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RISK FACTORS AND CLINICAL PROFILE OF PERIPARTUM CARDIOMYOPATHY IN KASHMIRI POPULATION: A PROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Background: Peripartum cardiomyopathy (PPCM) is a rare but potentially life-threatening form of heart failure that occurs in the last month of pregnancy or within five months of delivery. The etiology remains poorly understood, and data from the Kashmiri population is limited. This study aimed to evaluate the risk factors and clinical profile of PPCM in Kashmiri women. ***Materials and Methods:*** This prospective observational study was conducted in the Postgraduate Department of Medicine at Government Medical College, Srinagar from December 2019 to December 2021. A total of 36 postpartum women diagnosed with PPCM based on NHLBI criteria were enrolled. Comprehensive clinical assessment, electrocardiography, and two-dimensional echocardiography were performed. Data were analyzed using SPSS Version 20.0. ***Results:*** The mean age of patients was 29.6 ± 5.23 years, with the majority (30.6%) in the 30-34 years age group. Most patients belonged to upper-lower (30.6%) and lower-middle (27.8%) socioeconomic classes. The most common presenting symptom was dyspnea (72.2%), and the first symptom onset occurred within 4 weeks postpartum in 47.2% of patients. Tachycardia was the most frequent sign (63.9%). Blood group B positive was predominant (41.7%). Tocolytic use (oxytocin) was observed in 52.8% of patients, and 30.6% had a history of blood transfusion. The mean ejection fraction was 33.4 ± 7.75%, with moderate mitral regurgitation in 41.7% of patients. ***Conclusion:*** PPCM in the Kashmiri population predominantly affects women in their third decade, with low socioeconomic status, B positive blood group, tocolytic use, and blood transfusion emerging as notable risk factors. Early recognition and prompt management are essential for improving maternal outcomes.

Keywords: *Peripartum cardiomyopathy, heart failure, pregnancy, risk factors, ejection fraction, Kashmir*

Introduction

Peripartum cardiomyopathy (PPCM) is defined as new onset cardiomyopathy between the last month of pregnancy and five months post-delivery, without any determinable cause1. It is marked by the development of maternal systolic heart failure late in pregnancy or early in the postpartum period, representing a rare but serious complication that carries significant morbidity and mortality2. The incidence of PPCM varies considerably based on geographic location and racial background. The highest incidence of 1 in 100 to 1 in 300 live births has been reported from Nigeria and Haiti3-4. In India, the incidence is approximately 1 in 1374 live births, which is intermediate between the high rates in Africa and the lower rates in the United States (1:3000 live births)5-6. The etiology of PPCM remains poorly understood despite extensive investigation. Multiple hypotheses have been proposed, including viral myocarditis, autoimmune responses, hemodynamic stress, nutritional deficiencies (particularly selenium), prolonged tocolysis, and genetic predisposition7-9.

A significant advancement in understanding PPCM pathophysiology came from Hilfiker-Kleiner et al., who proposed a unifying pathway involving oxidative stress-induced activation of cathepsin D, which cleaves prolactin into a 16-kDa angiostatic and proapoptotic fragment that appears to initiate and drive the disease process10. This discovery has therapeutic implications, as bromocriptine, a dopamine D2 receptor agonist that suppresses prolactin production, has shown promise in improving outcomes11. Several risk factors have been consistently associated with PPCM, including advanced maternal age (>30 years), multiparity, twin gestation, hypertensive disorders of pregnancy (preeclampsia/eclampsia), black race, obesity, and prolonged tocolytic therapy12-15. However, the clinical profile and risk factor distribution may vary across different populations due to genetic, environmental, and cultural factors.

Kashmir, with its unique geographical location, ethnic composition, and cultural practices related to pregnancy and the postpartum period, may have distinct patterns of PPCM presentation and risk factor prevalence. However, data specifically addressing PPCM in the Kashmiri population is sparse. Understanding the local epidemiology and clinical characteristics is essential for early recognition, prompt management, and development of preventive strategies.

This study was therefore undertaken to systematically evaluate the risk factors and clinical profile of PPCM in Kashmiri women, with the aim of contributing to the global understanding of this condition while providing region-specific insights for healthcare providers in Kashmir.

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Materials and Methods

This prospective observational study was conducted in the Postgraduate Department of Medicine at Government Medical College, Srinagar, which is a tertiary care referral center in Jammu and Kashmir, India. The study was carried out over a period of two years from December 2019 to December 2021. The study protocol was reviewed and approved by the Institutional Ethics Committee of Government Medical College, Srinagar, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Patients were selected based on predefined eligibility criteria. Written informed consent was obtained from all participants or from their legally authorized representatives prior to enrollment in the study. The consent was obtained in the local language (Urdu/Kashmiri) to ensure that the participants clearly understood the nature and purpose of the study.

