Retrograde jugular venous flow in hypertensive humans: a risk factor for cerebral disease?

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Background
- Retrograde flow in internal jugular veins (RJF) is associated with dementia pathology of structural changes in brain parenchyma [1].
- In dementia patients, RJF is associated with risk factors, such as hypertension [2]
- Interestingly, hypertensives are considered more at risk of developing dementia.
- Hypertension is associated with increased white matter hyperintensities.
- RJF may explain why cerebral pathology occur in hypertensives.

Aim and hypothesis
- We aimed to determine whether there is a difference in RJF between hypertensives (HTN) and normotensives (NTN).
- We hypothesized there would be more RJF in HTNs.

Methods
- 3T MRI- GE
- Brain parenchyma volumes for grey and white matter were measured using T1 structural scans (FSPGR). Analysed using FSL (Oxford).
- Phase contrast MRI was used to quantify venous flow (figure 1 and 2). Analysed using Segment (Medviso)

Figure 1. 3D plot of jugular blood flow in NTN (left) and HTN (right)

Figure 2. Total flow through jugular vein over 1 cardiac cycle in NTN participant (left) and in HTN participants (right).

Results

<table>
<thead>
<tr>
<th></th>
<th>Age (yrs)</th>
<th>BMI (kg/m²)</th>
<th>Office SBP (mmHg)</th>
<th>Office DBP (mmHg)</th>
<th>Daytime SBP (mmHg)</th>
<th>Daytime DBP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertensive 25-74</td>
<td>56 ± 10</td>
<td>29 ± 4</td>
<td>149 ± 16</td>
<td>89 ± 10</td>
<td>136 ± 13</td>
<td>84 ± 8</td>
</tr>
<tr>
<td>Normotensive 24-67</td>
<td>45 ± 14</td>
<td>24 ± 3</td>
<td>124 ± 9</td>
<td>75 ± 6</td>
<td>118 ± 9</td>
<td>76 ± 7</td>
</tr>
</tbody>
</table>

Table 1. Average office and ambulatory daytime blood pressure

Figure 3. a) total flow b) total backward flow c) total forward flow d) grey matter to white matter ratio (WM) in HTNs vs. NTN, *P<0.001.

Conclusion
- The findings suggest that HTNs have more retrograde flow in the left jugular vein, possibly due to high blood pressures causing damage to valvular structures [2] resulting in RJF.
- Why the left side? RJF has shown to be localized to the left side in other diseases such as dementia [3]. Currently why there is ‘sidedness’ is unclear.
- The GM:WM demonstrated that the HTNs GM was more atrophied than their WM
- Why would jugular venous back flow cause cerebral morphological changes? Backflow in jugular veins may increase capillary pressure [1] which affects metabolic exchange and may cause build up of waste products in tissue.

References

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