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MATERNAL-FETAL MEDICINE

Pregnancy outcomes in women with mitral valve stenosis: 10-year experience of a tertiary care center

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Abstract

Introduction Mitral stenosis (MS) is recognized as one of the most common cardiovascular diseases during pregnancy and can result in adverse outcomes including maternal and fetal mortality if not diagnosed and treated in a timely manner. This study aimed to investigate the pregnancy outcomes of women with MS who were treated at the cardio-obstetric clinic in Alzahra Hospital, Isfahan, from 2011 to 2020.

Methods A total of 81 pregnant women diagnosed with MS were selected for the study. Their demographic and clinical data, along with echocardiography information—including systolic pulmonary artery pressure (SPAP), severity of MS, and NYHA class—were monitored throughout pregnancy. Additionally, the maternal and fetal outcomes were examined.

Results Among the participants, 38.3% were diagnosed with progressive MS, 56.8% exhibited severe stenosis, and 4.9% presented with very severe stenosis. Prior to pregnancy, no cases were classified as NYHA class 3 or 4. However, during the first trimester, six patients (7.4%) were classified as NYHA class 3. In the second trimester, 23 patients (28.4%) were in class 3, and 1 patient (1.2%) was classified as class 4. In the third trimester, 24 cases (29.6%) were in class 3, and 14 cases (17.3%) were in class 4. Notably, significant changes in NYHA class were observed throughout pregnancy ($P < 0.001$). Furthermore, 16% of participants required percutaneous balloon mitral commissurotomy, highlighting the severity of their condition. Additionally, 2.5% experienced decompensated heart failure and another 2.5% developed arrhythmia after delivery. Unfortunately, there was one case (1.2%) of mortality due to complications from MS. The study also documented one stillbirth (1.2%), 11 cases (13.6%) of spontaneous abortion, 17 cases (21%) of induced abortion, six cases (7.4%) of birth anomalies, three cases (3.7%) of prematurity, and four cases (4.9%) of intrauterine growth restriction, underscoring the critical need for careful management.

Conclusion The results of the study suggest that cardiac function in women diagnosed with MS typically declines during pregnancy. Furthermore, even with optimal treatments, certain complications may still arise.

Keywords Mitral stenosis · Pregnancy · NYHA class

What does this study add to the clinical work

Although pregnancy can significantly affect cardiac function, especially in individuals with mitral valve stenosis, early screening and the use of targeted treatments can help mitigate potential complications.

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Introduction

While hypertensive disorders are the most prevalent cardiovascular diseases encountered during pregnancy, rheumatic valvular diseases continue to pose significant concerns, particularly in non-Western countries. Valvular heart diseases affect approximately 2–3% of the population and can result in complications in 0.5–1.5% of pregnancies. During pregnancy, mitral valve stenosis (MS) is recognized as the most common valvular disease, with a prevalence of only 1–2% in developed societies. However, in developing countries, including among immigrants to developed nations, its prevalence is significantly higher, accounting for up to 56–89% of cardiac diseases during pregnancy [1, 2].

MS manifests when the mitral valve area (MVA), typically ranging from 4 to 6 cm^2, is reduced to 2 cm^2. This reduction in MVA leads to the classic symptoms of MS. The condition hampers the emptying of the left atrium and subsequently impairs left ventricular filling. As a result, the stroke and ejection volume of the heart decrease. With the progression of stenosis severity, the left atrium dilates causing an increase in left atrial pressure and creating a pressure gradient during diastole between the left atrium and the left ventricle. This pressure gradient is a hemodynamic characteristic of MS. Consequently, the pulmonary vessels experience an increase in back pressure, which may result in pulmonary congestion and, in severe cases, pulmonary edema. Prolonged pulmonary venous congestion causes irreversible changes in vascular structure, ultimately resulting in chronic pulmonary hypertension [1, 3]. Women with severe MS often struggle to handle the cardiovascular demands of pregnancy. The increased volume load induced by tachycardia exacerbates their condition, causing patients to deteriorate and progress to higher NYHA (New York Heart Association) class levels. The elevated heart rate during pregnancy limits the filling time of the left ventricle and raises the pressure in the left atrium, potentially resulting in an increase in systolic pulmonary arterial pressure (SPAP) and, in some cases, pulmonary edema. Additionally, the development of atrial fibrillation (AF) in these patients further complicates the situation, as approximately 80% of systemic embolism cases occur in patients with AF [4].

