Valvular Heart Disease in Pregnancy

Kathryn J. Lindley, MD, FACC
Assistant Professor of Medicine
Assistant Professor of Obstetrics and Gynecology
Washington University in St. Louis
No Financial Disclosures
Objectives

• Discuss common valvular heart conditions in women of childbearing age
• Identify high risk valvular heart conditions during pregnancy
• Discuss management of common valvular heart conditions during pregnancy
Valves and Pregnancy

- In general L sided higher risk than R sided
- No medical cure
  - Can temporarily manage
- Per ACC/AHA guidelines, endocarditis prophylaxis is likely *unnecessary*
Risk Stratification

CARPREG II

ZAHARA

**TABLE 4** CARPREG II Risk Prediction Index: Incidence of Adverse Cardiac Events Stratified According to CARPREG II Risk Scores

<table>
<thead>
<tr>
<th>PREDICTOR/POINTS</th>
<th>0-1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>&gt;4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior cardiac events or arrhythmias</td>
<td>3</td>
<td>30</td>
<td>35</td>
<td>40</td>
<td>45</td>
</tr>
<tr>
<td>Baseline NYHA III-IV or cyanosis</td>
<td>3</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Mechanical valve</td>
<td>2</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Ventricular dysfunction</td>
<td>2</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>High risk left-sided valve disease/ left ventricular outflow tract obstruction</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Pulmonary hypertension</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>High risk aortopathy</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>No prior cardiac intervention</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Late pregnancy assessment</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

**Graph:** Cardiac complications in % of total number pregnancies

- **Risk score:**
  - 0-0.5: 2.9%
  - 0.51-1.5: 7.5%
  - 1.51-2.5: 17.5%
  - 2.51-3.5: 43.1%
  - >3.51: 70.0%

**Table:**

<table>
<thead>
<tr>
<th>Risk score</th>
<th>Number of pregnancies at risk</th>
<th>Percentage of total population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.28</td>
<td>63.6</td>
</tr>
<tr>
<td></td>
<td>2.80</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td>1.26</td>
<td>6.1</td>
</tr>
<tr>
<td></td>
<td>0.58</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.8</td>
</tr>
</tbody>
</table>

*The CARPREG (Cardiac Disease in Pregnancy Study) II risk score is based on 10 predictors, shown in the box. Each predictor is assigned a weighted point score. The sum of points represents the risk score. Risk scores are categorized into the 5 groups (n=axis). The predicted (light blue) and the observed frequency of primary cardiac events in the derivation (medium blue) and validation (dark blue) groups are shown on the y axis. NYHA = New York Heart Association.*
<table>
<thead>
<tr>
<th>WHO CLASS I</th>
<th>WHO CLASS II</th>
<th>WHO CLASS II-III</th>
<th>WHO CLASS III</th>
<th>WHO CLASS IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>No higher risk of maternal death than general population</td>
<td>Small increased risk of maternal death / complications</td>
<td>(May be classified as class II or III depending on individual)</td>
<td>Significant risk of maternal death / complications. Requires expert CV and OB care</td>
<td>Pregnancy contraindicated; very high risk of maternal death or complications</td>
</tr>
</tbody>
</table>

Uncomplicated, small or mild lesions including pulmonary stenosis, VSD, PDA and MVP with no more than trivial MR

- Un-operated ASD
- Mild LV impairment
- Mechanical valve
- PAH of any cause

Successfully repaired simple lesions including ostium secundum ASD, VSD, PDA, TAPVD

- Repaired Tetralogy of Fallot
- Hypertrophic CM
- Systemic RV (ie L-TGA, D-TGA s/p Mustard or Senning)
- Severe LV dysfunction (EF <30% or NYHA 3-4)

Isolated PVCs and PACs

- Most arrhythmias
- Marfan’s without aortic dilation
- Post Fontan operation
- Previous peripartum cardiomyopathy with any residual impairment of LV function

Coarctation of the aorta without significant gradient or aneurysm (repaired or unrepaired)

- Heart transplant
- Cyanotic heart disease
- Severe left heart obstruction
  - AVA < 1 cm^2 or peak gradient >50 mmHg
  - MVA < 1.5 cm^2

Long QT syndrome

- Native or tissue valve heart disease not considered WHO class 4
- Other complex congenital heart repair
- Marfan syndrome with aortic dilation >45 mm

Bicuspid aortic valve without aortic dilatation

- Aortic dilation with no known fibrinogen disease
- Bicuspid AV with aortic dilation >50mm

Coarctation of the aorta with residual gradient or aneurysm (repaired or unrepaired)

