

## Variant Course of Posterior Circumflex Humeral Artery Associated with the Abnormal Origin of Radial Collateral Artery: Could It Mimic the Quadrangular Space Syndrome?

Kappettu Gadahad Mohandas Rao<sup>1</sup>, Shiroor Nagabhushan Somayaji<sup>1</sup>, Lagadamane Sathyanarayana Ashwini<sup>1</sup>, Swamy Ravindra<sup>1</sup>, Padavinangadi Abhinitha<sup>1</sup>, Ashutosh Rao<sup>2</sup>, Marpalli Sapna<sup>1</sup>, and Patil Jyothsna<sup>1</sup>

<sup>1</sup> Department of Anatomy, Melaka Manipal Medical College, Manipal University, Manipal, India

<sup>2</sup> Department of Orthopedics, Faculty of Medicine, AIMST University, Semeling, Bedong- 08100, Kedah, Malaysia

Received: 25 Feb. 2012; Received in revised form: 17 Jul. 2012; Accepted: 22 Jul. 2012

**Abstract-** Variations in the origin of axillary artery branches are common. But, distinctly abnormal course of its posterior circumflex humeral branch is rare. We are reporting a case of posterior circumflex humeral artery (PCHA) originating from the axillary artery, passing through lower triangular space to reach the scapular region where it accompanied the axillary nerve and posterior circumflex humeral vein to pass around surgical neck of humerus, deep to the fibers of deltoid. Other variations observed in this specimen were the radial collateral artery arising from the PCHA, middle collateral artery arising directly from the brachial artery and absence of profunda brachii artery. PCHA forming a hair pin loop, traversing through lower triangular space instead of quadrangular space taking a long course is being reported for the first time. Further, the clinical and surgical importance of this case especially in relation with quadrangular space syndrome and relevant literature is discussed.

© 2012 Tehran University of Medical Sciences. All rights reserved.

*Acta Medica Iranica*, 2012; 50(8): 572-576.

**Keywords:** Posterior circumflex humeral artery; Quadrangular space syndrome; Radial collateral artery; Triangular space

### Introduction

Proper knowledge of vascular variations is essential not only for the anatomists but also for clinicians and surgeons. Variations of the branches of axillary artery are well documented. But, there are no reports of a long loop like abnormal course of posterior circumflex humeral artery (PCHA) associated with variant origin of radial collateral artery (RCA). Posterior circumflex humeral artery normally is a branch of 3<sup>rd</sup> part of axillary artery at the distal border of subscapularis. It runs backwards with axillary nerve through the quadrangular space which is bounded by subscapularis, the capsule of the shoulder joint and teres minor above, teres major below, the long head of triceps medially and the surgical neck of the humerus laterally. It then curves round the humeral surgical neck and supplies the shoulder joint deltoid and other muscles of around the quadrangular space. Posterior circumflex humeral vein is a tributary of axillary vein which follows the course of

PCHA. Profunda brachii artery is a branch of brachial artery which closely follows the radial nerve, passes through the lower triangular space which is bounded by teres major above, long head of triceps medially and shaft of the humerus laterally. On reaching the spiral groove, it gives a middle collateral artery (MCA) and continues as the radial collateral artery which accompanies the radial nerve as it passes through the lateral intermuscular septum, descends between brachialis and brachioradialis, and ends in front of the lateral humeral epicondyle by anastomosing with the radial recurrent artery (1).

The quadrangular space syndrome is a clinical condition associated with the PCHA, characterized by the tenderness over the quadrangular space and shoulder pain radiating to the arm, caused by the compression of axillary nerve and PCHA (2). Occlusion of PCHA is one of the commonest reasons for the quadrangular space syndrome (3,4).

**Corresponding Author:** Kappettu Gadahad Mohandas Rao

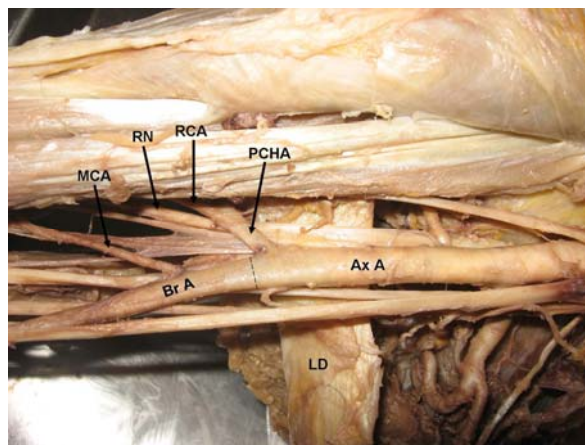
Department of Anatomy, Melaka Manipal Medical College (Manipal Campus), Manipal University Manipal-576104, Karnataka State, India.  
Phone: +91 984 4380839, Fax: +91 820 2571905, E-mail: mohandaskg@gmail.com

We report here a rare case of normal origin but an abnormal devious course and branching of PCHA which could mimic the quadrangular space syndrome.