Healthy women experience considerable hemodynamic changes during pregnancy, which include an increase in circulating blood volume and heart rate, accompanied by a decrease in peripheral resistance [5]. Since the pressure gradient across the mitral valve is significantly influenced by heart rate and circulating blood volume, the increased heart rate, and expanded plasma volume during pregnancy may lead to symptoms and complications associated with MS. Consequently, pregnancy becomes more challenging for these patients [6, 7]. Consequently, it is of utmost importance for these patients to undergo a comprehensive echocardiographic evaluation of the mitral valve and systolic pulmonary arterial pressure (SPAP) prior to planning for pregnancy. Moreover, exercise stress echocardiography should be conducted to assess the mitral valve gradient and the presence of pulmonary hypertension during exercise [8]. Women with severe valve stenosis should consider undergoing interventional procedures, such as valvuloplasty, before becoming pregnant. In line with the AHA/ACC 2020 Guideline, it is reasonable to perform percutaneous balloon mitral commissurotomy (PBMC) before pregnancy, even in asymptomatic women with a valve area less than or equal to 1.5 cm^2 who have favorable valve morphology [9].

The primary therapeutic approach for pregnant women presenting with symptoms of MS consists of symptomatic treatments, which include rest, adherence to a proper diet, and the administration of beta blockers and diuretics. These interventions can be advantageous by reducing heart rate, increasing diastolic time, and minimizing cardiac demands. However, should these treatments prove ineffective, PBMC may be performed during the second or third trimester of pregnancy, contingent upon the patient having favorable anatomical conditions and the absence of mitral regurgitation or atrial thrombus [10]. Notwithstanding guideline recommendations, numerous patients with MS enter pregnancy without having undergone the requisite screening tests. One of the most critical clinical aspects for MS patients is heart rate. Tachycardia results in decreased diastolic filling time, increased left atrial pressure and pulmonary venous pressure, and the decompensation of heart failure. Therefore, controlling heart rate can significantly improve symptoms. If there is a reversible cause for tachycardia, it should be addressed before considering dromotropic drugs [11]. Class B and C beta blockers are approved by the FDA for use during pregnancy; however, they may be associated with adverse effects such as intrauterine growth restriction (IUGR) and fetal tachycardia [12, 13]. Verapamil, diltiazem, and digoxin fall under category C of FDA-approved drugs for pregnancy and should only be used if the benefits outweigh the risks [13, 14]. Approximately 50% of patients with severe MS experience heart failure symptoms during pregnancy, with dyspnea (NYHA class > I) being an independent predictor of maternal cardiac events [1, 15]. Volume overload symptoms can be managed with diuretics like furosemide, but caution should be exercised and they should only be prescribed for a short period. Excessive diuresis can reduce amniotic fluid volume and lead to fetal distress. Fetal complications associated with MS include premature birth, IUGR, low birthweight, as well as fetal and infantile death [16]. Therefore, considering the high prevalence of MS and the increased

cardiac complications during pregnancy, along with the associated maternal and fetal morbidities, this study aims to investigate pregnancy outcomes in women with MS at our tertiary cardiac center between 2011 and 2020. The goal is to improve management and reduce mortality and morbidity rates in these patients and other similar cases affected by this disease.

Materials and methods

This study is a retrospective study conducted from 2011 to 2020 at the cardio-obstetric clinic in Alzahra Hospital in Isfahan. The target population of the study consisted of pregnant women diagnosed with MS based on echocardiography. All cases presented with rheumatic MS and none were congenital or drug-induced.

