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Original Article

Obstetrics and Gynaecology Section

Clinical Characteristics and Short-term Outcomes in Patients with Peripartum Cardiomyopathy: A Retrospective Descriptive Study from a Tertiary Care Hospital in Southern India

A POORANI DEVI[1], SAJU DENISHYA PRABHAKARAN[2], RICHU RAVIKUMAR[3], TAMILARASU KALIAPPAN[4]

ABSTRACT

Introduction: Peripartum Cardiomyopathy (PPCM) is a life-threatening condition characterised by heart failure that occurs towards the end of pregnancy or in the months following delivery, with no identifiable cause for the heart failure. Despite its severity, the clinical characteristics of PPCM remain relatively unexplored in the Indian subcontinent.

Aim: To investigate the clinical presentation and outcomes of patients with PPCM and to analyse the maternal and foetal outcomes of those affected by PPCM.

Materials and Methods: This retrospective descriptive study was conducted among PPCM patients admitted over the past 10 years in the Department of Obstetrics and Gynaecology and the Department of Cardiology at PSG Hospitals, a tertiary healthcare centre in in Coimbatore, Tamil Nadu, India. The study was carried out over a period of 6 months, from May 2021 to November 2021. A sample size of 34 cases was determined and included in the study. Essential data for the study were gathered from the hospital's electronic medical records, including patient demographics and clinical parameters (heart rate, blood pressure, respiratory rate, haemoglobin, creatinine, electrolyte levels), medical history, treatment details (hospitalisation history, drug intake, inotrope use, readmissions, mortality), echocardiographic findings and medication status. Maternal outcomes recorded included heart failure hospitalisation, the need for inotropes and mortality. Continuous variables were expressed using mean, standard deviation, minimum and maximum values, while categorical variables were represented in terms of frequency and percentage.

Results: The study encompassed 34 participants with a mean age of 29.26±5.73 years. Hypertension was the most common co-morbidity, observed in 7 patients (20.59%), followed by diabetes in 4 patients (11.76%). According to the New York Heart Association (NYHA) classification, 15 patients (44.12%) fell into Class II, while 14 patients (41.18%) were classified as Class III. The study revealed a readmission rate of 13 patients (38.24%) and unfortunately, 3 patients (8.82%) succumbed to the disease. Diuretics were the predominant type of medication used, prescribed to 26 patients (76.47%), with Tab Digoxin being the most commonly used inotrope, administered to 12 patients (47.37% of those on inotropes).

Conclusion: The PPCM poses a significant challenge in diagnosis due to its symptom overlap with normal pregnancy. Timely identification of PPCM is crucial for successful treatment outcomes.

Keywords: Diuretics, Hypertension, Inotropes, New york heart association, Pregnancy

INTRODUCTION

In the field of maternal cardiac health, PPCM stands as a distinct condition characterised by the onset of cardiac failure occurring from the final month of pregnancy up to five months after childbirth [1]. This condition is marked by several defining criteria: the absence of an identifiable cause, the lack of evident heart disease before the last month of pregnancy and the presence of left ventricular systolic dysfunction, which is confirmed through established echocardiographic criteria [1]. The incidence of PPCM varies from one case per 1,485 live births to one case per 15,000 live births, with probable mortality rates ranging from 7% to 60% [2]. It is well recognised in many countries where its incidence is high, such as Haiti, Nigeria and South Africa [3]. The highest incidence was reported in Nigeria (1 in 102 deliveries), while Japan reported the lowest (1 in 15,533 births) [4]. Additionally, in South India, the prevalence is estimated to be 1 in 1,374 live births [5]. These variations highlight the diverse nature of PPCM's occurrence across different regions and populations [6,7]. Hypotheses regarding the cause of PPCM revolve around the physiological connections between pregnancy and the postpartum period, as well as genetic disorders, infectious factors and hormonal and metabolic changes [8].

Some common symptoms of Peripartum Cardiomyopathy (PPCM) encompass breathlessness, persistent cough, orthopnoea, haemoptysis and paroxysmal nocturnal dyspnoea. The majority of individuals affected by PPCM present with impaired cardiac function, categorised under New York Heart Association (NYHA) Class III or IV. Other reported symptoms include general fatigue, a sense of overall discomfort, palpitations and episodes of low blood pressure upon changing posture [9,10]. Pregnancy brings about intricate physiological changes in a woman's body, including cardiovascular adaptations [11]. Understanding these adaptations is pivotal in unraveling the causes that might contribute to the development of PPCM. Managing PPCM is challenging because its symptoms closely resemble those of a healthy pregnancy, often leading to delayed diagnosis [12]. The objective of the present study is to examine the clinical presentations and outcomes among PPCM patients in tertiary healthcare settings while also investigating maternal outcomes such as mortality. The present study addresses a critical knowledge gap, shedding light on

the unique aspects of this condition in the context of the Indian subcontinent.

