SHORT REPORT

Eur J Anat, 13 (2): 91-95 (2009)

The posterior circumflex humeral artery turning under the tendon of the latissimus dorsi: a case report

Marek Konarik[1], Jakub Knize[1], Vaclav Baca[1,2], David Kachlik[1,2]

1- Department of Anatomy, Third Faculty of Medicine, Charles University in Prague, Praha 10, 100 00, Czech Republic

2- Department of Medicine and Humanities, Faculty of Biomedical Engineering, Czech Technical University in Prague, 272 01 Kladno, Czech Republic

SUMMARY

We present a case of an anomalous branching of the axillary artery, combined from two variants with mutual linkage, concerning the posterior circumflex humeral and profunda brachii arteries. A female cadaver axillary fossa was dissected and the combined variant exposed. The first variant represented a case of the posterior circumflex humeral artery running not within the humerotricipital triangle but branching more distally, turning under the tendon of the latissimus dorsi and teres major muscles and supplying its usual area around the glenohumeral joint. It resembled an anomalously enlarged deltoid branch of the profunda brachii artery. The second variant affected the profunda brachii artery (deep artery of arm) which did not stem from the brachial artery either, but from the posterior circumflex humeral one, not featuring a consistent state, but being replaced by three smaller branches, corresponding to its textbook terminal branches (medial and radial collateral artery and muscular branch for triceps brachii muscle). This variant is quite rare (1.25%) as reported in the only literature source available: Adachi 1928 – 4.3%.

This variant is important in the case of the collateral circulation because it reduces the number of collateral interconnections and increases the danger of the development of ischaemia in cases of an arterial occlusion.

Key words: Posterior circumflex humeral artery – Axillary artery – Variant – Anatomy – Latissimus dorsi

ABBREVIATIONS:

AA – axillary artery
PCHA – posterior circumflex humeral artery
PBA – profunda brachii artery
SS – subscapular artery
LDM – latisimus dorsi muscle
TMM – teres major muscle
PM – pectoralis major muscle
PMiM – pectoralis minor muscle

INTRODUCTION

The axillary artery (AA) is one of the most variable arteries in the human body. Owing to the easy approach to the axillary fossa, it has attracted interest since the first half of the 19th century. Tiedemann (1831) was the first to describe arterial variants in the upper limb. Many others concentrated on this region and

Submitted: May 4, 2009
Accepted: July 20, 2009

Correspondence to:
David Kachlik. Department of Anatomy, Third Faculty of Medicine, Charles University in Prague, Ruská 87, Praha 10, 100 00, Czech Republic. Phone: +420267102508; Fax: +420267102504. E-mail: david.kachlik@lf3.cuni.cz

AA variability, among others Quain (1844), Henle (1868), Müller (1903), Poynter (1920), Adachi (1928), De Garis and Swartley (1928), Trotter et al. (1930), Coulouma and Bastien (1934), Miller (1939), McCormack et al. (1953), Huelke (1959), Wankoff (1962), Skopakoff (1959), Keen (1961), Lippert and Pabst (1985), Uglietta and Kadir (1989), Srivastava and Pande (1990), Rodríguez-Baeza et al. (1995), Rodríguez-Niedenfuhr et al. (2001).

The borders of the AA are set proximally to the clavicle, subclavian muscle (Langer and Toldt, 1897), first rib (Thorek, 1951; Williams et al., 1999) or superior border of the pectoralis minor muscle (PMiM) (Robinson, 1923) and distally to the inferior border of the pectoralis major muscle (PM) (Langer and Toldt, 1897), the teres major muscle (TMM) (Thorek, 1951; Williams et al., 1999) or the surgical neck of humerus. The textbook type of AA is described as an artery with 6 separately originating branches (superior thoracic artery, thoracoacromial artery, lateral thoracic artery, subscapular artery, anterior and posterior circumflex humeral arteries) (Adachi, 1928; Williams et al., 1999). Trotter et al. (1930) reported that the six-branched pattern is present in 47% of males and in 30% of females. De Garis and Swartley (1928) stated that the branch number ranges from five to eleven and that the most frequent situation is eight. The length of the AA can be divided into three parts (Thorek, 1951; Huber, 1930; Anson and Maddock 1952; Boyd et al., 1956; Hollinshead, 1958):

- Proximal (first) part of the AA, stretching from the clavicle to the proximal border of PMiM.
- Middle (second) part of the AA, limited by the width of PMiM, being located dorsally and thus hidden behind the belly of the PMiM.
- Third (distal) part of the AA, extending from the distal border of the PMiM to the surgical neck of humerus or to the distal border of the PMM.

