Anatomical variation of the musculocutaneous and median nerves

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Background
Various authors in the literature have reported anatomical variations in the brachial plexus. A 29-year-old male patient presented with a delayed upper brachial plexus injury on the right upper limb. The absence of the musculocutaneous nerve was observed during the brachial plexus exploration. Two muscles of the anterior compartment of the arm, namely the biceps brachii and brachialis, received their nerve supply directly from the median nerve. It is crucial to take into account variations in the formation of the brachial plexus during surgical exploration of brachial plexus injuries to prevent damage to these vital nerves.

KEYWORDS: Musculocutaneous nerve, median nerve.

Case Report

Plastic Surgery

OPEN ACCESS

The musculocutaneous nerve originates from motor-sensory fibers derived from the primary ventral branches of the C5 to C7 spinal nerves. Upon emerging from the lateral cord, it courses towards the coracobrachialis muscle, penetrating it. Subsequently, the nerve proceeds deeply between the brachialis and biceps brachii muscles, providing innervation to these muscles(1). Upon supplying all three muscles of the anterior compartment of the arm, the musculocutaneous nerve (MCN) emerges laterally to the tendon of the biceps brachii muscle, continuing as the lateral cutaneous nerve of the forearm.

Understanding the anatomy of this nerve and its variations holds clinical and surgical significance, as numerous surgical procedures in the upper limb often require mobilization or displacement of the muscles in the anterior arm compartment(2). Most of these anatomic variations are based on cadaveric dissections(3–5).

In this article, we contribute to the existing literature by reporting a case of anatomical variation in the formation of the brachial plexus in the arm during a brachial plexus repair.

Case report

We present a case of a 29-year-old male who presented 9 months after injury with a right upper brachial plexus injury. This occurred through a road traffic accident involving a fall from a speeding motorbike. The initial injury resulted in a global loss of function in the right upper limb. However, there was a gradual recovery, with significant improvement observed at the 3-month mark, except for deficits in shoulder abduction and elbow flexion.

During surgical exploration, it was observed that the musculocutaneous nerve was absent. There was no nerve penetrating the coracobrachialis. The biceps brachii and brachialis were innervated by two branches that emerged from the median nerve in the arm. The most cranial branch was from the lateral aspect and headed for the biceps brachii. The second branch emerged from the medial aspect of the median nerve headed to the depth of the brachialis muscle, to innervate it (Figure 1). The nerve to the coracobrachialis was not observed, suggesting the possibility that it was directly innervated by the lateral cord. However, dissection to confirm this was not performed, as it was not part of the surgical plan. No other anatomical variations were found in the brachial plexus or the nerves of the arm.

During electrical nerve stimulation, activity was detected in the nerve to the brachialis, while the nerve to the biceps brachii remained silent. Based on this, no nerve transfer was performed to the brachialis. Instead, ulnar nerve fascicles to flexor carpi ulnaris were transferred to the nerve supplying the biceps brachii to power elbow flexion (figure 2). Additionally, the radial nerve branch to the lateral head of the triceps was transferred to the anterior

From the Department of Plastic, Reconstructive & Aesthetic Surgery, University of Nairobi, Nairobi, Kenya. Received on January 28, 2024. Accepted on February 9, 2024. Published on February 11, 2024.

DOI 10.5281/zenodo.10648738

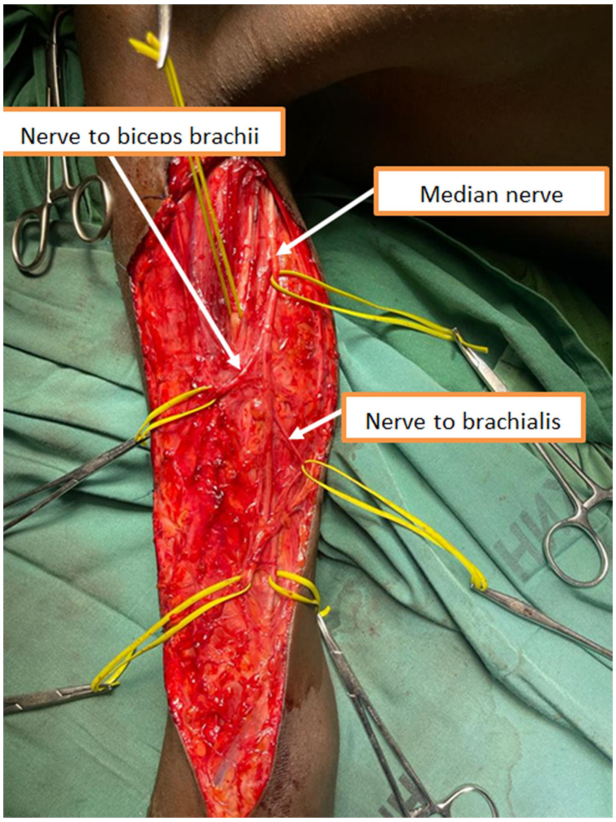

Figure 1: demonstrating the nerves to the biceps brachii and brachialis originating from the median nerve with an absent musculocutaneous nerve.

division of the axillary nerve to facilitate shoulder abduction (figure 3).

