A Review on Study of Peripartum Cardiomyopathy Prevention Strategies

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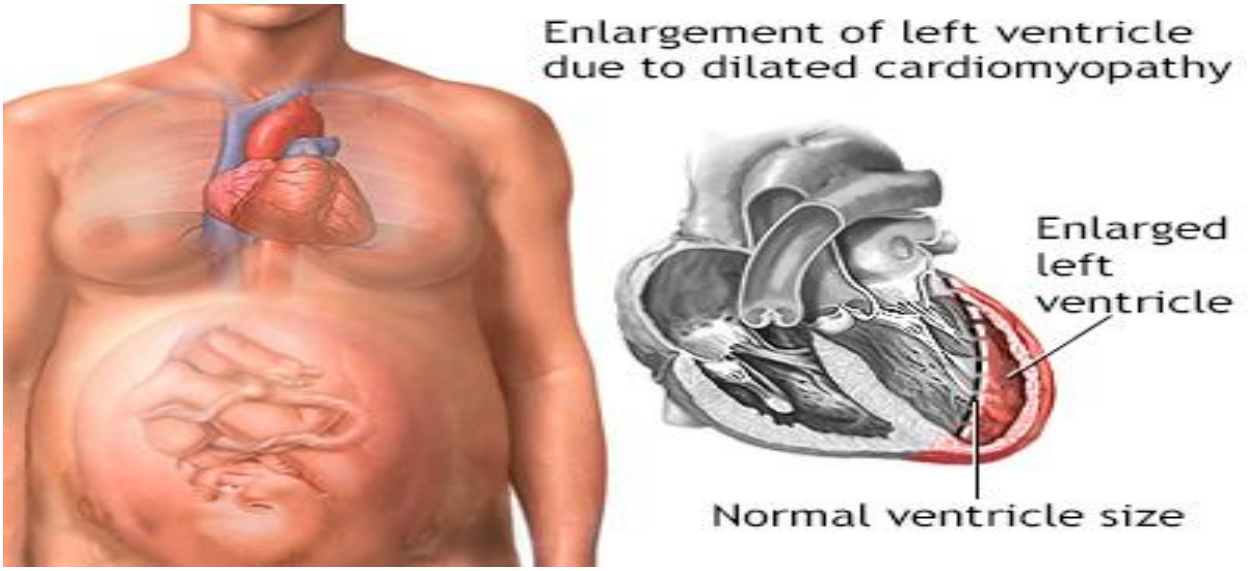
***Abstract*—Factors associated With Right Ventricular Dysfunction and Elevated Pulmonary Artery Systolic Pressure were identified as the main factors leading to death. In few cases Left Ventricular Dysfunction also has caused morbidity and mortality. Heart failure during pregnancy was recognized as early as 1849, but it was first described as a distinctive form of cardiomyopathy only in the 1930s. In 1971, Demakis etal described 27 patients who presented during the puerperium with cardiomegaly, abnormal electrocardiographic findings, and congestive heart failure, and named the syndrome peripartum cardiomyopathy. The European Society of Cardiology recently defined peripartum cardiomyopathy as a form of dilated cardiomyopathy that presents with signs of heart failure in the last month of pregnancy or within 5 months of delivery. Peripartum cardiomyopathy is relatively rare but can be life-threatening. The National Hospital Discharge Survey (1990–2002) estimated that it occurs in 1 in every 2,289 live births in the United States. The disease appears to be more common in African American women. The rate varies in other populations: it is highest in Haiti, with 1 case in 300 live births, which is nearly 10 times higher than in the United States. The reason for such a variation remains unclear. Although early reports suggested the death rate was nearly 50%, more recent reports show it to be 0 to 5% in the United States, and the higher numbers in the earlier reports likely represented publication bias**

***Index Terms*—ventricular dysfunction, heart failure, peripartum, cardiomyopathy**

I. INTRODUCTION

Peripartum cardiomyopathy (PPCM), also known as postpartum cardiomyopathy, is an uncommon form of heart failure that happens towards the end of pregnancy or in the months following delivery, when no other cause of heart failure can be found. PPCM is most commonly diagnosed in the last month of pregnancy and the weeks following delivery but can occur up to five months into the postpartum period. PPCM is diagnosed in individuals without a prior diagnosis of heart disease. Cardiomyopathy means heart muscle disease but is often described as heart muscle weakness.



