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Case Report

A SINGLE TRUNKED BRACHIAL PLEXUS WITH BILATERAL COMMUNICATION BETWEEN MUSCULOCUTANEOUS NERVE AND MEDIAN NERVE –A CASE REPORT

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INTRODUCTION

Brachial plexus is a network of nerves supplying the upper limb. It is formed in the posterior triangle of the neck by union of anterior primary rami of the C5-T1 roots. These roots join with each other to form three trunks *i.e.*, Upper, middle and lower by union of C5-C6 the continuation of C7 and the union of C8-T1 respectively. These three trunks bifurcate into the anterior and posterior division. The anterior divisions of upper and middle trunks unite to form lateral cord. The anterior division of lower trunk continues as the medial cord. The posterior division of three trunks unites to form the posterior cord. These cords give rise to different nerves of the upper limb (Williams *et al.*, 1995).

A knowledge of morphology and variational patterns of brachial plexus is extremely important for radiologists, anaesthetists, neurologists, neurosurgeons,vascular surgeons and orthopaedic surgeons (Makhoul and Machleder, 1992; Collins *et al.*, 1995) not only to distinguish between the lesions involving its roots,trunks,divisions or cords (Mausat, 1977) but also to properly treat them (Honda, 1993).

The commonly reported variational patterns of the brachial plexus are:

1. A prefixed or postfixed brachial plexus (Williams *et al.*, 1995).
2. Non formation of upper trunk and C5-C6 roots directly forming divisions (Singla *et al.*, 2011).
3. Formation of two trunks instead of the usual three (Singla *et al.*, 2013a, b).
4. Formation of single trunk instead of the usual three (Singer, 1932).
5. Formation of four trunks instead of the usual three (Choudhary *et al.*, 2012).
6. Absence of posterior cord (Pandey and Kumar, 2004).
7. Three roots of median nerve (Chauhan and Roy, 2002).
8. Communication between the musculocutaneous and median nerve or absence of musculocutaneous nerve (Li Minor, 1992).

These variant patterns of brachial plexus may be seen singly or rarely in combination. One such rare combination comprising of a single trunk of brachial plexus with bilateral communication between musculocutaneous nerve and median nerve is being reported here.

CASES

During the routine undergraduate dissections of a 60 year old male cadaver, the left brachial plexus depicted a single trunk (see figure 1). Its root values could not be ascertained as 'Head and Neck' region was already dissected and separated. However it was seen to be formed by union of 4 big roots with one very small root cranio-caudally, giving impression of value being C5-T1. This single trunk further instead of dividing into anterior and posterior divisions, directly trifurcated behind the axillary artery into medial, lateral and posterior cords. The medial and posterior cords depicted a normal course and branches. The lateral cord also bifurcated into lateral root of median nerve and musculocutaneous nerve. However the later (musculocutaneous nerve) after giving a branch to coracobrachialis and without piercing it, completely fused with median nerve. The flexors of forearm i.e. biceps brachii and brachialis were supplied by median nerve (see figure 2). Similiarly lateral cutaneous nerve of forearm also emanated from median nerve.

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In the right limb of the same cadaver, the roots, trunks, divisions and cords of brachial plexus were normal but a communicating ramus was seen coming from musculocutaneous nerve to median nerve before it pierced the coracobrachialis. However, all the muscles of anterior compartment of arm were supplied by musculocutaneous nerve.

DISCUSSION

Many variant patterns of brachial plexus have been reported but the one in which the entire roots join to form a single trunk is extremely rare. Only Singer has reported one such case earlier. The present case is similar to that but has associated bilateral communication between musculocutaneous nerve and median nerve in the same cadaver. No other case of single trunked brachial plexus could be traced in the accessible literature. As far as communication between musculocutaneous nerve and median nerve is concerned, many classifications of such communications are provided. Out of these, the most widely used classification is by Li Minor (1992) according to which these are divided into V types-

Type I-There is no communication between median nerve and musculocutaneous nerve.

Type II- Some fibres of lateral root of median nerve pass through musculocutaneous nerve and join median nerve in the middle of the arm.

Type III- All the fibres of lateral root of median nerve pass along musculocutaneous nerve and after some distance leave it to form the lateral root of the median nerve.

Type IV- Musculocutaneous nerve joins the lateral root of median nerve and after some distance the musculocutaneous nerve arises from the median nerve.

Type V- Musculocutaneous nerve is absent and entire fibres of musculocutaneous nerve pass through lateral root of median nerve to median nerve. The fibres to the muscles supplied by musculocutaneous nerve branch out directly from the median nerve.

Thus the left limb of the present case doesn't fit into any of the above types while the right limb fits into type II.

