Pregnancy and Cardiovascular Disease

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Cardiology
Adult Congenital Heart Disease
Objectives

- Overview of the problem
- Learn about risk assessment prior to pregnancy
- Discuss common cardiovascular problems during pregnancy
- Overview safety of cardiac medications during pregnancy
- Discuss management of CV risk in the Post-pregnancy period
Questions

1. What type of adverse pregnancy outcome increases cardiovascular risk?
   a) Pre-eclampsia
   b) Multiparty
   c) Delivery with Csection
   d) Twin pregnancy
   e) All
Questions

2. Which women should receive aspirin during pregnancy
   a) Patients with valve disease
   b) All patients can be on aspirin
   c) Patients with risk of pre-eclampsia
   d) No patient should be on aspirin
   e) A and c
Why should you care?

- CVD is #1 cause of mortality during pregnancy
- Mortality/Morbidity from CVD and chronic conditions during pregnancy is increasing
- Pre conception evaluation and planning is important

Fryearson J. Clinical Obstetrics and Gynecology. 2014
Causes of US maternal death 2010

- Cardiovascular: 15%
- Cardiomyopathy: 12%
- CVA: 6%
- Hypertension: 9%
- Infection: 14%
- Non-Cardiovascular: 13%
- PE-DVT: 10%
- Bleeding: 11%
- Other: 5%

Creanga AA. Obstet Gynecol. 2015
Causes of US maternal death 2010

Cardiovascular: 35%
- Hypertension: 9%
- Infection: 15%

Non-Cardiovascular: 14%
- PE-DVT: 10%
- Bleeding: 12%

Other: 5%

Creanga AA. Obstet Gynecol. 2015
The perfect “stress test”
Changes in pregnancy

- 50% ↑ plasma volume
- 10-20 bpm ↑ heart rate
- 30-45% ↑ Cardiac output
- ↓ Systemic vascular resistance
- ↓ to = Blood pressure 5-10 mmHg below baseline
- ↓ Pulmonary vascular resistance

Greutmann M. Eur Heart Journal. 2015
Hemodynamic changes thru pregnancy

Greutmann M. Eur Heart Journal. 2015
Normal during pregnancy

- Shortness of breath on exertion
- Fatigue
- Physiological anemia
- Gestational dependent edema in up to 80%
  - Due to increased vasopresin secretion and increased water retention
- Loud first sound and exaggerated split
- Early systolic flow murmur (90%)
Normal vs Abnormal

- Clinical exam and History are important
- Abnormal during pregnancy
  - JVD and crackles
  - Harsh systolic murmurs
  - Diastolic murmur
  - Dyspnea equivalent to NYHA > II
  - Persistent palpitations +/- lightheadedness or syncope

Echo
Holter
CV Pre-conception counseling

- Risk to the mother
- Risk to the baby
- Long-term outlook for the mother
- Alternative options: adoption, surrogacy
- Effective and appropriate contraception
CV risk scoring: pregnancy

- CARPREG
- ZAHARA
- Modified WHO
Modified WHO risk

• **WHO class I** (no increased risk)
  – Uncomplicated or mild pulmonary stenosis
  – Successful repair simple lesions (VSD, ASD, PDA)

• **WHO class II** (small increased risk mortality, moderate increased morbidity)
  – Un-operated ASD or VSD
  – Repaired Tetralogy of Fallot

• **WHO class II-III** depending on individual
  – Repaired Coarctation
  – Marfan without aortic dilation
  – Bicuspid aortic valve with aorta > 45 cm
  – Mild ventricular impairment
Modified WHO risk

• **WHO class III**: significant increase in mortality or severe morbidity
  – Mechanical valve
  – Systemic right ventricle
  – Fontan circulation/Single ventricle
  – Unrepaired cyanotic heart disease
  – Marfan with aorta 40-45 cm
  – Bicuspid aortic valve with aorta 45-50 cm
Modified WHO risk

- WHO class IV: pregnancy contraindicated due to extreme high risk of death and morbidity
  - Pulmonary hypertension
  - Eisenmenger syndrome
  - EF <30%
  - NYHA class III and IV
  - Severe mitral stenosis or severe symptomatic aortic stenosis
  - Marfan syndrome with aorta of 45 mm
  - Bicuspid aortic valve with aorta > 50 mm
  - Severe Coarctation
Primary cardiovascular conditions during pregnancy

• Arrhythmias

• Congestive heart failure
  - Peripartum cardiomyopathy

• Ischemia
Peripartum cardiomyopathy

- **Definition**: Heart failure during last month of pregnancy or 5 months post delivery + EF < 45% + no other causes

- **Risk factors**: advanced maternal age, multiparity, hypertension, twin pregnancy, pre-eclampsia, cocaine, African descent
CV drugs in pregnancy

