Original Article

Risk Factors of Cardiac Complications in Pregnant Women with Hypertrophic Cardiomyopathy

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Abstract

Background: Hypertrophic cardiomyopathy (HCM) is a common inherited genetic cardiac disease during pregnancy. Studies of risk factors are of great significance for maternal and fetal outcomes. **Aim:** The aim of the study was to identify predictive risk factors for cardiac complications in pregnant women with HCM. **Methods:** One hundred patients with HCM who delivered at the Shanghai obstetrical cardiology intensive care center between January 2000 and December 2022 were retrospectively reviewed. A logistic regression model was used to identify independent risk factors for cardiac complications. **Results:** Twenty-one cases were obstructive HCM (21%), 16 with cardiac function grade I and 5 with grade II; 79 cases were non-obstructive HCM (79%), 67 with cardiac function grade I, 11 with grade II, and 1 with grade III. Ninety-one cases had abnormal electrocardiogram (ECG) (91%), mainly with ST-T changes (77%). The average interventricular septum was 19.39 ± 6.13 mm by echocardiography (21.75 ± 5.86 mm for obstructive HCM and 18.73 ± 6.08 mm for non-obstructive HCM). The main cardiac complications were maternal death (n = 2, 2%), heart failure (n = 7, 7%), and sustained ventricular tachyarrhythmia (n = 1, 1%). Cardiac complications occur commonly during the third trimester and postpartum period. Three independent risk factors to predict cardiac complications in pregnant women with HCM were obstructive HCM (P = 0.036), New York Heart Association (NYHA) class ≥II (P = 0.022), and previous history of syncope (P = 0.037). **Conclusions:** HCM increases the risk of maternal death, heart failure, and malignant arrhythmia. More attention should be given to risk assessment and pregnancy management. Early detection of risk factors can reduce the incidence of maternal mortality and cardiac complications.

Keywords: *Cardiac complications, hypertrophic cardiomyopathy, pregnancy, risk factor*

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Introduction

Hypertrophic cardiomyopathy (HCM) is a common inherited genetic cardiac disease. The prevalence of HCM in the general population is one in 500.[1] HCM is increasingly diagnosed in women of childbearing age due to the more widespread use of echocardiography and genetic screening programs. The majority of young women with HCM wish to consider pregnancy. HCM confers an increased risk of heart failure, malignant ventricular arrhythmias, sudden cardiac death (SCD), and embolic stroke.[2] Pregnancy causes hemodynamic changes including increased cardiac output, decreased systemic vascular resistance, activation of the rennin angiotensin aldosterone system, and increased heart rate. Due to the extracardiac load during pregnancy, women with HCM have much higher maternal morbidity.

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At present, there is little research on pregnancy with HCM in China. We therefore analyzed the clinical data of 100 women with HCM who gave birth at the Shanghai obstetrical cardiology intensive care center between January 2000 and December 2022 to identify the risk factors for cardiac complications in pregnant women with HCM and identify high-risk women.

Materials and Methods

A retrospective analysis of the maternal outcomes of pregnancies in women with HCM who delivered at our center between January 2000 and December 2022 was carried out. This study was approved by the Research Ethics Committee of the Shanghai Renji Hospital, School of Medicine, Shanghai Jiao Tong University (KY2020-057) and conducted according to the Declaration of Helsinki. One hundred women with HCM were identified. All were supervised in the cardioobstetric clinic under the joint supervision of an obstetrician and cardiologist. Cardiac diagnosis was established by electrocardiogram (ECG) and echocardiography. The diagnosis of HCM was made mainly based on the 2022 Guidelines for Hypertrophic Cardiomyopathy in China.[3] The New York Heart Association (NYHA) class was defined by the NYHA functional classification.[4]

