‘Abnormal origin of superior thoracic artery- a cadaveric study.’

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ABSTRACT-

Background- The arterial pattern of the human superior extremity exhibits a host of variations. Knowledge of these anatomical variations is of great utility in vascular and reconstructive surgeries as well as in angiographic evaluations. The axillary artery gives six branches. They are superior thoracic artery from first part; lateral thoracic artery and thoraco-acromial artery from second part; anterior circumflex humeral artery, posterior circumflex humeral artery and subscapular artery from third part. This pattern shows a multitude of variations.

Aim of the study- To study the variations of branching pattern of axillary artery in formalin fixed cadavers using classical dissection methods and incisions.

Materials and methods- The study was conducted on fifteen formalin fixed cadavers and thirty upper limbs were dissected. The axillary arteries and their branches were exposed and they were observed for any variation in the branching pattern of axillary artery.

Results- A unilateral variation was observed in single, adult, male cadaver (3.33% of upper limbs) on the right side in which the superior thoracic artery originated from the lateral thoracic artery instead of the first part of the axillary artery.

Conclusion- Our study will be of great importance in anatomy, vascular surgery and orthopedic surgery.
Key Words- Axillary artery, Superior thoracic artery, Branching pattern.

INTRODUCTION:

Variations in the arterial pattern of human upper extremity are relatively common. These anomalous arterial patterns have long aroused the interest of anatomists, cardiologists, vascular reconstruction surgeons, radiologists and orthopedicians. Knowledge of these vascular patterns are significant in diagnostic interventions as well as surgical procedures(1). Axillary artery arises as the continuation of the third part of the subclavian artery beyond the outer border of the first rib. It is closely related to the cords of brachial plexus and their branches and is enclosed in the axillary sheath along with the axillary vein(2). The axillary artery is divided into three parts by the pectoralis minor muscle. The first part gives rise to one branch- superior thoracic artery. The second part gives rise to two branches- lateral thoracic artery and thoraco-acromial artery. The third part gives rise to three branches- anterior circumflex humeral artery, posterior circumflex humeral artery and subscapular artery(3). Variations in branching pattern of axillary artery are due to defective embryonic development of the vascular plexus of the upper limb bud(3). A part of the developing aortic arch system and the seventh segmental artery get transformed into the subclavian-axillary stem on the right side and the seventh segmental artery alone gets transformed into the left subclavian-axillary system. Any anomalies in this embryonic pattern gives rise to variations in the branching pattern of the axillary artery(3).

MATERIALS AND METHODS:

The study was conducted on fifteen formalin fixed adult cadavers (ten male and five female) used for regular class room dissection in MBBS discourse in a Medical College in Eastern India. The period of study was from August, 2015 to January, 2020. The thirty upper limbs were dissected using classical dissection procedure exposing the axillary arteries and their branching pattern.

RESULT:

During the routine dissection, a unilateral variation of branching pattern of axillary artery (Figure 1) was observed in a cadaver belonging to a sixty years old male who died of natural causes. The right axillary artery of the said cadaver exhibited no branches from its first part. The second part showed the two usual branches- lateral thoracic artery and thoraco-acromial artery. However the lateral thoracic branch of the second part gave rise to the superior thoracic artery. The third part gave rise to the three usual branches. The branching pattern was observed to be normal on the left side of the cadaver.

DISCUSSION:

We found the abnormal origin of the superior thoracic artery from the lateral thoracic artery in one out of thirty upper limbs studied (3.33% of upper limbs). Similar origin of the superior thoracic artery from the lateral thoracic artery has been observed by various authors. Huelke(4) has reported 1.7% cases where the superior thoracic artery emerged from the lateral thoracic artery. Pelligrini(5) has reported similar variations in 1% cases in his study.

The embryonic development of the arterial pattern of the superior extremity occurs in five different stages as follows(6).
Stage I- The lateral branch of the seventh intersegmental artery extends up to the wrist as the axis artery of the upper limb where it ends by dividing into terminal branches for the fingers. The proximal portion of the artery gives rise to the axillary and brachial arteries whereas the distal portion forms the anterior interosseous artery.

Stage II- Then a median artery arises from the anterior interosseous artery, accompanies the median nerve to unite with the palmar capillary plexus. By this time, the anterior interosseous artery has regressed.

Stage III- The ulnar artery arises from the brachial artery and unites with the artery accompanying the median nerve to form superficial palmar arch.

Stage IV- The superficial brachial artery arises in the axillary region, extends up to the wrist and divides over the carpus into branches for the dorsum of the thumb and index finger.

Stage V- The artery accompanying the median nerve regresses and becomes arteria nervi mediana. The superficial brachial artery gives rise to a branch that anastomoses with superficial palmar arch. An anastomosis develops between main trunk of brachial artery and existent superficial brachial artery, which later forms the radial artery.

Anomalies of the blood vessels may be due to formation of unusual vascular paths in the primitive vascular plexuses; unusual persistence of vessels that normally get obliterated; disappearance of vessels which normally persist; incomplete development or fusion and absorption of various parts. Fibroblast growth factor 2 (FGF 2) induces formation of hemangioblasts. Vascular endothelial growth factor (VEGF) directs the hemangioblasts to form blood cells. VEGF also induces budding of capillaries. Final modelling and stabilization of the vasculature are accomplished by platelet derived growth factor (PDGF) and transforming growth factor β (TGF β). Any disturbance in this process may result in variation in the arterial distributing pattern.

Knowledge of abnormal arterial pattern in the axilla is of great utility in harvesting arterial flap in plastic surgery; protection of axillary artery in breast cancer surgeries; in cases of aneurysm, arterio-venous fistulae, draining abscesses in the axilla; treating axillary vasculature thrombosis; during antegrade cerebral perfusion in aortic surgery; during surgical intervention of fractures of upper end of humerus and shoulder dislocation; for reparative surgery and angiography of coronary arteries.

CONCLUSION:
The findings of our study will be useful in anatomy, vascular surgical intervention, angiography and orthopedic procedures.

REFERENCES:

FIGURE 1 (Photograph showing abnormal origin of superior thoracic artery from lateral thoracic artery.)