Inclusion Criteria: As defined by the National Heart, Lung, and Blood Institute (NHLBI) and the European Society of Cardiology Working Group on Myocardial and Pericardial Diseases[16], the diagnosis of peripartum cardiomyopathy (PPCM) was based on the following criteria:

1. Postpartum women developing signs and symptoms of heart failure within five months after delivery
2. Absence of any identifiable cause for heart failure during the peripartum period
3. No known pre-existing cardiac disease
4. Echocardiographic findings showing left ventricular ejection fraction (LVEF) <45%, left ventricular fractional shortening <28%, and left ventricular end-diastolic dimension (LVEDD) >5.5 cm or >2.7 cm/m²
5. Kashmiri patients (those born and residing in Kashmir and following Kashmiri culture and lifestyle)

Exclusion Criteria

- Patients with previous history of structural or functional heart disease
- Chronic pulmonary disorders
- Chronic hypertension or any other morbidity known to cause heart failure
- Development of signs and symptoms of heart failure beyond five months after pregnancy
- Non-Kashmiri patients

Methodology

All enrolled patients underwent a detailed clinical evaluation that included comprehensive history taking and thorough physical examination. Information regarding demographic characteristics, obstetric history, potential risk factors, and presenting clinical features was recorded in a structured study proforma designed for the purpose of this research. Electrocardiography and echocardiography were performed for all enrolled patients. A standard 12-lead electrocardiogram (ECG) was recorded to assess cardiac rhythm, conduction abnormalities, chamber enlargement, and possible ischemic changes. Two-dimensional and Doppler color-flow echocardiography were performed using Saint Jude Medical, Zonare, and Siemens Acuson SC 2000 Prime echocardiography systems. Echocardiographic assessment included evaluation of left ventricular ejection fraction, left ventricular end-diastolic dimension, and left ventricular fractional shortening. Additional parameters such as valvular regurgitation, particularly mitral regurgitation, pulmonary artery hypertension or tricuspid regurgitation, diastolic dysfunction, global hypokinesia, and chamber dilatation of the left atrium and left ventricle were also assessed. Routine laboratory investigations were carried out for all patients. Blood samples were collected and analyzed for complete blood count, serum creatinine, blood urea, serum electrolytes, and blood grouping in order to assess the general clinical status of the patients and to rule out other possible contributing conditions.

Statistical Analysis: The collected data were compiled and entered into Microsoft Excel and subsequently analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were summarized as frequencies and percentages. Graphical representation of the data was performed using appropriate visual tools such as bar diagrams and pie charts.

Results

A total of 36 patients diagnosed with peripartum cardiomyopathy were enrolled in this study during the two-year period. The results are presented in the following sections.

Table 1: Distribution of patients as per age, district, educational level and socioeconomic class

Parameter	Category	No. of Patients	Percentage
Age Group in Years	20-24	7	19.4
	25-29	10	27.8
	30-34	11	30.6
	≥35	8	22.2
District	Budgam	6	16.7
	Srinagar	6	16.7
	Anantnag	5	13.9
	Kupwara	5	13.9
	Baramulla	4	11.1
	Pulwama	4	11.1
	Others	6	16.6
Education level	No formal education	4	11.1
	Primary	8	22.2
	High school	14	38.9
	Higher secondary	6	16.7
	Graduate	4	11.1
Socioeconomic class	Upper	2	5.6
	Upper middle	4	11.1
	Lower middle	10	27.8
	Upper lower	11	30.6
	Lower	9	25.0

Table 1 presents the distribution of patients according to age, district of residence, educational status, and socioeconomic class. The majority of patients were in the 30-34 years age group (30.6%), followed by those aged 25-29 years (27.8%), while 22.2% were aged ≥35 years and 19.4% were between 20-24 years, indicating that most cases occurred in women in their late twenties and early thirties. With respect to district distribution, the highest proportion of patients belonged to Budgam and Srinagar (16.7% each), followed by Anantnag and Kupwara (13.9% each), while Baramulla and Pulwama each accounted for 11.1%, and other districts constituted 16.6% of the cases. This pattern likely reflects the referral catchment area of the tertiary care center. Regarding educational status, the largest group of patients had education up to high school level (38.9%), followed by primary education (22.2%) and higher secondary education (16.7%), whereas 11.1% were graduates and

another 11.1% had no formal education. In terms of socioeconomic status (Kuppuswami scale), most patients belonged to the upper-lower class (30.6%) and lower-middle class (27.8%), followed by the lower class (25.0%). A smaller proportion belonged to the upper-middle (11.1%) and upper class (5.6%), suggesting that peripartum cardiomyopathy in this study was more frequently observed among women from relatively lower socioeconomic backgrounds.

