Objectives

- Identify pregnancy risk factors in the development of cardiovascular disease
- Discuss potential modifiable risk factors in the development of cardiovascular disease from complications of pregnancy
- Introduce components of new Cardiovascular Disease in Pregnancy Toolkit

Transforming Maternity Care

Maternal Mortality Rate, California and United States; 1999-2013

HP 2020 Objective – 11.4 Deaths per 100,000 Live Births

How do we know what we know?

Transforming Maternity Care

CVD is the leading cause of pregnancy associated maternal mortality (Nickens, Long & Geraci, 2013)

- 26.4% of all maternal deaths (Hameed & Stellar, 2015)

<table>
<thead>
<tr>
<th>Grouped cause of death – per CA-PAMR</th>
<th>Pregnancy related deaths N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>64 (25%)</td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>42 (16%)</td>
</tr>
<tr>
<td>Other cardiovascular</td>
<td>22 (9%)</td>
</tr>
<tr>
<td>Preeclampsia/Eclampsia</td>
<td>45 (18%)</td>
</tr>
<tr>
<td>Obstetric Hemorrhage</td>
<td>25 (10%)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>23 (9%)</td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>22 (9%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>257</td>
</tr>
</tbody>
</table>

CVD: Pregnancy Related Mortality. Rate 2.4 deaths per 100,000 live births

Transforming Maternity Care
In the CA-PAMR review, 24% of ALL CVD pregnancy-related deaths (and 31% of cardiomyopathy deaths) were determined to be POTENTIALLY PREVENTABLE.

Timing of CVD diagnosis

- Preexisting
- Prenatal period
- In L&D
- Postpartum
- Postmortem

n=64

Peripartum cardiomyopathy

Transforming Maternity Care
Peripartum cardiomyopathy

- Presents in the final month of pregnancy up to the fifth month of the postpartum period
- More than half of these women recover completely within six months
  - 30%-50% increased risk of recurrence is subsequent pregnancies
    (Nickens, Long, & Geraci, 2013)

Risk factors

- Substance abuse
- African-American race
- Obesity
- Low income
- Pregnancy related hypertension

Contributing Factors: Health Care Provider Related

- Misdiagnosis (37.5%)
- Failure to refer or consult (30%)
- Delayed or inadequate response to clinical warning signs (61%)
- Ineffective or inappropriate treatment (39%)

(Hameed, et al., 2015)
CA-PAMR conclusions…

Signs & symptoms of normal pregnancy may mimic cardiac disease—should be interpreted with caution with abnormal vital signs.

Most CVD was not diagnosed until after the woman gave birth or died.

Increased awareness and elevated index of suspicion may lead to appropriate intervention and transfer to appropriate facility—best care.

Transforming Maternity Care

Cardiovascular Disease in Pregnancy Toolkit

Improving Health Care Response to Cardiovascular Disease in Pregnancy and Postpartum

A California Quality Improvement Toolkit

Cardiac disease assessment

Racial and ethnic disparities

Clinical and facilities resources for treating women with CVD

Postpartum visits (ED, OB, or PCP)

Infographics

Patient Information

CVD medications in pregnancy

Clinical and facilities resources for treating women with CVD

Transforming Maternity Care
Quick cardio review

- **Preload**
  - The degree that the ventricles are stretched prior to the contraction (heart not uterus)
  - Determined primarily by volume and speed of venous return

Quick cardio review

- **Contractility**
  - Amount of squeeze – largely impacted by both sympathetic and parasympathetic systems

Quick cardio review

- **Afterload**
  - The aortic pressure systole (systolic blood pressure) determined by vascular resistance
Quick cardio review

- Ejection fraction
  - The fraction of blood pumped outwards from the left ventricle per beat
  - SV/End diastolic left ventricular volume

What women do you care for?

- WHO pregnancy risk classification
- Cardiovascular conditions by WHO risk class
- Clear guidance on who goes where and who cares for who

