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CASE REPORT

# Bilateral Variation of the Suboccipital Region Musculature

**AR Dickerson*, CL Fisher PhD**

Center for Anatomical Sciences, University of North Texas Health Science Center, Fort Worth, Texas, USA

## Abstract

Dissection of the posterior cervical and suboccipital regions of an embalmed 81-year-old male cadaver revealed bilateral variations in the muscular anatomy, including two accessory muscles lying deep to the semispinalis capitis on each side, as well as a bilateral doubling of the rectus capitis posterior major muscle. These two sets of anatomical variations have little to no previous documentation in the literature. The accessory muscle bands were observed to have unique relationships with the greater occipital nerve on each side. This case report describes the findings in detail and examines their precedent in the literature. The suboccipital region has been implicated in the etiology of cervicogenic pain, headaches, and occipital neuralgia. Variations in the muscular anatomy have the potential to create structural interactions with vascular and neurologic structures in the area. Anatomic variations like those reported here should be considered in the diagnosis and treatment of pain and other conditions of the suboccipital region.

**Keywords:** Anatomic Variation, Suboccipital, Accessory Muscle, Greater Occipital Nerve, Rectus capitis posterior major muscle

## Background

This case report describes variation of the musculature in the suboccipital region observed during dissection of an embalmed 81-year-old male cadaver. Bilateral variations in the muscular anatomy were observed, including two accessory muscles lying deep to the semispinalis capitis on each side, as well as a bilateral doubling of the rectus capitis posterior major muscle. The suboccipital muscle group consists of four paired muscles located inferior to the occipital bone. The muscles in this group include the rectus capitis posterior major muscle, rectus capitis posterior minor muscle, obliquus capitis superior muscle, and obliquus capitis inferior muscle. They are innervated by the suboccipital nerve and lie deep to the trapezius muscle and the semispinalis capitis muscle.

Muscular variations of the morphology noted in this case report have little to no precedent in the literature. Martin (1994) reported an accessory paraspinous unilateral muscle band similar in location to the accessory muscles reported here and postulated that it may be a morphologically different spinalis capitis muscle, separate from the overlying semispinalis capitis [1]. However, the muscle reported in Martin's case had bony attachments medially to the spinous process of the sixth cervical vertebrae and laterally to the transverse process of the same vertebrae, making it morphologically and, most likely, functionally different than the muscles observed here. Others have observed accessory slips of the spinalis cervicis muscle [2] or the suboccipital muscles [3, 4] in this region, but none matching the attachments or morphology of the accessory muscles described here. There are few other reported cases involving muscles resembling the bands found in this report, leading us to believe that we had encountered accessory muscles that had been previously unreported. The muscles were delicate and located in a region often removed to expose the suboccipital region just beneath, so we postulate that the potential presence of such accessory muscles can often be overlooked or underreported, as there currently is no research on the occurrence of such a variation in the human neck.

Bergman and Miyauchi (1995) report previous observation of doubling of the rectus muscles as "frequent [2]," and a study involving 112 Japanese cadavers by Mori (1964) describes a division of the rectus capitis posterior major muscle into two parts in 2.6% of specimens [4]. Tagil et al. (2005) reported a bilateral division of rectus capitis posterior major in a cadaveric specimen accompanied by a unilateral doubling of the rectus capitis posterior minor muscles [5]. Another case reported by Nayak et al. (2011) has a bilateral doubling of the rectus capitis posterior major muscles accompanied by absence of the rectus capitis posterior minor muscles bilaterally [6]. Most literature references division of the rectus capitis posterior major muscle [2, 4, 5], while in this case we observed a clear doubling of the rectus capitis posterior major into two separate muscles.