Table 2: History of herbal intake, smoke exposure, family history of PPCM			
Parameter	**Category**	**No. of Patients**	**Percentage**
Herbal Intake	Yes	4	11.1
	No	32	88.9
Smoke exposure	Yes	5	13.9
	No	31	86.1
Family history of PPCM	Yes	2	5.6
	No	34	94.4

Table 2 shows the distribution of patients according to history of herbal intake, smoke exposure, and family history of peripartum cardiomyopathy (PPCM). A history of herbal intake was reported in 11.1% of patients, while the majority (88.9%) had no such history, suggesting that traditional herbal practices were present only in a small proportion of cases. Exposure to smoke (active or passive) was observed in 13.9% of patients, whereas 86.1% had no smoke exposure. Regarding family history of PPCM, only 5.6% of patients reported a positive family history, while 94.4% had no such history, indicating that familial occurrence of PPCM was relatively uncommon in the study population.

Table 3: Distribution of patients as per Mode of delivery, oxytocin use, Maximum IV fluid received, history of blood transfusion and obstetric complications			
Parameter	**Category**	**No. of Patients**	**Percentage**
Mode of delivery	Normal Vaginal Delivery	20	55.6
	LSCS	16	44.4
IV fluid received	1-2	8	22.2
	2-3	20	55.6
	>3	8	22.2
Obstetric Complications	Intrauterine death	3	8.3
	Pre-eclampsia	2	5.6
	Abruptio placenta	1	2.8
	None	30	83.3

Table 3 shows the distribution of patients according to mode of delivery, maximum intravenous (IV) fluid received during parturition, and obstetric complications. The majority of women (55.6%) had normal vaginal delivery, while 44.4% underwent lower segment cesarean section (LSCS). Regarding IV fluid administration, most patients (55.6%) received 2-3 liters of IV fluids, whereas 22.2% received 1-2 liters and 22.2% received more than 3 liters. With respect to obstetric complications, the majority of patients (83.3%) had no complications. Among those with complications, intrauterine death was observed in 8.3% of cases, followed by pre-eclampsia in 5.6% and abruptio placenta in 2.8%. These findings indicate that although obstetric complications were present in some patients, most women with peripartum cardiomyopathy did not have major obstetric complications in the present study.

Table 4: Distribution as per presenting symptoms, NYHA classification, Ejection fraction and echocardiographic findings			
Parameter	**Category**	**No. of Patients**	**Percentage**
Presenting symptom	Dyspnea	26	72.2
	Pedal edema	7	19.4
	Fatigue	3	8.4
NYHA Class	Class I	5	13.9
	Class II	16	44.4
	Class III	10	27.8
	Class IV	5	13.9
Ejection fraction	20-29	9	25.0
	30-39	14	38.9
	40-44	13	36.1
Echocardiographic findings	Mild MR	13	36.1
	Moderate MR	15	41.7
	Diastolic dysfunction	14	38.9
	Global hypokinesia	12	33.3

Table 4 shows the distribution of patients according to presenting symptoms, NYHA functional class, ejection fraction, and echocardiographic findings. Dyspnea was the most common presenting symptom, observed in 72.2% of patients, followed by pedal edema (19.4%) and fatigue (8.4%), indicating that breathlessness was the predominant clinical complaint in patients with peripartum cardiomyopathy. According to the NYHA classification, the majority of patients presented with Class II symptoms (44.4%), followed by Class III (27.8%), while 13.9% each were in Class I and Class IV, suggesting that most patients had moderate functional limitation at presentation. Regarding left ventricular ejection fraction, the largest proportion of patients (38.9%) had an EF between 30-39%, followed by 36.1% with EF between 40-44%, and 25.0% with severely reduced EF between 20-29%, indicating varying degrees of systolic dysfunction among the study population. Echocardiographic findings revealed that moderate mitral regurgitation was the most common abnormality (41.7%), followed by mild mitral regurgitation (36.1%), diastolic dysfunction (38.9%), and global hypokinesia (33.3%), highlighting significant structural and functional cardiac abnormalities in patients with peripartum cardiomyopathy.

