



Unique Variation of Brachial Plexus with Unilateral Rudimentary Musculocutaneous Nerve and Contralateral Communication Between Musculocutaneous and Median Nerve

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KEYWORDS

Musculocutaneous nerve, median nerve, communicating branch, brachial plexus, intercommunications

ABSTRACT:

Background: Brachial plexus variations are not uncommon. Intercordal communications and communications between different branches have been reported in the literature. The median nerve and musculocutaneous nerve had shown maximum variations compared to other branches. The communications between different branches of brachial plexus is not uncommon. Martin Gruber anastomosis, Berretini anastomosis and Cannieu and Riché anastomosis are few examples of some clinically significant communications. Present case report is about rudimentary right musculocutaneous nerve and variant nerve supply of anterior compartment muscles of arm on right side while presence of musculocutaneous nerve and intercommunication between musculocutaneous and median nerve on left side. Orthopedic, general surgeons and neurosurgeons must consider the possibility of such variations in the surgery of arm and elbow. Cutting of such communicating branch can lead to altered mobility of limb. The knowledge of such variations is clinically significant in neurosurgeries like surgery for Neurofibromatosis, in peripheral nerve injuries and neurotization procedures.

INTRODUCTION

Variations of brachial plexus (BP) are not uncommon. Variation incidence of 13% is reported in literature^[1]. C5 to T1 nerve roots contribute in the formation of BP. In infraclavicular portion of BP, the cords and its branches are seen. It has three trunks which later forms three cords lateral, medial and posterior.

Musculocutaneous nerve (MCN) is the branch of lateral cord of BP. It is formed by contribution from roots C5, C6 and C7. It is motor to arm and sensory to forearm. It supplies all muscles of anterior compartment of arm, biceps, brachialis and coracobrachialis. Median nerve (MN) is formed by two roots medial root from medial

cord and lateral root from lateral cord of BP. MN normally does not innervate any muscle of anterior compartment of arm.

Median nerve and musculocutaneous are the two nerves which are more prone for variations.^[2] Nerve communications like Martin Gruber anastomosis, Cannieu and Riché anastomosis and Berretini anastomosis between MN and Ulnar nerve, branch of Medial cord have been reported in literature^[3,4,5] Present case depicts variation of BP with the rudimentary MCN on right side with variant nerve supply to anterior compartment muscles and intercommunication between MCN-MN on left side. On literature search maximum



incidence of MCN –MN intercommunications up to 63.5% is reported with wide range from 2.1 to 63.5%.^[5-8]

Knowledge of such variations is important for clinicians, anesthetists, surgeons and physiotherapists. This information is also useful in neurotization procedure and peripheral nerve injuries.^[9]

Case report

In a 45 year old female cadaver during upper limb axilla dissection, bilateral variations of brachial plexus were found. Normally musculocutaneous nerve, branch of lateral cord of brachial plexus supplies all three muscles of anterior compartment that is coracobrachialis, biceps brachii and brachialis muscle.

On the right side, normal three cords of brachial plexus were present. There were three branches of the lateral cord, MCN, lateral root of MN and Lateral pectoral nerve. MCN to our surprise was very small and rudimentary and terminated by supplying coracobrachialis only. Remaining two muscles of anterior compartment, biceps brachii and brachialis were supplied by MN instead of MCN [Fig 1]. Lateral cutaneous nerve of arm was given by MN instead of MCN. Rests of the branches of brachial plexus on right were normal. No intercommunication between MN and MCN were noted on this side.

On the left side, unlike on right side, MCN was present. MCN was long and supplied all anterior compartment muscles, coracobrachialis, biceps brachii and brachialis. Intercommunication was found between MCN and MN. The communicating branch was originated from MCN and travelled medially and downwards towards MN. It was present between muscular branches to biceps and brachialis muscle [Fig 2]. It was around 4cm in length. Lateral cutaneous nerve of arm was given by MCN on this side. Rests of the branches of brachial plexus were normal on this side

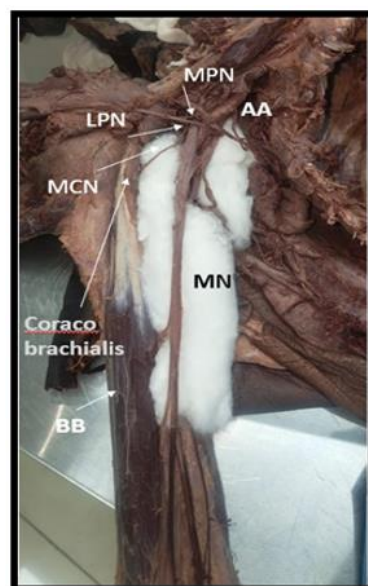


Fig 1: showing rudimentary MCN supplying only coracobrachialis. Biceps and brachialis supplied by MN.

