A CONGENITAL ANOMALY OF THE AXILLARY ARTERY

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Abstract

Axillary artery was found bifid on both sides, in a routine dissection of the cadaver of a Sri Lankan, Jaffna Tamil. It has terminated into unequal anterior and posterior divisions. The medial cord of the brachial plexus exhibited posterior position to the second part of the artery. The medial root of the median nerve penetrated the artery to bring bifidity. In right axilla the short median root brought division of the artery at a high level. In left axilla the long median root brought division of the artery at a low level. The roots of the median nerve embraced the narrow posterior stem and it extended into the elbow. The wide anterior stem continued as the brachial artery.

Introduction

The axilla transmits the neurovascular bundle from the neck to the upper limb. The axillary artery is a curved artery and the continuation of the subclavian artery in the neck. This enters the apex of axilla behind the mid point of the clavicle. At the lower border of the posterior wall of the axilla it becomes the brachial artery. This descends into the elbow region dividing into radial and ulnar arteries (McMinn, 1992).

The three nerve cords of the brachial plexus are formed behind the clavicle. They enter the upper part of the axilla above the artery, approach and embrace the 2nd part of the artery and lies laterally, posteriorly and medially. They give off their branches around the lower part of the artery. The medial and

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lateral cords of the brachial plexus, after giving off their branches continue as medial and lateral roots of the median nerve respectively. The median root of the median nerve crosses in front of the artery to meet the lateral cord just as lateral to the artery. Thus the artery is embraced by the two roots of the median nerve. The median nerve in its course first lie lateral to brachial artery but crosses infront of it in the lower 1/3rd of the upper arm to lie on its medial side. Thus the main axillo-brachial system appears in a posterior plane of the median nerve. This is called "deep pattern" in the development of the artery (McMinn, 1992).

Development

The upper limb buds grows out of the embryo at the beginning of 5th week of development (William et. al., 1995). As it grows, a capillary plexus is produced in its substance. Many capillaries would disappear, some enlarge and straighten their union respecting a genetic programme. Thus an arterial pattern occupying a constant position is produced. The developing subclavian artery in the neck grows into the axilla to join the axillary artery. As the apex of the axilla is small the nerves for the upper limb join to form the three trunks of the brachial plexus. They pass through the apex and divide to form the three cords of the brachial plexus. The cords initially occupy a superior position to the first part of artery and then surround the 2nd part. The nerves are produced in a centrifugal manner from these cords around the 3rd part of the artery. The median root of the median nerve is an exception and it passes through the capillary plexus of the axilla. The capillaries which lie in front of the median root disappears and the developing axillary artery normally passes behind the two roots of the median nerve. The developing brachial artery which is the continuation also lies deep to the median nerve in the lower 1/3rd of the upper arm. This is the normal "Deep pattern" in development of the main upper arm artery. At times due to the complexity of development, individual variants of the axillo-brachial axis might occur. The present observation is bilateral bifidity of the axillary artery with domination of superficial pattern where the main superficial division of the axillary artery dominates and the brachial artery lies in front of the median nerve. This is called the "superficial pattern" in the development.

Materials and Methods

Anomalous bifid termination of the axillary artery was observed in each axilla of a male cadaver in a routine dissection in the Department of Anatomy, Faculty of Medicine, Jaffna. The bifid terminal branches are named superficial and deep divisions and were traced up to the elbow region. The relations of the median root of the median nerve to these divisions were noted. The lengths of the medial and lateral roots of the median nerve, the distance of the point of bifurcation of the axillary artery from mid clavicular point were measured with millimetre scale in each axilla with 90 degrees abduction of the upper limb.

Results

The axillary artery was found bifid in each axilla above the median root of the median nerve. The medial cord was situated posterior to the artery and medial root of the median nerve penetrated the artery from behind dividing it into two unequal divisions. The wide anterior divisions of the artery descended anterior to medial root in a forward inclination to be continued as the brachial artery which crosses in front of the median nerve. The narrow posterior division of the artery descended in a posterior plane to reach the elbow region to join the plexus of arteries around it. In the right axilla the median root is short and thick (24mm) meeting the lateral root at a wider angle than in left. These roots embraced the posterior division of the artery. The division of the axillary artery was 70mm from the mid-clavicular point at a relatively higher level than that in the left axilla (Fig. 1).

In the left axilla the median root is long (53mm) and narrow meeting the lateral root at a relatively narrower angle than in right. The divisions of the artery was 117 mm from the mid clavicular point at a lower level than in right. Both divisions were narrower than those of the right. The posterior division of the artery in the left axilla is the narrowest. The medial and lateral roots of the median nerve loosely embraced the posterior division of the artery in the form of V. When the arm is abducted to 90 degrees and laterally rotated the axillary artery pursues a straight course and the roots of the median nerve lie loosely on it. But in the present specimens the roots were taut on the posterior divisions of the arteries but more taut on the right side than on left (Table. 1) (Fig. 2).

