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Indian Journal of Clinical Anatomy and Physiology

Journal homepage: <https://www.ijcap.org/>

Case Report

High origin of radial artery in mid-arm and possible complications: A cadaveric case study

Pankaj Kumar Rathi ^{1,*}

¹Dept. of Anatomy, Maulana Azad Medical College, New Delhi, India



ARTICLE INFO

Article history:

Received 15-06-2023

Accepted 16-08-2023

Available online 21-10-2023

Keywords:

Anatomical variation

Cadaveric study

Complications

High origin

Mid-arm

Radial artery

ABSTRACT

The radial artery is a vital vessel supplying the forearm and hand. Variations in its origin can occur, leading to potential complications during clinical procedures. This cadaveric case study investigates the high origin of the radial artery in the mid-arm and its associated complications. Two cadaveric specimens were examined, at Department of Anatomy, Maulana Azad Medical College, New Delhi, and the anatomical variations were documented. The study highlights the importance of recognizing such variations and their implications in clinical practice, aiding healthcare professionals in minimizing procedural complications and optimizing patient outcomes. The tortuous course and kinking observed in this study may predispose the artery to thrombosis, spasm, or occlusion, potentially leading to ischemic complications in the forearm and hand.

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1. Introduction

The radial artery is a major vessel of the upper limb that plays a crucial role in supplying the forearm and hand with oxygenated blood.¹ Typically, it originates from the brachial artery in the cubital fossa and follows a well-established course along the forearm. However, anatomical variations in the origin of the radial artery have been documented, and one such rare anomaly is the high origin of the radial artery in the mid-arm.²

The high origin of the radial artery refers to its departure from the brachial artery at a location higher than the expected cubital fossa level.³ Instead of arising at the usual anatomical location, this variant emerges in the mid-arm, presenting an interesting anatomical anomaly that may have important clinical implications. Although this variation has been reported in the literature, its prevalence remains low, making it an area of interest for anatomical studies and

clinical observations.^{2–5}

Understanding anatomical variations of the radial artery is crucial for healthcare professionals involved in various clinical procedures, including arterial line placement, blood sampling, and cannulation.^{6,7} Knowledge of these variations helps to ensure successful and accurate procedures while minimizing the risk of complications. The high origin of the radial artery in the mid-arm presents unique challenges and potential complications, which need to be recognized and managed appropriately to optimize patient care.^{6,8}

This cadaveric case study aims to investigate the high origin of the radial artery in the mid-arm through the examination of two cadaveric specimens. By meticulously dissecting the upper limbs, documenting the anatomical variations, and assessing potential complications associated with this variation, we aim to enhance the understanding of this rare anomaly among healthcare professionals and raise awareness of its clinical significance.

* Corresponding author.

E-mail address: pnkjrth79@gmail.com (P. K. Rathi).

Ultimately, the goal is to improve patient safety and outcomes by minimizing procedural risks and optimizing the management of this anatomical anomaly.

2. Materials and Methods

Two formalin fixed cadaveric specimens were obtained for this study from Department of Anatomy at Maulana Azad Medical College, New Delhi. The upper limbs were dissected meticulously from axilla to downwards, to identify the origin and course of the radial artery. Detailed measurements were taken, documenting the distance from the origin to the elbow crease, as well as the presence of any tortuosity or kinking along the arterial course. Photographs and sketches were made to accurately depict the anatomical variations.

3. Results

In one of the cadaveric specimens, a high origin of the radial artery (RA) was observed in the mid-arm, approximately 7 cm proximal to the elbow crease, from brachial artery (BA). (Figure 1).

Artery passed anterior to medial nerve (Figure 1) and lying lateral to biceps brachii, reached elbow where a communication between radial artery and brachial artery is seen in cubital fossa. Communication (yellow dotted arrow in Figures 2 and 3) is related deeper to biceps brachii aponeurosis. The artery followed non-tortuous course, displaying varying degrees of kinking. The radial artery then continued its normal course along the forearm, supplying the hand. It ended by making communication for superficial and deep palmar arches of hand.

The other limb showed normal course of axillary, brachial, radial artery. No aberrant course was noted.