(Nickens, Long & Garaci, 2013)
Transforming Maternity Care

### Maternal Risk Assessment

<table>
<thead>
<tr>
<th>WHO I</th>
<th>Risk Category: Maternal risk no higher than the general population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>Small or mild lesions: PS, PDA, VSD, MVP/MVR</td>
</tr>
<tr>
<td></td>
<td>Repaired simple lesions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO II</th>
<th>Risk Category: Small increase in maternal risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASD, TOF</td>
<td>Unrepaired ASD, repaired TOF, most arrhythmias</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO III</th>
<th>Risk Category: Depends on individual case</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVOTO</td>
<td>Mild left ventricular impairment</td>
</tr>
<tr>
<td>HC</td>
<td>Hypertrophic cardiomyopathy</td>
</tr>
<tr>
<td>MS</td>
<td>Marfan syndrome without aortic dilation</td>
</tr>
<tr>
<td>MVD</td>
<td>Most valvular heart diseases (not including AS)</td>
</tr>
<tr>
<td>HT</td>
<td>Heart transplantation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO IV</th>
<th>Risk Category: Significant increase in maternal risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV</td>
<td>Mechanical heart valve</td>
</tr>
<tr>
<td>SVR</td>
<td>Systemic right ventricle</td>
</tr>
<tr>
<td>Fontan</td>
<td>Single ventricle/Fontan operations</td>
</tr>
<tr>
<td>Cyanotic</td>
<td>Complicated/unrepaired cyanotic heart diseases: PDA, TOF, TAPVC, HLHS, d-TGA, valvular atresia, persistent AVC</td>
</tr>
</tbody>
</table>

| Abbreviations: d-TGA: transposition of the great arteries; HLHS: hypoplastic left heart syndrome; TAPVC: total anomalous pulmonary venous connection; TOF: tetralogy of Fallot; VSD: ventral septal defect |

### New York Heart Association functional class and pregnancy outcomes

<table>
<thead>
<tr>
<th>NYHA Class</th>
<th>Activity</th>
<th>Symptoms</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Uncompromised</td>
<td>Asymptomatic</td>
<td>Favorable</td>
</tr>
<tr>
<td>Class II</td>
<td>Slight limitation of physical activity</td>
<td>Symptoms with greater than normal activity</td>
<td>Favorable</td>
</tr>
<tr>
<td>Class III</td>
<td>Marked limitation of physical activity</td>
<td>Symptoms with normal activity</td>
<td>Very high risk of morbidity and mortality</td>
</tr>
<tr>
<td>Class IV</td>
<td>Severely compromised physical activity</td>
<td>Symptoms on bedrest</td>
<td>Very high risk of morbidity and mortality</td>
</tr>
</tbody>
</table>

### Why during pregnancy?

- **Physiologic changes during pregnancy**
  - First 24 gestational weeks, blood volume increases while SVR decreases = increase of 30%-50% augmentation in resting CO
  - Early in pregnancy, this is accomplished by an increase in stroke volume
  - Later pregnancy is accomplished by an increase in HR
  - CO=SVxHR
What’s going on in there?

- Enlargement/dilation of the cardiac chambers (esp. R side), aorta, and peripheral vessels
- Increased GFR, Na+ and H2O retention, increasing circulating blood volume
- Third trimester – increased HR, volume mediated preload augmentation and decreased afterload increase CO even more

L&D

- Labor and delivery produces an additional burden to the mother’s CV system

L&D considerations for women with cardiac risk

- Keep laboring patients in semi-recumbent position with lateral tilt
- VTE prophylaxis
- Pulse oximetry > 95%
- Strict I&O
- Pain control –
- 2nd stage mgmt – laboring down or assisted delivery
Postpartum
- First 24 hours
  - Fluid shifts may result in decompensation of a previously stable patient
  - Consider continuous maternal heart rhythm monitoring
  - Closely monitor vital signs
  - Closely monitor fluid status

Postpartum at home
- May worsen 4-8 weeks postpartum with new or worsening symptoms

Heart Failure
- Complex clinical syndrome from structural or functional cardiac disorder
  - Dyspnea
  - Fatigue
  - Signs – related to fluid retention
**Signs and Symptoms**

**Symptoms**
- Shortness of breath
- Fatigue

**Signs**
- HR > 120 bpm
- Adventitious lung sounds
  - Crackles
  - Wheezes
- Edema
- Oxygen saturation ≤ 94%
- JVD

---

**JVD – Jugular Venous Distention**

---

**Pregnancy focused self assessment**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Scale</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopnea</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Need to elevate head</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>Need to elevate ≥45 degrees</td>
<td>2 points</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Walking 1 story 100 feet</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>Walking 1 block</td>
<td>2 points</td>
</tr>
<tr>
<td>Unexplained cough</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Climbing 8 or more steps</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>Walking on level</td>
<td>2 points</td>
</tr>
<tr>
<td>Snoring, talking, silent, bowel</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Silent time</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>Night time</td>
<td>2 points</td>
</tr>
<tr>
<td>Yellowish, weight gain during last month of pg</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Under 2 lbs/mo</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2-4 lbs/mo</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>&gt; 4 lbs/mo</td>
<td>2 points</td>
</tr>
<tr>
<td>Palpations</td>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>When lying down</td>
<td>1 point</td>
</tr>
<tr>
<td></td>
<td>Day and night, any position</td>
<td>2 points</td>
</tr>
</tbody>
</table>
Pregnancy focused self assessment - PPCM
- Any pregnant woman with a score of 4 or greater indicates a need for further evaluation

Pull out that stethoscope

Quick review – lung sounds
What you might expect…

- CXR
- EKG
- CBC, BMP, TSH
- BNP
- D-Dimer
- Tox screen
- Echo

- Venous doppler and/or CT pulmonary angiogram
- Cardiology consult prn

B-Type Natriuretic Peptide (BNP)

Neurohormone secreted by the cardiac ventricles in response to ventricular volume expansion and overload

Adapted from Hammed, A.
CASE STUDY

Janine is a 27-year-old African American woman who gave birth to her second baby without complications ten days ago.

