Cardiac Diseases in Pregnancy

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Case

• 23 year-old woman, G1P0, 8/40 gestation

• Tetralogy of Fallot repair in infancy

• Lost to congenital cardiac follow-up 7 years
Haemodynamic Changes During Pregnancy

- Plasma volume
- Erythrocyte volume (iron supplements)
- Erythrocyte volume (no iron supplements)
- Hematocrit (iron supplements)
- Hematocrit (no iron supplements)

**Graph:**
- Y-axis: Percentage change from prepregnant value
- X-axis: Duration of pregnancy (weeks)

Pitkin Clin Obstet Gynecol 1976
Haemodynamic Changes During Pregnancy

From Otto, The Practice of Clinical Echocardiography 2012
Changes in Cardiac Output during Labour and Delivery
Changes with left lateral decubitus position by CMRI

Cardiac Disease in Pregnancy

1. Maternal Risk/Pre-conception planning
2. Foetal Risk
3. Risk of Transmission to Offspring (including where father has CHD)
4. Drugs in Pregnancy
5. Delivery Plan
6. Long-term Issues to mother
1. Maternal Risk/Pre-conception planning

- Risks of Various Conditions
- Risk Score
- Risk of Decompensation
<table>
<thead>
<tr>
<th>No Risk</th>
<th>Small Increased Risk</th>
<th>Significant Risk</th>
<th>Pregnancy Contraindicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Uncomplicated, small VSD or PDA, or mild- PS.</td>
<td>• Unoperated ASD, Repaired TOF</td>
<td>• Mechanical valve</td>
<td>• PAH</td>
</tr>
<tr>
<td>• MVP with no more than trivial MR</td>
<td>• Mild LV impairment HCM</td>
<td>• Systemic right ventricle (TGA)</td>
<td>• Severe LV dysfunction (LVEF &lt;30%)</td>
</tr>
<tr>
<td>• Successfully repaired simple lesions, e.g.-ASD, VSD, PDA, APVR</td>
<td>• Marfan without dilated aortic root</td>
<td>• Fontan</td>
<td>• Previous peripartum cardiomyopathy with residual LV dysfunction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• cyanotic heart disease</td>
<td>• Severe LVOTO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• other complex congenital lesions</td>
<td>• Marfan with an aortic root &gt; 40 mm</td>
</tr>
</tbody>
</table>

Thorne S et al. Heart 2006
Congenital Heart Disease in Pregnancy

- Maternal mortality 18-fold higher in pts with ACHD
- Complications higher for pregnant women with ACHD:
  - cardiac complications (2.3% vs 0.2%)
  - induction (37% vs 33%)
  - caesarean or surgically assisted birth (45% vs 35%)
  - preterm delivery (10% vs 7%)
Congenital Heart Disease in Pregnancy

Drethen W et al JACC 2007
Pre-pregnancy Assessment

• All patients with cardiac conditions should be counselled (accurately) about main pregnancy issues prior to pregnancy

• Patients at prohibitive risk of pregnancy counselled against pregnancy. Contraception advice given and referral made if necessary

• Delaying pregnancy to fit into lifestyle can have disadvantages for some women
Pre-pregnancy Assessment-Minimising Risk

- Reducing risk with pre-procedure intervention:
  - Moderate or severe mitral stenosis
  - Aortic stenosis: symptomatic; asymptomatic pts with LV dysfunction or pathological exercise test, severe LVH
  - Bicuspid aortic valve with ascending aorta > 50 mm (beware Turner syn.)
  - Mitral and aortic regurgitation based on usual criteria
  - Pulmonary regurgitation: symptomatic, asymptomatic with usual criteria
  - Pulmonary stenosis: severe
  - Marfan syndrome: aortic root > 45 mm, root 40-45 mm with rapid growth, family history of dissection
Pregnancy Risk Assessment

- Prior cardiac event or arrhythmia
- Poor functional class (NYHA >II) or cyanosis
- Systemic ventricular systolic dysfunction (EF < 40%)
- Left heart obstruction
  - Aortic valve area < 1.5 cm²
  - Peak LVOT gradient > 30 mmHg
  - Mitral valve area < 2.0 cm²

Siu et al Circulation. 2001;104:515-521
Decompensation in Pregnancy

• Importance of assessment in pregnancy
  – Frequency of reviews
  – Clinical review, investigations, biomarkers

• Management of decompensation (slight modification to non-pregnant patients)
  – Heart failure
  – Arrhythmia
  – Management of pts with pulmonary hypertension

• Surgery or Intervention in Pregnancy

• Cardiac Decompensation in woman without prior cardiac disease
Assessing for decompensation during pregnancy

Tanous et.al. JACC 2010, 1247 - 1253
Assessing for decompensation during pregnancy

