Congenital Heart Disease Patient and Pregnancy

Gurur Bilociler-Denktas, M.D.
Assistant Professor
Division of Pediatric Cardiology,
Department of Pediatrics
The University of Texas Health Science Center at Houston (UTHealth) Medical School
Cardiac Disease in Pregnancy

- Normal physiology of pregnancy
- Pre-pregnancy risk assessment: mum and baby
- Special issues encountered during pregnancy
- Obstetrics consideration
- Contraception
Pregnancy and the heart

- 1-4% of pregnancies
- CV diseases rarely preclude pregnancy, but pose increased risk to mother and fetus
Risk of transmission to offspring

- 6% if mom is affected
- 3% if dad is affected

Fetal echo for screening
Heart diseases and pregnancy

• CV physiological changes with pregnancy
• Pre-pregnancy counseling
• Peripartum management
Physiological Changes During Pregnancy

• 40-70% decrease in total peripheral vascular resistance
• 30-50% increase in blood volume
• 10-20 bpm increase in mean heart rate
• 30-50% increase in cardiac output
• Physiologic anemia (secondary to increase in plasma volume in excess of red cell mass
Physiological Changes During Pregnancy

- 40% ↑ blood volume
- 30-50% ↑ cardiac output
Physiological Changes During Labor and Peripartum

- Additional increase in cardiac output
- 300-500 mL additional blood into venous system with each uterine contraction
- Increase in HR and BP during the second stage of labor secondary to pain
- Autotransfusion of 500 mL of blood from uteroplacental bed back into the maternal circulation immediately after delivery of placenta and splanchnic vasoconstriction
Physiological Changes During Postpartum

• Diuresis and natriuresis after 48 hrs of delivery
• 4-12 weeks after delivery: normalization of blood volume, PVR and CO
Normal pregnancy vs heart failure

**Maybe normal in pregnancy**
- Fatigue
- Exertional dyspnea
- Palpitation (PVC, PAC)
- Elevated JVP
- Sinus tachycardia, 10-15%
- S3
- Systolic flow murmur
- Pedal edema

**Suggests cardiac pathology**
- Chest pain
- PND, severe breathlessness
- AF, VT
- Hypotension
- Sinus tachycardia > 15%
- S4
- Pulmonary edema
- Pleural effusion
Maternal Cardiac Adverse Events in Pregnancy

- Pulmonary edema
- Arrhythmia
- Stroke
- Death
Risk Factors for Maternal Cardiac Events in Pregnancy

- Poor functional class (NYHA class III or IV) or cyanosis
- Systemic ventricular ejection fraction <40%
- Left heart obstruction (mitral valve area <2 cm², aortic valve area <1.5 cm², peak left ventricular outflow tract gradient >30 mm Hg)
- Cardiac event (arrhythmia, stroke, pulmonary edema) prior to pregnancy
- Known lesion-specific risk
Adverse Neonatal Event in Maternal CHD

• Premature birth
• Small-for-gestational age birth weight
• Respiratory distress syndrome
• Intraventricular hemorrhage
• Fetal or neonatal death
Risk Factors for Perinatal Adverse Events in Maternal CHD

• Poor maternal functional class (NYHA class III or IV) or cyanosis
• Maternal left heart obstruction
• Maternal age <20 or >35 years
• Obstetric risk factors
• Multiple gestation
• Smoking during pregnancy
• Anticoagulant therapy
Cyanotic heart disease

- Maternal mortality 2%, morbidity 30% (endocarditis, arrhythmia, CHF)
- Fetal risk: high risk for abortion, premature delivery (50%), low birth weight
Pregnancy Risk
WHO Classification

Class 1 → No higher than general population

Class 2 → Small increased risk of maternal mortality and morbidity

Class 3 → Significant increased risk

Class 4 → Pregnancy contraindicated
Pregnancy Risk
Class 1: No Risk

• Uncomplicated, small or mild
  - PS
  - VSD
  - PDA
  - MVP with trivial MR

• Successfully repaired simples lesions
  - Secundum ASD
  - VSD
  - PDA
  - TAPVR/PAPVR

• Isolated PACs or PVCs
Pregnancy Risk
Class 2: Small Risk

• If otherwise well and uncomplicated
  - Unoperated ASD
  - Repaired TOF
  - Most arrhythmias
Pregnancy Risk
Class 2-3: Variable Risk

• Depending on individual
  – Mild LV impairment
  – Marfan syndrome without aortic dilatation
  – Native or tissue valvular heart disease not considered class 4
Pregnancy Risk
Class 3: Significant Risk

- Mechanical valve
- Systemic RV (CTGA; D-TGA s/p Mustard/Senning)
- Post Fontan
- Cyanotic heart disease
- Other complex heart lesions
Pregnancy Risk
Class 4: Extremely High Risk

