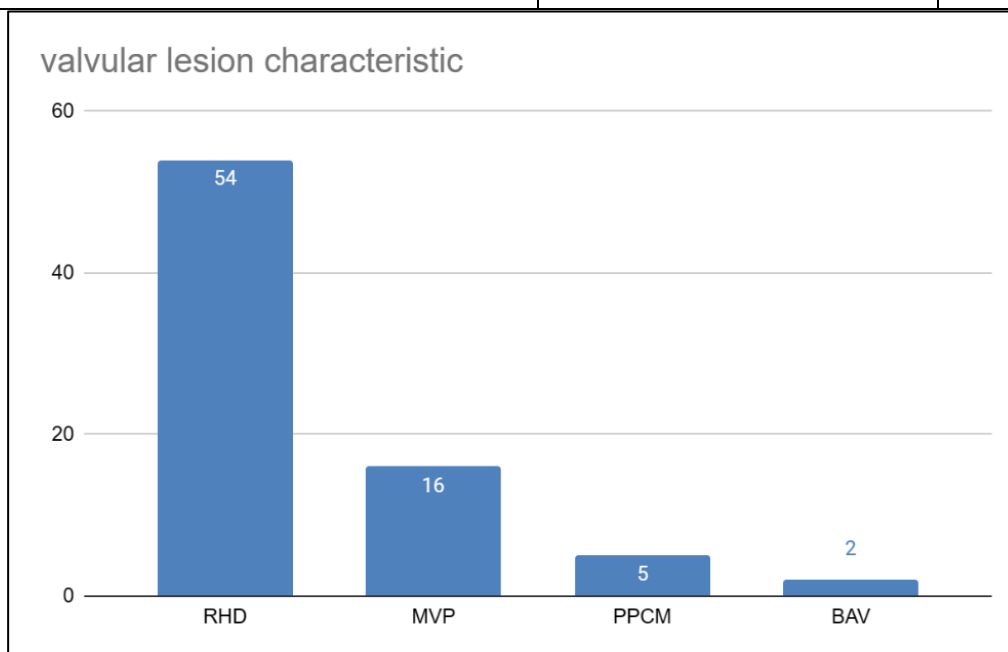
**Figure 3: Valvular lesion characteristic of pregnant women in the group.**

Table 6: Echocardiographic data of Pregnant women with Mitral stenosis (n-19).

Characteristic	Mild to Moderate MS (n-11)		Severe MS (n-9)	
	Range	Mean±SD	Range	Mean±SD
MVA	1.6-2.4	1.8±0.2	0.8-1.5	1.24±0.22
Mean Gradient	2.5-10.5	8.2±2.1	9-27	18.3±2.8
Peak Gradient	8.9-25.8	16.4±3.9	15-43	28±4.3
LVIDD	3.8-5.6	4.7±0.4	4.0-5.3	4.5±0.36
LVIDS	2.2-4.5	2.9±0.22	2.3-4.1	2.7±0.46
LAD	3.5-6.0	4.5±0.41	3.9-6.2	4.9±0.5
EF	55-74	64±7.0	45-75	63±8.2

Table 7: Echocardiographic data of Pregnant women with Mitral regurgitation(n-48).

Characteristic	Mild MR (n-33)		Moderate to Severe MR (n-15)	
	Range	Mean±SD	Range	Mean±SD
Vena contracta	0.1-0.3	0.2±0.12	0.4-0.9	0.5±0.24
LVIDD	4.0-6.7	5.3±0.23	4.8-6.6	5.8±0.35
LVIDS	2.2-5.0	3.3±0.21	3.1-5.1	3.7±0.43
LAD	3.2-5.5	4.5±2.2	3.4-5.7	4.6±3.3
EF	52-74	59±7.0	45-75	60±7.2

Table 8: Echocardiographic data of Pregnant women with Aortic regurgitation(n-9).

Characteristic	n-9	
	Range	Mean±SD
LVIDD	4.5-6.6	5.7±0.62
LVIDS	2.4-4.9	3.7±0.57
LAD	2.5-3.9	3.5±0.44
EF	45-70	62±6.2

Table 9: Echocardiographic data of Pregnant women with Aortic stenosis(n-2).

