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CASE REPORT

A Rare Bilateral Variation of the Median Cubital Vein Traversing Deep to the Bicipital Aponeurosis

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Abstract

Objective: To describe a rare anatomical variation of the Median Cubital Vein (MCV) identified during human donor dissection and discuss its potential clinical implications for venipuncture and vascular access procedures.

Methods: Routine anatomical dissection of the upper limbs of a 78-year-old female donor was performed at a medical school anatomy laboratory. The superficial venous anatomy of the cubital fossa was examined, with particular attention to the course and relationships of the MCV relative to the bicipital aponeurosis and surrounding neurovascular structures.

Results: Dissection revealed a bilateral variation in which the MCV coursed deep to the bicipital aponeurosis rather than superficial to it, as is typically observed. The vein maintained its usual connections with the cephalic and basilic veins but passed beneath the aponeurotic layer on both sides. Previously documented cases of this variation have been limited to unilateral findings in male donors, making the present case the first reported bilateral occurrence in a female donor. The deeper location of the MCV may reduce venous visibility and palpability, potentially increasing the difficulty of venipuncture and placing the vein in closer proximity to the brachial artery and median nerve.

Conclusion: A median cubital vein located deep to the bicipital aponeurosis represents a rare anatomical variation with important clinical implications. Awareness of this configuration may help clinicians anticipate difficult venous access and reduce the risk of neurovascular injury. In such cases, ultrasound-guided vascular access may improve procedural success and patient safety, particularly in emergency or high-risk clinical settings.

Key Words: *Bicipital aponeurosis; Medial cubital vein; Venipuncture; Cubital fossa; Anatomical variation*

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Introduction

The cubital fossa is an important clinical region that typically contains the median cubital vein (MCV), one of the most common sites for venipuncture [1]. Usually located deep to the MCV lies the bicipital aponeurosis, a thick fascial layer that protects the underlying brachial artery and the more medially positioned median nerve [2]. Because the MCV is superficial and generally stable, it is routinely used for intravenous (IV) cannulation, diagnostic blood sampling, administration of imaging contrast, and rapid vascular access in emergency settings [1,3]. Venipuncture is among the most frequently performed medical procedures, yet first-attempt success rates in the emergency department vary widely [4]. Anatomical variation is one contributor to failed or difficult venous access and can increase the risk of bruising, hematoma formation, arterial puncture, nerve irritation, and patient discomfort [1,4]. Awareness of potential variations in the superficial venous anatomy of the cubital fossa is therefore essential to minimizing procedural complications.

Case Presentation

Routine upper-limb dissection of a 78-year-old female donor, whose cause of death was mesenteric hemorrhage and known past medical history included esophageal cancer, gastric bypass surgery, and hypertension, revealed bilateral anomalous anatomy within the cubital fossa, with the MCV coursing deep to the bicipital aponeurosis on both sides (Figures 1 and 2). Standard fixation and preparation for anatomical study had been performed prior to dissection. No abnormal scaring was observed over either cubital fossa. Multiple puncture marks, however, were present on the dorsal hand, forearm, and antecubital regions with multiple sites of blown veins characterized by disruption of the vein wall and localized hematomas. Notably, there were no puncture marks directly over the region where the MCV would normally be accessed. In this donor, the MCV maintained its typical connections, joining medially with the basilic vein and laterally with the cephalic vein (Figure 2). Due to tissue fixation, the functional impact of elbow positioning on venous patency or blood flow through this deep segment could not be determined.

