Third head of biceps brachii perforated by the musculocutaneous nerve*

**Abstract**

The musculocutaneous nerve (MCN) is well-known for perforating the coracobrachialis. It is also known to pierce the short head of the biceps and brachialis on occasion. Recent comprehensive summaries of human anatomic variation, however, have not reported the MCN perforating a supernumerary biceps head. We report a case of the MCN perforating a third, infero-medial head of the biceps brachii and then continuing as the lateral antebrachial cutaneous nerve (LACN) in an 82 year-old Caucasian female cadaver. We propose that this case and similar recently reported cases indicate the necessity of including this variation in any future, formal summaries and classifications of MCN variation. Its anatomical significance, as well as its potential as a possible etiology in the clinical assessment of MCN and LACN compression syndromes is also discussed.

**Key words** [biceps brachii] [third head] [supernumerary head] [musculocutaneous nerve] [anatomical variation]

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**Introduction**

Aside from its motor and sensory functions, the musculocutaneous nerve (MCN) is known for its classic perforation of the coracobrachialis - which is attested to by its eponym *nervus perforans Casserii* (after Julius Casserius, the 16th – 17th century Italian anatomist who was the first to illustrate this perforation in his book *Tabulae Anatomicae*) [1]. However, the MCN is known to perforate other muscles. Bergman et al.’s *Compendium of Human Anatomic Variation* [2], considered by many modern anatomical researchers to be the “definitive tome of anatomical human variants” (e.g. see Vilensky [3]), describes the MCN as occasionally piercing the short head of the biceps and even brachialis. However, their summary of MCN variation does not include it perforating supernumerary heads of the biceps brachii [2].

**Case Report**

During routine dissection in a gross anatomy course for dental students, we identified a three-headed biceps in the right arm of an 82 year-old Caucasian female cadaver (Figure 1). The third head originated on the anteromedial surface of the humerus near the coracobrachialis insertion and inserted into the common biceps tendon. The MCN originated from the lateral cord, passed medial to the coracobrachialis without piercing it, and then sent muscular branches to the deep surface of the short and long biceps heads. It continued inferiorly, pierced the third biceps head and, within this head, gave off a muscular branch to the brachialis. Continuing inferolaterally from the third head, the MCN passed the biceps tendon laterally to become the lateral antebrachial cutaneous nerve (LACN). The coracobrachialis was supplied by a direct branch from the lateral cord of the brachial plexus.

On the left side, the MCN, biceps, and coracobrachialis exhibited classic relationships, with the MCN perforating the coracobrachialis, except that the latter also received direct branches from the lateral and posterior cords of the brachial plexus.

**Discussion**

Finding that perforation of supernumerary biceps heads by the MCN was not included in Bergman et al.’s 1988 *Compendium of Human Anatomic Variation* [2] or the more recent online version [4], we conducted a literature search and found only one study and three case reports, published since 1988, that describe this variation. In our discussion below, we use Rodriguez-Niedenfuhr et al.’s simplified classification of supernumerary biceps brachii heads into infero-medial, infero-lateral, and superior types [5].

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Miller and Trelease

Kosugi et al. [6] conducted a study of supernumerary heads of biceps brachii and the branching pattern of the MCN in 273 cadavers from a Japanese population. In their results, they listed five cases of the MCN perforating a third head of the biceps, all of which also perforated the coracobrachialis. This reflected a 1.8% frequency of occurrence in Japanese cadavers. Supernumerary head type was not reported. The focus of their study was the communication pattern of the MCN with the median nerve and how this related to supernumerary heads, not the perforation of supernumerary biceps heads by the MCN.

Vasquez et al. [7] reported a case of a four-headed biceps brachii in the right arm of an 87-year-old female from Cambridge, England with superior and infero-medial heads. The latter originated near the coracobrachialis insertion and inserted into the common biceps tendon. The MCN pierced the coracobrachialis and then double-pierced the infero-medial head before coursing laterally between the biceps and brachialis to become the lateral antebrachial cutaneous nerve.

Balasubramanian [8] reported a case of a three-headed biceps brachii in the right arm of a 45-55 year old male cadaver in India. The third head originated from the upper and medial brachialis (corresponding to the infero-medial head type described by Rodriguez-Niedenfuhr et al., [5]). The MCN did not perforate the coracobrachialis. It coursed inferiorly and gave muscular branches to the biceps and brachialis, then perforated the third head and continued on to become the LACN.

Sunitha and Narasingarao [9] reported a bilateral occurrence of a three-headed biceps brachii in a 60-year-old male cadaver in Nellimarla, India. The third head, in both arms, was of the infero-medial type and originated near the coracobrachialis insertion and inserted into the common biceps tendon. On the left side, however, the third head was perforated by the MCN, which then continued laterally as the LACN.

Our case report, in conjunction with the other four post-1988 reports discussed above, demonstrates that a critical mass of scientific observation has now been reached for the recognition of the perforation of supernumerary biceps brachii heads by the MCN as an important variant in all future summaries of MCN course variation (e.g., such as Bergman et al. [4]) and classification schemes (e.g., see Guerri-Guttenberg and Ingolotti [10]).

Additionally, in our case, as well as in those of Vasquez et al. [7], Balasubramanian [8], and Sunitha and Narasingarao [9], the MCN perforated the infero-medial head. This occurred even when other supernumerary heads were present (e.g., a superior head, as in Vasquez et al. [7]). Kosugi et al. [6] did not indicate which type of third head (i.e., infero-medial, infero-lateral, or superior) was perforated by the MCN in their five cases. To our knowledge, perforation of infero-lateral or superior supernumerary head types has not yet been reported in the literature. Future studies should test whether there is a preferential perforation of the infero-medial supernumerary head by the MCN.

Interestingly, the MCN perforated both the coracobrachialis and the infero-medial supernumerary head in Kosugi et al.’s [6] five cases and in that reported by Vasquez et al. [7]. However, it did not perforate the coracobrachialis in the case reported by Balasubramanian [8] or in the case presented here. This relationship between the perforation of supernumerary biceps heads and that of the coracobrachialis should be investigated further.

Clinically, a nerve may be compressed when it courses within a muscle [7]. In our case, a motor branch to the brachialis originated from the MCN as it perforated the third biceps head (Figure 1) – which provided an anatomical basis for...
possible MCN compression by the third head due to muscular spasm, hypertrophy, or other aggravating repetitive motions. This anatomical variation presents a potential etiology for clinicians to consider in the differential diagnosis of MCN or LACN compression syndromes.

Because of its intrinsic anatomical interest as a relatively newly recognized variation and also because of its potential clinical significance, we have initiated further investigations of the perforation of biceps supernumerary heads by the MCN.

References

[1] Casserius J. Tabulae Anatomicae. Venice, Italy. 1627. Figure I, Table XX.