Discussion

Variations in brachial plexus anatomy have been described(8) According to findings by Tountas and Bergman, the musculocutaneous nerve originates predominantly from the lateral cord (90.5%). Alternative sources are the lateral and posterior cord (4%), the median nerve (2%), two distinct bundles emerging from the medial and lateral cords (1.4%), or from the posterior cords (1.4%)(6). While the absence of the musculocutaneous nerve has been documented before, its actual prevalence remains unknown(8–10). According to Bhattarai et al., variations of the musculocutaneous nerve were found to occur in 6.25% of cases(11).

Leminor categorizes the variations in the musculocutaneous and median nerves into five types(12). Type 1 is characterized by the lack of communication between the median and musculocutaneous nerves. In Type 2, the fibers of the medial root of the median nerve pass through the musculocutaneous nerve and eventually unite with the median nerve in the middle of the arm. Type 3 has lateral root fibers of the medial root of the median nerve travel through the musculocutaneous nerve, departing after a certain distance to form the root of the median nerve. For Type 4, the musculocutaneous fibers join the lateral root of the median nerve, and thereafter, the musculocutaneous nerve emerges from the median nerve after covering a certain distance. In Type 5, the musculocutaneous nerve is nonexistent, and all the fibers of the musculocutaneous pass through the lateral root. Subsequently, fibers destined for muscles typically innervated by the musculocutaneous nerve branch out from the median nerve(12).

Our case falls under Leminor's type 5 classification though the nerve to the coracobrachialis was not coming from the median nerve. The nerves to the brachialis and biceps brachii were otherwise originating from the median nerve. This was similar to a cadaveric case reported by Gümüsburun et al in 1999(7) as shown in Figure 4 below as (*)

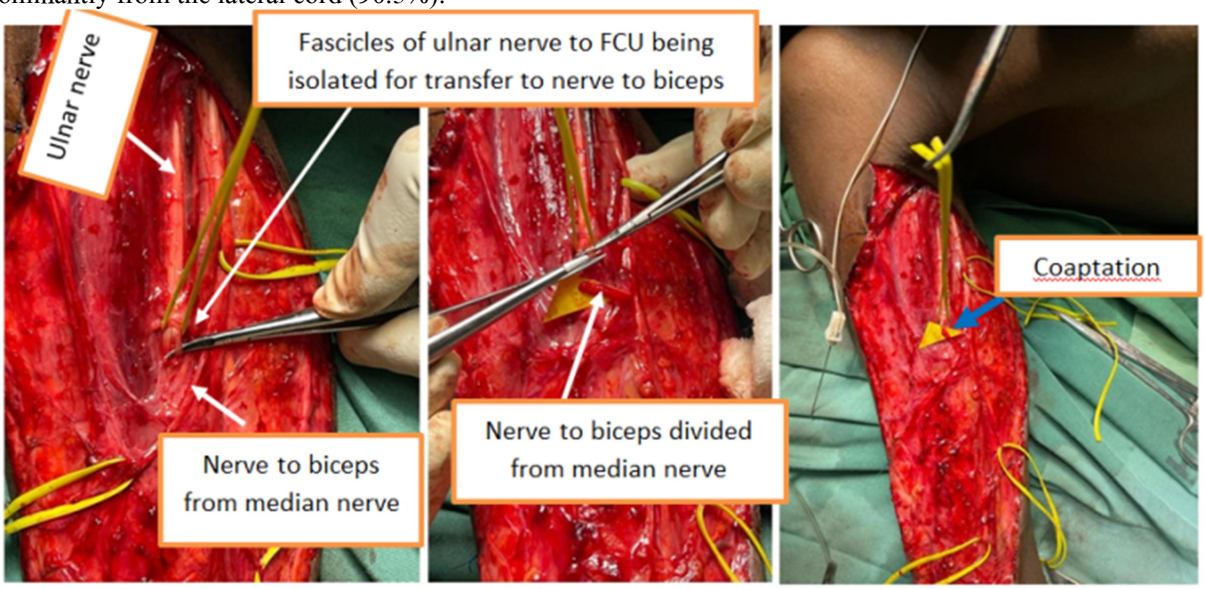

Figure 2: demonstrating transfer of flexor carpi ulnaris (FCU) ulnar nerve fascicles to biceps brachii