Discussion

Peripartum cardiomyopathy (PPCM) is an uncommon yet potentially life-threatening form of heart failure that occurs during the last month of pregnancy or within the early postpartum period. Despite increasing recognition worldwide, its epidemiology, clinical characteristics, and risk factors remain incompletely understood, particularly in geographically distinct populations such as Kashmir. The present prospective observational study was conducted to evaluate the risk factors and clinical profile of PPCM among Kashmiri women, and the findings provide important insights into demographic patterns, obstetric characteristics, clinical manifestations, and echocardiographic abnormalities associated with this condition.

In the present study, the mean age of patients was 29.6 ± 5.23 years, with the majority of cases occurring in the 30-34 years age group (30.6%), followed by 25-29 years (27.8%). These findings indicate that PPCM predominantly affects women in the later reproductive age group, which is consistent with the recognized association between advanced maternal age and increased susceptibility to PPCM.[17] Comparable findings have been reported in several studies from different geographic regions. Sarkar SM et al. (2021) reported a mean age of 28.27 ± 5.64 years,

with nearly 60% of patients belonging to the 30–39 years age group.[18] Similarly, Laghari AH et al. (2013) observed a mean age of 27.4 ± 6.05 years among PPCM patients in Pakistan.[19] In contrast, Binu AJ et al. (2020) from southern India reported a relatively lower mean age of 25.5 years.[20] These variations may reflect regional differences in maternal age at marriage, parity patterns, socioeconomic status, and healthcare accessibility.

The socioeconomic analysis in the present study revealed that the majority of patients belonged to upper-lower (30.6%) and lower-middle (27.8%) socioeconomic classes, with relatively fewer patients from upper socioeconomic groups. These findings suggest that PPCM may be more prevalent among women from economically disadvantaged backgrounds, possibly due to inadequate prenatal care, poor nutritional status, delayed healthcare access, and limited awareness of cardiac symptoms during pregnancy. Similar observations have been reported by Priya Biyyani MS et al. (2017), who demonstrated that socioeconomic factors significantly influence the occurrence of PPCM, with higher incidence observed among women belonging to lower socioeconomic strata.[21] The association between socioeconomic deprivation and PPCM highlights the importance of improving maternal health services, antenatal screening, and early cardiovascular evaluation in high-risk populations.

An interesting observation in the present study was the predominance of blood group B positive (41.7%), followed by O positive (30.6%). Although blood group has not been widely studied as a risk factor for PPCM, similar findings have been reported by Ahmed I et al. (2003) from Pakistan, who also observed B positive blood group in 66.6% of PPCM patients.[22] This observation raises the possibility of genetic susceptibility related to blood group antigens or population-specific genetic factors, although the current evidence remains insufficient to establish a causal relationship. Larger studies incorporating control populations are required to determine whether blood group truly represents a risk factor for PPCM. In the present study, 52.8% of patients received oxytocin during delivery, suggesting a possible association between uterotonic or tocolytic exposure and the development of PPCM. The relationship between prolonged tocolytic therapy and cardiomyopathy has been discussed in previous literature.[23–24] Ahmed I et al. (2003) reported that 6.6% of PPCM patients had a history of prolonged tocolytic therapy, while Whitlin AG et al. (1997) documented exposure to tocolytic therapy in 2 of 28 patients with PPCM.[25] Several mechanisms have been proposed to explain this association, including fluid retention, electrolyte imbalance, increased cardiac workload, and potential myocardial toxicity, all of which may contribute to the development or exacerbation of ventricular dysfunction in susceptible individuals.

A history of blood transfusion was present in 30.6% of patients in the present study. This finding may reflect postpartum hemorrhage, complicated labor, or severe maternal anemia, which remain common in resource-limited settings. Maternal anemia is a known contributor to high-output cardiac states, which may exacerbate myocardial stress and precipitate heart failure in women with underlying cardiac vulnerability. Obstetric complications were observed in 16.7% of patients, including intrauterine death (8.3%), pre-eclampsia (5.6%), and abruptio placenta (2.8%). Hypertensive disorders of pregnancy, particularly pre-eclampsia, have been consistently associated with PPCM. Lindley KJ et al. (2017) demonstrated that PPCM occurring in association with pre-eclampsia is associated with greater morbidity, altered patterns of left ventricular remodeling, and poorer event-free survival.[27] Similarly, Malhame I et al. (2019) reported that women with PPCM complicated by pre-eclampsia have a significantly higher risk of major adverse cardiovascular events.[28] These findings support the hypothesis that vascular endothelial dysfunction and systemic inflammation, which are hallmarks of pre-eclampsia, may contribute to the pathogenesis of PPCM.

