



## Case Study

### Study of trifurcation of brachial artery

Ganesa Murugapermal<sup>1\*</sup> and S.MelaniRajendran<sup>2</sup>

<sup>1</sup>Department of Anatomy, Tagore Medical College and Hospital, Chennai,  
Tamilnadu, India

<sup>2</sup>Department of Anatomy, Madha Dental College and Hospital, Chennai-69, India

\*Corresponding author

#### A B S T R A C T

##### Keywords

Brachial  
Artery,  
Profunda  
Brachii  
Artery,  
Ulnar artery

Variations in the origin and branching pattern of the brachial artery are reported frequently. Since the brachial artery is the chief artery of the arm and the knowledge of its variations is very much essential to avoid complications in the clinical practice, an attempt was made to find out whether any notable variant branching pattern is seen. The present study revealed in two cases, two major variant branching pattern as trifurcation of the brachial artery.

## Introduction

Knowledge of the arterial variations in the upper limb is of considerable importance during invasive and non-invasive investigations. Variations of the brachial artery and its branching pattern are frequently observed and reported (Testus and Latarjet, 1982; Fuss *et al.*, 1985; Lippert and Pabst, 1985).

It has been increasingly recognized that variations in the major arteries of the upper limb are common, being found in up to one fifth of the individuals (Claassen *et al.*, 2010; Jacquemin *et al.*, 2001; Rodriguez *et al.*, 2001). Cardiologists and radiologists are utilizing the brachial artery with increasing frequency for catheter based diagnostic and therapeutic intervention procedures.

Therefore detailed knowledge of the vascular anatomy of the upper limb is of great importance, since this is a site of frequent injury and of various surgical and invasive procedures (Claassen *et al.*, 2010; Jacquemin *et al.*, 2001).

Since the brachial artery is regarded as an important structure clinically with the high prevalence variations in the branching pattern, the study was carried out to find out whether any new branching pattern was found which was so far not reported.

## Materials and Methods

50 embalmed upper limbs of both sides were dissected out. The brachial arteries were identified. Their level of origin, termination

and the branching pattern were studied. In two cases, trifurcation of the brachial artery were noted.

## Results and Discussion

### Observations

The origin and course of the brachial arteries studied were found to be normal as mentioned in the standard text books in both the cases. The brachial artery began as the continuation of axillary artery at the lower border of teres major.

#### Case 1

In one case, in the middle of the arm, the brachial artery was trifurcated into radial artery, ulnar artery and profundabrachii artery (Fig.1). In this case, the ulnar artery was winding around the median nerve (Fig.1). The superior and inferior ulnar collateral arteries arose as branches from the ulnar artery. This observation was found bilaterally. The further course of the branches in the fore arm was found to be normal.

#### Case 2

In another case, the brachial artery was trifurcated into radial artery, ulnar artery and common interosseous artery (Fig.2). These three arteries passed deep to the pronator teres muscle. The further courses of the branches were found to be normal.

Variations of the brachial artery and its branching pattern were quite commonly reported viz., absence of the brachial artery (Ciervo *et al.*, 2001); origin of profundabrachii artery with superior ulnar collateral artery (Anson *et al.*, 1952; Patnaik, 2001b; Chauhan *et al.*, 2013); origin of profundabrachii artery in common with the inferior ulnar collateral artery (Chauhan *et al.*, 2013) origin of profundabrachii artery,

posterior circumflex humeral artery, superior ulnar collateral arteries from the superficial brachial artery (Adachi, 1928; Fuss *et al.*, 1985) absence of inferior ulnar collateral artery (Patnaik, 2001a) ulnar artery as a branch of brachial artery (Mc Cormack *et al.*, 1953; Devansh, 1996) radial artery as a branch of brachial artery (Keller *et al.*, 1980; Uglieta and Kadir, 1989; Gonzalez-Compta, 1991) high origin of radial artery (DeGaris and Swartley, 1928; Miller, 1939; Anson *et al.*, 1952).

Commonly the brachial artery bifurcates into radial and ulnar arteries at its termination in the cubital fossa. The incidence of trifurcation of brachial artery is a rare variation.

Trifurcation of brachial artery into radial artery, ulnar artery and common interosseous artery observed in the present study was also reported by Huber (1930), Lockhardt *et al.*, (1959), Romanes (1964), Williams *et al.*, (1999), Patnaik *et al.*, (2001a) and VenkataRamana Vollala *et al.*, (2008). But the observation of trifurcation in the Case 1 is a new finding since the trifurcation was found in the middle of the arm and not in the cubital fossa as described by others.

