Endothelial function is impaired in women who had pre-eclampsia

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Pre-eclampsia

Hypertension
Proteinuria
> 20 weeks gestation
Without pre-existing hypertension

Maternal
• Oedema
• Headaches / blurred vision / seizures
• Renal Failure
• Coagulation problems
• HELLP syndrome

Foetal
• Intra-uterine growth restriction
• Preterm delivery
• Death
Pre-eclampsia

The process of spiral artery remodelling following implantation

Unmodified artery

Trophoblast-modified artery

http://www.rcdrg.sgul.ac.uk/research/trophoblasts
LONG-TERM EFFECT OF PRE-ECLAMPSIA ON BLOOD-PRESSURE

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Though much has been written on the subject, the later effects of pre-eclampsia are still uncertain. Difficulties arise because definitions and concepts are variable and often vague. Is pre-eclampsia the first expression of an underlying hypertensive tendency; or is it a cause of hypertension in middle age? Though pre-eclampsia and hypertension may overlap, should they perhaps be regarded as separate conditions, different in aetiology and prognosis? If so, how are they to be distinguished?
Pre-eclampsia and Cardiovascular Risk

Pre-eclampsia

Obesity
Genetic factors
Endothelial dysfunction
Insulin resistance
Inflammation

Healthy adult life

Cardiovascular disease
Here: to examine cardiovascular phenotypes and markers of subclinical cardiovascular organ damage in women with a history of pre-eclampsia and matched controls.

To study the mechanisms of the relationship between pre-eclampsia and cardiovascular risk.
Cardiovascular Consequences of Pre-eclampsia Study (COPS)

**Generation Scotland**
- Women with history of preeclampsia 10-30 yrs ago
- Women with history of normotensive pregnancy 10-30 yrs ago

**PIP Study**
- Women with history of preeclampsia 3-5 yrs ago
- Women with history of normotensive pregnancy 3-5 yrs ago

**BP Clinics**
- Women with history of preeclampsia 1-30 yrs ago
- Women with history of normotensive pregnancy 1-30 yrs ago

Vascular function studies

Blood and urine for biomarker studies
**Endothelial function (ultrasound)**
Flow-mediated dilatation

**Vascular stiffness (SphygmoCor)**
Pulse wave analysis
Pulse wave velocity

**Early atherosclerosis (ultrasound)**
Carotid intima-media thickness
### Clinical Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Cases N = 86</th>
<th>Controls N= 80</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>47.6 ± 10.1</td>
<td>48.8 ± 8.5</td>
<td>0.601</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.6 ± 18.5</td>
<td>162.7 ± 6.7</td>
<td>0.193</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>76.4 ± 15.0</td>
<td>70.1 ± 11.2</td>
<td>0.004</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.4 ± 6.1</td>
<td>26.6 ± 4.5</td>
<td>0.002</td>
</tr>
<tr>
<td>Heart rate (bpm)</td>
<td>73 ± 10</td>
<td>70 ± 9</td>
<td>0.175</td>
</tr>
<tr>
<td>Sitting SBP (mmHg)</td>
<td>130 ± 14</td>
<td>122 ± 10</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sitting DBP (mmHg)</td>
<td>82 ± 9</td>
<td>78 ± 7</td>
<td>0.001</td>
</tr>
<tr>
<td>Lying SBP (mmHg)</td>
<td>126 ± 15</td>
<td>118 ± 10</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Lying DBP (mmHg)</td>
<td>77 ± 9</td>
<td>74 ± 7</td>
<td>0.010</td>
</tr>
<tr>
<td>Chol (mmol/L)</td>
<td>5.3 ± 1.0</td>
<td>5.4 ± 1.0</td>
<td>0.538</td>
</tr>
<tr>
<td>HDL (mmol/L)</td>
<td>1.5 ± 0.3</td>
<td>1.5 ± 0.3</td>
<td>0.737</td>
</tr>
<tr>
<td>Chol/HDL ratio</td>
<td>3.8 ± 1.1</td>
<td>3.7 ± 1.0</td>
<td>0.833</td>
</tr>
<tr>
<td>Trig (mmol/L)</td>
<td>1.4 ± 0.7</td>
<td>1.4 ± 0.7</td>
<td>0.941</td>
</tr>
</tbody>
</table>

BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL, high density lipoprotein.
Results: Pulse Wave Velocity

\[ P = 0.002 \]
After adjustment for SBP there was no significant difference in pulse wave velocity between cases and controls.
There were no statistically significant differences in aortic augmentation index and carotid intima-media thickness between cases and controls after adjustment for SBP.
The difference in FMD between cases and controls remained statistically significant ($P = 0.030$) after adjustment for SBP.
# Vascular Data: Summary

<table>
<thead>
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<th>Cases N = 86</th>
<th>Controls N= 80</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMD (%)</td>
<td>5.9 ± 3.3</td>
<td>7.0 ± 3.3</td>
<td><strong>0.030</strong></td>
</tr>
<tr>
<td>AIx@HR75 (PWA) (%)</td>
<td>25.7 ± 11.0</td>
<td>22.5 ± 9.6</td>
<td>n.s.</td>
</tr>
<tr>
<td>PWV (m/s)</td>
<td>7.8 ± 1.6</td>
<td>7.1 ± 1.1</td>
<td>n.s.</td>
</tr>
<tr>
<td>cIMT CCA (mm)</td>
<td>0.655 ± 0.132</td>
<td>0.622 ± 0.112</td>
<td>n.s.</td>
</tr>
<tr>
<td>cIMT bulb (mm)</td>
<td>0.676 ± 0.148</td>
<td>0.679 ± 0.146</td>
<td>n.s.</td>
</tr>
<tr>
<td>cIMT ICA (mm)</td>
<td>0.552 ± 0.125</td>
<td>0.553 ± 0.135</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

AIx, augmentation index; PWA, pulse wave analysis; AIx@HR75, augmentation index adjusted to a heart rate of 75 bpm; PWV, pulse wave velocity; cIMT, carotid intima-media thickness; CCA, common carotid artery; ICA, internal carotid artery.

* Adjusted for SBP
Women who had pre-eclampsia have higher blood pressure and BMI compared to women at similar age who had normotensive pregnancies.

Women with a history of pre-eclampsia have impaired vascular endothelial function.

In our study we found no differences between cases and controls in markers of more advanced vascular damage between cases and controls.
Limitations

• Cohort of women with no major health problems

• These women were younger than women in previous studies

• No end-stage renal disease or death

• Our study focussed on vascular phenotypes and did not look into cardiac or cerebral phenotypes