In PPCM the heart chambers enlarge and the heart muscle weakens. This causes a decrease in the amount of blood the heart pumps with each heartbeat. The amount of blood ejected from the heart with each contraction is called the left ventricular ejection fraction (LVEF), or simply ejection fraction (EF). A weakened heart may have a lower EF which can cause fatigue and low blood pressure due to less blood flow to the body, and can cause swelling in legs and abdomen due to fluid buildup in organs including the lungs and liver.

DIAGNOSIS

PPCM may be difficult to detect because symptoms of heart failure can mimic those of pregnancy, such as shortness of breath and swelling in the feet and legs. Any new shortness of breath, especially at rest, or swelling that occurs after delivery or sudden onset of these symptoms during pregnancy should lead to prompt evaluation.

PPCM is diagnosed when the following three criteria are met:

1. Heart failure develops in the last month of pregnancy or within months following delivery.
2. Heart pumping is reduced, with a left ventricular ejection fraction less than 45% (typically measured by an echocardiogram). A normal LVEF is between 50% and 70%.

Laboratory blood tests are a standard part of the evaluation. This includes tests to assess kidney, electrolytes, liver, thyroid function and a complete blood count to look for anemia or evidence of infection. Other blood tests, brain natriuretic peptide (BNP) and N-terminal pro-BNP levels may be done to evaluate cardiac injury, stress and level of risk.

SYMPTOMS

- Shortness of breath or breathlessness with light activity and when lying flat
- Fatigue
- Fluid retention which causes swollen ankles or feet, cough, chest congestion and increased urination at night.
- Chest pain or tightness
- Sensation of heart racing or skipping beats (palpitations), lightheadedness or almost fainting.

CAUSES:

The exact cause of Peripartum Cardiomyopathy (PPCM) remains unclear, but research suggests it may involve multiple factors, including:

1. Prior viral illness: Some studies suggest a possible link between viral infections and PPCM development.
2. Nutritional deficiency: Nutritional deficiencies may contribute to PPCM, although this is still speculative.
3. Hemodynamic stress: The stress of pregnancy on the heart may trigger PPCM in some women.
4. Abnormal immune response: An abnormal immune response during pregnancy might contribute to PPCM development.

More recent research points to the potential role of:

1. Hormonal overactivity: Certain hormones, particularly those involved in pregnancy-related hypertension, may damage the vascular system and contribute to PPCM.
2. Preeclampsia connection: Women with preeclampsia have higher levels of these hormones, which may explain their increased risk of developing PPCM.

Predisposition and Risk Factors

It's still unclear why some women are more susceptible to the effects of these hormones than others. Potential factors include:

1. Genetics: Family history might play a role, although most women with PPCM have no known family history of cardiomyopathy.
2. Individual variability: Differences in individual responses to hormonal changes during pregnancy might contribute to PPCM development.

Several risk factors include:

- Maternal age of 35+
- High blood pressure , including preeclampsia or gestational hypertension
- Multiple gestations (e.g., twins)
- PPCM is more common in patients who identify as Black, though it is not understood how race plays a role in the development of PPCM

TREATMENT:

The following medications are commonly used to treat heart failure. However, health care professionals will be cautious about using the medications as some are harmful if you are pregnant or breastfeeding.

1. Angiotensin converting enzyme (ACE) inhibitors/angiotensin receptor blockers (ARBs) – Lower blood pressure and helps the heart work more efficiently.