MATERIALS AND METHODS

A retrospective descriptive study was conducted by the Department of Obstetrics and Gynaecology and the Department of Cardiology at PSG Hospitals, a tertiary healthcare centre in Coimbatore, Tamil Nadu, India. The study subjects were recruited from January 2011 to January 2021. The study was carried out over a period of six months, from May 2021 to November 2021. Ethical clearance for the study was obtained from the Institutional Human Ethics Committee (Ref. No.: PSG/IHEC/2021/Appr/Exp/204).

Inclusion and Exclusion criteria: The study included female patients aged 18 years or older who were diagnosed with PPCM and admitted to the Department of Obstetrics and Gynaecology and Cardiology. Patients with available follow-up data for at least one year were included. Those with pre-existing cardiac conditions unrelated to PPCM, incomplete medical records, or those lost to follow-up were excluded.

Study Procedure

Data was retrieved from in-hospital patient records, including relevant obstetric and gynaecological history, as well as co-morbidities such as diabetes mellitus, hypertension, obesity, chronic kidney disease and family history of Coronary Artery Disease (CAD) and Chronic Obstructive Pulmonary Disease (COPD). Vitals such as blood pressure, respiratory rate, heart rate and blood parameters including serum creatinine levels, sodium and potassium levels were measured and charted.

These study participants required administering medications such as inotropes, diuretics, beta blockers, Angiotensin Converting Enzyme (ACE) inhibitors and Mineralocorticoid Receptor Antagonists (MRAs), tailored to the severity of symptoms and NYHA classification [13] as determined by echocardiography findings (pretreatment). Post-treatment involved follow-up care, including adjustments to medication regimens based on subsequent clinical and echocardiography findings. Additionally, the study compared participants' symptom status graded based on NYHA classification pre- and post-treatment. Echocardiographic findings included Ejection Fraction (EF), left bundle branch block, Right Ventricle (RV) dysfunction, severe Mitral Regurgitation (MR), severe Tricuspid Regurgitation (TR) and Pulmonary Artery (PA) measurements assessed by Right Ventricular Systolic Pressure (RVSP) outcomes. Data on readmission and mortality were also charted.

STATISTICAL ANALYSIS

Continuous variables were represented using the mean, standard deviation, minimum and maximum values, while categorical variables were presented in terms of frequency and percentage. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) Statistics for Windows, Version 24.0.

RESULTS

The present study involved 34 women diagnosed with PPCM, with a mean age of 29.26±5.73 years. At baseline, participants had a mean heart rate of 112.74±27 bpm and a respiratory rate of 26.74±6.96 breaths per minute. Notably, 9 patients (26.47%) had low potassium levels and 7 patients (20.59%) had low sodium levels [Table/Fig-1]. A range of co-morbidities were identified among the study participants, with the prevalence of each as follows: 23.53% had a family history of CAD, 20.59% had hypertension and 11.76% had diabetes mellitus [Table/Fig-2]. Additionally, medical history revealed that 2.94% of participants had a history of Non Steroidal Anti-inflammatory Drug (NSAID)/steroid use. Readmissions occurred in 38.24% of patients and mortality was reported at 8.82% [Table/Fig-3].

Variables	Mean±SD	Minimum	Maximum
HR	112.74±27.00	72	197
SBP	115.76±17.66	80	160
DBP	77.59±16.05	50	120
RR	26.74±6.96	16	48
Haemoglobin	10.91±2.47	5.9	15
Creatinine	0.87±0.35	0.31	1.96
Hyponatremia	138.26±5.77	125	148
Hypokalemia	3.93±0.63	2.83	5.8

[Table/Fig-1]: Patient characteristics and clinical parameters.
HR: Heart rate; SBP: Systolic blood pressure; DBP: Diastolic blood pressure; RR: Respiratory rate

