Brief Communication

Chronic Headache Relief After Section of Suboccipital Muscle Dural Connections: A Case Report

Gary D. Hack, DDS; Richard C. Hallgren, PhD

The presence of a connective tissue bridge, attaching suboccipital muscles to the dura mater, is now recognized as a feature of normal human anatomy. The role that this myodural bridge may play in headache production is uncertain; however, a new conceptual model is emerging. Postsurgical myodural adhesions have been reported as a complication resulting from excision of acoustic tumors. Extensive research now exists implicating these myodural adhesions as a possible source of postoperative headache. Integrating these 2 types of myodural unions (anatomic and pathologic) into a unified theory of headache production, we report a single patient who experienced relief from chronic headache after surgical separation of the myodural bridge from the suboccipital musculature.

Key words: myodural bridge, suboccipital muscles, dura mater, headache

Abbreviation: POH postoperative headache

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The naturally occurring physical connection between suboccipital muscles and the dura mater at the atlanto-occipital junction (Figure 1) has been described in recent studies.[1-9] The 38th edition of *Gray's Anatomy* now notes the presence of a myodural bridge connecting the rectus capitis posterior minor muscles to the dura mater.[1] Humphreys et al and Rothman et al have independently observed the myodural bridge by means of magnetic resonance imaging (MRI).[2,3] Physical manipulation of the nuchal musculature, and specifically the rectus capitis posterior minor muscles in fresh cadaveric specimens (Figure 2), has been shown to produce observable changes in the position of the dura.[4]

While researchers speculate about the functional significance of the myodural bridge,[5,6] its precise function is unknown. In the absence of pathology, researchers have suggested that the myodural bridge provides anatomic and physiologic answers to the etiology of some headache conditions.[8,9] More relevant to the present article is the possibility that pathology may facilitate the transmission of excessive or abnormal muscular forces through the myodural bridge to the pain-sensitive dura, resulting in headache. Alix and Bates suggest the myodural bridge, acting as a dynamic connection, may transmit abnormal levels of tension from hypertrophied suboccipital muscles to the pain-sensitive dural membrane.[7]

The mechanism by which the myodural bridge might transmit abnormal tractional forces to the pain-sensitive dura is well supported (Figure 3). The dura is innervated by the same nerves that supply the upper 3 cervical segments.[10,11] It has been demonstrated that tension applied to the dura, during neurosurgical procedures, induces pain that is interpreted as headache. It is also known that dural traction caused by tumors or other space-occupying lesions produces headache.[12]

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CASE HISTORY

The role that the myodural bridge may play in headache production has been evaluated in a patient with chronic headache.[13] A 40-year-old man

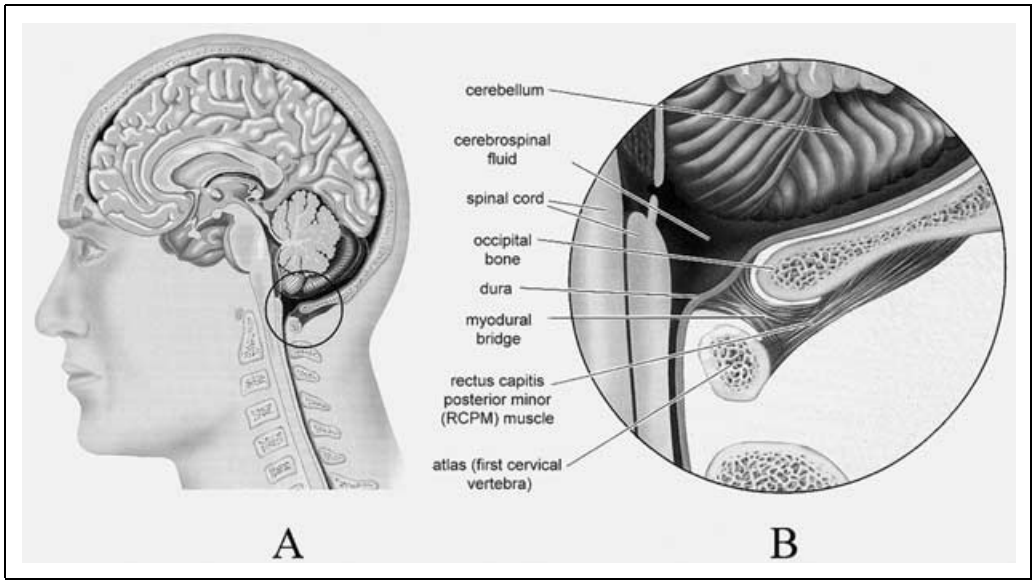

Fig 1.—Illustration of relations of anatomic myodural bridge. Area within circle in image A (left) is enlarged and labeled in image B (right).

complained of long-term headache which was initially precipitated by physical trauma. These headaches had become debilitating from the age of 32 years, and rendered him unable to work from the age of 35. Intracranial pathology had been excluded as a cause of the pain. The headaches failed to respond to antimigraine drug therapy. By early 1996, the patient was grossly overweight, contracting frequent respiratory and intestinal infections. He was taking up to 720 mg per day of morphine in an attempt to control the pain.

