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A Comprehensive Multicenter Study on the Development of the Pediatric Cranial Venous System and Its Clinical Relevance

Alexander I Evins MD; Gunjan Goel BA, MD; Andrea Boschi; Salazar Jones MD; Michael L. Levy MD, PhD; Philip E. Stieg MD, PhD; Antonio Bernardo MD

Weill Cornell Medicine, Neurological Surgery, New York, New York

Introduction

Embryology has shown that development of the cranial venous system continues into the post-natal period, such that a neonate or an infant may display configurations of dural sinuses or veins not seen in adults. Precise understanding of the stages of development of the cranial venous system and dura, and the duration of each, is not yet fully understood. Previous studies on the development of this system have been observational in nature and were conducted before the advent of modern imaging modalities that now allow us to clearly define changes in the cranial venous system over the course of its development beginning in utero.

Methods

A multicenter retrospective study of postnatal magnetic resonance imaging, ultrasonography, and angiography data is currently being undertaken to develop a model of the gross structural development of the cranial venous system during specific developmental periods in order to identify the formation of common surgical targets including but not limited to the tentorium, cavernous sinus, ophthalmic vein, perivertebral and peribasilar plexuses, and jugular bulb. For prenatal subjects, histopathological studies were performed on cadaveric specimens and correlated with available magnetic resonance imaging.

Results

A complete understanding of the structural development of the cranial venous system allows for stratification by developmental milestones that allows for enhanced surgical understanding during neurosurgical interventions in neonates and infants.

Conclusions

Complete description of the development of the cranial venous system will expand understanding of the associated surgical anatomy and facilitate the study of the development of acquired as well as congenital vascular anomalies observed in adults.

Objective

We perform a comprehensive anatomosurgical and histopathological study of the development of the cranial venous system and dura and correlate that with known developmental milestones of the cranium in order to enhance clinical understanding of the pre- and post-natal dura and venous system and how it changes through cranial development.