She came into the emergency room with complaints of cough and extreme tiredness. She attributes the fatigue to her new baby’s sleep schedule.

She spoke in bursts because she appeared to be short of breath.

Janine’s vitals

- BMI 36
- Blood pressure 120/60
- Heart rate – 112 bpm
- Afebrile
- Respiratory rate 28
  - Oxygen saturation 93%
- Edema in her feet
Case Study - Janine

- She is given antibiotics, steroids and breathing treatments. She feels better and is discharged home.

- A week later she returns to her physician with continued and worsening symptoms.
  - The physician changes her antibiotic for an upper respiratory infection and suggests further testing for asthma.

- A few days later, the patient experiences cardiac arrest at home and resuscitative attempts are not successful.
  - Autopsy findings indicate she died from cardiomyopathy
WHAT ABOUT AFTER PREGNANCY?

Women and cardiovascular disease

- Risk factors for future risk of CVD
  - Pregnancy related
    - Preeclampsia
    - Gestational diabetes

What does preeclampsia mean to women once they are “cured”?
It's a MYTH that ALL pregnancy related high blood pressure and gestational diabetes complications go away after the baby is born!

REMEMBER!

If you had GESTATIONAL DIABETES, you are 50% more likely to develop Type II diabetes within 5 years, putting you at higher risk for heart disease.

Women with PRETERM BIRTH AND PREECLAMPSIA have an 8-10x higher chance of death from heart disease.

Which pregnancy complications can increase your risk for heart disease as you age?

DID YOU HAVE COMPLICATIONS DURING PREGNANCY?

You may be at a higher risk for heart disease over your lifetime. See your health care provider 3-6 months after birth to check your overall physical health. Discuss your pregnancy and any complications you experienced.

Get a copy of your pregnancy and post-delivery medical records to share with your providers for the rest of your life. Don't wait – records may be destroyed.

Breastfeed as long as possible. Women whose total lifetime breastfeeding is 6-12 months were 10% less likely to develop heart disease (and it's good for baby too).

Get annual checkups and be screened for heart disease. At this visit, your provider should check your overall physical condition. Ask your provider what your test results mean and how you can lower your heart disease risk.

Try a mobile app to automatically retrieve and store your medical records, so you always have them handy.

Take medications as directed. Sometimes a healthy diet and exercise is not enough to lower your risk for heart disease, so your provider may prescribe medications to help.

Mothers With Kids Over One Year

New Mothers

HIGH BLOOD PRESSURE
GESTATIONAL DIABETES
PRETERM BIRTH
Gestational hypertension
Preeclampsia
once known as Pregnancy Induced Hypertension (PIH) and Toxemia
Eclampsia
HELLP syndrome
Can include:

If you had PREECLAMPSIA, you have 2x the risk of stroke, heart muscle damage, or blood clot and 4x the risk of developing high blood pressure for the rest of your life!

If you had complications in pregnancy, you can lower your risk:

Eat healthy! A diet low in salt, fat, cholesterol and sugar can help you lower your risk for obesity, diabetes and heart disease.

Maintain a healthy weight. Body Mass Index (BMI) is an estimate of body fat based on height and weight. Less than 25 is healthy.

Get active for 30 minutes a day, or as recommended by your provider.

If you smoke, make a plan to quit. Your provider may have resources to support you.

5-10% of all pregnant women
7-14% of all pregnancies
11.5% of babies were born preterm in 2012.

Blood Pressure < 120/80 mm hg
Total Cholesterol < 200 mg/dl
Fasting Blood Glucose < 100 mg/dl
Body Mass Index  < 25 kg/m2

These screening numbers show desirable results.

If you had one of these complications, speak with your provider when planning your next pregnancy to optimize your health.

Mothers who had gestational diabetes are more likely to have the condition again in a future pregnancy.

Babies born before 37 completed weeks of pregnancy are preterm, or premature.
INFOGRAPHIC

Signs & Symptoms of CVD in Pregnancy and Postpartum

Available in Spanish
Available in JPG and PDF formats

www.cmqcc.org

References


Transforming Maternity Care