Marfan Syndrome with aortic root dilation <45 mm or s/p aortic replacement

Bicuspid AV with aortic root dilation 45-50mm

- Mechanical valve
- PAH of any cause
Stenotic Lesions

- Generally poorly tolerated
- Increased CO and HR will increase pressure gradient
- Pre-load dependent lesions
- **Valve area will NOT change over 9 months ... but pressure gradient WILL!**

![Graphs showing changes in cardiac output, mean BP, and SVR over pregnancy weeks.](image-url)
Regurgitant Lesions

• Generally well-tolerated
  – Volume overloading lesions
  – Pregnancy is already a volume overloaded state
  – Reduced SVR of pregnancy reduces regurgitation during pregnancy

• Afterload-responsive lesions

• Highest risk: Worsening regurgitation/reversible heart failure post-partum or third trimester
Left Sided Obstructive Lesions
Valvular Aortic Stenosis

- Bicuspid Valve >>> Rheumatic
- Severe:
  - Peak gradient >64 mmHg
  - >50 mmHg per risk stratification tools
- Consider exercise testing in the asymptomatic patient
Bicuspid AV

- Most common congenital heart defect
- Increased risk for coarctation and aortic aneurysms
  - MRA for all patients
  - Aortopathy more likely to dictate severity of risk
- Risk for both AS and AI
- Surprisingly limited data...likely indicates low risk
Management of AS in Pregnancy

- Likely Complications:
  - Reversible CHF > Arrhythmia

- Symptom Management
  - Beta-blockade (reduce flow)
  - Diuretics as needed
  - Balloon valvuloplasty in select cases if necessary
Medication Safety

- **Beta-Blockers**
  - Exception: Avoid ATENOLOL
  - Preferred: Propranolol, Metoprolol, Nadolol, Labetalol

- **Calcium Channel Blockers**
  - Diltiazem, Nifedipine, Verapamil

- **Diuretics - Furosemide**

- **Antiarrhythmics**
  - Avoid AMIODARONE if possible
  - Sotalol, Flecainide, Quinidine, Procainamide

- **Digoxin**

- **Adenosine**

- **Plavix**

- **Aspirin – 81 mg**
Mitral Stenosis

- **Etiology:**
  - Congenital MS – Parachute MV/Shone Complex
  - Rheumatic Heart Disease
- **Severe MS is very high risk lesion**
- **“Severe”:**
  - MVA < 1.5 by risk stratification tools
  - Mean gradient > 10 mmHg
- **Flow-dependent:** gradients WILL increase with pregnancy
- **Exercise testing can be useful**
Shone Complex

- Serial L sided obstructive Lesions – at least 3
  - Parachute MV
  - Supravalvular mitral membrane
  - Subaortic Stenosis
  - Bicuspid AV
  - Coarctation
Rheumatic Heart Disease

- Decreasing in incidence
  - Immigrants/Refugees
- Calcification of mitral leaflet tips and chordae
- Mitral stenosis and regurgitation
Complications of MS in Pregnancy

- Reversible CHF
  - Increased MV gradients $\rightarrow$ Pulmonary edema
- Atrial arrhythmias
  - LA enlargement $\rightarrow$ atrial fibrillation, SVT
- Thromboembolism
  - LA enlargement/afib $\rightarrow$ CVA
Management of MS in Pregnancy

- Frequent clinical and echo follow up
- Exercise restriction if symptomatic
- Beta-blockade (reduce flow) → reduce gradients
- Diuretics as needed
- Therapeutic Anticoagulation
  - If AF, LA thrombus, prior CVA, spontaneous echocontrast in LA, or LAVI >40 ml/m²
- Balloon valvuloplasty in select cases if necessary
  - NYHA III-IV patients with favorable anatomy
  - Second trimester
Delivery: Hemodynamics and Positioning

- Cardiac Output Increases
  - 30% during first stage
  - Up to 80% immediately post-partum
- 300-500 cc “autotransfusion” with each contraction
- Blood pressure increases with each contraction
- Post-partum increase in pre-load due to relief of IVC obstruction
Delivery with Left Sided Obstructive Lesions

- Pre-load Dependent
  - *ALSO risk for pulmonary edema
- Maintain euvolemia
- Early epidural
  - Slow titration, no bolus
  - Avoid spinal anesthesia
- Labor in left lateral decubitus position
- Assisted second stage vs. cesarean delivery
Post-Partum = THE WEEDS!
Postpartum Management