The inclusion criteria consisted of pregnancy, a prior history of MS or a diagnosis of MS at the time of referral based on echocardiography, and the provision of consent to participate in the study. The exclusion criteria were delineated as follows: incomplete records, the presence of prosthetic heart valves, serious diseases that may affect data interpretation (including malignancy), physical conditions that restrict activity, gynecological or midwifery complications necessitating absolute rest, and therapeutic abortion for non-cardiac reasons. The sampling method utilized in this study was a census, encompassing all eligible participants from the years 2011 to 2020, which amounted to a total of 81 individuals.

The working method was as follows: the researcher was referred to the medical records unit of the cardio-obstetric clinic at Alzahra Hospital, where a list of pregnant women diagnosed with MS who visited during the study period was extracted. Utilizing the information contained in the patients' files, individuals who underwent echocardiography due to auscultation or other factors, such as dyspnea, elevated blood pressure, or a family history of valvular diseases, and were diagnosed with MS during pregnancy, were selected for inclusion in the study. Demographic information and data related to delivery were extracted from the patients' documents and systematically recorded in the data collection form. This encompassed age, height, weight, body mass index (BMI), history of smoking, use of anticoagulants, the number of previous abortions, and the number of previous deliveries (both cesarean section and normal vaginal delivery). Furthermore, the history of various gynecologic problems during pregnancy, echocardiographic information (including SPAP, severity of mitral stenosis, and the presence and severity of other valvular and non-valvular diseases such as hypertrophic obstructive cardiomyopathy and hypertension), NYHA class of patients, and information related to pregnancy outcomes (including the incidence of pregnancy-induced hypertension, multiple gestation, pre-eclampsia, eclampsia, stillbirth, maternal death, perinatal death, gestational age, and birth weight) were also recorded. The severity of MS was divided into three categories very severe (MVA less than 1 cm^2), severe (MVA 1–1.5 cm^2), and progressive MS (MVA more than 1.5 cm^2). The condition of pregnancy in general and according to the severity of MS was investigated and compared.

The functional class of the patient's heart was determined with the NYHA index. NYHA (New York Heart Association Functional Classification) is a simple system for diagnosing diseases in the field of heart failure. This system places the patient into four classes according to these statements during the clinical interview or visible signs in terms of breathing rate, limitation in physical activity, and the patient's complaint of anginal chest pain. Class I (the patient has no symptoms and signs and does not have any restrictions on physical activity, for example, he does not have breathing problems when climbing the stairs), Class II (mild symptoms such as anginal chest pain and difficulty in breathing after doing an ordinary physical activity), class III (significant symptoms such as breathing difficulty and chest pain even during a mild physical activity while the patient's resting time is not a problem, and class IV (severe symptoms can be seen even while resting). Placement in this class is a serious warning for patients who are at absolute rest [17]. The obtained data were entered into SPSS software version 26 and analyzed using Chi-square, *t* test, and one-way analysis of variance tests at a significance level of $P < 0.05$.

Results

In this study, 81 pregnant women with MS who were visited at the cardio-obstetric clinic in Alzahra Hospital, Isfahan between 2011 and 2020 were included. The disease was diagnosed in 45 individuals (55.6%) before pregnancy and 36 individuals (44.4%) during pregnancy. The average mitral valve area (MVA) for all patients was $1.47 +/- 0.48$ cm^2. Based on this, 31 individuals (38.3%) had progressive MS, 46 individuals (56.8%) had severe MS, and 4 individuals (4.9%) had very severe MS. There was no significant difference in the time of disease diagnosis based on the severity of MS ($P = 0.16$). The mean left ventricular ejection fraction was $56.5 +/- 6.9\%$. Additionally, 19 patients (23.5%) had significant simultaneous valvular diseases [including severe Tricuspid valve regurgitation ($N = 16$), severe aortic valve insufficiency ($N = 2$), and severe Aortic valve stenosis ($N = 1$)], and 10 patients (12.3%) had systolic RV dysfunction defined as tricuspid annular place systolic excursion (TAPSE) < 17 mm and/or tricuspid annular systolic velocity (s') < 9.5 cm/s. The average systolic pulmonary artery pressure (SPAP) for the patients was 45.7 ± 16.24 mmHg,

