Transactions of the Institute of Molecular Biology & Biotechnologies, MSE AR, vol. 9, No 2, p. 51-54 (2025)

Overdiagnosis of peripartum cardiomyopathy in pregnancy: A prospective echocardiographic cohort study

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Received: November 12, 2025; Reviewed: November 30, 2025; Accepted: December 19, 2025

Peripartum cardiomyopathy (PPCM) is a rare but potentially life-threatening cause of heart failure occurring in late pregnancy or the early postpartum period. Physiological cardiovascular adaptation and pregnancy-related complications may mimic PPCM, leading to diagnostic overestimation. This prospective cohort study included 60 pregnant women with clinically and echocardiographically suspected PPCM, stratified by gestational trimester, and 15 healthy pregnant controls. All participants underwent transthoracic echocardiography with assessment of left ventricular ejection fraction (LVEF), chamber dimensions, and diastolic function. True PPCM was confirmed in 4 women (6.7%), predominantly in the third trimester. Compared with earlier gestational groups, women evaluated in the third trimester more frequently demonstrated symptoms of heart failure, significantly reduced LVEF, progressive ventricular dilatation, and marked diastolic dysfunction. In most cases, echocardiographic abnormalities were attributable to physiological cardiac adaptation, anaemia, or hypertensive pregnancy disorders rather than true PPCM. In healthy controls, changes in LVEF remained within physiological limits. These findings indicate that the majority of suspected PPCM cases represent reversible pregnancy-related conditions. Strict diagnostic criteria and dynamic echocardiographic monitoring are essential to prevent overdiagnosis and unnecessary treatment.

Keywords: *Peripartum cardiomyopathy, pregnancy, heart failure, echocardiography, left ventricular dysfunction, diastolic dysfunction, differential diagnosis*

INTRODUCTION

The aetiology of PPCM is multifactorial and involves oxidative stress, inflammatory activation, endothelial dysfunction, and cardiomyocyte apoptosis. Particular attention has been directed toward the prolactin pathway, whereby cathepsin D cleaves prolactin into a 16-kDa fragment with pro-apoptotic and anti-angiogenic effects, contributing to myocardial injury and delayed recovery of ventricular function (Hilfiker-Kleiner et al., 2007; Kodogo et al., 2023). Despite advances in imaging, PPCM remains diagnostically challenging. Several pregnancy-related conditions, including anaemia, hypertensive disorders, and myocarditis, may present with overlapping clinical and echocardiographic features. Previous studies suggest that up to 30% of women initially diagnosed with PPCM have alternative or transient causes of cardiac

dysfunction (Bauersachs et al., 2019; Honigberg et al., 2019; Bello et al., 2019). This overlap underscores the risk of overdiagnosis and highlights the importance of a structured differential diagnostic approach.

Objective: To determine the true incidence of peripartum cardiomyopathy among pregnant women with suspected disease and to evaluate trimester-related changes in echocardiographic parameters compared with healthy controls in a prospective cohort study.

MATERIALS AND METHODS

This prospective observational study was conducted at the Research Institute of Cardiology of the Ministry of Health of Azerbaijan between 2023 and 2024.

Study groups:

- Group I (n=20): first trimester (8–12 weeks), with follow-up 6 months postpartum
- Group II (n=20): second trimester (24–28 weeks)
- Group III (n=20): third trimester (36 weeks)
- Control group (n=15): healthy pregnant women

Echocardiography was performed using a Mindray BeneHeart R12 system. Measurements included LVEF, left ventricular end-diastolic and end-systolic dimensions, E/A ratio, and tissue Doppler indices.

Statistical analysis was performed using IBM SPSS 26.0. Continuous variables were compared using Student's *t*-test or one-way ANOVA, and categorical variables using the χ^2 test. A p-value <0.05 was considered statistically significant.