Some others also observed trifurcation into radial artery, ulnar artery and superior ulnar collateral artery and radial artery, ulnar artery and muscular branches (Yalcin *et al.*, 2006). But the observation of trifurcation into profundabrachii artery, radial artery and ulnar artery in the Case 2 is a rare finding and not hitherto reported radial recurrent artery. The winding of ulnar artery around the median nerve observed in this case may compress the median nerve and may cause complications.

Upper limb vascular variations are presently thought to result from a stochastic process of

persistence, enlargement and differentiation of parts of the initial capillary network which would normally remain as capillaries or even regress. The precise mechanisms that lead to the higher frequency of certain variants over others remain to be elucidated (Quain, 1844; Shen and Hong, 2008). Arey (1957) had opined that anomalous blood vessels may be due to the following reasons:

- i. Choice of unusual paths in the primitive vascular plexuses.
- ii. Persistence of vessels normally obliterated.
- iii. Disappearance of vessels normally retained.
- iv. Incomplete development.
- v. Fusion and absorption of the parts usually distinct.

Rodriguez *et al.*, (2001) postulated that the presence of the arterial variations in the upper limb may be due to chemical factors, haemodynamic forces and foetal position in

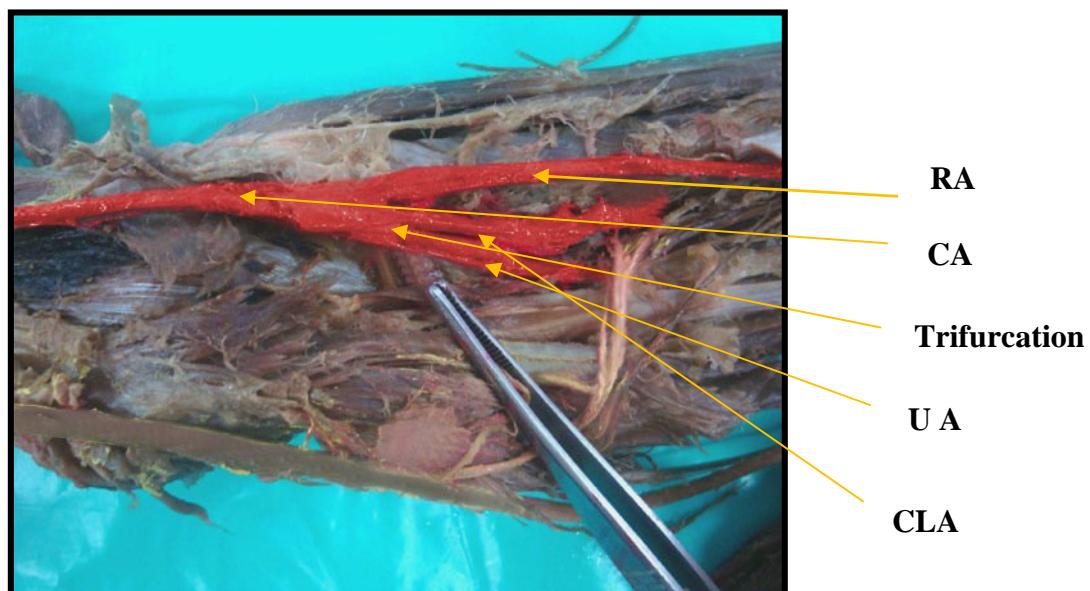
the uterus, genetic predisposition and developmental changes.

Since the clinical importance of variations of the arteries of the upper limb are increasingly being recognized (Claassen *et al.*, 2010). They can be easily mistaken for subcutaneous veins, leading to inadvertent artery cannulation, with the potential risk of distal limb ischemia (Mayhew and Mohiuddin, 2005; Dearlove and Perkins, 2005; Claessen *et al.*, 2010) as well as possible arteriographic misinterpretations when the contrast dye is injected distal to the origin of these variant arteries (Keller *et al.*, 1980; Karlsson and Niechajev, 1982). Knowledge of these variations may facilitate ascending catheterization of the cardiac cavities Drizenko *et al.*, (2000).

Knowledge of the arterial variations in the upper limb is of considerable importance during clinical and surgical procedures.

