

## DOES THE PATTERN OF INNERVATION OF BRACHIALIS BY THE MUSCULOCUTANEOUS NERVE INFLUENCE THE PRESENCE OR ABSENCE OF THE RADIAL NERVE CONTRIBUTION?

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### ABSTRACT

The innervation of brachialis muscle by the musculocutaneous nerve has been described as either type I or type II and the main trunk to this muscle is rarely absent. The contribution by the radial nerve however ranges from 30 to 100%. It is not clear if the presence or patterns of supply to this muscle by either nerve are interdependent. The aim of this study was to determine the pattern of innervation of brachialis by the musculocutaneous nerve and relate it to the presence and contribution from the radial nerve. Fifty seven arms (25 male and 4 female); 29 right and 28 left from formalin-fixed adult cadavers were used. The pattern of musculocutaneous branch to brachialis was recorded based on the classification by Yang *et al.* into either type I or II. The presence and number of branches by the radial nerve to the same muscle were determined and related to the pattern from brachialis. The musculocutaneous nerve supplied brachialis in all (100%) of the cases while the radial nerve did so in 33 arms (57.9%). Type I was the predominant pattern in both left and right arms (91.2%) with no correlation between the type of innervation by musculocutaneous nerve and the radial nerve contribution.

**Key words:** Brachialis, radial nerve, musculocutaneous nerve.

### INTRODUCTION

Brachialis is the workhorse of the elbow flexion. This muscle is dually innervated by the musculocutaneous nerve running via the anterior division of the brachial plexus and the radial nerve running via the posterior division of the plexus (Mahakkanukrauh *et al.*, 2002; Oh *et al.*, 2009). Of these, the musculoskeletal nerve consistently supplies the muscle, although it shows variations in the number of branches and the point of entry into the belly of the muscle (Yang *et al.*, 1995). These branching variations may influence

the presence of the inconsistent (Prakash *et al.*, 2009) motor contribution by the radial nerve to this muscle. The understanding of the pattern of innervation of the brachialis muscle is important in planning of humeral surgery (Srimathi and Sembian, 2011). The aim of the present study was therefore to determine the pattern of innervation of brachialis by the musculocutaneous nerve and relate this to the presence of the contribution from the radial nerve in an African population.

### MATERIALS AND METHODS

Fifty seven arms, 29 right and 28 left from 29 formalin-fixed adult cadavers from the Department of Human Anatomy, University of Nairobi were assessed during routine dissection. Of these, 25 were male and 4 female. The musculocutaneous nerve was identified as it entered the substance of coracobrachialis and

between biceps brachii and brachialis muscles. The pattern of its innervation to brachialis was classified based on the description by Yang *et al.* (1995);

**Type 1:** Single motor nerve supplying the muscle

**Type 2:** Two motor nerves supplying the muscle

The level at which it pierced the muscle and the position in a medio-lateral plane were also recorded. The radial nerve was located between brachialis and brachioradialis muscles in the lateral distal arm and followed proximally through the

lateral intermuscular septum and the radial groove to the posterior cord of the brachial plexus. Supply to brachialis including the number of branches and region of entry to the muscle were recorded.

## RESULTS

Brachialis was supplied by the musculocutaneous and radial nerves in 57 (100%) and 33 arms (57.9%) respectively. The musculocutaneous nerve entered the muscle medially in the proximal 1/2 of the muscle belly in 56 (98%) cases and in the distal half in a single case.

The predominant (91.2%) pattern of musculoskeletal supply was type I (Figure

1). When present, the radial nerve was a single branch entering the inferolateral belly of the muscle (Figure 2). There were no relationship between the type of innervation and the radial nerve contribution. On further dissection, the radial nerve ramification in the muscle was deep to that of musculocutaneous.

## DISCUSSION

Consistent with previous reports, the musculocutaneous was present, supplying all the brachialis muscles in the present study (Yang et al., 1995; Prakash et al., 2009). In contrast with the initial report by Chang (1968) that the radial is a consistent supply to the brachialis muscle, this branch was absent in some limbs. Therefore, dual innervation of the brachialis was observed in only 57% of the limbs lower than the 65% and 72% reported Argentinians and Indians respectively [Table 1] (Prakash et al., 2009; Bendersky and Bianchi, 2012). Caution should be always be exercised to

preserve the musculocutaneous nerve in preserving the flexor functions of brachialis.

The 91% type I dominant musculoskeletal supply of brachialis did not influence the presence of radial nerve supply. This may imply that the two nerves synergistically supply the muscle. Consistent with the previous studies the radial nerve ramification within the muscle substance was deep to that of musculocutaneous with the former supplying the inferolateral portion of the muscle and that the two overlap in a proximo-distal and medio-lateral manner (Frazer et al., 2007).

Table 1: Rate of dual innervation of the brachialis muscles in different populations

Study	Population	Rate of double innervation
Srimathi and Sembian., 2011	Indian	88%
Mahakkanukrauh et al., 2002	Thai	81.61%
Prakash et al., 2009	Indian	72.14%
Bendersky and Bianchi, 2012	Argentinian	65%
Present study, 2013	Kenyan	57.9%

Though the brachialis is a flexor, the radial nerve gives a minor branch (C7) to the brachialis muscle. This is explained by the derivation of the lateral portion of the muscle from the extensor premuscle mass (Hollinshead, 1997; Yan et al., 1998). This theory however doesn't account for the cases of absence of the radial nerve.

Furthermore, the presence of the median nerve supply to the muscle has been reported (Beheiry, 2004).

In conclusion, brachialis is consistently supplied by musculocutaneous nerve. Type I musculocutaneous nerve pattern is predominant and it does not preclude the presence of radial nerve.

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