Evaluation of intracranial volume after the posterior cranial vault distraction osteogenesis (PVDO) in craniosynostosis patients

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Introduction

• Recently several institutes have reported on PVDO.

• We had started to carry out PVDO for unilateral lambdoid synostosis from 2004.

• The posterior cranium expansion could acquire the greater capacity than the anterior by computer simulations.

PVDO: Posterior cranial vault distraction osteogenesis

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Introduction

• The posterior cranium expansion seems to be more helpful to control the intracranial pressure than the anterior.

• We evaluated the intracranial volume after PVDO in craniosynostosis patients and compared with FOA previously reported.

PVDO : Posterior cranial vault distraction osteogenesis
FOA : Front-orbital advancement
Materials and Methods

• A retrospective review of craniosynostosis patients who underwent PVDO before FOA in Juntendo University from 2011 to 2014.

• The intracranial volume was measured before and after PVDO on 3DCT scans with the workstation (Ziostation®)

PVDO: Posterior cranial vault distraction osteogenesis
FOA: Front-orbital advancement
3DCT: Three-dimensional computed tomography
Materials and Methods

Schema of intraoperative view

1. Biparietal and occipital osteotomy
2. 3 distracters
3. Barrel stave osteotomy
4. Foramen magnum decompression
5. Extend 1 mm/day over 4 weeks

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### Results

#### Overview of our study group

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (month)</th>
<th>Sex</th>
<th>Diagnosis</th>
<th>Operation</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>M</td>
<td>Saetre-Chotzen syndrome</td>
<td>PVDO + FOR</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>F</td>
<td>Pancraniosynostosis</td>
<td>PVDO + FOR</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>F</td>
<td>Frontonasal dysplasia</td>
<td>PVDO + FOR</td>
<td>Wound infection</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>F</td>
<td>Apert syndrome</td>
<td>PVDO</td>
<td>CSF fistula</td>
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<tr>
<td>5</td>
<td>12</td>
<td>F</td>
<td>Pancraniosynostosis</td>
<td>PVDO + FOA</td>
<td>Device displacement</td>
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<tr>
<td>6</td>
<td>39</td>
<td>M</td>
<td>Plagiocephaly</td>
<td>PVDO + FOR</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>33</td>
<td>M</td>
<td>Trigonocephaly</td>
<td>PVDO + FOR</td>
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</tr>
</tbody>
</table>

PVDO: Posterior cranial vault distraction osteogenesis  
FOR: Front-orbital remodeling  
FOA: Front-orbital advancement
# Results

Comparison of advancement and volumetric change in PVDO and FOA

<table>
<thead>
<tr>
<th></th>
<th>Distraction Length Mean ± SD (mm)</th>
<th>Volume Increase Mean ± SD (cm³)</th>
<th>Volume Increase / Distraction Length Mean ± SD (cm³/m m)</th>
<th>Volume change Rate Mean ± SD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PVDO alone</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Our Cases</td>
<td>31.0 ± 5.4</td>
<td>192 ± 48</td>
<td>6.31 ± 1.56</td>
<td>120 ± 7</td>
</tr>
<tr>
<td><strong>FOA alone</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Freudlsperger</td>
<td>-</td>
<td>157 ± 128</td>
<td>-</td>
<td>112 ± 10</td>
</tr>
<tr>
<td>Christopher</td>
<td>12.5 ± 2.59</td>
<td>144 ± 100</td>
<td>4.6 ± 4.5</td>
<td>-</td>
</tr>
</tbody>
</table>

PVDO: Posterior cranial vault distraction osteogenesis

FOA: Front-orbital advancement

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Discussions

Intracranial volume comparisons of the patients after PVDO and normal population


PVDO: Posterior cranial vault distraction osteogenesis

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Conclusions

• PVDO could efficiently obtain the greater intracranial volume than FOA.

• Initially PVDO may be helpful to control intracranial pressure for syndromic craniosynostosis patients.

• Cosmetically the anterior remodeling may be performed without unnatural anterior advancement.

PVDO: Posterior cranial vault distraction osteogenesis

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