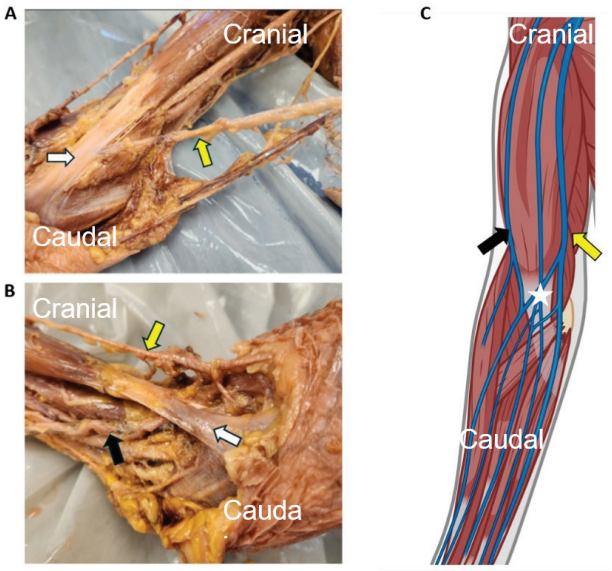

Figure 1) *Initial dissection of the upper right arm of the donor following removal of the skin distal to the cubital fossa. (A, B) The course of the superficial veins is shown, including the cephalic vein (black arrow) and the median cubital vein (MCV; yellow arrow), which branches from the basilic vein and travels deep to the bicipital aponeurosis (white arrow). (C) Schematic illustrating the typical anatomical course of the MCV running superficial to the bicipital aponeurosis. White stars indicate MCV.*

Discussion

Previous case reports have documented anomalous courses of the MCV, with two reports describing the vein passing deep to the bicipital aponeurosis [2,5]. Bhat et al. (2017) referenced a case that featured a partial split in the aponeurosis allowed only a portion of the MCV to remain superficial [2], whereas

Newton et al. (2022) described a case with the aponeurosis running entirely superficial to the MCV [5]. Both previously published cases were unilateral findings in male donors. To our knowledge, the present case is the first to describe this variation occurring bilaterally and in a female donor.

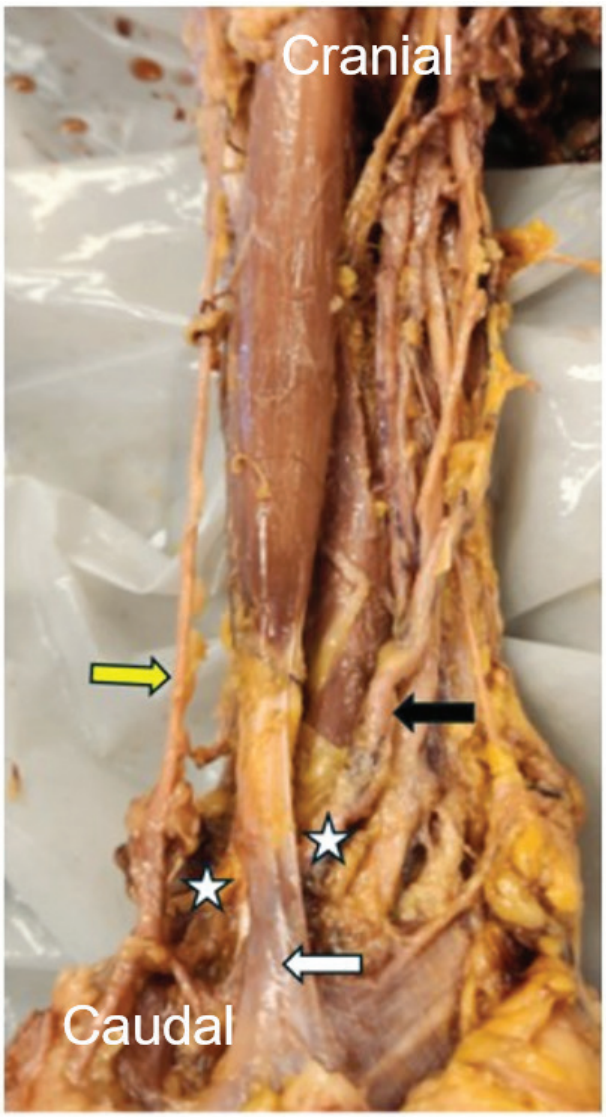

Figure 2) *Continued dissection of upper right arm of the donor. Black arrow indicates cephalic vein, white arrow indicates bicipital aponeurosis, yellow arrow indicates basilic vein, white stars indicate MCV running deep to the bicipital aponeurosis.*

