



# Long head of biceps brachii perforated by a duplicated musculocutaneous nerve

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Joseph M. A. MILLER<sup>1†</sup>

Robert B. TRELEASE<sup>1‡</sup>

Laboratory for Anatomical Variation Research <sup>1</sup>1, Laboratory for Anatomical Informatics <sup>1</sup>2, Division of Integrative Anatomy, Department of Pathology and Laboratory Medicine, David Geffen School of Medicine, UCLA, Los Angeles, CA, USA.



† Joseph M. A. Miller, PhD  
Laboratory for Anatomical  
Variation Research  
Division of Integrative Anatomy  
Department of Pathology and  
Laboratory Medicine  
David Geffen School of Medicine  
UCLA, 10833 Le Conte Ave.  
Los Angeles, CA 90095, USA.  
☎ +1 (310) 206-4288  
✉ [jmamiller@mednet.ucla.edu](mailto:jmamiller@mednet.ucla.edu)

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## Abstract

The musculocutaneous nerve (MCN) is characterized, in part, by its classic perforation of the coracobrachialis muscle. It has also been reported to occasionally perforate the short head of the biceps brachii and brachialis. However, comprehensive modern summaries of its anatomical variation do not include perforation of the long head of the biceps brachii as an MCN variant. We describe a rare case of a “duplicated” MCN that perforates the long head of the biceps brachii in a 92-year-old, Caucasian female cadaver. We provide the first description and photographic documentation of this variant and discuss its anatomical and clinical significance.

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**Key words** (biceps brachii) (long head) (supernumerary head) (perforation) (duplicated musculocutaneous nerve)

## Introduction

The musculocutaneous nerve (MCN) is one of the few nerves in the body that perforates a muscle belly in its normal course. Classically, it is described as originating from the lateral cord of the brachial plexus, perforating coracobrachialis, traveling inferiorly and laterally between the biceps and brachialis, then emerging lateral to the biceps tendon to become the lateral antebrachial cutaneous nerve (LACN) [1]. On occasion, the MCN has been reported to perforate brachialis [2] and the short head of biceps brachii [2, 3] as well as supernumerary biceps heads [4, 5]. “Duplication” of the MCN has also been recently reported in which its classic integral functions are separated into proximal and distal nerves that supply the muscles of the anterior compartment of the arm and also provide lateral antebrachial cutaneous sensation [6, 7]. However, comprehensive summaries of anatomical variation (see references 2, 8) do not list the perforation of the long head of biceps brachii by the MCN as a variant – in either its normal single or duplicated form. Nor, to the best of our knowledge, is there a description, case report, or photographic documentation of this variant in the extant literature.

## Case Report

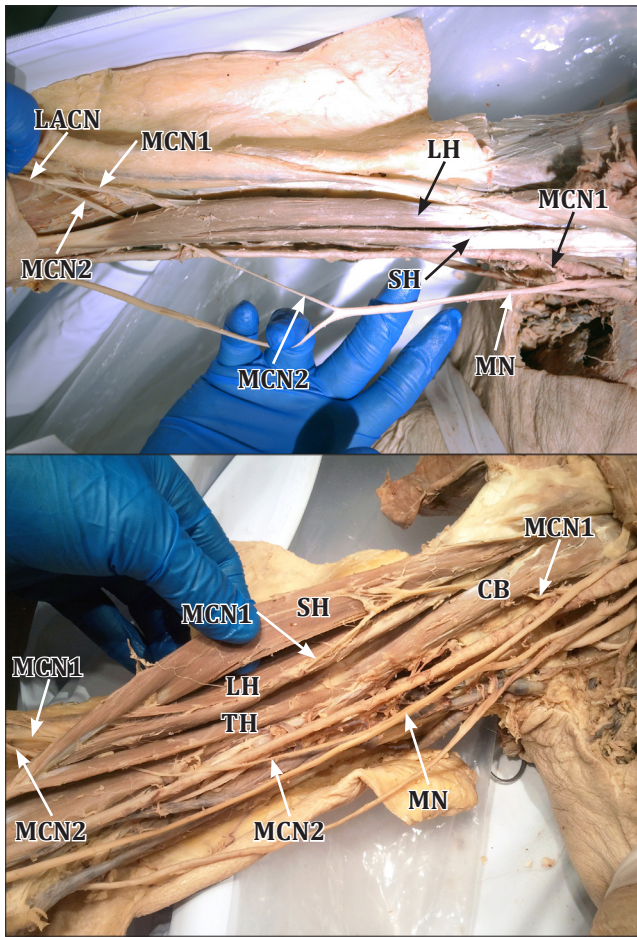
During routine dissection in a gross anatomy course for dental students, we identified a duplicated MCN and a three-headed

biceps brachii in the right arm of a 92-year-old Caucasian female cadaver (Figure 1). The third head originated on the medial surface of the humerus near the coracobrachialis insertion and inserted into the common biceps tendon. The proximal MCN originated from the lateral cord, pierced the coracobrachialis, then perforated and traveled within the long head. It exited mid-belly along the lateral aspect of the long head and continued to the lateral forearm. The distal MCN originated from the median nerve midway along its course in the medial neurovascular bundle of the arm. It coursed laterally, superficial to the brachial artery, gave a muscular branch to brachialis, continued between brachialis and biceps, and emerged lateral to the biceps. There, it joined the proximal MCN to form the LACN.

