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RESEARCH ARTICLE

Anatomico Surgical Variations In Lateral Cord of Brachial Plexus

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Abstract

The study of variations in brachial plexus has gained more importance due to the wide use and reliance on computed imaging in diagnostic medicine. Also, presence of anatomic variations of the peripheral nervous system is often used to explain unexpected clinical signs and symptoms of nerve palsy syndrome and vascular problems. Imaging of brachial plexus can be difficult because of its anatomy and location. The study of brachial plexus and its variations is revealed better by dissection than by investigative procedures since better exposure of the part provides ready accessibility for detailed study

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INTRODUCTION

The brachial plexus is a complex network of nerves arising from nerve roots in the neck and continues by dividing into peripheral nerves in axilla. Brachial plexus has a complex structure and is in close relationship with the important anatomical structures. Anatomical variations in different parts of brachial plexus may attribute to unusual formation during the development of trunks, divisions or cords and these variations usually occur at the junction or separation of individual parts. The knowledge of detailed anatomy of brachial plexus along with its variations is of interest to anatomists, radiologists, neurosurgeons, neurologists, vascular surgeons, orthopedicians and anesthesiologists.

Aim of Study :

The main objectives of the study includes the following:

To study the variations in the branching pattern of brachial plexus in axilla.

To study the relationship of brachial plexus with axillary artery.

To observe intercommunications between nerves of brachial plexus.

Material Methods

The present study was conducted at SKIMS Medical College, Department of Anatomy and Shadan Institute of medical sciences, Hyderabad from 2012 to 2015.

Result:

The variations noted were significant . Variations were in the found in the formation of trunks, divisions, cords and terminal branches

Discussion:

Anatomical variations of the peripheral nerves constitute a potentially important clinical and surgical issue. Anomalies of brachial plexus and its terminal branches are not uncommon. They have been invariably studied and widely documented. Variations may occur in the formation of trunks, divisions, cords and terminal branches

In 1873, John C¹ reported a small communicating branch between the medial and lateral roots of median nerve which crossed the axillary artery under the pectoralis muscle. The two roots did not unite in the axilla but joined each other in the middle of the arm. In another subject he reported median nerve was arising from three roots. Third root coming from lateral cord. He also reported a case in which the ulnar nerve was originating from the medial and lateral cords.

In 1877 Walsh² described the variations in the formation of brachial plexus and also in its branches. He reported that 325 plexuses out of 350 he dissected, an additional head of ulnar nerve coming from lateral cord. This additional head was named as lateral head of ulnar nerve. He also observed a communicating branch between medial head of median nerve and lateral cord in 10 cases.

Herringham WP³, in 1887 conducted a study on 175 brachial plexuses and observed that in 36 plexuses there was no real posterior cord formed.

In 1904, G.E.Smith⁴ noted on dissection of adult male cadaver that on both sides, radial nerve gave a large branch immediately below the tendon of teres major, this split into two rami, one of which entered the upper part of the medial head of triceps and the other joined the ulnar nerve.

W. Harris⁵ in 1904 reported that in his study on 4 foetal and 26 adult cadavers he found a fine branch from ulnar nerve communicating with the medial cord in 36% of brachial plexuses. He also stated that he traced a branch which arises from medial cord and runs across the front of axillary artery, passes behind the lateral root of median nerve to join the nerve to coracobrachialis.

In 1939, Miller RA.⁶ reported in his study on arrangement of axillary artery and brachial plexus done on 480 upper extremities, that 8% cases had aberrant relationship.

In 1955 Buch-hansen K.⁷ reported a case in which the medial and lateral roots of the median nerve did not unite in the axillary fossa. Instead they united in the arm, 5 cms distal to the lower border of latissimus dorsi muscle.

In 1985, Watanabe M et al⁸ studied 140 upper limbs and found fusion of the musculocutaneous and the median nerve in two cases.

S.K. Pandey et al⁹ in 2004 studied the anomalies in the formation of the brachial plexus cords and median nerve on axillary region in 172 cadavers. The total incidence of anomaly was 12.8%. All the cords merged to form a common cord in 2.3% cadavers. Absence of the posterior cord was observed in 3.5% cadavers. Anomaly in the formation and course of the median nerve was observed in 7% cadavers.