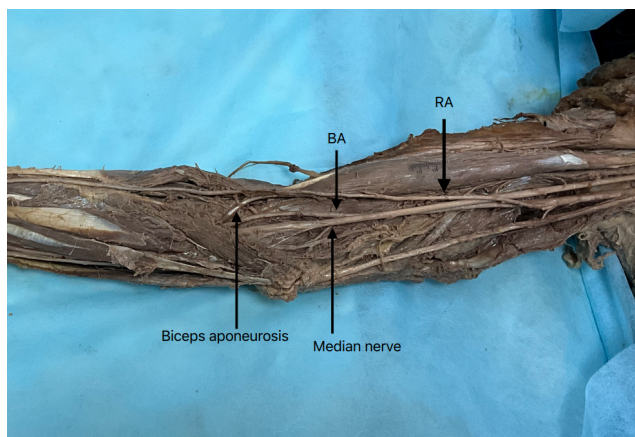


Fig. 1: High origin of radial artery in mid arm. RA- Radial artery, BA- Brachial artery

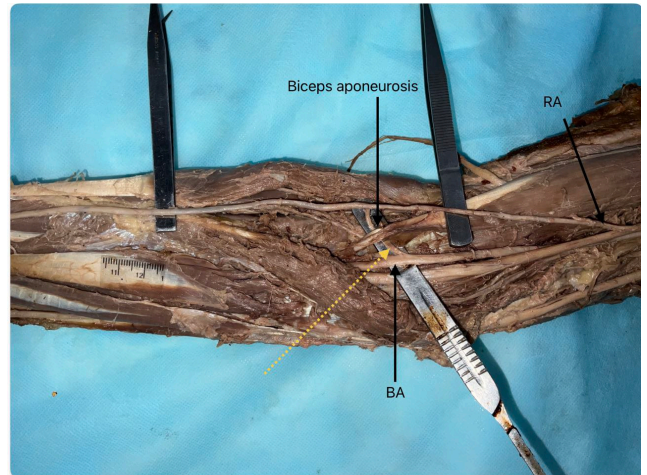


Fig. 2: Communication between radial artery and brachial artery, shown by yellow dotted arrow



Fig. 3: Further course of radial artery in arm

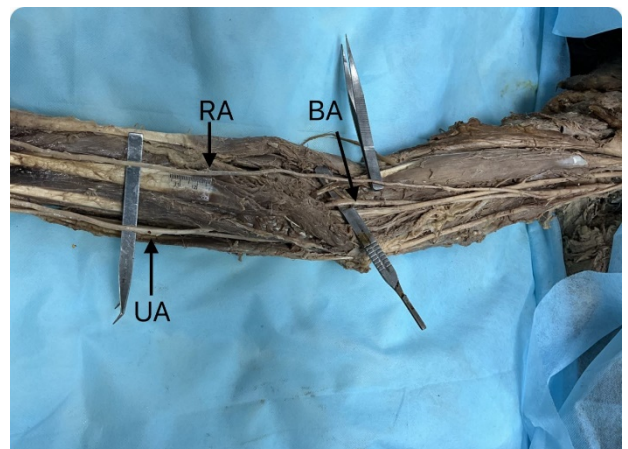


Fig. 4: Radial and ulnar arteries in forearm

4. Discussion

4.1. Anatomical variations of the radial artery

The radial artery typically arises from the brachial artery at the cubital fossa. However, variations in its origin can occur, including a high origin in the mid-arm. These variations can result from embryological development and have important clinical implications.¹⁻⁴

4.2. Clinical implications and complications

The high origin of the radial artery in the mid-arm can present challenges and potential complications during various clinical procedures.⁷ Cannulation and arterial line placement may become more difficult due to the altered anatomical location. The tortuous course and kinking observed in this study may predispose the artery to thrombosis, spasm, or occlusion, potentially leading to ischemic complications in the forearm and hand.

Furthermore, the longer course observed in the high origin of the radial artery can increase the risk of complications such as thrombosis, spasm, or occlusion. The altered anatomy may lead to inadequate blood flow to the forearm and hand, potentially resulting in ischemic complications.⁹ Therefore, clinicians need to be aware of this anatomical variation to ensure accurate placement of catheters,¹⁰ avoid damage to the vessel, and prevent downstream ischemic complications.