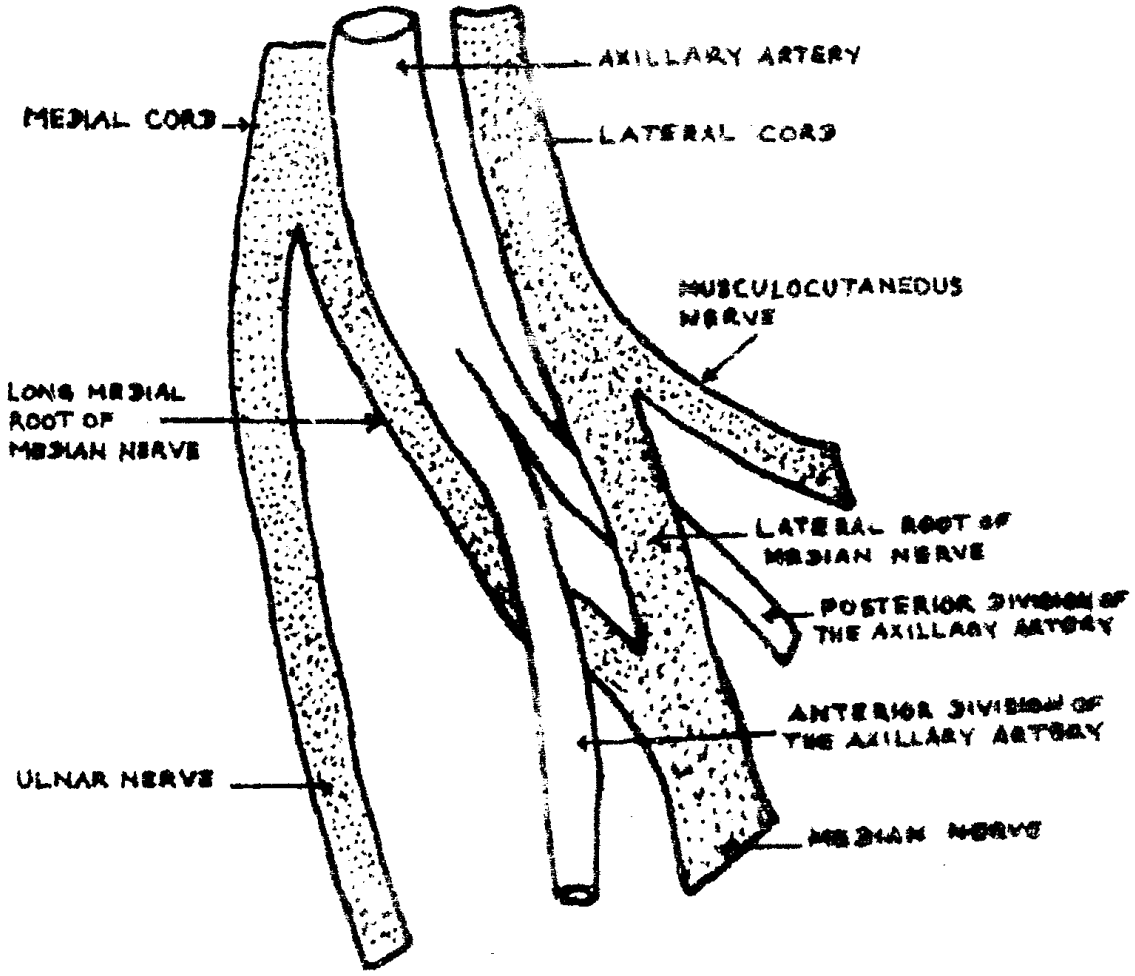

Fig. 2 : Left Axillary Artery is penetrated by long median root of the median nerve at a lower level

Discussion

Having developed from a capillary plexus (William et. al., 1989) the individual variations of the axillo-brachial axis are due to their complex development (Matsummoto et. al., 1994). The median root of the median nerve get entangled in the capillary plexus and the variations of the axillary artery are related to this (Basmajian and Slonecker, 1989). In 82 % of cases the developing axillary artery passes behind and in between the medial and lateral roots of the median nerve. The brachial artery which is the continuation of the axillary artery, crosses behind the median nerve in the lower $1/3^{rd}$ of upper arm. This is called "deep pattern" in the development of the axillary artery. In 13 % of cases the axillary artery appears normal, but the brachial artery lies in front of the median nerve in the lower third of the upper arm. This is called "superficial pattern" in the development of brachial artery. In 5 % of cases the axillary artery is bifid in that in 88 % of cases it is bilateral. In the present observation the axillary artery showed bifidity in a bilateral manner. The incidence of the bifidity of axillary artery has been estimated as 13.4 % in Negroes (De Garis and Swartley, 1928) and 4.6 % in White persons (Miller, 1939). It is a normal finding in a variety of primates but in man it is considered as an anomaly (Matsumoto et. al., 1994). In man the bifidity of the axillary artery appears above the median root of the median nerve and the divisions are of equal calibre. When it occurs (Hollinshed, 1958b) the anterior stem is called as superficial brachial artery and the posterior stem as deep brachial artery. The superficial stem continues as the radial artery in the forearm and the deep stem as ulnar artery. The present observations exhibited the rarely observed unequal divisions of the axillary artery. The wider anterior stem continued as the normal brachial artery which get divided into radial and ulnar arteries in the elbow. The median nerve has crossed behind the artery in the lower $1/3^{rd}$ of upper arm. This confirmed the "superficial pattern" in the development of axillary artery. The posterior stem of the axillary artery descends in a deeper plane to reach the elbow region and join the plexus of arteries around the elbow joint.