• Gradual return to baseline hemodynamics
  – 6 months for complete normalization
  – Most changes in first 2 weeks
• Reduced myocardial contractility
• Significant mobilization of fluid 24-72 hours after delivery
  – POST-PARTUM IS MOST COMMON TIME FOR CARDIAC COMPLICATIONS
  – Sickest patients should be monitored in ICU 48-72 hours
• Rule of Thumb – Never let a parturient leave the hospital unless she can lie flat
Left Sided Regurgitant Lesions
Aortic Regurgitation

- Etiology:
  - Bicuspid AV
  - Aortic root dilatation
    - Marfan, Loeys-Dietz, Ehler’s Danlos
  - Prior endocarditis
- LV Volume Overload and Dilation
- Generally well-tolerated
Mitral Regurgitation

- **Etiology:**
  - Mitral Valve Prolapse
  - Ischemic
  - Functional
  - Cleft Mitral Valve
  - Prior endocarditis
- Generally well-tolerated
- Four chamber dilatation of pregnancy may transiently worsen MR
Management of Left Sided Regurgitant Lesions in Pregnancy

- Likely Complications:
  - Reversible CHF >> Arrhythmia

- Symptom Management
  - Afterload Reduction (hydralazine, nitrates)
  - Diuretics as needed
Delivery with Left Sided Regurgitant Lesions

- Afterload responsive
- Risk for pulmonary edema
  - Maintain euvolemia to slightly dry
  - Maintain afterload reduction
- No contraindication to vaginal delivery unless acute decompensated CHF
- ANTICIPATE VOLUME OVERLOAD 24-48 hours postpartum
Pulmonic Valve
Management of PS in Pregnancy

- Very well tolerated even if severe (peak gradient >60 mmHg)
  - Particularly if asymptomatic and normal RV
- **Pulmonary stenosis ≠ Pulmonary HTN**
- Most common complications
  - Reversible RV failure, arrhythmias
- Symptom Management
  - PRN diuretics, beta-blockade
- Balloon valvuloplasty unlikely to be needed
Delivery in Severe PS

- Pre-load Dependent
- Maintain adequate hydration
- Early epidural
- Labor in left lateral decubitus position
- Assisted second stage
- May need gentle diuresis 24-48 hours postpartum
Pulmonic Regurgitation

- Etiology:
  - Tetralogy of Fallot
  - Tetralogy of Fallot
  - Tetralogy of Fallot
  - Prior valvotomy for PS
- RV Volume Overload and Dilation
- Generally well-tolerated – can eventually lead to RV failure
Management of PI in Pregnancy

• Likely Complications:
  – Generally well-tolerated
  – Pre-pregnancy NYHA and RV function can help gauge risk
  – Reversible Right sided CHF, Arrhythmia

• Symptom Management
  – Diuretics as needed
  – Digoxin/inotropes if severe RV dysfunction
Delivery in Severe PI

- Epidural
- No contraindication to vaginal delivery unless acute decompensated CHF
- May need gentle diuresis 24-48 hours postpartum
- If severe RV dysfunction, consider temporary dobutamine for RV support
Prosthetic Valves in Pregnancy

- Bioprosthetic
- Mechanical
- Ross Procedure
- Valvular Repairs
- Prior valvuloplasty/valvotomy
Bioprosthetic Valves

- Last 10-20 years
  - Patients will likely need another valve intervention in lifetime
  - Accelerated valve degeneration with pregnancy
  - Prone to stenosis and regurgitation
- ASA for thrombus prevention
- No need for IE prophylaxis with delivery
- Low risk for complication with pregnancy/delivery
Mechanical Valves in Pregnancy
Mechanical Valves in Pregnancy

- WHO Class III
- High risk of bleeding AND thrombosis
  - Pregnancy and post-partum are MARKEDLY hypercoagulable periods
- Teratogenic risk of Warfarin
- Concerns about inadequacy of LMWH
- Thrombosis risk: TV>MV>PV>AV
  - Increased with ventricular dysfunction, afib
Mechanical Valves

**FIGURE 4** Maternal Composite Outcome

<table>
<thead>
<tr>
<th>Alternative strategy</th>
<th>Favors Alternative</th>
<th>Favors VKA</th>
<th>Ratio [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMWH</td>
<td></td>
<td></td>
<td>3.1 [1.3, 7.5]</td>
</tr>
<tr>
<td>LMWH + VKA</td>
<td></td>
<td></td>
<td>3.2 [0.9, 8.8]</td>
</tr>
<tr>
<td>UFH + VKA</td>
<td></td>
<td></td>
<td>3.1 [1.5, 7.4]</td>
</tr>
</tbody>
</table>

Ratio of the meta-analytic averaged risk for the maternal composite outcome between a VKA regimen and each alternative regimen. Abbreviations as in Figures 1 and 2.

