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Research Article

Angiosomes of medial cord of brachial plexus

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ABSTRACT

This anatomical study analyzed the neurovascular relationship of the brachial plexus. Ten formalized specimens of brachial plexuses were examined after injection of lead oxide in to the subclavian artery. The vascular, anatomical features of the brachial plexus were documented .The specimens were analyzed by dissection method, subjected for microscopic study. The vascular supply was markedly rich, often with true anastomotic channels found within the nerves. There was much variation in supply, depending on the branching pattern of subclavian artery.

Keywords: Sub clavian artery, Dorsal scapular artery, Axillary artery

INTRODUCTION

Angiosome is a three dimensional block of tissue supplied by the single course of the artery. Angiosomes travels through the mesoneurium and then divides in to capillaries within the nerves to deliver oxygen and nutrients (Abdul, Bowden 1960).[1]

Angiosomes is known as anatomical territory and is accompanied by veins. It can be composite of skin, fascia, muscle, bone. These blocks of tissue form a complex three dimensional jigsaw puzzle. Each angiosome made up of arteriosomes and venosomes and they are linked to neighbouring angiosomes (Grays Anatomy, 39th edition).[2]

Development

The arm buds develop at the level of lower four cervical and upper two thoracic segments. The flattened limb buds have a cephalic preaxial border and a caudal post axial border. The mesenchyme situated along the preaxial border becomes associated and innervated with the lower four cervical nerve Where as the mesenchyme of the postaxial border becomes associated with eighth cervical and first thoracic nerves. These two factors the anterior primary rami of the spinal nerves become arranged in complicated plexus around the bases of each limb so that the brachial plexus formed (Richard sneell 8th edition).

Normal anatomy

The brachial plexus gives motor innervations to all muscles of the upper limb except trapezius, levator scapula. The brachial plexus consist of roots, trunks (and their divisions) and cords.

Roots: Ventral rami of spinal nerves C5-C8 and T1

Trunks:

a) C5-C6 join to form the upper trunk

b) C7 continues as middle trunk

c) C8-T1 join to form the lower trunk.

Divisions and cords: Each trunk divides in to an anterior and a posterior divisions.

The anterior divisions of the upper and middle trunks to form the lateral cord.

The anterior division of lower trunk continues as the medial cord.

The posterior division of all the three trunks join to form the posterior cord.

The roots and trunks lie in posterior triangle of the neck, cords and their branches lie in the axilla. In the axilla branches of cords are closely related to axillary artery (Inderbingh Singh 5th edition).[4]

Branches of medial cord:

1) Medial pectoral nerve arises from the medial cord behind the first part of the axillary artery.

2) Medial root of median nerve is the continuation of medial cord as it crosses the axillary artery.

3) Medial cutaneous nerve of arm is the smallest branch, it runs down on the medial side of the axillary vein and it supplies medial side of the arm.

4) Medial cutaneous nerve of the forearm is the large nerve it runs down between artery and vein

5) The ulnar nerve is the largest branch of the medial cord it runs downwards between the artery and vein. (Chummy S. Sinnatamby 12th edition).[5]

Roots are supplied by the minor branches of vertebral artery, ascending cervical artery. Trunks supplied by the transverse cervical artery and subclavian artery, Cords supplied by axillary artery (Gouaze et al 1961).[6]

METHODS

This study was carried out irrespective of age, sex, race in 10 specimens preserved in formalin solution collected from Department of Anatomy in Kamineni Institute of Medical Sciences, Narketpally, Nalgonda (Dist.), A.P. by gross dissection the brachial plexus from roots to cords and branches exposed along with their blood supply from adjacent vessels follow according to ROMANS Cunningham's method of volume 1.

Materials:
Scalpel, scissors, forceps, hand lens

Angiosome for nerves done by two techniques
1. Specimens subjected to histological techniques
2. For best results two stages perfusion is performed.

a) First perfusion is with saline solution to remove blood and other debris through an open venous system.
b) Lead oxide is available in powder form, dissolved with detergent solution. A lead oxide solution was prepared for second perfusion to visualize the fine vasa nervosum. The authors showed that the nerves of the upper limb were supplied segmentally by source vessels, which reinforced the angiosome concept.

The nerve sample of 1cm is taken along with its supplying vessels to histological techniques for the confirmation of blood supply to nerves microscopically. Nerve pieces along with blood vessels were fixed in 5-10 ml of formal saline solution and processed for paraffin embedding. 3-5 microns sections are cutting by rotator microtome. Sections mounted on glass slides. Mounted tissue is allowed to dry for 24 hours before taking the tissue staining .Blood supply to each nerve has been confirmed in compound microscope with 10x and 40x magnifications. The suitability of each nerve for harvest in free vascularized nerve transfer was assessed according to its pattern of blood supply. The nerve trunks and vascular supply of brachial plexus were identified. Digital enhancement of radiographed can demonstrate the extrinsic blood supply of the brachial plexus. By digital enhancement of radiographs, we will be able to understand the longitudinal intraneural anastomotic circulation within the brachial plexus.

