Case Report

Complex Branching Patterns of the Left Brachial Plexus: A Case Report of Five Concurrent Anatomical Variations

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Abstract

Background
Anatomical variations of the brachial plexus are common and may significantly influence surgical approaches, regional anaesthesia, and the interpretation of peripheral nerve injuries. Variations involving the musculocutaneous nerve and its relationship with the median nerve are particularly important given their clinical implications.
Case presentation
During a routine surgical anatomy dissection course on a formalin-fixed adult male cadaver, a rare variation was identified in the left upper limb. A 4 cm common trunk arising from both the medial and lateral cords of the brachial plexus bifurcated into the median and musculocutaneous nerves. The musculocutaneous nerve did not pierce the coracobrachialis muscle but supplied it via an accessory branch, with an additional branch arising directly from the lateral cord. A distal communicating ansa brachialis between the musculocutaneous and median nerves was also observed.
Conclusion
This case highlights a rare median–musculocutaneous trunk with associated neural communications and atypical muscular innervation. Awareness of such variations is essential for clinicians involved in upper limb surgery, peripheral nerve repair, and regional anaesthesia, as they may alter expected anatomical landmarks, influence surgical strategies, and affect clinical outcomes.
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Keywords: Brachial plexus variation, musculocutaneous nerve, median nerve, peripheral nerve anatomy, case report

Introduction

The brachial plexus is a complex neural network formed by the anterior rami of spinal nerves C5 to T1, responsible for motor and sensory innervation of the upper limb. These nerve roots organise to form three trunks, six divisions, three cords, and five main branches to the upper extremity. Although its general pattern is well established, anatomical variations are frequently encountered, with resulting important clinical implications. The musculocutaneous nerve typically arises from the lateral cord, pierces the coracobrachialis muscle, and supplies the anterior compartment of the arm before continuing as the lateral antebrachial cutaneous nerve. The median nerve therefore receives a combination of branches from the lateral and medial cords and contains fibers from C6 toT1 and sometimes of C5.[1,2]

Variations involving communication between the musculocutaneous and median nerves are among the most commonly reported anomalies of the brachial plexus. These may alter expected anatomical relationships and complicate clinical diagnosis of nerve injuries, surgical procedures, and brachial plexus blockade.[2]

This report describes a rare variation characterised by a long common median–musculocutaneous trunk with multiple atypical features and discusses its clinical relevance.

Case presentation

A 34-year-old formalin-fixed adult male cadaver was dissected during a routine surgical anatomy dissection course on 21st October, 2023, at the Department of Human Anatomy, University of Rwanda. Dissection of the left upper limb revealed an unusual configuration of the brachial plexus in the axillary region. The dissection followed all the steps from the subcutaneous tissue and superficial fascia to exposure of neurovascular structures. Particular attention was directed towards the course and branching of the musculocutaneous and median nerves, which appeared atypical.

A common neural trunk was identified, formed by contributions from both the medial and lateral cords. We named this anatomical variation the median–musculocutaneous trunk. This trunk extended distally for 4 cm before dividing into two terminal branches: the median nerve medially and the musculocutaneous nerve laterally.

The musculocutaneous nerve followed an atypical course. It did not pierce the coracobrachialis muscle as expected, but instead gave a branch to the muscle externally. In addition, a separate muscular branch to the coracobrachialis originated directly from the lateral cord, resulting in dual innervation of the muscle.

