

Duplicated superficial branch of the radial nerve and brachioradialis muscle belly: prevalence and significance

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Background: The superficial branch of the radial nerve (SBRN) is a sensory nerve innervating the dorsoradial part of the hand. It originates in the cubital fossa, runs under the belly of the brachioradialis muscle (BM), emerges from underneath in the distal third of the forearm and continues in the subcutaneous tissue towards the hand. There exist several anatomical variations of its branching and course, including a rare variation of its duplication combined with a duplication of the brachioradialis muscle belly. The aim of this study was to find out the prevalence of this variation on a sample of cadaveric human bodies which has not been reported yet.

Materials and methods: We have carefully dissected 208 cadaveric upper limbs (Central European population). All cases of limbs containing the variation of a double SBRN and/or a double BM belly were measured and documented.

Results: We have identified 2 cases of a double SBRN combined with a double BM belly (0.96%). Both were present in the right forearm of a male donor and in both cases the nerve was impinged by muscle bundles connecting the 2 muscle bellies together. Moreover, we have encountered 1 case of a double SBRN without a double BM belly (0.48%), i.e. the total prevalence of a double SBRN was 1.44%.

Conclusions: The duplicated SBRN with the duplicated BM is a relatively rare anatomical variation that might cause complications while performing various surgical procedures in the forearm, moreover it might be a rare cause of Wartenberg's syndrome. (Folia Morphol 2023; 82, 3: 558–561)

Key words: superficial branch, radial nerve, duplication, brachioradialis, variation, double

INTRODUCTION

The superficial branch of the radial nerve (SBRN) is one of the two terminal branches of the radial nerve. It originates in the cubital fossa and continues distally along the forearm accompanying the radial vessels, covered by the belly of the brachioradialis muscle

(BM). It leaves the lateral compartment of the forearm in the distal third of the forearm by penetrating the antebrachial fascia in a close relationship with the BM tendon, branches numerous and continues distally within the subcutaneous tissue over tendons surrounding the radial foveola (anatomical snuff box)

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at the wrist, innervating the dorsolateral aspect of the hand and the lateral two and half fingers [3].

Although the above described course of the SBRN is well known, there are some anatomical variations — absence, aberration or connections with other sensory nerves of the upper limb — that may mislead clinicians or be a cause of iatrogenic damage to the nerve during various medical interventions over the forearm and hand (treatment of De Quervain's disease, extensor tendons rupture, surgery of wrist ganglia, etc.) [2].

In 2017, we have described an interesting anatomical variation of the SBRN and BM. The muscle had a duplicated belly (one of them was superficial, the other one deep) with one origin and one insertion. The SBRN was also duplicated, both branches originated in the cubital fossa and each of them ran underneath one of the muscle bellies — the proper SBRN underneath the deep belly and the accessory SBRN underneath the superficial one. The accessory nervous branch was impinged by two pairs of blood vessels and pierced through muscle bundles connecting the two bellies together [5].

A similar variation was indirectly described by Murphy and Blair in a patient with a Wartenberg's syndrome caused by impingement of an accessory nerve with the same anatomical course as the accessory SBRN in our case [8]. While this anatomical variation is of clinical significance and the anatomical literature on this topic is missing (either due to its rarity or neglect in the academic literature), we aimed to find out its prevalence in population.

MATERIALS AND METHODS

From 2017 to 2021 we have dissected 208 upper limbs (97 left and 111 right, 104 males and 104 females) of donor cadavers from the Central European population, fixed with classical formaldehyde embalming method. The SBRN was identified in each limb and carefully visualized in the whole extent from the cubital fossa to the level of the metacarpophalangeal joints. Each variation of either SBRN or BM muscle was identified, measured and documented.

Ethical statement

The protocol for the research project has been approved by the Ethics Commission of the Second Faculty of Medicine, Charles University (No. EK76/21) and it conforms to the provisions of the Declaration of Helsinki of 1975, as revised in 2000 and 2008.