2. Angiotensin receptor/neprilysin inhibitor (ARNI) – Lower blood pressure and makes it easier for the heart to pump blood.
3. Beta blockers – Cause the heart to beat more slowly so it has recovery time.
4. Diuretics – Reduce fluid retention.
5. Digitalis – Strengthens the pumping ability of the heart, but due to narrow safety margins with the need to monitor levels, it is not frequently used.
6. Anticoagulants – Help thin the blood. Patients with PPCM are at increased risk of developing blood clots, especially if the ejection fraction is very low.
7. Inotropic therapies – Used in intensive care and for advanced heart failure to help the heart beat stronger.
8. Bromocriptine – Blocks the release of prolactin, a hormone that promotes lactation. Bromocriptine may help the heart recover, but the recommendations for use are not specific. Additional research is needed to understand if bromocriptine should be prescribed for patients with severe PPCM.
9. No other cause for heart failure can be found.

The imprecise definition can reflect our incomplete understanding regarding the PPCM. The exact cause of disease is unknown. Many possible causes of disease have been proposed such as viral myocarditis, nutritional deficiencies, autoimmunity, hemodynamic stress etc.

II. METHODS

SOURCE: SCOTLAND

In Scotland every citizen gets easy access to their health care with the help of NHS (NATIONAL HEATH SERVICE) which is a service provided by their country. When a person is born, they are given with a unique code or number which is linked to the government so that everytime the person visits a hospital, the details get into the database.

1. Scotland's NHS collects data on all healthcare interactions.
2. Researchers used this data to study hospitalizations, demographics, and medical conditions.
3. The data is highly accurate, especially for cardiovascular conditions.
4. The study reviewed individual case records to ensure accuracy.

STUDY POPULATION:

Researchers aimed to develop a reliable method for detecting PPCM cases using hospital discharge codes and validating the diagnoses through individual case record reviews.

Identifying Potential Cases:

1. Discharge Codes: Researchers used specific International Classification of Diseases (ICD) codes related to PPCM, heart failure, or cardiomyopathy to identify potential cases. These codes helped them find women who might have had PPCM.
2. Timeframe: They looked at hospital records for women who had a pregnancy outcome (delivery or termination) and had a discharge diagnosis of PPCM, heart failure, or cardiomyopathy up to 6 months before or 2 years after the pregnancy outcome.

Validating Diagnosis:

1. Case Record Review: Researchers reviewed individual case records to confirm whether the potential cases actually had PPCM.
2. Inclusion Criteria: To be included in the study, cases had to meet specific criteria, such as:
   - Impaired left ventricular (LV) systolic function, which means the heart's ability to pump blood was weakened.
   - No clear alternative cause for the heart condition.
   - No pre-existing diagnosis of LV systolic dysfunction or cardiomyopathy.
   - Presentation of symptoms during pregnancy (after the first trimester) to 2 years postpartum.
3. Exclusion Criteria: Researchers excluded cases with specific causes of heart conditions, such as myocarditis, primary valvular heart disease, or severe sepsis.

Researchers analyzed the ICD codes used in validated PPCM cases and non-cases to identify the combination of codes that resulted in the optimal sensitivity for detecting PPCM (92%). This method was then used to identify cases of PPCM in women without available records for validation.

Study Cohort:

The final study cohort consisted of consecutive women with PPCM from 1998 to 2017.

III. CONTROLS

Each case was matched to 10 controls, except for 5 women for them only 5 controls were available. Controls were women without PPCM /Heart failure

/cardiomyopathy matched for 1) age during delivery 2) year of delivery +/- 1year and 3) health board of delivery. If the match with controls was limited by smaller health boards or high variation /extremes of age, the health board criteria was dropped.