Moris Loukas et al in 2005 reported observations of a study done on 129 cadavers. In all, eighty-two cadavers contained communication between musculocutaneous and median nerve, with bilateral communications in thirty-seven cadavers and unilateral in forty-five cadavers. In eleven cadavers the musculocutaneous nerve did not pierce the coracobrachialis muscle.

In 2005, Gupta M et al¹⁰ reported a case of left upper limb of 35 year old male cadaver in which formation of Lateral cord was distal than usual, in relation to the second part of axillary artery behind the pectoralis minor muscle. Anterior division of middle trunk gave rise to the nerve to coracobrachialis and an additional lateral root of the median nerve. Communications were also found between additional lateral root of the median nerve and medial root of the median nerve, medial root of median and ulnar nerve, ulnar and radial nerve.

Goyal N et al¹¹ in 2005 reported a case of bilateral formation of median nerve by union of three roots. The additional root was lateral, on both sides. On left side it was arising from the anterior division of middle trunk and on right side it was contributed from the lateral cord.

In 2005, Srijit Das et al¹² reported a case of 55 year old male cadaver in which on right side lateral cord gave two roots to the median nerve. The upper branch united with the medial root of median nerve anterior to axillary artery. The median nerve thus formed was related medially to axillary artery.

Avinash Abhaya et al¹³ in 2006 reported a case of 33 year old male cadaver in which the musculocutaneous nerve was having a dual origin. Variation of its origin, course and distribution was symmetrical bilaterally. The higher origin was reduced to a thin nerve and supplied only coracobrachialis muscle while the lower origin was of normal thickness, supplying other muscles.

Saeed M.A.M et al¹⁴ in 2007 reported a case of 65 year old male cadaver with two communicating branches from lateral cord to the medial root of the median nerve. The lateral cord, after receiving communication, bifurcated into

two branches. The first division gave muscular branches while the second division formed lateral root of the median nerve.

In 2010, Jamuna M et al¹⁵ reported a variation in brachial plexus. Instead of lateral, medial and posterior cords only two cords, anterior and posterior were present lateral to the axillary artery. Anterior cord was represented by fusion of lateral and medial cords. musculocutaneous, median, ulnar, medial cutaneous nerve of arm and forearm originated from the anterior cord. Radial nerve and axillary nerve originated from posterior cord.

Ajay.R.Nene¹⁶ in 2010 reported a case of 65 year old male cadaver in which median nerve was formed by union of two roots posterior to the third part of axillary artery. The fork of the median nerve thus formed was hooked down by another fork formed by third part of axillary artery and one of its branch.

Flora M.F Taylor and associates¹⁷ in 2010 reported a case of a 45 year old male cadaver. In this case the musculocutaneous nerve was absent. Ulnar nerve was formed by lateral and posterior cords. The whole medial cord continued down as medial root of median nerve, which received a lateral root from the lateral cord. After giving lateral root of median nerve, the lateral cord gave off an additional branch that joined the posterior cord to form a short common trunk. This common trunk divided into two – one additional root for median nerve and second continued down as the ulnar nerve.

Sinha R.S et al¹⁸ in 2012 studied forty upper limbs from twenty adult cadavers and observed 5% cases showed variant branching pattern of brachial plexus. In two cases axillary nerve arose from posterior division of upper trunk instead from the posterior cord. In three cases median nerve had an extra root. Communication between median and musculocutaneous nerve was seen in three cases.

Patil S.T et al¹⁹ in 2012 reported a case of adult male cadaver in which, on left side median nerve was formed from lateral cord only. On right side a communicating branch from median nerve to musculocutaneous nerve was present.

Neelanjit K et al²⁰ in 2013 reported that out of sixty upper limbs dissected by them, different types of communications between musculocutaneous and median nerve were observed in seven limbs. In two limbs median nerve was formed by three roots, two lateral and one medial. In one limb musculocutaneous nerve was absent and in another one limb musculocutaneous nerve was fused with median nerve.

Material and Methods

A study was done on properly embalmed and formalin fixed adult human cadavers during routine dissection practice for undergraduate students at SKIMS Department of Anatomy, Shadan institute of Medical Sciences and Dr. V.R.K Women Medical college, Hyderabad during the period of 2012 to 2015.

The study was carried out on eighty brachial plexuses in axilla in forty adult human cadavers. Out of forty cadavers thirty were males and ten females and age group 30-70 years.

