Superficial Veins of the Cubital Fossa: A Review

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Introduction

The main superficial veins in the cubital fossa are cephalic, basilic and median veins (median cephalic, median basilic, median cubital and median antebrachial). These superficial veins are very often visible through the skin [1, 2]. These veins may acquire different anatomical arrangements and anastomosis, especially in the antecubital region. Furthermore, their relations with cutaneous nerves may also vary [3, 4, 5, 6].

Superficial veins of cubital fossa are very important for day to day clinical practice as they are commonly used for venipuncture, transfusion, intravenous injections and cardiac catheterization, thus requiring knowledge regarding the morphological and functional aspects of the venous vessels as well as their anatomical relationships [7, 8].

In addition, it is important to know the anatomy patterns of the superficial veins of the cubital region to plan dialysis access in a given patient. In some superficial vein pattern types, arteries and nerves lie near or below the superficial veins and missed injections could be dangerous to the underlying structures [9]. Also, Lack of knowledge may lead to repetitive attempts in cases where the veins are not prominent enough, which can lead to complications such as hemorrhage and phlebitis [8, 10]. Although there are numerous variations of the superficial venous system in the cubital fossa, it was classified into several types by investigators. Most of them classified the courses of the superficial veins into four or six types [3, 11, 12, 13, 14, 15]. So, knowledge of the venous arrangements of the cubital fossa may imply better outcomes and lower complications rates of the procedure [16].

The present review paper aims to recollecting data regarding superficial veins of the cubital fossa with the purpose to improve knowledge in this area and help clinicians to make successful venipuncture procedures by reading different published journals mainly from browsing different journal catalogs on internet like PubMed, Medline, Hinnary and Google scholar.

REVIEW

Anatomy of the superficial veins of the cubital fossa

The superficial veins are situated between the two layers of the superficial fascia and are accompanied by cutaneous nerves and superficial lymphatic vessels [17]. The major superficial veins of the upper limb include the Cephalic, Basilic, Median Cubital, and Antebrachial veins. Most of these veins originate in the subcutaneous tissue on the dorsum of the hand from the dorsal venous arch [18].
The cephalic vein (CV) begins usually over the ‘anatomical snuff-box’ from the radial end of the dorsal venous network [19]. It curves around the radial side of the forearm and ascends along the lateral aspect of the arm within the superficial fascia [20]. It then crosses the cubital fossa, enters the arm on the lateral aspect of biceps and ends by piercing deep fascia in lateral pectoral groove and draining into axillary vein [21].

The basilic vein starts medially in the dorsal venous network of the hand. It ascends posteromedially in the forearm, including forwards to the anterior surface distal to the elbow, where it is joined by the median cubital vein. It then ascends superficial to and between biceps and pronator teres, and it is crossed by filaments of the medial cutaneous nerve of the forearm that pass both superficially and deeply into the vein [22]. The median cubital vein unites the basilic and cephalic veins superficial to bicipital aponeurosis in the roof of cubital fossa [23].

Cubital Fossa

The cubital (or antecubital) fossa is a triangular space with its apex pointed distally to the limb. Its lateral and inferior boundary is the brachioradial muscle, while the pronator teres muscle binds the cubital fossa medially and inferiorly. The base of the “triangle” is done by an imaginary horizontal line between both epicondyles of the humerus. Its floor is formed by the brachial and the supinator muscles, while its roof is composed by the superficial fascia, subcutaneous tissue and the skin [4]. The cubital fossa is seen superficially as a depression on the anterior aspect of the elbow. Deeply, it is a space filled with a variable amount of fat anterior to the most distal part of the humerus and elbow joint [12]. The deep content of the cubital fossa includes the distal biceps tendon, the brachial artery, the median and the radial nerves, while the superficial content includes the CV, BV, median cubital vein and the lateral and medial cutaneous nerves of the forearm. These structures are separated by the bicipital aponeurosis [17, 22].