## Discussion

The variant we report has two interesting aspects – each of which is rare: the first is a duplicated MCN; the second is perforation of the long head of biceps brachii. Duplicate MCNs are rarely reported. We could only locate two case reports in the extant literature.

Abu-Hijleh [6] reported a case of a duplicated MCN in associated with a three-headed biceps brachii. The proximal MCN originated from the lateral cord of the brachial plexus, pierced the coracobrachialis, and then ended by innervating



**Figure 1.** Composite photographs show a dissected right arm with a duplicated musculocutaneous nerve (MCN). The proximal MCN perforates the coracobrachialis, travels within the biceps long head, exits laterally, then continues as the LACN. The distal MCN originates from the median nerve, gives a motor branch to brachialis, travels between the third, infero-medial head of the biceps and brachialis, then joins the proximal MCN to form the LACN. (LH: long head of biceps; SH: short head of biceps; CB: coracobrachialis; MN: median nerve; MCN1: proximal musculocutaneous nerve; MCN2: distal musculocutaneous nerve; TH: third head of biceps; LACN: lateral antebrachial cutaneous nerve)

the biceps short and long head. The distal MCN originated from the median nerve, coursed laterally between the supernumerary biceps head and brachialis, innervating the former, and continued to become the lateral antebrachial cutaneous nerve. Aside from the perforation of the coracobrachialis by the proximal MCN, no other muscle was perforated by either MCN duplicate.

Avinash et al. [7] reported a case of bilaterally duplicated MCNs. The proximal MCNs were thin nerves that originated from the lateral cord and terminated by innervating the coracobrachialis. The distal MCNs originated from the median nerve, coursed laterally between the biceps and brachialis and supplying them with motor branches, then continued as

the lateral antebrachial cutaneous nerve. In this case, the duplicate MCNs did not perforate any muscle.

Perforations of the biceps short head, supernumerary heads, and brachialis have been reported in the literature. For example, Pontell et al. [3] reported a case of the MCN perforating the short head of the biceps, then passing between the biceps long head and brachialis to continue as the lateral antebrachial cutaneous nerve. Miller and Trelease [4] described a case of a third, infero-medial head of biceps brachii that was pierced by the MCN, which then continued as the lateral antebrachial cutaneous nerve. Seven other cases of perforation of supernumerary biceps heads have also been reported [4, 5, 9, 10]. These cases illustrate the variability of the MCN with respect to which muscle or biceps head it can perforate.

Despite its known variation of perforating the short head and even supernumerary heads, we could find no description, case report, or photographic documentation of the MCN perforating the biceps long head. However, Kosugi et al [5], in their study of supernumerary biceps heads and the MCN, did report an instance of a motor branch that perforated the long head and then, forming a loop, rejoined the main trunk of the MCN. But, this was not an instance of the MCN trunk itself perforating the biceps long head. Nor was the MCN, in that case, a duplicated nerve.

Our case report of a duplicated MCN perforating the long head of biceps brachii extends our knowledge of MCN variation in providing the first description, case report, and photographic documentation of this anatomical variant. Since this case involves a “duplicated MCN,” it also points to the need to further clarify and define what is meant by this term since there is some controversy as to whether it simply describes what could equally be characterized as variant median nerve branches [11]. We believe this term has merit and is useful, but needs further clarification. As such, the variation, of either a single or duplicate MCN perforating the long head of biceps brachii, should now be included in any future summaries or classifications of MCN variation [see references 2, 8, 11].

In addition to its intrinsic anatomical interest, this variation of an MCN perforating the long head of the biceps should also be of interest to clinicians since it provides another anatomical configuration that can give rise to potential entrapment symptoms in a manner that may differ from typical MCN and LACN entrapment syndromes. For example, in the configuration represented by our case, entrapment of the proximal MCN could potentially result in motor symptoms (i.e., weakness, atrophy) of the biceps long head and sensory deficits on the lateral forearm. Yet, the brachialis, biceps short head, and coracobrachialis would be unaffected. This set of symptoms does not correspond to typical MCN or LACN entrapment syndromes resulting from classic MCN anatomy.

Because of its anatomical and clinical significance, we have initiated longer-term studies to further characterize the muscular perforation pattern and duplicate variants of the MCN.

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