Material and Methods

The cadaver of a 65-year-old woman, fixed with the classic formaldehyde method, was dissected during a routine dissection course for medical students at the Department of Anatomy, Third Faculty of Medicine, Charles University in Prague. The right axillary fossa was dissected and the PCHA was followed in its atypical course.

Results

We observed a case of abnormal branching of the AA featuring two variants involving the PCHA and the profunda brachii artery (PBA). The PCHA was a branch of the AA, running laterally, but its origin was not found in its usual position in the middle part of the AA but was shifted distally at its very end to the level of the distal border of the PMM, 7.5 cm distant from the arbitrary beginning of the AA. The other variant, concerning the PBA, comprised two elements. First, the origin of the PBA was not observed in its usual position from the proximal third of the brachial artery but was shifted proximally. The PBA originated from the PCHA, shortly after the PCHA stemmed from the AA. Second, there was no consistent PBA; instead it was replaced by three smaller branches that fully supplied the distribution area of the PBA. Two of them corresponded to textbook terminal branches of the PBA – the medial and radial collateral arteries – and the third one was a muscular branch for the triceps brachii muscle. The distance between the origin of the PCHA and the first smaller branch was 0.8 cm. The AA and its other branches, main venous trunks and nerves of the brachial plexus followed the textbook pattern. For calibers of mentioned vessels, see Table 1.

Table 1. Calibers of the arteries involved.

Artery	Caliber
Axillary artery	8 mm
Subscapular artery	6 mm
Posterior circumflex humeral artery	6 mm
Radial collateral artery	3 mm
Medial collateral artery	3 mm
Artery for triceps brachii muscle	3 mm

Discussion

There we present a rare combined variant in the vascular pattern of the upper limb. We observed a variant involving two arteries from different sources: the PCHA and PBA.

Regarding the first variant, the PCHA turning under the tendon of LDM, this has been reported several times in the reference literature, first by Adachi in 1928, and then

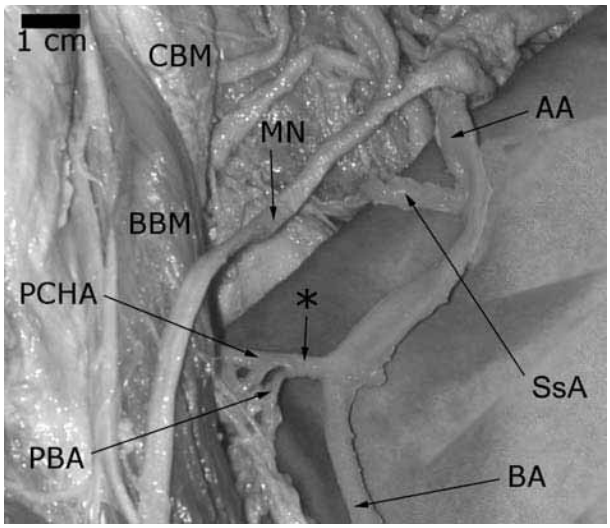

Figure 1.- The origin of the PCHA and PBA from the AA. AA – axillary artery, BA – brachial artery, BBM – biceps brachii muscle, CBM – coracobrachialis muscle, MN – median nerve, PBA – profunda brachii artery, PCHA – posterior circumflex humeral artery, SsA – subscapular artery, * - common trunk for PCHA and PBA.

