

Original Article

Prevalence of Peripartum Cardiomyopathy in Pre-Eclampsia Patients Presenting To a Tertiary Care Health Facility

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Abstract

Objective: To determine the frequency of Peripartum cardiomyopathy (PPCM) in Pre-eclamptic women presenting to a tertiary care facility.**Methodology:** This descriptive cross-sectional study was conducted over a period of six months, from December 9, 2021, to June 10, 2022, in the Gynecology and Obstetrics Unit I of Liaquat University Hospital, Hyderabad. The study population comprised preeclampsia women aged 18 to 45 years, with a gestational age of more than 20 weeks as confirmed by early ultrasound, regardless of parity, and carrying a single alive fetus. PPCM was diagnosed based on echocardiographic findings, with the key diagnostic criterion being a left ventricular ejection fraction (LVEF) of less than 45%.**Results:** Of 102 patients, the mean age of the patients was 25.57 ± 3.73 years. The mean height, weight, and BMI of the patients were 160.11 ± 8.89 cm, 75.09 ± 14.82 kg, and 29.08 ± 5.19 kg/m² respectively. The mean 24 hours proteinuria level of the patients was 344.62 ± 16.35 mg/24 hours. The mean ejection fraction was found to be $55.01 \pm 9.69\%$. Frequency of PPCM was observed in 9 (9%) patients, which was statistically insignificant according to age, residential status, BMI and mode of delivery (>0.05).**Conclusion:** PPCM was concluded to be 9% among pre-eclamptic women, highlighting a notable association between pre-eclampsia and the development of cardiac dysfunction during the peripartum period, which underscoring the need for enhanced clinical observation and routine cardiovascular assessment in this population.**Keywords:** Peripartum cardiomyopathy, pre-eclamptic women, ejection fraction

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Introduction

Peripartum cardiomyopathy (PPCM), an uncommon idiopathic cardiomyopathy, is a potentially fatal medical condition that results from systolic heart failure associated with reduced ejection fraction below 45%. It typically develops in the third trimester or within five months postpartum. It carries a significant disease burden and maternal mortality rates around the world, affecting around 3-5% of pregnancies.^{1,2}

PPCM is diagnosing among 19% of females during their third trimester, while 75% of the women are diagnosed during initial postpartum days, 45% of these

postpartum diagnosis are encountered during first week.³ The international reports on PPCM incidence varies between 1/100 and 1/20000 live births based on geographic, socioeconomic, and ethnic factors, with an average incidence of 1 in every 2000 viviparities.⁴ European and Japanese regions have been reported with least incidence varying between 1/2500 and 1/20000, while high estimates have been documented from Caribbean and African regions, ranging between 1/100 and 1/300 viviparities.⁵

In Pakistan, PPCM incidence has not been well-established, but emerging data has suggested a

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considerable prevalence among pregnant and hypertensive women in this region. While, PPCM estimates from European region show 1 PPCM case per 4950 childbirths.^{6,7} The prevalence of PPCM may be getting higher due to a number of factors including older maternal age, higher rates of multiple gestations as a result of contemporary fertility techniques, improved detection and better awareness of PPCM.^{8,9}

Preeclampsia (PE) and other Pregnancy-related hypertensive disorders have been linked to PPCM development. Previous studies suggest that that PE is found in 22% of PPCM patients,¹⁰ while, more recent studies suggest a much higher prevalence of preeclampsia (80%) in all PPCM cases.¹¹⁻¹⁴ PPCM and PE share similar mechanisms in terms of pathophysiology, especially immunological and inflammatory responses that involve angiogenic imbalance and endothelial dysfunction. Both of these pregnancy-related conditions reveal elevated anti-angiogenic factors (sFlt-1) via antagonizing the vasculotropin and placental growth factor (PlGF), causing angiogenic imbalance and endothelial dysfunction in PPCM and PE cases.^{15,16} PPCM frequency among preeclampsia patients in Pakistan has not been well-explored. However, a recent study revealed 62% prevalence of preeclampsia among PPCM cases, with higher rates of serious maternal complications among preeclampsia patients. Early identification of the patients, who are at risk of PPCM development, would allow better planning and prompt interventions that may involve heart failure therapies.¹⁷

As PPCM is a rare but serious complication of pregnancy, with pre-eclampsia being a significant risk factor. Despite this link, data on the frequency of PPCM among pre-eclamptic women is limited, especially in low-resource settings. This study aims to address that gap by assessing how often PPCM occurs in pre-eclamptic patients, which could lead to earlier diagnosis, better management, and improved maternal outcomes. The findings may also help shape clinical screening protocols and inform health policies to reduce maternal morbidity and mortality.