Variables	Sub-category	n (%)
Diabetes	Yes	4 (11.76)
	No	30 (88.24)
Hypertension	Yes	7 (20.59)
	No	27 (79.41)
F/H CAD	Yes	8 (23.53)
	No	26 (76.47)
Obesity	Obese	3 (8.82)
	Not obese	31 (91.18)
Kidney disorder	Acute	1 (2.94)
	Chronic	1 (2.94)
	No	32 (94.12)
COPD	Yes	3 (8.82)
	No	31 (91.18)
Infection	Yes	2 (5.88)
	No	32 (94.12)
H/O CAD	Yes	7 (20.59)
	No	27 (79.41)
Congestion	Pulmonary	33 (97.06)
	Systemic	1 (2.94)
Angina	Yes	5 (14.71)
	No	29 (85.29)
Syncope/ Presyncope	Yes	2 (5.88)
	No	32 (94.12)

[Table/Fig-2]: Clinical conditions and history of the patients N=34.
#Presence of missing values. F/H-Family History, H/O- History of, CAD: Coronary artery disease; COPD: Chronic obstructive pulmonary disease

Variables	Sub-category	n (%)
H/O Hospitalisation HF	Yes	2 (5.88)
	No	32 (94.12)
NSAID/Steroid intake	Yes	1 (2.94)
	No	33 (97.06)
Drug defaulter	Yes	1 (2.94)
	No	33 (97.06)
Inotropes#	Yes	19 (55.88)
	No	13 (38.24)
Readmission	Yes	13 (38.24)
	No	21 (61.76)
Mortality	Yes	3 (8.82)
	No	31 (91.18)

[Table/Fig-3]: Treatment status of the patients N=34.
#Missing values; H/O-History of; DAPT: Dual antiplatelet therapy; CABG: Coronary artery bypass grafting; HF: Heart failure; NSAID: Non steroidal anti-inflammatory drug

Inotropes were prescribed, with digoxin being the most common (63.16%), followed by Ivabradine (21%) and a combination of both (15.79%) [Table/Fig-4]. Notably, the use of inotropes is not reflected in

Inotropes	n (%)
Tab. Digoxin	12 (63.16)
Tab. Ivabradin	4 (21)
Tab. Ivabradin + Tab. Digoxin	3 (15.79)

[Table/Fig-4]: Different inotropes used by the patients.
n: number of patients; %: Percentage of patients; Tab: Tablet

the post-treatment data presented. Severe Mitral Regurgitation (MR) and tricuspid regurgitation (TR) were observed in 26.47% and 11.76% of participants, respectively, while 2.94% had a Left Ventricular (LV) clot. Compared to these pretreatment findings, post-treatment results showed a positive shift. Myocardial function also improved, as evidenced by an increase in mean Ejection Fraction (EF) from 39.79% pretreatment to 45.56% post-treatment and fractional shortening increased from 19.76% to 22.41% [Table/Fig-5].

Variables	Sub-categories	Pretreatment	Post-treatment	
		n (%)	n (%)	
LVH	Yes	30 (88.24)	15 (44.12)	
	No	4 (11.76)	19 (55.88)	
RV dysfunction	Yes	34 (100)	19 (55.88)	
	No	0	15 (44.12)	
Severe MR	Yes	9 (26.47)	6 (17.65)	
	No	25 (73.53)	28 (82.35)	
Severe TR	Yes	4 (11.76)	5 (14.71)	
	No	30 (88.24)	29 (85.29)	
Clot	Yes	1 (2.94)	0	
	No	33 (97.06)	34 (100)	
Variable	**Category**	**Mean±SD**	**Minimum**	**Maximum**
EF	Pre	39.79±11.66	20	78
	Post	45.56±14.17	15	65
LVID (diastolic)	Pre	48.06±8.38	24	64
	Post	48.21±8.3	20	59
LVID (systolic)	Pre	38.82±8.04	24	54
	Post	37.74±8.82	20	49
FS	Pre	19.76±5.79	12	39
	Post	22.41±7.05	7	32
RVSP	Pre	42.56±5.46	35	522
	Post #	45±16.48	32	68

[Table/Fig-5]: Echo findings in patient N=34.
n: number of patients; %: Percentage of patients; LVH: Left ventricular hypertrophy; RV: Right ventricle; MR: Mitral regurgitation; TR: Tricuspid regurgitation; # Presence of missing values. EF: Ejection fraction; LVID: Left ventricular internal dimensions; FS: Fractional shortening; RVSP: Right ventricular systolic pressure

Diuretics were the most frequently prescribed medication category in both treatment phases. Pretreatment, 76.47% of participants received diuretics, with Furosemide (Inj./Tab Lasix) being the dominant choice (92.31%). Post-treatment, diuretic use increased slightly to 79.41%, with Furosemide remaining the most common choice (92.59%) [Table/Fig-6,7]. The study participants were graded according to the NYHA classification based on the above findings and echocardiogram results. Pretreatment, 44% of patients were categorised as Class II, while 41% were categorised as Class III. Post-treatment, 53% were in Class II and 41% were in Class III [Table/Fig-8].

