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Original Article

Variation in the branching pattern of Brachial artery: A morphological and statistical study

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ABSTRACT

Upperlimb injuries are the most frequent occupational accidents. Awareness of variations in the anatomy of brachial artery and its branches is important to avoid serious complications while treating the cases of arterio-venous fistulae, aneurysms and abscess drainage in the region of axilla, arm and cubital fossa. The present study was undertaken on 54 upper limbs of both sexes from embalmed adult human cadavers . The specimens were studied by detailed dissection method. In the present study, 59.3% of specimens showed variations of brachial artery. Better anatomical knowledge about the branches of brachial artery and their variations are important for surgeons, physicians, radiologists and interventionists, because based on anatomical study, new diagnostic and therapeutic approaches can be proposed.

1. Introduction

The vascular anatomy of the human upper limb which is man's important earning tool, is a complex and challenging area. The arterial supply of the upper limb is mainly maintained by brachial artery through its branches. The brachial artery begins as the continuation of the axillary artery(AA) at the distal border of teres major. It terminates by dividing into the radial(RA) and ulnar arteries(UA) in the cubital fossa at the level of the neck of radius. The main branches of the brachial artery are the profunda brachii artery(PBA) and the superior(SUCA) and inferior ulnar collateral arteries1. Recent progress in vascular surgery has engendered a need for precise knowledge of the frequency of anatomical variations in the branching pattern of brachial artery2. These variations have drawn attention of surgeons, physicians, radiologists and interventionists, because based on anatomical study, new diagnostic and therapeutic approaches can be proposed3. The origin of anomalies in the branching pattern of the upperlimb arteries is attributed to defects in the embryonic development of the vascular plexus of the upperlimb buds.4 Attention has to be given to the branching pattern of brachial artery while treating the cases of arterio-venous fistulae, aneurysms and abscess drainage in the region of axilla, arm and cubital fossa5. Particular attention has to be given to the anatomical position of brachial artery while performing cardiac-catheterization, intra-arterial injections and angiographic procedures via brachial artery.6,7 Considering all these factors, study of vascular pattern of upper limb and its variations assume great importance to prevent and avoid possible complications and achieve best results after surgeries as well as diagnostic and therapeutic interventions.

Objectives

The present study was undertaken with the following objectives :

1) To study the origin and course of brachial artery.

2) To study the branching pattern of brachial artery.

2. Methods :

Dissection method : 54 upper limbs from embalmed cadavers allotted for dissection in the Department of Anatomy, J.J.M. Medical College, Davangere were used for the study.

With the limb on its back, two transverse incisions were made, first at the level of anterior axillary fold, second at the cubital fossa. A vertical incision connecting the midpoints of these

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lines were taken. Then skin and superficial fascia were reflected. Longitudinal incision was taken through the deep fascia along the midline of arm and then brachial artery was identified and cleaned. The origin of brachial artery and branches were identified. In cubital fossa, bicipital aponeurosis was dissected and terminal branches of brachial artery were exposed and observed. Then the point of origin of profunda brachii artery, nutrient artery, superior ulnar collateral and inferior ulnar collateral artery were located.. The findings were noted down. Photograph of each specimen is taken after dissection, with digital camera.

Variations of the brachial artery[8] :

1) Superficial brachial artery (SBA) : This is a brachial artery coursing in front of rather than behind the median nerve and at the level of elbow it branches into the radial and ulnar arteries. The SBA originates from the third part of axillary artery above the teres major muscle.

2) Deep brachial artery (DBA) : This is a brachial artery coursing behind the median nerve co-existing with a superficial brachial artery and gives off branches of brachial and third part of axillary artery. The DBA originates from the third part of axillary artery above the teres major muscle.

3) Brachioradial artery (BR) : This is defined as a radial artery with a high origin.The artery runs superficial to the median nerve along the arm and gives off branches of brachial artery. The BR originates from the axillary artery, the upper third of the brachial, the middle third of the brachial or the lower third of the brachial artery.

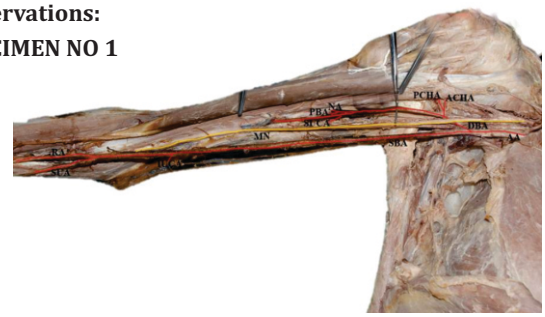
4) Superficial ulnar artery (SUA) : This is defined as an ulnar artery with a high origin, and which courses over the superficial forearm flexor muscles.The SUA originates from the axillary artery, the upper third of brachial or thelower third of brachial artery.

