

## BILATERAL NEUROVASCULAR VARIATIONS IN UPPER LIMBS OF AN ADULT CADAVER – ANATOMICAL OBSERVATIONS, ONTOGENIC EXPLANATION AND CLINICAL IMPLICATIONS

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### ABSTRACT

Bilateral Vas aberrans (VA)/superficial brachial artery originating from 3rd part of axillary artery with variations in the formation and branching of cords of brachial plexus on right side and additional contribution to median nerve from musculocutaneous nerve on both sides were observed in a male cadaver among the 25 dissected for student demonstration. In the literature there is no reported incidence of bilateral superficial brachial artery with associated variations in brachial plexus or its branches.

**Key words :** Vas Aberrans (VA), superficial brachial artery, brachial plexus

### INTRODUCTION

Isolated neural and vascular variations of upper limb of clinical significance have been reported in the literature. Most of them are either on variant formation and branching of brachial plexus or on vascular variations in the axillary, brachial, radial and ulnar arteries. Very few cases of combined neurovascular variations have been reported<sup>1</sup>. Cases of bilateral neurovascular variations in upper limb have not been reported in the literature.

The incidence of superficial brachial artery reported in the literature varies from 0.2% to 25.0% and the only reported case of bilateral superficial brachial artery was that of Sharma et.al.<sup>2</sup>.

### CASE REPORT

During routine medical students dissection of both upper limbs of 19 male and 3

female adult cadavers bilateral neurovascular variations were observed in one male cadaver of 65 years age. On detailed dissection of right side two common arterial trunks originating from medial side of 3rd part of axillary artery were seen. One of the trunks divided into three branches, subscapular, thoraco-acromial arteries and a vas aberrans (VA) (Fig.1.A&B). After giving this common trunk the axillary artery continued as brachial artery up to cubital fossa where it divided into radial and ulnar arteries. The VA was connecting 3rd part of axillary artery with the radial artery at the level of cubital fossa (Fig.2.A&B). The circumflex scapular arteries were arising from the second common trunk on the medial side of 3rd part of axillary artery. The radial artery in the middle of forearm divided into an anterior and a posterior division (Fig.2. B). On the left side the VA was originating from the front of 3rd part of axillary artery and joined the radial artery at cubital fossa (Fig.3).

In the same cadaver on the right side C5 and C6 roots joined and formed the upper trunk of brachial plexus. Roots of C7, C8 and T1 joined and formed a common lower trunk (Fig.4. A&B).

The brachial plexus presented two trunks instead of three trunks. Each of these upper and common lower trunks divided into anterior and posterior divisions (Fig.4.B).

The posterior division of upper trunk after giving upper subscapular, lower subscapular and thoraco-dorsal nerves joined the posterior division of common lower trunk to

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form combined posterior cord (Fig. 4. A & C). The combined posterior cord divided into axillary and radial nerves (Fig. 4. A & C). Anterior divisions of upper and common lower trunks united around 3rd part of axillary artery to form a combined medial and lateral cord (Fig.4. B). This combined cord is the cord of origin for all nerves of flexor aspect of limb Viz. musculocutaneous, median, ulnar and medial cutaneous nerves of arm and forearm (Fig.4. A & D).

The formation of brachial plexus was normal on left side. In the same cadaver on both sides the musculocutaneous nerve gave a communicating twig to median nerve in the middle of arm (Fig.3).

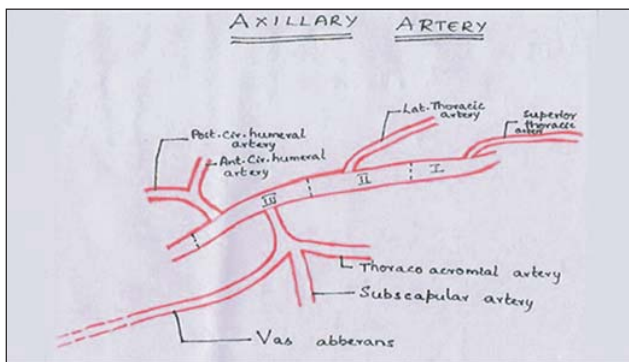


Figure 1. (A) Schematic diagram of Right side vascular variations observed in the axilla of a 65 years male cadaver