(MCN –Musculocutaneous nerve, MN – Median nerve, LPN –lateral pectoral nerve, MPN- Medial Pectoral nerve, AA- Axillary Artery, BB –Biceps brachii)

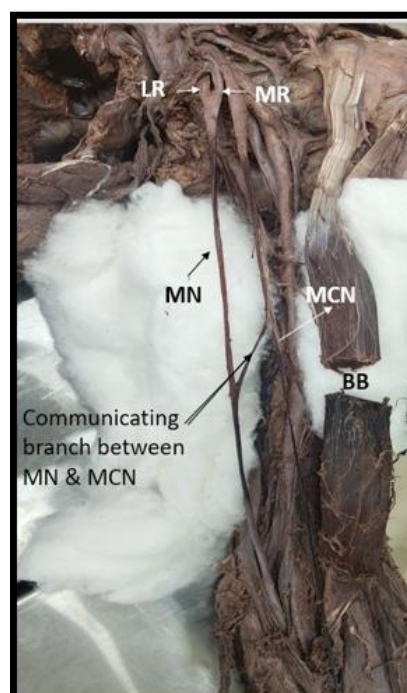


Fig 2- showing MN formed by MR and LR. MCN is supplying anterior compartment muscle. Presence of communicating branch between MCN and MN



(MCN –Musculocutaneous nerve, MN – Median nerve, LR –Lateral Root, MR- Medial Root, BB – Biceps brachii)

DISCUSSION

Communicating branches between MCN and MN have been reported in the various studies. Maximum reports of such intercommunications have contralateral absence of MCN.^[10,11] Embryological basis of these variations have been traced differently in various studies.

BP is formed as a single stump on day 34 during the development. After four to five days of this stage, various branches start appearing. MN and ulnar nerve originates from ventral segment of BP and MCN arises from MN. The intercommunications between MCN–MN can be due to common embryological source of development.^[10,11, 12]

Significant variations in the nerve patterns may be a result of altered signaling between mesenchymal cells and neuronal growth cones or circulatory factors at the time of fusion of brachial plexus cords.^[10,13,14]

According to another theory, MCN is the branch from lateral cord of BP. MN also takes contribution from the lateral cord of BP in the form of lateral root. In case of transfer of nerve fasciculi of MCN through lateral root, MN found to supply few muscles of anterior compartment instead of MCN. In case of total absence of MCN, MN only supplies all muscles of anterior compartment and gives rise to Lateral cutaneous nerve which is normally continuation of MCN.^[15,16]

Chiarapattanakom *et al.*^[8,10] stated that the lack of coordination between the formation of the limb muscles and their innervation is responsible for the appearance of a communicating branch.

Various classifications of intercommunications between MCN and MN are proposed by different authors. To name few Le Minor, Maeda *Et al.* and Mari Hayashia.^[15,17-20]

Le Minor Classification

Type	Description
Type I	Absence of Communication between MN and MCN

Type II	Communication of MN and MCN in the middle of arm
Type III	MCN joins the lateral root of MN
Type IV	MCN arises from MN
Type V	Absence of MCN and anterior compartment muscles supplied by MN

Present case report, right sided variation doesn't fit into any types of Le Minor classification where MCN was rudimentary and not completely absent and supplied coracobrachialis muscle. All muscles of anterior compartment are not solely supplied by MN. Absence of musculocutaneous nerve is also reported by some authors in literature.^[14,15,16] Author Bhingardeo^[15] et al. and Parchand^[16] and had reported unilateral absence of MCN and contralateral intercommunication between MCN–MN.

Maeda *et al.*^[2] classified nerve communication between MCN-MN into basic two types depending upon the location of the communicating branch.

I(a): Intramuscular CB between MCN and MN in coracobrachialis muscle

I(b): CB present before nerve branch supplying to biceps muscle

I(c): CB present between innervating branches to biceps and brachialis

I(d): CB present after the nerve branch supplying brachialis muscle

Similarly, the occurrence of communicating branches between the MN and the MCN was recorded as Type II with 2 subtypes, IIa: the branch from MN reached the segment between the origins of Biceps and Brachialis muscular branches and IIb: when the communicating branch was connected with the branch to Brachialis muscle



Left sided variation in present case report fits into type I(c). Author Ballesteros^[16] had mentioned similar variation in his study.

Multiple number of communicating branches reported from 0-3.8% of cases.^[10] In our previous case report we found three multiple MCN-MN communication.^[15] Author Sthapak et al. reported 2% of cases with 2 intercommunications while 1% of cases with more than two intercommunications.^[10]

Present case report the communicating branch was originating from MCN and going towards MN. In literature this direction of communicating branch from MCN to MN is common and reported in 34% of cases.

The knowledge of such variations helps us in neurosurgeries like surgery for Neurofibromatosis. Orthopedic, general surgeons and neurosurgeons must consider the possibility of such variations in the surgery of arm and elbow. Cutting of such communicating branch can lead to altered mobility of limb.^[21,22]

Communication between MN and MCN is attributable to common origin of the musculocutaneous and median nerve during development. Compression of this communicating branch may simulate the finding of compression of median nerve.^[23]

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