DISCUSSION

In the present study, the participants, with an average age of 29.26±5.73 years, align with findings from similar research by Sliwa K et al., and Binu AJ et al., indicating a similar age demographic [14,15]. Conversely, variations in age reported by Salam AM et al.,

Variables	Sub-categories	Pretreatment	Post-treatment
		N (%)	N (%)
Diuretics	Yes	26 (76.47)	27 (79.41)
	No	8 (23.53)	7 (20.59)
Beta blockers	Yes	19 (55.88)	14 (41.18)
	No	15 (44.12)	20 (58.82)
ACEI	Yes	26 (76.47)	22 (64.71)
	No	8 (23.53)	12 (35.29)

[Table/Fig-6]: Medication status of the patients N=34.
n: number of patients, %: Percentage of patients; ACEI: Angiotensin converting enzyme inhibitor

Variables	Sub-category	Pretreatment	Post-treatment
		n (%)	n (%)
Diuretics Pre (n)=26 Post (n)=27	Inj/Tab Lasix	24 (92.31)	25 (92.59)
	Tab. Lasilactone	1 (3.85)	1 (3.70)
	Tab. Lasix + Tab. Zutanix	1 (3.85)	0
	T. Dytor	0	1 (3.70)
Beta blockers Pre (n)=19 Post (n)=14	Tab. Metoprolol	9 (47.37)	8 (50)
	Tab. Carvedilol	6 (31.58)	5 (31.25)
	Tab. Bisoprolol	1 (5.26)	1 (6.25)
	Tab. Labetalol	3 (15.79)	0 (0.00)
ACEI Pre (n)=26 Post (n)=22	Tab. Ramipril	12 (46.15)	10 (45.45)
	Tab. Perindopril	1 (3.85)	1 (4.55)
	Tab. Enalapril	11 (42.31)	10 (45.45)
	Tab. Ramipril + Tab. Enalapril	1 (3.85)	0
	Tab. Ramipril + Tab. Atorva	1 (3.85)	1 (4.55)
MRA Pre (n)=23 Post (n)=21	Tab. Aldactone	23 (100)	20 (95.24)
	Tab. Lasilactone	0	1 (4.76)

[Table/Fig-7]: Drugs used in patients.
n: number of patients, %: percentage of patients. Inj: Injection; Tab: Tablet; Cap: Capsule

NYHA classification	Pretreatment n (%)	Post-treatment n (%)
Class-I	1 (3%)	2 (6%)
Class-II	15 (44%)	18 (53%)
Class-III	14 (41%)	14 (41%)
Class-IV	4 (11.76%)	0

[Table/Fig-8]: Patient condition based on New York Heart Association (NYHA) classification before and after treatment.
n: number of patients, %: Percentage of patients

could be attributed to evolving trends in heart failure occurrence among older age groups [16].

The mean heart rate of patients was recorded at 112.74±27 bpm, exceeding the established normal range. This observation mirrors the findings of a study conducted by Karaye KM et al., where PPCM patients exhibited a heart rate of 103±18 bpm, significantly higher than the control group's 88±14 bpm [17].

Two earlier studies have substantiated a concerning fact: the presence of preeclampsia escalates the risk of developing PPCM by four to six times. This significant association highlights the seriousness of preeclampsia as a predisposing factor for PPCM, warranting careful attention and further research [18,19].

Among the reported co-morbidities, 20.59% of participants were diagnosed with hypertension, a prevalence higher than that noted in a previous study where hypertension affected only 10.9% of patients. This disparity underscores the significance of hypertension as a prevalent risk factor for PPCM within this studied population [16]. However, this finding contrasts with another study where diabetes was identified as the most prevalent co-morbidity, affecting

15.1% of patients [15], while the present study showed that 11.76% of participants had diabetes. This disparity highlights the varying patterns of co-morbid conditions associated with PPCM across different research studies [15]. Additionally, a previous systematic review also identified hypertension as the predominant co-morbidity among PPCM patients [20].

