Posterior Vault Distraction in Multi-Suture Craniosynostosis: A radiologic morphometric assessment

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Purpose

The first-line treatment of multi-suture syndromic craniosynostosis has shifted to an emphasis on posterior vault distraction (PVD) techniques as a way of increasing intracranial volume. To date, the effect of PVD on craniofacial dysmorphology in these patients has not been well studied. This study was designed to examine the effect of PVD on craniofacial morphology in patients with syndromic multi-suture synostosis using radiologic morphometric analysis.

Methods

With IRB approval, 22 patients (11M, 11F: age 4 to 149 months) with syndromic craniosynostosis (3 Apert, 4 Pfeiffer, 4 Muenke, 3 Crouzon, 2 chromosomal anomaly, 1 craniofrontonasal dysplasia, 5 unknown) underwent PVD for correction of elevated intracranial pressure (n=12) and/or correction of turribrachycephaly (n=16). Morphometric analysis of sequential CT scout radiographs and lateral skull radiographs assessed turricephaly index (TI=cranial length/height), vertical growth index (VGI=cranial base length/height), absolute vertical height (AVH=sella to vertex distance), and occipital inclination angle (OIA).

Results

Preoperatively, patients exhibited a mean TI of 1.34 (range=1.02-1.53, SD=0.16), VGI of 0.41 (range=0.26-0.58, SD=0.08), AVH of 107.37mm (range=87.4-149.4, SD=15.38), and OIA of 44.54 degrees (range=12.5-67.2, SD=12.17). PVD (n=18) demonstrated association with increased TI (mean=1.53,$p<0.001$) and VGI (mean=0.44,$p=0.001$), while flattening the OIA (mean=37.5,$p=0.004$). Additional frontal advancement procedures after PVD (n=15) yielded further increase in TI (mean=1.59,$p=0.004$) and VGI (mean=0.47,$p=0.012$). AVH did not change significantly once distraction was initiated.

Conclusions

PVD results in significant improvements in craniofacial dysmorphology by increasing calvarial length relative to AVH and flattening occipital inclination, effectively normalizing turricephalic proportions. These results are improved by further frontal advancement surgery. AVH does not appear to increase or decrease after PVD initiation, suggesting aesthetic benefits are due to calvarial length attaining proportion to pre-treatment cranial height.