**An Analysis of Posterior Vault Distraction and its Effects on the Posterior Fossa and Cranial Base**

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**Disclosure/Financial Support:** None of the authors have any relevant financial disclosures.

**INTRODUCTION:** Posterior vault distraction osteogenesis (PVDO) is used to manage severe turribrachycephaly and elevated intracranial pressure. PVDO allows for greater expansion of the cranial vault (CV) when compared to more conventional modalities[1-3]. However, little is known about how PVDO affects the cranial base, such as posterior fossa volume and the foramen magnum. The goal of our study was to use 3-dimensional craniometric analysis to better elucidate these relationships.

**MATERIALS AND METHODS:** We identified children with syndromic craniosynosis who underwent PVDO at our institution between 2009 and 2012 who had no previous intracranial surgery and underwent pre/post-operative 3DCT of adequate resolution. Three-dimensional volumes of the CV and posterior fossa (PF) were generated. Craniometric analysis of the cranial base included measurement of the dimensions and surface area of the foramen magnum (FM), cranial base angle (CBA: FM-Sella-Nasion), and posterior vault inflection angle (PIA: Sella-FM-Occipital protuberance). Statistical analysis was performed comparing pre- and post-operative measurements using the Wilcoxon matched pairs sign rank test (significance: $p<0.05$).

**RESULTS:** A total of 10 children (5M, 5F) were identified who met inclusion criteria for this study. Each patient carried a diagnosis of syndromic craniosynostosis: 2 Apert, 2 Crouzon, 3 Saithre-Choutzen, 1 Pfieffer, 1 Muenke and 1 undefined syndrome. The mean age of intervention was 13.0+/-12.2 months. We found an average total increase in CV volume of 299.75+/-154.64$cm^3$ ($p= 0.0069$). On average, the ratio of PF volume to CV volume increased by 9.8% ($p=0.0051$). The CBA and PIA increased by an average of -1.26+/-8.36 deg ($p=0.075$) and 7.33+/-13.40 deg ($p=0.58$) respectively as the result of PVDO. The dimensions of the FM increased by 0.22+/-0.33cm ($p=0.074$) and 0.18+/-0.2cm ($p=0.0284$) resulting in increased total surface area of 0.72+/-0.93$cm^2$ ($p=0.028$).

**CONCLUSION:** The results of our study suggest that posterior vault distraction osteogenesis results in a large relative increase in the posterior fossa component of cranial vault volume. The surface area of the foramen magnum is similarly expanded. These data potentially have important implications for cerebellar tonsillar herniation and regional cerebral blood flow, which will be the focus of future studies.

**REFERENCES:**

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**FIGURE LEGENDS:**

**Figure 1.** Three-dimensional skull reconstruction divided para-sagitally to demonstrate craniometric measurements.

**Figure 2.** Three-dimensional volumetric and cranial vault volumetric rendering demonstrating Cranial vault volumetric rendering (sum of yellow/red) with posterior fossa divided (red).

**Figure 1**

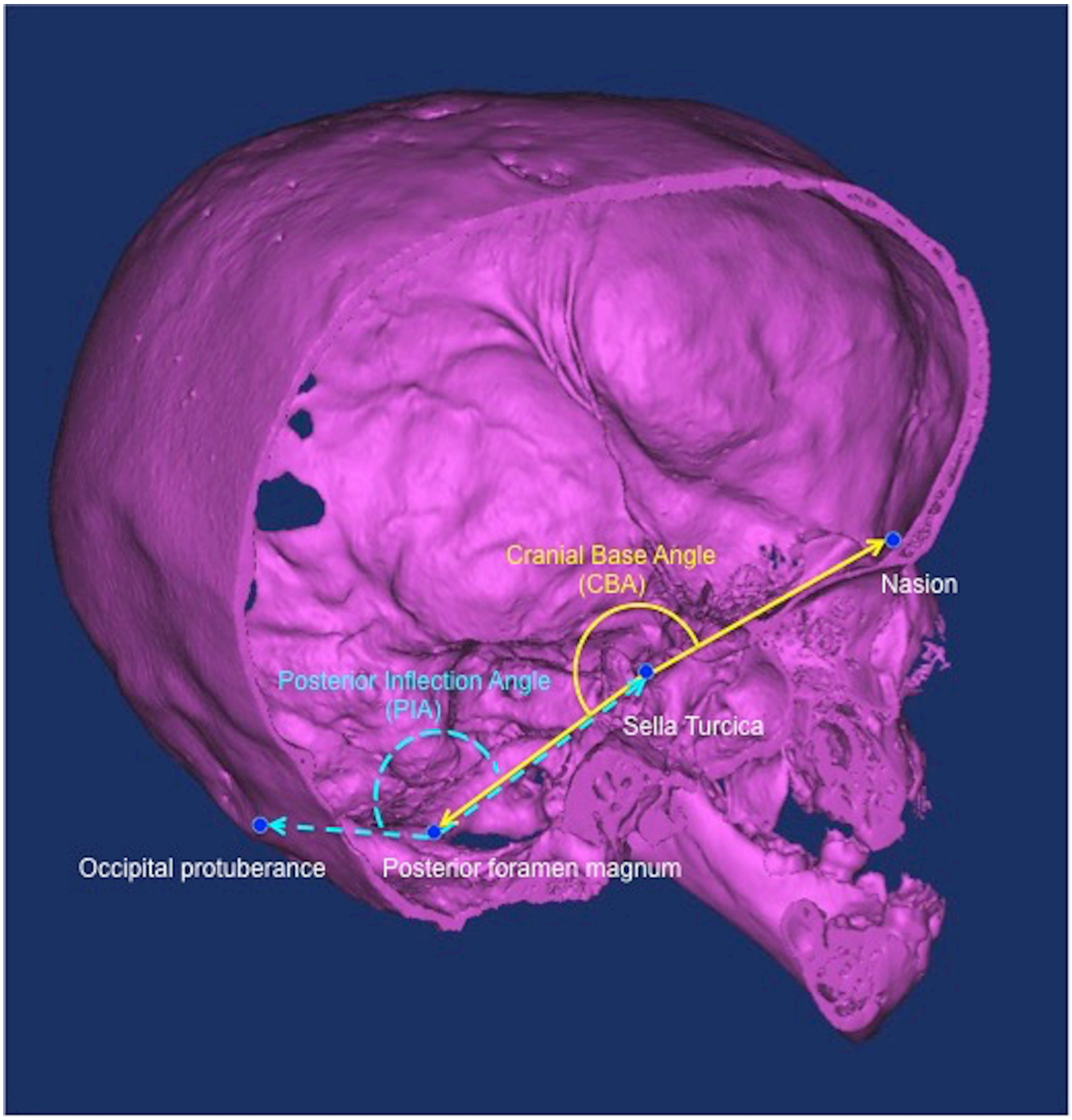
Cranial Base Angle
(CBA)
Nasion
Posterior Inflection Angle
(PIA)
Sella Turcica
Occipital protuberance
Posterior foramen magnum

**Figure 2**