The treatment data revealed that 55.88% of participants required inotropic support, a figure markedly different from a prior study where only 16% of patients necessitated such intervention [16]. This disparity emphasises the evolving treatment trends in managing PPCM and highlights the varying clinical approaches employed in different research contexts. During the study period, 13 patients (38.24%) required readmission and unfortunately, 3 patients (8.82%) did not recover from the condition. These figures closely align with another study that indicated a mortality rate of 9.3% [15]. In contrast, another study reported readmission and mortality rates of 10% and 6%, respectively, among 739 PPCM patients. These variations highlight the complex nature of PPCM outcomes, prompting the need for further investigation into the factors influencing readmission and mortality rates among different patient cohorts [14].

A study conducted within the Taiwanese population documented a mortality rate of 7.78% among 925 patients [21]. A Nigerian study reported variations in mortality rates across different regions, although these differences were not statistically significant [22]. The variations in mortality rates among different regions could stem from a multitude of factors that warrant thorough research and investigation. Understanding these factors is crucial for planning targeted interventions and improving outcomes for PPCM patients across diverse geographical areas.

The classification of patients according to the New York Heart Association (NYHA) criteria revealed that a significant proportion fell into Class II (44.12%), with 41.18% categorised as Class III/IV. This distribution diverged from findings in previous studies by Sliwa K et al., and Salam AM et al., where the majority of participants were diagnosed with severe symptoms, falling under NYHA grades III/IV classification [14,16]. This result contrasts with another study that showed most patients belonged to NYHA classification III (53.7%) [15]. A systematic review further supported the observation that the majority of PPCM patients are typically classified as NYHA Class III or IV at the time of diagnosis [20]. This difference in disease status can be attributed to the larger sample sizes of the comparison studies.

The mean Ejection Fraction (EF) was recorded at 39.79±11.66%, a noteworthy finding in contrast to a study conducted by Sliwa K et al., which reported a lower mean EF of 31±10% [14]. The obtained result aligns with a prior study reporting a mean EF of 36.9% [15], which falls within the range observed in the present study.

In the context of India, standard therapeutic approaches involve the administration of diuretics and inotropes such as digoxin to manage PPCM patients effectively. Continued research efforts are indispensable, offering the promise of refining existing protocols and ultimately mitigating the challenges posed by PPCM.

Limitation(s)

The present study has several limitations. First, its retrospective design introduces the possibility of selection bias and limits the ability to establish causality. Second, the small sample size (34 patients) may affect the generalisability of the findings to a larger population. Third, the study was conducted at a single tertiary care centre in South India, which may not fully represent the diverse patient population across different geographic regions. The absence of data from the transplantation era and short patient follow-up, coupled with a lower representation of cases from primary healthcare, further limits the generalizability of the findings. Lastly, the absence of a control group limits direct comparisons with non PPCM patients. Future studies with larger, multicentre cohorts and prospective designs are needed to validate and expand upon these findings.

CONCLUSION(S)

The PPCM poses a significant threat to pregnant women, often masquerading as typical pregnancy symptoms, making timely diagnosis challenging. The findings of the present study reinforce existing evidence, indicating that parameters such as heart rate, preeclampsia status, hypertension, creatinine and sodium levels are crucial for the diagnosis of PPCM. The New York Heart Association (NYHA) classification and echocardiographic assessments, specifically focusing on diastolic function, play a pivotal role in determining the extent of cardiac damage. Additionally, integrating routine screening protocols and raising awareness among healthcare providers can facilitate early detection, ultimately improving prognosis. Strengthening postpartum care and access to advanced heart failure therapies could further reduce PPCM-related complications. By addressing these gaps, we can move toward more effective prevention and management strategies, ensuring better maternal and neonatal outcomes.

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PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Obstetrics and Gynaecology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.
2. Research Associate, MBBS, Department of Cardiology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.
3. Research Associate, MBBS, Department of Cardiology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.
4. Professor and Head, Department of Cardiology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Tamilarasu Kaliappan,
Professor and Head, Department of Cardiology, A-Block, PSG IMSR Campus,
Off Avinashi Road, Coimbatore, Tamil Nadu-641004, India.
E-mail: drtamil1977@gmail.com

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