## Case Information

Two variations in the suboccipital region musculature were

***Correspondence to:** Austin Dickerson, Center for Anatomical Sciences, University of North Texas Health Science Center, Fort Worth, Texas, USA, Tel: (713) 822-6468, E-mail: austin.dickerson [AT]my.unthsc[DOT]edu

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observed during dissection of an embalmed 81-year-old male cadaver. Two accessory bands of muscle were noted on each side, as well as doubling of the rectus capitis posterior major muscle. The accessory muscles observed were distinct bands of muscle lying in the fascial plane deep to semispinalis capitis, but superficial to the muscles that form the suboccipital triangle. Each consisted of two separate bands of muscle bilaterally: one medial band and one lateral band (Figure 1). The medial band on each side originated from the ligamentum nuchae at the level of the second cervical vertebrae. The lateral bands originate from the fascia overlying the transverse process of the third cervical vertebrae, which consists of a meshwork of fascial tissue containing the greater occipital nerve, the dorsal ramus of the third cervical spinal nerve, as well as a venous plexus. The medial bands ran superolateral and the lateral bands ran superomedial to share a common insertion in the area between the superior and inferior nuchal lines of the skull. Both the medial and lateral bands measured 4 mm across at their widest point on the right side. The accessory bands on the cadaver's left side were less prominent than the right, with a width of 3 mm each at their widest point.

The rostral attachment site was distinct from the insertion of the semispinalis capitis, as well as the insertion of the rectus capitis posterior major and minor on the inferior nuchal line. A significant fascial plane existed both superior and inferior to the attachment of these muscles on the occiput, clearly delineating them from their superficial and deep neighbors. Furthermore, the rostral attachment of the accessory muscles lacked a distinct tendinous region, which was morphologically different from the tendinous insertion of the nearby semispinalis, further differentiating the two on visual inspection. The distal end of both the medial and lateral muscle bands tapered down into a distinct tendon, which connected them to their respective fascial attachments.

The accessory muscle bands on each side had unique relationships with the greater occipital nerve (Figure 2). On the left side, the greater occipital nerve emerged as two separate nerves. They angled medially and joined together on the medial side of the medial band to become a single greater occipital nerve. On the right side, the greater occipital nerve did not interact with the muscle bands, while the third occipital nerve ran deep to the lateral band and became superficial to run its typical course to the scalp. The communicating branch between the greater occipital and third occipital nerves was found crossing superficial to the lateral muscle band on the right side.

