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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

HEART DISEASE
& PREGNANCY



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

Parameter	Percentage of change	
Cardiac output	40–50%	Increase
Stroke volume	30%	Increase
Heart rate	15–25%	Increase
Intravascular volume	45%	Increase
Systemic vascular resistance	20%	Decrease
Systolic BP		Minimal
Diastolic BP	20%	Decrease at mid-pregnancy Pre-pregnant values at term
CVP		Unchanged
O ₂ consumption	30–40%	Increase

Cardiovascular Changes

Heart Rate and Stroke Volume increase

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

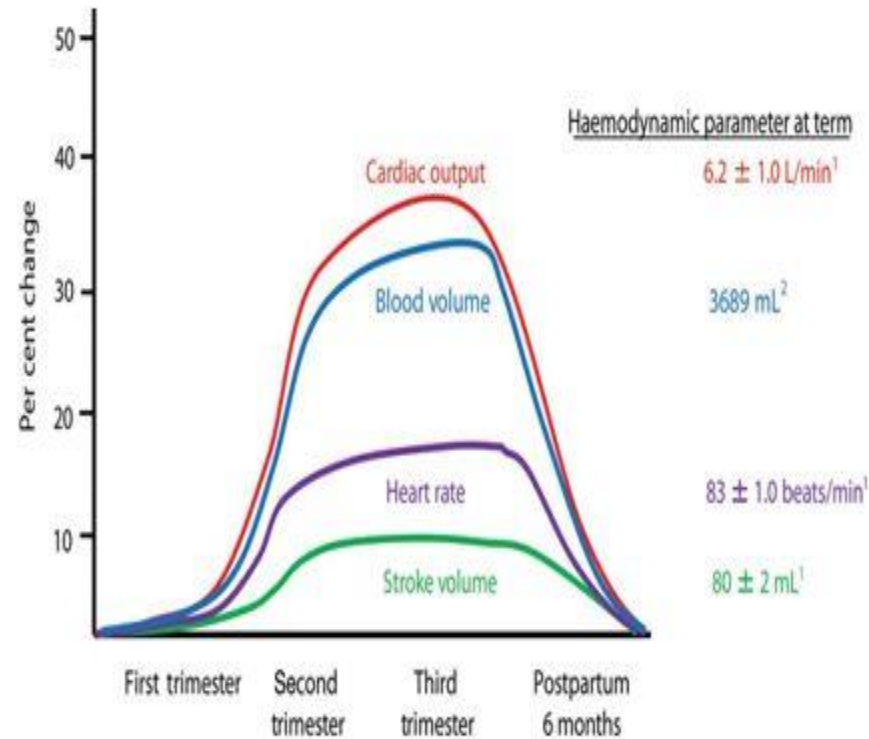
Blood Volume increases

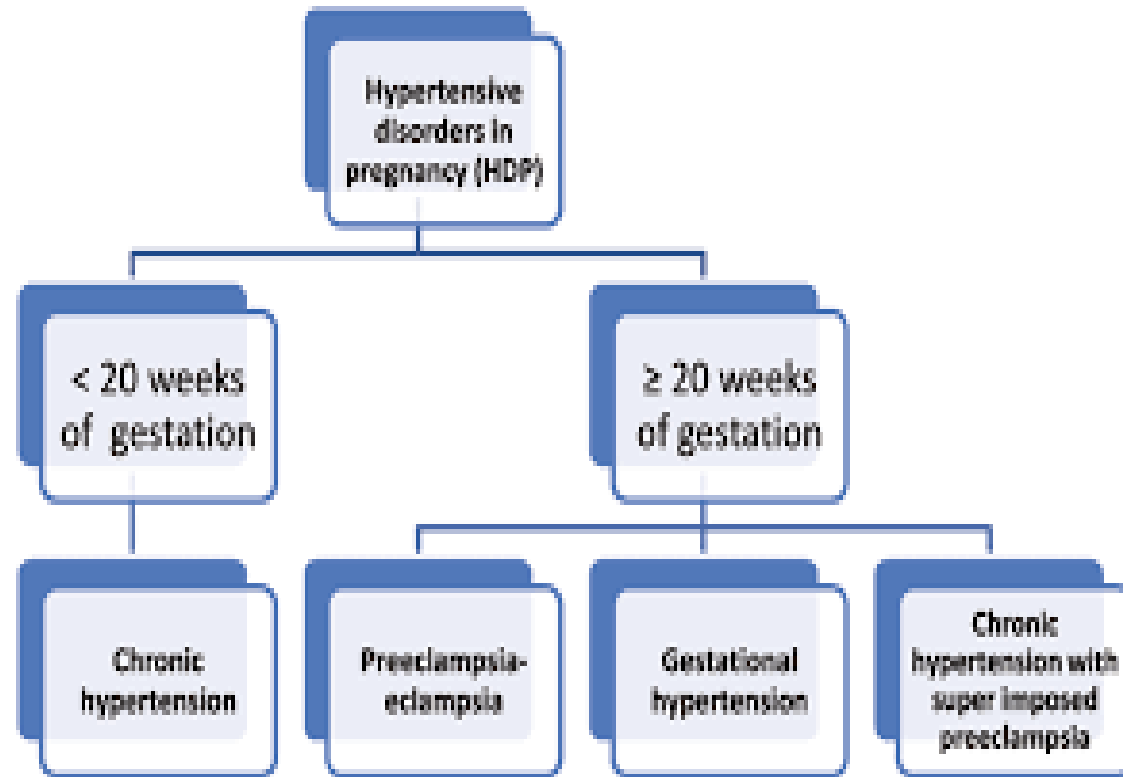
To provide nutrients to the fetus.

