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CASE REPORT

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Innervation of the coracobrachialis muscle by a branch from the lateral root of the median nerve

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Anomalies of the brachial plexus have previously been described in the literature. The coracobrachialis muscle is typically innervated by the musculocutaneous nerve. During a gross anatomy dissection we found that the coracobrachialis muscle was innervated by a branch from the lateral root of the median nerve. Knowledge of the anatomical variations of the peripheral nervous system is important in interpreting unusual clinical presentations. This report will assist clinicians and surgeons by pointing out anatomical anomalies associated with the musculocutaneous nerve, the median nerve and their branches to the anterior compartment muscles of the upper arm.

Key words: brachial plexus, median nerve, musculocutaneous nerve, coracobrachialis muscle

INTRODUCTION

Anomalies of the brachial plexus and its terminal branches are not uncommon [1, 3, 4, 6, 7, 9, 10, 11, 15, 17, 18]. The musculocutaneous nerve is a motor and sensory peripheral nerve that originates from the lateral cord of the brachial plexus in the axilla. It usually supplies the coracobrachialis, biceps brachii and the brachialis muscles in the anterior compartment of the arm and then continues as the lateral cutaneous nerve of the forearm. The branch to the coracobrachialis is given off from the nerve close to its origin, and in some instances as a separate filament from the lateral cord of the plexus. It is derived from the 7th cervical nerve. The median nerve typically does not innervate muscles in the upper arm. However, a branch to the *pronator teres* muscle can occasionally be observed [21].

In our case, the musculocutaneous nerve innervated the biceps brachii and brachialis, but not the coracobrachialis muscle. Instead, the coracobrachialis muscle was innervated by a branch of the lateral root of the median nerve.

A review of the embryological development of the brachial plexus is helpful in understanding the origin of possible anatomical variations. The upper limb buds are visible by day 26 or 27 in the developing embryo. During the 5th week the peripheral nerves grow from the brachial plexus into the mesenchyme of the upper limb buds. The brachial plexus is a union of the lower 4 cervical ventral rami and the first thoracic ventral ramus, with a small contribution from the ventral ramus of the 4th cervical spinal nerve.

These ventral rami are the roots of the plexus and are variable in their mode of junction. The lateral cord gives off the lateral pectoral nerve, the musculocutaneous nerve and the lateral root of the median nerve, whereas the medial cord gives off the medial pectoral nerve, the medial cutaneous nerve of the arm, the medial cutaneous nerve of the forearm, the ulnar nerve and the medial root of the median nerve [12].

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The musculocutaneous nerve has frequent variations and these were discussed in detail in earlier articles. It may be doubled, unusually short, or even absent. The musculocutaneous nerve arises from the lateral cord (90.5%), from the lateral and posterior cord (4%), from the median nerve (2%), as two separate bundles from the medial and lateral cords (1.4%) or from the posterior cords (1.4%). Some fibres of the median nerve may run in the musculocutaneous nerve, leaving it to join their proper trunk. Less frequently the reverse occurs, the median nerve sending a branch to the musculocutaneous nerve. A single puncture wound, therefore, could theoretically impair the muscles innervated by both the musculocutaneous and the median nerves if there were complete or partial fusion of these nerves. Nerves following an anomalous course are more susceptible to accidental injury [8].

Very rarely the whole lateral cord of the brachial plexus pierces the coracobrachialis and only then does the cord divide into the musculocutaneous nerve and the lateral root of the median nerve.

