Visual neurovascular coupling altered in a subgroup of formerly pre-eclamptic women
Martens, E.G.H.J.; Gommer, E.D.; van de Vosse, F.N.; Reulen, J.P.H.

Published: 01/01/2007

Document Version
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:
• A submitted manuscript is the author's version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

Citation for published version (APA):
Visual neurovascular coupling altered in a subgroup of formerly pre-eclamptic women


Departments of Clinical Neurophysiology 1, Gynecology and Obstetrics 2, University Hospital Maastricht
Department of Biomedical Engineering 3, Eindhoven University of Technology

Introduction

Neurovascular Coupling (NVC) controls cerebral blood flow to metabolic need, for example a visual stimulus results in a higher metabolic need and thus demands an increased blood flow to and in the visual cortex. Since pre-eclamptic women may experience abnormal visual symptoms such as light flashes, we investigated NVC of formerly pre-eclamptic patients by visual stimulation.

Blood flow velocity to the visual cortex is measured by Transcranial Doppler Ultrasonography (TCD, fig. 1) of the posterior cerebral artery (PCA).

Our hypothesis is: NVC is reduced in formerly pre-eclamptic patients compared to matched controls.

Patients and methods

Patients

The NVC has been evaluated in three groups:
- Formerly pre-eclamptic patient group (PE, n = 15)
- Formerly eclamptic patient group (E, n = 13)
- An age, BMI and post-pregnancy-period (0.5-6.0 yrs) matched control group (C, n = 13)

Methods

TCD blood flow velocity (CBFV) of the P2-segment of the left PCA was recorded during 10 minute cyclic visual stimulation (40s "on" [cartoon], 20s "off" [eyes closed]). The 10 CBFV response cycles are averaged and "on"-PCA responses were expressed as a percentage of the mean of the last 10s of the "off"-PCA response.

Results

Quantitative results

Table I. Mean Parameter values per group

<table>
<thead>
<tr>
<th></th>
<th>PE (n=15)</th>
<th>E (n=13)</th>
<th>C (n=13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K (%)</td>
<td>24 ± 9</td>
<td>24 ± 6</td>
<td>20 ± 5</td>
</tr>
<tr>
<td>ζ</td>
<td>0.8 ± 0.4</td>
<td>0.7 ± 0.3</td>
<td>0.6 ± 0.2</td>
</tr>
<tr>
<td>ω (1/s)</td>
<td>0.21 ± 0.08</td>
<td>0.25 ± 0.11</td>
<td>0.21 ± 0.08</td>
</tr>
<tr>
<td>T_v (s)</td>
<td>11.0 ± 16.7</td>
<td>5.8 ± 6.6</td>
<td>4.9 ± 7.8</td>
</tr>
</tbody>
</table>

Qualitative results

fig 3. Based on dynamic behaviour parameters T_v and ζ (zeta), 3 types of responses can be identified (Section I, II and III)

Discussion

Control parameters nicely match literature values. In 8 subjects (fig. 3 sec. II-III) damping ζ exceeds 1, suggesting a critically damped response. In 5 of them also T_v is enlarged. A large ζ (sec. III) may indicate greater stiffness of the cerebrovascular system. An additionally enlarged T_v (sec. II) means upregulation of the differentiator of the transfer function. This may be a compensation mechanism for damped responses to attain adequate blood flow.

Conclusions

NVC is altered in a subgroup of formerly (pre-)eclamptics. In some of them compensation seems to occur, but in others compensation fails. Further research is mandatory to explain this physiologically.