**FIGURE 5** Fetal Composite Outcome

<table>
<thead>
<tr>
<th>Alternative strategy</th>
<th>Favors Alternative</th>
<th>Favors VKA</th>
<th>Ratio [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMWH</td>
<td></td>
<td></td>
<td>0.4 [0.1, 0.8]</td>
</tr>
<tr>
<td>LMWH + VKA</td>
<td></td>
<td></td>
<td>0.4 [0.0, 1.1]</td>
</tr>
<tr>
<td>UFH + VKA</td>
<td></td>
<td></td>
<td>0.9 [0.4, 1.5]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternative strategy</th>
<th>Favors Alternative</th>
<th>Favors low dose Warfarin</th>
<th>Ratio [95% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMWH</td>
<td></td>
<td></td>
<td>0.9 [0.3, 2.1]</td>
</tr>
<tr>
<td>LMWH + VKA</td>
<td></td>
<td></td>
<td>0.8 [0.2, 2.3]</td>
</tr>
<tr>
<td>UFH + VKA</td>
<td></td>
<td></td>
<td>2.1 [1.1, 4.4]</td>
</tr>
</tbody>
</table>

Ratio of Averaged Risks

Steinberg ZL et al. JACC 2017;9(22):2681-91.
<table>
<thead>
<tr>
<th>Therapy</th>
<th>Risk to Mother (%)</th>
<th>Risk to Baby (%)</th>
<th>Risk of Either Maternal or Fetal Event (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfractionated heparin + VKA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-molecular-weight heparin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-dose warfarin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin K antagonist (VKA)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Anti-Xa Monitoring

• Typically follow peak levels once weekly
  – Increased volume of distribution
  – Increasing weight
  – Increased renal clearance

• Lack of evidence regarding:
  – Peak vs trough monitoring
  – Ideal therapeutic levels
  – Ideal measurement intervals
Anticoagulation Recommendations

- Continue warfarin throughout pregnancy if maintenance dose ≤5 mg/day
- Alternatively substitute weight based lovenox weeks 6-12
  - Weekly peak anti-Xa level monitoring
    - Goal 1.0-1.2
    - Weekly trough anti-Xa level >0.6
Delivery with Mechanical Valves

- Planned delivery
- Switch from warfarin to IV heparin or LMWH at 36 weeks
  - UFH – aPTT >2x control
  - Anti-Xa level 1.0-1.2
- Switch from LMWH to UFH 36 hours prior to delivery*
  - Hold heparin 4 hours prior to delivery
  - Resume 6-12 hours after delivery
  - Resume warfarin evening of delivery
  - Aspirin during labor/delivery
- If delivery occurs while on warfarin → cesarean
  - Warfarin crosses placenta → intracranial hemorrhage
Contraception

• Women with heart disease should receive counseling on contraception
  – PLANNING pregnancy for lower-risk patients
  – PREVENTING pregnancy for highest-risk patients
• Many women do not recall discussing with their cardiologist
• Others recall inaccurate information


Contraception

- Is it safe?
- Does it work?
Safety Concerns

• Combined hormonal methods
  – Pill, patch, and ring
  – Associated with increased risk of thromboembolism
  – Absolute or relative contraindication in some cardiovascular conditions

WHO COC Risk: Contraindications

- PHTN or Fontan Palliation
- Atrial Fibrillation
- Mechanical Valves
- R to L Shunt
- Coronary or Aortic Diseases
- Previous Thromboembolism
- LV Dysfunction
- Hypertension (relative)

Tiers of Contraceptive Effectiveness

- **I** – Failure Rate <1%
  - Permanent sterilization
  - Long Acting Reversible Contraception (LARC)
- **II** – Failure Rate 6-12%
  - Combined Hormonal Contraceptives
  - Progestin Only Contraceptives
- **III** – Failure Rate 12-24%
  - Barrier methods
  - Withdrawal
  - Fertility awareness methods
- **None** – 85% pregnancy rate within 1 year
Long Acting Reversible Contraception

• 3 Options:
  – Levonorgestrel impregnated IUD
    • Mirena, Skyla, Liletta, Kyleena
  – Copper IUD
  – Etonogestrel impregnated rod

• More effective than tubal ligation
• Estrogen-free
• Completely reversible
• FDA approved for 3 to 10 years
Recommendations: Contraception for Women with Heart Disease

- Method of contraception assessed and documented annually
- Long acting reversible contraception should be preferred method for:
  - WHO Class III-IV
  - All patients taking potentially teratogenic medications
Thank You!!