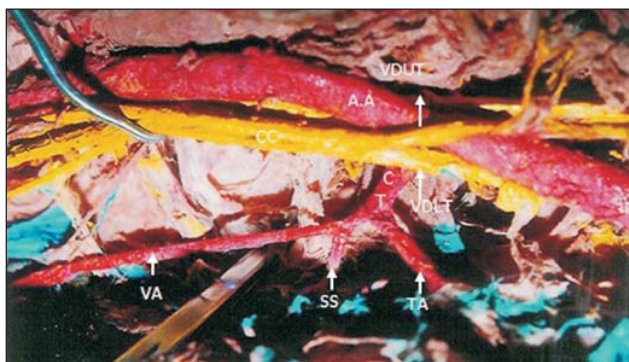


Figure 1(B). Photograph of Right side vascular variation in axilla of 65year Male - Ventral division of upper trunk (VDUT),Ventral division of combined lower trunk (VDLT) of brachial plexus, Common trunk (CT) of 3rd part of Axillary atery, Thoraco-acromial (TA), Subscapular (SS) and Vas aberrans(VA)

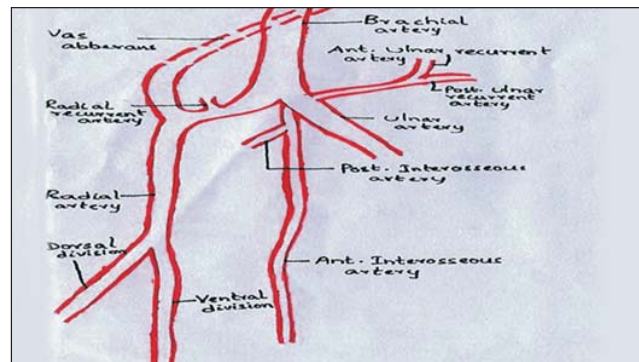


Fig.2 (A) Schematic diagram of Right side vascular variation at cubital fossa showing Vas aberrans or superficial brachial artery joining radial artery at cubital fossa.

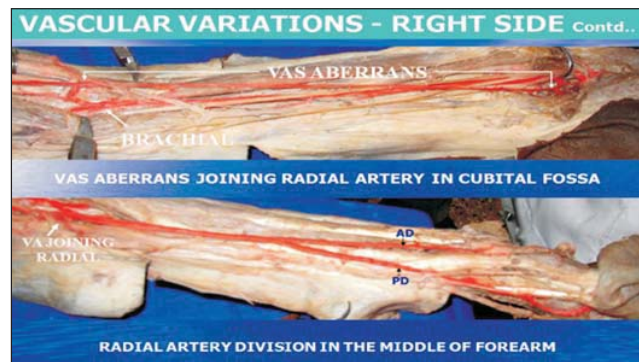


Fig.2 (B) Right side vascular variation of adult cadaver-Upper -Vas aberrans joining radial artery in cubital fossa; Lower - division of radial artery in the middle of forearm into anterior division (AD) and posterior division (PD)

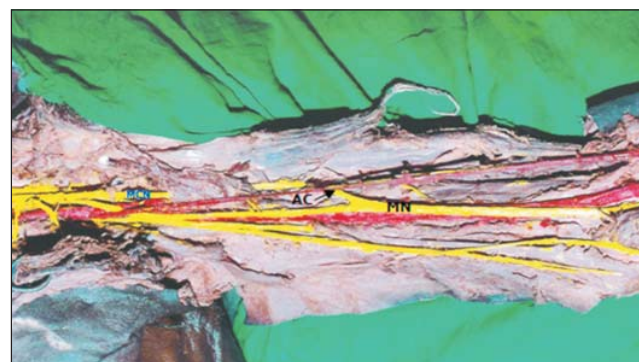


Fig.3. Left side Brachial plexus variation showing communicating branch (AC) from MCN to MN in middle of arm and Vas aberrans (VA) joining radial artery