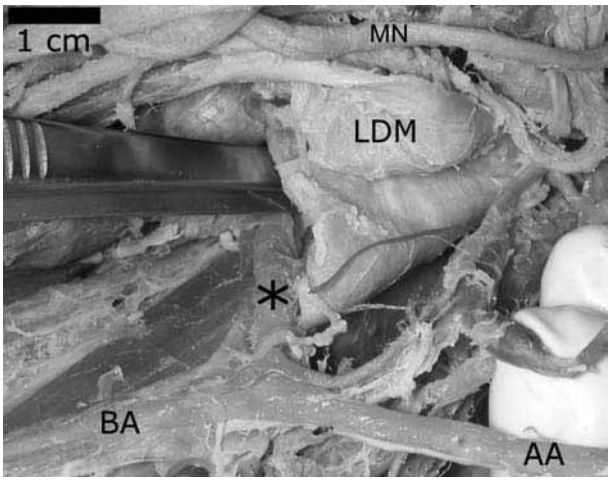

Figure 3.- The common trunk for the PCHA and PBA with the PCHA running underneath the LDM tendon. AA – axillary artery, BA – brachial artery, LDM – latissimus dorsi muscle, MN – median nerve, * - common trunk for PCHA and PBA

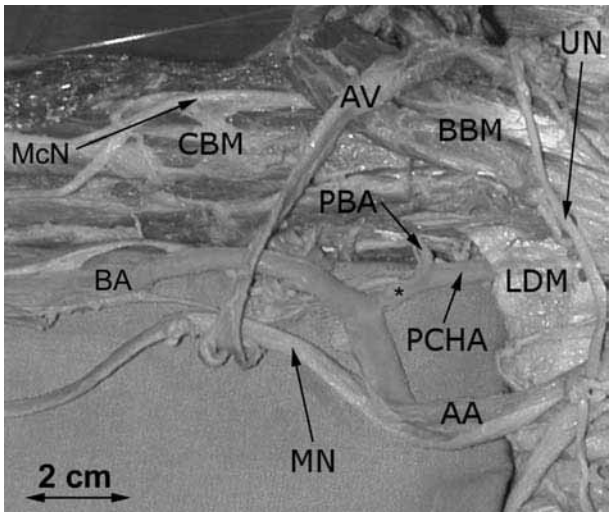

Figure 2.- The common trunk for the PCHA and PBA. AA – axillary artery, AV – axillary vein (reverted), BA – brachial artery, BBM – biceps brachii muscle, CBM – coracobrachialis muscle, LDM – latissimus dorsi muscle, McN – musculocutaneous nerve, MN – median nerve, PBA – profunda brachii artery, PCHA – posterior circumflex humeral artery, UN – ulnar nerve, * - common trunk for PCHA and PBA.

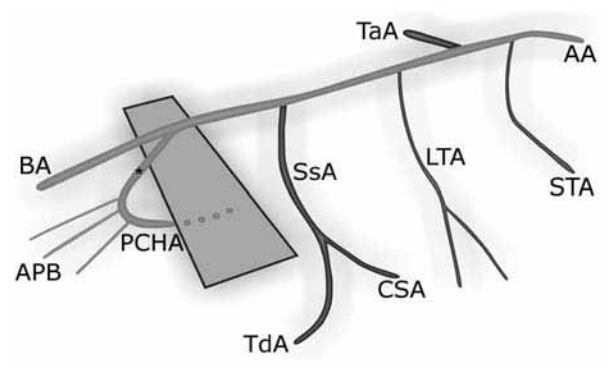

Figure 4.- Schema of the AA and the common trunk for the PCHA and PBA with the PCHA running underneath the LDM tendon. AA – axillary artery, BA – brachial artery, CSA – circumflex scapular artery, LTA – lateral thoracic artery, PBA – profunda brachii artery, PCHA – posterior circumflex humeral artery, SsA – subscapular artery, STA – superior thoracic artery, TaA – thoracoacromial artery, TdA – thoracodorsal artery, * - common trunk for PCHA and PBA.

by Couloma and Bastien (1934), Skopakoff (1959) and Keen (1961) – see Table 2. In the majority of cases, the PCHA is a branch from the middle part of the AA and reaches the glenohumeral joint and its vicinity via the humerotricipital foramen (quadrangular space) together with the corresponding vein and the axillary nerve.