Instruments used

1. Scalpel – 6 inches in length with detachable pointed blades
2. Forceps – 4 inches in length : blunt forceps, fine forceps, toothed forceps.
3. Scissors – 10 inches long and straight with blunt tip
4. Gloves – 6 1/2 size
5. Cotton

Method:

The dissection of axilla and arm was done according to the methods described by Romanes in Cunningham's Manual of Practical Anatomy. The skin, superficial and deep fascia of the pectoral and axillary region were incised and reflected. The pectoralis major muscle was cut across the clavicular head reflected laterally to its insertion. Pectoralis minor was removed at its origin and reflected superiorly. Loose connective tissue, fat and lymph nodes from the axilla were removed to expose its contents. The brachial plexus and axillary vessels were exposed. The various components of brachial plexus in this region were delineated by careful fine dissection. Adequate care was taken to preserve its relations to important surrounding structures. Brachial plexus was studied systematically, noting its pattern of branching and relationship to axillary artery. Inter communications between nerves of plexus were also noted.

Inclusion criteria

Adult formalin fixed cadavers irrespective of gender.

Age group varied in between 30 - 70 years.

Exclusion criteria

Cadavers of newborn, infants and children.

Cadavers in which axilla and upper limb is traumatised or with burns

Result and observations

The observations recorded in the present study pertained to the meticulous dissection and naked eye examination of eighty human brachial plexus in axilla. It focused on variations of the brachial plexus in terms of branching pattern of cords and its terminal branches.

Out of forty cadavers dissected, variations in one or more forms was found in nine cadavers. In five cadavers variation was bilateral and in four cadavers it was found to be unilateral.

All the variations were carefully observed and were recorded and tabulated under the following headings:

TABLE 1: Depicting the normal and variants of cords of brachial plexus

Cords	Normal				Variation			
	Right		Left		Right		Left	
	No.	%	No.	%	No.	%	No.	%
No. of cords	40	100	39	97.5	Nil	0	1	2.5
Relation to second part of Axillary artery (AA)	40	100	39	97.5	Nil	0	1	2.5

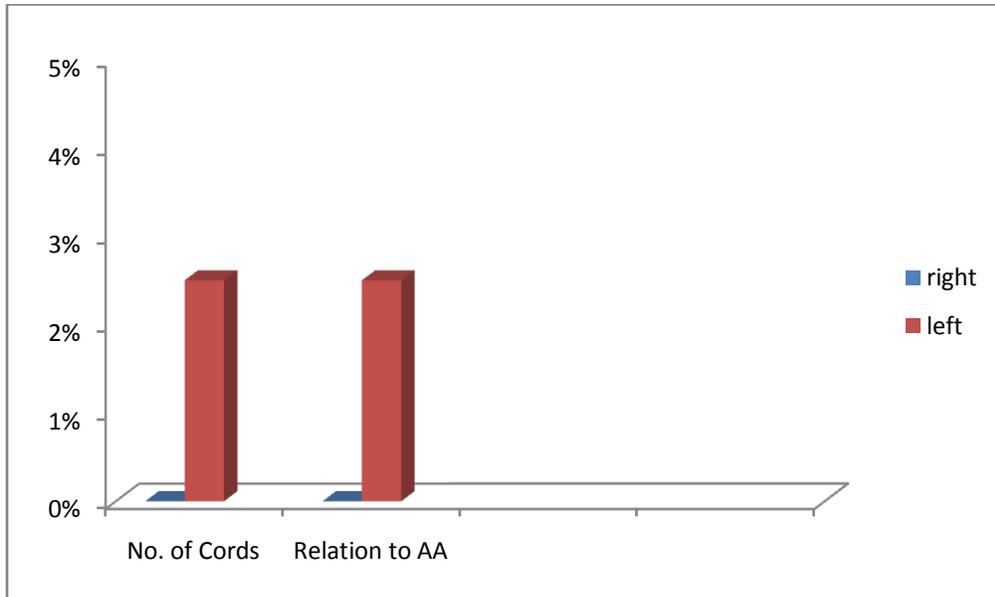
TABLE 2: Depicting normal pattern and variations of lateral cord (LC)