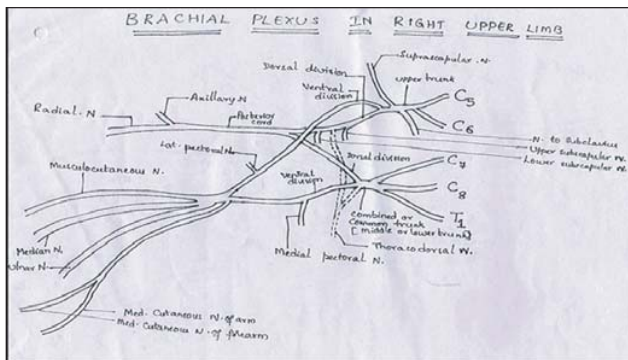


Fig.4 (A) Schematic diagram of Rt. side Brachial plexus variation

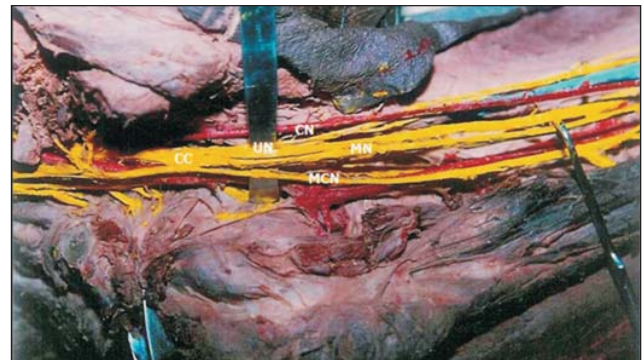


Fig.4 (D) Right side Brachial plexus variation showing branches from combined cord (CC) from fusion of ventral divisions – Median(MN), Musculocutaneous (MCN), Ulnar (UN) and cutaneous nerves (CN) of arm and forearm

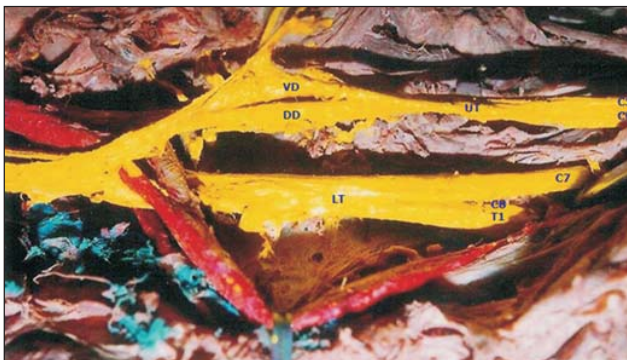


Fig.4 (B) Right side Brachial plexus variation - Upper trunk (UT) and combined lower trunk (LT), fusion of ventral division (VD) of the two trunks with axillary artery between the two trunks

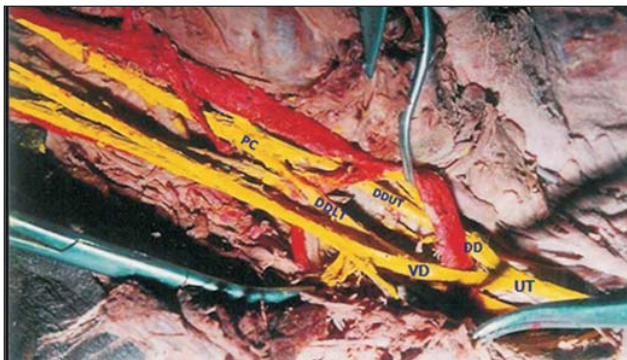


Fig.4© Right side Brachial plexus variation showing fusion of dorsal division (DD) of upper trunk (DDUT) and combined dorsal division of lower trunk (DDL) forming combined posterior cord (PC)

## DISCUSSION

In the present study adult cadaver of 65 years age presented a variant type of formation of brachial plexus with only two trunks and two cords, a variant type of division of 3rd part of axillary artery on right side, bilateral superficial brachial artery and presence of a communicating branch between musculocutaneous and median nerve bilaterally. This type of bilateral neurovascular variation have not been reported in the literature.