Another classification is provided by Kosugi *et al.,* (1992) which is as follows-

Group I-No communication between musculocutaneous nerve and median nerve.

Group II- A communicating branch from the musculocutaneous nerve to the median nerve

Group II is further divided into 3 subgroups-

Subgp A- The communicating ramus originates before the musculocutaneous nerve entered the coracobrachialis.

Subgp B - The communicating ramus passes through the coracobrachialis.

Subgp C - Communicating ramus originates after musculocutaneous nerve exits coracobrachialis.

Div I - Communicating branch came before the branch to the biceps.

Div II - Communicating branch came after the branch of the biceps.

Group III - A communicating branch from median nerve to musculocutaneous nerve.

Group IV - The above two communications occuring simultaneously.

Group V - Any other pattern.

So according to this classification in the left limb of the present study since musculocutaneous nerve completely fused with median nerve, it doesn't fit into any groups ie. It may be assigned to group V. The right limb fits into Group II, Subgroup A.

Recently Kaur and Singla (2013) reviewed all these classification and proposed a new and more elaborated classification for these communications which is as follows-

Type I- No communication.

Type II-Some fibres of lateral root of median nerve pass through musculocutaneous nerve and join the median nerve at different levels in the form of communicating ramus.

GroupA-A communicating ramus leaves musculocutaneous nerve immediately after the later is formed so that it gives appearance of trifurcation of lateral cord into a musculocutaneous nerve and two lateral roots.

Group B-The communicating ramus leaves musculocutaneous nerve before it pierces coracobrachialis (All flexor muscles supplied by musculocutaneous nerve)
Group C- The communicating ramus leaves musculocutaneous nerve after it has pierced coracobrachialis. (All flexor muscles supplied by musculocutaneous nerve before the origin of communicating ramus)
Type III-All fibres of lateral root of median nerve pass with musculocutaneous nerve. The median nerve is just continuation of medial root only. However the musculocutaneous nerve after supplying flexors of forearm gives lateral root of median nerve to join the same. In other words the lateral root arises distal to origin of muscular branches from musculocutaneous nerve.
Type IV- Whole of lateral cord continues as lateral root of median nerve i.e. Musculocutaneous nerve joins lateral root of median nerve and after some distance musculocutaneous nerve arises from the median nerve.
Group A- Musculocutaneous nerve arises from median nerve proximal to muscular branches for flexors of arm which are thus supplied by musculocutaneous nerve.
Group B- Musculocutaneous nerve arises from median nerve after the former had supplied muscles of forearm. Then the musculocutaneous nerve continues only as lateral cutaneous nerve of forearm.
Type V- Complete fusion of musculocutaneous and median nerve at different levels.
Group A- Musculocutaneous nerve is altogether absent with all its fibres passing through lateral root of median nerve. All branches of musculocutaneous nerve come from median nerve.
Group B- Musculocutaneous nerve supplies coracobrachialis and then completely fuses with median nerve, rest of its branches come from median nerve.
Group C- Musculocutaneous nerve supplies all flexors of arm and then fuses with median nerve. The lateral cutaneous nerve of forearm comes from median nerve.
Type VI- The communicating ramus arises in lower one-third of arm after musculocutaneous nerve has supplied all flexors of arm. It crosses the elbow joint and reaches forearm where it joins median nerve.
Group A- The communicating ramus joins median nerve without piercing pronator teres.
Group B- The communicating ramus joins median nerve after piercing pronator teres.
Thus the left limb of the present study fits into TypeV Group B and the right limb fits into Type II Group B.
Both these variant patterns of brachial plexus i.e. single trunked brachial plexus and communications between musculocutaneous nerve and median nerve are important ontogenically, phylogenically and clinically.

Ontogeny

Ontogenically, the human brachial plexus appears as a single radicular cone in the upper limb bud. Initially a plexus is formed by anastomosis of between spinal nerves and then it develops into a solid plate which essentially divides into separate trunks and finally into divisions and cords (Rao and Chaudhary, 2000). In the present case there seems to be a failure on the part of solid cord to divide and form trunks and divisions. Rather it directly formed cords. Why it occurred, may be explained by the observations of Sannes *et al.,* (2000). According to whom, since the guidance of developing axons is regulated by expressions of chemoattractants and chemorepulsants in a highly co-ordinated site specific fashion, any alteration in signaling between mesenchymal cells of muscles and neuronal growth cones can lead to significant variations. Once formed, any developmental differences would obviously persist postnatally.
The same theory of alteration of signaling between chemoattractants and chemorepulsants may be forwarded to explain the development of communicating ramus between musculocutaneous and median nerve.