Lateral cord	Normal				Variation			
	Right		Left		Right		Left	
	No.	%	No.	%	No.	%	No.	%
Existence	40	100	39	97.5	Nil	0	1	2.5
Number of Branches	37	92.5	38	95	3	7.5	2	5
Relation to second part of Axillary artery (AA)	40	100	40	100	Nil	0	Nil	0

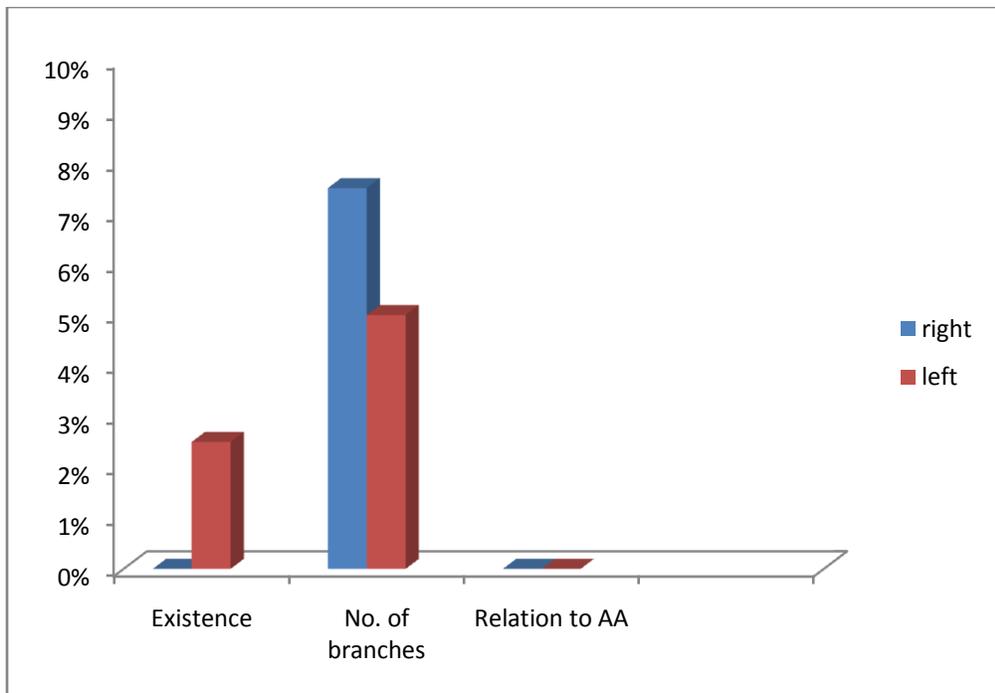
TABLE 3: Depicting normal and variations in branching pattern on lateral cord

No. of Branches	Right		Left	
	No.	%	No.	%
3 Branches (Normal): Lateral Pectoral, Musculocutaneous, Lateral root of Median nerve	37	92.5	38	95
2 Branches: Lateral Pectoral, Lateral root of Median nerve	1	2.5	0	0
3 Branches: Lateral Pectoral, two Lateral roots of Median nerve	1	2.5	1	2.5

4Branches: Lateral Pectoral, Musculocutaneous, two Lateral roots of Median nerve	1	2.5	1	2.5
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Graph 1: Depicting the variations in cords