Table 1 Distribution of findings according to the severity of mitral valve stenosis

Variables	All patients	Severity of mitral stenosis			*P* value
		Progressive (*N* = 31)	Severe (*N* = 46)	Very severe (*N* = 4)	
Time of diagnosis					
Pre-pregnancy	45 (55.6)	21 (67.7)	23 (50)	1 (25)	0.14
During pregnancy	36 (44.4)	10 (32.3)	23 (50)	3 (75)	
Mean valve area (by planimetry) (cm^2)	0.48 ± 1.47	0.39 ± 1.94	0.20 ± 1.22	0.13 ± 0.78	0.001 >
Mean LVEF (Percentage)	6.9 ± 56.5	8.5 ± 56.9	5.6 ± 56.3	7.5 ± 56.3	0.92
Simultaneous significant valvular disease	19 (23.5)	7 (22.6)	10 (21.7)	2 (50)	0.44
Systolic RV dysfunction	10 (12.3)	3 (9.7)	6 (13)	1 (25)	0.67
Systolic pulmonary blood pressure	16.41 ± 45.7	8.6 ± 38.23	16 ± 48.02	22.3 ± 75.75	0.001 >
SPAP > 50	25 (30.9)	3 (9.7)	18 (39.1)	4 (100)	0.001 >
Cardiac rhythm during pregnancy					
Normal sinus	74 (91.4)	28 (90.3)	43 (93.5)	3 (75)	0.44
AF	7 (8.6)	3 (9.7)	3 (6.5)	1 (25)	
Occurrence of cardiac events in pregnancy	9 (11.1)	3 (9.1)	6 (13.6)	0 (0)	0.65
Need for PBMC	13 (16)	2 (6.5)	9 (19.6)	2 (50)	0.046
Incidence of DHF after delivery	2 (2.5)	2 (6.5)	0 (0)	0 (0)	0.24
Incidence of arrhythmia after delivery	2 (2.5)	1 (3.2)	1 (2.2)	0 (0)	0.99

LVEF left ventricular ejection fraction, *RV* right ventricle, *SPAP* systolic pulmonary arterial pressure, *AF* atrial fibrillation, *PBMC* percutaneous balloon mitral commissurotomy, *DHF* decompensated heart failure

and 25 patients (30.9%) had a history of SPAP > 50 mmHg during pregnancy.

According to the aforementioned findings, there was a significant difference in the mean MVA, mean pulmonary artery pressure, and SPAP > 50 according to the severity of MS ($P < 0.001$). During pregnancy, seven individuals (8.6%) experienced atrial fibrillation, but there was no significant difference based on the severity of MS ($P = 0.47$). Among them, 13.6% encountered cardiovascular events, including five cases (6.2%) of pulmonary edema, five cases (6.2%) of peripheral embolism, and one case (1.2%) of hemorrhagic stroke resulting in death during the study. The incidence of cardiac events during pregnancy did not significantly differ based on the severity of stenosis ($P = 0.45$) (Table 1). Pulmonary edema, peripheral embolism, and cerebrovascular accident (CVA) occurred on average in the 26.8 ± 8.2, 29.6 ± 5.9, and 35th week of pregnancy, respectively; however, this relationship did not reach statistical significance ($P = 0.57$). According to the obtained results, 13 patients (16%) required PBMC, and the need for it significantly differed based on the severity of MS as expected ($P = 0.046$). Two patients (2.5%) experienced decompensated heart failure and two individuals (2.5%) developed arrhythmia, after delivery.

