

Case Report



Replacement of the medial and lateral cords of the brachial plexus by a common cord and its trifurcation into major branches

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ABSTRACT

During routine dissection of the brachial plexus of an elderly female cadaver of Indian origin, an unusual variation was noted on the left side. The roots and trunks were formed as routinely described in textbooks. The upper and lower trunks, each divided into anterior and posterior divisions. However, the middle trunk divided into two branches, an upper and lower, each of which gave an anterior and posterior division. The four anterior divisions so formed fused to form a common cord, which replaced the medial and lateral cords. This common cord was observed lateral to the 2nd part of the axillary artery and trifurcated to form the musculocutaneous, median and ulnar nerves. Associated with this variation were other less striking variations of the brachial plexus and the axillary artery. Such a variant cord and its relationship to the axillary artery needs to be kept in mind while performing surgeries in this region. © IJAV. 2010; 3: 205–207.

Key words [brachial plexus] [common cord] [trifurcation] [axillary artery]

Introduction

In fetal life, the upper limb buds develop as outgrowths from the ventrolateral body wall opposite the lower five cervical and the upper two thoracic segments. The ventral rami of the corresponding spinal nerves enter the limb buds to supply them. These ventral rami rearrange themselves to form the brachial plexus, with its constituent roots, trunks, divisions and cords. The extensor and flexor musculatures are supplied by derivatives of dorsal and ventral segmental branches, respectively [1]. In the view of the fact that complex developmental processes govern its formation, it is not surprising that anatomical variations of the brachial are common. While many of these variations have little functional significance, they nevertheless need to be borne in mind while performing surgery in the axillary region [2]. The present case report describes a highly unusual origin of the musculocutaneous, median and ulnar nerves from a common cord. Associated with this variation were other less striking variations of the brachial plexus and the axillary artery.

Case Report

During routine dissection of the brachial plexus of an elderly female cadaver of Indian origin, an unusual variation was noted on the left side. The roots were contributed by the ventral rami of the fifth to eighth cervical and the first thoracic spinal nerves. The roots formed the upper, middle and lower trunks as commonly described [3]. The upper and lower trunks, each divided into anterior and posterior divisions. However, the middle

trunk divided into two branches, an upper and a lower, each of which gave an anterior and posterior division (Figures 1, 2). The four anterior divisions so formed fused to form a common cord, which replaced the medial and lateral cords. This common cord was observed lateral to the 2nd part of the axillary artery and trifurcated to form the musculocutaneous, median and ulnar nerves (Figures 1, 2). The ulnar nerve at its origin was lateral to the axillary artery, but more distally crossed anterior to the axillary artery to attain a medial relation.

All the four posterior divisions fused to form the posterior cord, from which arose the branches usually described [3]. The medial pectoral nerve was formed by fusion of two branches from each of the anterior divisions of the middle trunk. The medial cutaneous nerve of the forearm arose from the anterior division of the lower trunk.

Both the dorsal scapular and suprascapular arteries arose from the 1st part of the axillary artery, the former more proximally. The dorsal scapular artery passed between the lower and middle trunk. The suprascapular artery was seen to pass between the anterior division of the upper trunk and the anterior division of the upper branch of the middle trunk (Figure 1). On the right side, no major deviation from the usually described pattern in the formation and branching of the brachial plexus was observed.

