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Research Article

Frequency of abnormal branching pattern of axillary artery: a cadaveric study

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ABSTRACT

Many authors suggest that abnormal branching pattern of axillary artery is very common. This compelled us to explore the axillary region of 20 formalin fixed cadavers of either sex to note the frequency of unusual branching of axillary artery over a period of five years. Axillary artery branched normally as described in various textbooks of Anatomy in thirty nine (97.5%) out of forty axillae examined. Only in one axilla (2.5%), it was observed that the second part of axillary artery branched unusually whereas on the other side it branched normally. Knowledge of such abnormal presentation of the axillary artery in the era of reconstructive surgeries is of great help to the interventionist so as to avoid any vascular catastrophe resulting in some kind of mishap. Awareness of such unusual branching pattern of axillary artery is also of great importance to vascular surgeons and radiologists dealing with this region. Embryological origin and the clinical relevance of the abnormality encountered in the branching pattern of the axillary artery in the present study have been discussed in the paper.

Keywords: Axillary artery, Branching pattern, Embryological basis

INTRODUCTION

Axillary artery begins as a continuation of third part of subclavian artery at the outer border of the first rib and ends at the lower border of teres major muscle to continue as brachial artery in the upper part of arm. Pectoralis minor muscle divides it into three parts- the first part being proximal, second part posterior and the third part distal to the muscle. Superior thoracic artery arises from the first part of axillary artery. Two branches i.e. thoraco-acromial and lateral thoracic arteries are given off from the second part while the third part normally gives off three branches i.e, anterior and posterior circumflex humeral and subscapular arteries.[1]

The frequency of deviation from the normal branching pattern of the axillary artery should be remembered during various surgical approaches in the axillary region. In the present era where vascular reconstructive surgeries are on increasing trend, the need to enrich the pool of existing anatomical knowledge regarding the frequency of occurrence of variation in the branching pattern of axillary artery was felt. Hence, the present study was conducted. Clinical correlation and the embryological basis of abnormal branching pattern of axillary artery have been discussed.

METHODS

Over a span of five years, axillary regions of 20 formalin fixed cadavers (10 males, 10 females) were dissected in the dissection hall of Anatomy Department of University College of Medical Sciences, Dilshad garden, Delhi, India. Medical history and cause of the death of these cadavers were not known. Dissection instruments were used to dissect the axillary regions according to the dissection steps given in Cunningham's manual of practical anatomy.[2] As described in the manual, the

pectoralis minor muscle was identified and cut near its insertion. The course of the axillary artery was traced in all the axillae and the branching pattern of all the parts of axillary artery was seen. Frequency of deviation from the normal was noted, analysed and discussed.

RESULTS

Axillary artery followed a normal course and branching pattern in 39 (97.5%) out of a total of 40 axillary regions dissected. Only in one axilla (2.5%) of a 60 years old male cadaver abnormal branching pattern of the second part of left axillary artery was seen. The 1st part of this axillary artery gave its usual branch i.e. superior thoracic artery. After giving off thoracoacromial and lateral thoracic arteries, the second part of axillary artery bifurcated into a medial and a lateral divisions (Fig 1, 2) posterior to the pectoralis minor muscle. The medial division was of larger caliber as compared to the lateral division. It first supplied pectoralis major and minor muscles (Fig 3). Then it continued as the brachial artery. The lateral division passed between the two roots of median nerve and divided further into a medial and a lateral branch. Posterior circumflex humeral and subscapular arteries were given off by the medial branch of this lateral division. Thin anterior circumflex humeral artery arose from the lateral branch after which it continued as arteria profunda brachii that reached the spiral groove along with the radial nerve (Fig 2). Normal branching pattern of the axillary artery was seen on the right side in this cadaver.