### Case 1

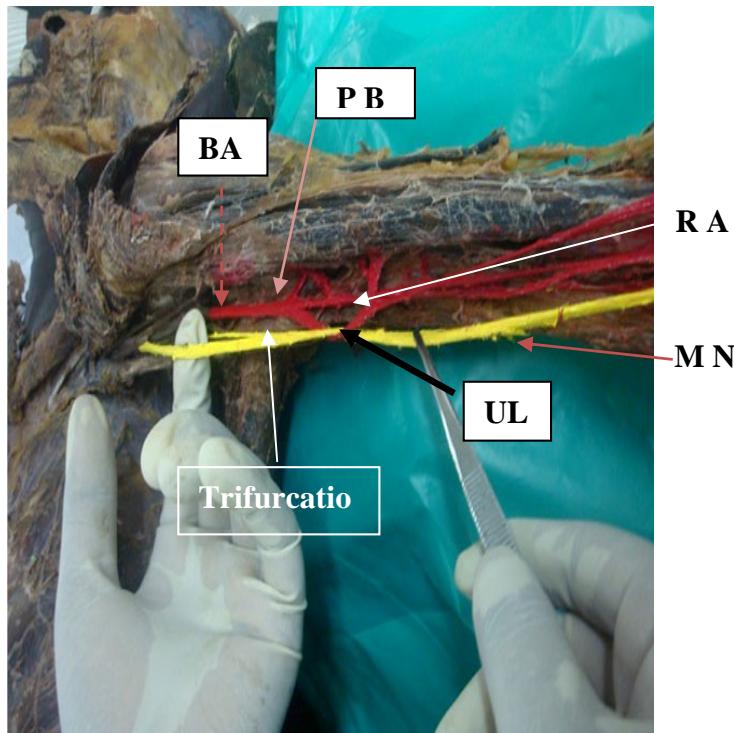
**Fig.1** Showing the trifurcation of brachial artery into radial, ulnar, and common interosseousarteries



BA - brachial artery, RA - radial artery, UL - ulnar artery,  
CIA - common interosseous artery - ulnar artery

## Case 2

**Fig. 2** Showing trifurcation and ulnar artery winding around median nerve.



BA - brachial artery, RA - radial artery, UL - ulnar artery, PB - profundabrachii artery

## References

- Anson, B.J., Maddock, W.G., 1952. Callander's surgical anatomy. In: Arm or Brachial region, 3<sup>rd</sup> Edn., W.B. Saunders Co., Philadelphia, pp. 762–64.
- Arey, L.B., 1957. Developmental Anatomy: Development of the arteries, 6<sup>th</sup> Edn., W.B. Saunders Co., Philadelphia, pp.37-577.
- Adachi, B., 1928. In: Das Arterien system der Japaner, Maruzen, Kyoto, Vol. 1, pp. 205–210.
- Chauhan, K., Udainia, A., Bhatt, C., Patil, D., Patel, V., Prajapati, B., 2013. Morphological study of variation in branching pattern of brachial artery. *Int. J. Basic Appl. Med. Sci.*, 3(2): 10–15.
- Ciervo, A., Kahn, M., Pangilinan, A.J., Dardik, H., 2001. Absence of the brachial artery: report of a rare human variation and review of upper extremity arterial anomalies. *J. Vasc. Surg.*, 3(1): 191–194.
- Claassen, H., Schmitt, O., Werner, D., Schareck, W., Kroger, J.C., Wree, A., 2010. Superficial arm arteries revisited: brother and sister with absent radial pulse. *Ann. Anat.*, 192: 151–155. doi:10.1016/j.anat.2010.02.005.
- Dearlove, O.R., Perkins, R., 2005. Inadvertent median artery cannulation. *Paediatr. Anaesth.*, 15: 439–440. doi: 10.1111/j.1460-9592.2005.01628.x.
- DeGaris, C.F., Swartley, W.B., 1928. The axillary artery in white & negro stocks. *Am. J. Anat.*, 41: 352–397.
- Devansh, S., 1996. Superficial ulnar artery flap. *Plast. Reconstr. Surg.*, 97(2): 420–426.
- Drizenko, A., Maynou, C., Mestbagh, H., Mauroy, B., Bailleul, J.P., 2000. Variations of the radial artery in man. *Surg. Radiol. Anat.*, 22(5-6): 299–303.