CASE REPORT

Variation was detected in a 55-year-old male cadaver's right axilla during a gross anatomy dissection during the autumn 2002 phase at the dissection room of the Anatomy Department of the Faculty of Medicine, Hacettepe University. The coracobrachialis in our specimen was not innervated by the musculocutaneous nerve. Instead, the coracobrachialis was innervated by a branch from the lateral root of the median nerve. This branch bifurcated into an upper and lower division prior to piercing the coracobrachialis muscle. The musculocutaneous nerve was found to course deep to the upper division of the branch of the lateral root of the median nerve. The branch from the lateral root of the median nerve originated 8 mm proximal to the junction of the lateral and medial roots of the median nerve. The branch of the lateral root of the median nerve measured 50 mm prior to bifurcation into upper and lower divisions. The musculocutaneous nerve passed deep to the upper division 7 mm distal to the bifurcation. The upper division of the branch of the lateral root of the median nerve pierced the coracobrachialis muscle and measured 32 mm in length. The lower division measured 15 mm in length. The brachial artery was not related to these small branches and coursed classically among the medial and lateral cords of the median nerve (Fig. 1).

DISCUSSION

Variations in the brachial plexus have been well described by many authors. Unilateral brachial plexus anomalies were demonstrated in 4 of 71 cadavers by Sarsilmaz et al. [18]. Sargon et al. [16] described an unusual formation of the median nerve in the axilla. Basar et al. [2], Uzun and Seelig [19] reported a connecting branch between the musculocutaneous and median nerves.

During the dissection of a 72 year-old female cadaver, Gumusburun et al. [8] observed a variation of the brachial plexus characterised by the absence of the musculocutaneous nerve bilaterally. The variation in the musculocutaneous and median nerves was classified into the following 5 types by Gumusburun et al. [8]. Type 1: there are no receiving fibres between the nerves as described in the classic textbook; Type 2: some fibres of the medial root of the median nerve merge with the musculocutaneous nerve and, after some distance, leave to join the proper trunk; Type 3: the lateral root of the median nerve runs into the musculocutaneous nerve and after some distance leaves it to join its proper trunk; Type 4: the fibres of the musculocutaneous nerve unite with the lateral root of the median nerve and after some distance the musculocutaneous nerve arises from the median nerve; Type 5: the musculocutaneous nerve is absent.

Venieratos et al. [20] classified the sites of communication between the musculocutaneous and median nerves into 3 types. Type 1: the communication is proximal to the point of entry of the musculocutaneous nerve into coracobrachialis muscle; Type 2: the communication is distal to the muscle; Type 3: the musculocutaneous nerve (as well as the communicating branch) does not pierce the coracobrachialis muscle. Choi et al. [5] classified the variations between the musculocutaneous and the median nerve into 3 patterns. Pattern 1: fusion of both nerves (19.2%); Pattern 2: the presence of one supplementary branch between the two nerves (72.6%); Pattern 3: two branches (6.8%).

There are 2 more articles closely related to our case. In the dissection of 36 arms El-Naggar investigated variations in the musculocutaneous nerve in the form of a lower origin from the lateral root of the median nerve and a nerve with a short course, after which it united with the median nerve [6].

During gross anatomy dissections of 60 embalmed cadavers by Gumusalan et al. the coracobrachialis muscle was found to be innervated by a nerve branch arising from the lateral root of the

