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Rare variations of cephalic vein drainage: two case reports

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Throughout the years, anatomic studies have demonstrated numerous variations in the course of the cephalic vein (CV). There are, however, very rare cases of uncommon formation, course, or termination of the vein to which our attention should be drawn.

During routine dissections conducted in the Department of Anatomy and Neurobiology, in 2 formalin-fixed cadavers, very rare anatomical variants were found. In an 80-year-old Caucasian female the right cephalic vein, after crossing the clavipectoral triangle, ascended anterior and superior to the clavicle and drained into the lateral branch of the right external jugular vein, which in turn opened to the right subclavian vein. In the second case, the dissection of an 83-year-old Caucasian male cadaver revealed that, after passing through the deltopectoral groove, the left cephalic vein ran between clavicle and subclavius muscle to terminate in the left subclavian vein.

Understanding of the topography, morphology, and anatomical variations of the cephalic vein is important not only for anatomists but for clinicians and nurses. Such knowledge can prevent multiple complications during many invasive procedures including implantation of cardiac implantable electronic devices, central venous access, arteriovenous fistula creation, or iatrogenic injuries during clavicle or glenohumeral joint surgery. (Folia Morphol 2024; 83, 3: 740–744)

Keywords: human cadavers, dissection, external jugular vein, subclavius muscle

INTRODUCTION

Superficial veins, located in the subcutaneous tissue, play a significant role in carrying blood to the heart, especially from the upper and lower extremities. One of the main superficial veins of the upper limb is the cephalic vein (CV), a relatively large vessel used for numerous invasive procedures, due to its consistent anatomy and low risk of postoperative complications in comparison to venous punctures via subclavian or axillary veins [10, 12, 15, 17, 21, 25, 26].

Typically, the CV begins distally at the radial extension of the dorsal venous network of the hand, then crosses superficial to the anatomical snuffbox and ascends along the anterior border of the brachioradialis muscle on the forearm. In most cases, the CV anastomoses with the basilic vein by an obliquely

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Table 1. The sex and age profiles of cadavers used in the study.

	No. of cadavers	Minimum age	Maximum age	Median age
Female	5	63	82	71
Male	22	52	87	71

crossing median cubital vein in the antecubital region. After leaving the antecubital region, the CV continues superficially along the lateral border of the biceps brachii muscle until the proximal third of the arm, where it enters the deltopectoral groove. Then it enters the clavipectoral triangle, a triangular space bordered by the clavicle (superiorly) and deltoid muscle (laterally) and pectoralis major muscle (medially). There the CV pierces the clavipectoral fascia and empties into the axillary or subclavian veins [15].

Several anatomical variations of the cephalic vein have been previously reported [1, 6, 15, 18, 20, 24]. Therefore, clinicians and anatomists should be aware of possible anatomical variants of the CV to prevent any complications concerned with invasive procedures performed on the vein, especially when it comes to emergency procedures, when there is no time for identification of the CV.

To draw attention to the existence of very rare anatomical variants of the course and termination of the CV, in this paper we present 2 unique cases discovered during routine anatomical dissections conducted in the Department of Anatomy and Neurobiology at the Medical University of Gdansk.

MATERIALS AND METHODS

During 2018–2022, at the Department of Anatomy and Neurobiology of the Medical University in Gdansk, 27 formalin-fixed adult human cadavers (5 female and 22 male) were routinely dissected (Tab. 1). The causes of death were unknown. All cadavers had neither lesions nor history of operation on the upper limb region. All cadavers used in this study were donated through the body donation program with consent for educational and scientific purposes. The Institutional Ethics Committee gave approval for conducting this study (Institutional Review Board number: Ordinance No. 26/2016 of the Rector of the Medical University of Gdansk of 6 June 2016 on the implementation of the "Program of Conscious Donation of Corpses"). Gratitude to the donor cadavers and their families is expressed within the Acknowledgements section. These follow the recently proposed recommendations created by 20 editors-in-chief of 17 anatomical journals aimed at standardising the writing approach by which donors are acknowledged in anatomical studies [7].

All the cadavers were routinely fixed in a formalin solution. The dissections were carried out with the use of traditional techniques. After visualising the vein of interest, measurements of vessels lengths and diameters were made with a digiMax caliper (Wiha Werkzeunge GmbH, Schonach im Schwarzwald, Germany). Each distance was measured 3 times, and then the average was calculated. Following preliminary examination, images from all the dissected specimens were captured with a Cannon PowerShot G1 X Mark II digital camera (Canon Inc., Tokyo, Japan).

RESULTS

During the routine dissection procedures, in 2 of 27 cadavers very rare anatomical variants were found.