The cords of the brachial plexus enter the axilla above the first part of the axillary artery and approach the second part. Thus the medial cord initially appears superior to axillary artery then become posterior and finally medial. In the present case the medial cord remained posterior to the second part of the artery. The median root of the median nerve had

to penetrate the artery from posterior to lateral side to meet the lateral root. In the right axilla the median root is short (24mm) and thick, hence the division of the artery is at a higher level (70mm). The short V formed by the roots of the median nerve has cleaved a narrow postero-lateral segment from the axillary artery. This segment is embraced by the roots of the nerve and maintained in a posterior plane. The anterior stem of the bifid axillary artery has inclined forwards, as it was not pressed backwards. In the left axilla the median root of the median nerve is long (53mm), hence the penetration of the artery occurred at a lower level than in right axilla (117 mm). The long V formed by the roots of the median nerve cleaved a postero-lateral segment which was the narrowest of all the stems of the axillary arteries. Very rarely 0.6 % (Miller, 1939) and 02 % (Toshio and Tanaka, 1996) the axillary artery is bent behind the roots and the proximal part of the median nerve. The collateral joining the bifid artery enlarges and portions of the arterial stems are retained to produce a combined deep and superficial pattern of the axillo-brachial axis.

Applied anatomy

If the narrowed division is continued, the brachial artery can give rise to feeble brachial as well as radial pulse. Regional blood supply from a narrowed division can be reduced. The narrowing of a division or narrowing of the main vessel beyond all its branches can cause an embolism expelled from the heart, to be lodged at the site of narrowing (Basmajian and Slonecker, 1989).

In the present observation there were no obvious peripheral ischemic changes noted in the upperlimbs. This could be due to wider anterior division of the axillary artery which has continued as the brachial artery. There is also no ischemic changes in the back of the upper arm as the posterior division of the axillary artery is directly connected to the arterial plexus (circulus vasculosus) around the elbow joint.

Summary and Conclusion

The medial cord remained posterior to the axillary artery hence median root has penetrated each axillary artery. In the right axilla as the median root was short, the division of the artery was at a higher level while in left axilla the median root was long and the division of the artery was a lower level. The stems of the bifid axillary artery are of unequal calibre. The wider anterior stem continued as the normal brachial artery and the narrow posterior stem in a posterior plane to the elbow region. The roots of the median nerve embraced the posterior stem of each axillary artery. The

upper limbs didn't exhibit any ischemic changes in these specimens.

Posteriorly existed medial cord was responsible for the unequal bifidity of the axillary artery. This anomaly was compatible with life.

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References

1 Basmajian, J.V. and Slonecker, C.E. (1989). Upper limb and back in Grant's method of Anatomy. 11ThEd. William Wilkins, Baltimore, pp : 343-440.

2. De Garis, C.F. and Swartley, W.B. (1928). The axillary artery in white and Negro stocks. *Amer.J.Anat.* 41 353.

3. Hollinshead, W.H. (1958b). General Survey of the upper limb in : Anatomy for surgeons Volume 3, Hoeber-Harper, New York, pp : 207-262.

4. Matsummato, S. Kuhn, H. Vogt, H. Gerke, M. (1994). Embryological development of the arterial system of the forelimb in Tupaia. Anat.Rec. 240 : 416-422.

5. McMinn, R.M.H. (1990). Last's Anatomy. 8ThEd. Churchill Livingstone, Edinburgh, pp : 53-144.

6. Miller, R.A. (1939). Observations upon tha arrangements of the axillary artery and brachial plexus *Amer.J.Anat.* 64 : 143.

7. Toshio, N. and Tanaka, S. (1996). Bilateral location of the axillary artery posterior to the medial cord of the brachial plexus. case report. *J.Anat.* 189, 457-459.

8. Williams, P.L., Warwick, R., Dyson, M., and Bannister, L.H., (1989a). Embryology in Gray's Anatomy, 37ThEd. Churchill Livingstone, Edinburgh pp : 95-226.