

CASE REPORTS

A unique case of brachial plexus form lateral to the axillary artery: a case reportEranga URR¹, Samarawickrama MB¹¹*Department of Anatomy, Faculty of Medicine, University of Ruhuna***Abstract**

Anatomical variations of the formation and distribution of the brachial plexus are fairly common and it is related to the embryological development of upper limbs. The present report describes an unusual variation of the brachial plexus in which the cords are arranged lateral to the 1st and 2nd parts of the axillary artery. Therefore, some of the main terminal branches show different relationship to the 3rd part of the axillary artery and the brachial artery. Awareness of such variations of the formation, relations and distribution of main branches of brachial plexus is of remarkable clinical importance for clinicians who carry out surgical, interventional radiological and anaesthetic procedures in the axillary region.

Keywords: Brachial plexus, cords variation, anatomical variations, median nerve, ulnar nerve

Introduction

Brachial plexus is essentially a network of nerve fibres which provide motor and sensory innervation for the upper extremity. It is comprised of ventral rami of lower cervical segments C₅ to C₈ and the first thoracic segment (T₁) which form the roots of the plexus¹. For the descriptive purposes, this neve

plexus is divided into roots, trunks, divisions, cords and branches. Its five roots are located in between the anterior and middle scalene muscles within the posterior triangle of the neck. Roots join to form the trunks as follows. The C₅ and C₆ unite to form the upper trunk, C₇ and T₁ unite to form the lower trunk and the C₈ continues alone as the middle trunk.

Each trunk divides into anterior division and posterior divisions behind the middle third of the clavicle. These six divisions link up again to form cords behind the 1st part of the axillary artery and arranged around the second part of the axillary artery according to their respective positions; lateral, medial and posterior. Each of these cords acquires their name from the position around the second part of the axillary artery.

At the lower border of Pectoralis minor muscle, the brachial plexus is divided into its main branches which are having a similar relation to the third part of the axillary artery as their parent cords (Fig 1).

We have encountered an unusual case in which the cords of the plexus are arranged on the lateral side of the axillary artery during routine educational dissections of the cadavers in the Department of the Anatomy Faculty of Medicine University of Ruhuna, Sri Lanka.



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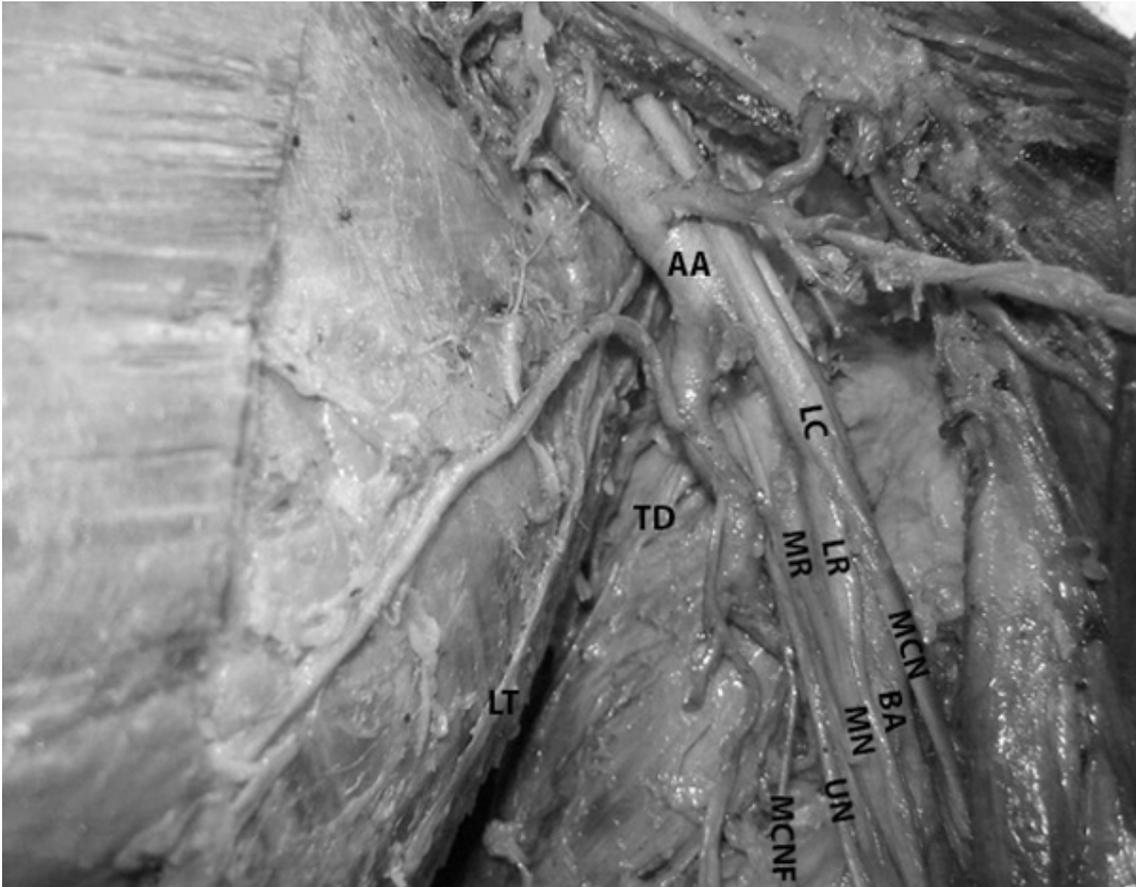


