

# The Incidence and Anatomical Features of the McKenzie Branch: A Cadaver Study

## McKenzie Dalının Anatomik Özellikleri ve İnsidansı: Kadavra Çalışması

### ABSTRACT

**AIM:** The aim of this study was to demonstrate the morphological characteristics of the connections between the spinal accessory nerve and the anterior root of the first cervical nerve (C1) which is also called the McKenzie branch.

**MATERIAL and METHODS:** The cranial cervical regions of 49 specimens from 27 human cadavers were used for this study under an operating microscope. The topographical relationship of the accessory nerve to the anterior roots of C1 were studied.

**RESULTS:** One cadaver had a connection branch (McKenzie branch) on both sides.

**CONCLUSION:** The knowledge of the anatomy of these connections may help the clinician in determining treatments and surgical approaches in this anatomical area.

**KEYWORDS:** Spinal accessory nerve, First cervical spinal nerve, Anterior root, McKenzie branch

### ÖZ

**AMAÇ:** Birinci servikal spinal sinirin ön kökleri ile aksesuar sinirin spinal kökü arasındaki bağlantının (McKenzie dalı) morfolojik özelliklerini göstermek.

**YÖNTEM ve GEREÇ:** Kranioservikal bölge 27 kadavra üzerinde 49 taraf cerrahi mikroskop altında incelendi. Birinci servikal spinal sinirin ön kökü ile aksesuar sinirin spinal kökü arasındaki ilişkisi araştırıldı.

**BULGULAR:** Bir kadvrada bilateral McKenzie dalı saptandı.

**SONUÇ:** Bu bağlantının varlığının bilinmesinin kranioservikal cerrahide tedavinin planlanmasına katkısı olacağını düşünmekteyiz.

**ANAHTAR SÖZCÜKLER:** Aksesuar sinirin spinal kökü, Birinci servikal spinal sinir, Ön kök, McKenzie dalı

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**INTRODUCTION**

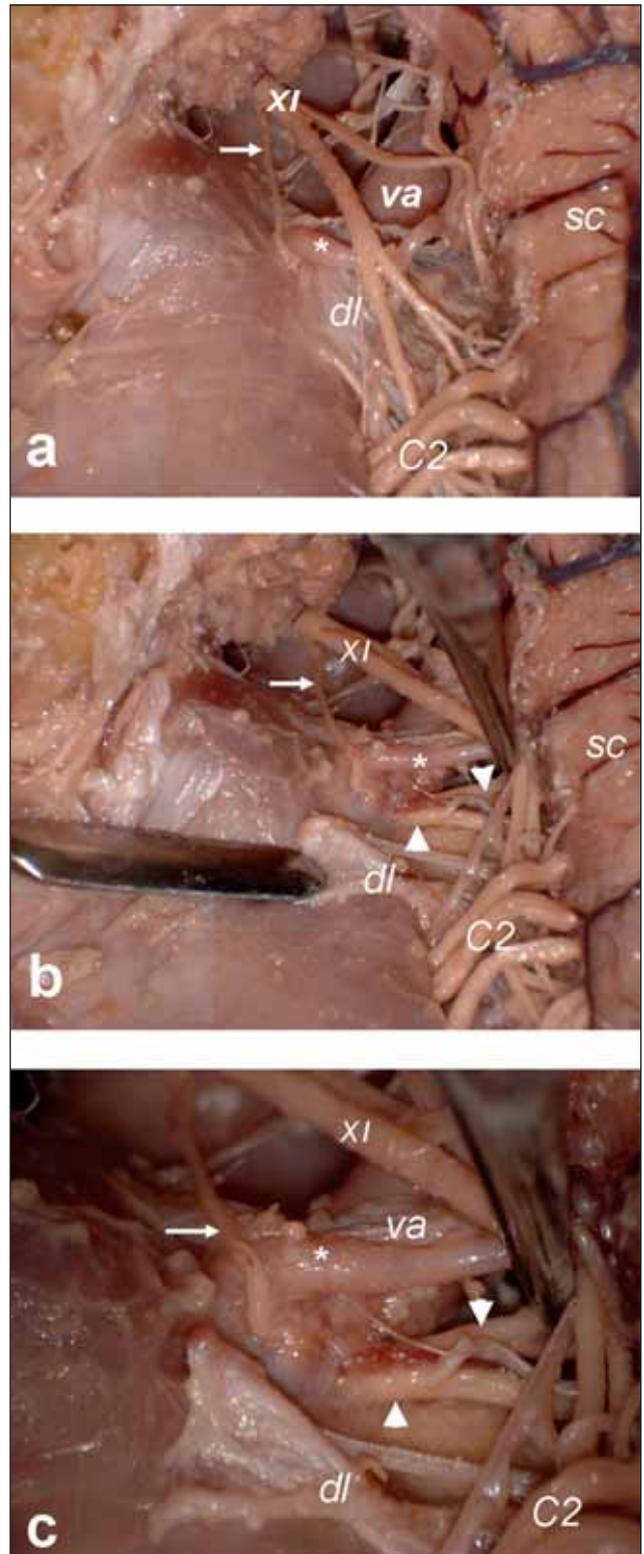
The upper cervical motor roots and the rootlets of the spinal accessory nerve are severed in intradural selective rhizotomy (1,5). The communicating branch between the anterior root of the first cervical nerve (C1) and the spinal accessory nerve is called the McKenzie branch. Treatment of spasmodic torticollis with intradural selective rhizotomy requires identifying the anatomic features of the McKenzie branch as this branch is a structure severed during intradural selective rhizotomy (5).

