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Original Research Article

Variations in the Course of Musculocutaneous Nerve in Relation with Coracobrachialis & Median Nerve with Its Surgical Importance

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ABSTRACT

Introduction: Musculocutaneous nerve is nerve of anterior compartment of arm branches out from the lateral cord of brachial plexus, supplies coracobrachialis, biceps & brachialis. After piercing coracobrachialis later it pierces deep fascia to continue as lateral cutaneous nerve of forearm without exhibiting any communication with any other nerve

Aim: The aim of this study was to a study in the course of MCN which could be important for clinical investigation and the surgical treatment of peripheral nerve injury.

Material & methods: The 50 upper extremities of both male & female cadavers of aged between 50 yrs to 80yrs were taken for this study from the department of anatomy VIMS& RC Bangalore. During the routine dissection of both the upper limb, Musculocutaneous nerve was dissected carefully from the brachial plexus, its origin, course, branches, termination & communication with other nerves in the arm was looked & recorded.

Results: out of 50 dissected upper limb we found two bilateral variation in the course of MCN not piercing the coracobrachialis muscle, in 2 cases musculocutaneous joined with median nerve without piercing coracobrachialis & in 3 cases with piercing coracobrachialis, giving branch to coracobrachialis muscle, Biceps, Brachioradialis muscle & passing between Biceps & Brachioradialis muscle, later piercing deep fascia to become lateral cutaneous nerve of forearm.

Conclusions: These variations have clinical significance during surgical procedures, in brachial plexus block and in diagnostic clinical neurophysiology. Knowledge of such variations helps in the management of shoulder and arm traumas, nerve grafting and diagnosing peripheral neuropathies.

Key words: musculocutaneous nerve (MCN), coracobrachialis muscle (CB), biceps, Median nerve (MN), Brachial plexus, Peripheral nerve repair.

INTRODUCTION

The musculocutaneous nerve (MCN) branches out from the lateral cord of brachial plexus. It pierces coracobrachialis muscle (CB) to innervate it and biceps brachii muscle. It then descends inferolaterally between the biceps brachii and brachialis muscles, giving a branch to the latter and continues as the lateral cutaneous nerve of forearm without exhibiting any communication with any other nerve. [1]

As per medical & surgical aspect, nerve supply of arm is very important. Variations in the formation and branching

of the brachial plexus are common and have been reported by several investigators

Aim: Knowledge about the musculocutaneous nerve variation in origin, course, and pattern of branching, distribution will be useful for surgeons to avoid injury while performing surgeries in arm.

MATERIALS & METHODS

The 50 upper extremities of both male & female cadavers of aged between 50 yrs to 80yrs were taken for this study from the department of anatomy VIMS& RC Bangalore. During the routine dissection of both the upper limb, Musculocutaneous nerve was dissected carefully from the brachial plexus, its origin, course, branches, termination & communication with other nerves in the arm was looked & recorded

OBSERVATION/RESULTS

Observed course of Musculocutaneous nerve & its variations was been showed in the photograph below:

Types of variations	Relation with coracobrachialis muscle	Communication with median nerve	No. Of cases present-age/gender/side	Percentage %
Type 1	not piercing corachobrachialis muscle	No communications with other nerve	4 cases 60 yrs male-bilateral 75 yrs male- bilateral	8%
Type 2	not piercing coracobrachialis muscle	communicate with median nerve	2 cases 65 yrs male-right side &68 yrs female- right side	4%
Type 3	piercing coracobrachialis muscle	Communicate with median nerve after piercing coracobrachialis	3cases 70yrs male-right side, 60yrs male left side & 72yrs female left side	6%

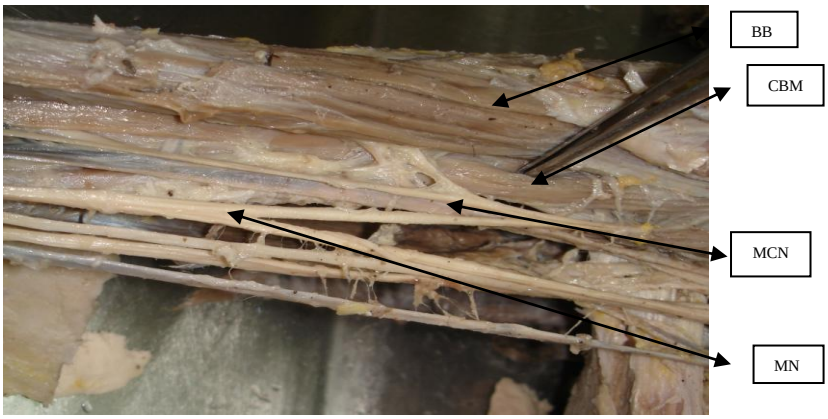

Fig no.1 shows right upper limb musculocutaneousnerve(MCN)not piercing corachobrachialis muscle (CBM) giving branch to coracobrachialis muscle & main nerve passing between coracobrachialis muscle & biceps muscle(BB) no communication with median nerve(MN)