Pattern of Superficial Venous Arrangement

According to several studies the arrangement of the superficial veins in the cubital fossa has shown regional, gender and side differences [12, 24, 25]. On the other hand, their comparison is difficult due to differences in methodology, sample size and numerous discrete classifications of venous anastomoses [13]. Figure 1 below shows the eight types which are usually reported in the literature [25]. The “M” (or “Y” or classical) shaped arrangement called type 1 is a pattern where a dominant MAV continues with two terminal branches, the MCV and the median basilica vein (MBV), joining CV and CB, respectively [17]. The “N” (or “H”) shaped arrangement or embryonal type (type 2) is a pattern where a poorly developed MAV ends into the MCV which connects CV and BV in the cubital region [26]. The “I” or “O” type (type 3) presents with no communicating branch between CV and BV [27]. Type 4 is a pattern where the CV drains into BV, and MAV drains into CV or BV below the cubital fossa while the CV is poor developed or missing and in rare cases, the MCV is doubled (type 5) [28, 29].
Type 6 is a pattern where the CV and BV are joined by an arched vein, with a proximally oriented concavity into which two or more veins are drained from the forearm [12, 25]. Few authors also identified two additional types. The ‘‘M’’-like type (type 7) where MCV does not link to CV or when the CV is divided into MCV and MBV. In that case MCV drains into the accessory CV [13]. Type 8 is very rarely described in literature; it includes nonclassifiable patterns such as an absent antebrachial BV or a doubled brachial CV [12, 30].

![Diagram of superficial cubital veins](image)

Figure 1. Pattern types of superficial cubital veins (C – cephalic vein, B – basilic vein, MAV – median antebrachial vein, MCV – mediancephalic vein, MBV – median basilic vein, MCuV – median cubital vein)

**Clinical Significance**

Due to their numerous variations, it is important to master the anatomy of the superficial veins of the cubital fossa for clinical procedures such as venipuncture, transfusion, infusion, cardiac catheterization, or placement of dialysis access [31]. On the other hand, different vein patterns existing in the cubital fossa can provide collateral venous pathways in the case of occlusion [20].

Complications of venipuncture can involve the aforementioned anatomical variations. Cutaneous nerve injury and accidental arterial cannulation have been reported due to the spatial disposition of the cutaneous nerves and the variant known as superficial ulnar artery, respectively [32, 33].

Anatomical studies observed that the most dangerous region is near the medial margin of the antecubital fossa, due to the presence of more sensorial branches, and the safer zone would be the radial part of the antecubital fossa [3].
According to anatomical textbooks, the most used vein for venipuncture is the median cubital vein, as it is large and more prominent [17]. The radial portion of the median cubital vein is the safest region to perform venipuncture [6].

With the purpose of reducing iatrogenic errors during venipuncture, several institutions have adopted the new vein visualization display system, which works through near-infrared light and accurately displays the superficial venous network. Thus, it can be used as a guide during venipuncture procedures [8, 27].

**Conclusion**

This review article concluded that superficial veins of the cubital fossa are prone to possess diverse patterns of anastomosis. This is highly important, as venipunctures, in the upper limb are among the most performed procedures in the world and they often rely on the veins of the cubital fossa. In addition, the relationships of these veins to the cutaneous nerves and arteries are also prone to vary and are often uncertain. It is known that anatomical variations of the vessels and nerves on the cubital fossa may induce the professionals to error, and one of the most common complications of venipuncture are accidental nerve puncture, which can lead to paresthesia and pain. This review also explores venous arrangements of the cubital fossa and their clinical aspects from an anatomical point of view, with the purpose of compiling available data and help healthcare professionals to reduce puncture errors complications and improve patient care.

**Acknowledgment**

The authors are thankful to all those who were supporting, giving constructive evaluation and comments during the writing article of biomedical science and bio biology department staffs.

**Funding**

Self-funded

**Competing interests**

The authors declare that they have no competing interests

**Availability of data and materials**

Not applicable

**Code availability**

Not applicable

**Authors’ contributions**

DGN conceptualized and wrote the manuscript. MGK edited and revised the manuscript. Then the authors read and approved the final manuscript.
References


