Aparato Locomotor

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Variations in the formation and branching pattern of brachial plexus

Variaciones en la formación y patrón de ramificación del plexo braquial

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Abstract

Aim: Brachial plexus has a complex anatomical structure. Variations in brachial plexus are important since it has close relation to important structures.
Method: 50 upper limbs were studied from the adult cadavers of which 44 from male and 6 from female cadavers.
Result: In 20% of the limbs musculocutaneous nerve did not pierce the coracobrachialis muscle. Communication between the median nerve and musculocutaneous nerve was found in 2% of the limbs. In 4% of cases Axillary nerve supplied the long head of triceps. In one limb there was an unusual formation of long thoracic nerve from C6 &C7 and no contribution from C5. In the same limb formation of posterior trunk was different. Most of the variations were unilateral.
Conclusion: Knowledge of the variations in the brachial plexus is important for the anatomist, radiologist, surgeons, and anaesthesiologist.

Keywords: brachial plexus, posterior cord, axillary nerve, long thoracic nerve, musculocutaneous nerve

Resumen

Objetivo: *Plexo braquial tiene una estructura anatómica compleja. Las variaciones en el plexo braquial son importantes ya que tiene estrecha relación con las estructuras importantes.*
Método: *50 miembros superiores fueron estudiados a partir de los cadáveres adultos de los cuales 44 de sexo masculino y 6 de cadáveres femeninos.*
Resultado: *En el 20% de los miembros del nervio musculo cutáneo no perforar el músculo coracobraquial. La comunicación entre el nervio mediano y el nervio musculo cutáneo se encontró en 2 % de las extremidades. En el 4% de los casos del nervio axilar suministra la cabeza larga del tríceps. En una extremidad no había una formación inusual del nervio torácico largo de C6 y C7 y ninguna contribución de C5. En la misma formación extremidad del tronco posterior era diferente. La mayor parte de las variaciones eran unilaterales.*
Conclusión: *El conocimiento de las variaciones en el plexo braquial es importante para el anatomista, radiólogo, cirujanos y anestesiólogo.*

Palabras clave: *plexo braquial, fascículo posterior, axilar nerviosas, nervio torácico largo, nervio musculo cutáneo*

Introduction

The brachial plexus is a network of nerves which supplies motor, sensory, and sympathetic fibres to the upper extremity.

The brachial plexus is a complex network of nerves which extends from the neck to the axilla and supplies motor, sensory, and sympathetic fibres to the upper extremity. The brachial plexus is formed by the union of ventral rami of the lower four cervical and the first thoracic nerves. The brachial plexus, divided into supraclavicular and infraclavicular parts. The ventral rami of C5 and C6 unite to form superior trunk, C7 becomes middle trunk and C8 and T1 form inferior trunk. These three trunks divide into anterior and posterior divisions behind the clavicle. The infraclavicular part of brachial plexus consists of three cords, lateral, medial and posterior.

Posterior cord is formed by the union of posterior divisions of superior, middle and inferior trunks. The lateral cord is formed by the union of anterior division of superior and middle trunk. The medial cord is formed by the continuation of the anterior division of inferior trunk.[1] It must be remembered that the brachial plexus is merely a routing mechanism to get the nerves with common function into proper terminal nerves and thus errors in distribution may occur that are corrected distally in the arm, forearm or hand, resulting in anatomical variations of the plexus. Some variations are vulnerable to damage during radical neck dissection and other surgical procedures in the axilla and upper arm. Unusual branching pattern of the brachial plexus may compress the axillary vessels; hence variations in the brachial plexus have clinical and surgical importance.[2]

Material and Methods

50 upper limbs from 25 embalmed adult cadavers of both the sexes (22 male and 3 female cadavers) were studied at M.S.Ramaiah medical college and ESIC medical college. In all the limbs the brachial plexus was studied to its entire course. Data obtained were recorded in order and analyzed.