Characteristic	n-2	
	Range	Mean±SD
LVIDD	4.0-5.5	4.75±0.75
LVIDS	1.9-2.9	2.4±0.5

Mean gradient	42-55	48.5±6.5
Peak gradient	62-87	74.5±13.5
LAD	2.5-4.4	3.45±0.95
EF	63-72	67.5±4.5

Discussion:

In developing countries like India, Cardiac disease in pregnancy especially RHD still pose a major health problem and is linked with significant adverse maternal and perinatal outcome¹¹. A study done in PGI Chandigarh¹² over a 12 years period showed RHD incidence of 2.4%. In our study, 70.1% (54/77) patient had RHD while only 23.4% (18/77) accounts for Congenital Heart Disease (CHD). RHD to congenital heart disease ratio in our study was 3:1 which was similar to the findings done in a study in Pakistan-3:1⁴. RHD symptoms typically presents in the 4th or 5th decade but pathophysiologic changes in pregnancy causes women to present symptoms earlier. 52(67.5%) patients in our study was in the age group of 20-30 years which was comparable to the study done by D. Pratibha et al¹³. Usually in countries like India, pregnancy serves as a purpose of screening young women for cardiac lesions; Hence 70.3% of our patient were diagnosed to have valvular heart disease in the index pregnancy which was different in a study done by Hameed et al¹¹ where 30.3% of women were diagnosed in the index pregnancy to have heart disease. When it comes to valve involvement, Mitral valve was the most common valve involved accounting for 77.9% which was similar to studies done by D. Pratibha et al¹³ where 80.5% of the women had Mitral valve involvement. The New York Heart Association (NYHA) functional class has a direct effect on both maternal and fetal outcome. In our study 24.7% (19/77) of women had NYHA class III and IV, comparable to studies done by Sawhney et al¹² and D. Pratibha et al¹³ where 22.3% and 28% had NYHA class III, IV respectively. When it comes to Mode of delivery, 63.6% (49/77) women had caesarean sections but only 24.7(19/77) of women had vaginal delivery which was very different from many studies done namely 73.5% in D. Pratibha et al¹³, 86% in Hameed et al¹¹ and 91.42% in Sawhney et al¹². 63.3% of Cesarean section had obstetric indication while 36.7% had cardiac indication. Instrumental delivery accounted for 31.6% of vaginal deliveries similar to studies series 34% by Pratibha et al¹³. Only 4(21%) women had medically induced vaginal delivery which was compared to studies done by 8.4% in Sawhney et al¹² and 4.25% in Asghar et al⁴.

In our study cardiac complication accounted for 23.4% which was different from studies recorded by Siu SC et al¹⁴. where 13% had cardiac complications. CCF was reported in 17 women (22%) compared to 38% in study series by Hameed et al¹¹ and 20% in series done by Asghar F et al⁴.

In our study, the maternal mortality was 1/77(1.2%). A study done by Sawhney et al¹² and Barbosa et al¹⁹ reported maternal mortality of 2% and 2.3% respectively.

Perinatal outcome: In our study, the Low Birth Weight (LBW) was 48% which was compared to 29.4% in a series done by Barbosa et al¹⁹. Preterm labour was 28.6% which was comparable to studies done by Hameed et al¹¹ and Asghar F et al⁴ with 23% and 14% respectively. IUGR was seen in only 4(5.2%) in our study, compared to 9.3% and 18.2% in D. Pratibha et al¹³ and Sawhney et al¹² respectively. In our study, a significant difference was seen in perinatal outcome when compared between NYHA class I, II and III, IV. The perinatal mortality rate was 7.5% in class I, II compared to 42.1% in class III, IV. This finding was compared to study done by Pratibha et al¹³ where perinatal mortality rate was 3.4% in class I and II compared to 14.28% in class III and IV. The perinatal mortality seen in Sawhney series¹² was 1.5% in class I & II and 3.5% in class III and IV.

Echocardiography in Maternal and perinatal outcome:

In our study, Mitral Regurgitation (62.3%) was the most frequently encountered valve disease. This finding was different from studies done in many studies where Mitral stenosis (MS) accounts for predominant lesion, 69.6% in Hameed et al¹¹, 89.2% in Sawhney H et al¹², 48.5% in D. Pratibha et al¹³. In severe MR, LVIDD, LVIDS, LAD increased significantly in consecutive trimester with deterioration of functional class, findings which was similar to study done by L. Agata et al²⁰. Despite significant increase in LVIDD, LVIDS and LAD in severe MR, good tolerance was observed in women in the course of pregnancy; these findings were similar to previous observation noted in literature on the subject^{21,22}. Despite increase in overall volume of blood, there is decreased systemic vascular resistance due to pregnancy which ultimately determines the decrease of regurgitation in the course of pregnancy. No Maternal or fetal death was noted in the group.