Graph 2: Depicting the variations of lateral cord of brachial plexus

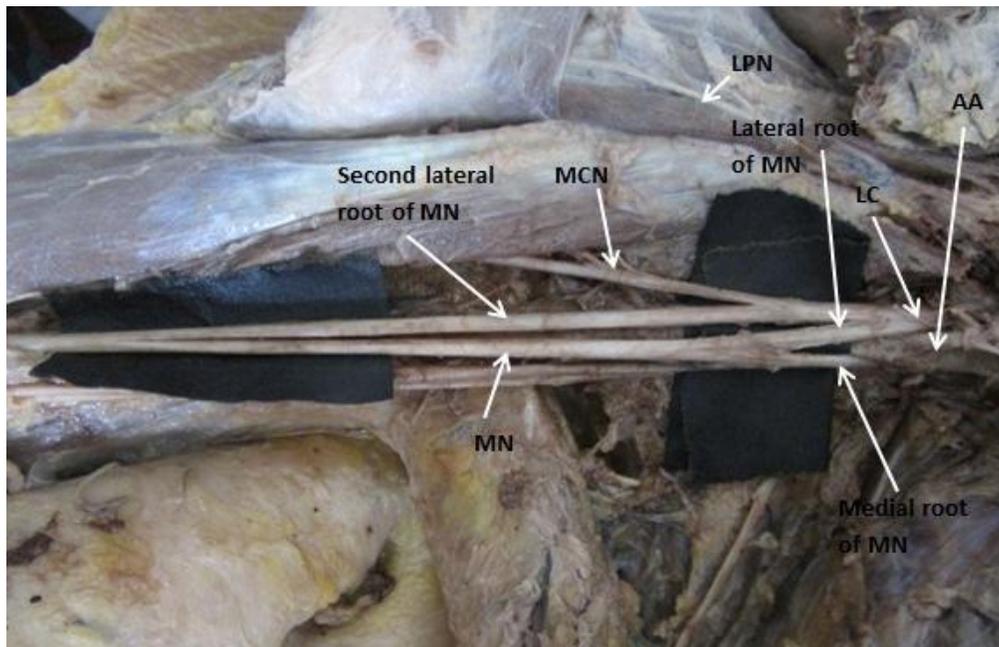
Figures:

Figure 1(Cadaver 16, Right side): Showing 2 lateral and 1 medial root of Median nerve. First lateral root joining medial root in front of third part of Axillary artery and second root joining in upper arm.
(LC-Lateral cord; MN- Median nerve; MCN- Musculocutaneous nerve; LPN- Lateral pectoral nerve; AA-Axillary artery)

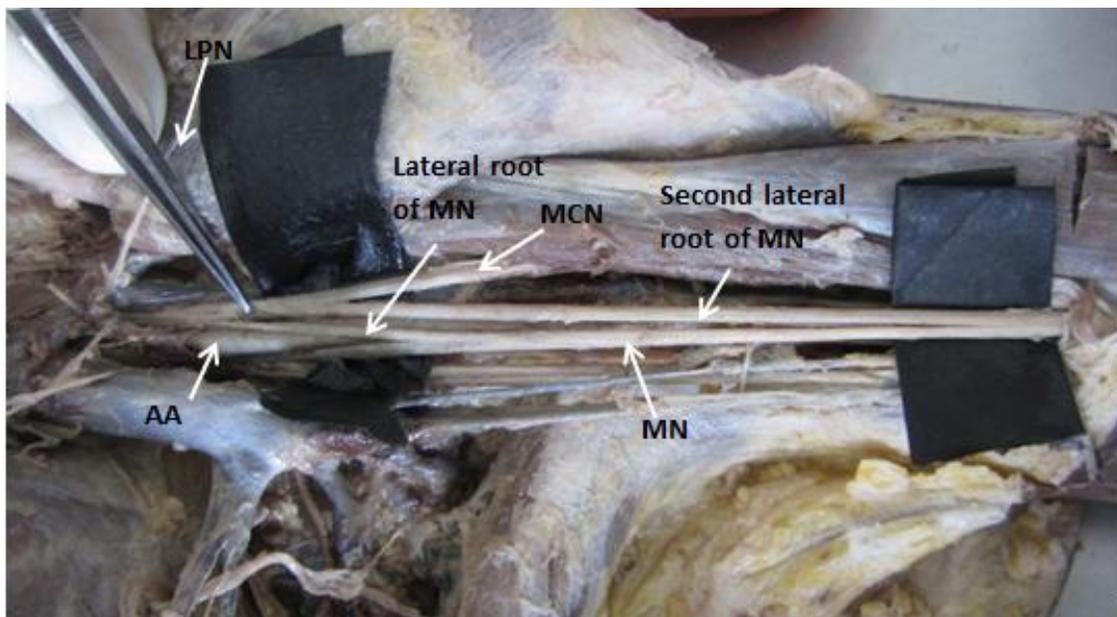


Figure 2(Cadaver 16, Left side): Showing 2 lateral and 1 medial root of Median nerve with absent Musculocutaneous nerve. First lateral root joining medial root, medial to third part of Axillary artery and second root joining in upper arm
(LC-Lateral cord; MN- Median nerve; MCN- Musculocutaneous nerve; LPN- Lateral pectoral nerve; AA-Axillary artery)