Multiple anatomical studies have examined the superficial venous patterns of the cubital fossa, most commonly identifying the classic N-shaped configuration in which the MCV connects the cephalic and basilic veins [1,3]. Despite descriptions of up to eight recognized venous patterns in this region, none have reported an MCV positioned deep to the bicipital aponeurosis. This absence suggests that the variation is either extremely rare or easily missed during routine anatomical examination, particularly when visualization relies on superficial transillumination.

In this donor, the MCV's position deep to the bicipital aponeurosis would likely increase resistance during venipuncture, potentially contributing to the numerous failed venous access attempts observed elsewhere on the upper limbs. The bicipital aponeurosis is a dense, fibrous structure, historically known as the Grace a Dieu fascia, that can obstruct needle passage, and increased venous depth itself poses an added challenge [6]. Prior work has shown that veins deeper than approximately 1.44 mm and 1.89 mm have reduced palpability and visibility, respectively, making landmark-guided venipuncture more difficult [7]. Together, these factors heighten the likelihood of failed cannulation, extravasation, and the need for repeated attempts.

The bicipital aponeurosis also provides critical protection to the neurovascular bundle, including the median nerve and brachial artery, which lie deep to it. Complications from brachial artery catheterization, though uncommon, can include median nerve injury through direct trauma, compression, or ischemia, with cases of complete median nerve palsy reported [8,9]. In the setting of an anomalously deep MCV positioned adjacent to these structures, the risk of inadvertent arterial or neural injury during attempted venipuncture is theoretically increased. Awareness of this

anatomical variation is therefore clinically important. Patients with this configuration would likely benefit from ultrasound-guided vascular access to reduce procedural risk and improve cannulation success [10]. If other veins do not appear in the case of a shocked patient, the cephalic vein can be used for venous access in part of its course when it is located behind the distal anterior border of the radius [11].

Conclusion

This case describes a rare anatomical variation in which the MCV courses deep to the bicipital aponeurosis bilaterally in a female donor. Although two prior reports have documented this variation, both were unilateral and occurred in male donors, making the present case the first of its kind. While numerous patterns of superficial venous anatomy in the cubital fossa have been well characterized, this particular configuration is uncommon and carries important clinical implications. A deeply positioned MCV may increase the difficulty and risk of routine venipuncture or brachial artery catheterization. Even successful cannulation may pose added danger due to limited visibility and greater needle depth. These challenges are especially consequential in emergency or trauma settings, where rapid and reliable vascular access is critical. This donor likely suffered greater discomfort at the end of her life due to this variation and the need for multiple puncture wounds. These wounds, in combination with blown veins, suggest that medical providers had difficulty obtaining adequate vascular access, likely causing the patient pain with each additional attempt. Knowledge of this patient's anomalous MCVs may have reduced discomfort for her by decreasing the number of attempts it took for providers to successfully gain vascular access. Greater awareness of this variation may help clinicians anticipate difficult access and consider early use of ultrasound guidance to minimize complications.

Ethics Statement

This study was approved by the Rocky Vista University Institutional Review Board (IRB #2025-325). The donor specimen was obtained through the University of Utah Body Donor Program. Informed consent for body donation and use for medical education and research was obtained by the donor program prior to donation. No identifiable donor information is included in this report.

Acknowledgement

The authors sincerely thank those who donated their bodies to science so that anatomical research could be performed. Results from such research can potentially increase mankind's overall knowledge that can then improve patient care. Therefore, these donors and their families deserve our highest gratitude. Figure 1C was created in Biorender.com.

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