TREATING X for TWO
Safer Medication Use in Pregnancy
Cardiovascular drugs in pregnancy

• Relative safe
  - Digoxin
  - Quinidine
  - Procainamide
  - Calcium channel
  - B blockers
  - Lasix
  - Heparin

• Not safe
  - ACE /ARB
  - Coumadin **
  - Statins
Cardiac medications during pregnancy

• **Antiplatelet**: Safe
  – Low dose aspirin recommended for prevention of pre-Eclampsia

• **Clopidroogrel**: Category B no harm in animal studies,
  – No epidural within 24 hours of last dose

• **Heparin**: Safe, does not cross placenta
  – No epidurals 24 hrs since last does of LMWH
Cardiac medications during pregnancy

• **Beta blockers**: Atenolol and metoprolol are the most well studied
  – No documented teratogenicity
  – Intra uterine growth restriction (maybe more with atenolol)
  – Safe while breastfeeding (minimal breast milk concentrations)

• **Nitrates**: No teratogenicity found
  – Safe as long as maternal Hypotension and placental hypo perfusion avoided
Cardiac medications during pregnancy

- ACE/ARB/Aldosterone blockers: Unsafe: teratogenic
  - Not safe during breastfeeding
- Statins: Unsafe
- Coumadin: New valve guidelines 2014
Low dose aspirin to prevent preeclampsia

- **USPSTF**: 81 mg of aspirin after 12 weeks of pregnancy in women at high risk of pre-eclampsia
  - **Risk factors for preeclampsia**: history of preeclampsia, IUGR, preterm birth, placental abruption, fetal death, maternal comorbidities (diabetes, hypertension, renal disease, autoimmune disease) multi-fetal gestation

LeFevre ML. Annals of Internal Medicine. 2014
Low dose aspirin to prevent preeclampsia

- ASA 81 mg decreased risk for preeclampsia by 24% in clinical trials
- Reduced risk of preterm birth by 14%
- Reduced IUGR by 20%
- No increase in placental abruption, postpartum hemorrhage or fetal intracranial hemorrhage

LeFevre ML. Annals of Internal Medicine. 2014
Adverse pregnancy outcomes and CV disease

• Pre-eclampsia
  – 4 fold increase risk hypertension
  – Double risk of stroke
  – **Triples** risk of CV

• Gestational diabetes
  – 15-60% women will develop diabetes at 5-15 ys

• Multiple miscarriages
  – Independent risk of future MI (HR 5.1)

Bellamy L. BMJ 2007
Kim C. Diabetes care 2002
Kharazami E. Heart. 2011
## Post pregnancy CV risk screening - Hyperlipidemia

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Recommendation</th>
<th>Women</th>
</tr>
</thead>
</table>
| 2013 ACC AHA | Reasonable to screen 12 weeks post partum and post lactation | • 10 year risk >7.5% consider statins  
• 10 year risk < 7.5 may need **clarification: CRP, calcium score, ABI**  
• LDL increases and HDL decreases with pregnancy  
• Statins should be avoided during pregnancy |
## Post pregnancy CV risk screening

### Hypertension

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Recommendation</th>
<th>Women</th>
</tr>
</thead>
</table>
| JNC 8      | Screen within 6 months to 1 year post partum | • Child bearing age avoid ACE, ARB  
• **Hypertension that persist 3 months post partum = chronic hypertension**  
• OCP with estrogen can increase BP  
• **If HTN during pregnancy screen yearly** |
<table>
<thead>
<tr>
<th>Indicator Guidelines</th>
<th>Recommendation</th>
<th>Women</th>
</tr>
</thead>
</table>
| ACOG 2013 ADA 2014   | **Screen within 6 weeks if GD** | • Gestational diabetes increases seven fold risk of diabetes  
• Check glucose 6-12 weeks and if impaired fasting glucose treat  
• If normal recheck at 1 year |
Post pregnancy CV risk screening

1. When assessing CV risk inquire about adverse pregnancy outcomes

2. Adverse pregnancy outcomes increase women’s CV risk
   - ASCVD risk <7.5 you might chose to further risk stratification
   - Screen for HTN annually

3. Emphasize CV lifestyle changes in women with adverse pregnancy outcomes
Post pregnancy CV risk screening

4. Assess further desire for pregnancy when consider medications that should be avoided during pregnancy

5. Counsel about repeat risk of adverse pregnancy outcomes
Questions

1. What type of adverse pregnancy outcome increases cardiovascular risk?
   a) Pre-eclampsia
   b) Multiparty
   c) Delivery via C section
   d) Twin pregnancy
   e) All
Questions