In our study, Mitral stenosis accounts for 24.7% of pregnant, 2nd most common valve disease encountered. Mitral valve area (MVA) of less than 1.5 cm² is considered severe MS, which may be the single most reason responsible for rapid deterioration in pregnancy. EF, LVIDD or LVIDS remains within normal range but LAD, Mean and Peak gradient increased significantly with consecutive trimester which was seen similar to the finding in L. Agatha series²⁰. 55.6% of women had class III, IV dyspnea, mostly observed in 2nd and 3rd trimester, findings which was similar to the L. Agatha series²⁰. 3 fetal deaths almost due to cardiac complications in women with CCF. 1 Maternal death noted in the group due to CCF with severe PHTN.

1 patient with Atrial fibrillation was noted in the group, who went for Acute pulmonary edema and preterm delivery at 8th month of pregnancy with new born having low birth weight. AF or supraventricular tachycardia (SVT) causes rapid deterioration in pregnancy^{21,23}.

Our echocardiographic findings where increase in mitral gradient exceeding mean of above 18 mmHg leads to pulmonary edema, was similar to findings in the literature²⁴; proving that mitral gradient is a significant hemodynamic factor which can be of great value in prognostication.

In our study, there was good tolerance in pregnant women with Mild to moderate Aortic regurgitation, most of them in NYHA I and II. Similar finding was noted in L. Agatha series²⁰. Usually AR is well tolerated because of the decrease in peripheral resistance and shortened diastole. 3 out of 9 women with Aortic insufficiency had severe aortic regurgitation, 2 of whom developed acute pulmonary edema and both women had fetal loss at 3rd month of pregnancy. In pregnant with severe AR with enlarged LVIDD, clinical deterioration is well expected and consistent with data cited in many literatures^{21-22, 25}. In studies done by Banning JE et al²⁷, Brian JE et al²⁸, Arias F et al²⁹, Aortic valve stenosis occurred only in 0.5% to 3% of pregnant. In our study, only 2 women presented with Aortic stenosis, both had severe Aortic stenosis due to Bicuspid Aortic valve (BAV), out of which 1 patient had fetal loss at 3rd month of pregnancy and the other - preterm delivery with new born having low birth weight. These finding were quite contradictory to a series done by A. Les'niak²⁶ which stated that in spite of severe AS, majority of pregnant women did not present with any significant clinical symptoms. However, our study had very less entry in terms of Aortic stenosis, making it difficult to represent all population. Severe decrease in stroke volume and cardiac out are results of such adverse events²⁶. Increase in Aortic pressure gradient may also add to the adverse outcome.

Both women in our study had high gradient across aorta and LV, which decreased after delivery by almost 20-25 mmHg. Therefore, It is highly advisable to hospitalize those patients to minimize adverse outcome or emergency valve surgery. In symptomatic severe

AS, percutaneous balloon valvuloplasty or valve replacement may be considered as viable option²⁷.

PBMV in pregnancy: Currently in severe MS, Percutaneous Transvenous Mitral Commissurotomy (PTMC) is recommended as a safe procedure where medical therapy proves ineffective^{15,16} but it has certain prerequisite before the procedure viz the valve should be devoid of calcification, and there should be no Moderate to above Mitral regurgitation, which renders them impossible for Balloon valvoplasty. The other options being surgical valve replacement. These procedures are not devoid of complications¹⁷. In our study only 9 women presented with severe MS, most of them managed medically and others contraindicated due to associated Mitral regurgitation. Elkayam et al¹² in his article concluded that, PBMV should be reserved only for severe MS with symptoms, not responding to medical therapy.

The global incidence of major BMV complications is about 12%¹⁸ and mortality ranging from 0-3%. Cardiac tamponade, severe MR and deterioration of the woman's general condition being the major cause of death. The procedure is also associated with fetal risk related to unavoidable ionizing radiation exposure.

Conclusions

- High gradient across aorta and LV, Depressed LV function and increased LV volume especially in patients with obstructive valvular lesion like Mitral and Aortic stenosis have life threatening complications to both women in the course of pregnancy and to the fetus.
- Mitral Regurgitation is the most common valvular heart disease in pregnancy. Regurgitant lesion have better tolerability and outcome as compared to obstructive lesion.
- There is close association of NYHA class and maternal and fetal outcome, with higher risk in NYHA class III and IV.
- Critical outcome in severe lesion than in mild and moderate population. Need for hospitalization in high risk patients especially with increased gradient to avoid valvular intervention and adverse outcome.
- Proper guidelines for Maternal follow-up and fetal monitoring, and whenever indicated, repair of valvular lesion to be carried out before and during the course of pregnancy

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