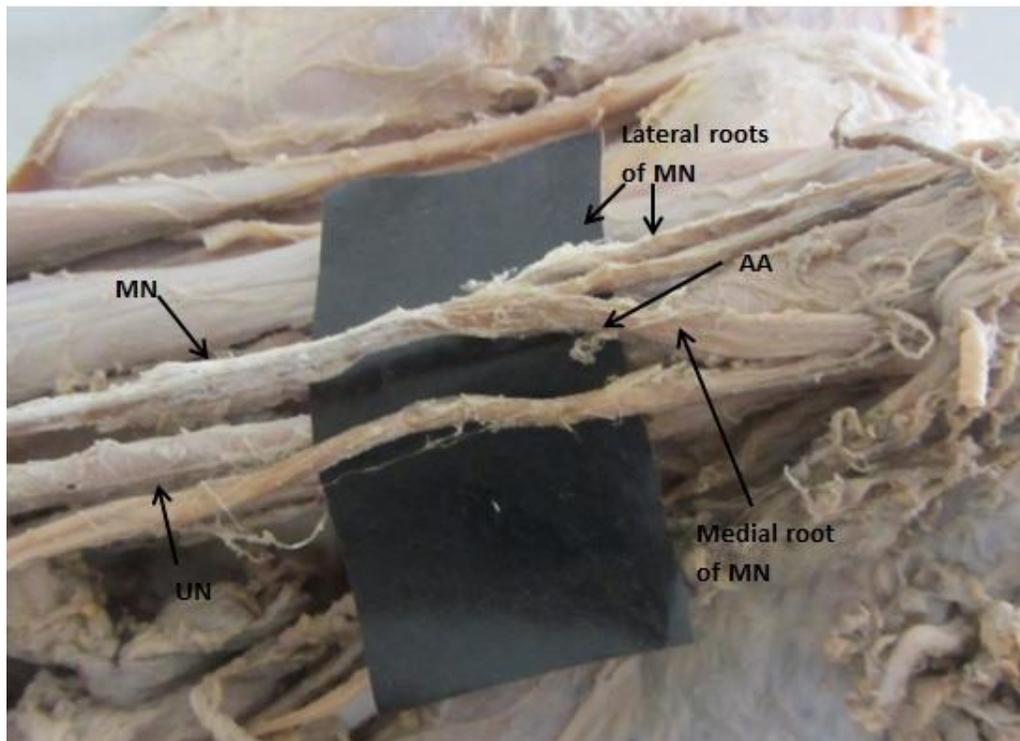


Figure 3 (Cadaver no. 30, Right side): Showing 2 lateral and 1 medial root of Median nerve with absent Musculocutaneous nerve
(MN- Median nerve; UN-Ulnar nerve; AA-Axillary artery)

Number of cords:

In seventy-nine out of eighty cases the number of cords observed, were three. Only in one case, two cords were found. The number of cords on right side were three in all forty cases whereas on left side normal number of cords were found in thirty-nine cases and in one case (2.5%) only two cords were found. Also the relation of cords with second part of axillary artery, on right side was normal in all forty cases and on left side it was normal in thirty-nine cases and variation was found in one case (2.5%). In this case instead of the lateral, medial and posterior cords, only two cords were present lateral and posterior to the second part of axillary artery. Lateral and medial cords fused to form a common cord which was lateral to second part of axillary artery. This common cord gave all the branches of medial and lateral cord. Posterior cord was present normally, posterior to second part of axillary artery and gave its branches in normal pattern.

Lateral cord:

Lateral cord was found in seventy-nine cases and in one case it was united with medial cord to form common cord. So lateral cord was present in all forty cases on right side and in thirty-nine cases on left side. Normal number of branches from lateral cord, that is, three was found in seventy-five cases, thirty-seven cases (92.5%) on right and thirty-eight (95%) cases on left. It varied in five cases (12.5%) which includes three (7.5%) on right and two (5%) on left. In all eighty cases Lateral cord was lying lateral to second part of axillary artery.

In five cases where variations in the number of branches were found, one case had only two branches, lateral pectoral nerve and lateral root of median nerve were formed and musculocutaneous nerve was absent. In two cases musculocutaneous nerve was absent but an additional lateral root of median nerve was present (Fig 3). In two cases four branches were present. These were lateral pectoral nerve, musculocutaneous nerve and two lateral roots of median nerve (Fig 1, 2)

Conclusion:

Variations in the nerves with abnormal origin, course and distribution are usually more prone to iatrogenic injuries and entrapment neuropathies. Failure to recognise these variations can also confound the assessment of severity of nerve injury as well as recovery.