Baseline data were collected at the first prenatal visit, including maternal age, pregnancy history, gestational age, previous cardiac events (cardiac failure, severe arrhythmia, syncope, and sudden cardiac arrest), previous cardiac surgery, family history, NYHA functional classification, physical examination results (heart rate, blood pressure, breathing rate, cyanosis, cardiac murmur, and pulmonary rales), laboratory values, 12lead electrocardiography, Holter monitoring ECG, and echocardiography. Maternal cardiac complications included the following: heart failure, severe arrhythmia (atrial fibrillation, supraventricular tachycardia, and ventricular tachycardia), cardiac arrest, and maternal death. The patients were followed up until 42 days post-delivery.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) for Windows, version 23.0 (SPSS Inc., Chicago, Illinois, USA). Baseline data are expressed as means with standard deviations; categorical data are expressed as percentages. A comparison of measurement data was performed using a ttest. A comparison of enumeration data was performed using the Chisquare test. A univariate logistic regression model was used to identify risk factors for maternal cardiac complications. The prospective risk factors identified in the univariate analysis were then included in a multivariate logistic regression model to determine factors that remained statistically significant ($P < 0.05$).

Results

One hundred pregnant women with HCM were identified and analyzed in this study. All these patients with HCM were definitely diagnosed by cardiologists or cardiac surgeons. The mean age of these women was 29.21 ± 4.41 years, ranging from 21 to 42 years. Seventynine patients (79%) were primiparas, while the others (21%) were multiparae. Twenty-one patients (21%) were reported to have obstructive HCM; the

Table 1: Baseline characteristics of women with HCM

	All women with HCM n=100 (100%)	Women with obstructive HCM n=21 (21%)	Women with non-obstructive HCM n=79 (79%)	*P*
Age, years	29.21±4.41	29.57±4.21	29.11±4.48	0.675
Primiparas	79 (79%)	12 (57.1%)	67 (84.8%)	0.013
Multipara	21 (21%)	9 (42.9%)	12 (15.2%)	0.013
Hypertension	3 (3%)	1 (4.8%)	2 (2.5%)	0.511
Diabetes	6 (6%)	0 (0%)	6 (7.6%)	—
Family history	16 (16%)	3 (14.3%)	13 (16.5%)	1.000
History of cardiac surgery	3 (3%)	2 (9.5%)	1 (1.3%)	0.111
Diagnosed before pregnancy	63 (63%)	12 (57.1%)	51 (64.6%)	0.164
Diagnosed during pregnancy	37 (37%)	9 (42.9%)	28 (35.4%)	0.164
NYHA class				
NYHA I	83 (83%)	16 (76.2%)	67 (94.4%)	0.343
NYHA II	16 (16%)	5 (23.8%)	11 (13.9%)	0.013
NYHA III	1 (1%)	0 (0%)	1 (1.3%)	1.000
NYHA IV	0 (0%)	0 (0%)	0 (0%)	—
History of heart failure	1 (1%)	0 (0%)	1 (1.3%)	1.000
History of syncope	5 (5%)	1 (4.8%)	4 (5.1%)	1.000
History of cardiac arrest	0 (0%)	0 (0%)	0 (0%)	—
Family history of cardiac arrest	2 (2%)	1 (4.8%)	1 (1.3%)	0.378

NYHA: New York Heart Association functional class

average pressure gradient of the left ventricular outflow tract was 55.50 mmHg, ranging from 30 mmHg to 162 mmHg. Seventynine patients (79%) were reported to have non-obstructive HCM. Three patients (3%) had undergone cardiac surgery before pregnancy. One patient underwent aortic valve replacement due to aortic stenosis at the age of 16; one patient underwent left ventricular outflow tract drainage, right ventricular outflow tract drainage, and mitral valve replacement due to obstructive HCM at the age of 23; another patient underwent left ventricular outflow tract drainage, aortic valve replacement, and mitral valve replacement due to obstructive HCM at the age of 20. The gestational ages of these patients when admitted to our hospital were as follows: Six patients were <20 weeks (6%), three patients were between 20 weeks and 27 weeks and 6 days (3%), 44 patients were between 28 weeks and 36 weeks and 6 days (44%), and 47 patients were ≥37 weeks (47%). The average hospital days were 10.68 ± 10.36 days. Baseline characteristics are presented in Table 1. ECG data are presented in Table 2 and echocardiography data are shown in Table 3.