There was consensus among the treating physicians that the headache was probably cervicogenic in origin, as the patient's suboccipital musculature appeared hypertrophied when examined by MRI. After reviewing the publication describing the myodural bridge,[4] and the accompanying comments postulating a possible association between the myodural bridge and head pain,[5] the medical team elected to attempt surgical relief of these headaches by severing the connection between the hypertrophic suboccipital muscles and the dura mater. Informed consent was obtained, and Dr. H. Edeling performed the "myodural release." The myodural bridge was easily identified and the nuchal musculature appeared hypertrophied, possibly because of a history of repeated neck trauma (Figure 4). During surgery, all tissue attachments connecting the nuchal musculature to the dura were severed. Passive displacement of the suboccipital musculature produced visible movement of the dura. The site of severance was made well away from the dura to reduce the possibility of dural puncture. In an attempt to prevent postoperative adhesions from restoring the myodural connection, a dural substitute was placed between the nuchal musculature and the dura. The patient, followed postoperatively for 2 years, reported significant relief of his chronic headaches following this surgical procedure.[13]

COMMENTS

Hypertrophy of the nuchal muscles, with accompanying headache, has been reported in the literature and represents a pathophysiological extreme that may produce headache.[14,15] Support for the concept of muscle/dural tension-producing headache comes from extensive literature describing a high incidence of postoperative headache (POH) following surgical removal of acoustic tumor, particularly when the surgery is performed via the suboccipital approach.[16-45] In the traditionally performed operation, surgical access was gained by permanent bone removal, leaving the dura in intimate contact with the nuchal musculature postsurgery. Consequently, dense adhesions formed postoperatively that directly attached the posterior cervical muscles to the surgically exposed dura. These adhesions between the neck muscles and the dura have frequently been observed in cases of a second op-

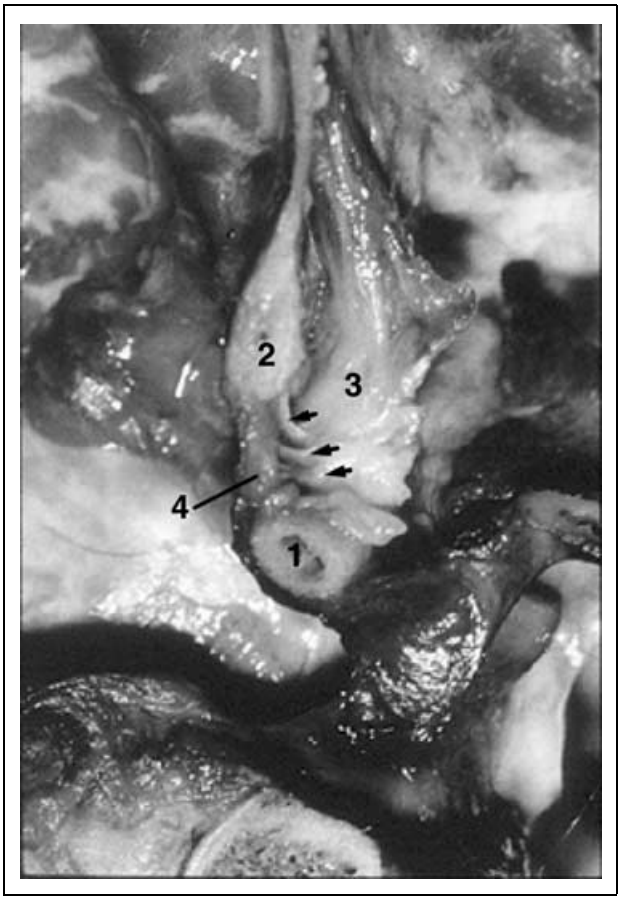

Fig 2.—Fresh cadaveric specimen showing relations of anatomic myodural bridge. 1, First cervical vertebra. 2, Occiput. Arrows indicate the anatomic myodural bridge, which attaches the suboccipital musculature (3) to the dura (4).

eration and have been demonstrated histologically.[16] Schessel et al demonstrated histologic adherence of nuchal musculature to the dura in a patient with persistent severe POH undergoing reoperation for tumor recurrence (Figure 5). The patient had experienced 7 months of head pain after previous suboccipital excision of an acoustic tumor. Schessel et al proposed that POH is the result of adherence of the nuchal musculature to the pain-sensitive dura with dural traction produced by the adherent musculature. It has been reported that surgically separating the adherent dura from the neck muscles during reoperation results in relief of this type of headache. For example, Soumekh et al demonstrated that severing the myodural adhesions could substantially palliate POH.[17]

According to the "nuchal-dural-adhesion theory,"[18] traction on the dura, because of activation of