Variations of brachial plexus are vulnerable to injuries during surgical exploration of axilla and upper arm, during cervical rib correction which is a cause of thoracic outlet syndrome, anesthetic block either through cervical or axillary approach, internal fixation of humeral fracture from common anterior approach, radical mastectomy etc.

These anatomical variations should be taken into consideration by a clinician while trying to explain unusual symptoms which may occur during examination of upper limb nerve injury as these variations may give rise to variable clinical presentations depending upon the type of variation.

References:

1. John Curnow. Notes of some irregularities in muscles and nerves. *J. Anat Physiol*, June 1873; 7(2):304-310.
2. Walsh JF. The anatomy of the Brachial plexus. *Am J M Sci*, 1877; 74: 387-428.
3. Herringham WP. The minute anatomy of Brachial plexus. *Proc Ray Soc London*, 1887; 41:423-441.
4. G. Elliot Smith. A note on the communication between the musculospiral and ulnar nerve. *J. Anat Physiol*, Jan 1904;38(2):162-163
5. Wilfred Harris. The true form of the Brachial plexus and its motor distribution. *J. Anat Physiol*, July 1904;38(4):432-434.
6. Miller RA. Observation upon the arrangement of Axillary artery and Brachial plexus. *An J Anat*, 1939;64:143-163.
7. Buch-Hansen K. Ubervarianten des nervus medianus und des nervus Musculocutaneus und deren Beziehungen. *Anat Anz*, 1955;102:187-203.
8. S.K. Pandey, Sushil Kumar. Anomalous formation of Brachial plexus cords and Median nerve. *J. Anat. Soc. India*, 2004;53(1):31-37.
9. Marios Loukas, Haqq Aqueelah. Musculocutaneous and Median nerve connections within, proximal and distal to the Coracobrachialis muscle. *Folia Morphol*, 2005;64(2):101-108
10. Gupta M, Goyal N, Harjeet. Anomalous communications in branches of Brachial plexus. *J Anat Soc India*, 2005; 54:22-25.
11. Goyal N, Harjeet, Gupta M. Bilateral variant contributions in the formation of the Median nerve. *Surg Radiol Anat*, 2005; 25:562-5.
12. Srijit Das, Shipra Paul. Anomalous branching pattern of lateral cord of Brachial plexus. *Int J. Morphol*, 2005;23(4):289-292.
13. Avinash Abaya, Bhardwaj R, Prakash R. Bilaterally symmetrical dual origin of Musculocutaneous nerve. *J. Anat, Soc, India*, 2006;55(2):56-59.
14. Saeed M, Abud Makarem, Ahmed F, Ibrahim, Haseen HD. Absence of Musculocutaneous nerve associated with a third head of biceps muscle and entrapment of Ulnar nerve; *Neurosciences*, 2007;12(4):340-342.
15. Jamuna M, Amudha G. Two cord stage in infraclavicular part of Brachial plexus. *Int J Anat var*, 2010;3:128-129.
16. Ajay Ratnakarrao Nene, KS Gajendra, MVR Sharma. Variant formation and course of the Median nerve. *Int J Anat Var*, 2010;3:93-94.
17. Flora M, Fabian Taylor, KS Verma. Brachial plexus variation involving the formation and branching of cords. *Int J Anat Var*, 2010;3:191-193.
18. Sinha RS, Chawera PN, Pandit SV, Motewar, Sapna S. Variations in the branching pattern of Brachial plexus with their embryological and clinical correlation. *J.morph.sci*, 2012; 29(3):167-170.
19. Patil ST, Meshram MM, Kasote AP, Kamdi NY. Formation of Median nerve from single root on left side and communicating branch from Median nerve to Musculocutaneous nerve on right side. *Morphologie*, 2012 Aug;96(313):51-4.
20. Neelamjit Kaur, Rajan Kumat Singla. Different types of communications between Musculocutaneous and Median nerve - A cadaveric study in north Indian population. *CIB Tech J Surgery*, 2013 Jan-April;2(1):21-28.