The Unique Interplay of Peripartum Cardiomyopathy and Preeclampsia in an Appalachian Obstetric Patient.

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The Unique Interplay of Peripartum Cardiomyopathy and Preeclampsia in an Appalachian Obstetric Patient

Appalachian Student Research Forum

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Outline

• Introduction
• Maternal Cardiovascular Changes in Pregnancy
• Hypertensive Disorders of Pregnancy
• Peripartum Cardiomyopathy
• Case Presentation
• Discussion/Conclusion
Introduction

Cardiovascular disease (CVD) has emerged as the leading cause of Maternal Mortality in the United States.

CVD accounts for >33% of all pregnancy-related deaths in the United States.

Peripartum Cardiomyopathy (PPCM) affects 1 in 3,000 pregnancies and it accounts for 5% of heart transplants in US women.

Preeclampsia is one of the Hypertensive Disorders of Pregnancy (HDOP) and it has been epidemiologically associated with PPCM.

Epidemiological studies have shown that Preeclampsia is present in 20% of PPCM cases.
Maternal Cardiovascular Changes in Pregnancy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Percentage of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac output</td>
<td>40–50% Increase</td>
</tr>
<tr>
<td>Stroke volume</td>
<td>30% Increase</td>
</tr>
<tr>
<td>Heart rate</td>
<td>15–25% Increase</td>
</tr>
<tr>
<td>Intravascular volume</td>
<td>45% Increase</td>
</tr>
<tr>
<td>Systemic vascular resistance</td>
<td>20% Decrease</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>Minimal</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>20% Decrease at mid-pregnancy</td>
</tr>
<tr>
<td>CVP</td>
<td>Unchanged</td>
</tr>
<tr>
<td>$O_2$ consumption</td>
<td>30–40% Increase</td>
</tr>
</tbody>
</table>
Cardiovascular Changes

Heart Rate and Stroke Volume increase

Due to increased blood volume and oxygen requirements of maternal tissues and the fetus.

Blood Volume increases

To provide nutrients to the fetus.

Safeguard against blood loss during birth.

Cardiac Output increases

Help propel the greater circulatory volume.
Hypertensive Disorders of Pregnancy

- <20 weeks of gestation
  - Chronic hypertension
  - Preeclampsia
- ≥20 weeks of gestation
  - Gestational hypertension
  - Chronic hypertension with superimposed preeclampsia
<table>
<thead>
<tr>
<th>Hypertensive Disorders of Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preeclampsia</strong></td>
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<tr>
<td><strong>Chronic hypertension</strong></td>
</tr>
<tr>
<td><strong>Gestational hypertension</strong></td>
</tr>
<tr>
<td><strong>Preeclampsia superimposed on chronic hypertension</strong></td>
</tr>
</tbody>
</table>
Peripartum Cardiomyopathy

PPCM is a dilated cardiomyopathy defined by left ventricular dysfunction and development of cardiac failure that presents in late pregnancy or early postpartum.

PPCM is a steadily increasing cause of pregnancy-associated morbidity and mortality.

The risk factors for PPCM include multiparity, advanced maternal age >35 years, multiple gestation, African descent, and hypertension.
Clinical Criteria for Diagnosis of Peripartum Cardiomyopathy

• Cardiac failure that occurs during last month of pregnancy or first five month after delivery.

• Absence of an identifiable cause for cardiac failure

• Absence of pre-existing heart disease

• Echocardiographic criteria showing left ventricular dysfunction:
  
  Ejection Fraction <45%
  
  (LVEF demonstrates severe left ventricular dysfunction)
Pathophysiology of Peripartum Cardiomyopathy

PPCM and Preeclampsia are diseases that are both vascular in nature.

It has been suggested that PPCM and Preeclampsia share a common pathophysiological mechanism that leads to the clinical manifestation of heart failure.