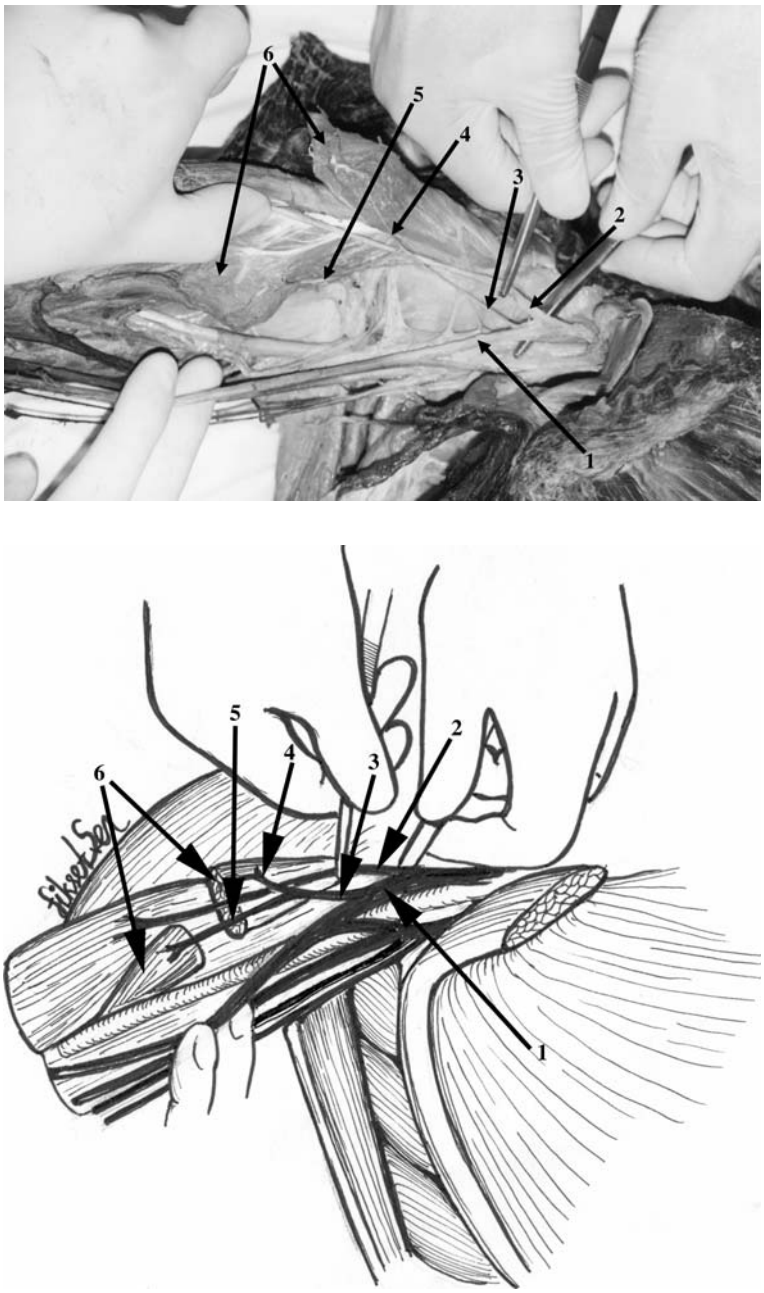

Figure 1. 1 — lateral root of the median nerve (LRMN), 2 — musculocutaneous nerve, 3 — branch from the LRMN (bf-LRMN) to the coracobrachialis muscle, 4 — upper division from the bf-LRMN to the coracobrachialis muscle, 5 — lower division from the bf-LRMN to the coracobrachialis muscle, 6 — the coracobrachialis muscle.

median nerve (as in our case), but not from the musculocutaneous nerve nor from the lateral cord of the brachial plexus. Furthermore, the musculocutaneous nerve was found not to pierce the coracobrachialis muscle and to course downwards medial to it. [7]. In our case, in contrast, the musculocutaneous nerve pierced the coracobrachialis muscle.

The absence of the musculocutaneous nerve and innervation of the coracobrachialis by the median nerve is an unusual variation of the brachial plexus [8, 13, 15]. Anatomical variants of the brachial plexus may be significant in the context of axillary trauma. Theoretically, in a person with an anomaly of the brachial plexus that we have described injury to the musculocutaneous nerve would not result in loss of function of the coracobrachialis muscle. By the same token, injury to the lateral root could result in functional deficiency of the coracobrachialis.

The length of the nerve to the coracobrachialis muscle in our case was about 7–8 cm. This nerve

may extend to the long thoracic nerve, posterior cord of the brachial plexus, radial nerve and musculocutaneous nerve without grafting. Although the incidence of this variation is not known, its lengthy course makes it available for the functional restoration of irreparable lesions of these particular nerves. Transfer of this nerve to the musculocutaneous nerve may be a viable alternative to Oberlin's procedure [14] for proximal musculocutaneous nerve injuries.

Consideration of possible anatomical variations of the brachial plexus is important when approaching the upper extremity surgically.