Methodology

This was a descriptive cross-sectional study conducted over a period of six months, from December 9, 2021, to June 10, 2022, at the Ward of Gynecology and Obstetrics Unit I, Liaquat University Hospital, Hyderabad. The total sample size was calculated to be 102 using the WHO sample size calculator, considering

a 95% confidence interval, a margin of error of 6.3%, and a reported frequency of preeclampsia in PPCMP (Peripartum Cardiomyopathy) of 11.9%. A consecutive sampling technique was employed. Inclusion criteria consisted of pre-eclamptic women aged 18 to 45 years with a gestational age greater than 20 weeks as determined by an early ultrasound scan, regardless of parity, and carrying a single, alive fetus. Women with a known history of heart failure, ischemic heart disease, smoking, or pre-existing hypertension were excluded from the study. Following approval from the CPSP Research Evaluation Unit Ref no CPSP.REU/Obg-2020-164-10026 and the ethical review committee of the institute, data were collected prospectively. All eligible patients presenting during the study period were enrolled after obtaining verbal informed consent.

Preeclampsia was diagnosed in women with gestational amenorrhea of more than 20 weeks, systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg on two separate occasions at least four hours apart, with previously normal blood pressure readings, and proteinuria ≥ 300 mg in a 24-hour urine collection. Peripartum cardiomyopathy (PPCMP) was diagnosed in women developing heart failure in late pregnancy or up to five months postpartum, with no prior heart disease, and a left ventricular ejection fraction below 45% on echocardiography. Heart failure (HF) was identified by the presence of at least two symptoms such as shortness of breath, fatigue, leg swelling, irregular heartbeat, or abdominal bloating. Gestational age was determined using an ultrasound performed before 24 weeks of gestation. A joint team comprising a cardiologist and a gynecologist assessed each patient.

Blood pressure was measured using an aneroid sphygmomanometer. A detailed history, clinical examination, and 2-D echocardiography were performed to evaluate left ventricular (LV) systolic function and rule out other cardiac causes of heart failure. PPCM was diagnosed based on echocardiographic evidence of LV ejection fraction less than 45%. Additional data, including age, parity, residential and educational status, were recorded in a structured questionnaire. Data were entered and analyzed using SPSS version 20.

Results

A total of 102 patients included in the study revealed a mean age of 25.57 ± 3.73 years, mean of 34.04 ± 3.33 weeks (range 25–40 weeks), average height of 160.11

± 8.89 cm, and the average weight was 75.09 ± 14.82 kg, ranging from 48 to 117 kg. The mean Body Mass Index (BMI) was 29.08 ± 5.19 kg/m². Most participants (64.71%) were from rural areas, while 35.29% were from urban settings. In terms of education, 41.18% were illiterate, 55.88% had education up to matriculation, and only 2.94% had completed intermediate or higher. The majority (94.12%) presented during the antepartum period, and 70.59% delivered via cesarean section. (Table I)

Table I: Demographic distribution of patients. (n=102)		
	Frequency	Percentage
AGE (years)		
≤ 25	49	48.03%
> 25	53	51.96%
Mean $\pm$ SD	25.57 $\pm$ 3.73	
Min-Max	18-35	
HEIGHT (cm)		
Mean $\pm$ SD	160.11 $\pm$ 8.89	
Min-Max	142-183	
WEIGHT (Kg)		
Mean $\pm$ SD	75.09 $\pm$ 14.82	
Min-Max	48-117	
BMI (kg/m²)		
≤ 30	63	61.76%
> 30	39	38.23%
Mean $\pm$ SD	29.08 $\pm$ 5.19	
Min-Max	15.95 – 46.99	
GESTATIONAL AGE (Weeks)		
≤ 34	47	46.07%
> 34	55	53.92%
Mean $\pm$ SD	34.04 $\pm$ 3.33	
Min-Max	25-40	
Residence status		
Rural	66	64.71%
Urban	36	35.29%
Educational status		
Illiterate	42	41.18%
$\leq$ Matric	57	55.88%
$\geq$ Intermediate	3	2.94%
Period of presentation		
Prepartum	96	94.12%
Postpartum	6	5.88%
Mode of delivery		
NVD	30	29.41%
C-section	72	70.59%