Figure 1: Normal anatomical relation of brachial plexus to the axillary artery and brachial artery.

(AA - Axillary artery, BA - Brachial artery, LC - Lateral cord, LR - Lateral root of median nerve, MR - Medial root of median nerve, MN - median nerve, MCN - Musculocutaneous nerve, UN - Ulnar nerve, MCNF - Medial cutaneous nerve of the forearm, TD - Thoracodorsal nerve, LT - Long thoracic nerve)

Case report

On routine dissection of the axilla of an adult male cadaver of Sri Lankan origin, we encountered that the all three cords (medial, lateral and posterior) of the brachial plexus were positioned lateral to the axillary artery throughout its course. Although the main branching pattern of the brachial plexus noted to be normal, their anatomical relations to the axillary artery are altered.

The nerves of the medial cord; (ulnar, medial cutaneous nerve of the forearm

(MCNF) and arm) begin lateral to the artery. The ulnar nerve and the MCNF cross the 3rd part of the axillary artery from lateral to medial. The median nerve forms anterior to the ulnar nerve by joining its lateral and medial roots. Median nerve continues medial to the brachial artery up to the cubital fossa. Both roots of the median nerve noted to be on the lateral side of the axillary artery (Fig 2). Therefore, neither the roots nor the median nerve crosses the axillary or brachial artery throughout its course. Branches of the lateral cord

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take normal pathway thus musculocutaneous nerve enters the coracobrachialis muscle. The posterior cord lies in between and posterior to the medial and the lateral cords (Fig 3). Therefore, the radial nerve does not relate posterior to the axillary artery. Radial nerve exits the axilla through the lower triangular space to pass behind the spiral groove of the humerus along with the profunda brachii vessels.

However, the upper part of the left brachial plexus above the level of the clavicle and its relations were normal. The right-side brachial plexus was also carefully inspected subsequently and it was found to be normal.

Discussion

Anomalies of the brachial plexus that relate to the formation and distribution of its main nerves are not uncommon and have been widely documented². These abnormalities include variations of roots³, trunks⁴, different combinations of formation of cords⁵⁻⁶, variations of its branches⁶⁻⁷ and different relations to the axillary artery⁸⁻⁹.

According to the available literature, the formation of the whole brachial plexus lateral to the axillary artery is very rare. However, Satyanarayana et al in Nepal report a case where all three cords of the brachial plexus form lateral

