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Type I Chiari Malformation, RBANS Performance, and Brain Morphology: Connecting the Dots on Cognition and Macro-Level Brain Structure

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Purpose

Cognitive effects are commonly self-reported in CMI; however, because pain is known to be positively correlated with cognitive dysfunction, it is unclear whether cognitive effects in CMI are due to direct effects of CMI pathophysiology, or secondary effects of pain. The aim of this study was to evaluate cognitive performance upon a standardized clinical instrument, in a sufficiently large sample of patients with CMI, to determine whether: 1) cognitive effects in CMI can be detected using standardized clinical instruments, and 2) whether cognitive deficits assessed via a clinical tool are the direct result of CMI pathophysiology or the indirect consequence of pain and related factors.

Methods

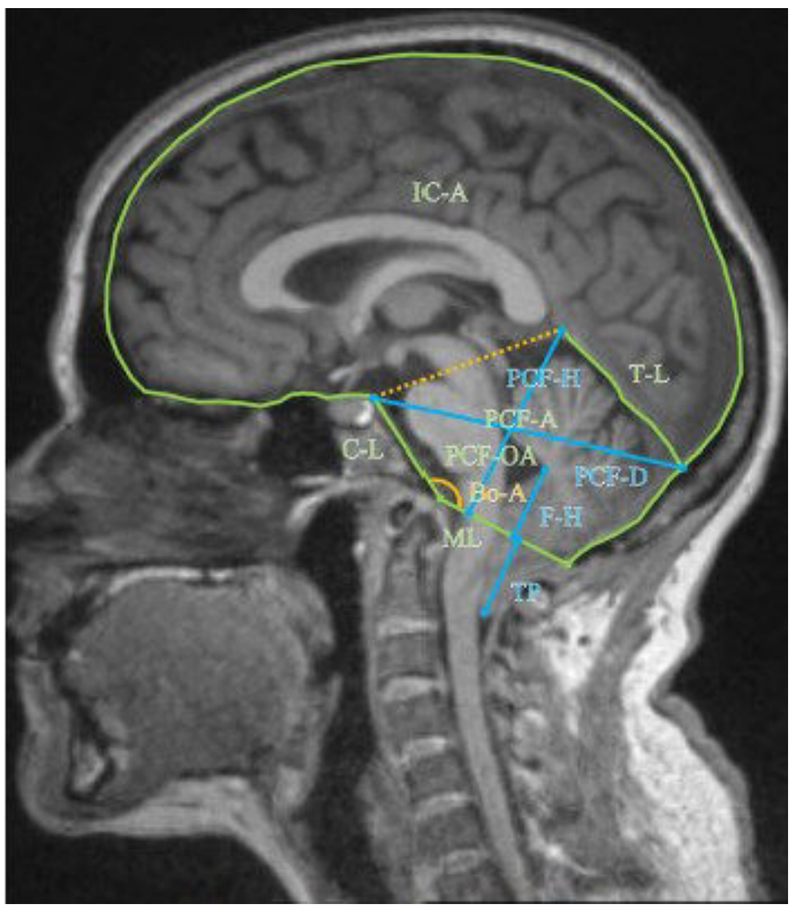
Eighteen untreated adults with CMI, and 18 gender-, age-, and education-matched healthy controls completed the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), which assesses five cognitive domains: immediate memory, visual construction, attention, language, and delayed memory. Participants also completed standardized measures of pain, mood, and disability . Morphometric measurements of key neural and bony elements were also obtained from structural brain magnetic resonance images, for correlation with symptom outcomes.

Results

After controlling for pain and associated affective disturbance, the CMI group exhibited statistically significant reductions in RBANS attention domain. A non-significant trend between attention function and the extent of tonsillar descent was detected, while tonsillar herniation was significantly correlated with pain and disability outcomes.

Conclusions

Adult CMI is associated with domain-specific cognitive change, specifically attention, which is detectable using a standard clinical instrument. The extent of cognitive impairment is independent of pain or affective symptomatology and may be related to the extent of tonsillar herniation. This study adds to the growing evidence that Chiari directly impacts cognitive function. Continued and expanded research is necessary to further quantify the nature of cognitive deficits in Chiari patients and whether decompression surgery alleviates these deficits.



Demographics and Symptoms of Participants

CSP= Chiari Symptom Profile Score. The CSP scale values correspond to the following: 0 – "never", 1 – "rarely", 2 – "some of the time", 3 – "most of the time", 4 – "all of the time". Values in parentheses indicate standard deviation by group. Bolded values represent group differences (all $p < 0.004$).

Measure	CM Status	
	CM Patients	Control Participants
Number of females	18	18
Age	34.4 *(12.7)*	37.3 *(15.6)*
Years of Education	13.8 *(2.5)*	14.2 *(2.2)*
Tonsillar position	**12.4** *(4.9)*	**1.1** *(1.7)*
Number with syrinx	4	0
CSP - Headaches	**2.9** *(1.0)*	**1.3** *(0.7)*
CSP - Neck pain	**2.9** *(1.4)*	**0.7** *(0.7)*
CSP - Arm pain	**2.3** *(1.6)*	**0.3** *(0.8)*
CSP - Back pain	**2.7** *(1.3)*	**1.2** *(1.0)*
CSP - Dizziness	**2.1** *(1.1)*	**0.7** *(0.7)*
CSP - Tinitis	**2.0** *(1.6)*	**0.5** *(0.8)*
CSP - Difficulty concentrating	**2.2** *(1.2)*	**0.9** *(0.8)*
CSP - Insomnia	**2.3** *(1.2)*	**0.8** *(1.1)*
CSP - Chronic fatigue	**2.8** *(1.3)*	**1.2** *(1.0)*
CSP - Irritability	**2.1** *(1.2)*	**0.9** *(0.8)*
CSP - Forgetfulness	**2.0** *(1.0)*	**0.4** *(0.7)*
CSP - Valsalva head pain	**2.4** *(1.5)*	**0.1** *(0.2)*
CSP - Generalized body pain	**2.2** *(1.6)*	**0.3** *(0.7)*