Most of the cases had elevated 24-hour proteinuria levels and reduced ejection fractions, indicating possible renal and cardiac involvement. Heart failure was present in 15.69% of cases, while 8.82% were diagnosed with peripartum cardiomyopathy (PPCM), reflecting notable cardiac complications among the study population. (Table II)

The comparison of peripartum cardiomyopathy (PPCM) with various study variables among 102 patients

revealed that PPCM was significantly associated with heart failure ($p < 0.001$) and reduced ejection fraction ($EF \leq 55\%$) ($p = 0.007$). No statistically significant associations were found between PPCM and other factors such as age, BMI, gestational age, residence, period of presentation, mode of delivery, or proteinuria levels. (Table III)

Table II: Clinical characteristics of patients. (n=102)		
Parameters	Frequency	Percentage
24 hours proteinuria level (mg)		
≤ 340	34	33.33%
> 340	68	66.67%
Mean $\pm$ SD	344.62 $\pm$ 16.35	
Min-Max	320-360	
Ejection Fraction (%)		
≤ 55	59	57.84%
> 55	43	42.16%
Mean $\pm$ SD	55.01 $\pm$ 9.69	
Min-Max	25-75	
Heart failure		
Yes	16	15.69%
No	86	84.31%
PPCM		
Yes	9	8.82%
No	93	91.18%

Discussion

PPCM, a potentially reversible and de novo, cardiomyopathy, may occur either during third trimester or during initial postpartum days. The potential risk factors of PPCM include age, ethnicity/race, multiple gestations, multiparity, and preeclampsia.¹⁸ In this study 102 patients were enrolled and the mean age of the patients was 25.57 ± 3.73 years. Majority of patients (52%) were aged >33 years. Rural residence was observed in majority 66 (65%) of patients. Larger proportion of patients had attained matric or below (56%), followed by illiterate (41%). In line with these demographic details, Sliwa et al.¹⁹ suggested that underprivileged women with limited healthcare access, lower literacy rate, and poor living standards are more subjected to delayed diagnosis and poor management of conditions like PE and PPCM, which result in significantly poorer fetomaternal outcomes.

In this study, BMI in 63 (62%) patients was ≤ 30 kg/m² and in 39 (38%) subjects BMI was >30 kg/m². The mean height, weight, and BMI of the patients were 160.11 ± 8.89 cm, 75.09 ± 14.82 kg, and 29.08 ± 5.19 kg/m² respectively. Moreover, patients with >34 weeks of gestational age 55 (54%) were more than those with 34 weeks or less (46%), with the mean gestational age

of 34.04 $\pm$ 3.33 weeks. Comparable figures were documented in the study of Khade et al.,²⁰ where mean BMI and gestational age of the patients diagnosed with peripartum cardiomyopathy were 25.6 kg/m² and 36 weeks respectively.

Table III: Comparison of PPCM with study variables. (n=102)

Age, years	PPCM		Total	p-value
	Yes	No		
≤25	6 (12.2)	43 (87.8)	49 (100)	0.241
>25	3 (5.7)	50 (94.3)	53 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
BMI, kg/m ²				
≤30	7 (11.1)	56 (88.9)	63 (100)	0.301
>30	2 (5.1)	37 (94.9)	39 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Gestational age (years)				
≤34	4 (8.5)	43 (91.5)	47 (100)	0.918
>34	5 (9.1)	50 (90.9)	55 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Residential Status				
Rural	7 (10.6)	59 (89.4)	66 (100)	0.487
Urban	2 (5.6)	34 (94.4)	36 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Period of presentation				
Peripartum	8 (8.3)	88 (91.7)	96 (100)	0.485
Postpartum	1 (16.7)	5 (83.3)	6 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Mode of Delivery				
Normal Vaginal Delivery	3 (10.0)	27 (90.0)	30 (100)	0.787
Cesarean Section	6 (8.3)	66 (91.7)	72 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Heart Failure				
Yes	6 (37.5)	10 (62.5)	16 (100)	<0.001
No	3 (3.5)	83 (96.5)	86 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Proteinuria level (mg/24 hrs)				
≤340	1 (2.9)	33 (97.1)	34 (100)	0.266
>340	8 (11.8)	60 (88.2)	68 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	
Ejection Fraction (%)				
≤55	9 (15.3)	50 (84.7)	59 (100)	0.007
>55	0 (0)	43 (100)	43 (100)	
Total	9 (8.8)	93 (91.2)	102 (100)	

In current study, period of PPCM presentation was prepartum in 96 (94%) and postpartum in 6 (6%) patients, while normal vaginal delivery was observed in 30 (29%) and cesarean section in 72 (71%) of the patients. Partially supporting these findings, in the study of Douglass et al.,²¹ significantly higher number of women with PPCM diagnosis (43.8%) underwent emergency c-section than those without PPCM (14.6%) ($P < 0.001$). While contrary to our findings, they reported that majority of PPCM (77.1%) cases were

diagnosed postpartum, with median diagnosis time of 4 days.