During pregnancy, 67 patients were treated with cardiac medications. Thirty-six patients were treated with beta-blockers (36%), 32 patients were treated with diuretics (32%), 43 patients were treated with myocardial nutritional drugs (such as coenzyme Q10, adenosine triphosphate, etc.), one patient was treated with drugs for lowering pulmonary artery pressure, and 15 patients were treated with anticoagulants (such as low molecular weight heparin and aspirin).

Table 2: ECG data of women with HCM

	All women with HCM n=100 (100%)	Women with obstructive HCM n=21 (21%)	Women with non-obstructive HCM n=79 (79%)	*P*
Left ventricular high voltage	29 (29%)	5 (23.8%)	24 (30.4%)	0.787
Pathological Q-wave	11 (11%)	2 (9.5%)	9 (11.4%)	1.000
ST-T change	77 (77%)	15 (71.4%)	62 (78.5%)	0.562
Supraventricular arrhythmias	42 (42%)	11 (52.4%)	31 (39.2%)	0.325
Ventricular arrhythmia	48 (48%)	13 (61.9%)	35 (44.3%)	0.219
NSVT	10 (10%)	5 (23.8%)	5 (6.8%)	0.032

NSVT: Non-sustained ventricular tachycardia

Table 3: Echocardiography data of women with HCM

	All women with HCM n=100 (100%)	Women with obstructive HCM n=21 (21%)	Women with non-obstructive HCM n=79 (79%)	*P*
MR	57 (57%)	15 (71.4%)	42 (53.2%)	0.147
Mild	48 (48%)	8 (38.1%)	40 (50.6%)	0.336
Moderate	8 ((8%)	6 (28.6%)	2 (2.5%)	0.001
Severe	1 ((1%)	1 (4.8%)	0 (0%)	0.210
Systolic anterior motion	21 (21%)	17 (81.0%)	4 (5.1%)	<0.001
LVDD	21 (21%)	4 (19.0%)	17 (21.5%)	1.000
LVEF <50%	4 ((3%)	1 (4.8%)	3 (3.8%)	1.000
LVEFS <25%	5 ((5%)	1 (4.8%)	4 (5.1%)	1.000
Pulmonary hypertension	41 (41%)	13 (61.9%)	28 (35.4%)	0.044
Mild (25–50 mmHg)	35 (35%)	10 (47.6%)	25 (31.6%)	0.203
Moderate (50–80 mmHg)	6 ((6%)	3 (14.3%)	3 (3.8%)	0.105
Severe (≥80 mmHg)	0 ((0%)	0 (0%)	0 (0%)	—
LVAA	3 ((3%)	2 (9.5%)	1 (1.3%)	0.111
Maximum LVWT ≥30 mm	6 ((6%)	3 (14.3%)	3 (3.8%)	0.105
Mean IVST (mm)	19.39±6.13	21.75±5.86	18.73±6.08	0.069
Mean LVPWT (mm)	9.38±2.97	9.76±2.74	9.29±3.03	0.764
Mean LAD (mm)	41.95±7.04	43.69±6.47	41.35±7.14	0.190
Mean LVEDD (mm)	43.75±7.14	43.30±8.31	43.86±6.86	0.760
Mean LVESD (mm)	28.45±6.99	25.98±6.32	29.10±7.05	0.083
Mean LVEF (%)	64.74±9.62	64.31±9.44	66.35±10.33	0.446

LVDD: left ventricular diastolic dysfunction; LVEF: left ventricular ejection fraction; LVEFS: left ventricular endocardium fractional shortening; LVAA: left ventricular apical aneurysm; LVWT: left ventricular wall thickness; IVST: interventricular septal thickness; LVPWT: left ventricular posterior wall thickness; LAD: left atrial diameter; LVEDD: left ventricular end diastolic diameter; LVESD: left ventricular end systolic diameter

