

A MORPHOLOGICAL STUDY OF AXILLARY ARTERY AND ITS BRANCHING PATTERN

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ABSTRACT

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. Recent progress in vascular surgery has engendered a need for precise knowledge of the frequency of anatomical variations in the branching pattern of axillary artery. 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 axillary artery. Better anatomical knowledge about the branches of brachial artery and their variations are important for surgeons, physicians, radiologists and interventionalists, because based on anatomical study, new diagnostic and therapeutic approaches can be proposed.

KEYWORDS: Axillary artery; Superficial brachial artery; Deep brachial artery; Profunda brachii artery.

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INTRODUCTION

The axillary artery the continuation of the subclavian artery commences at the outer border of the first rib, and ends at the lower border of the tendon of the teres major muscle, where it takes the name of brachial artery. To facilitate the description of the vessel it is divided into three portions; the first part lies above, the second behind, and the third below the pectoralis minor. The axillary artery is conveniently described as giving off six branches but the number arising independently from it, is subject to considerable variations; two or more of its standard branches may arise by a common trunk or a usually named artery may arise separately. The commonly described branches of the axillary artery are superior thoracic artery,

thoraco-acromial artery, lateral thoracic artery, subscapular artery, anterior circumflex humeral artery and posterior (1) circumflex humeral artery[1]. The brachial artery is the continuation of the axillary artery at the distal (inferior) border of the tendon of teres major and it ends about a centimetre distal to the elbow joint, at the level of the neck of the radius, by dividing into radial and ulnar arteries [2].

The present study was designed to establish the branching pattern of axillary artery including points of origin of various branches, prevalence of deviations from usual description and to analyse the data in the light of the accessible literature [3]. The origin of anomalies in the branching pattern of the upper limb arteries is attributed to defects in the embryonic develop-

ment (sprouting and regression) of the vascular plexus of the upper limb 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 vessels [4]. Morphological variations in the arterial pattern of the upper limb is very important for vascular surgeons, plastic surgeons, cardiologists, anaesthetists and radiologists. Brachial artery is used in diagnostic angiography, cardiac catheterization for angioplasty, carotid stenting, transbrachial access for endovascular renal artery intervention and embolectomy through arteriotomy on brachial artery [5]. 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. The objectives of present study are to study the origin, course, branching pattern and termination of axillary artery.

MATERIALS AND METHODS

Source of data: The specimens for this study were obtained from the Department of Anatomy, J.J.M. Medical College, Davangere. Requisite consent has been obtained from Head of Department to conduct this study.

Sample size: Fifty four upper limbs were procured from the Department of Anatomy during the course of study over a period of two years.

Inclusion criteria: All the cadavers available during study period were included.

Exclusion criteria: Deformed or traumatized upper extremities were excluded from the study.

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 lines was taken. Then skin and superficial fascia were reflected.

Variation of the Axillary Artery

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 [6].

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: SBA and DBA, both arise from 3rd part of axillary artery, 5 cms above the lower

border of teres major. SBA is anterior to median nerve (MN). Profunda brachii artery (PBA), nutrient artery (NA), superior ulnar collateral artery (SUCA) and inferior ulnar collateral artery (IUCA) originates from deep brachial artery (DBA). SBA terminates into radial artery (RA) and ulnar artery (UA), 2.5 cms below the level of intercondylar line.

RESULTS AND DISCUSSION

Out of 54 specimens, in 9 specimens (16.6%) the brachial artery took origin from the axillary artery above the teres major muscle. In 45 specimens (83.4%) the brachial artery took origin from the axillary artery below the teres major muscle.

In six specimens (13%) posterior circumflex humeral artery took origin from the CT; in three specimens (5.6%) anterior and posterior circumflex humeral artery from DBA; in one specimen (1.9%) anterior and posterior circumflex humeral artery from CT; in one specimen (1.9%) posterior circumflex humeral artery from BA; in two specimens (3.8%) posterior circumflex humeral artery from DBA and in one specimen (1.9%) anterior circumflex humeral artery from DBA.

Out of fifty four specimens, four specimens (7.4%) showed brachioradial and superficial ulnar artery, which were arising from axillary artery, in sixteen specimens (29.6%) profunda brachii artery took origin from axillary artery.

Earlier studies by many observers showed that variations in the course of brachial artery occurred frequently. Quain [7] reported 0.2%, Gruber reported 0.4%, Uzan described 1%, Mc.Cormack reported 5.75%, Keen reported 12.3%, Baeza [8] described 4.9%, Patnaik [9, 10] reported 6% prevalence of superficial brachial artery arising from axillary artery above teres major muscle.

Keen [11] 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 took origin from common trunk and in 26% of specimens took origin from axillary artery.

Developmental Basis:

The seventh cervical intersegmental artery forms the axis artery of the upper limb and persists in the adult to form the axillary, brachial, and interosseous arteries. Transiently, the median artery arises as a branch of the interosseous artery, begins to regress and remains as a residual artery accompanying the median nerve. The radial and the ulnar arteries are later additions to the axis artery. The ulnar artery and the median artery are branches of the axis artery. The superficial brachial artery is a consistent embryonic vessel, coexisting or not with the brachial artery. It has two terminal branches, lateral and medial. The lateral continues as a part of the definitive radial artery and the medial i. e. superficial antebrachial artery, which divides into the median and ulnar artery branches, which are the trunks of origin of the median and ulnar arteries. The arterial pattern of the upper limb develops from an initial capillary plexus by a proximal and distal differentiation, due to maintenance, enlargement and differentiation of certain capillary vessels, and the regression of others. The number of upper limb arterial variations arise through the persistence, enlargement and differentiation of parts of the initial network which would normally remain as capillaries or even regress [12].

Clinical significance:

The knowledge of presence of the unusual high level bifurcation of brachial artery is clinically important for clinicians, surgeons, orthopaedicians and radiologists performing angiographic studies. Undoubtedly, such variations are important for diagnostic evaluation and surgical management of vascular diseases and injuries. Therefore both the normal and abnormal anatomy of the region should be well known for accurate diagnostic interpretation and therapeutic intervention [13].

CONCLUSION

The present study on brachial artery and its branching pattern showed that its origin, course and branches were variable. The brachial artery with normal origin and course was found in majority of specimens. Superficial brachial artery alone, which took origin from the third part of

axillary artery above the teres major was found in 1.9% of specimens. 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 vessels. 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.

Conflicts of Interests: None

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