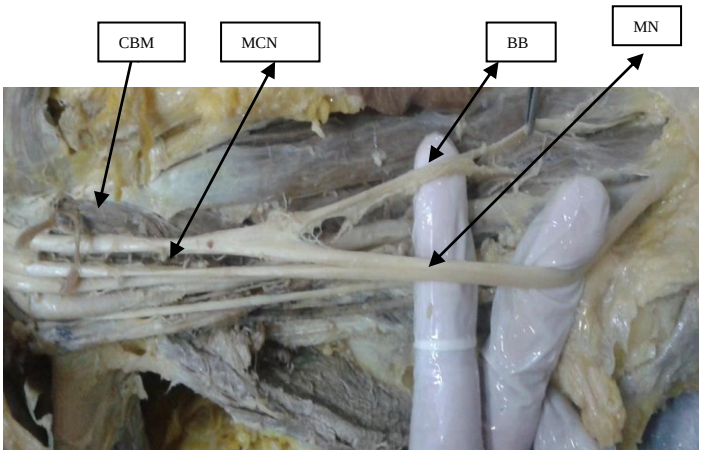

Fig no.2 shows right upper limb musculocutaneous nerve (MCN) not piercing coracobrachialis muscle(CBM)& dividing into one branch to supply coracobrachialis muscle & biceps muscle & other joining median nerve(MN).

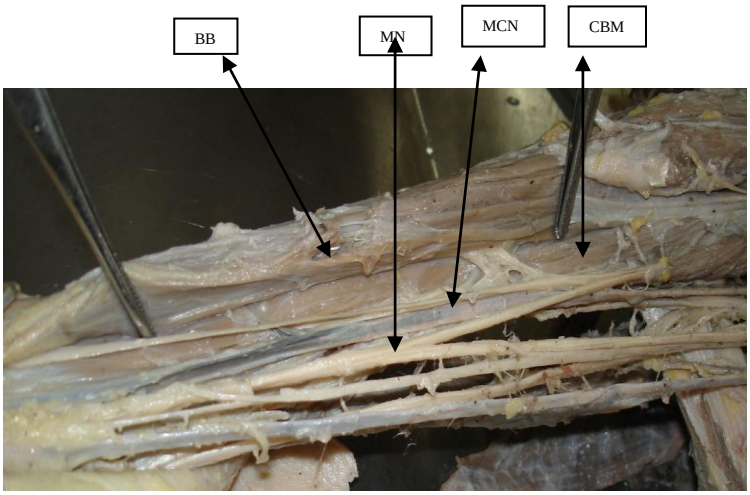

Fig no.3 shows left upper limb, musculocutaneous nerve (MCN) piercing coracobrachialis muscle (CBM) & the main trunk divide, one branch join median nerve (MN) & other branch continue as lateral cutaneous nerve of forearm after supplying the flexors of arm.

DISCUSSION

The variations of musculocutaneous nerve were described by many authors, as in some the musculocutaneous nerve is absent and the lateral cord supplies the coracobrachialis, biceps brachii and brachialis, giving rise to the lateral cutaneous nerve of forearm. [2,3]

Ramasamychitra [4] & Satheeshanayak [5] studies found that the nerve did not pierce coracobrachialis. It passed between the short head and the third head of Biceps. [4,5]

As per the studied done by Ramasamy Chitra, [4] Kazi AK, [6] Huban R T et al, [7] Prasada Rao PW et al, [8] Le Minor JM [9] there was abnormal communication between musculocutaneous nerve and median nerve. [4, 6-9]

The incidence of Musculocutaneous nerve not piercing coracobrachialis was 6% as per study done by Jamuna M and Amudha G, [10] KasiA K [6] reported an incidence of 11%. Nakatani [2] also reported 3 cases of musculocutaneous nerve not piercing coracobrachialis muscle. [10,6, 2]

Koizumi & Sakai [11] found that musculocutaneous nerve pierces coracobrachialis muscle in Chimpanzee, but not in Gorilla or Gib believes that the coracobrachialis is a composite muscle, which has at least two separate innervations, and that a change in the composition of the muscle altered the course of the musculocutaneous nerve. [11]

Variants of branching pattern of MCN and MN have been well described by many authors Le Minor [9] classified these variations in to five types. Type 1: no communication between the MN and MCN. Type 2: the fibers of medial root of MN pass through the MCN and join the MN in the middle of the arm. Type 3: fibers of the lateral root of the MN pass through the MCN and after some distance leave it to form lateral root of MN. Type 4: the MCN fibers join the lateral root of the MN and after some distance the MCN arise from the MN. Type 5: The MCN is absent and the entire fibers of MCN pass through lateral root of MN and fibers to the muscles supplied by MCN branch out directly from MN.