## Case Report

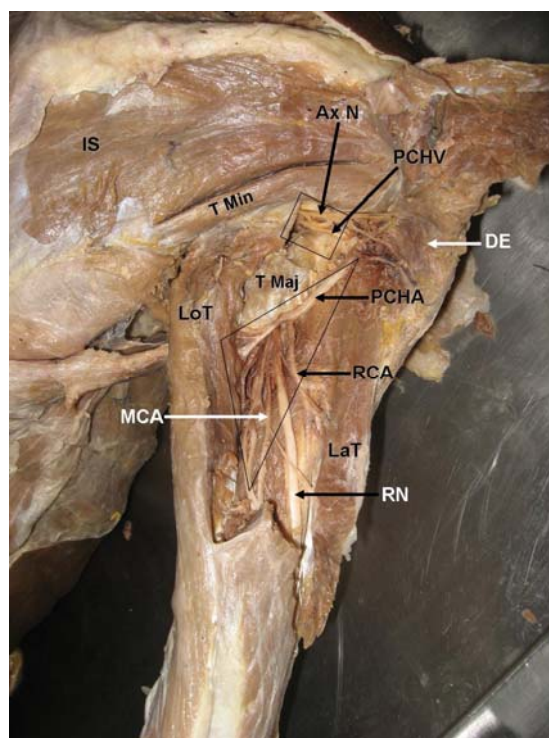
During routine dissections for the first-year medical students of Melaka Manipal Medical College, Manipal, a case of an unusual course of PCHA associated with abnormal origin of the RCA artery was encountered in a right upper limb of about 50 year-old male cadaver.

It was observed that the posterior circumflex humeral artery was originating from the 3<sup>rd</sup> part of axillary artery; it then passed downwards along the radial nerve through the lower triangular space where it curved upwards after winding around the lower border of teres major to reach the structures (axillary nerve and posterior circumflex humeral vein) passing through the quadrangular space. Its further course was similar to that of the normal PCHA, which is to pass around surgical neck of the humerus deep to the fibers of deltoid (Figures 1, 2, 3).



**Figure 1.** Axilla and the upper arm from the anterior side.

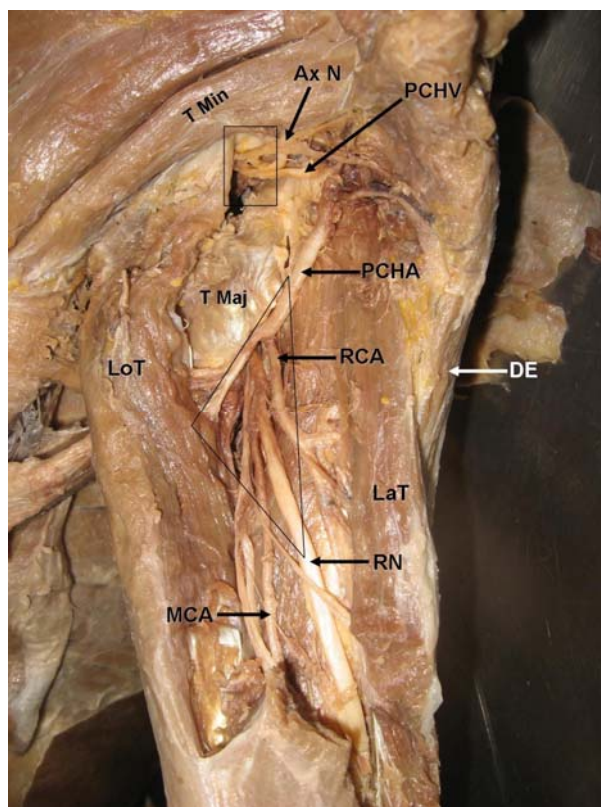
Dissection of the axilla and the upper arm showing the origin of posterior circumflex humeral artery (PCHA) from the axillary artery (Ax A). Also seen is the branching of middle collateral artery (MCA) from the brachial artery (Br A) and branching of radial collateral artery (RCA) from the posterior circumflex humeral artery (PCHA). RN- Radial nerve; LD- Latissimus dorsi