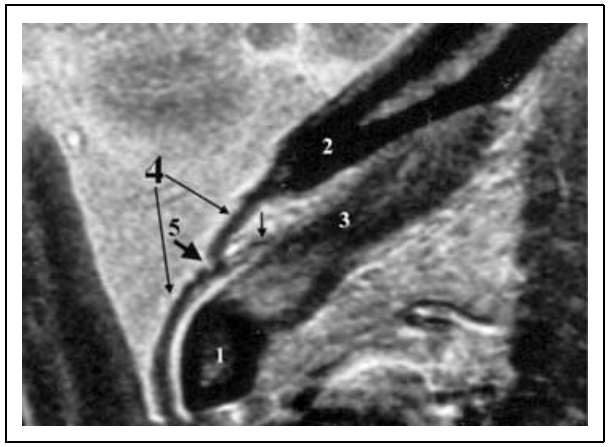

Fig 3.—Magnetic resonance imaging of atlanto-occipital junction. 1, First cervical vertebra. 2, Occiput. Note the ability of the anatomic myodural bridge (arrow) to transmit tractional forces from the suboccipital musculature (3) to the dura (4), as evidenced by the dural fold (5).

the neck muscles, stimulates nociceptive dural fibers with resultant pain.[19] Postoperative head pain mimics cervicogenic headache, which is also unilateral, originates in the neck, and then spreads to the head. This is in accordance with the observation that many of these patients noted that coughing, straining, or head and neck movement aggravated the POH.[18] Schaller and Baumann, in their retrospective study, recently concluded that these postoperative myodural adhesions may indeed produce abnormal dural tension and help to explain the etiology of POH.[19]

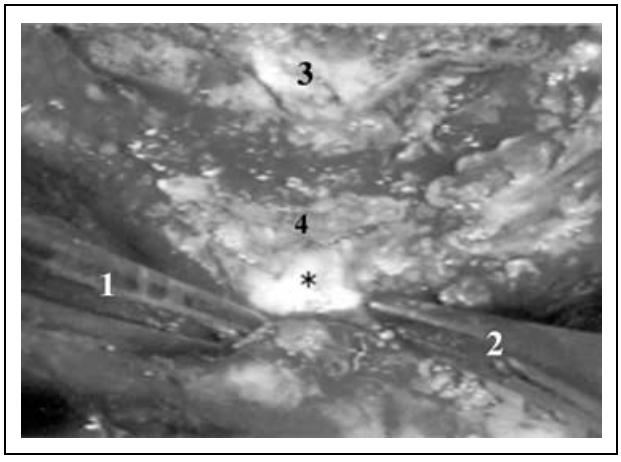

Fig 4.—Intraoperative photograph of anatomic myodural bridge (∗). 1, Hemostat reflecting the hypertrophied suboccipital musculature. 2, Hemostat reflecting myodural bridge. 3, Occiput. 4, Dura.

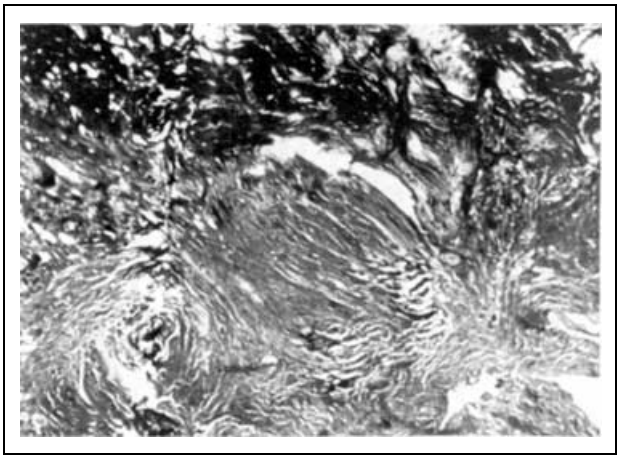

Fig 5.—Histologic section of pathologic myodural adhesion stained with elastin. Note the fusion of the nuchal musculature with the dura. Nuchal musculature (top of image) appears dark in the photograph and the dura (bottom of image) appears lighter. Reprinted with permission from Schessel et al.[22]

We suggest that increased tension within suboccipital muscles may produce abnormal traction on the dura, stimulating dural nociceptive fibers with resultant head pain, even in the absence of pathology.

CONCLUSIONS

We propose that formation of pathologic myodural connections, resulting from physical trauma or surgical complications, may result in abnormal dural tension accompanied by chronic head and neck pain. Procedures such as botulinum toxin injections and spinal manipulative therapy should be considered as possible alternatives to surgery, especially in high-risk patients.[46-49]

In addition, we suggest that the so-called suboccipital headache, in some instances, may result from increased tension in cervical muscles being transmitted to the pain-sensitive spinal dura through the myodural bridge. This may serve to explain why some cases of headache, particularly those with no specific pathology and often diagnosed as cervicogenic headache, have been so resistant to standard treatment protocols.

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