RESULTS

On the bases of our study we have identified five sources of blood vessels supplying the brachial plexus: axillary trunk (according to the terminology of Gouaze et al)[4], deep, ascending, transverse cervical arteries and vertebral arteries. The majority of all vessels originated from the subclavian artery.

Proximal portion of medial cord of brachial plexus supplied by the dorsal scapular artery. Axillary artery supplies the distal portions of the medial cord. Vasa nervosum penetrated the trunk at its origin (or) termination. The results are analyze and mode of devision of blood vesels were identified.

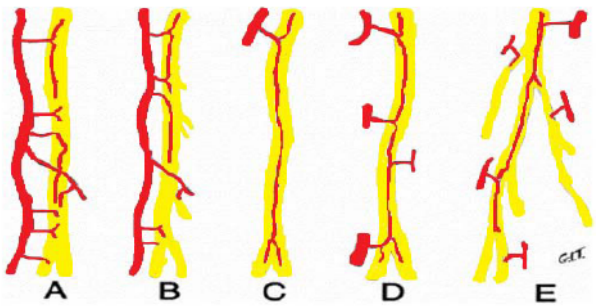
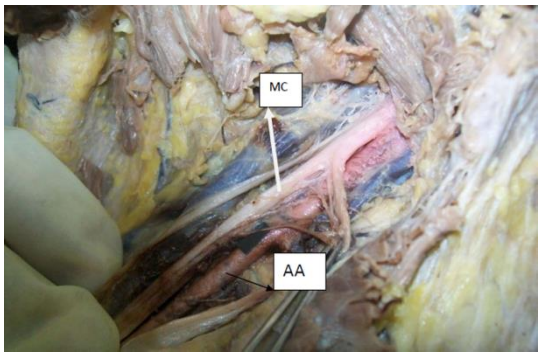


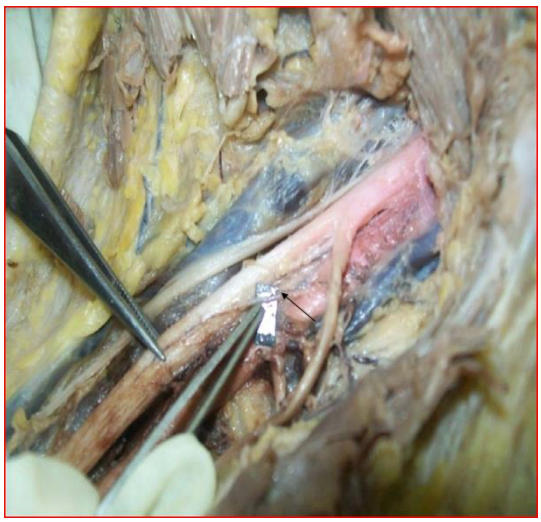
Figure 1: Classification of peripheral nerves according to their suitability for micro vascular free transfer, with type A being the best and type E being the worst. Type A indicates an unbranched nerve supplied segmentally by a vessel in parallel; type B is

similar but the nerve has branches. Type C has a long vessel coursing in the epineurium of an unbranched nerve. In types D and E, the nerve has a fragmented blood supply or many branches (J. Horigiechi).[10]

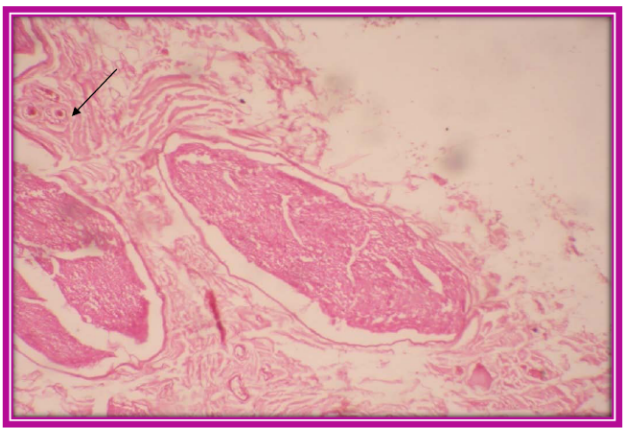
In our study Type-A and Type-C modes of divisions of angiosomes are observed.