Table 4: Description of cardiac complications of eight patients

Patient	Age	Disease type	Cardiac complication	Timing event	Echocardiography	Treatment	Fetal outcome
1	24	Non obstructive HCM	Heart failure	35^{+6}	IVST (22 mm) PH (48 mmHg) LVEF 56%	Diuretic	Alive
2	39	Obstructive HCM	Heart failure	33^{+1}	LVWT (24 mm) LVOTG (152 mmHg) PH (58 mmHg) LVEF 67%	Beta-blocker and diuretic	Alive
3	29	Obstructive HCM	Heart failure	33^{+4}	LVWT (38.5 mm) LVOTG (71 mmHg) PH (54 mmHg) LVEF 89%	Diuretic	Alive
4	38	Non obstructive HCM	Heart failure	34^{+3}	IVST (18 mm) PH (38 mmHg) LVEF 51.3%	Beta-blocker and diuretic	Alive
5	27	Obstructive HCM	Heart failure	29^{+4}	IVST (27 mm) LVOTG (40 mmHg) PH (47 mmHg) LVEF 47%	Beta-blocker and diuretic	Alive
6	28	Obstructive HCM	Heart failure	31	LVWT (30 mm) LVOTG (112 mmHg) LVEF 57%	Beta-blocker and diuretic Mechanical mitral valve replacement and left ventricular outflow tract dredging	Alive
7	32	Obstructive HCM	Heart failure	32^{+5}	IVST (17 mm) LVOTG (35 mmHg) LVEF 70%	Beta-blocker and diuretic	Alive
8	33	Obstructive HCM	VT	Postpartum	LVWT (32 mm) LVOTG (40 mmHg) LVEF 44% LVAA	Metoprolol ICD implantation	Alive

IVST: interventricular septal thickness; PH: pulmonary hypertension; LVEF: left ventricular ejection fraction; LVWT: left ventricular wall thickness; LVOTG: left ventricular outflow tract gradient; LVAA: left ventricular apical aneurysm; ICD: implantable cardioverter defibrillator

In this cohort, two maternal deaths occurred. One patient had a family history of cardiomyopathy and was diagnosed with HCM in childhood. She had a history of syncope before pregnancy, and her echocardiography in early pregnancy prompted non-obstructive HCM (interventricular septum thickness was 21 mm with normal Ejection fraction (EF) and her pulmonary hypertension was 47 mmHg). She complained of chest tightness at 29 weeks of pregnancy and echocardiography was rechecked. We found her EF significantly decreased to 26% and her pulmonary artery pressure increased to 58 mmHg from the data of her echocardiography. We terminated pregnancy by cesarean section after promoting fetal lung maturation promptly, we had a live newborn. The surgical process was successful and the patient was admitted to the intensive care unit (ICU) after surgery. However, acute left heart failure occurred 72 hours after surgery and she died. Another patient did not know she had HCM before pregnancy; she was diagnosed with HCM by echocardiography because her ECG indicated premature ventricular contractions during pregnancy. Her echocardiography at 18^{+4} weeks of gestation prompted a diagnosis non-obstructive HCM with 44% EF and her pulmonary hypertension was 47 mmHg. She complained of chest tightness at 31^{+4} weeks of pregnancy and echocardiography was rechecked. We found her EF significantly decreased to 30% and her pulmonary artery pressure increased to 66 mmHg from the data of echocardiography. We promoted fetal lung maturation promptly and terminated pregnancy by cesarean section; we had a live newborn. However, acute left heart failure occurred on the day of surgery and she died. Seven patients developed heart failure (7%). Heart failure mainly occurred in the third trimester. Mechanical mitral valve replacement and left ventricular outflow tract dredging were performed on a

Table 5: Univariable analysis of predictors of cardiac complications in women with HCM