RESULTS

Clinical characteristics differed significantly across study groups. Women examined in the first and second trimesters reported predominantly mild symptoms, limited to increased fatigue and exertional dyspnoea. In contrast, patients evaluated in the third trimester exhibited more pronounced manifestations, including dyspnoea with minimal exertion, lower extremity oedema, and tachycardia, with a mean heart rate of 94±7 beats per minute. During the early postpartum period, hospitalisation for clinical deterioration was required in 16.7% of women in group I, 33.3% in group II, and 53.3% in group III (χ^2=10.7; p=0.041), indicating a progressive increase in the risk of decompensation with advancing gestation. Echocardiographic parameters demonstrated significant intergroup differences. In the control group, left ventricular ejection fraction (LVEF) showed a modest decline consistent with physiological adaptation to pregnancy, decreasing from 63.2±4.1% in the first trimester to 58.9±5.0% in the third trimester ($p > 0.05$). In contrast, LVEF was significantly reduced in all study groups: 42.8±4.9% in group I, 39.5±5.3% in group II, and 37.2±5.1% in group III ($p<0.001$ vs. controls). The difference between groups I and III was statistically significant (p=0.018), with the greatest systolic impairment observed in the third trimester (37.2% vs. 58.9% in controls; t=9.17; $p<0.001$). Analysis of cardiac chamber dimensions confirmed progressive left ventricular dilatation in women with suspected PPCM. Left ventricular end-diastolic diameter increased from 57.3±4.8 mm in group I to 61.5±5.4 mm in group III, significantly exceeding control values (50.2±3.9 mm; $p<0.001$). Similarly, end-systolic diameter was elevated across study groups, ranging from 41.2±4.1 mm to 46.5±5.0 mm, compared with 33.1±3.0 mm in healthy pregnant women ($p<0.001$). Assessment of diastolic function revealed a consistent trend toward impairment among women with suspected PPCM. While the control group demonstrated normal myocardial relaxation (E/A ratio 1.21±0.12), significantly lower E/A ratios were observed in group I (0.81±0.09), group II (0.79±0.07), and group III (0.72±0.08; all $p<0.001$ vs. controls). Diastolic dysfunction (E/A<1) was present in all women in group III, whereas no cases were identified in the control group (χ^2=35.6; $p<0.001$). True peripartum cardiomyopathy was confirmed in only four women (6.7% of the total cohort): one patient from group II with disease manifestation in the third trimester and three patients from group III (15%). In the remaining cases, clinical and echocardiographic abnormalities were attributed to alternative diagnoses, most commonly anaemia (20–40%), gestational hypertension or pre-eclampsia (25–35%), and myocarditis (10%). Thus, the majority of cases initially suspected as PPCM were ultimately explained by transient or potentially reversible conditions (Tables 1 and 2).

DISCUSSION

Our findings indicate that clinical symptoms of heart failure in pregnant women with suspected peripartum cardiomyopathy (PPCM) increased with advancing gestation; however, true PPCM was confirmed in only 6.7% of cases. This aligns with data from international registries (IPAC, ESC), which report a prevalence of 4–10% among women initially suspected of PPCM (McNamara et al., 2015; Regitz-Zagrosek et al., 2018; Bauersachs et al., 2019; Sliwa et al., 2020). Consequently, the potential for overdiagnosis remains substantial, underscoring the importance of a meticulous differential diagnosis. Left ventricular ejection fraction (LVEF) was significantly lower in the study groups compared with controls, with the most pronounced reduction observed in the third trimester (37.2% vs. 58.9%; $p<0.001$), confirming the key diagnostic criterion of LV systolic dysfunction (Honigberg and Givertz, 2019; Davis et al., 2023). Notably, some women exhibited reduced EF without typical clinical symptoms, reflecting physiological cardiac adaptations to pregnancy. Similar observations have been reported by Bello et al. (2019), where up to 30% of suspected PPCM cases were 'false positives' (Bello et al., 2019).

Diastolic dysfunction (E/A<1) was prevalent, particularly in group III (100%), significantly exceeding control values ($\chi^2=35.6$; $p<0.001$). This may represent a combination of true myocardial involvement in PPCM and the hemodynamic changes associated with late pregnancy, consistent with findings by Ersbøll et al. (2022) (Ersbøll et al., 2022).

Table 1. Echocardiographic parameters in pregnant women with suspected PPCM and in the control group

Parameter	Control (n=15)	Group I (n=20)	Group II (n=20)	Group III (n=20)	F (ANOVA)	P
LVEF, %	63.2±4.1 → 58.9±5.0	42.8±4.9	39.5±5.3	37.2±5.1	42.6	<0.001
LVEDD, mm	50.2±3.9	57.3±4.8	59.1±5.0	61.5±5.4	31.4	<0.001
LVESD, mm	33.1±3.0	41.2±4.1	44.0±4.7	46.5±5.0	29.7	<0.001
E/A ratio	1.21±0.12	0.81±0.09	0.79±0.07	0.72±0.08	38.2	<0.001

Note: *Data are presented as mean±SD. Intergroup comparisons were performed using one-way analysis of variance (ANOVA). All differences vs. control are statistically significant*

