A pilot study to evaluate the changes of motor evoked potentials during aortic cross clamping in thoracoabdominal aortic aneurysm surgery

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Objective
Postoperative paraplegia is a devastating complication after thoracoabdominal aortic aneurysm (TAAA) surgery, and believed to result from spinal cord ischemia (SCI). Recently, the monitoring of myogenic motor evoked potentials (MEP) has been recognized as a reliable method to prevent intraoperative SCI during TAAA surgery. However, the previous studies have indicated that MEP can fluctuate intraoperatively due to the aortic clamp and induction of cardiopulmonary bypass under hypothermic condition, in which plasma concentrations of propofol and neuromuscular blocking agent may be increased (1,2). Although these conditions may disturb the interpretation of the results of intraoperative MEP monitoring, MEP data during aortic clamping is limited. In this preliminary study, we retrospectively evaluated the changes in MEPS during aortic clamping and the anesthetic conditions associated with a reduction of MEP after aortic clamping in TAAA surgery.

Materials & Methods

1. 18 patients undergoing TAAA surgery
2. All patients were divided into 2 groups
   - **Group 1**: More than 50% decrease of baseline MEP from the upper limb (n=7)
   - **Group 2**: Without more than 50% decrease of baseline MEP from the upper limb (n=11)
3. Exclusion criteria: Hypothermic circulatory arrest
4. Maintenance of anesthesia: propofol (TCI 0.3-0.9 μg/ml) and remifentanil (0.05-0.25 mcg/kg/min) and fentanyl with rocuronium (0.2-0.4 mcg/kg/h)
5. Infusion rates of propofol and rocuronium were decreased just before aortic clamping.
6. MEP settings:
   1) Transcranial electrical train-of-fives stimulation with an interstimulus interval of 2 msec to C3 and C4 (international 10-20 system)
   2) Recording muscles: abductor pollicis brevis muscles for upper limb and abductor hallucis muscles for lower limb

Assessments
- Baseline and minimum MEP
  - Baseline MEP: before aortic cross clamping
  - Minimum MEP: during aortic cross clamping
- Anesthetic conditions when minimum MEP was recorded
- Statistical analysis: Unpaired t test, Mann-Whitney U test or Chi-square test

Results

Table 1. Patients' characteristics

<table>
<thead>
<tr>
<th></th>
<th>Group1 (n=7)</th>
<th>Group2 (n=11)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>68.7 ± 7.6</td>
<td>62.4 ± 11.7</td>
<td>0.223</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>159.1 ± 9.2</td>
<td>166.5 ± 5.9</td>
<td>0.053</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>59.9 ± 13.1</td>
<td>67.0 ± 11.9</td>
<td>0.249</td>
</tr>
<tr>
<td>BMI</td>
<td>23.4 ± 3.0</td>
<td>24.0 ± 3.4</td>
<td>0.679</td>
</tr>
<tr>
<td>Smoking</td>
<td>3 (43.3%)</td>
<td>7 (63.6%)</td>
<td>0.367</td>
</tr>
<tr>
<td>Hypertension</td>
<td>5 (85.7%)</td>
<td>10 (90.9%)</td>
<td>0.732</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1 (14.3%)</td>
<td>0 (0%)</td>
<td>0.197</td>
</tr>
<tr>
<td>Renal disease</td>
<td>1 (14.3%)</td>
<td>0 (0%)</td>
<td>0.197</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD, or as number of patients (%). BMI: body mass index, PVD: peripheral vascular disease

Discussion

- In all patients, baseline MEP amplitude was successfully recorded from all recording sites.
- Of 18 patients, more than 50% decrease of baseline MEP was observed in 7 patients (38.9%).
- Infusion rates of propofol and rocuronium in group1 tended to be higher than those in group2, but not significantly.
- The decrease of MEP amplitudes during the thoracic aortic cross clamping might be resulted from the increase of the plasma propofol concentration in the upper body due to the almost “split circulation” produced by the thoracic aortic cross clamping.
- During aortic cross clamping, propofol infused via an upper limb could not directly reach to the liver. The reduction of hepatic metabolism might make plasma concentrations of propofol increase.

Conclusions
The results in this study indicated that the incidence of MEP reduction after aortic clamping is relatively high in patients under propofol-based anesthesia. Further studies would be required to develop the anesthetic regime to accomplish reliable MEP monitoring during TAAA surgery.

References