ROPAC - Pregnancy in women with cardiovascular disease: trends in outcome from 10 years ESC Registry Of Pregnancy And Cardiac disease

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ROPAC is part of the EURObservational Research Programme (EORP) of the ESC

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Hemodynamic impact of pregnancy

Figure 1.4  Percent changes of heart rate, stroke volume, and cardiac output measured in the lateral position throughout pregnancy compared to prepregnancy values. (Modified from Robson et al, Am J Physiol 1989;256:H1060–H1065.)
Maternal mortality by cause

Cardiac disease
Other indirect
Thrombosis & thromboembolism
Haemorrhage
Neurological
Psychiatric
Sepsis
Amniotic fluid embolism
Malignancies
Early pregnancy deaths
Pre-eclampsia
Anaesthesia
Goals ROPAC

• Assess risks for both mother and child
• Outline variation between different regions
• Support guidelines

Ultimate goal: reduce maternal mortality
## Risk stratification:
### Modified WHO classification

<table>
<thead>
<tr>
<th>Risk class</th>
<th>Risk of pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>mWHO I</td>
<td>No detectable increased risk of maternal mortality and no/mild increase in morbidity.</td>
</tr>
<tr>
<td>mWHO II</td>
<td>Small increased risk of maternal mortality or moderate increase in morbidity.</td>
</tr>
<tr>
<td>mWHO II-III</td>
<td>Significantly increased risk of maternal mortality or severe morbidity.</td>
</tr>
<tr>
<td>mWHO III</td>
<td>Extremely high risk of maternal mortality or severe morbidity; pregnancy contraindicated.</td>
</tr>
</tbody>
</table>

Prospective inclusion in ROPAC from 2007-2018
138 participating centres, 53 countries

5739 pregnancies
Diagnoses

- Congenital heart disease: 56%
- Valvular heart disease: 29%
- Cardiomyopathy: 8%
- Ischemic heart disease: 2%
- Aortic pathology: 4%
- Pulmonary arterial hypertension: 1%
Diagnoses in detail

Congenital heart disease diagnoses

Valvular heart disease diagnoses

Pulmonary hypertension diagnoses

Aortic pathology diagnoses

Cardiomyopathy diagnoses
## Outcome: Events

<table>
<thead>
<tr>
<th></th>
<th>ROPAC</th>
<th>Normal</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mortality</strong></td>
<td>0.6%</td>
<td>0.007%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Heart failure</td>
<td>11%</td>
<td>&lt;0.1%</td>
<td>0.002</td>
</tr>
<tr>
<td>Supraventricular tachycardia</td>
<td>2%</td>
<td>&lt;0.5%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Ventricular tachycardia</td>
<td>2%</td>
<td>&lt;0.5%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>(Pre-)eclampsia</td>
<td>3%</td>
<td>4%</td>
<td>0.50</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>44%</td>
<td>23%</td>
<td>0.005</td>
</tr>
<tr>
<td>Fetal mortality</td>
<td>1%</td>
<td>0.35%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neonatal mortality</td>
<td>1%</td>
<td>0.4%</td>
<td>0.12</td>
</tr>
<tr>
<td>Premature birth</td>
<td>16%</td>
<td>8%</td>
<td>0.06</td>
</tr>
</tbody>
</table>
Cardiovascular outcomes per diagnosis group

Mortality
Heart failure
Arrhythmias

0%
5%
10%
15%
20%
25%
30%
35%

Congenital heart disease
Valvular heart disease
Cardiomyopathy
Ischemic heart disease
Aortic pathology
Pulmonary arterial hypertension
Pre-pregnancy predictors for maternal mortality and/or heart failure

Univariable analysis
Maternal mortality and/or heart Failure

- Emerging country
- WHO4
- Hypertension
- Clinical signs of HF
- Atrial fibrillation
- NYHA > 2
- Systemic EF < 40%
- Age
- Smoking
- Mechanical heart valve
- Oral anticoagulation
- Other cardiac medication
- Nulliparous
- Prior intervention

Multivariable analysis
Maternal mortality and/or heart Failure

- Nulliparity
- NYHA > 2
- Systemic EF < 40%
- Cardiac medication
- Prior intervention
- Anticoagulation
- WHO4
- Clinical signs of HF
Trends over time
Variation between developed and emerging countries
Pregnancy outcome per mWHO category

<table>
<thead>
<tr>
<th>Pregnancy outcome</th>
<th>mWHO I (n=1185)</th>
<th>mWHO II (n=828)</th>
<th>mWHO II-III (n=2698)</th>
<th>mWHO III (n=593)</th>
<th>mWHO IV (n=407)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal mortality</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>Heart failure</td>
<td>5%</td>
<td>5%</td>
<td>12%</td>
<td>7%</td>
<td>33%</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>36%</td>
<td>36%</td>
<td>46%</td>
<td>48%</td>
<td>60%</td>
</tr>
<tr>
<td>Post-partum hemorrhage</td>
<td>2%</td>
<td>1%</td>
<td>3%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Fetal mortality</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Neonatal mortality</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Premature birth</td>
<td>13%</td>
<td>12%</td>
<td>15%</td>
<td>22%</td>
<td>28%</td>
</tr>
</tbody>
</table>

mWHO: Maternal Health and Obstetric Risk Assessment
Obstetric and fetal outcomes per diagnosis group

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>CHD (n=3295)</th>
<th>VHD (n=1648)</th>
<th>CMP (n=428)</th>
<th>IHD (n=95)</th>
<th>AOP (n=217)</th>
<th>PAH (n=45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstetric complications</td>
<td>16%</td>
<td>18%</td>
<td>23%</td>
<td>22%</td>
<td>18%</td>
<td>24%</td>
</tr>
<tr>
<td>Fetal and neonatal complications</td>
<td>18%</td>
<td>20%</td>
<td>31%</td>
<td>28%</td>
<td>28%</td>
<td>53%</td>
</tr>
</tbody>
</table>
Conclusions

• Maternal mortality in women with cardiac disease is 100x higher than expected with highest mortality in women with pulmonary arterial hypertension (9%).

• However, many women can go through pregnancy at low risk: **counseling!**

• Heart failure is the most common complication, occurring in 11%, most prevalent in cardiomyopathy and pulmonary arterial hypertension.

• After an initial increase there is now a decline in maternal mortality and heart failure, despite more women being in the highest mWHO category.

• Improvement was observed mainly in emerging countries.

• Caesarean section was used often (44%) in women with cardiac disease, although not advised in the guidelines.
Future: ROPAC will continue in 2 focussed areas

- Aortic Pathology
- Prosthetic Valve

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Thank you for the attention