Examining the NYHA class from before to the third trimester of pregnancy showed that there were no grade 3 and 4 diseases before pregnancy. However, in the first trimester, six patients (7.4%) were in grade 3. In the second trimester, 23 patients (28.4%) were in grade 3, and 1 person (1.2%) was in grade 4. In the third trimester, 24 people (29.6%) were in grade 3, and 14 people (17.3%) were in grade 4. The NYHA grade changes were significant during pregnancy ($P < 0.001$). However, there was no significant difference in the changes of the mentioned grade according to the severity of mitral valve stenosis ($P = 0.20$) (Fig. 1).

According to Table 2, out of the 81 patients in the study, 10 people (12.3%) did not receive beta-blockers either before or during pregnancy. Among them, four people (44.4%) received beta-blockers both before and during pregnancy, while 34 patients (42%) did not receive beta-blockers before pregnancy but were prescribed the drug during pregnancy. One patient (1.2%) was also receiving beta-blockers before pregnancy, but her drug was stopped during pregnancy. McNamara's test showed a significant difference between receiving beta-blockers during pregnancy compared to before pregnancy ($P = 0.009$). In total, 70 of the 81 patients (86.4%) were receiving beta-blockers during pregnancy.

With respect to diuretic use, 40 patients (49.4%) did not receive diuretics either prior to or during pregnancy. Conversely, three individuals (3.7%) utilized diuretics both before and during pregnancy. Furthermore, 38 patients (46.9%) did not receive diuretics before pregnancy but were prescribed them during pregnancy, indicating a significant difference in diuretic intake ($P < 0.001$).

All patients diagnosed with AF rhythm received anticoagulation therapy. The anticoagulant agents were also prescribed to patients with normal sinus rhythm who exhibited a severe smoky pattern, had a left atrial diameter of 5.5 cm or greater, or had a history of embolic events [18].