Observations and Results

In 20% of the limbs musculocutaneous nerve has not pierced the coracobrachialis muscle. Communication between the median nerve and musculocutaneous nerve was found in 2% of the limbs. **(Fig.1)**

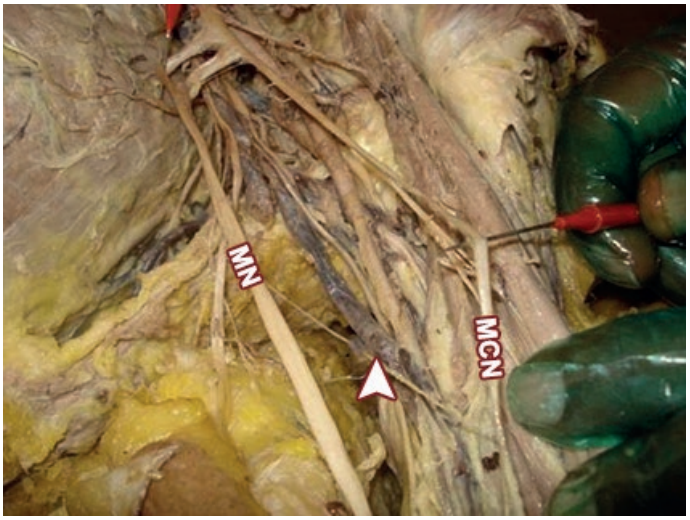

Fig. 1: Communication between the median nerve and musculocutaneous nerve. MN: Median nerve. MCN: Musculocutaneous nerve. (Arrow shows communicating nerve)

In right side of the one limb there was an unusual formation of long thoracic nerve from C6 & C7 and no contribution from C5. **(Fig.2)**

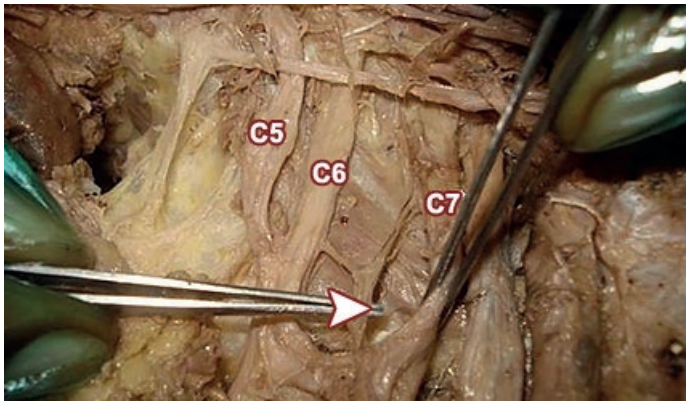

Fig. 2: Formation of long thoracic nerve from C6 & C7 and no contribution from C5. (Arrow shows long thoracic nerve)

In the same limb formation of the posterior cord was different. Posterior cord was formed by two parts, upper and lower. The upper part was the continuation of posterior division of upper trunk and lower part was formed by the union of the posterior divisions of middle and lower trunks. Upper posterior cord gave off lower subscapular, axillary and three muscular branches in place of upper subscapular nerve. The lower posterior cord after giving off thoracodorsal nerve joins the upper posterior cord to form radial nerve. **(Fig.3, 4, 5)**