**MATERIALS and METHODS**

The cranial cervical regions of 49 specimens from 27 human cadavers (25 male and 2 female) were examined under an operating microscope (Möller-Wedel Spectra, Germany) in rgwEge University Department of Anatomy. Five specimens were dissected unilaterally. Only the right sides could be used in two cadavers and only the left sides in three cadavers. Both sides were observed in 22 cadavers. No specimens found to have prior surgery in the region of the craniocervical junction were used in this study. The mean age of this group was 73 years (range 57-82). The skin, suboccipital muscles and posterior vertebral arch of the upper cervical vertebrates (C1-C5) were removed. Dura mater and arachnoid mater were dissected vertically on the posterior view. The formation and course of the accessory nerve were followed on both sides from its most caudal point to the jugular foramen. The intradural posterior and anterior roots of C1 were also identified and followed. The topographical relationship of the accessory nerve to the anterior roots of C1 were studied under the operating microscope.

**RESULTS**

We identified the connection between the spinal accessory nerve and the anterior root of C1 in a male cadaver bilaterally (two specimens of 49) (4.1%). The anatomic features of the connection was same on both sides. The McKenzie branch arose from the accessory nerve and crossed the anterior spinal artery and vertebral artery posteriorly and then passed anterior to the denticulate ligament and reached the anterior side of subarachnoid space. It joined the anterior root of C1 out of the dura mater and just behind to the vertebral artery. The posterior root of C1 was absent on both sides (Figure 1A,B,C).



**Figure 1.** A) The McKenzie branch (arrow) B) and C) The connection of the McKenzie branch with the anterior root of the first cervical nerve (arrowhead) after removing the denticulate ligament (DI). XI, accessory nerve; sc, spinal cord; C2, posterior root of the second spinal nerve; va, vertebral artery; asterisk, spinal artery.

## DISCUSSION

We reported the connections between posterior root of C1 and accessory nerve using the criteria of Hagenah (2). There was four types in this study. There are some reports on this connections but not about the McKenzie branch recently (4, 6).

Intradural selective rhizotomy is a modified form of intradural rhizotomy in which the upper cervical motor roots and rootlets of the spinal accessory nerve mediating sternocleidomastoid contraction are severed along with sectioning of the McKenzie branch, if it was present. The severance of the McKenzie branch is important to provide a complete surgical effect, as the branch is considered to convey motor fibers from the accessory nerve to the anterior root of C1 (5).

Friedman et al. (1) reviewed 58 patients with spasmodic torticollis who had undergone ventral cervical and selective spinal accessory nerve rhizotomy. Each nerve rootlet was electrically stimulated and a strong sternocleidomastoid contraction was observed when the McKenzie branch was electrically stimulated. This is an evidence for motor fibers going to the muscle via the McKenzie branch. Therefore, the McKenzie branch, if present, must be severed for spasmodic torticollis treatment.

The frequency of the McKenzie branch in present study was 4.1%. McKenzie (3) observed the McKenzie branch in 50% of the specimens. Friedman et al. (1) determined this branch in two of 58 patients (3.4%). Oh et al. (5) found the McKenzie branch in seven of 100 specimens (7%). Four of these seven were of the cranial type. The long and slender connections arose from the accessory nerve superior

to the level of C1. Two coexisting McKenzie branches were determined in one cranial specimen. Three specimens were of the spinal type in that study. Those short and thick connections joined the anterior C1 root beneath the vertebral artery (5). All the studies except the study of McKenzie (3) demonstrated this branch at a rate of 3-7% so it is not a very common branch in recent studies (1, 5, present study)

The anatomic topographical features of the McKenzie branch has clinical importance during surgery of the cranial cervical region. It runs very close to the vertebral artery (5). The connection site was just behind the vertebral artery on both sides in our cadaver. This anatomic knowledge may also help clinicians explain the irritations caused by compression of the accessory nerve in some cases.

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