Table 2. Cases of the PCHA turning under the tendon of the latissimus dorsi muscle (or teres major muscle).

Author	Number of cases	PCHA under tendon	%
Adachi 1928	398	63	15.8%
Coulouma 1934	284	8	2.8%
Skopakoff 1959	610	69	11.3%
Keen 1961	104	3	2.9%
Kachlík 2008	80	7	8.8%

It is surprising that some researchers, e.g. Huelke (1959), have totally overlooked this variant of the PCHA turning under the tendon of the LDM (or in some cases designated as the PCHA turning under the tendon of the TMM – both muscles insertions are very close to each other). The difference among the five studies dealing with this variant is also striking: from 2.8% of cases stated by Couloma and Bastien (1934) to 15.8% reported by Adachi (1928) (performed on Japanese population). As is evident in Table 2, the numbers of cases examined ensures a sufficient number of limbs studied. Our results (8.8%) are in agreement with the study of Skopakoff (1959)

(11.3%) reporting the largest number of cases dissected – 610 samples. Clinically, it can be concluded that the PCHA in this case represented an enlarged deltoid branch of the PBA in its normal course, while the PCHA was missing in its usual course, although it irrigated its usual territory.

The second component of this variant involves the PBA and its origin, course and branching pattern. In this case, the status of the PBA was completely changed and can ever be said to have been missing. First, it originated from a branch of the AA (PCHA) and not as usual from the brachial artery. Second, there was no trunk of the PBA; instead it was substituted by three smaller branches, corresponding to normal branches of the PBA. Their further distal course showed no abnormalities. The deltoid branch was enlarged and changed in the anomalous PCHA.

Before giving off these three smaller branches, the segment of the PCHA was rather short (8 mm) and could have been designated as a common trunk of the PCHA and PBA; however, the distal shift of the trunk origin in comparison to the normal origin of the PCHA has to be emphasized.

This combined variant, which we have encountered once out of 80 cases (1.25%), has only ever been reported once in the reference literature by Adachi (1928). He found it in 17 cases out of 398 (i.e. 4.3%) Japanese cadavers and designated this variant as a group F in his study. It is bewildering that there are no cases reported by other authors in their extensive sets.

Regarding the nomenclature, we followed the last revision of the Latin terminology, as proposed and substantiated in one of our previous articles (Kachlik et al., 2008).

This variant is important when a collateral circulation between the AA and the distal part of the brachial artery is required. The PCHA contributes to the parallel axis of the upper limb, represented mainly by the suprascapular and thoracoacromial arteries proximally and profunda brachii artery distally. If the PCHA is missing in the humerotricipital foramen, both networks lack this important interconnection. Thus, a reduced number of collateral interconnections can increase the danger of ischaemia developing after acute arterial occlusion in the region of the axillary and proximal brachial arteries. Finally, this variant may offer a high risk for complications in shoulder surgery.

References

Adachi B (1928). *Das Arteriensystem der Japaner*. Maruzen, Kyoto, pp 285-356.

Anson BJ, Maddock WG (1952). Callander's Surgical Anatomy. In: *Shoulder-Axillary region.* 3rd Ed. W.B. Saunders Co., Philadelphia, pp 728-732.

Boyd JD, Clark WE, Hamilton WJ, Yoffey JM, Zuckerman S, Appleton AB (1956). Textbook of Human Anatomy. In: *Cardiovascular system - Blood vessels*. Macmillan & Co. Ltd. St. Martin's Press, New York, pp 341-346.

Coulouma P, Bastien R (1934). Résultats de cent quatre observations sur la disposition des branches de l'axillaire. *Bull Ass Anat,* 29: 193-199.

De Garis CF, Swartley WB (1928). The axillary artery in White and Negro stocks. *Am J Anat,* 41: 353-397.