Theories implicated as possible causes or triggering events for PPCM are:
- simply a failed hemodynamic “Stress Test” of pregnancy
- secretion of antiangiogenic factors, the soluble vascular endothelial growth factor fms-like tyrosine kinase-1 (sFlt-1)
- Prolactin has vasculotoxic and proinflammatory properties
Pathophysiology of Peripartum Cardiomyopathy

Pregnancy is characterized by secretion of prolactin by the maternal pituitary, and at the same time, the placenta secretes high levels of the antiangiogenic molecule sFlt-1.

Interestingly, sFlt-1 serum levels are 10-15 times higher at 4-6 weeks postpartum in women who have peripartum cardiomyopathy.
Case Presentation

A 22 year old primigravida @ 33 weeks and 1 day gestation was a transfer of care from an outside hospital.

• No prenatal care
• Homeless
• History of depression and substance abuse
• History of alcohol, tetrahydrocannibol and tobacco use.

She presented with abdominal pain, shortness of breath, cough, and was ill-appearing. Patient was not aware of her due date as she had no ultrasounds done until admission.
Case Presentation

Vitals on presentation:
Temp 99.2F
Elevated BP 175/99 mmHg
HR 113
RR 32

Fetal heart tracing showed a baseline of 145 bpm with minimal variability and no accelerations or decelerations.
The tocodynamometer showed contractions q 3-5 minutes
Case Presentation

Lab results:
Elevated AST/ALT 234/102 units/L
LDH 903 units/L
Uric Acid 7.0 mg/dl
WBC 26.2 /L
BNP 1935 pg/mL
24 hour urine total protein = 4455 mg.
Case Presentation

Transthoracic echocardiogram revealed LV ejection fraction of 30 to 35% with global hypokinesis of the LV wall.

The CXR was consistent with bilateral infiltration and pulmonary edema.
Hospital Course

She was admitted to L & D and given a dose of Betamethasone and treated with Ceftriaxone and Azithromycin. Cardiology and Social work consults were ordered.

The Ultrasound evaluation showed cephalic presentation and adequate amniotic fluid volume. Patient was treated with a diuretic Lasix, beta-blocker Metoprolol, and seizure prophylaxis with Magnesium Sulfate.
Hospital Course

The clinical diagnosis of Peripartum Cardiomyopathy, Preeclampsia with severe features, and Bilateral Pneumonia was made.

Patient underwent a primary low transverse cesarean delivery for non-reassuring fetal heart tracing (NRFHT).

A live female infant weighing 1920 grams, 4 pounds 4 ounces, and Apgars: 6, 8 was delivered.
Discharge

The patient was discharged home with the usual treatment for PPCM of beta-blocker, ACE inhibitor, and calcium channel blocker. Her medications were Metoprolol XL 25 mg bid, Lisinopril 10 mg daily, Procardia 30 mg daily. Lovenox 40 mg daily was given as anticoagulation for VTE prophylaxis and Depo-Provera for contraception.
Pre-delivery
- diuretics if symptomatic
- anticoagulation (heparin)
- beta-blockers if definitely euvolaemic
- hydralazine and nitrate (especially if BP elevated)
- monitor with cardiac imaging and biomarkers
- delivery plan (with obstetric team)

Post-delivery
- conventional medical therapy for heart failure
- low molecular weight heparin or warfarin
- heart failure team follow-up
- counselling re contraception
- counselling re subsequent pregnancy
- consider psychological input

Long-term
- on-going counselling re contraception and subsequent pregnancy
- if persisting severe left ventricular dysfunction consider ICD
- if myocardial recovery consider withdrawal of medical therapy with biomarker and imaging monitoring
### Clinical Overview