**Figure 2.** Quadrangular and triangular spaces from the posterior side

Dissection of the scapular region showing quadrangular and lower triangular spaces. Axillary nerve (Ax N) and posterior circumflex humeral vein (PCHV) can be seen passing through the quadrangular space. However, posterior circumflex humeral artery (PCHA) passes through the lower triangular space along with the radial nerve (RN). Also seen is the origin of the radial collateral artery (RCA) from the posterior circumflex humeral artery (PCHA) given at the lower border of teres major (T maj). IS- Infraspinatus; T min- Teres minor; Lo T- Long head of triceps; La T- Lateral head of triceps; DE- Deltoid; MCA- Middle collateral artery

## Variant course of posterior circumflex humeral artery



**Figure 3.** Closer view of the quadrangular and triangular spaces from the posterior side

Dissection of the scapular region showing quadrangular and lower triangular spaces. Axillary nerve (Ax N) and posterior circumflex humeral vein (PCHV) can be seen passing through the quadrangular space. However, posterior circumflex humeral artery (PCHA) passes through the lower triangular space along with the radial nerve (RN). Also seen is the origin of the radial collateral artery (RCA) from the posterior circumflex humeral artery (PCHA) given at the lower border of teres major (T maj). T min- Teres minor; Lo T- Long head of triceps; La T- Lateral head of triceps; DE- Deltoid; MCA- Middle collateral artery

After passing through the lower triangular space, PCHA gave a large branch that is radial collateral artery at the lower border of teres major. The course and distribution of this RCA was similar to that of normal RCA.

The middle collateral artery was arising directly from the brachial artery and there was a total absence of profunda brachii artery. The point of origin and the course of MCA were similar to that of a normal profunda brachii artery in the proximal part and normal MCA in the distal part (Figures 2, 3).

## Discussion

Many reports are available regarding the variant origin of the posterior circumflex humeral artery. In a study of 83 cadavers conducted by Olinger and Benninger PCHA originated from the subscapular artery in about 12% of cases. In about 8.4% of cases the PCHA originated from

the deep brachial artery and traversed the triangular interval to supply the deltoid muscle (5). In a case where 3<sup>rd</sup> part axillary artery on both sides divided into a superficial brachial artery and brachial artery proper, the latter gave anterior and posterior circumflex humeral branches and profunda brachii of brachial artery (6). A case of large common trunk from the 2<sup>nd</sup> part of axillary artery giving off lateral thoracic, thoracodorsal, subscapular, circumflex scapular arteries and then continuing as posterior circumflex humeral artery is also reported (7). Though there are many reports of variations in the origin of PCHA, reports of its variant course and anomalous branching as observed in the present case, are not available.

Variation in the origin of the radial collateral artery is not usual. Casoli et al. found it always as a branch of the profunda brachii artery in 69 upper limbs dissected by them (8). However, Patnaik et al. found one case out of 50 limbs where it was arising as direct branch of the brachial artery (9). As per available literature, there is

only one case of RCA originating from the PCHA which is reported by Rao et al. (10). In their case the RCA originated from PCHA at a higher level in the quadrangular space (10). In our finding in this case, RCA branched at a much lower level in the lower triangular space at the level of the lower border of teres major.

The posterior circumflex humeral artery is the main artery which supplies the upper humeral epiphysis, a major part of the deltoid and the rotator cuff and capsule of the shoulder joint (11-13). In its normal course, the artery is relatively more vulnerable in the quadrangular space possibly because of its close relationship with the shoulder joint and other muscles (10). There are reports of traumatic aneurysm of PCHA artery causing ischemia of the arm and hand in volleyball players (14). However, in the present case, though the artery is not in the quadrangular space, its devious course through the lower triangular space making a hair pin bend as it winds around the teres major makes it even more vulnerable than a normal PCHA.