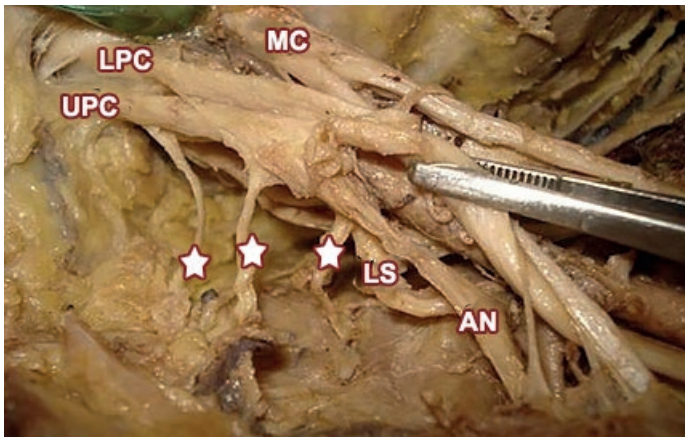

Fig. 3: Posterior cord was formed by two parts, upper and lower. UPC: Upper posterior cord. LPC: Lower posterior cord. MC: Medial cord. AN: Axillary nerve. LS: Lower subscapular nerve. (Stars shows Muscular branches)

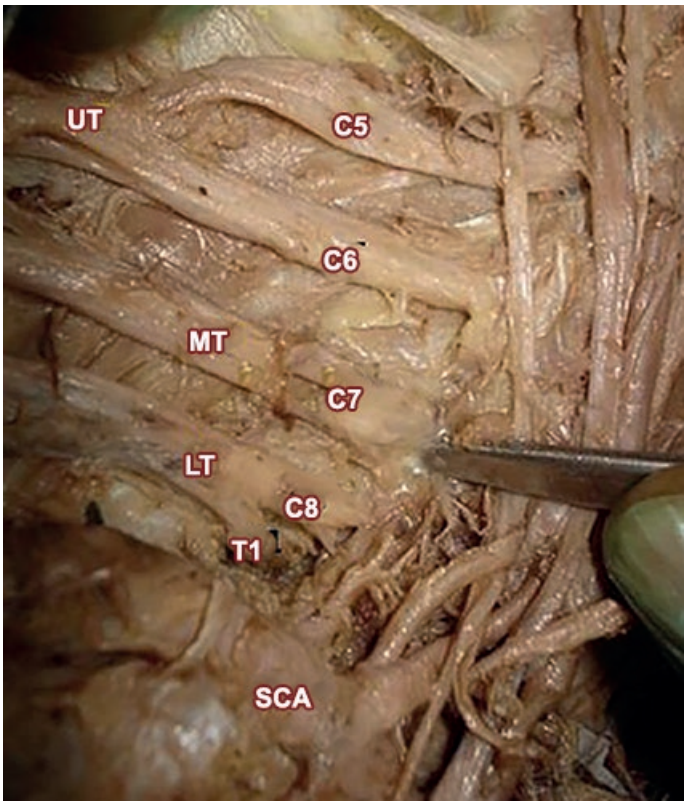

Fig. 4: Formation of the brachial plexus. (UT: Upper trunk. MT: Middle trunk. LT: Lower trunk. SCA: Subclavian artery)

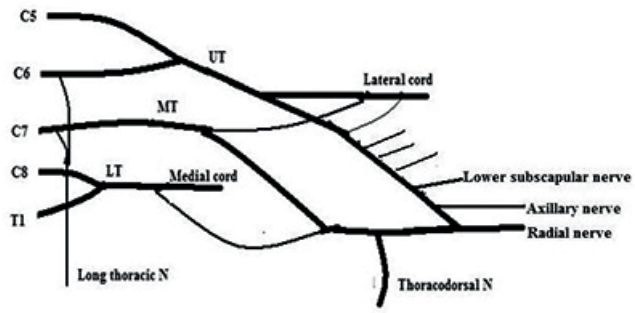

Fig. 5: Posterior cord was formed by two parts, upper and lower. The upper part was the continuation of posterior division of upper trunk and lower part was formed by the union of the posterior divisions of middle and lower trunks. (UT: Upper trunk. MT: Middle trunk. LT: Lower trunk)

In the same case a small communicating nerve was observed between upper posterior cord and lateral cord. **(Fig. 6)** Most of the variations were unilateral. In 4% of cases axillary nerve supplied the long head of triceps.