<table>
<thead>
<tr>
<th></th>
<th>Pre Delivery</th>
<th>Post Partum</th>
<th>Reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blood pressure</strong></td>
<td>175/99 mmHg</td>
<td>106/66 mmHg</td>
<td>&lt;130/85 mmHg</td>
</tr>
<tr>
<td><strong>Pulse Rate</strong></td>
<td>113 bpm</td>
<td>87 bpm</td>
<td>60-100 bpm</td>
</tr>
<tr>
<td><strong>Serum K⁺</strong></td>
<td>3.3 mEq/L</td>
<td>4.3 mEq/L</td>
<td>3.5 mEq/L</td>
</tr>
<tr>
<td><strong>AST</strong></td>
<td>234 units/L</td>
<td>26 units/L</td>
<td>10 – 40 units/L</td>
</tr>
<tr>
<td><strong>ALT</strong></td>
<td>102 units/L</td>
<td>34 units/L</td>
<td>7 – 56 units/L</td>
</tr>
</tbody>
</table>
Risk of Recurrence of Peripartum Cardiomyopathy

Women with a history of peripartum cardiomyopathy remain at high risk for recurrence of cardiac dysfunction in subsequent pregnancies, despite seemingly full recovery.

It was emphasized to the patient that she would need close follow-up with both Cardiology and Obstetric.

She was informed that she would need a repeat echocardiograms at 3 and 6 months to assess left ventricular function.

Both the baseline Echo and the 6 month Echo can be used for counselling about a subsequent pregnancy (recurrence, cardiac event, death).
All Peripartum Cardiomyopathy (PPCM) Subjects (Apply American Heart Association Evidence-based Guidelines Treatment) (29)

Baseline LVEF $\geq 0.30$ at diagnosis
(No events and $>80\%$ recovery rate.)

RECOVERED PPCM patients ($LVEF \geq 0.50$) have the lowest risk for relapse of heart failure in a post-PPCM pregnancy. There is always some risk for relapse.

Baseline LVEF $< 0.30$ at diagnosis
$LVEDD \geq 60$ mm also concerning (More events and only around 33 % recovery rate.)
This group needs more focus and new intervention strategy.

*Estimates derived from studies reported in References 10,13-16. Definitions:*
- $LVEF$ = left ventricular ejection fraction
- $LVEDD$ = left ventricular end-diastolic diameter
- Events = death or transplant or left ventricular assist device or severe chronic cardiomyopathy with $LVEF < 0.35$
- Recovery = $LVEF \geq 0.50$
Discussion

In this Appalachian region, there is an increasing occurrence of Peripartum Cardiomyopathy presenting concurrently with Preeclampsia.

Maternal morbidity and mortality are increased with these two combined clinical entities.
The Appalachian Region

This concurrent clinical presentation of PPCM with associated Preeclampsia appears to be an increasing trend in rural Northeast Tennessee.

The Appalachian region is plagued with economic and psychosocial factors that have impacted the health of pregnant women and may have contributed to this increase in PPCM.

- Obesity
- Physical Inactivity
- Poor Health Literacy
- Mental Health Disorders
- Smoking
- Substance Abuse
- Poverty
Public Health Perspective

From a Public Health point of view:

This clinical case highlights the associated psychosocial factors such as poverty level, homelessness, substance abuse, maternal mental health disorder, and lack of importance of health and wellness that all together lead to major clinical disease.
Rural Social Determinants of Health

- Race/ethnicity
- Community infrastructure
- Housing
- Transportation
- Environment
- Food
- Education
- Income
Conclusion

The distinct features of this case are a Caucasian primigravida with a singleton gestation presenting antepartum @ 33 weeks with both PPCM and Preeclampsia.

Healthcare providers should have heightened awareness of this concurrent clinical presentation of PPCM and Preeclampsia, especially in the postpartum period.

There is a significant overlap between signs and symptoms of cardiac disease and those of normal pregnancy.

Healthcare providers must familiarize themselves with risk factors, warning signs/symptoms, and physical examination findings that are suggestive of an underlying cardiac condition to ensure prompt diagnosis and treatment.
References


3. Codsi E et al Subsequent pregnancy outcomes in Patients with Peripartum Cardiomyopathy American College of Obstetrician and Gynecologist Journal 2018 131 (2) 322-327


5. California Maternal Quality Care Collaborative Improving Health Care Response to Cardiovascular Disease in Pregnancy California Department of public Health.

Thank You