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REFERENCES

1. Adachi B (1928) Das arterien system der Japaner. Bd.1. Kyoto: Maruzen, pp. 196–341.
2. Basar R, Aldur MM, Celik HH, Yuksel M, Tascioglu AB (2000) A connecting branch between the musculocutaneous nerve and the median nerve. Morphol, 84: 25–27.
3. Bergman RA, Thompson SA, Afifi AK, Saadeh FA (1988) Compendium of human anatomic variation. Baltimore: Urban & Schwarzenberg, pp. 139–143.
4. Buch-Hansen K (1955) Uber varietaten des Nervus medianus und des Nervus musculocutaneus und deren Beziehungen. Anat Anz, 102: 187–203.
5. Choi D, Rodriguez-Niedenfuhr M, Vazquez T, Parkin I, Sanudo JR (2002) Patterns of connections between the musculocutaneous and median nerves in the axilla and arm. Clin Anat, 15: 11–17.
6. El-Naggar MM (2001) A study on the morphology of the coracobrachialis muscle and its relationship with the musculocutaneous nerve. Folia Morphol (Warsz), 60: 217–224.
7. Gumusalan Y, Yazar E, Ozan H (1998) Variant innervation of the coracobrachialis muscle and unusual course of the musculocutaneous nerve in man. Anatomical Science International, 73: 269–272.
8. Gumusburun E, Adiguzel E (2000) A variation of the brachial plexus characterized by the absence of the musculocutaneous nerve; a case report. Surg Rad Anat, 22: 63–65.
9. Iwata H (1960) Studies on the development of the brachial plexus in Japanese embryo. Rep Dept Anat Mic Prefect Univ Sch Med, 13: 129–144.
10. Kerr At (1918) The brachial plexus of nerves in man, the variations in its formation and branches. Am J Anat, 23: 285–395.
11. Linell EA (1921) The distribution of nerves in the upper limb, with reference to variabilities and their clinical significance. J Anat, 55: 79–112.
12. Moore KL (1988) The Developing Human: Clinically Oriented Embryology. 4th Ed. Philadelphia: W.B. Saunders Company, pp. 351–353.
13. Nakatani T, Tanaka S, Mizukami S (1997) Absence of the musculocutaneous nerve with innervation of coracobrachialis, biceps brachii, brachialis and the lateral border of the forearm by branches from the lateral cord of the brachial plexus. J Anat, 191: 459–460.
14. Oberlin C, Beal D, Leechavengvongs S, Salon A, Dauge MC, Sacry JJ (1994) Nerve transfer to biceps muscle using a part of ulnar nerve for C5–C6 avulsion of the brachial plexus: anatomical study and report of four cases. J Hand Surg, 19: 232–237.
15. Prasada Rao PVVR, Chaudhary SC (2001) Absence of musculocutaneous nerve: two case reports. Clin Anat, 14: 31–35.
16. Sargon MF, Uslu SS, Çelik HH, Akæit D (1995) A variation of the median nerve at the level of brachial plexus. Bulletin de l' Assoc des Anat, 79: 25–26.
17. Saeed M, Rufai AA (2003) Median and musculocutaneous nerves: variant formation and distribution. Clin Anat, 16: 453–457.
18. Sarsilmaz M, Şendemir E, Çelik HH, Gumusalan Y, Simsek C (1993) Some variations of the brachial plexus in man. Turk J Med Res, 11: 161–165.
19. Uzun A, Seelig LL (2001) A variation in the formation of the median nerve: communicating branch between the musculocutaneous and median nerves in man. Folia Morphol, 60: 99–101.
20. Venieratos D, Anagnostopoulou S (1998) Classification of communications between the musculocutaneous and median nerves. Clin Anat, 11: 327–331.
21. Williams PL, Warwick R, Dyson M, Bannister LH (1989) Gray's Anatomy. 37th Ed. Edinburgh: Churchill Livingstone, pp. 1130–1137.