In the present study, family history of PPCM was present in only 5.6% of patients, indicating that familial clustering is relatively uncommon. Comparable findings were reported by Sarkar SM et al., who documented a family history in 3.3% of patients.[28] However, increasing evidence suggests that genetic predisposition plays a role in a subset of PPCM cases. Christiansen MN et al. (2019) demonstrated that having a first-degree relative with heart failure was significantly more common among PPCM patients compared with controls, suggesting a shared genetic susceptibility with other forms of cardiomyopathy.[29] Furthermore, Ware JS et al. (2016) identified truncating variants in the TTN gene in PPCM patients, similar to those observed in idiopathic dilated cardiomyopathy, supporting the hypothesis of overlapping genetic mechanisms.[30]

Dyspnea was the most common presenting symptom in the present study (72.2%), followed by pedal edema (19.4%) and fatigue (8.4%). These findings are consistent with the classical clinical presentation of PPCM as acute or subacute heart failure occurring in the peripartum period. Similar observations have been reported in previous studies. Sarkar SM et al. reported dyspnea in 100% of patients, with associated palpitations and peripheral edema in a large proportion of cases.[18] Ahmed I et al. also reported dyspnea corresponding to NYHA class III-IV symptoms in 86.6% of patients.[22] Because dyspnea, fatigue, and pedal edema are common physiological symptoms during pregnancy and the postpartum period, PPCM may be easily overlooked unless clinicians maintain a high index of suspicion, particularly in women with persistent or progressive symptoms.

Functional status assessment using the NYHA classification revealed that most patients in the present study presented with Class II (44.4%) and Class III (27.8%) symptoms, indicating moderate functional impairment at presentation. Early recognition and prompt initiation of heart failure therapy are essential to prevent progression to advanced heart failure.

Echocardiography plays a crucial role in both the diagnosis and prognostic evaluation of PPCM. In the present study, the mean left ventricular ejection fraction was 33.4 ± 7.75%, with 25% of patients demonstrating severe systolic dysfunction (EF 20–29%) and 38.9% having EF between 30–39%. These findings are consistent with those reported in the IPAC study by McNamara DM et al. (2015), which reported a mean baseline LVEF of 36 ± 9%.[32] Similarly, Sarkar SM et al. reported severe LV systolic dysfunction (EF <30%) in 80% of patients, highlighting the severity of myocardial impairment in PPCM.[18] Valvular abnormalities were also frequently observed in our study. Moderate mitral regurgitation was present in 41.7% of patients, while mild mitral regurgitation was observed in 36.1%. These findings are likely secondary to left ventricular dilatation and papillary muscle dysfunction resulting from myocardial remodeling. Other echocardiographic abnormalities included diastolic dysfunction (38.9%) and global hypokinesia (33.3%), which are characteristic features of dilated cardiomyopathy.[33] These structural and functional abnormalities reflect the underlying myocardial damage associated with PPCM. Left ventricular ejection fraction remains the most important predictor of prognosis in PPCM.[34] Li W et al. (2016) demonstrated that LVEF <34% and BNP >1860 pg/mL were independent predictors of persistent LV systolic dysfunction.[35] Additional biomarkers and imaging parameters are currently being explored to improve risk stratification. For example, Ekizler FA et al. (2019) proposed the monocyte-to-HDL cholesterol ratio as a novel predictor of persistent LV dysfunction.[36] Similarly, Sugahara M et al. (2019) demonstrated that global longitudinal strain at presentation provides additional prognostic information beyond LVEF alone.[37] Right ventricular involvement has also emerged as an important prognostic factor. Blauwet LA et al. (2016) reported that baseline right ventricular fractional area change independently predicted subsequent LV recovery and clinical outcomes.[38] Furthermore, Haghikia A et al. (2019) demonstrated that bromocriptine therapy in PPCM patients with right ventricular involvement was associated with high rates of both LV and RV recovery.[39]

These findings highlight the importance of early echocardiographic evaluation, careful risk stratification, and close follow-up in patients diagnosed with PPCM.

Conclusion

Peripartum cardiomyopathy in the Kashmiri population was most commonly observed among women in their third decade of life, particularly those from lower socioeconomic backgrounds. The study identified several potential risk factors, including oxytocin use during delivery, history of blood transfusion, and short birth intervals. Blood group B positive was the most frequent blood group among affected patients, suggesting a possible association that requires further investigation. Clinically, patients most often presented with dyspnea, tachycardia, and other features of heart failure, usually occurring within the first month postpartum. Echocardiographic findings typically demonstrated moderate to

severe left ventricular systolic dysfunction, often associated with mitral regurgitation and diastolic dysfunction. Given the serious complications of PPCM, early diagnosis and prompt initiation of appropriate medical therapy are essential. Women at risk should receive adequate counseling and close monitoring, and those with recovered ventricular function should be advised regarding the risks of future pregnancies.

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