5) Superficial radial artery (SRA) : This is defined as a radial artery with a normal origin, which at the wrist level crosses over the tendons which define the snuff box.

6) Accessory brachial artery (ABA) : This originates above the elbow level from the upper third of the brachial artery. It crosses anterior to the median nerve to rejoin proximal to the elbow with the brachial artery, before its division into ulnar and radial arteries.

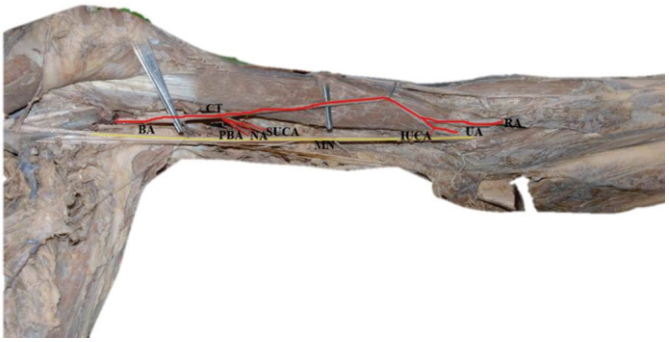
Observations:

SPECIMEN NO 1



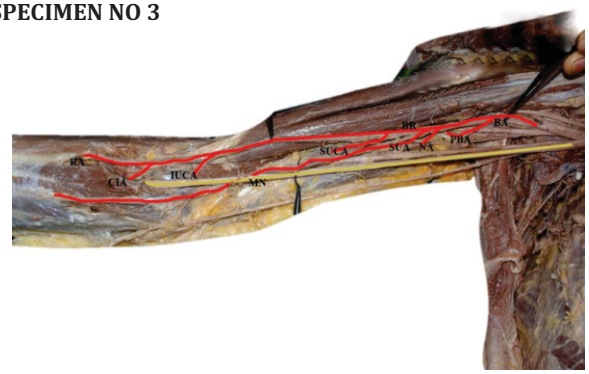
Specimen No 1 -2 BA are present, 3rd part of AA bifurcates into SBA & DBA. DBA give rise to ACHA,PCHA,PBA,NA,SUCA & a branch which goes along with Median nerve and terminates at the level of elbow. SBA bifurcates into RA & SUA. SUA takes part in formation of superficial palmar arch

SPECIMEN NO 2



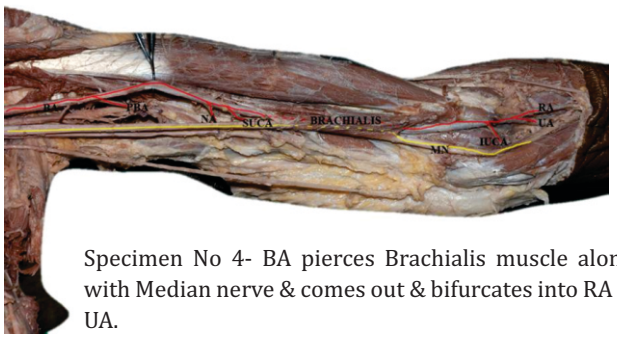
Specimen No 2- Common trunk arises from BA, 1 cm below the lower border of Teres major & it give rise to PBA,NA& SUCA. BA terminates into RA & UA at higher level about 5 cm above intercondylar line. IUCA arises from UA.

SPECIMEN NO 3



Specimen No 3- BA bifurcates into BR & SUA at proximal 1/3rd of arm. BR terminates by dividing into RA & CIA. SUA takes part in the formation of superficial palmar arch.

SPECIMEN NO 4



Specimen No 4- BA pierces Brachialis muscle along with Median nerve & comes out & bifurcates into RA & UA.