CHARACTERISTICS AND OUTCOMES:

The study collected a wide range of data on women with Peripartum Cardiomyopathy (PPCM), including:

Demographics:

Age, Location, Other relevant demographic information

Comorbidities:

Other health conditions or diseases that may be present alongside PPCM

Clinical Data:

Laboratory tests:

Blood work, biomarkers, etc., Electrocardiographic data: ECG readings

Echocardiographic data: ultrasound images of the heart

Obstetric Data:

Pregnancy-related information, such as:

Pregnancy outcomes (delivery, termination, etc.), Gestational age, Complications during pregnancy or delivery

Neonatal Data:

Newborn health outcomes, including:

Birth weight, Apgar scores, Any health complications or conditions

The study examined several outcomes, including:

Mortality:

- All-cause death: death from any cause

Rehospitalization:

- All-cause rehospitalization: hospital readmission for any reason
- Cardiovascular (CV) rehospitalization: hospital readmission due to cardiovascular-related issues

Thromboembolic Events:

- Composite outcome of subsequent stroke or thromboembolism (excluding events that occurred at the initial presentation)

Severe Cardiac Complications

- Composite outcome of:
  - All-cause death
  - Intra-aortic balloon pump (IABP) use
  - Ventricular assist device (VAD) use
  - Extracorporeal membrane oxygenation (ECMO) use
  - Cardiac transplantation

Device Therapy:

- Implantable cardioverter-defibrillator (ICD) or cardiac resynchronization therapy (CRT) use

Left Ventricular (LV) Function:

- LV recovery: defined as a left ventricular ejection fraction (LVEF) ≥55% or normal qualitative assessment
- LV decline after recovery: defined as a reduction in LVEF >10% from the LVEF at recovery and to <50% on subsequent echocardiogram

Neonatal and Child Outcomes:

- Death
- Hospitalization
- Disease incidence: development of specific health conditions or diseases

The study combined data from: -

Administrative data: hospital records, claims data etc

Case record reviews: detailed review of individual patient records

STATISTICAL ANALYSIS:

The study used various statistical methods to analyze the data, including:

Incidence Rates

- Derived using population estimates from National Records of Scotland and Office for National Statistics

Comparisons

- T-tests, Wilcoxon rank-sum test, and chi-squared tests were used to compare variables

Associations

- Logistic regression was used to examine associations between patient characteristics and PPCM development, adjusting for:
  - Age at delivery
  - Year of delivery (1998-2007 vs. 2008-2017)
  - Health board of delivery

Model Evaluation

- C-statistic was used to assess the discriminatory ability of each model

Event Rates

- Calculated using the start date of the episode of care or date of baseline echocardiogram
- Event rates were calculated for various outcomes, including all-cause death and CV rehospitalization

Cumulative Incidences

- Displayed using Kaplan-Meier curvesCumulative Incidences

- Displayed using Kaplan-Meier curves

Regression Analysis

- Multivariable Cox and logistic regression were used to examine variables associated with:
  - All-cause death or CV rehospitalization
  - LV recovery within 1 year
- Backward selection was used, with a P-value <.1 to retain variables in the model

Statistical Significance

- A two-sided P-value <.05 was considered statistically significant

Software

- Analyses were performed using Stata v16 (Stata Corp LLC, College Station, TX, USA)