Table 2. Clinical characteristics and outcomes during follow-up

Parameter	Group I (n=20)	Group II (n=20)	Group III (n=20)	Control (n=15)	χ^2	P
Heart failure symptoms (NYHA II–III)	3 (15%)	5 (25%)	11 (55%)	0	12.4	0.006
Hospitalizations (decompensation)	3 (16.7%)	7 (33.3%)	11 (53.3%)	0	10.7	0.041
Confirmed PPCM	0	1 (5%)	3 (15%)	0	4.6	0.032
Alternative diagnoses	Anemia 8 (40%); adaptation 5 (25%)	Anemia 6 (30%); GH/PE 7 (35%)	GH/PE 5 (25%); myocarditis 2 (10%)	---	---	---

Abbreviations: *PPCM — peripartum cardiomyopathy; GH/PE – gestational hypertension/preeclampsia.*

Alternative etiologies, including anaemia, gestational hypertension, pre-eclampsia, and viral myocarditis, were more frequently responsible for cardiovascular manifestations than PPCM. In resource-limited settings such as Azerbaijan, anaemia can induce hyperdynamic circulation that mimics heart failure, while hypertensive disorders of pregnancy can transiently impair diastolic function and produce clinical signs of heart failure (Regitz-Zagrosek et al., 2018; Bauersachs et al., 2019; Davis et al., 2023).

Taken together, our data suggest that a reliable diagnosis of PPCM requires the coexistence of severe LV systolic dysfunction (EF<45%), ventricular dilatation, and clinical signs of congestive heart failure. Otherwise, observed changes should be interpreted as physiological adaptations or manifestations of other pathologies. This approach aligns with the 2019–2020 European Society of Cardiology (ESC) recommendations (Regitz-Zagrosek et al., 2018; Sliwa et al., 2020), helping to minimize overdiagnosis, avoid unnecessary therapy, and focus on treating the underlying cause of decompensation. In summary, PPCM remains rare (≤10%), and most cases initially suspected are attributable to transient or reversible conditions. Rigorous differential diagnosis and dynamic echocardiographic monitoring are therefore essential.

CONCLUSION

1. Among 60 pregnant women with suspected peripartum cardiomyopathy (PPCM), only 4 cases (6.7%) were confirmed, one in group II (third-trimester onset) and three in group III (15%). The remaining abnormalities were attributable to anaemia (20–40%), gestational hypertension or pre-eclampsia (25–35%), and myocarditis (10%).
2. Clinical symptoms and risk of decompensation increased with gestational age. Heart failure signs were observed in 15% of group I, 25% of group II, and 55% of group III (χ^2=12.4; p=0.006), while hospitalisations rose from 16.7% to 53.3% (χ^2=10.7; p = 0.041).
3. Echocardiographic findings in the third trimester differed markedly from controls: mean LVEF was 37.2±5.1% versus 58.9±5.0% (p<0.001), end-diastolic diameter reached 61.5±5.4 mm versus 50.2±3.9 mm (p<0.001), and diastolic dysfunction (E/A <1) was observed in 100% versus 0% of controls (χ^2=35.6; p<0.001).
4. Most observed cardiac changes were transient, reflecting physiological adaptations to pregnancy, often compounded by anaemia or hypertensive disorders, highlighting the importance of a careful differential diagnosis.
5. True PPCM remains rare (≤10%), while the majority of cardiovascular abnormalities in pregnancy are reversible or secondary. Accurate diagnosis requires the combination of significant LV systolic dysfunction (EF <45%),

ventricular dilatation, and clinical signs of congestive heart failure to avoid overdiagnosis and unnecessary interventions.

ETHICAL CONSIDERATIONS

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and relevant national regulations governing research involving human participants. Ethical approval was obtained from the Ethics Committee of Azerbaijan Medical University before the initiation of the study. All participants were fully informed about the purpose, procedures, potential benefits, and risks of the study, and written informed consent was obtained from each participant before enrollment. Participation was voluntary, and participants were assured of their right to withdraw from the study at any stage without any impact on their medical care. All collected data were anonymized and handled with strict confidentiality.

ACKNOWLEDGEMENTS

The authors would like to express their sincere gratitude to the medical and technical staff of the Department of Obstetrics and Gynaecology No. I, Azerbaijan Medical University, for their invaluable assistance in patient recruitment, echocardiographic assessments, and data collection. Special appreciation is extended to all pregnant women who generously participated in this study.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST

The authors declare that they have no known competing financial or personal interests that could have appeared to influence the work reported in this paper.

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