- Fuss, F.K., Matula, C.H.W., Tschabher, M., 1985. Die arteria brachialis superficial. *Anat. Anzeles*, 160: 285–294.
- Gonzalez-Compta, X., 1991. Origin of the radial artery from the axillary artery and associated hand vascular anomalies. *J. hand surg.*, 16a: 293–296.
- Huber, G.C., 1930. Piersol's human anatomy. In: *The Vascular System*, 9<sup>th</sup> Edn., Vol. I., J.B. Lippincott Co., Philadelphia, pp.767–791.
- Jacquemin, G., Lemaire, V., Medot, M., Fissette, J., 2001. Bilateral case of superficial ulnar artery originating from axillary artery. *Surg. Radiol. Anat.*, 23: 139–143. doi: 10.1007/s00276-001-0139-2.
- Keller, F.S., Rosch, J., Dotter, C.T., Porter, J.M., 1980. Proximal origin of the radial artery: potential pitfall in hand angiography. *Am. j. Roentgenol.*, 134: 169–170.
- Karlsson, S., Niechajev, I.A., 1982. Arterial anatomy of the upper extremity. *Acta Radiol. Diag.*, 23: 115–121.
- Lippert, H., Pabst, R., 1985. Arterial variations in man. Springer, New York, pp. 68–73.
- Lockhardt, R.D., Hamilton, G.F., Fufe, F.W., 1959. Anatomy of the human body. In: *Vascular System – Systemic arteries*. Faber & Faber Ltd., London, pp. 612–619.
- Mayhew, J.F., Mohiuddin, S., 2005. Inadvertent median artery cannulation. *Paediatr. Anaesth.*, 15: 1149.
- Mc Cormack, L.J., Caudwell, E.W., Anson, B.J., 1953. Brachial & ante brachial arterial patterns. *Surg. Gynaecol. Obstet.*, 96: 43–54.
- Miller, R.A., 1939. Observations upon the arrangement of axillary artery and brachial plexus. *Am. J. Anat.*, 64: 143–163.
- Patnaik, V.V.G., Kalsey, G., SinglaRajan, K., (2001a). Trifurcation of Brachial artery – a case report. *J. Anat. Soc. India.*, 50(2): 163–165.
- Patnaik, V.V.G., Kalsey, G., SinglaRajan, K., (2001b). Bifurcation of axillary artery in its 3rd part – A Case Report. *J. Anat. Soc. India.*, 50(2): 166–169.
- Quain, R., 1844. Anatomy of the arteries of the human body. Taylor & Walton, London, pp. 326–337.
- Rodriguez-Niedenfuhr, M., Vazquez, T., Nearn, L., Ferreira, B., Parkin, I., Sanudo, J.R., 2001. Variations of the arterial pattern in the upper limb revisited: a morphological and statistical study, with a review of the literature. *J. Anat.*, 199: 547–566. doi: 10.1046/j.1469-7580.2001.19950547.x.
- Romanes, C.J., 1964. Cunningham's Textbook of Anatomy. In: *The blood vascular system. Arteries of the upper limb*. Walls, E.W., (Ed.), 10<sup>th</sup> Edn., Oxford University Press, New York, pp. 885–893.
- Shen, S., Hong, M.K., 2008. A rare case of bilateral variations of upper limb arteries: brief review of nomenclature, embryology and clinical applications. *Surg. Radiol. Anat.*, 30: 601–603. doi: 10.1007/s00276-008-0380-z.
- Testus, L., Latarjet, A., 1982. *Tratado de anatomia humana*. Vol. 2, Salvat, Barcelona, pp. 287–3097.
- Uglieta, J., Kadir, S., 1989. Arteriographic study of variants arterial anatomy of the upper extremities. *J. Cardiovasc. Intervent. Radiol.*, 12(5): 145–148.
- VenkataRamana Vollala, S., Somayaji Nagabhooshana, Seetharama ManjunathaBhat, 2008. Trifurcation of brachial artery with variant course of radial artery: Rareobservation. *Anat. Sci. Int.*, 83: 307–309.
- Williams, P.L., Bannister, L.H., Berry, M.M., Collins, P., Dyson, M., Dussek, J.E., Fergusson, M.W.J., 1999. Gray's anatomy. In: *Cardio Vascular System*. Gabella, G., (Ed.), 38<sup>th</sup> Edn. Churchill Livingstone. Edinburgh, London: 15: 42–44.
- Yalcin, B., Kocabiyik, N., Yazar, F., Kirici, Y., Ozan, H., 2006. Arterial variations of the upper extremities. *Anat. Sci. Int.*, 81: 62–64.