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Weak Neck Muscles Found With Chiari

The rectus capitis posterior minor muscles (RCPmi) are important muscles in the back of the neck. Specifically, they are sub-occipital muscles located just below the bottom of the skull (Figure 1) and play an important role in stabilizing the skull on the spine and possibly in promoting spinal fluid circulation as well. Previous research using MRIs has shown that Chiari patients have smaller RCPmi muscles than healthy people[1], but now a study from China has revealed that these muscles also exhibit abnormal electrical activity during activation.[2]

The study recruited 40 Chiari patients and 30 healthy volunteers. Each participant underwent electromyograph testing (EMG), where needles are inserted into the muscles (Figure 1) and the electrical signals that the muscles receive from the nerves activating them are recorded. The participants were tested while at rest with their head bent forward and while coughing (Valsalva maneuver). The people performing the EMG testing were not aware of whether the subjects were Chiari patients or volunteers.

The researchers found a number of significant differences in the strength and timing of the electrical activity between the two groups at rest, and these differences were much stronger during the Valsalva maneuver. Figure 2 shows the electrical activity of a volunteer while coughing (D) compared to a Chiari patient (H). It is obvious that there is much less activity in the Chiari patient. The researchers also looked at Chiari patients with headaches versus those without and found some differences, but these were not as large as the differences between the Chiari group as a whole and the volunteer group. They found no significant differences between Chiari patients with a syrinx and those without.

The authors believe that the RCPmi muscles play an important role during Valsalva maneuvers such as coughing. Specifically, that the muscles – which are connected to the cervical dura through the myodural bridge complex – allow the body to adapt to the sudden outrush of spinal fluid from the brain to the spine by changing the tension of the dura. This in turn prevents the pressure in the brain from spiking as a result of the cough. In Chiari patients, the RCPmi muscles can't perform this task anymore and thus the pressure in the brain spikes during Valsalvic activities. This is similar to a theory that Conquer Chiari researchers put forth a couple of years ago which said that repeated overactivity of these muscles caused a failure of the myodural bridge complex resulting in an abnormal pressure environment between the brain and spine. The authors further believe that with Chiari the C1 nerve (which innervates the RCPmi muscles) is compressed by the herniated tonsils. However, when they compared the EMG results of Chiari patients with herniations at or beyond C1 to those with smaller herniations they did not find many differences.

The Chinese study has a number of limitations and much more research is needed to fully understand the role, if any, the RCPmi muscles play in spinal fluid circulation. The most significant limitation is that it is difficult to control how hard a subject coughs during this type of testing which could change the activation of the RCPmi muscles. The authors do not describe what instructions, if any, they gave to the participants in this regard.

Despite the limitations on any one study, there is growing evidence that the sub-occipital muscles may play an important role in Chiari. Whether it is related to providing stability to the complicated joints between the skull and the top two vertebrae, preventing pressure spikes in the brain during Valsalva, or both, remains to be seen. In either case it appears these muscles are smaller and weaker in Chiari patients. Further, the potential negative effect that decompression surgery may have in terms of their function has not been tested.

Figure 1: EMG Needle Insertion Points into RCPmi Muscles

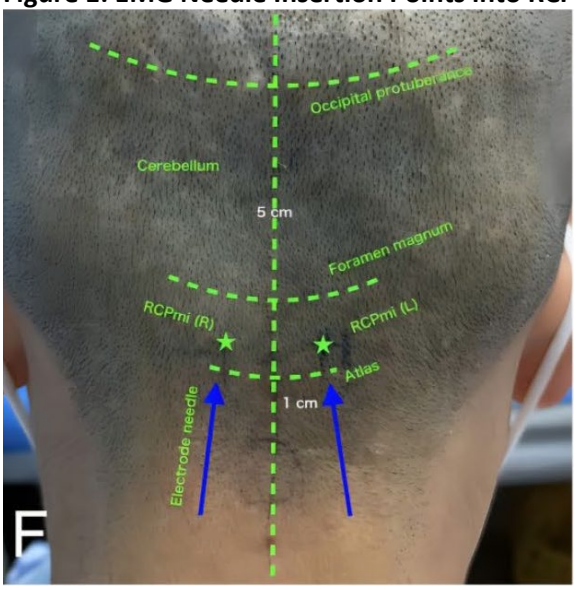
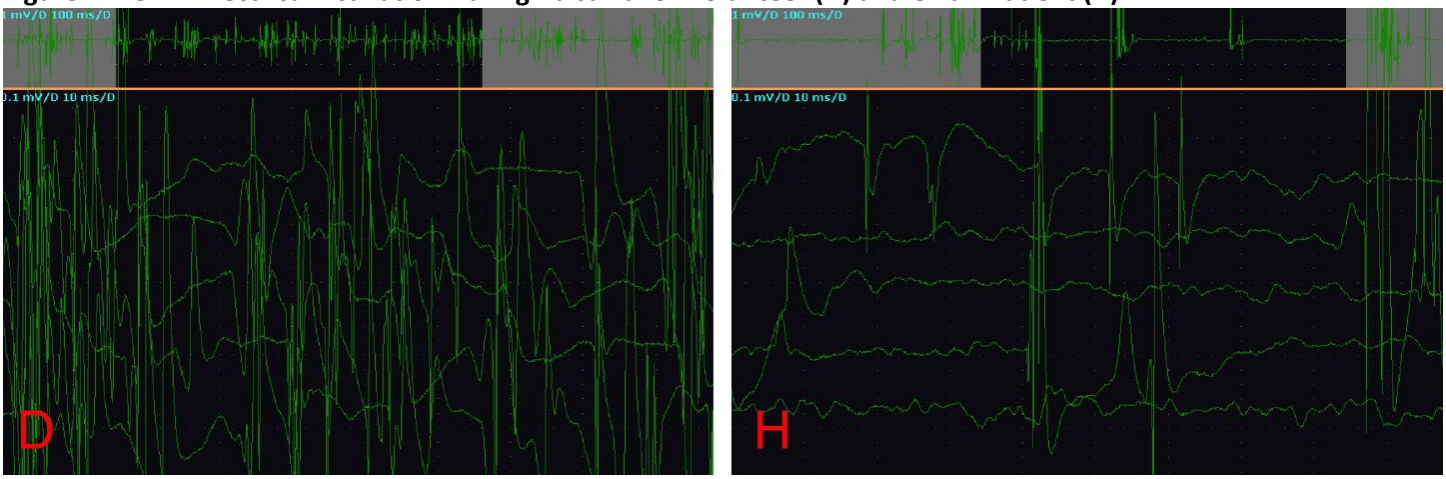


Figure 2: RCPmi Electrical Activation During Valsalva for Volunteer (D) and Chiari Patient (H)



Sources:

1. Thakar S, Kurudi Siddappa A, Aryan S, Mohan D, Sai Kiran NA, Hegde AS. Does the mesodermal derangement in Chiari Type I malformation extend to the cervical spine? Evidence from an analytical morphometric study on cervical paraspinal muscles. *J Neurosurg Spine*. 2017;27(4):421-427. doi:10.3171/2016.12.SPINE16914

2. He Y, Huang Q, Bao M, et al. Denervation of rectus capitis posterior minor as neglected factor in Chiari malformation type I revealed by double blinded prospective study. Sci Rep. 2025;15(1):9197. Published 2025 Mar 17. doi:10.1038/s41598-025-86528-4

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understanding of Chiari. Introductory information and many more research articles can be found in the Conquer Chiari Library.

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