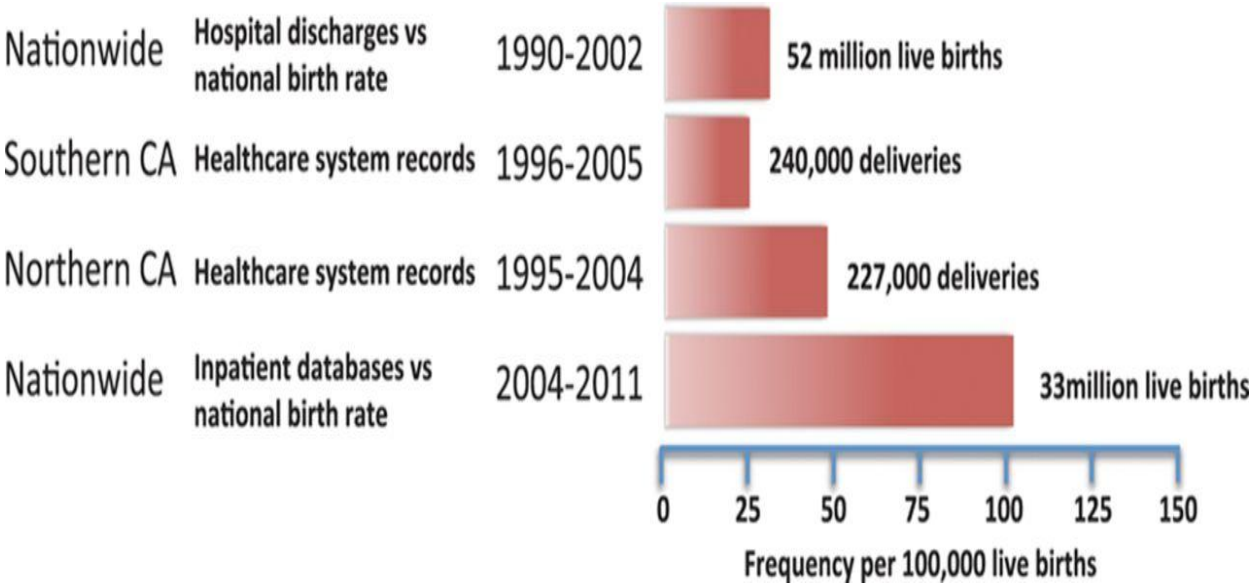
Reporting Guidelines

- The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement guidelines.

OTHER COUNTRIES:

The incidence of PPCM in the United States ranges from approx. 1 in 1000 to 4000 live births. The range of incidence likely reflects different population demographics, rigor of definition, and underreporting resulting from a lack of awareness or misdiagnosis. national inpatient database analysis of 64 million discharge hospital records from 1000 hospitals in 47 states identified 34 219 cases of PPCM, with an incidence of 1 in 968 births. More than half of the cases of PPCM occurred in southern United States, likely reflecting racial differences (see below). The incidence is increasing, for example, in the above study from 8.5 to 11.8 per 10 000 live births between 2004 and 2011 and in a previous study also of national hospital discharges from s2.3 to 4.5 per 10 000 live births between 1990 and 2002. The increasing incidence may reflect increased awareness and diagnosis, rising maternal age, changing demographics, or rising multifetal pregnancies.

The incidence of PPCM outside the United States is less well documented. Data in Africa and Asia suggest an incidence of ≈1 in 1000 live births.



PREVENTION STRATEGIES:

Pre-Conception & Early Pregnancy Care:

Pre-Pregnancy Counseling

- Women with cardiac disease & comorbidities should have pre-pregnancy risk assessment by a multidisciplinary team (cardiologist, obstetrician, endocrinologist).
- Optimize chronic conditions (control BP, glucose, kidney function).

Early Cardiovascular Risk Assessment

- Echocardiography before conception and every trimester in high-risk patients.
- NT-proBNP & Troponin monitoring in symptomatic patients.

Medication Adjustment

- Avoid teratogenic drugs (ACE inhibitors, ARBs, statins) and switch to pregnancy-safe alternatives.
- Start thromboprophylaxis in high-risk women to prevent thromboembolism.

Antenatal & Delivery Management:

Frequent Monitoring

- BP and glucose control: Strict monitoring & adjustment of medications.
- Serial echocardiography: Every 4–6 weeks in cardiomyopathy patients.

Hospitalization for Worsening Symptoms

- Admit early if there is worsening dyspnea, arrhythmias, or fluid overload.
- Consider elective delivery at 32-34 weeks in unstable cases.

Delivery Planning

- Multidisciplinary approach: ICU, obstetric, anesthesia, and neonatology team involvement.
- C-Section vs. Vaginal Delivery:

o Stable patients: Trial of vaginal delivery with epidural analgesia.

o Unstable patients: Elective C-section with cardiac monitoring.