3. Results

Table 1 : Type of Brachial Artery

Type	Number	Percentage(%)
Normal	22	40.7
Variation	32	59.3
Total	54	100

Out of fifty four specimens, twenty two specimens (40.7%) showed normal pattern of brachial artery and thirty two specimens (59.3%) showed variations either in its course or in branches, indicating that variations of brachial artery was common rather than an exception(Table-1)

Table 2 : Arteries Classified By Topographical Criteria

Arterial pattern	Number	Percentage(%)
BA	43	79.6
SBA alone	1	1.9
SBA & DBA	6	11.1
BR & SUA	4	7.4
Total	54	100.0

Eleven (20.4%) out of fifty four specimens showed three types of variations in its course. One specimen (1.9%) showed superficial brachial artery alone, six specimens (11.1%) showed superficial brachial and deep brachial artery. Four specimens (7.4%) showed brachioradial and superficial ulnar artery, out of which two were arising from axillary artery and remaining two were from upper one third of the brachial artery(Table2).

Table 3 : Sites of Origin of Profunda Brachii Artery

Site	Number	Percentage(%)
BA	29	53.7
CT	16	29.6
DBA	05	9.3
BR	02	3.7
AA	01	1.9
2PBA from DBA	01	1.9
Total	54	100

Out of fifty four specimens, in twenty nine specimens (53.7%) the profunda brachii artery took origin from the brachial artery; in sixteen specimens (29.6%) from the common trunk(CT); in five specimens (9.3%) from the deep brachial artery; in two specimens (3.7%) from the brachioradial and in one specimen (1.9%) from the axillary artery. In one specimen (1.9%) two profunda brachii arteries took origin from the deep brachial artery(Table3).

4. Discussion

In the present study, 59.3% of specimens showed variations of brachial artery either in its course or in branches. This showed slightly higher incidence when compared to observations of previous workers, Mc. Cormack2 (18.53%), (18%), Bergmann6 (25%), Patnaik9 and Rodriguez10 (23%).

In the present study, 9 specimens (16.6%) showed that the brachial artery took origin from the axillary artery above the teres major muscle and in 45 specimens (83.4%) the brachial artery took normal origin from the axillary artery. Keen11 conducted a similar study which correlates with the present study.

In the present study, superficial brachial artery alone was found in 1 specimen (1.9%) and terminated into radial and ulnar artery. Earlier studies by many observers showed that variations in the course of brachial artery occurred frequently. Quain10 reported 0.2%, Gruber quoted 0.4%,Uzan12 described 1%, Mc. Cormack2 reported 5.75%, Keen11 reported 12.3%, Baeza8 described 4.9% and Patnaik9 reported 6% prevalence of superficial brachial artery.

In the present study, 6 specimens (11.1%) showed superficial and deep brachial artery which took origin from the third part of axillary artery. This study showed slightly higher incidence when compared with the observations made by Rodriguez8 which showed 5%. Vijayabhaskar13 reported a similar case which showed that the axillary artery divided into superficial and deep brachial artery. This observation co-relates with the present study.

In the present study, 4 specimens (7.4%) showed brachioradial and superficial ulnar artery. In 2 specimens both took origin from third part of axillary artery and in other 2 specimens took origin from upper one-third of brachial artery. Rodriguez8 conducted a similar study and observed brachioradial and superficial ulnar artery in 52 specimens (13.5%). In 12 specimens both took origin from third part of axillary artery and in 40 specimens took origin from upper one-third of brachial artery. Keen11 studied 284 specimens out of which 17 specimens (5.98%) showed brachioradial and superficial ulnar artery, which took origin from upper one-third of brachial artery. This study co-relates with the present study.

In the present study, in 53.7% of specimens, profunda brachii artery took origin from the brachial artery, in 29.6% of specimens from common trunk, in 9.3% of specimens from deep brachial artery and in 1.9% of specimens took origin from axillary artery. Patnaik9 conducted a similar study and observed that the profunda brachii artery took origin from common trunk in 6 specimens (12%). Keen11 conducted a similar study on 284 specimens and observed that in 61% of specimens, profunda brachii artery took origin from brachial artery, in 13% of specimens from common trunk and in 26% of specimens took origin from axillary artery.

In the present study, 1 specimen (1.9%) showed that two profunda brachii arteries took origin as separate branches from deep brachial artery. The origin of anomalies in the branching pattern of the upperlimb arteries is attributed to defects in the embryonic development of the vascular plexus of the upperlimb buds. An arrest at any stage of development, showing regression, retention or reappearance, may produce various variations in the arterial origins and courses of the major upper limb vessels4.

Better anatomical knowledge about the branches of brachial artery and their variations are essential in avoiding iatrogenic injuries by surgeons and also during interpretations of angiograms by radiologists. Knowledge of variations is also important for plastic surgeons, cardiologists, anaesthetists and orthopaedicians

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