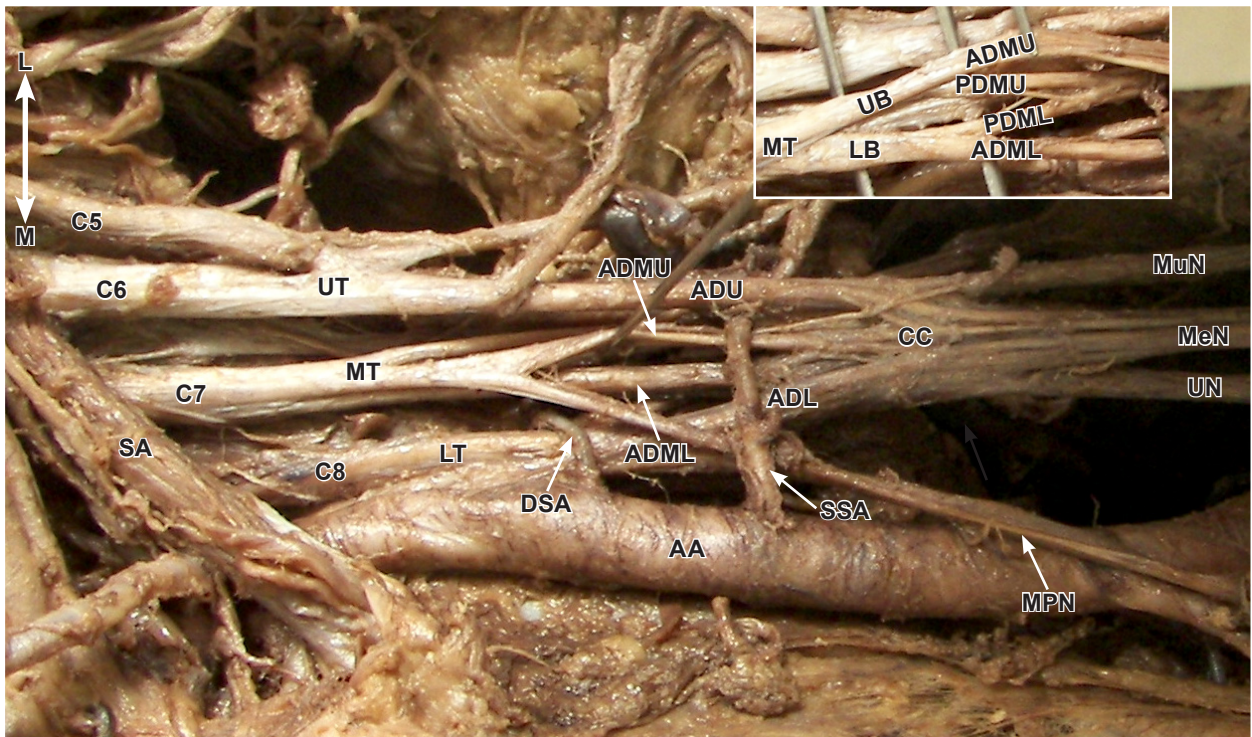


Figure 1. Anterior view of the left brachial plexus with the arm abducted. The contribution from T1 is not visualized as it is obscured by the axillary artery (AA). Inset shows the division of the middle trunk (MT) into upper and lower branches (UB and LB), each giving off an anterior division (ADMU and ADML) and posterior division (PDMU and PDML). (L: lateral; M: medial; SA: scalenus anterior; C5–C8: ventral rami of fifth to eighth cervical nerves; UT and LT: upper and lower trunks; ADU and ADL: anterior divisions of upper and middle trunks; CC: common cord; MuN: musculocutaneous nerve; MeN: median nerve; UN: ulnar nerve; MPN: medial pectoral nerve; DSA: dorsal scapular artery; SSA: suprascapular artery)

