CSF Stroke Volume is reduced in Pediatric Subjects with Chiari but Returns to Normal Values with Decompression Surgery

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Purpose and Hypothesis

The purpose of this study was to measure CSF flow at the foramen magnum and C6 in pediatric CM-I patients pre- and post-surgery, and in a set of age-matched controls.

We ***hypothesized*** that cerebrospinal fluid (CSF) stroke volume at the foramen magnum (FM) and C6 would be different in pre-surgical Chiari patients than in control subjects, and that the CSF stroke volume would change from pre– surgery to post-surgery.

Methods

Subjects: All subjects were scanned at Children's Healthcare of Atlanta (CHOA) under an IRB-approved study.

- 10 Chiari patients (10 +/- 3.5 years of age, 4 M, 6 F) imaged pre- and post-decompression surgery.
- 8 control subjects, (7.8 +/- 5.4 years of age, 3 M, 5 F),

MRI exams: Clinically indicated MRI exams included a 2D, ECG-gated transverse phase contrast (PCMR) scan at the FM and at C6.

- CSF flow as a function of time in the cardiac cycle at the FM and C6 over a user defined region of interest (ROI)
- The Primary hydrodynamic variable calculated was the forward stroke volume (ml), figure 1.

Results

The stroke volumes in the pre-surgical Chiari patients were *significantly lower* than the control subjects (table 1).

The stroke volumes were *not significantly different* in post-surgical Chiari patients compared to controls (table 2).

The pre-surgical stroke volume were *significantly less* than the post-surgical stroke volume at both the FM and C6, figure 2.

Conclusions

Pediatric control subjects had higher CSF stroke volume than Chiari patients, and sub-occipital decompression surgery increased CSF stroke volume to values equal to normal control subjects.

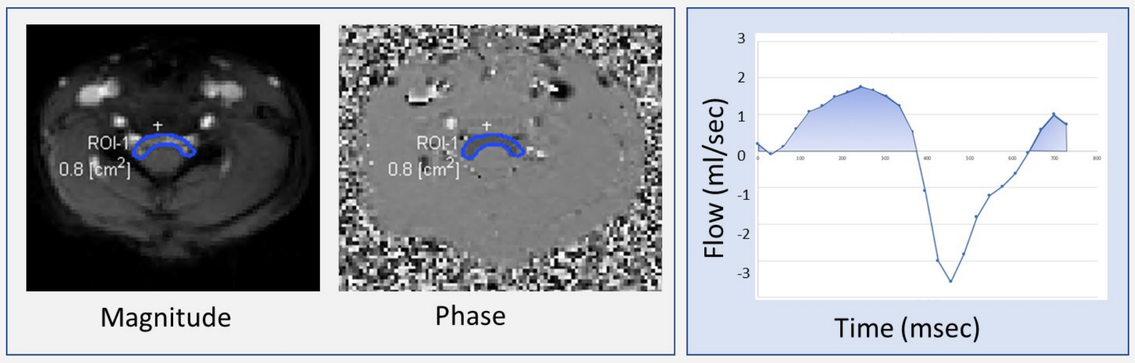

Figure 1. Magnitude (left) and phase (center) images from cine phase contrast (PCMR) scan at C6. CSF flow as a function of time in the cardiac cycle at C6 over a user defined region of interest (blue ROI) was plotted (right). The stroke volume was calculated was the forward flow volume (ml), shown as blue area under curve.

Control Vs Pre-Surgery Stroke Volume (ml)			
	Control	Pre-Surgery	T-Test P-value
Volumes	0.57	0.44	0.047

Table 1. *Stroke volumes in the pre-surgical Chiari patients were significantly lower than the control subjects*

Control Vs Pre-Surgery Stroke Volume (ml)			
	Control	Post-Surgery	T-Test P-value
Volumes	0.57	0.60	0.67

Table 2. *The stroke volumes were not significantly different in post-surgical Chiari patients compared to controls*

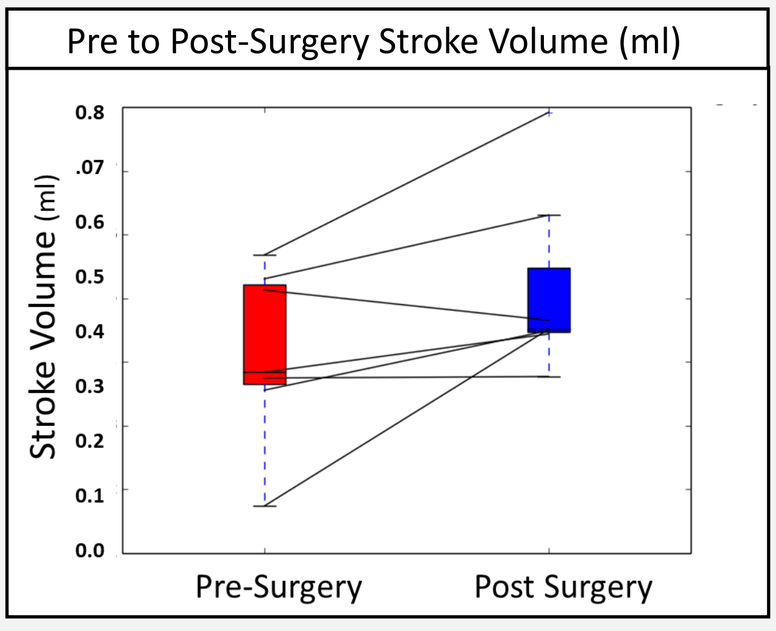

Figure 2. The pre-surgical stroke volumes were significantly less than the post-surgical stroke volume at both the FM and C6