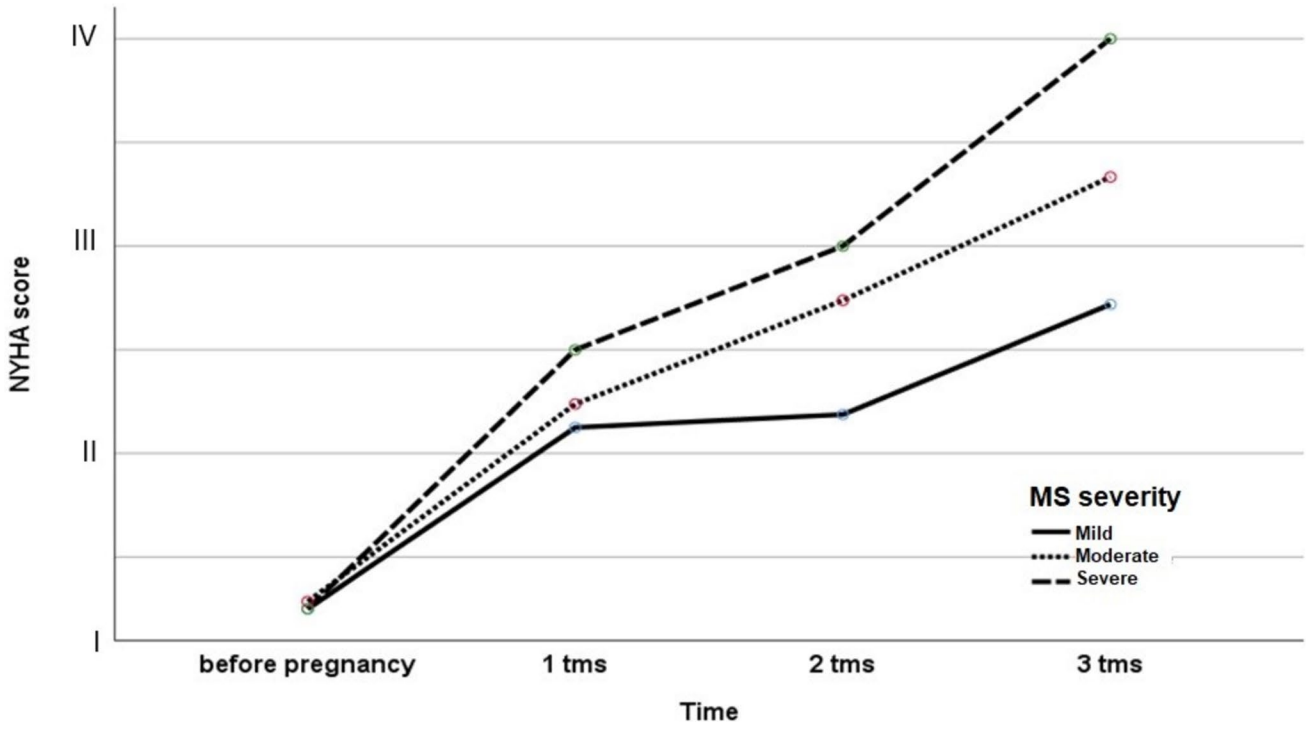

Fig. 1 NYHA grade percentage during pregnancy

Table 2 Distribution of drug intake frequency before and during pregnancy in the patients under study

Pre-pregnancy	During pregnancy	No	Yes	*P* value
Beta blocker	No	10 (12.3)	1 (1.2)	0.001 >
	Yes	34 (42)	36 (44.4)	
Diuretic	No	40 (49.4)	0 (0)	0.001 >
	Yes	38 (46.9)	3 (3.7)	
Anticoagulant	No	65 (80.2)	2 (2.5)	0.013
	Yes	12 (14.8)	2 (2.5)	

In terms of anticoagulant administration, 65 individuals (80.2%) did not receive anticoagulants either prior to or during pregnancy. Conversely, two individuals (2.5%) received anticoagulants both before and during pregnancy. Additionally, 12 patients (14.8%) did not receive anticoagulants prior to pregnancy but were prescribed them during pregnancy, while two individuals (2.5%) utilized anticoagulants before pregnancy but did not receive them during pregnancy. The analysis revealed a statistically significant difference in the administration of anticoagulant drugs before and during pregnancy ($P = 0.013$).

In Table 3, the distribution of the frequency of pregnancy outcomes is shown. The frequency of cesarean section in all patients was 70 cases (86.4%). One patient (1.2%) died due to complications of mitral valve stenosis. The incidence of stillbirth was 1 case (1.2%), spontaneous abortion 11 cases (13.6%), induced abortion 17 cases (21%), birth anomaly 6 cases (7.4%), prematurity 3 cases (3.7%), and lUGR 4 cases (4.9%). There was no significant difference in the frequency of the mentioned complications according to the severity of mitral stenosis ($P > 0.05$).

The average age of pregnancy termination among all women participating in the study was determined to be 33.9 ± 8.1 weeks. The mean birth weight of the newborns was recorded at 2645.5 ± 547 g, and the average duration of hospital stay for all patients was 5.5 ± 5.8 days. There were no statistically significant differences in the means of these variables based on the severity of mitral valve stenosis.

It should be noted that of the 81 patients included in the study, 65 (80.2%) underwent surgery under general anesthesia. This decision was based on the preload dependence of these patients and the elevated risk of preload reduction associated with the use of epidural anesthesia. Furthermore, among the 81 patients, 36 (44.4%) experienced preterm labor, and 25 infants (30.86%) had low birthweight (< 2500 g). Five-minute APGAR score < 7 was found in 16 neonates (19.7%).