2. Which women should receive aspirin during pregnancy
a) None- aspirin is not safe during pregnancy
b) Patients with valve disease
c) All patients can be on aspirin
d) Patients with risk of pre-eclampsia
e) B and D
• Thank you
<table>
<thead>
<tr>
<th>Condition</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior Cardiac Event</td>
<td>1</td>
</tr>
<tr>
<td>NYHA class III/IV or cyanosis</td>
<td>1</td>
</tr>
<tr>
<td>Left heart obstruction</td>
<td>1</td>
</tr>
<tr>
<td>Reduced EF</td>
<td>1</td>
</tr>
<tr>
<td>Multiple gestation</td>
<td>1</td>
</tr>
<tr>
<td>Smoking</td>
<td>1</td>
</tr>
<tr>
<td>Heparin/warfarin during pregnancy</td>
<td>1</td>
</tr>
</tbody>
</table>
CARPREG

• Risk of maternal cardiovascular complication:
  – Heart failure, arrhythmia, death
• 0 points → 5%
• 1 point → 27%
• 2 points → 75%

• Risk of offspring higher with higher score no percent assigned
<table>
<thead>
<tr>
<th>Condition</th>
<th>Maternal risk points</th>
<th>Fetal risk points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior Arrhythmia</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>NYHA III/IV</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Left heart obstruction (LVOT &gt; 50 mmHg, AVA &lt; 1cm²)</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Mechanical valve prosthesis</td>
<td>4.25</td>
<td>2.5</td>
</tr>
<tr>
<td>Systemic AV valve regurgitation (moderate to severe)</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>Pulmonic valve regurgitation (moderate to severe)</td>
<td>0.75</td>
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<tr>
<td>Cardiac medication</td>
<td>1.5</td>
<td>0.75</td>
</tr>
<tr>
<td>Cyanotic heart disease</td>
<td>1</td>
<td>0.75</td>
</tr>
<tr>
<td>Multiple gestation</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>0.5</td>
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## Zahara

<table>
<thead>
<tr>
<th>Maternal risk</th>
<th>Offspring risk</th>
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<tbody>
<tr>
<td>&lt;0.5 points</td>
<td>&lt; 0.5 points</td>
</tr>
<tr>
<td>0.51 – 1.5 points</td>
<td>0.51 – .99 points</td>
</tr>
<tr>
<td>1.51 – 2.5 points</td>
<td>1 – 1.49 points</td>
</tr>
<tr>
<td>2.51 – 3.5 points</td>
<td>&gt;1.5 points</td>
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<tr>
<td>&gt; 3.5 points</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>2.9%</td>
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<tr>
<td></td>
<td>7.5%</td>
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<tr>
<td></td>
<td>18%</td>
</tr>
<tr>
<td></td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td>70%</td>
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<td></td>
<td>20%</td>
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<tr>
<td></td>
<td>34%</td>
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<tr>
<td></td>
<td>47%</td>
</tr>
<tr>
<td></td>
<td>60%</td>
</tr>
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# Low dose aspirin to prevent preeclampsia

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Risk Factors</th>
<th>Recommendation</th>
</tr>
</thead>
</table>
| High       | • Hx preeclampsia  
• Multifetal gestation  
• Chronic hypertension  
• Diabetes  
• Renal Disease  
• Autoimmune disorder | Low dose aspirin |
| Moderate   | • Nuliparity  
• Obesity (BMI >30)  
• Family hx of preeclampsia  
• Socioeconomical factors: African amerian, low socioeconomical status  
• Personal factors: age>35, >10 yr pregnancy interval, Hx of low birth weight or small for gestational age, previous adverse pregnancy outcome | Consider low dose aspirin if several of these risk factors |
| Low        | Previous uncomplicated full term pregnancy | No ASA recommnended |
Pregnancy-related cardiovascular risk indicators

<table>
<thead>
<tr>
<th>Table – Pregnancy-related cardiovascular risk indicators.</th>
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</thead>
<tbody>
<tr>
<td>Pre-eclampsia, HELLP, and eclampsia</td>
</tr>
<tr>
<td>Gestational hypertension</td>
</tr>
<tr>
<td>Gestational diabetes</td>
</tr>
<tr>
<td>Gestational impaired glucose tolerance</td>
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<tr>
<td>IUGR (&lt;2500 g at term, &lt;5th percentile)</td>
</tr>
<tr>
<td>Idiopathic preterm birth</td>
</tr>
<tr>
<td>Placental abruption</td>
</tr>
<tr>
<td>Excessive weight gain in pregnancy</td>
</tr>
<tr>
<td>Postpartum weight retention</td>
</tr>
</tbody>
</table>
Are beta blockers safe during pregnancy?

Meta analysis of the association between exposure to BB during first trimester and risk of congenital heart defects

Yakoob MY. Hypertension 2013
Indications for C section

- Coumadin
- Severe obstructive lesions
- Aortopathy (Marfan syndrome, dissection, coarctation)
- Severe pulmonary hypertension