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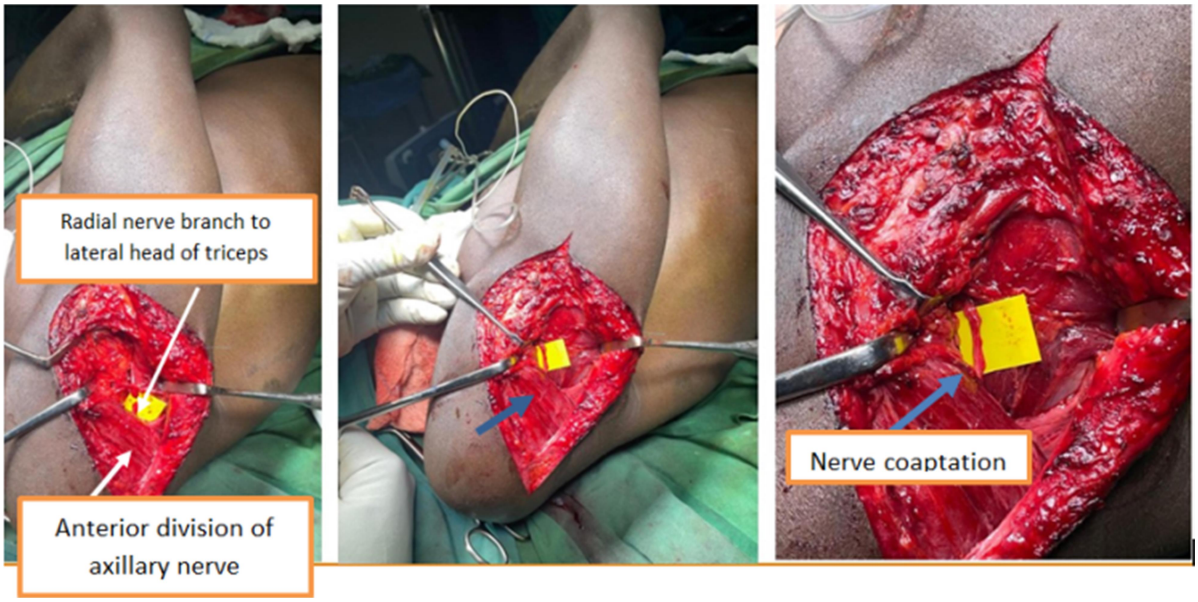

Figure 3. Demonstrating radial nerve branch to the lateral head of triceps to the anterior division of the axillary nerve transfers.

Conclusion

It is crucial to take into account anatomical variations in the formation of the brachial plexus during surgical exploration of brachial plexus injuries to prevent damage to these vital nerves.

In clinical practice, it is essential for surgeons to approach the procedure with an open mind. Surgical approaches should be dynamic, adapting to anatomical variations discovered intraoperatively.

Conflicts of interest

The authors declare no conflict of interest.

Acknowledgements

We extend our heartfelt gratitude the patient who entrusted us with his care

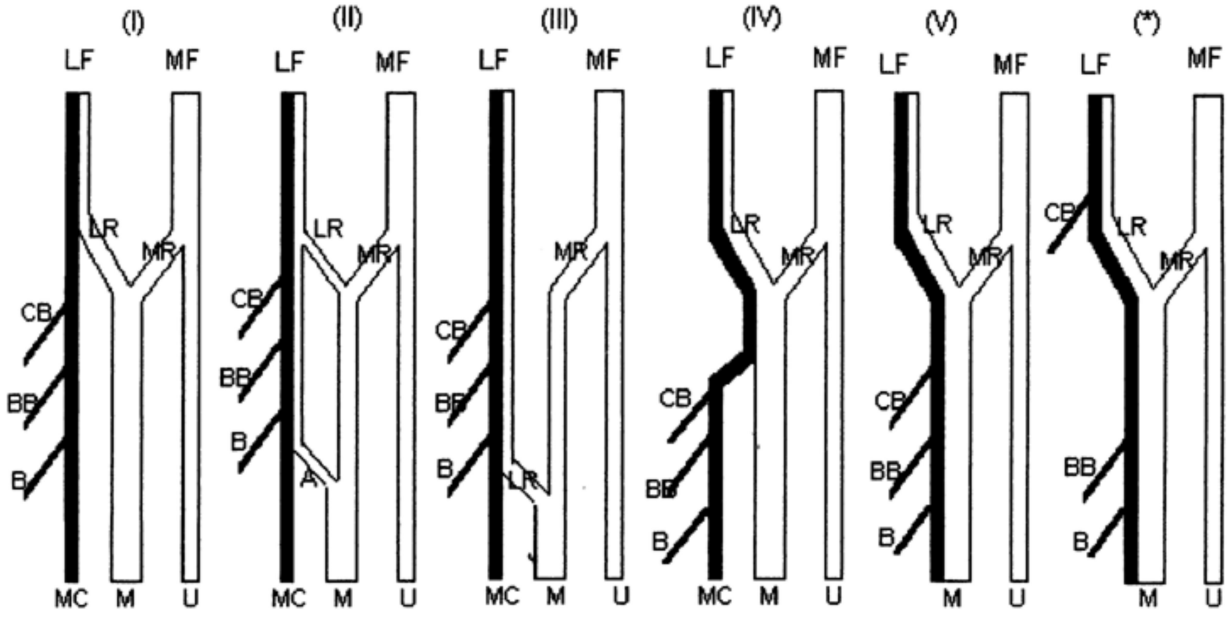

Figure 4. Showing illustrations of five types of the musculocutaneous and the median nn. (I-V) and our case (*). LF, lateral cord MF, medial cord MC, musculocutaneuos n. M, median n. U, ulnar n. CB,coracobrachialis m. BB, biceps brachii m. B, brachialis m.(7)

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 DOI 10.5281/zenodo.10648738