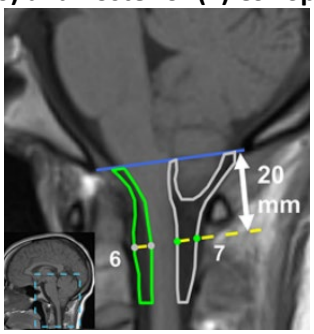
Anterior CSF Space May Explain Why More Women Have Chiari Than Men

Conquer Chiari researchers (including the author of this update) undertook a project with the late Dr. David Frim to see if pre-surgical morphometric measurements can predict surgical outcomes and if this differs by age and sex. Recall that morphometrics in this context refers to anatomical measurements taken from patient images, most often MRIs. For example, tonsillar position is a morphometric measure.

The study looked at 115 surgical Chiari patients. There were 54 adults (39 women, 15 men) with an average age of 36 years, and 61 children (24 girls, 37 boys) with an average age of 9 years. The researchers selected 7 morphometrics measures that are thought to have some association with symptom severity. For surgical outcomes they used the Chicago Chiari Outcome Scale (CCOS) developed by Dr. Frim. The CCOS rates outcomes on a 1-4 basis across four domains: pain, non-pain symptoms, functionality, and complications. A score of 16 represents the best possible outcome. Although the CCOS is not perfect, it has been used extensively in Chiari research as a quantitative means of comparison.

On average the CCOS scores were pretty good for the boys (14.8), girls (14.4), and even the men (14.2). However, they were significantly lower for adult women at 12.8. Interestingly, they also found that adult women had the smallest anterior CSF spaces, and that this was associated with the lower CCOS scores. The anterior CSF space (Figure 1, green outline) is the space on the front side of the spinal cord between the foramen magnum (opening in the bottom of the skull) and the C2 vertebra where cerebrospinal fluid flows. The average anterior CSF space in square millimeters was close to equal between the boys and girls (112 versus 115); however, there was a large difference between the adult men and women (140 versus only 108). The team further narrowed this difference down to the lower half of the space (Figure 1). Interestingly, there did not appear to be a single, common anatomical reason for this reduction among the women.

Figure 1: Anterior (6) and Posterior (7) CSF Space Measurements



Since decompression surgery is primarily targeted at the posterior space around the tonsils, it is easy to see why it may not provide relief from anterior constriction. However, why a reduction on the lower anterior side causes problems is not entirely clear. It could be that this pinches nerves which route to the occipital region, but more research is needed to explore and understand this.

Perhaps the most significant implication of this finding is that it may explain why symptomatic Chiari is so much more prevalent among adult women than men. Among children, the breakdown of girls and boys with symptomatic Chiari is roughly 50-50, however among adults, it is about 80-20 in favor of women. The fact that adult women, for one or more reasons, experience a substantial reduction in the anterior CSF space compared to adult men could explain this phenomenon.

Source: Allen PA, Loth F, Loth D, et al. Correlation of anterior CSF space in the cervical spine with Chicago Chiari Outcome Scale score in adult females. J Neurosurg Spine. Published online December 6, 2024. doi:10.3171/2024.7.SPINE24370

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Conquer Chiari is a 501(c)(3) public charity dedicated to improving the experiences and outcomes of Chiari patients through education, awareness and research.