Safeguard against blood loss during birth.

Cardiac Output increases

Help propel the greater circulatory volume





Hypertensive Disorders of Pregnancy

Preeclampsia	New-onset hypertension (systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg) occurring after 20 weeks of pregnancy in a woman with previously normal blood pressure, and Proteinuria: ≥ 300 mg protein in a 24-h specimen.
Chronic hypertension	Hypertension documented before 20 weeks of gestation. Hypertension first noted after 20 weeks that subsequently persists longer than 6 weeks postpartum.
Gestational hypertension	New-onset hypertension without proteinuria after 20 weeks' gestation that resolves postpartum.
Preeclampsia superimposed on chronic hypertension	New-onset proteinuria in a woman with chronic hypertension. if proteinuria prior to 20 weeks is present, any of the following suggest superimposed preeclampsia: Sudden increase in proteinuria. Sudden increase in hypertension. Thrombocytopenia. Increase in liver enzymes.

Hypertensive Disorders of Pregnancy

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 >35years, 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, tetrahydrocannabinol 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

	Pre Delivery	Post Partum	Reference value
Blood pressure	175/99 mmHg	106/66 mmHg	<130/85 mmHg
Pulse Rate	113 bpm	87 bpm	60-100 bpm
Serum K⁺	3.3 mEq/L	4.3 mEq/L	3.5 mEq/L
AST	234 units/L	26 units/L	10 – 40 units/L
ALT	102 units/L	34 units/L	7 – 56 units/L

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.)

**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.**

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.**

*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.

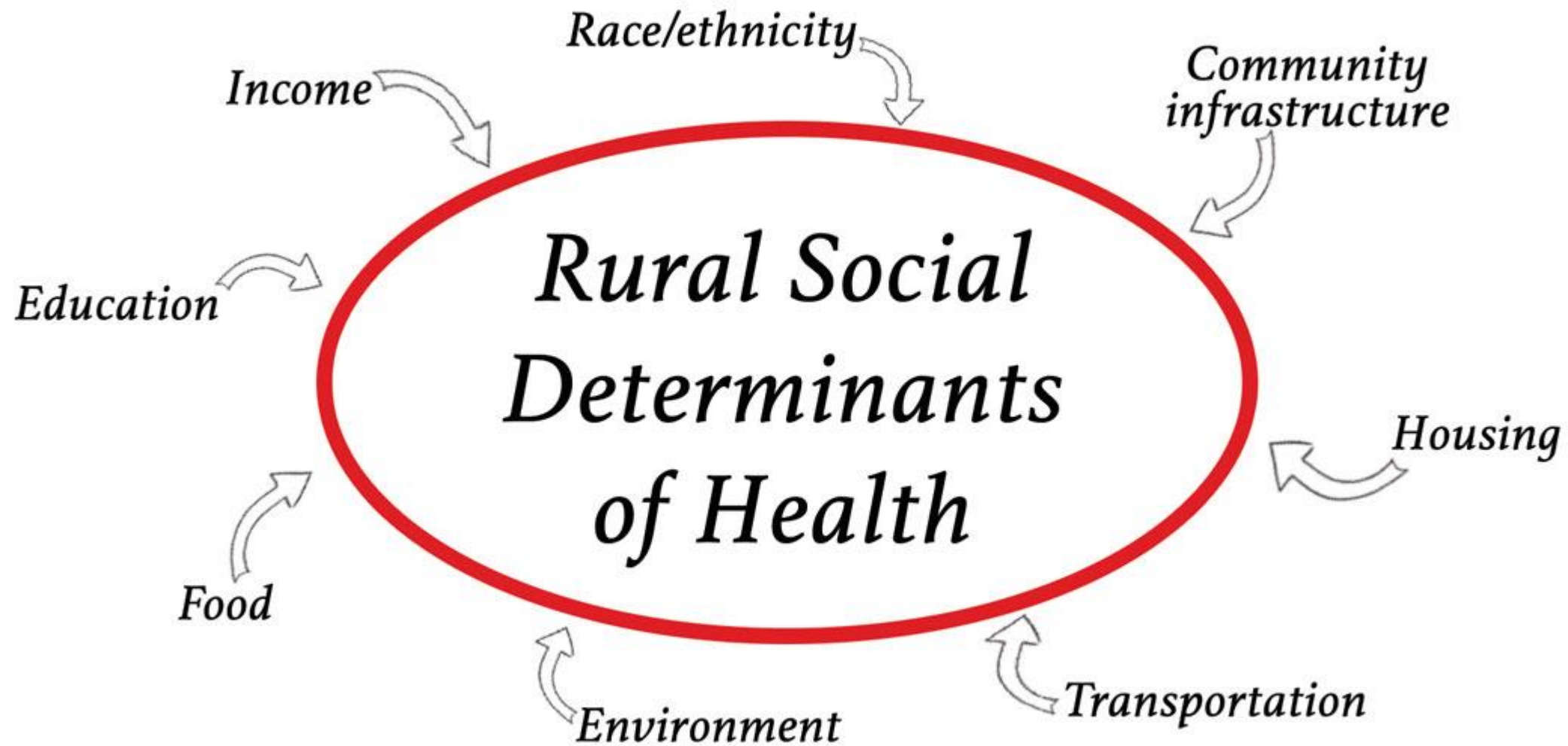
The Appalachian region is plagued with economic and psychosocial factors that have impacted the health of pregnant women and may have contributed to this increase in PPCM.

- 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.



Conclusion

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

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Thank You