RESULTS

We have identified 2 cases of a double SBRN combined with a double BM belly in a sample of 208 limbs (0.96%). Both were present in the right forearm of a male donor cadaver and in both cases the nerve was impinged by muscle bundles connecting the 2 muscle bellies together. The diameter of the trunk of the radial nerve in the cubital fossa was 3.5 mm in both cases. The diameter of SBRN was 1.5 mm and 1.7 mm, respectively, and the diameter of the accessory SBRN was 1 mm and 1.5 mm, respectively. In both cases, the SBRN and the accessory SBRN merged after certain extent in a common trunk for 17 mm and 11 mm, respectively, and then they separated again. The division of the common nerve trunk was 42 mm and 58 mm proximally from the styloid process of the radius, respectively. Then, the SBRN and accessory SBRN pierced the antebrachial fascia superficially into the subcutaneous layer and divided into terminal branches for the hand: in 1 case into 3 branches of the SBRN and 2 branches of the accessory SBRN, and in the other case into 3 branches of the SBRN and 1 branch of the accessory SBRN. In both cases, the SBRN innervated the skin of the thumb and the accessory SBRN innervated the dorsolateral aspect of the hand. In 1 case, the accessory SBRN innervated the superficial belly of the BM as well (Figs. 1, 2).

We have also encountered 1 case of a double SBRN without a double BM belly present in a left upper limb of a male donor cadaver. In this case the nerve branches were impinged neither by blood vessels nor by muscle bundles. The thinner accessory SBRN (diameter 1.2 mm) innervated the thumb with three branches and the thicker proper SBRN (diameter 3.5 mm) supplied the dorsal aspect of the hand with 2 branches. Both branches were interconnected by a 3-mm-thick interneural communication and the accessory SBRN was also connected to the lateral antebrachial cutaneous nerve via a 1-mm-thick communicating branch. The connection between the SBRN and the accessory SBRN was located 30 mm proximal to the styloid process of the radius and the connection between the accessory SBRN and the lateral antebrachial cutaneous nerve was situated 23 mm proximal to the styloid process of the radius (Fig. 3).

In our sample, the prevalence of a double SBRN combined with a double BM belly was 0.96% and the prevalence of a double SBRN without a double BM belly was 0.48%, i.e. the total prevalence of a double SBRN was 1.44%.

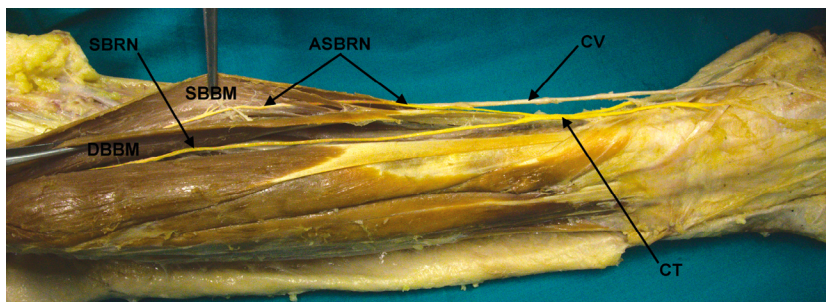


Figure 1. The accessory superficial branch of the radial nerve runs under the superficial belly of the brachioradialis muscle while innervating it. After emerging from underneath, the accessory superficial branch of the radial nerve merges with the superficial branch of the radial nerve into a common nerve trunk; ASBRN — accessory superficial branch of radial nerve; CT — common trunk; CV — cephalic vein; DBBM — deep belly of brachioradialis muscle; SBBM — superficial belly of brachioradialis muscle; SBRN — superficial branch of radial nerve.

