Endoscopic Pedicled Nasoseptal Flap Reconstruction for Pediatric Skull Base Defects

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Introduction

• Endoscopic endonasal approach (EEA) is more frequently used for exposure and resection of intradural lesions including pediatric skull base disease.
• A neurovascular pedicled flap of the nasal septum mucoperiosteum and mucoperichondrium based on the nasoseptal artery is the workhorse for anterior skull base, transellar, and transclival EEA reconstruction; it has been shown to reduce CSF leaks after EEA by 50%.
• Anecdotal data from the senior authors revealed less available flap size in pediatric patients for skull base reconstruction.
• Normal craniofacial growth trends have shown early rapid cranial growth in contrast to late rapid midface growth.

Objectives

• To use radioanatomic analysis of CT scans to determine limitations of the nasoseptal flap in pediatric skull base reconstruction and to describe clinical outcomes after using the nasoseptal flap in six pediatric patients.

Methods

• Six pediatric patients out of 150 patients undergoing EEA with nasoseptal flap reconstruction were prospectively analyzed for flap coverage and postoperative CSF leak.
• 50 pediatric CTs and 10 adult CTs underwent radioanatomic analysis; images were grouped by age. Measurements included potential maximum nasoseptal flap dimensions and potential anterior skull base, transellar, and transclival defect dimensions. Measurements within each age group were compared to determine if flap size would be sufficient to cover each approach defect.

Results

• 2/3 patients <14y had insufficient defect coverage, and one had a postoperative CSF leak.
• 3/3 patients >14y had sufficient flap coverage and no postoperative CSF leak.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Pathology</th>
<th>Approach/ Module</th>
<th>Flap Coverage</th>
<th>Post Operative Leak</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>CP</td>
<td>Transellar Transdorsal</td>
<td>80%</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>GSW to Cribriform</td>
<td>Transcribriform</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>Olfactory Meningioma</td>
<td>Transcribriform</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>PA</td>
<td>Transellar</td>
<td>100%</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>CP</td>
<td>Transellar Transplanar</td>
<td>90%</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>CP</td>
<td>Transellar Transplanar</td>
<td>100%</td>
<td>No</td>
</tr>
</tbody>
</table>

PA – Pituitary Adenoma; GSW – Gun Shot Wound; CP – Craniopharyngioma

Radiographic measurements: A) anterior width of anterior skull base defect (SKB-AEA) - distance between both lamina papyracea at the level of the anterior ethmoidal artery in coronal plane. B) flap length required to cover anterior skull base defect (SPF-SKB) - distance from posterior frontal sinus to planum sphenoidale to projection of SPF in midsagittal plane. C) flap length (FL-SPF-NB) - distance from SPF projection to anterior border of the nasal bone in a line parallel to the hard palate in the midsagittal plane.

Graphical representation of the ratio of flap length (FL-SPF-NB) to anterior skull base approach defect (SPF-SKB) according to age. AF = anterior fossa defect

Graphical representation of flap length (FL-SPF-NB) growth and anterior skull base (SPF-SKB) growth. Rate of septal growth is most rapid between the ages of ten and thirteen. AF = anterior fossa

Conclusions

• The pedicled nasoseptal flap may not be a viable option for EEA reconstruction in children <10 years.
• The nasoseptal flap is reliable in patients >14 years as their septums are comparable to adults.
• Patients 10-13 years require careful consideration of facial analysis and preoperative radioanatomic evaluation to determine reconstructive options.