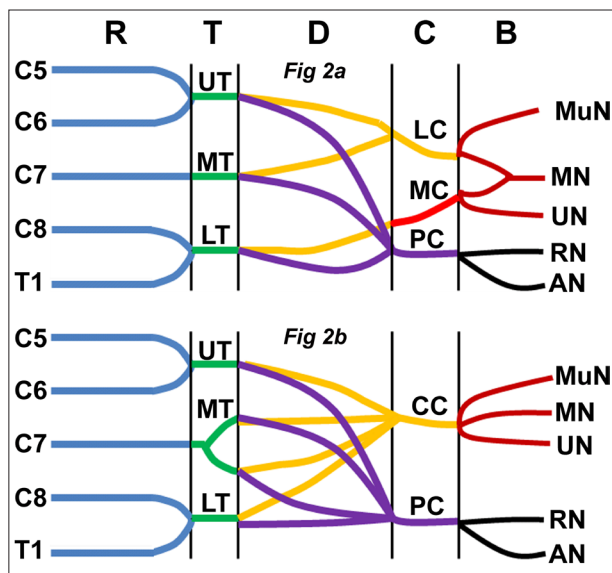


Figure 2. a) Simplified schematic diagram of a textbook description of the brachial plexus. b) Simplified schematic diagram of the brachial plexus as described in the present case. (R: roots; T: trunks; D: divisions –anterior divisions in yellow and posterior divisions in violet; C: cords; B: branches of cords; C5–T1: roots of brachial plexus; UT: upper trunk; MT: middle trunk; LT: lower trunk; LC: lateral cord; MC: medial cord; PC: posterior cord; CC: common cord; MuN: musculocutaneous nerve; MN: median nerve; UN: ulnar nerve; RN: radial nerve; AN: axillary nerve)

Discussion

While numerous variations have been described in the formation of the brachial plexus, division of the middle trunk into upper and lower branches, each giving off anterior and posterior divisions has not been previously described [4–10]. The fusion of the medial and lateral cords to form a single cord has been documented, though its rarity is exemplified by the fact that it has not been reported in recently conducted large studies of the brachial plexus [5–8]. Kerr in his treatise on the brachial plexus has documented this variation in 3 of 175 (1.71%) brachial plexuses [4]. In these three specimens, the single cord so formed, trifurcated to form the ulnar, median and musculocutaneous nerves, just as in the present case. However, the present case differs in that replacement of the medial and lateral cords by a single cord occurred directly by a fusion of the anterior divisions.

A survey of the literature revealed two case reports in which only a single cord was present [11,12]. The common cord so formed was lateral to the axillary artery, just as in the present case report. A possible explanation for this lies in the fact that separation of the cords is intimately related to the development of the axillary artery [12]. The precursor of the axillary artery, termed the arteria axillaris profunda, perforates through the nerve plate which then separates into bundles. If this precursor regresses, then fusion of the cords is

likely to occur. The axillary artery is then likely to be derived from compensatory development of the arteria axillaris superficialis. Alternatively, the cause for altered relationship of the common cord to the axillary artery could be the embryological origin of the subclavian artery from a more distal cervical intersegmental artery rather than the more usual 7th cervical intersegmental artery [13].

Numerous studies have documented and classified variations in the formation of the median and musculocutaneous nerves [14–18]. However, these studies have not included trifurcation of a common cord to form the ulnar, median and musculocutaneous nerves as described in the present study. This variation could have potential clinical implications while performing axillary surgery, as a result of the unusual relationship of the axillary artery with the cords of the brachial plexus and their branches. Also, injury to the common cord at the point of trifurcation could result in serious compromise of upper limb function.

In a study conducted in Brazil, the medial pectoral nerve arising from the anterior division of the middle trunk was observed in 9% of limbs [8]. The origin of the medial

cutaneous nerve of the forearm from the lower trunk of the brachial plexus has been reported with an incidence varying from 2% to 9% [4,8].

The suprascapular artery is usually a branch of the thyrocervical trunk, which arises from the 1st part of the subclavian artery. When this is the case, the suprascapular artery passes over the brachial plexus. When the artery arises more distally it passes through the brachial plexus as in the present case. The suprascapular artery rarely arises from the axillary artery, though such an origin has been reported with a frequency as high as 10% in some studies [5]. Of 178 dorsal scapular arteries studied, Huelke noted that 3 (1.8%) of them arose from the axillary artery [19]. When the dorsal scapular artery arises from the subclavian artery, it usually passes between either the upper and middle or the middle and lower trunk of the brachial plexus, as described here [5].

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