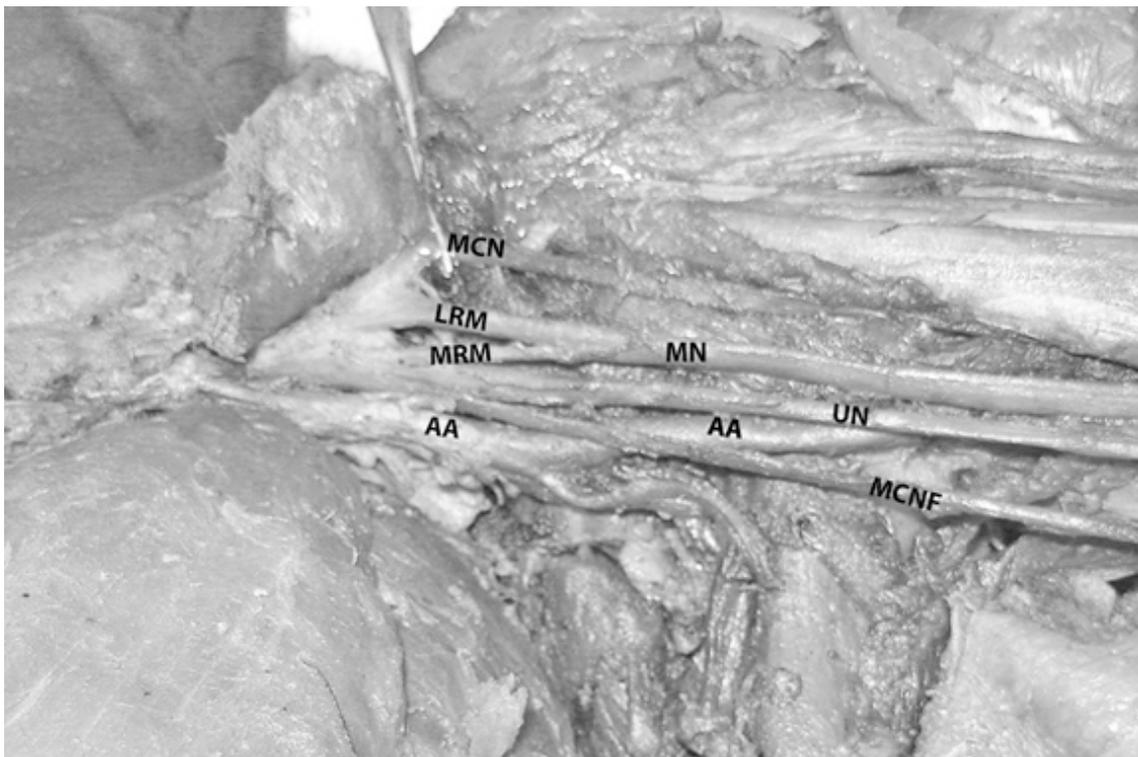


Figure 2: Abnormal relation of cords of brachial plexus and its main terminal branches to the axillary artery in the left upper limb (AA - Axillary artery, MCN - Musculocutaneous nerve, LRM - Lateral root of the median nerve, MRM - Medial root of the median nerve, MN - Median nerve, UN - Ulnar nerve, MCNF - Medial cutaneous nerve of the forearm, MC - Medial cord, LC - Lateral cord)

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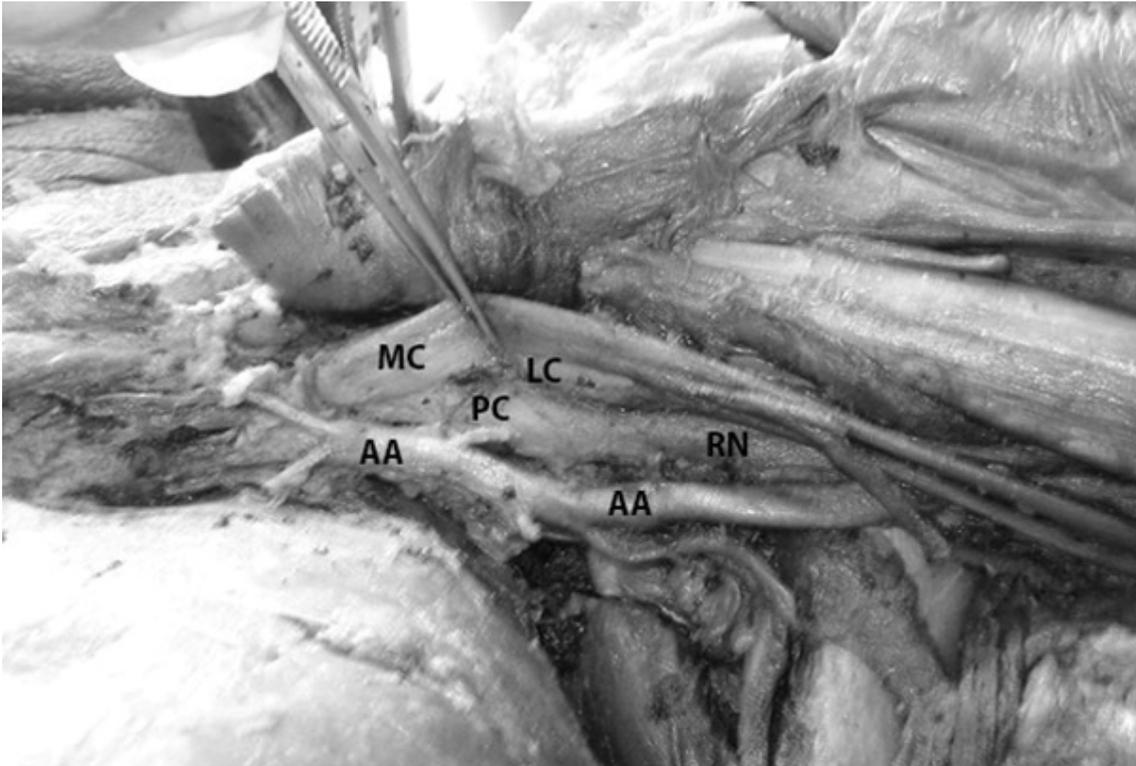