Phylogeny

Miller (1932) threw a flood of light on phylogeny of brachial plexusand observed that in amphibians, reptiles and dogs no trunk is formed. Further, in amphibians, the separation into anterior and posterior divisions is purely arbitrary. While in birds, marsupials and lemurs no anterior and posterior divisions are formed. Thus the left limb of our case represent any of these lower animals.

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The communicating ramus between musculocutaneous nerve and median nerve as seen in both the upper limbs of the present case has been found usually in dogs (Rao and Chaudhary, 2000).

Clinical Implications

For an orthopaediacian and surgeon,to have the variational patterns of brachial plexus at their finger tips is mandatory in the light of not only the frequency with which a surgery is performed in axilla and the rapid development of the neurosurgical techniques but also to give an explaination when they encounter an incomprehensible clinical sign (Singla *et al.,* 2011).

Apart from the surgeons, the brachial plexus variations are of interest not only to radiologists who interpret CT images and MRI and anaesthetists who place needles in the neck to give anaesthetic blocks, but also to the neurosurgeons, neurologists and vascular surgeons (Makhoul and Machledu, 1992; Collins *et al.,* 1995). While Ongaiba *et al.,* (2002) laid stress on the fact that a variant brachial plexus could fail the brachial plexus loco-regional anaesthesia, Sargon *et al.,* (1995) commented that such a plexus is more prone to injury in radical neck dissections and in other surgical operations in axilla.

A single trunked brachial plexus as observed in the present case may produce comprehensible clinical signs in both Erb's paralysis and Klumpke's paralysis. The clinical symptomatology may be more widespread than usual in both conditions for obvious reasons. It may confuse a clinician unfamiliar with such a variant of brachial plexus.

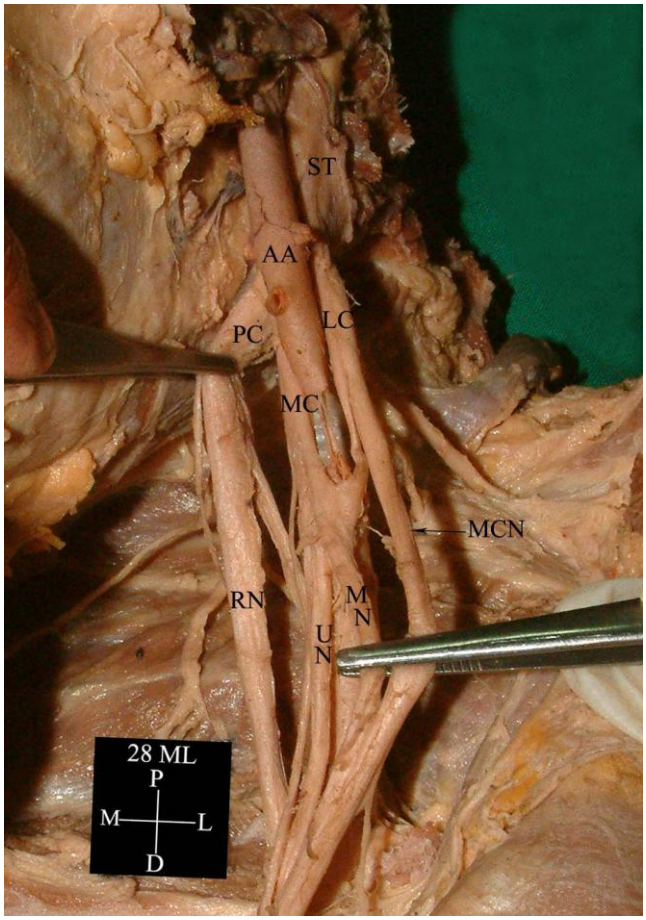

Figure 1: Single trunk (ST) of brachial plexus

(Abbreviations: *AA-Axillary artery, LC-Lateral cord; MC-Medial cord; PC-Posterior cord; MCN-Musculocutaneous nerve; MN-Median nerve; UN-Ulnar nerve; RN-Radial nerve***)**