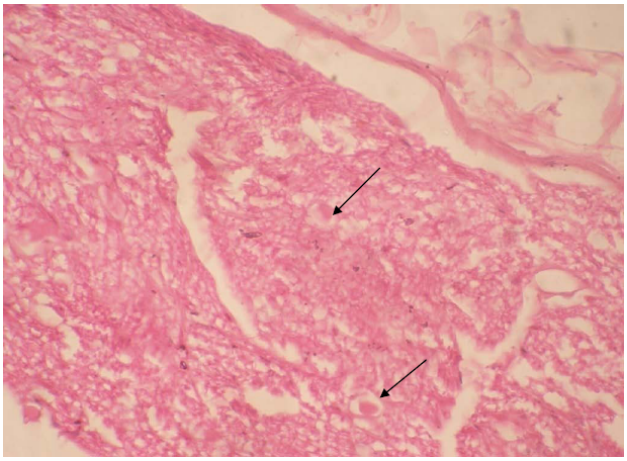
Photograph showing MC-medial cord, AA-axillary artery



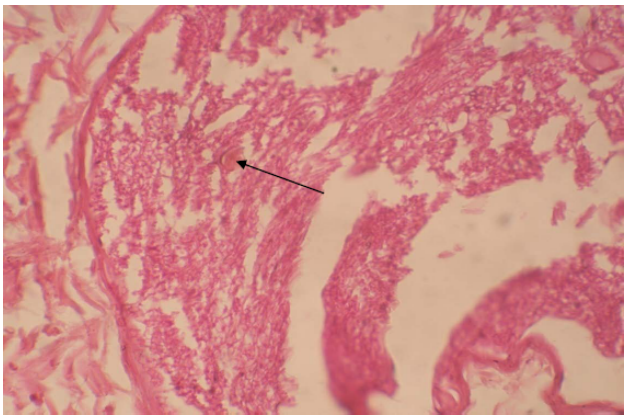
Photograph showing vasa nervosum between the axillary artery and medial cord.



Photograph showing minor branches of vertebral artery gives vascular supply to the roots of the brachial plexus.



Photograph showing the branches of first part of subclavian artery supply to trunk. Showing arteriole from transverse section of nerve (H&E10X).



Photograph showing medial cord is supplied by the branches of the second part of the axillary artery, showing presence of angiosome in transverse section of nerve (H&E40X).

DISCUSSION

The blood supply of brachial plexus depends upon the caliber of subclavian artery and its branches. Transverse cervical and dorsal scapular artery crosses (or) passes through the trunks of the brachial plexus supplying branches to their vasa nervosum. The vessels supplying the structures of the brachial plexus; originate anterior& posterior to the plexus.

In our study the roots C5-C6 are mainly supplied by the branches of ascending cervical artery and vertebral artery. C7 receives direct branches from subclavian artery. C8-T1 from the branches of deep cervical artery. The trunks are supplied by the subclavian artery and its branches. The lateral cord is mainly supplied by transverse cervical artery and the medial and posterior cords by the branches from axillary artery.

According to Adam kiewifz (18860, Bartholdy (1897), Tonkoff (1898), Bergmann and Alexander (1947), cords and branches of brachial plexus supplied by vertebral, ascending cervical, deep cervical and superior inter costals artery.[7]

Abdullach et al described branches from the vertebral artery that supplied the roots of cervical spinal nerves. The trunks of the plexus were supplied directly by muscular branches of the ascending and deep cervical arteries and superior intercostalis and occasionally from the subclavian artery. The cords received small direct branches from the subclavian, axillary and subscapular vessels.[8]

Gouaze et all described two groups of vessels supplying the brachial plexus, the first group consisted of the branches from deep, ascending and transverse cervical arteries and the second group were long and short vessels which arise from the subclavian and axillary arteries along their course.[6]

The cords received small direct branches from the subclavian, axillary and subscapular vessels. In this series there were no vasa nervosum from the suprascapular and transverse cervical arteries (Tonkoff, 1898; Ramage, 1927).[9] All available papers concerning the arterial blood supply of the brachial plexus were published from 1897 to 1967. In our study we observed medial cord supplied by branches of axillary artery.

CONCLUSION

The intra neural true anastomotic circulation between the adjacent nutrient arteries provides significant collateral circulation in certain pathological conditions. The detail knowledge of angiosomes is essential for plastic and reconstructive surgeons, when designing and surgically raising flaps of tissue which can reliably be moved from one part of the body to another without disrupting their blood supply. A detailed knowledge of the anatomy of the brachial plexus is required not only for surgeons but also for anaesthesiologists to gain proper access for interscalene block during operation of the shoulder and proximal upper extremity. Compression of the vasa nervosum can also cause nerve degeneration.

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