The quadrangular space syndrome is one of the major clinical conditions associated with the PCHA. There are many reports of occlusion of PCHA leading to quadrangular space syndrome (3,4). There are also reports of occlusion of the posterior circumflex humeral artery causing the shoulder pain (4). The abnormal course of the PCHA through the lower triangular space making a hair pin bend as it winds around the teres major and its intimate relationship with the shaft of the humerus and the muscles as seen in the present case makes it more prone for occlusion and may mimic the symptoms of quadrangular space syndrome. In addition, in variant conditions as in the present case, the ischemia and the pain resulting from the occlusion of PCHA can be more extensive reaching the posterolateral part of the arm, lateral part of the forearm and elbow, due to the involvement of RCA. In cases of quadrangular space syndrome, if the patients are not responding to the conservative treatments, surgical decompression of the space through the posterior approach is considered (10,15). In such surgeries, it is essential for the surgeons to be aware of this variant course of the PCHA and abnormal origin and the course of the RCA as reported in this case. In conclusion, variation in the origin of the posterior circumflex humeral artery is common. However, its abnormal course through the lower triangular space making a hair pin bend as it winds around the teres major is being reported for the first time. The other variation observed in the present case, that is the origin of the radial collateral artery from the

PCHA is also rare. It is vital for clinicians and surgeons to be aware of these variations especially in diagnosis and surgical treatment for the quadrangular space syndrome.

## References

1. Standring S, Borley NR, Collins P, Crossman AR, Gatzoulis MA, Healy JC, Johnson D, Mahadevan V, Newell RLM, Wigley CB, editors. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 40<sup>th</sup> ed. London: Elsevier, Churchill Livingstone; 2008. p. 815-28.
2. Chautems RC, Glauser T, Waeber-Fey MC, Rostan O, Barraud GE. Quadrilateral space syndrome: case report and review of the literature. *Ann Vasc Surg* 2000;14(6):673-6.
3. Okino S, Miyaji H, Matoba M. The quadrilateral space syndrome. *Neuroradiology* 1995;37(4):311-2.
4. Cormier PJ, Matalon TA, Wolin PM. Quadrilateral space syndrome: a rare cause of shoulder pain. *Radiology* 1988;167(3):797-8.
5. Olinger A, Benninger B. Branching patterns of the lateral thoracic, subscapular, and posterior circumflex humeral arteries and their relationship to the posterior cord of the brachial plexus. *Clin Anat* 2010;23(4):407-12.
6. Sharma T, Singla RK, Sachdeva K. Bilateral superficial brachial artery. *Kathmandu Univ Med J (KUMJ)* 2009;7(28):426-8.
7. Baral P, Vijayabhaskar P, Roy S, Kumar S, Ghimire S, Shrestha U. Multiple arterial anomalies in upper limb. *Kathmandu Univ Med J (KUMJ)* 2009;7(27):293-7.
8. Casoli V, Kostopoulos E, Péliissier P, Caix P, Martin D, Baudet J. The middle collateral artery: anatomic basis for the "extreme" lateral arm flap. *Surg Radiol Anat* 2004;26(3):172-7.
9. Patnaik, VVG, Kalsey G, Singla Rajan K. Branching pattern of brachial artery: a morphological study. *Anat Soc India* 2002;51(2):176-86.
10. Mohandas Rao KG, Bhat SM, Vollala VR. Unusual origin of radial collateral artery noted in quadrangular space syndrome. *J Chin Med Assoc* 2006;69(6):276-7.
11. Duparc F, Muller JM, Fréger P. Arterial blood supply of the proximal humeral epiphysis. *Surg Radiol Anat* 2001;23(3):185-90.
12. Hue E, Gagey O, Mestdagh H, Fontaine C, Drizenko A, Maynou C. The blood supply of the deltoid muscle. Application to the deltoid flap technique. *Surg Radiol Anat* 1998;20(3):161-5.

### **Variant course of posterior circumflex humeral artery**

13. Determe D, Rongières M, Kany J, Glasson JM, Bellumore Y, Mansat M, Becue J. Anatomic study of the tendinous rotator cuff of the shoulder. *Surg Radiol Anat* 1996;18(3):195-200.
14. Vlychou M, Spanomichos G, Chatziioannou A, Georganas M, Zavras GM. Embolisation of a traumatic aneurysm of the posterior circumflex humeral artery in a volleyball player. *Br J Sports Med* 2001;35(2):136-7.
15. Cahill BR, Palmer RE. Quadrilateral space syndrome. *J Hand Surg Am* 1983;8(1):65-9.