The transcranial Doppler of maternal cerebral arteries and the prediction of pre-eclampsia

JOÃO PAULO DIAS DE SOUZA

Training in Reproductive Health Research
Geneva 2005

IAMANEH Scholarship
Pre-eclampsia is a major cause of maternal and perinatal death.

Preeclamptic women frequently present cerebral involvement, which can be attributed to pathological vascular alterations, mainly affecting the parietal and occipital lobe.
Background

- Any pregnant woman experiences several physiological adaptations, including changes in the cerebral hemodynamics.
- Ethical and Technical constraints:
  - The major part of the information about these cerebral changes has been obtained from cross-sectional studies or studies with small animals.
It is important to note that, of all organ systems affected by PE, the brain can only be assessed by signs and symptoms.

No simple laboratory blood or urine investigation can provide any mechanism of assessing cerebral function.
Background

- There are other non-invasive techniques:
  - Computed tomography (CT) scan
  - Magnetic resonance imaging (MRI)
- But they are not feasible in most of the settings
The introduction of the transcranial Doppler in the clinical practice is considered by some researchers as a possibility to assess the cerebral state during pregnancy.
The transcranial Doppler is a non-invasive method, able to measure parameters of the cerebral hemodynamics.
Previous studies evaluated parameters derived from the Doppler waveform in different vascular beds to study their ability to predict the occurrence of PE
The Question

- Can transcranial Doppler predict PE?

Refining...

- Can transcranial Doppler of maternal cerebral arteries predict the occurrence of PE?
To assess whether second–trimester changes in transcranial Doppler parameters of normotensive pregnant women are associated with the subsequent development of pre-eclampsia
CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

- **Types of studies**
  - All case-control and cohort studies providing measures of the transcranial Doppler parameters

- **Types of participants**
  - Any normotensive pregnant woman at the 2nd trimester of pregnancy

- **Types of outcome measures**
  - For all women: pre-eclampsia / eclampsia
SEARCH STRATEGY FOR IDENTIFICATION OF STUDIES

- Period: between 1994 and 2004
- Key Words: Transcranial Doppler, Preeclampsia, pre-eclampsia, eclampsia, prediction (multiple combination of them)
- Language: any
- Database Searched: Medline, Popline and SciELO
- In addition: reference lists of retrieved articles were checked
Moutquin (1999):
- Cohort of 395 normotensive women (20 developed PE)

Riskin-Mashiah (2002):
- Nested case-control study
- 10 preeclamptic and 20 normotensive pregnant women
- Matching for gestational age, maternal age and parity

Williams (2004):
- Nested case-control study
- 20 preeclamptic and 40 normotensive pregnant women
- Matching for maternal age
Moutquin (1999):
- The blood flow velocity was similar in the second and third trimester in both groups

Riskin-Mashiah (2002):
- The pulsatility and resistance indices were lower in the second trimester in women who later would develop pre-eclampsia

Williams (2004):
- The blood flow velocity and the pulsatility index did not differ in the second or third trimester between the case and the control groups
Changes in maternal middle cerebral artery among women who later developed PE

<table>
<thead>
<tr>
<th>STUDY</th>
<th>n</th>
<th>BFV</th>
<th>PI</th>
<th>RI</th>
<th>BFV</th>
<th>PI</th>
<th>RI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moutkin (1999)</td>
<td>375 / 20</td>
<td>60.3 ± 10.4</td>
<td>-</td>
<td>-</td>
<td>63.7 ± 8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riskin-Mashia (2002)</td>
<td>20 / 10</td>
<td>-</td>
<td>0.83 ± 0.03</td>
<td>0.54 ± 0.01</td>
<td>-</td>
<td>0.73 ± 0.03*</td>
<td>0.50 ± 0.01*</td>
</tr>
<tr>
<td>Williams (2003)</td>
<td>40 / 20</td>
<td>66.46 ± 1.2</td>
<td>1.05 ± 1.9</td>
<td>-</td>
<td>69.25 ± 14.7</td>
<td>1.92 ± 0.21</td>
<td></td>
</tr>
</tbody>
</table>


The meta-analysis of these studies was considered not feasible
Changes in maternal middle cerebral artery among women who later developed PE

<table>
<thead>
<tr>
<th>STUDY</th>
<th>n</th>
<th>BFV NTW</th>
<th>PI NTW</th>
<th>RI NTW</th>
<th>BFV PEW</th>
<th>PI PEW</th>
<th>RI PEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moutkin (1999)</td>
<td>375 / 20</td>
<td>60.3 ± 10.4</td>
<td>-</td>
<td>-</td>
<td>63.7 ± 8.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Riskin-Mashia (2002)</td>
<td>20 / 10</td>
<td>-</td>
<td>0.83 ± 0.03</td>
<td>0.54 ± 0.01</td>
<td>-</td>
<td>0.73 ± 0.03*</td>
<td>0.50 ± 0.01*</td>
</tr>
<tr>
<td>Williams (2003)</td>
<td>40 / 20</td>
<td>66.46 ± 1.2</td>
<td>1.05 ± 1.9</td>
<td>-</td>
<td>69.25 ± 14.7</td>
<td>1.92 ± 0.21</td>
<td>-</td>
</tr>
</tbody>
</table>


The meta-analysis of these studies was considered not feasible
Considerations

- Methodological problems:
  - Case-control studies: the controls capacity for representing the population that generated the cases is uncertain, considering its reduced number
  - Possible measurement bias:
    - The number of examiners performing the Doppler
    - No assessment of the inter and intra-examiner variability
  - Possible Confounder:
    - The smoking status of the women in any study was not clarified
Implications for practice
- Until further evidence is available, the transcranial Doppler may not be performed to predict or promote the earlier detection of pre-eclampsia

Implications for research
- Further research is needed to define the ability of transcranial Doppler in the prediction of pre-eclampsia
- Future studies should include larger samples and address the inter and intra-examiner variability
Pre-eclampsia is a major problem in the field of reproductive health

Developing strategies to allow its early detection, ideally before its clinical manifestation, must remain a goal for researchers dealing with this topic

However, considering the available data, the ability of transcranial Doppler in the prediction of pre-eclampsia is still uncertain

Further research is needed to define the ability of transcranial Doppler in the prediction of pre-eclampsia