Additionally, the altered anatomy of the high origin of the radial artery may impact the accuracy of procedures that rely on the radial artery for monitoring purposes, such as transradial cardiac catheterization or radial artery harvesting for vascular grafting. Careful consideration and modifications in technique may be required to accommodate the anatomical variations and ensure successful outcomes.

4.3. Embryological background

Anatomical variations in the radial artery, such as the high origin in the mid-arm, can arise due to deviations or disruptions in the normal processes of arterial development and remodelling.¹¹ These variations may result from aberrant migration or persistence of arterial segments during embryogenesis.^{1,12} Genetic and environmental factors may also contribute to the occurrence of these variations, although the specific mechanisms involved remain to be fully elucidated.

During early embryonic development, the upper limb bud undergoes a series of intricate morphogenetic events, including the formation and remodelling of arterial structures.¹² The initial vascularization of the upper limb involves the axial artery, a network of vessels that forms the foundation of the arterial system.¹³ The axial artery gives rise to major arteries such as the brachial artery, which provides the primary blood supply to the upper limb.

As development progresses, the axial artery undergoes remodelling and regression to establish the final arterial pattern. The exact mechanisms involved in this remodelling process are still not fully understood. However, it is believed that complex interactions between genetic factors, signalling molecules, and mechanical forces play crucial roles in shaping the arterial system.

The axillary artery is a major vessel located in the upper limb that supplies blood to the shoulder, upper arm, and surrounding structures.^{1,2,6,14} During embryological development, the axillary artery arises from the third branchial arch artery, which is derived from the dorsal aorta.¹⁻³

The branching pattern of the axillary artery can exhibit anatomical variations, which can be attributed to alterations in the development and regression of arterial segments during embryogenesis. These variations occur due to changes in the establishment and remodelling of the arterial system in the upper limb.

One common anatomical variation involves the origin and course of the thoracoacromial artery, which is a branch of the axillary artery that supplies the pectoral muscles and the shoulder region.¹⁵ In the typical branching pattern, the thoracoacromial artery arises directly from the axillary artery.⁷ However, in some variations, the thoracoacromial artery may arise from the second part of the axillary artery or even from one of its branches, such as the lateral thoracic artery. These variations can lead to differences in the distribution of blood supply to the corresponding regions.

Another variation involves the branching pattern of the subscapular artery, which is another major branch of the axillary artery.⁹ The subscapular artery typically gives rise to two branches: the circumflex scapular artery, which supplies the scapular region, and the thoracodorsal artery, which supplies the latissimus dorsi muscle. However, in some cases, the thoracodorsal artery may arise directly from the axillary artery or from other branches, such as the lateral thoracic artery or the posterior circumflex humeral artery.

These embryological variations in the branching pattern of the axillary artery can have clinical implications, particularly during surgical procedures or interventions involving the upper limb.¹⁰ Knowledge of these variations is crucial for surgeons and interventionalists to accurately identify and preserve the arterial branches during surgical dissections, minimize the risk of complications, and ensure optimal patient outcomes.¹¹

5. Conclusion

This cadaveric case study provides evidence of the high origin of the radial artery in the mid-arm and its associated anatomical variations.¹³ Recognition of such variations is crucial for healthcare professionals involved in clinical procedures and interventions. Understanding the potential

complications and challenges posed by this anatomical anomaly can aid in selecting appropriate techniques and minimizing procedural risks, ultimately improving patient outcomes.¹³

Recognition of this anatomical variation can aid in the selection of appropriate techniques and approaches during procedures involving the radial artery.¹¹ It enables healthcare professionals to anticipate challenges, minimize procedural risks, and optimize patient outcomes.⁹ Further studies and awareness of such anatomical variations will enhance our understanding and provide valuable insights for clinical practice, ultimately improving patient safety and care.

6. Source of Funding

None.

7. Conflict of Interest

None.

Acknowledgments

We would like to express our gratitude to the donors who generously contributed their bodies to medical education and research, making this study possible. We also acknowledge the support of the anatomical laboratory staff and researchers involved in the dissection and data collection process.

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Author biography

Pankaj Kumar Rathi, PG 3rd Year  <https://orcid.org/0000-0002-0979-3663>

Cite this article: Rathi PK. High origin of radial artery in mid-arm and possible complications: A cadaveric case study. *Indian J Clin Anat Physiol* 2023;10(3):181-184.