Tanous et.al. JACC 2010, 1247 - 1253
<table>
<thead>
<tr>
<th>Predictor</th>
<th>Adverse Maternal Cardiac Events (n = 8)</th>
<th>No Adverse Maternal Cardiac Events (n = 55)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age, mean ± SD (yrs)</td>
<td>31 ± 7</td>
<td>31 ± 5</td>
<td>0.86</td>
</tr>
<tr>
<td>Cardiac event before pregnancy</td>
<td>5 (63%)</td>
<td>6 (11%)</td>
<td>0.003</td>
</tr>
<tr>
<td>New York Heart Association functional class &gt;2</td>
<td>1 (13%)</td>
<td>1 (2%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Use of cardiac medications</td>
<td>5 (63%)</td>
<td>6 (11%)</td>
<td>0.003</td>
</tr>
<tr>
<td>Use of anticoagulants</td>
<td>4 (63%)</td>
<td>2 (4%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Subaortic ventricular dysfunction*</td>
<td>4 (50%)</td>
<td>11 (20%)</td>
<td>0.08</td>
</tr>
<tr>
<td>Subaortic ventricular dilation (n = 57)†</td>
<td>3/6 (50%)</td>
<td>9/49 (18%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Left heart obstruction‡</td>
<td>2 (25%)</td>
<td>9 (16%)</td>
<td>0.62</td>
</tr>
<tr>
<td>Aortic or subaortic atrioventricular valve regurgitation ≥ moderate</td>
<td>1 (13%)</td>
<td>7 (13%)</td>
<td>1.0</td>
</tr>
<tr>
<td>Pulmonic or subpulmonic atrioventricular valve regurgitation ≥ moderate</td>
<td>2 (25%)</td>
<td>10 (18%)</td>
<td>0.64</td>
</tr>
<tr>
<td>Pulmonary arterial hypertension§</td>
<td>3/6 (50%)</td>
<td>7/45 (16%)</td>
<td>0.08</td>
</tr>
<tr>
<td>LVEF on initial echocardiogram (%)</td>
<td>54 ± 4</td>
<td>62 ± 7</td>
<td>0.005</td>
</tr>
<tr>
<td>BNP max (pg/ml), median (IQR)</td>
<td>354, (229–805)</td>
<td>73, (43–131)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Maximum BNP &gt;100 pg/ml</td>
<td>8 (100%)</td>
<td>16 (19%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Initial BNP &gt;100 pg/ml</td>
<td>4 (50%)</td>
<td>2 (4%)</td>
<td>0.002</td>
</tr>
</tbody>
</table>
2. Neonatal Risk

NYHA functional class >II or cyanosis 3 (1.1–6.1) 0.035
Heparin/warfarin during pregnancy 3 (1.4–8.2) 0.0093
Smoking 2 (1.3–3.9) 0.0045
Multiple gestation 22 (6–85) 0.001

Neonatal events were defined as any of the following: premature birth (<37 weeks gestation), small-for-gestational-age birthweight (<10th per- centile), respiratory distress syndrome, intraventricular hemorrhage, fetal death (≥20 weeks gestation), or neonatal death (within 28 days after birth)
3. Risk of Transmission to Offspring

- About 3-5 % compared to 0.8 % in mothers without CHD, little less if father has CHD
- 6% in one study with TOF*
- Higher in parents with left-sided obstructive lesions e.g. aortic stenosis, coarctation
- Some syndromes are autosomal dominant (e.g. velocardiofacial syndrome-seen in ~6 % pts with TOF)**
- Consider foetal echocardiography ~ 20 weeks
- Consider geneticist involvement

4. Drugs in Pregnancy

- Some drugs are contraindicated in pregnancy, e.g. ACE inhibitors
- Some drugs have adverse effects on foetus but benefits may outweigh risk, e.g. amiodarone, warfarin
- Some drugs have low risk of adverse foetal effects and are widely used, e.g. metoprolol
Warfarin and Mechanical Valves

Risk of Valve thrombosis

• 2-4 % with OAC throughout pregnancy
• 9-10% UFH was used in the first trimester, OACs in the second and third trimester
• 33 % for UFH throughout pregnancy
• 9 % for LMWH (monitoring pre- and post- Xa levels) throughout pregnancy, ~ 3 % for first trimester only
• Risk of embryopathy 6-12 weeks gestation: ~ 2 % if warfarin dose ≤ 5mg d, ~ 8 % if > 8 %
• Valve thrombosis: surgery vs. low dose thrombolysis

5. Delivery Plan

• Team approach: obstetrician, anaesthetist, cardiologist
• Most women with heart disease do not need a caesarian for cardiac reasons (exception Marfan with dilated aortic root, acute/chronic aortic dissection, intractable heart failure). Relative indication: mechanical valves
• If haemodynamic lesion of significance, then epidural, vaginal delivery with assisted second stage
5. Delivery Plan

- Oxytocin: give slow infusion to avoid hypotension
- Ergometrine: peripheral vascular constriction and coronary spasm
- Autotransfusion post-delivery, may need diuretics
- In rTOF*: all parturients received neuraxial analgesia, 3 (14%) experienced congestive heart failure that required diuresis

6. Long-term effects on mother

• Uncertain, some studies suggesting:
  – Accelerated ventricular dysfunction in women with transposition of the great arteries
  – Accelerated prosthetic valve function
  – Accelerated right ventricular dilatation in pregnant women with rTOF
  – Worsening ventricular function in some women with aortic stenosis

• Mother needs to care for child, issue if has significant functional limitation or has condition with poor prognosis

Int J Cardiol. 2013 Oct 3;168(3):1847-52
Int J Cardiol. 2010 Feb 18;139(1):50-9
Summary

- Preconception planning preferable
- Importance of team approach