In this study, 24 hours urine protein level was > 340 mg/24 hours in 68 (67%) patients and ≤ 340 mg/24 hours in 34 (33%), with mean proteinuria level of 344.62 ± 16.35 mg/24 hours. Proteinuria levels above 300 mg/24h are associated with poor neonatal and fetal-maternal outcomes in pre-eclampsia patients.²² Similarly, studies conducted by Xu et al.²³ and Yildiz & Yilmaz²⁴, showed unfavorable outcomes in during pregnancy and post-delivery among neonates and their PE diagnosed mothers at elevated proteinuria levels, suggesting significantly poorer effect among pre-eclamptic women when urine protein levels are > 5000 mg/24h.

In this study, PPCM was observed in 9 (9%) of pre-eclampsia patients. The mean ejection fraction (EF) was $55.01 \pm 9.69\%$ and a higher frequency of 59 (58%) patients showed ejection fraction $\leq 55\%$ in comparison to 43 (42%) patients with ejection fraction of $> 55\%$. Heart failure was observed in 16 (16%) patients, suggesting mild cardiac dysfunction. Corresponding to these statistics, a longitudinal study of Lindley et al.,²⁵ found preeclampsia among 44% PPCM patients. They found considerably lower mean EF values (29%) at diagnosis of preeclampsia than ours (55.1%), possibly be due to differences in inclusion criteria, as they included diagnosed cases of PPCM, whereas our study enrolled pre-diagnosed pre-eclamptic patients with or without PPCM. Additionally, they found better EF recovery (80%) among PPCM and preeclampsia patients compared to those without preeclampsia (25%). Another study by Osterman-Pla et al.²⁶ reported preeclampsia history in 50% of their PPCM patients, with lower mean EF of $35\% \pm 8\%$ at diagnosis of PPCM.

In the present study, no significant differences were observed between peripartum cardiomyopathy (PPCM) and various study variables, including age groups, BMI, gestational age, residential status, educational status, prepartum and postpartum periods of presentation, mode of delivery, and proteinuria levels ($p < 0.05$). These findings differ from several studies that have identified these factors as potential risk factors for PPCM. Like Lee et al.²⁷ found that older age (≥ 35 years), mode of delivery (cesarean section), and preeclampsia were significantly associated with PPCM ($p < 0.01$). Similarly, Davis et al.²⁸ identified lower social class and obesity as significant risk factors for PPCM

development ($p < 0.05$). These findings support the notion that socio-demographic factors, such as age and obesity, may play a role in the development of PPCM. In contrast, partially supporting our findings, Elkayam et al²⁹ reported a non-significant association between PPCM and several study variables, including age, BMI, gestational age, and mode of delivery. The lack of insignificant associations in our study in contrast to other studies may be due to the differences in the study population, sample size, or regional factors. It suggests that while traditional risk factors may be relevant in some settings, other unexamined factors may also contribute to the development of PPCM in pre-eclampsia patients. Present study highlights the significant association between pre-eclampsia and PPCM, emphasizing the need for routine cardiac evaluation in high-risk pregnancies to improve maternal outcomes. Despite certain limitations such as the single-center setting, small sample size, and lack of long-term follow-up, the study highlights the need for future multicenter, longitudinal research focused on developing standardized screening protocols and identifying early diagnostic markers to improve the early detection and management of PPCM in pre-eclamptic women.

Conclusion

Overall peripartum cardiomyopathy identified to be 9% as a notable frequency of peripartum among pre-eclampsia patients, with heart failure and reduced ejection fraction being key predictors. Elevated proteinuria and low ejection fractions were common, suggesting renal and cardiac involvement. The findings underscore the importance of early detection of cardiac dysfunction, particularly reduced ejection fraction, in pre-eclampsia patients to prevent PPCM. Based on certain study limitations, further longitudinal studies are recommended to improve diagnostic strategies and early intervention for better maternal outcomes.

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