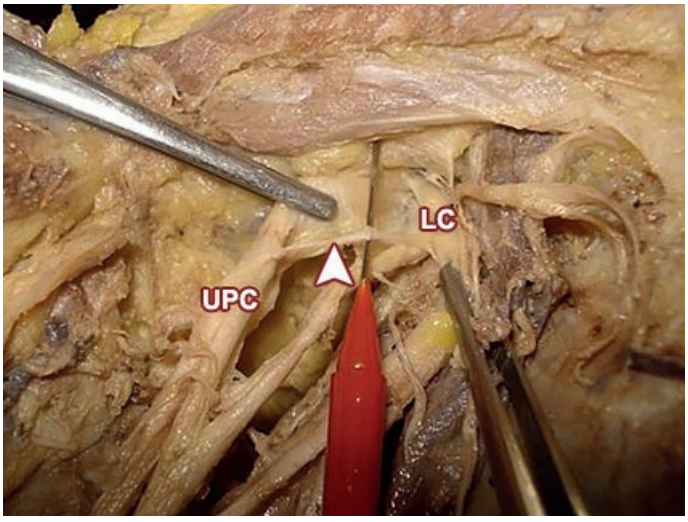

Fig. 6: Communication between upper posterior cord and lateral cord (UPC: Upper posterior cord. LC: Lateral cord. Arrow shows communicating nerve)

Discussion

Guerri-Guttenberg RA reported communications were seen between the musculocutaneous nerve (MC) and median nerves in 53.6%. In six out of 54 dissections where the MC was present, the nerve did not pierce the coracobrachialis muscle.[3] In our study it was 2%. Le Minor JM reported a rare variant of the origin of the median and the musculocutaneous nerve. The lateral cord pierced the coracobrachialis muscle, gave muscular branches to the coracobrachialis and biceps brachii, and then divided at the middle of the upper arm in two terminal branches. The first one trifurcated, giving two branches for the brachialis muscle, and the lateral cutaneous nerve of forearm, the second one corresponded to the lateral root of the median nerve. This lateral root joined the medial root, and gave the proper median nerve. [4]

Venieratos D described three types of communications based on the sites of communication. Type I: The communication was proximal to the entrance of the musculocutaneous nerve into coracobrachialis (9/22); Type II: The communication was distal to the muscle (10/22); Type III: The nerve as well as the communicating branch did not pierce the muscle (3/22).[5] Loukas M classified the communication patterns as Types I, II, III and IV. Type IV (8%), the communications were proximal to the point of entry of the MCN into the coracobrachialis and additional communication took place distally.[6] In our study it was Type II.

Wu-chul song et.al reported a case of long thoracic nerve formation from C6 and C7 and no contribution from C5.[7] One case of our study shows the same pattern.

Kumar MRB and Jamuna M reported that the posterior cord was splitting into anterior and posterior divisions and the radial nerve was formed by the union of the two divisions and the axillary nerve was arising from the posterior division.[8-9] Bertha et al. reported case where posterior cord was formed by two parts, upper and lower. The upper part was the continuation of posterior division of upper trunk. The lower part was formed by the union of the posterior divisions of middle and lower trunks. The upper posterior cord continued as axillary nerve after giving off upper and lower sub scapular nerves and upper root of radial nerve. The lower posterior cord after giving off thoracodorsal nerve continued as lower root of radial nerve and joined with the upper root to form radial nerve.[10] Our study coincides with the Bertha's report.

Rezzouk and De Sèze did extensive study on patients and on the cadavers, to show that the motor branch to long head of the triceps arise from axillary nerve.[11-12] In our study 4% of cases the long head of triceps were supplied by axillary nerve.

Conclusion

Variations in the formation of nerve plexus are common. Some are of greater clinical significance and few of them are of academic interest. Though the variations mentioned may not alter the normal functioning of the limb of the individual, but knowledge of the variations is of importance to be kept in mind by radiologist, surgeons and anaesthesiologist.

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