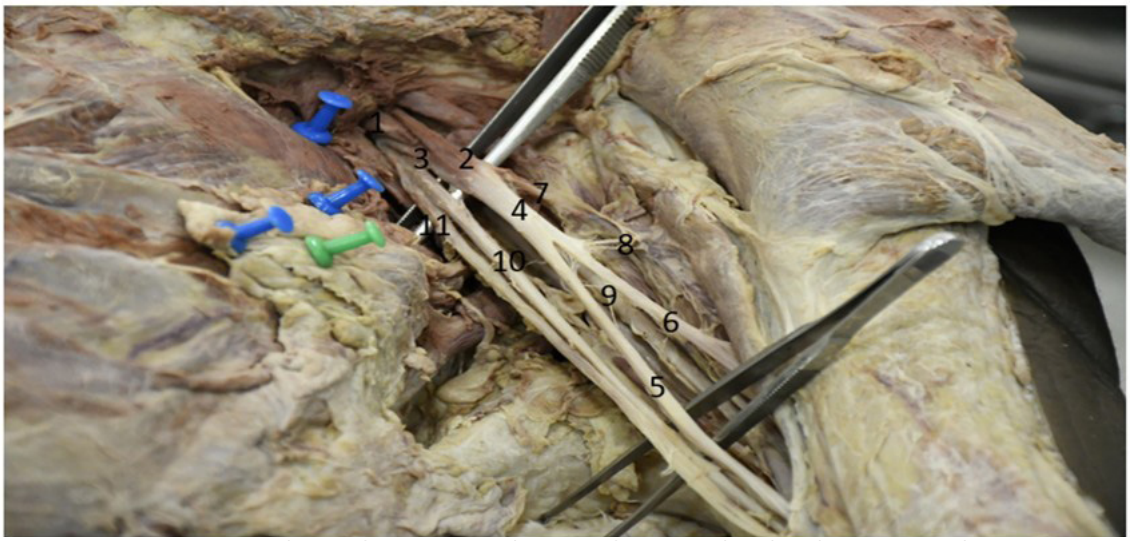

Figure1. Topography of a Complex Left Brachial Plexus with Five Distinct Anatomical Variations

Legend: 1. Axillary artery, 2. lateral cord, 3. Medial root of median nerve from medial cord, 4. median-musculocutaneous trunk, 5. median nerve, 6. musculocutaneous nerve, 7. branch to the coracobrachialis from lateral cord, 8. second branch to the coracobrachialis muscle from musculocutaneous nerve, 9. ansa brachialis (communication between musculocutaneous and median nerves), 10. ulnar nerve, 11. medial cutaneous nerve of the forearm.

A distal communicating branch between the musculocutaneous and median nerves: ansa brachialis (labelling 9) was also observed. The ulnar nerve and other surrounding structures followed their typical anatomical course.

These findings represent a combination of rare anatomical variations involving trunk formation, nerve course, and inter-nerve communications. The details of our report architecture are shown in the Figure1.

Discussion

In recent years, Anatomical variations of the musculocutaneous and median nerves have been widely reported, particularly regarding their relationships within the arm, primarily to reduce the risk of iatrogenic injury during surgical interventions.[3–5]

The musculocutaneous nerve may exhibit several anatomical variations. It can give off a distinct branch to the coracobrachialis muscle without piercing it and may course parallel to the median nerve for a variable distance before passing beneath the biceps brachii. In some cases, fibers destined for the median nerve may initially travel within the musculocutaneous nerve before rejoining the median nerve trunk. Additionally, it may provide muscular branches to the pronator teres or, in rare instances, may innervate the dorsum of the thumb when the superficial branch of the radial nerve is absent.[9]

Classification systems such as those proposed by Le Minor and by Venieratos and Anagnostopoulou attempt to categorise these variations based on patterns of communication and nerve formation.[4,6,7] The present case partially resembles previously described patterns,[4,6,7] but does not fit completely within any single classification. The presence of a long common trunk, absence of coracobrachialis penetration, dual muscular innervation, and distal communication between nerves through the ansa brachialis represents a unique combination of features.

From a clinical perspective, such variations are highly relevant. During surgical procedures in the axillary and brachial regions, unexpected nerve courses may increase the risk of iatrogenic injury. Similarly, regional anaesthesia techniques relying on standard anatomical landmarks may be less effective or incomplete.[8] In the context of nerve injuries, communications between the musculocutaneous and median nerves may lead to atypical clinical presentations. Injury proximal or distal to the communicating branches can result in partial preservation or unexpected loss of function, complicating diagnosis and management.[8,9]

The observed branching pattern in our case suggests a potential compensatory mechanism in cases of injury occurring proximal or distal to the median–musculocutaneous trunk. Proximally, compensation may be facilitated by dual innervation of the coracobrachialis muscle, via a direct branch from the lateral cord and an additional branch from the musculocutaneous nerve, forming an ansa brachialis–like configuration. Distally, compensatory function may be maintained through the presence of the ansa brachialis.

Furthermore, knowledge of such variations is important in nerve transfer procedures. Alternative neural pathways may provide opportunities for surgical reconstruction or influence the choice of donor and recipient nerves.[10]

Overall, this case contributes to the growing body of evidence highlighting the variability of brachial plexus anatomy and underscores the importance of careful anatomical

assessment in both clinical and surgical practice.

Conclusion

This report describes a rare anatomical variation involving a long median–musculocutaneous trunk, absence of coracobrachialis penetration, dual muscular innervation, and distal neural communication through the ansa brachialis. Awareness of such variations is essential for improving surgical safety, enhancing diagnostic accuracy, and optimising outcomes in regional anaesthesia and nerve repair procedures.

Ethics considerations

The use of cadavers during the dissection course complied with institutional ethical standards of the University of Rwanda. No identifying information was associated with the specimens.

Authors' contribution

All the authors contributed to the conception, drafting, and final approval of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

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Generative AI

No artificial intelligence (AI) tools were used in this study.

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