Henle J (1868). *Handbuch der Systematischen Anatomie des Menschen, vol. 3*. Vieweg, Braunschweig.

Hollinshead WH (1958). Anatomy for surgeons. The back and limbs. In: *Pectoral region, axilla and shoulder - The axilla Vol. 3*.Paul B.Hoebar, Inc., New York, pp 290-300.

Huber GC (1930). Piersol's Human Anatomy. In: *The vascular system. 9th Ed. Vol. 1*. J.B. Lippincott, Philadelphia, pp 767-791.

Huelke DF (1959). Variation in the origins of the branches of the axillary artery. *Anat Rec*, 35: 33-41.

Kachlik D, Baca V, Bozdechova I, Cech P, Musil V (2008). Anatomical Terminology and Nomenclature: Past, Present and Highlights. *Surg Rad Anat,* 30: 459-466.

Keen JA (1961). A study of the arterial variations in the limbs with special reference to symmetry of vascular patterns. *Am J Anat*, 108: 245-261.

Langer K Von, Toldt C (1897). *Lehrbuch der systematischen und topographischen Anatomie*. Braumüller, Wien.

Lippert H, Pabst R (1985). *Arterial Variations in Man*. J.F. Bergmann, München, pp 71-73.

McCormack LJ, Cauldwell EU, Anson J (1953). Brachial and antebrachial arterial patterns. *Surg Gynecol Obstet*, 96: 43-45.

Miller RA (1939). Observations upon the arrangement of the axillary artery and the brachial plexus. *Am J Anat,* 64: 143-163.

Müller E (1903). Beiträge zur Morphologie des Gefässsystems. I. Die Armarterien des Menschen. *Anatom Hefte*, 22: 377-421.

Poynter CWM (1920). Congenital anomalies of the arteries and veins of the human body. *Univ Nebr University studies*, 22: 1-106.

Quain R (1844). *Anatomy of the Arteries of the Human Body*. Taylor and Wolton, London, pp 326-337.

Robinson A (1923). The Blood vascular system - Arteries of the upper limb. In: Walls EW (ed). *Cunningham's Textbook of Anatomy. 10th Ed*. Oxford University Press, London, pp 885-893.

Rodríguez-Baeza A, Nebot J, Ferreira B, Reina F, Pérez J, Sañudo JR, Roig M (1995). Anatomical study

and ontogenetic explanation of 23 cases with variations in the main patterns of the human brachio-antebrachial arteries. *J Anat*, 187: 473-479.

Rodríguez-Niedenführ M, Vázquez T, Nearn L, Ferreira B, Parkin I, Sañudo JR (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.

Skopakoff C (1959). Uber die Variabilität der Ab- und Verzweigung der A. brachialis superficialis. *Anat Anz*, 106: 356-368.

Srivastava SK, Pande BS (1990). Anomalous pattern of median artery in the forearm of Indians. *Acta Anat*, 138: 193-194.

Thorek P (1951). Anatomy in Surgery. In: *Superior Extremity - Axillary and Pectoral region.* 2nd Edn. J.B. Lippincott Co., Philadelphia, pp 673-675.

Tiedemann F (1831). *Plates of arteries of human body*. McLachlan and Stewart, Edinburgh.

Trotter M, Henderson JL, Gass H, Brua RS, Weisman S, Agress H, Curtis GH, Westbrook ER (1930). The origins of branches of axillary artery in whites and in American negros. *Anat Rec*, 46: 133-137.

Uglietta JP, Kadir S (1989). Arteriographic study of variant arterial anatomy of the upper extremities. *Cardiovasc Inter Rad,* 12: 145-148.

Wankoff W (1962). Uber einige Gesetzmässigkeiten bei der Variabilität der Arterien der oberen Extremität. *Anat Anz*, 111: 216-240.

Williams PL, Bannister LH, Berry MM, Collins P, Dyson M, Dussek JE, Ferguson MW (1999). Gray's Anatomy. In: Gabella G (ed). *Arteries of the limbs and cardiovascular system. 38th Edn*. Churchill Livingstone, London, pp 1537-1539.