In our study the MCN falls in category of Le Minor [9] study type 1, where there was no communication between the MN and MCN & type 4 where the MCN fibers join the lateral root of the MN and after some distance the MCN arise from the MN.

Venieratos and Anangnostopoulou [12] suggested classification in relation to coracobrachialis muscle. Type I: communication is proximal to

coracobrachialis muscle. Type II: communication is distal to muscle. Type III: neither the nerve nor the communicating branch pierce the coracobrachialis muscle.

In Our study MCN applies to type 2 & 3 of Venieratos and Anangnostopoulou [12] study communication is distal to muscle.

Loukas and Aqueelah [13] identify 4 different patterns of communication. Type I (54 communications, 45%): the communications were proximal to the point of entry of the MCN into the coracobrachialis; type II (42 communications, 35%): the communications were distal to the point of entry of the MCN into the coracobrachialis; type III (11 communications, 9%): the MCN did not pierce the coracobrachialis; and Type IV (9 communications, 8%) out of 129 formalin-fixed cadavers.

In our study the MCN falls in study of Loukas and Aqueelah [13] category of type 2 &3 the communications were distal to the point of entry of the MCN into the coracobrachialis in one case, & in other the MCN did not pierce the coracobrachialis muscle.

Out of 50 dissected upper limbs we found two bilateral variations in the course of MCN not piercing the coracobrachialis muscle & giving branch to coracobrachialis muscle, Biceps, Brachioradialis muscle & passing between Biceps & Brachioradialis muscle, later piercing deep fascia to become lateral cutaneous nerve of forearm. In 2 cases of musculocutaneous joined with median nerve without piercing& 3 cases with piercing coracobrachialis & communicatication with median nerve. Our present finding falls in the type 1 &4 variant of Le Minor, [9] with type 2 &3 of Venieratos's [12] classification &with type 2 & 3 of Loukas and Aqueelah [13] classification.

Thus this study of unusual courses, branching pattern and termination of musculocutaneous nerve is of clinical importance during flap dissections, post traumatic evaluation of the arm or peripheral nerve repair and even for peripheral nerve stimulation in practice of anaesthesia.

Embryological basis: The growth as well as the path finding of nerve fibres towards the target is dependent upon concentration gradient of a group of cell surface receptors in the environment. Several signaling molecules and transcription factors induce the differentiation of the dorsal and ventral motor horn cells. Two theories have emerged concerning the directional growth of nerve fibres – The Neurotropism or Chemotropism hypothesis of Ramon Y Cajal and the Principle of Contact –Guidance of Weiss. The salient features of Chemotropism are that axonal growth cones act as sensors to concentration gradients of molecules in the environment and grow up the gradient towards the source, i.e. the target. Contact Guidance mechanisms operate in parallel with Neurotropism. Adhesion to the structures with which the growth cone contacts also play a role. A group of cell surface receptors viz. Neural cell adhesion molecule (N-CAM) and L1 and the cadherin's act as transcription factors which recognize and bind to components of the extracellular matrix. Thus both cell-cell and cell-matrix interactions may be involved in axonal path finding. Over or under expression of one o multiple transcription factors as mentioned above have been found to be responsible for the variations in the formation, relation and distribution of the motor nerve fibres. [14]

CONCLUSION

out of 50 dissected upper limb we found two bilateral variation in the course of MCN not piercing the coracobrachialis muscle, in 2 cases of musculocutaneous join with median nerve without piercing

coracobrachialis & in 3 cases with piercing coracobrachialis, giving branch to coracobrachialis muscle, Biceps, Brachioradialis muscle & passing between Biceps & Brachioradialis muscle, later piercing deep fascia to become lateral cutaneous nerve of forearm.

Knowledge of such variations helps in the management of shoulder and arm traumas, nerve grafting and diagnosing peripheral neuropathies. Important while performing neurotization of the brachial plexus lesions, shoulder arthroscopy by anterior glenohumeral portal and shoulder reconstructive surgery

We believe that this possibility of variation of the peripheral nerve noticed in cadaveric dissections should be included in surgical training programs, even if they are not necessarily for inclusion in routine anatomy education in medical schools

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