Figure 3: The posterior cord lies behind the other two cords (lifted up) - (AA - Axillary artery, MC - Medial cord, LC - Lateral cord, PC - Posterior cord, RN - Radial nerve)

to the axillary artery¹⁰. But his case is different from ours by having a different relationship in the formation and course of the main nerves. In our case, the median nerve forms lateral to the 3rd part of the axillary artery and anterior to the ulnar nerve. The case reported in Nepal, the median nerve forms around the profunda brachii artery. On the other hand, the ulnar nerve in our case forms at the usual level and crosses the 3rd part of the axillary artery along with the MCNF anteriorly from lateral to medial and pass medial to the artery. In the case reported in Nepal the ulnar nerve begins at a lower level close to the formation of the median nerve and continue to pass on the lateral side of the brachial artery.

There are other cases where the brachial plexus form lateral to the axillary artery. But in those cases, the brachial plexus itself is reported to have variations¹¹.

This means that our case is unique in keeping the lateral relation of cords to the 1st and 2nd part of the axillary artery and forming the branches lateral to the 3rd part of the axillary artery in normal pattern without any variation of the plexus itself. Therefore, our case is the first-ever case of this nature report in the literature.

The anatomical variations of the brachial plexus can be explained based on its embryogenic development. The upper limb buds are formed in the seventh week of development and they

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first lie opposite the lower five cervical and upper two thoracic segments. Ventral primary rami from the corresponding spinal nerves infiltrate into the mesenchyme establishing an intimate contact with the mesodermal condensations¹².

After that, the finding of the pathway of the nerve fibres depends on various factors like surface receptors and cell adhesions which involve in cell-cell and cell-matrix interactions. Over or under expression of these factors might be responsible for the variations in the formation and relations¹⁰.

A sound knowledge of the variations of the cords of brachial plexus and its terminal branches are imperative for clinicians especially surgeons and anaesthetists. Such anatomical variations may predispose patients to certain pathological conditions like thoracic outlet syndrome and may alter surgical approaches to the brachial plexus¹³.

Elective neurosurgeries in the axillary region require comprehensive knowledge on the anatomy of brachial plexus and a good awareness of these variations¹⁴. Additionally, the structures might be misidentified during surgeries of the cervical spine, particularly in the case of nerve sheath tumours such as schwannomas¹⁵.

Furthermore, the brachial plexus and its branches are susceptible to injury during surgical procedures done in the axillary region, such as emergency axillary exploration following a traumatic upper limb injury³. The plexus may be also vulnerable to injury

during oncological surgical procedures like radical neck dissection and axillary lymph node clearance¹⁰.

Regional anaesthetic procedures such as infraclavicular nerve blocks may be unsuccessful and sometimes damage important nerves of the plexus in complicated cases with anatomical variations¹⁶⁻¹⁷.

When considering the present case where the plexus show different relationship to the axillary and the brachial artery is at high risk in damaging during vascular interventional procedures of the axilla or open vascular surgery in the axillary or brachial artery. Therefore, it is very important to know the presence of such variations even though it is rare.

Conflict of interest

None declared.

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