Predictors of heart complication	With heart complication n=10 (10%)	Without heart complication n=90 (90%)	OR	95% CI	*P*
Age	29.60±5.84	29.17±4.26	1.02	0.88–1.18	0.767
Obstructive HCM	6 (60%)	15 (16.7%)	7.50	1.88–29.85	0.004
Family history	4 (40%)	12 (13.3%)	4.33	1.07–17.64	0.041
Diagnosed during pregnancy	5 (50%)	32 (35.6%)	1.81	0.49–6.76	0.375
NYHA ≥II	6 (60%)	11 (2.2%)	10.77	2.62–44.29	0.001
History of heart failure	1 (10%)	0	1.62E10	0.00	1.000
History of syncope	3 (30%)	2 (2.2%)	18.86	2.69–132.24	0.003
Hypertension	1 (10%)	2 (2.2%)	4.89	0.40–59.35	0.213
Diabetes	1 (10%)	5 (5.6%)	1.89	0.20–18.00	0.580
NSVT	1 (10%)	9 (10%)	1.00	0.11–8.83	1.000
Maximum LVWT ≥30 mm	3 (30%)	3 (3.3%)	12.43	2.10–73.40	0.005
Systolic anterior motion	5 (50%)	16 (17.8%)	4.63	1.20–17.88	0.026
MR	8 (80%)	49 (54.4%)	3.35	0.67–16.65	0.140
LVDD	2 (20%)	19 (21.1%)	0.93	0.19–4.77	0.935
LVEFS <25%	4 (40%)	1 (1.1%)	59.33	5.70–617.22	0.001
LVEF <50%	3 (30%)	1 (1.1%)	38.14	3.50–416.43	0.003
Pulmonary hypertension	7 (70%)	34 (37.8%)	3.84	0.93–15.87	0.063
LVAA	1 (10%)	2 (2.2%)	4.89	0.40–59.35	0.213

NYHA: New York Heart Association functional class; NSVT: non-sustained ventricular tachycardia; LVWT: left ventricular wall thickness; LVDD: left ventricular diastolic dysfunction; LVEFS: left ventricular endocardium fractional shortening; LVEF: left ventricular ejection fraction; LVAA: left ventricular apical aneurysm

Table 6: Multivariate analysis of predictors of cardiac complications in women with HCM

Predictors of heart complication	OR	95% CI	*P*
Obstructive HCM	62.99	1.32-3012.53	0.036
Family history	6.25	0.033-1166.57	0.492
NYHA ≥II	60.77	1.82-2031.66	0.022
History of syncope	352.41	1.43–86849.30	0.037
Maximum LVWT ≥30 mm	8.40	0.11–656.88	0.339
Systolic anterior motion	15.04	0.17–1374.01	0.239
LVEFS <25%	168.70	0.58–49264.20	0.077
LVEF <50%	47.91	0.03–77176.43	0.304

NYHA: New York Heart Association functional class; LVWT: left ventricular wall thickness; LVEFS: left ventricular endocardium fractional shortening; LVEF: left ventricular ejection fraction

patient with heart failure after delivery. One patient had ventricular tachyarrhythmia postpartum (1%) and an implantable cardioverter defibrillator (ICD) implantation was performed. The detailed information on these eight patients is shown in Table 4. There were no atrial fibrillation or thromboembolism events in this cohort study.

A univariate logistic regression model was used to identify potential risk factors for maternal cardiac complications. This analysis identified several factors with an OR greater than 1. These factors include the following: obstructive HCM; family history of cardiomyopathy; NYHA class ≥II; previous history of syncope; maximum left ventricular wall thickness ≥30 mm; systolic anterior motion; left ventricular endocardium shortening fraction <25%; left ventricular ejection fraction <50% [Table 5]. These potential risk factors were entered into a multivariate logistic regression model, and three factors remained statistically significant for maternal cardiac complications among patients with HCM. These factors were obstructive HCM, NYHA class ≥II, and a previous history of syncope [Table 6].

Discussion

Despite being a common inherited form of cardiomyopathy, there is a paucity of literature assessing pregnancy outcomes and risk factors in women with HCM. Due to the extracardiac load during pregnancy, women with HCM had much higher maternal morbidity compared to the general population. Therefore, it is worthwhile to identify risk factors for maternal complications in these patients.