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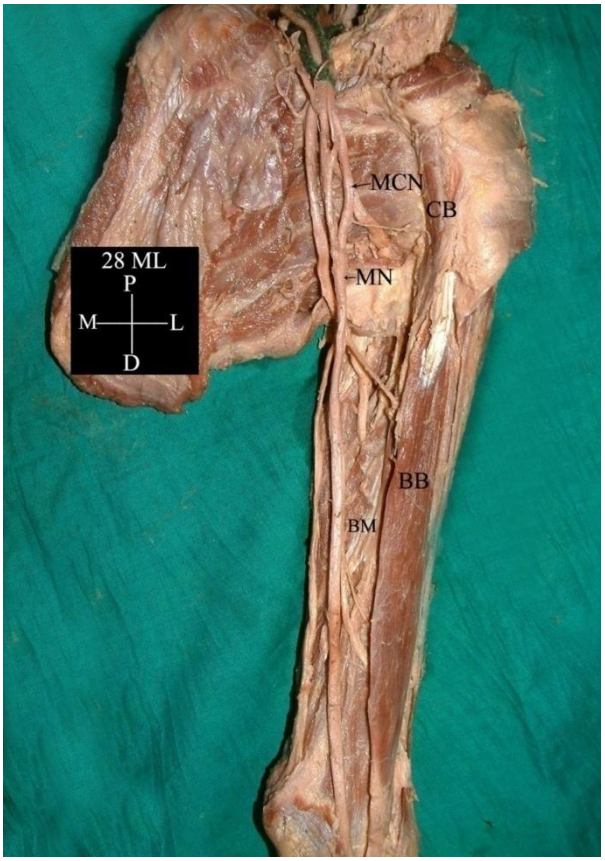

Figure 2: Musculocutaneous nerve (MCN) fuses with median nerve (MN) after supplying coracobrachialis (CB). Biceps brachii (BB), brachialis muscle (BM) supplied by median nerve (MN)

The knowledge of communication between musculocutaneous nerve and median nerve may prove to be valuable in the traumatology of shoulder joint as well as in relation to the repair operations. Also, it may be correlated to the entrapment syndrome of musculocutaneous nerve in which a part of median nerve also passes through the coracobrachialis and may exibit the symptoms similar to those encountered in median nerve neuropathy as in the carpal tunnel syndrome (Rao and Chaudhary, 2000).

REFERENCES

Chaudhary P, Singla R, Kalsey G and Arora K (2012). A four trunked Brachial plexus and a post fixed brachial plexus: A conjunction or co-incidence? Report of three cases. *Clinical Anatomy* **25** 593-600.

Chauhan R and Roy TS (2002). Communication between median nerve and musculocutaneous nerve: ACase Report. *Journal of the Anatomical Society of India* **51**(1) 72-75.

Collins JD, Shaver ML, Disher AC and Miller TQ (1995). Compromising abnormalities of the brachial plexus as displayed by magnetic resonance imaging. *Clinical Anatomy* **8** 1-16.

Honda K (1993). Study on the intraneural topography of the brachial plexus. *Nippon Seikeigeka Gakki Zasshi* **67** 58-70.

Kaur N and Singla RK (2013). Different types of communications between musculocutaneous nerve & median nerve- A cadaveric study in North Indian population, *Cibtech Journal of Surgery* **2**(1) 21-28. Available at: http://www.cibtech.org/cjs.htm.

Li Minor JM (2000). A rare variant of median nerve and musculocutaneous nerve in man. *Archives d Anatomie, d Histologie et d Embryologie* **73** 33-42.

Makhoul RG and Machleder HI (1992). Developmental anomalies at the thoracic outlet: an analysis of 200 consecutive cases, *Journal of Vascular Surgery* **16** 534-45.
Mansat M (1977). Anatomie topographique et chirugicale di plexus brachial. *Revue de chirugie orthopedique et reparations ie I' Appareil Moteur* **63** 20-26.
Miller RA (1932). Comparative study on the morphology and distribution of the brachial plexus. *American Journal of Anatomy* **54** 143-66.
Pandey SK and Kumar S (2004). Anomalous formation of brachial plexus cords and median nerve. *Journal of the Anatomical Society of India* **53**(1) 31.
Rao PVVP and Chaudhary SC (2000). Communication of the musculocutaneous nerve with median nerve. *East African Medical Journal* **77**(9) 498-503.
Sannes HD, Reh TA and Hrris WA (No Date). Axon growth and guidance: In: Developmental of nervous system. New York, AcademicPress 189-97.
Singer M (1932). Human brachial plexus united into a single cord: description & interpretation. *Anatomical Record* **54** 411-9.
Singla RK, Bhagyashree and Sekhon J (2013). Bilateral two trunked brachial plexus- A case report. *International Journal of Basic and Applied Medical Sciences* **3**(1) 215-219. Available at: http://www.cibtech.org/jms.htm.
Singla RK, Mahajan R, Sharma R and Sharma T (2011). Bilateral non formation of upper trunk of brachial plexus with a unilateral communication between musculocutaneous nerve and median nerve- A Case Report. *JCDR* **5**(8) 1637-40.
Singla RK, Sharma RK and Bhagyashree (2013). A two trunked brachial plexus: A case report. *JCDR* **7**(4) 704-5.
Williams PL, Bannister LH, Berry MM, Collins P, Dyson M and Dussek JE *et al.*, (1995). Embryology & Development, the Nervous System. In: Gray's Anatomy 38th Edition, Edinburgh, Churchill Livingstone 230-237 &1266-1274 resp.