Table 3 Frequency distribution of late pregnancy in women with mitral valve stenosis

Variables	All patients (*N* = 81)	Severity of mitral stenosis			*P* value
		Progressive (*N* = 31)	Severe (*N* = 46)	Very severe (*N* = 4)	
Normal vaginal delivery	11 (13.5)	6 (19.4)	4 (8.7)	1 (25)	0.21
Mean gestational week at birth	8.1 ± 33.9	8.1 ± 34.2	8.5 ± 33.4	2.4 ± 36.3	0.77
Maternal death	1 (1.2)	0 (0)	1 (2.2)	0 (0)	0.99
Stillbirth	1 (1.2)	1 (3.2)	0 (0)	0 (0)	0.43
Spontaneous abortion	11 (13.6)	4 (12.9)	7 (15.2)	0 (0)	0.69
Therapeutic abortion	16 (19.8)	6 (19.4)	10 (21.7)	0 (0)	0.73
Anomaly at birth	6 (7.9)	1 (3.6)	5 (11.4)	0 (0)	0.57
Prematurity at birth	3 (4)	1 (3.6)	2 (4.7)	0 (0)	0.99
Mean birthweight (grams)	547 ± 2645.5	376.7 ± 2784.2	639.2 ± 2564.8	377.7 ± 2537.5	0.25
IUGR	4 (5.5)	2 (7.4)	2 (4.8)	0 (0)	0.72
Length of hospital stay (day)	5.8 ± 5.5	0.98 ± 4.7	0.74 ± 5.61	6.5 ± 10.5	0.16
General anesthesia	65 (80.2)	21 (80.8)	41 (95.3)	0 (0)	0.26
Multiple pregnancy	2 (2.5)	0 (0)	2 (4.3)	0 (0)	0.56

IUGR intra-uterine growth restriction

Discussions

Considering the high prevalence of rheumatic MS during pregnancy, the present study aimed to investigate the maternal and fetal consequences of the disease, to provide the best services to this group of patients. According to the findings of this study, 81 women were identified as suffering from MS, with the presence of MS confirmed in 44.4% of them during pregnancy. This finding emphasizes the importance of screening pregnant women for cardiovascular diseases. The prevalence of MS in pregnant women in developed countries is estimated to be between 1 and 2%, while in developing non-western countries with a high prevalence of rheumatic fever, it may reach as high as 56–89% [1, 2, 19].

The results of the study indicated that the majority of pregnant women were classified as NYHA class III and IV upon entering the second and third trimester. Previous research has demonstrated an increased fetal death rate of approximately 30% when the mother's NYHA class reaches IV [20]. However, in the present study, despite a relatively high number of women in classes III and IV, fetal death was observed in only one case (1.2%). This suggests that effective medical interventions to control MS in pregnant participants may have played a role in reducing mortality.

Nevertheless, it is important to note that the rate of abortion among the women in our study was high. Approximately 11.1% of pregnant women experienced spontaneous abortion, while therapeutic abortion was performed in 19.8% of cases. A study conducted by Hosseinzadeh et al. in Tabriz, Iran in 2018 reported MS as the most common cardiac disease in pregnant women, with a prevalence of 39.6%. Additionally, 60% of the women examined in that study reported a history of abortion [20].

Dadgar et al. reported in their study that the most prevalent cardiac disease during pregnancy was MS, with a frequency of 96.8%. Among those with MS, 12.37% had a history of fetal and neonatal complications. The most common complications observed in this study were premature birth and stillbirth [21]. According to our findings, 16% of women required PBMC. Pregnancy poses substantial challenges for patients with MS, as it not only endangers the health of the mother but may also result in serious fetal complications. Therefore, given the increasing prevalence of cardiovascular diseases and the importance of maintaining the health of both mother and fetus, it is crucial to investigate the incidence of pregnancy and childbirth outcomes in women with this heart disease in every society [15].

In our study, among the 81 pregnant women with MS, one person (1.2%) died due to MS-related complications, one patient (1.2%) experienced heart failure, and one case (1.2%) developed cardiac arrhythmia after delivery.

Our study reported a maternal death rate of 1.2% and identified that 47% of patients were classified as functional class 3 or 4 during the third trimester, findings that are comparable to those of Van Hagen's 2018 study, which documented a mortality rate of 1% and the occurrence of heart failure symptoms in approximately 50% of patients [22].