The pathophysiology of HCM consists of dynamic left ventricular outflow tract obstruction (LVOTO), mitral regurgitation (MR), diastolic dysfunction, myocardial ischemia, arrhythmias, and autonomic dysfunction. For a given patient with HCM, the clinical outcome may be dominated by one of these components or may be the result of a complex interplay.[5] The clinical manifestations of HCM vary greatly; most patients are asymptomatic which is accidentally found during physical examination or ECG or echocardiography

due to other diseases. In our study, 37 patients did not know their condition before pregnancy, and HCM was detected during pregnancy through ECG and echocardiography. Some patients may experience symptoms related to exercise, such as difficulty breathing, chest pain, palpitations, and syncope. Among them, difficulty breathing and chest pain are the most common symptoms. A previous study showed that 94% of HCM patients had ECG abnormalities at their first visit, including left ventricular high voltage, pathological Q-waves, and ST-T changes. Only 6% of them had a normal ECG.[6] A dynamic ECG shows different types of arrhythmias, including supraventricular and ventricular arrhythmias.[7] In our study, nine patients had normal ECGs (9%), while the remaining 91 patients had single or multiple abnormalities, followed by ST-T changes (77%), ventricular arrhythmias (48%), supraventricular arrhythmias (42%), left ventricular high voltage (29%), and pathological Q-waves (11%).

The results of this study support data obtained from a few retrospective studies reporting a low mortality rate (0–2%) related to pregnancy in women with HCM. Across 17 cohorts and 1624 pregnancies, three patients died, resulting in a maternal mortality rate of 0.18%.[8] Among these 17 studies reporting maternal mortality data, maternal death occurred only in two studies.[9,10] In the study by Autore *et al.*,[9] two women (out of 100) with very high-risk profiles died during pregnancy, and the mortality rate was 2%, which is consistent with our research. The first woman was 39 years old; she had a septum thickness of more than 30 mm and a very high gradient of 115 mmHg on cardiac catheterization. She suffered heart failure during late pregnancy and had a SCD four days postpartum. The second woman was a 26-year-old primigravidae. She had an extremely strong family history of sudden death and experienced prolonged runs of Ventricular tachycardia (VT) before death. In the study by Billebeau *et al.*,[10] a woman did not know her new cardiac condition; the diagnosis of the underlying cardiomyopathy was not made before pregnancy but during an inaugural cardiovascular complication during pregnancy. She presented with SCD in the 36th week of gestation. Therefore, there is still a certain proportion of mortality in pregnant women with HCM, so more attention should be paid to the risk assessment of pregnant women with HCM.

A number of complications such as heart failure, arrhythmias, syncope, and thrombo-embolic complications have been described in women with HCM during pregnancy. The rates of these vary from 15% to 48%, depending on the study design and patient population.[9–15] In our registry, 7% of women experienced heart failure, mainly during the third trimester. In 2017, Goland *et al.*[15] conducted a study of 60 pregnant women with HCM, nine patients developed heart failure during pregnancy, with an incidence rate of 15%, which is higher than our study. In 2022, in Moolla's systematic review, 13 out of 17 articles reported the occurrence of heart failure, with an incidence rate of 5%, which is similar to our findings.[8] This also indicates that the incidence of heart failure is decreasing with the depth of people's understanding of HCM. At the same time, we found that heart failure occurred more frequently in patients with obstructive HCM (5% vs. 2%). In the retrospective study by Autore *et al.*,[9] heart failure symptoms tended to worsen more often in those with LVOT obstruction (25% vs. 11%). There were only five case reports of sustained VT among seven studies reporting data on sustained VT, resulting in a pooled incidence of 1%. Further clinical details regarding sustained VT were not available in two studies.[16,17] Tanaka *et al.*[12] report a case of a 33-year-old female who developed sustained VT at 24 weeks of gestation, with no further episodes after initiation of beta-blocker therapy. Schuler *et al.*[18] reported the case of a 36-year-old nulliparous female who had an ICD placed previously. She had an episode of asymptomatic sustained VT, in the third trimester, identified at the time of device interrogation before the cesarean section. Autore *et al.*[9] reported a case of sustained VT in one of the patients who died, as described earlier. These results highlight the importance of early pregnancy care, the use of beta-blockers where appropriate, and consideration of ICD in select patients at high risk for ventricular arrhythmias.[5] In our study, there were no incidents of atrial fibrillation or thrombo-embolic complications.