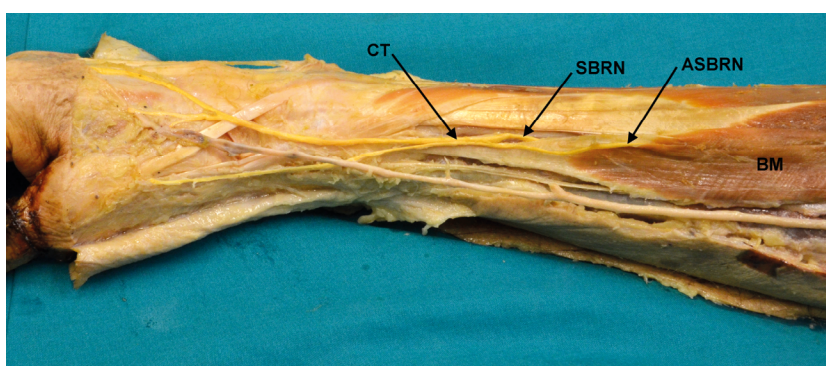


Figure 2. The superficial branch of the radial nerve and the accessory superficial branch of the radial nerve merge into a common trunk. The superficial branch of the radial nerve then innervates the dorsal aspect of the hand, while the accessory superficial branch of the radial nerve innervates the thumb; ASBRN — accessory superficial branch of radial nerve; BM — brachioradialis muscle; CT — common trunk; SBRN — superficial branch of radial nerve.

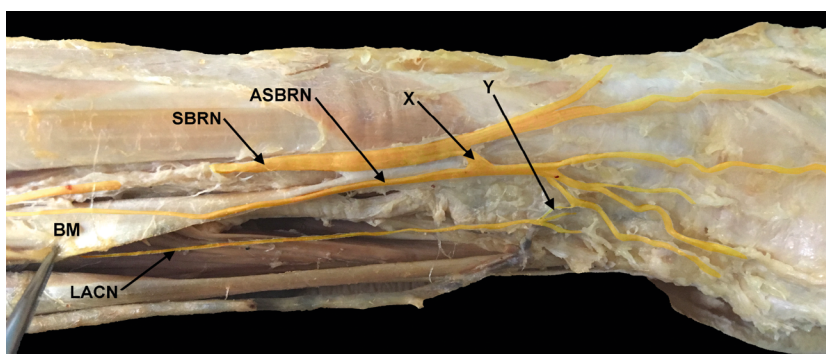


Figure 3. The superficial branch of the radial nerve and the accessory superficial branch are interconnected by a thick communicating branch. Moreover, there is a thin interconnection between the latter and the lateral antebrachial cutaneous nerve; ASBRN — accessory superficial branch of radial nerve; BM — brachioradialis muscle; LACN — lateral antebrachial cutaneous nerve; SBRN — superficial branch of radial nerve; X — thick communicating branch; Y — thin communicating branch.

DISCUSSION

We have found that the duplication of the SBRN and the BM is a rather rare variation in the Central European population with prevalence around 1%. It should be considered while performing surgeries in

the forearm or in the differential diagnostics of paraesthesia and neural pain over the dorsolateral aspect of the hand. A similar variation of duplicated and aberrant SBRN was described recently by Patel et al. [9] as a potential complication of harvesting the radial fore-

arm free flap (but in their case, the SBRN was duplicated, 1 branch ran under the belly of a one-bellied BM and the other crossed it superficially) and another similar case of an accessory SBRN joining the main trunk of the nerve was described by Murphy and Blair as a cause of Wartenberg's syndrome in a patient [8].

All cases of the SBRN duplication were present in male donors. We presume that this finding is a bias due to a small number of the described cases rather than due to real difference between males and females.

There exist several variations of the SBRN described in literature — absence, duplication, aberrant course [1, 5, 7, 10, 12] and some of them may cause an impingement — such as the SBRN running in between two slips or piercing the tendon of the BM [11, 13, 14].

There have been also reported cases of absence and duplications of the BM, accessory long supinator muscle, brachioradialis brevis muscle, aberrant origins, aberrant insertions, tendon splits, divided or accessory bellies of the BM as well as variant innervation of the BM by the musculocutaneous nerve [3, 4, 6, 10–14].

CONCLUSIONS

To our best knowledge, nobody has reported the coincidence of the BM belly and the SBRN duplication before. We stated its prevalence in population with potential impingement sites: the prevalence of a double SBRN combined with a double BM belly is 0.96% and the total prevalence of a double SBRN is 1.44%. It might be a rare cause of Wartenberg's syndrome.

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Conflict of interest: None declared

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