Rheumatic mitral stenosis is the most common and significant valvular abnormality observed in pregnant women in non-western countries. It can be associated with pulmonary congestion, edema, and atrial arrhythmia during and after pregnancy. However, the mortality rate among pregnant women with mild symptoms is less than 1% [20]. Therefore, it is of utmost importance to implement preventive measures, including the examination of women who are pregnant or planning to become pregnant, in terms of MS.

Numerous studies have investigated the features of MS during pregnancy. In 2003, Silverside et al. and in 2001, Hameed et al. demonstrated that the rate of cardiac morbidity in pregnant women with MS was approximately 30% [16, 23]. Today, more than two decades have elapsed since the publication of these articles, during which time advancements in treatment methods have resulted in a significant decrease in the maternal mortality rate, now approximately 1%. In a 2009 review conducted by Tsiaras et al., it was highlighted that the treatment and management of MS complications during pregnancy remain challenging and may require emergency and surgical interventions. The authors also noted that despite extensive and modern healthcare services in developed countries, many patients remain unaware of their valvular heart disease until they become pregnant and experience complications. This study further demonstrates that although the prevalence of MS has decreased in developed countries, it remains a significant risk factor for mortality and morbidity during pregnancy [24]. A study by Roos-Hesselink in 2013, focusing on 1321 pregnant women with heart disease, reported that only 13 patients (approximately 1%) died, with more than 30% of those deaths attributed to MS. This study also demonstrated that with the necessary care and examinations conducted prior to and during pregnancy, the majority of patients can safely undergo pregnancy and have a normal delivery [15]. In another study by Avila et al. in 2003, involving 1000 pregnant women with heart diseases, it was shown that pregnancy both causes and exacerbates complications of heart diseases and remains an important risk factor for pregnancy complications. Nevertheless, cardiac examination and care during and before pregnancy can help improve patient prognosis. These results are consistent with the findings of our study [25].

Regarding the occurrence of prenatal complications, the study found that the incidence of anomalies among the women under investigation was 7.9%, with about 4% experiencing prematurity at birth and 5.5% experiencing intrauterine growth restriction (IUGR). The most probable cause of these complications is identified as uteroplacental insufficiency, which is attributable to the mitral stenosis related inability to adapt to the increasing circulatory demands during pregnancy. A large multicenter review conducted by Silversides et al. in 2003 identified five predictive factors for fetal complications in pregnant women with progressive and severe rheumatic MS: NYHA class above II, maternal hypertrophic obstructive cardiomyopathy, smoking during pregnancy, multiple pregnancies, and the use of anticoagulants during pregnancy [16]. In another study by Siu et al. in 2002, which compared 302 pregnancies in women with heart diseases to 572 normal pregnancies, it was found that fetal complications were more prevalent in the patient group (18 vs. 7% in the control group) [26]. The findings of Silverside and Hameed also support the common occurrence of fetal complications, with a higher incidence observed in more severe cases of the disease [16, 23]. The rate of premature delivery and low birth weight was higher among these patients compared to the general population. The study revealed that 16.6% of the deliveries were premature and 19.3% of the babies weighed less than their gestational age and the general population.

In any case, the findings of the present study and other conducted studies indicate a higher prevalence of adverse maternal and fetal outcomes in women with MS compared to the general population. These findings highlight the importance of screening tests and specialized care for pregnant women with a history of MS [10]. However, it is important to consider the limitations of this study, such as the small sample size and short follow-up period, and therefore, it is recommended to conduct further research in this field.

Conclusions

In conclusion, the results of this study demonstrate a decline in cardiac function in women with MS during pregnancy, which may have significant implications for both pregnancy and fetal outcomes, including the need for PBMC, heart failure, postpartum arrhythmia, abortion, stillbirth, anomalies, and prematurity. Therefore, due to the relatively high prevalence of MS-related factors, it is crucial for women, particularly those with a history of heart and rheumatic diseases, to undergo early pregnancy screening and receive specialized care for MS.

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Declarations

Conflict of interest There was no conflict of interest.

Ethical approval The study has been performed in Chamran hospital, Isfahan, Iran.

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