In 2016, the expert consensus on pregnancy with heart disease in China classified non-obstructive HCM, obstructive HCM, and severe LVOTO as pregnancy risk stratifications III, IV, and V, respectively.[19] Left ventricular outflow tract obstruction is a single scoring item in the CARPREG score in Canada for the risk of pregnancy with heart disease. The 2018 European Society of Cardiology (ESC) guidelines classified HCM as a modified World Health Organization (mWHO) II–III risk.[20] Currently, the risk factors for adverse events in adult HCM patients reported in research include: previous cardiac arrest or persistent ventricular arrhythmia, family history of SCD, unexplained syncope, extreme left ventricular hypertrophy (maximum left ventricular wall thickness ≥30 mm), LVAA, LVEF ≤50%, ECG indicating non-sustained ventricular tachycardia (NSVT), left ventricular apical aneurysm, and Cardiac magnetic resonance (CMR) indicating extensive myocardial fibrosis.[5,21–24] The population studied for

these risk factors is non-pregnant women, and there is currently no risk prediction model for pregnant patients with HCM. Most studies abroad on the risk factors of pregnancy complicated with HCM are also small sample studies. In 2017, Goland S *et al*.[15] conducted a study on 60 pregnant women with HCM and found that NYHA functional class ≥II and signs of HF before pregnancy were risk factors for cardiac complications in HCM pregnant women. Tanaka *et al*.[12] identified the use of cardiac medication before pregnancy as a predictor of maternal complications in a retrospective study of 27 pregnancies in 23 women with HCM. Our study shows that obstructive HCM, NYHA class ≥II, and previous history of syncope are independent risk factors for predicting cardiac complications in pregnant women with HCM, which is consistent with previous studies. However, our article has limitations. The number of women with HCM who get pregnant is relatively small, and the sample size of women with HCM in our article is only 100. So the conclusions of our article are for reference only, we hope to accumulate more data on pregnant women with HCM in the future and propose a risk prediction model for them.

Conclusions

Over the last decades, considerable signs of progress have been made in the diagnostic evaluation, risk assessment, and clinical management of patients with HCM. Results of a contemporaneous, multicenter, prospective, worldwide registry showed that most women with HCM tolerated pregnancy well and had no mortality. However, cardiovascular complications such as heart failure and arrhythmias were not uncommon and influenced maternal outcomes. Obstructive HCM, NYHA class ≥II, and a previous history of syncope are important independent the risk factors for predicting cardiac complications in pregnant women with HCM. We hope that clinical doctors should attach great importance to risk assessment and pregnancy management of HCM patients and establish a multidisciplinary management team including cardiologists, obstetricians, neonatal experts, anesthesiologists, and other experts. Through early identification of risk factors, we can identify HCM pregnancy patients at high risk early and start appropriate treatment timely, so that cardiac events and maternal death can be avoided.

Author contributions

JH Lin and TT Huang conceptualized and designed the study. TT Huang and SH Feng were involved in data collection/acquisition and statistical analysis. All authors (TTH, SHF, and JHL) were involved in the writing and revising of the manuscript for intellectual content. All authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Ethical statement

This study was approved by the Research Ethics Committee of the Shanghai Renji Hospital, School of Medicine, Shanghai Jiao Tong University (KY2020-057) and conducted according to the principles of the Helsinki Declaration, and informed consent was obtained from every patient.

Availability of research data

Authors are available and ready to supply the data upon any request through the corresponding author.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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