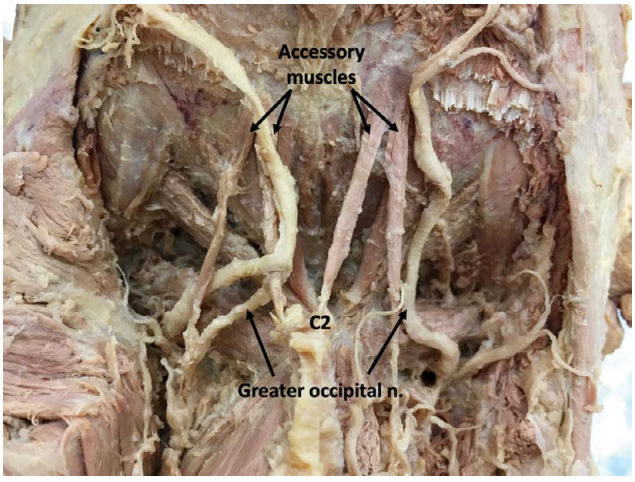


**Figure 1:** Posterior view of bilateral accessory muscles. Key: C2- spinous process of C2 vertebrae

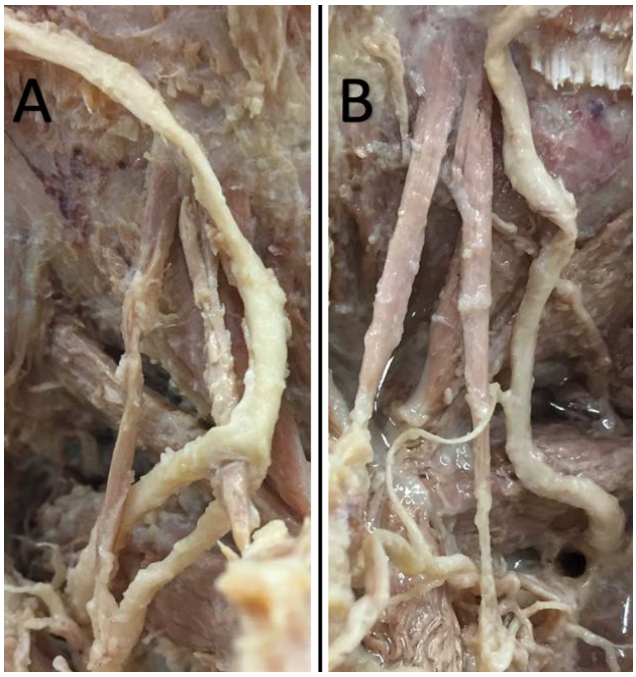


**Figure 2:** Comparison of the left (2A) and right (2B) accessory muscle bands and their interactions with the greater occipital nerve. 2A. The greater occipital nerve on the left starts as two components which merge immediately on the medial side of the medial accessory muscle band. 2B. On the right, the greater occipital nerve does not interact with the accessory muscle bands. A communicating branch can be seen between the greater occipital nerve and the third occipital nerve.

Another atypical finding in the suboccipital region of this cadaver was bilateral doubling of the rectus capitis posterior major muscles (Figure 3). Bilaterally, the double rectus capitis posterior major muscles arose from a common origin on the spinous process of the axis and ran superiorly and laterally to insert on the inferior nuchal line. Each side consisted of two clearly separate muscles, which were discrete both at origin and insertion. The typical rectus capitis posterior minor muscles were present bilaterally, with the medial belly of the rectus capitis posterior major muscle overlapping the minor slightly.

## Conclusion

The potential clinical implications of such anatomical anomalies include contributions to cervicogenic pain and chronic headaches, as well as occipital neuralgia. Others have described and reviewed the myodural bridge that is thought to exist between the suboccipital muscles and the spinal dura mater in

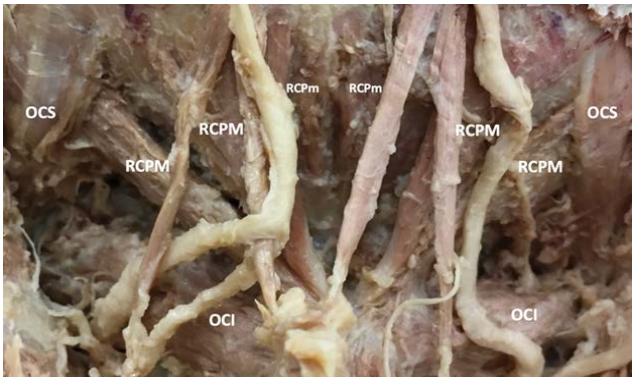


**Figure 3:** Muscles of the suboccipital region, including the rectus capitis posterior major muscles doubled bilaterally. Key: RCPM- rectus capitis posterior major muscle, RCPm- rectus capitis posterior minor muscle, OCS- obliquus capitis superior muscle, OCI- obliquus capitis inferior muscle.

the upper cervical region [7, 8]. Distortions or disturbances of the suboccipital musculature have been implicated in cervicogenic headaches [9]. The presence of a supernumerary rectus capitis posterior major would most likely affect the interactions between the suboccipital muscles and the dura, and such anatomical variation should be taken into consideration when determining the etiology of cervicogenic headaches. Occipital neuralgia stemming from entrapment of the greater occipital nerve has been documented and can be treated surgically. Variations in the course of the greater occipital nerve have been attributed to this condition [10]. The abnormal interaction of the accessory muscles reported here with the greater occipital nerve demonstrate a potential for a pain-causing focus, one that should be considered in the diagnosis of occipital neuralgia, as well as an anatomical consideration in the surgical exploration and treatment of the area.

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