The probable ontogenic and embryological explanation for vascular variation is persistence of embryonic vessel that failed to regress resulting in Vas aberrans running superficial to median nerve in arm as superficial brachial artery while original axis artery continued as deep brachial artery deep to median nerve in the arm. The only previous report available in literature on bilateral superficial brachial artery is that of Sharma et.al. of stage III variation of Singer<sup>3</sup> similar to the present study. 2% incidence of superficial brachial artery was reported in Korean population<sup>4</sup>.

Three types of superficial brachial artery were described by Yang et.al.<sup>4</sup>. In Type I superficial brachial artery bifurcates in to radial and ulnar arteries in cubital fossa; In Type II it

continues as radial artery; In Type III the superficial artery supplies the arm muscles and ends in the arm. In the present case the superficial brachial artery is connected to the deep brachial or original axillary artery at the cubital fossa below which it continued as radial artery while the deep artery continued as ulnar artery. The pattern of VA observed in the present study resembles Type II pattern of Yang et.al.<sup>4</sup>. Type II pattern of Yang et.al., was reported in the literature<sup>5,6,7,8</sup>.

Lesion or injury to the type of combined lower trunk observed in the present case can result in diffuse loss of function that is entirely different from that observed in lower trunk involvement alone. Brachial plexus formed by only two trunks is very rare in literature.

Anomalies of axillary and brachial arteries are related to brachial plexus and median nerve variations<sup>9</sup>. Over or undue expression of number of transcription factors that are concerned with formation of brachial plexus can result in its variations<sup>10</sup>.

## CONCLUSION

The present case is a unique presentation of bilateral neurovascular variations in the upper limbs of a single cadaver. The variations observed in the cadaver were bilateral Vas aberrans, presence of two common arterial trunks arising from 3rd part of axillary artery on right side, presence of only two trunks and two cords of brachial plexus on right side, bilateral presence of a communicating branch from musculocutaneous to median nerve. Knowledge of multiple variations of this type are useful for surgeons treating cases of accidental nerve or vascular injuries and for understanding cases of nerve compression in the region of axilla and arm.

## REFERENCES

1. George BM, Nayak S, Kumar P. Clinically significant neurovascular variations in the axilla and arm- A case report. *Neuroanatomy*, 2007; 8:36-38.
2. Sharma T, Singla RK, Sachdeva K. Bilateral superficial brachial artery. *Kathmandu University Medical Journal*, 2009; 7(4):426-428.
3. Singer E. Embryological pattern persisting in the arteries of the arm. *Anat Record*, 1933; 55:403-9.
4. Yang HJ, Gil YC, Jung WS. Variations of the superficial brachial artery in Korean cadavers. *J Korean Med Sci*, 2008; 23(5):884-87.
5. Rodriguez-Nedenfuhr M, Burton GJ, Den J, Sanudo JR. Development of the arterial pattern in the upper limb in staged human embryos: normal development and anatomic variations. *J. Anat.* 2001; 199:407-417.
6. Kazuya Yoshinga, Ichiro Tanii, Koda Kodama. Superficial brachial artery crossing over the ulnar and median nerves from posterior to anterior: Embryological significance. *Anatomical science International*, 2003; 78:177-180.
7. Tohno Y, Tohno S, Azuma C, Kdo K, Markwaka Y. Superficial brachial artery continuing in the forearm as the radial artery. *J. Nara Med Asso*, 2006; 58:189-193.
8. Krstonosic B, Srdic B, Maric D, Gudovic R, Mijatov S, Basovic SS. An anatomical study of double brachial arteries –a case report. *International journal of Anatomical variation*, 2010; 3:6-8.
9. Basar R, Aldur MM, Celik HH, Yuksel M, Tascioglu AB. A connecting branch between the musculocutaneous nerve and the median nerve. *Morphologie*, 2000; 84:25-7.
10. Baeza AR, Nebot J, Ferreira B et.al., An anatomical study and ontogenic explanation of 23 cases with variations in the main pattern of the human brachio-ante brachial arteries. *J Anat*, 1995; 187:473-79.