Pregnancy Contraindicated:

• PHTN of any cause
• Severe systemic ventricular dysfunction
  - NYHA III-IV or LVEF <30%
• Severe left heart obstruction
• Marfan syndrome with aortic dilation >40mm
• Peripartum cardiomyopathy with residual LV impairment
Pregnancy CONTRAINDIATED

Significant stenosis: Why?
- Placenta has very low SVR
- Lowering afterload (downstream pressure) increases gradient
- Increases symptoms of valve stenosis
Pregnancy CONTRAINDICATED

Cyanosis
- Risk of thrombosis
- Lowering SVR / lowering BP decreases perfusion to lungs via collateral vessels or systemic to pulmonary shunts
Pregnancy CONTRAINDICATED

- Eisenmenger Syndrome
  - 30-50% maternal mortality
  - Lowering SVR
    → Decreases perfusion to lungs
    → Increases R to L shunting
    → Increases cyanosis
Pregnancy Outcome in Women With Congenital Heart Disease

Drenthen, W. et al. J Am Coll Cardiol 2007;0:j.jacc.2007.03.027v1-12938
Distribution of Complications During Pregnancy in Women With CHD

Drenthen, W. et al. J Am Coll Cardiol 2007;0;j.jacc.2007.03.027v1-12938
Pregnancy Management

- High-risk center unless lesion is mild
- Begin when contemplating pregnancy
- Cardiology f/u depends on lesions severity
  - Physiology changes peak at 28-34 WGA
- Involve cardiology, OB, anesthesia
- Fetal echo at 18-20 weeks
Pregnancy Management

• Continue most cardiac meds
  - Except coumadin (controversial), ACEI
• Judicious use of diuretics in select patients
  - Avoid rapid volume changes
• Facilitated second stage labor
• Vaginal delivery preferred; C/S for OB reasons
• SBE prophylaxis
Prospective Multicenter study of Pregnancy Outcomes in Women with heart disease

Siu et al.  Circulation 2001; 104: 515
Pregnancy outcome in women with heart diseases

- 562 pregnant patients with heart disease
- 599 pregnancies
- 13% pregnancies complicated by arrhythmia, pulmonary edema, stroke, cardiac death
| One point for each:                                                                 |
| History of prior cardiac event or arrhythmias                                      |
| New York Heart Association functional class >II or cyanosis                         |
| Left heart obstruction (mitral valve area <2 cm², aortic valve area <1.5 cm², or left ventricular outflow tract gradient >30 mmHg) |
| Left ventricular ejection fraction <0.40                                             |

**Chance of cardiac complication:**

<table>
<thead>
<tr>
<th>Points</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5%</td>
</tr>
<tr>
<td>1</td>
<td>27%</td>
</tr>
<tr>
<td>≥2</td>
<td>75%</td>
</tr>
</tbody>
</table>

*Developed by Siu et al, 2001*
Pregnancy outcome in women with congenital heart disease

Landzberg et al.  Circulation 2006
Pregnancy outcome in women with congenital heart disease

- 54 women followed over 6 years
- 90 pregnancies
- 19% maternal cardiac events
- 28% adverse neonatal events
Maternal cardiac events

- Pulmonary edema 17%
- Symptomatic arrhythmias 2%
Neonatal adverse events

- Preterm delivery 20%
- Small for gestational age 8%
- Respiratory distress 8%
- Intraventricular hemorrhage 1.5%
- Death 3%
## Predictors of maternal cardiac events

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>16</td>
</tr>
<tr>
<td>Prior CHF</td>
<td>16</td>
</tr>
<tr>
<td>Low subpulmonary EF</td>
<td>8</td>
</tr>
<tr>
<td>Baseline NYHA &gt; 2</td>
<td>5</td>
</tr>
<tr>
<td>Severe PR</td>
<td>4.6</td>
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Mechanical prosthesis
Anticoagulation during pregnancy

Mom  Baby
Warfarin during pregnancy

- Coumadin crosses placenta: fetal loss, prematurity, stillbirth, fetal intracranial hemorrhage
- Retroplacental hemorrhage
- Embryopathy risk
- Package insert - class C in pregnancy
Warfarin embryopathy

- Bone and cartilaginous abnormality
- Chondrodysplasia, nasal hypoplasia, optic atrophy, developmental delay
Warfarin embryopathy

- Exposure during 6-12 weeks gestation
- Past reported 30%
- Incidence 4-10% (Br Heart J 1995)
- Dose related: low risk < 5 mg/day
Warfarin embryopathy
UF heparin during pregnancy

- Increased risk of valve thrombosis
- Long-term use not recommended: osteoporosis, sterile abscesses
- Increased risk of maternal hemorrhage: bleeding at uteroplacental junction
- Treatment of choice: late pregnancy, delivery
LMWH in pregnancy