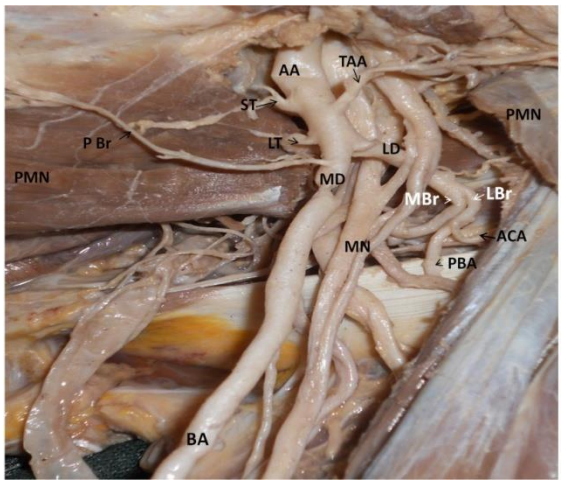

Figure 1: Showing the branches of left axillary artery (AA) - superior thoracic (ST), thoracoacromial (TAA) and lateral thoracic (LT). Second part of AA bifurcating into lateral division (LD) and medial division (MD). LD dividing into lateral (L Br) and medial (M Br) branches. L Br giving anterior circumflex humeral artery (ACA) and then continuing as profunda brachii artery (PBA). Also seen in this view are the median nerve (MN) and a muscular twig to pectoralis minor muscle (PMN) i.e. pectoral branch (P Br) from the medial division (MD). Brachial artery (BA) is the continuation of MD.

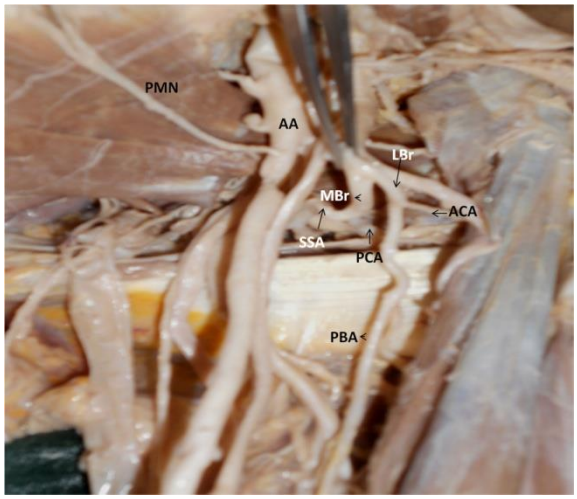

Figure 2: Showing the lateral division (LD) of left axillary artery (AA) [held by forceps] dividing into a medial branch (MBr) giving subscapular artery (SCA), posterior circumflex humeral artery (PCA) and a lateral branch (LBr) giving off anterior circumflex humeral artery (ACA) and then continuing as profunda brachii artery (PBA).

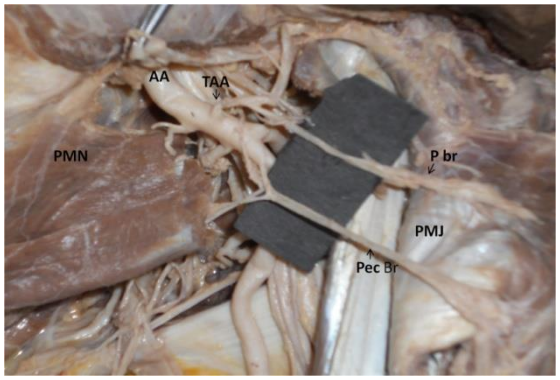

Figure 3: Showing the left axillary artery (AA) supplying pectoralis minor muscle (PMN) and pectoralis major muscle (PMJ). Pectoral branch (PBr) which is a normal branch from the thoracoacromial artery (TAA) is seen. An extra pectoral branch (Pec Br) given off by Medial division (MD) of axillary artery is also seen.