Postpartum & Long-Term Follow-Up

ICU Monitoring Post-Delivery

- Close hemodynamic monitoring for at least 48-72 hours postpartum.
- Diuretics & vasodilators to manage postpartum fluid shifts.

Long-Term Cardiac Follow-Up

- Echocardiography 6 weeks & 6 months postpartum to assess recovery.

Contraceptive counseling:

- Avoid further pregnancies in high-risk cases

REFERENCES

[1] Alice M. Jackson1, Mark Macartney2, Katriona Brooksbank1, Carolyn Brown3, Dana Dawson 4, Mark Francis5, Alan Japp6, Vera Lennie7, Stephen J. Leslie8, Thomas Martin9, Paul Neary10, Sowmya Venkatasubramanian11, Debra Vickers12, Robin A. Weir13, John J.V. McMurray1, Pardeep S. Jhund 1*, and Mark C. Petrie1*. A 20-year population study of peripartum cardiomyopathy. European Heart Journal (2023) 00, 1–14 https://doi.org/10.1093/eurheartj/ehad626

[2] Tasnim F. Imran et al . Clinical predictors of right ventricular dysfunction and association with adverse outcomes in peripartum cardiomyopathy. Published online in Wiley Online Library (wileyonlinelibrary.com) DOI: 10.1002/ehf2.14583

[3] Stergiopoulos K, Lima FV. Peripartum cardiomyopathy-diagnosis, management, and long-term implications. Trends Cardiovasc Med. 2019 Apr;29(3):164-173. [PubMed]

[4] Azibani F, Sliwa K. Peripartum Cardiomyopathy: an Update. Curr Heart Fail Rep. 2018 Oct;15(5):297-306. [PMC free article] [PubMed]

[5] Wang WW, Wang Y. Peripartum women with dyspnea in the emergency department: Is it peripartum cardiomyopathy? Medicine (Baltimore). 2018 Aug;97(31):e11516. [PMC free article] [PubMed]

[6] Bauersachs J, König T, van der Meer P, Petrie MC, Hilfiker-Kleiner D, Mbakwem A, Hamdan R, Jackson AM, Forsyth P, de Boer RA, Mueller C, Lyon AR, Lund LH, Piepoli MF, Heymans S, Chioncel O, Anker SD, Ponikowski P, Seferovic PM, Johnson MR, Mebazaa A, Sliwa K. Pathophysiology, diagnosis and management of peripartum cardiomyopathy: a position statement from the Heart Failure Association of the European Society of Cardiology Study Group on peripartum cardiomyopathy. Eur J Heart Fail. 2019 Jul;21(7):827-843. [PubMed]

[7] Sigauke FR, Ntsinjana H, Tsabedze N. Peripartum cardiomyopathy: a comprehensive and contemporary review. Heart Fail Rev. 2024 Nov;29(6):1261-1278. [PMC free article] [PubMed]

[8] Carlson S, Schultz J, Ramu B, Davis MB. Peripartum Cardiomyopathy: Risks Diagnosis and Management. J Multidiscip Healthc. 2023; 16:1249-1258. [PMC free article] [PubMed]

[9] Davis MB, Arany Z, McNamara DM, Goland S, Elkayam U. Peripartum Cardiomyopathy: JACC State-of-the-Art Review. J Am Coll Cardiol. 2020 Jan 21;75(2):207-221. [PubMed]

[10] Cruz MO, Briller J, Hibbard JU. New Insights in Peripartum Cardiomyopathy. Obstet Gynecol Clin North Am. 2018 Jun;45(2):281-298. [PubMed]

[11] Isezuo SA, Abubakar SA. Epidemiologic profile of peripartum cardiomyopathy in a tertiary care hospital. Ethn Dis. 2007 Spring;17(2):228-33. [PubMed]