- Does not cross placenta
- Antithrombotic protection
- Potential advantages: increased bioavailability, administration ease, decrease osteoporosis and thrombocytopenia

*Reported cases of valve thrombosis during pregnancy*
<table>
<thead>
<tr>
<th>Higher Risk</th>
<th>Lower Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>First generation PHV (e.g., Starr-Edwards, Bjork Shiley) in the mitral position, atrial fibrillation, history of TE on anticoagulation</td>
<td>Second generation PHV (e.g., St. Jude Medical, Medtronic-Hall) and any mechanical PHV in the aortic position</td>
</tr>
<tr>
<td>Warfarin (INR 2.5–3.5) for 35 weeks, followed by UFH (mid-interval aPTT &gt;2.5) or LMWH (pre-dose anti-Xa ~0.7) + ASA 80–100 mg q.d.</td>
<td>SC UFH (mid-interval aPTT 2.0–3.0) or LMWH (pre-dose anti-Xa level ~0.6) or UFH (aPTT 2.5–3.5) or LMWH (pre-dose anti-Xa ~0.7) for 12 weeks, followed by warfarin (INR 2.5–3.0) for 35 weeks, then SC UFH (mid-interval aPTT 2.0–3.0) or LMWH (pre-dose anti-Xa level ~0.6) or SC UFH (mid-interval aPTT 2.0–3.0) or LMWH (pre-dose anti-Xa ~0.6) throughout pregnancy</td>
</tr>
<tr>
<td>OR</td>
<td>OR</td>
</tr>
<tr>
<td>UFH (aPTT 2.5–3.5) or LMWH (pre-dose anti-Xa ~0.7) for 12 weeks, followed by warfarin (INR 2.5–3.5) to 35th week, then UFH (aPTT &gt;2.5) or LMWH (pre-dose anti-Xa ~0.7) + ASA 80–100 mg q.d.</td>
<td></td>
</tr>
</tbody>
</table>
Anticoagulation during pregnancy

- Decision regarding choice of anticoagulation requires detailed discussion
- Insufficient data to reliably predict efficacy and safety of any regimen
- Meticulous monitoring is necessary
Anticoagulation during pregnancy

1. LMW heparin SC BID
2. UF heparin SC BID
3. UF or LMWH SC BID until 13 WGA, Warfarin 13-35 WGA,
   UF of LMW heparin SC BID until delivery
Arrhythmias during pregnancy

- PACs, PVCs common and benign
- SVT, ventricular arrhythmias less common
- Pregnancy worsens pre-existing arrhythmias, can cause de novo arrhythmias
- Treatments
Peripartum Cardiomyopathy

- Rare: 1/3000- 1/15000
- Last month of pregnancy to 5 months post-delivery
- Increased incidence: twin pregnancy, age > 30, black women, multiparity
Peripartum Cardiomyopathy

- Etiology unknown
- Prognosis variable
- Recurrent risk in future pregnancy
- Management: standard CHF
Contraception for women with congenital heart disease

- Natural or barrier methods
- Combined oral contraceptives
- Progesterone-only pills
- IUD
- Sterilization
Obstetrical considerations

- Peripartum care
  - mode of delivery
  - maternal monitoring
- Antibiotic prophylaxis?
Vaginal delivery

- Feasible and preferable in most cases
- Facilitate second stage of labor
C-section indications

- Obstetric reasons
- Coumadin anticoagulation
- Severe pulmonary hypertension
- Fixed obstructive lesions
- Unstable aorta
Endocarditis prophylaxis

AHA guidelines

– prophylaxis not required during uncomplicated delivery
– reasonable to administer prophylaxis in high risk patients
Endocarditis prophylaxis

GI/GU regimen

- ampicillin and gentamycin im/iv 30 min before procedure
- 6 hrs later, ampicillin im/iv or amoxicillin po
- PCN allergic: vancomycin iv and gentamycin within 30 minutes of procedure
Cardiac drugs in pregnancy

- Most CV drugs cross placenta and secreted in breast milk
- Weigh risk/benefit ratio
- Use drugs with long safety record- prescribe lowest dose for shortest duration
Cardiac drugs in pregnancy

FDA Classification

- A- no disclosed fetal effects
- B- animal studies suggest risk
- C- animal studies suggest adverse fetal effects
- D- evidence of human fetal risk
- X- documented fetal abnormalities
Drugs - not safe

- ACE inhibitors/ARB
- Warfarin - esp first trimester
- Amiodarone - may be used in special cases
- Spironolactone
Drugs- safe

• digoxin
• β blockers- need close monitoring
• calcium channel blockers
• heparin
• quinidine
• flecainide
• adenosine
• amiloride
Thank you