DISCUSSION

The axillary artery is an important content of axilla. Any deviation from the usual branching pattern of the artery may lead to complications during various interventions in this region. Though various authors have reported variations in the branching pattern of axillary artery but no one to our knowledge has commented on its frequency. Hence the present study was conducted to note the frequency of occurrence of these variations.

George et al.[3] reported the bifurcation of terminal part of axillary artery into two equal sized trunks i.e. superficial and deep. The superficial trunk continued as brachial

artery while the deep trunk further bifurcated into circumflex humeral- subscapular trunk and profunda brachii artery. Anterior and posterior circumflex humeral and subscapular arteries arose from the common circumflex humeral-subscapular trunk. In the present study bifurcation of the second part of axillary artery into a medial and a lateral division was seen. These two divisions were not of equal caliber as reported by George et al. The lateral division in the current study again bifurcated into lateral and medial branches. Anterior circumflex humeral and profunda brachii arteries arose from the lateral branch while posterior circumflex and subscapular arteries were taking origin from the medial branch. Common circumflex humeral- subscapular trunk was not observed in this study as was observed by George et al.

Branches of axillary artery remained confined to the upper limb in the present study. This was in contrast to the observations of Kogan and Lewenson[4] who observed a common trunk branching out from the axillary artery, passing between the two roots of median nerve and then dividing into a lateral and medial branch. The lateral branch gave rise to muscular branches which supplied the muscles of the shoulder region and adjacent fascia while the medial branch reached the hypogastric region and anastomosed with the superficial epigastric artery according to their findings.

Johnson and Ellis[5] are of the opinion that posterior circumflex humeral and subscapular arteries arise from a common trunk in 30% of cases. Occasionally subscapular, circumflex humeral and profunda brachii artery may arise in common or profunda brachii artery may give rise to posterior circumflex humeral artery. In the current study, posterior circumflex and subscapular artery were given off by a common trunk as was stated by Johnson and Ellis. In contrast to their findings, in this study anterior circumflex humeral and profunda brachii artery arose from a common trunk.

Soubhagya et al.[6] observed that the third part of axillary artery was lying beneath an anomalous muscle - lattisimo-condylo-ideus and divided it into a lateral and medial branch. Common humeral circumflex and superior ulnar collateral arteries arose from the lateral branch. Anterior and posterior circumflex humeral arteries were arising from common humeral circumflex artery which then continued as profunda brachii artery. On the other hand, the superior ulnar collateral artery passed along the medial side of the arm till the elbow joint. They called the medial branch as subscapular artery which gave rise to three circumflex scapular arteries and finally continued as thoracodorsal artery. In contrast to their observations, the second part of the axillary artery ended by bifurcating into a lateral and medial branches and no third part was formed in the present study.

In rare cases the first part of the axillary artery may give rise to the subscapular artery or vascularise the subscapular muscles according to Bergman et al. (1988).[7] However in our study the subscapular artery branched from the second part of axillary artery which is in contrast to the observations of Bergman et al.[7]

The axillary arterial system is derived from the seventh cervical intersegmental artery.[8] In embryos of 11 mm length, the seventh cervical intersegmental artery enlarges and becomes the dominant vessel of axilla. Normally C6, C7 and T1 segmental arteries and most of the longitudinal anastomoses that link up the intersegmental arteries degenerate slowly. Any abnormality during this phase of development results in the unusual branching pattern.[9] The anomaly observed in the branching pattern of axillary artery in the present study could be due to incomplete degeneration of segmental arteries and the longitudinal anastomoses between C6, C7 and T1 segmental arteries as suggested by Wollard.

Although the abnormal branching pattern is encountered quite infrequently according to this study, yet the vascular surgeons and interventionists must be aware of this uncommon existence while operating in axillary region so as to avoid any vascular catastrophe. Radiologists must also be aware of such presentation of axillary artery so as to correctly interpret the angiograms. Plastic surgeons must also possess an accurate knowledge of such type of presentation of axillary artery while performing various reconstructive surgeries in this region.

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