Examination of an 80-year-old Caucasian female cadaver revealed bifurcation of the right external jugular vein into 2 vessels: medial and lateral branches (Fig. 1A, B). The bifurcation began approximately at the level of the angle of the mandible. Both branches drained directly to the right subclavian vein. On the forearm and arm, the right cephalic veins followed the typical course described above. However, after crossing the clavipectoral triangle it ascended anterosuperiorly to the lateral third of clavicle and drained directly into the lateral branch of the right external jugular vein. We detected no anastomoses between the right cephalic vein and right subclavian or right axillary vein. Measurements were made of the following lengths: 1) the right cephalic vein within the clavipectoral triangle and above to the point of drainage into the lateral branch of right external jugular vein; 2) both branches of the right external jugular vein (from the point of bifurcation to the junctions with the right subclavian vein; and 3) the lateral branch of external jugular vein from the point of junction with the right CV to the point of anastomosis with the right subclavian vein. In addition, at the midpoint of the cephalic vein within the clavipectoral triangle, the vessel was transected and the diameter was measured. The length of the cephalic vein within the clavipectoral triangle was 6.3 cm, while its supraclavicular length was 3.7 cm. The lateral branch of the external jugular vein measured 6.4 cm, while the medial branch was 9.3 cm. The length of the lateral branch of the external jugular

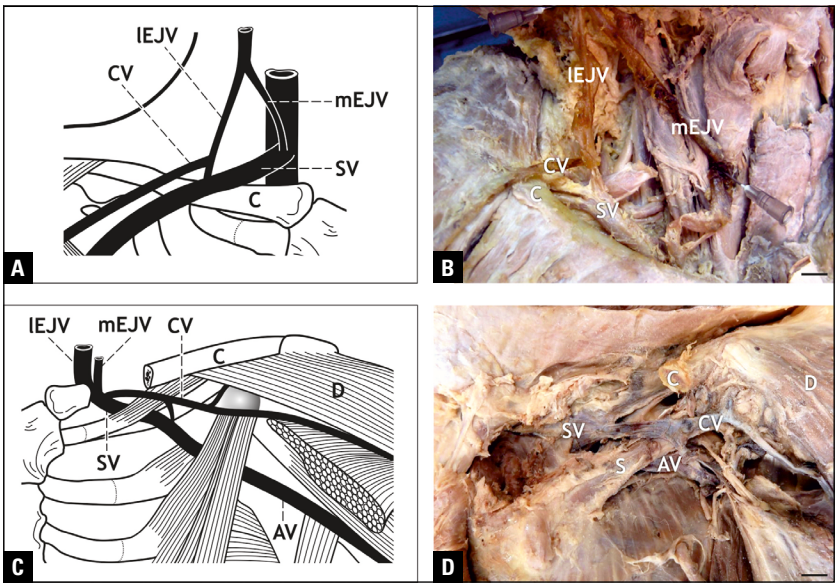

Figure 1. Schematic drawings and photographs of rare cases of drainage of CV into the lateral branch of the external jugular vein (**A**, **B**) and CV passing between the clavicle (medial 2/3 of clavicle removed) and subclavius muscle (**C**, **D**). AV— axillary vein; C — clavicle; CV — cephalic vein; D — deltoid muscle; lEJV — lateral branch of external jugular vein; mEJV — medial branch of external jugular vein; S — subclavius muscle; SV — subclavian vein. Scale bar = 1 cm.

vein between the points of junction with the right CV vein and the right subclavian vein was 1.5 cm. The CV diameter in the midpoint of the clavipectoral triangle was 0.9 cm.

In an 83-year-old Caucasian male cadaver an extremely rare unilateral course of the left CV was discovered (Fig. 1C, D). Up to the level of the deltopectoral triangle the left CV followed a typical course. After passing through the triangle, however, the vein ran between the clavicle and subclavius muscle to terminate in the proximal part of the left subclavian vein. One communicating branch between the cephalic vein and the axillary vein was found. On the right side, the CV followed its typical course. The CV diameter between the clavicle and subclavius muscle was 0.8 cm. The length of the CV within the clavipectoral triangle was 6.5 cm. The diameter of communicating branch between the CV and the axillary vein was 0.4 cm. On the right side, within the clavipectoral triangle the diameter of the CV was 0.5 cm.

DISCUSSION

Although the CV belongs to the superficial venous system, in which variabilities are commonly observed, the presence and course of the CV is relatively stable. For example, the study of Loucas et al. [15], performed bilaterally on 50 cadavers, revealed the presence of CV in 95% of cases. A similar observation was made by Le Saout et al. [13], who reported the absence of CV in 4 out of 74 autopsies (5.4%). In the scientific literature, however, one can find descriptions of several anatomical variations of CV course or drainage. The most common variants include drainage into the subclavian vein [15], doubled axillary vein [6], or basilic vein [18]. There have been also cases of a very thin CV [1] or the CV being accompanied by an accessory cephalic vein [1, 15].

In comparison to other anatomical variants, the supraclavicular course of the CV resulting in opening to the internal or external jugular vein is a rare finding, and only few clinical cases have been reported [2, 4, 8, 9, 15, 16, 20, 21, 24]. The supraclavicular variation is considered to originate during embryological development from the persistent anastomotic channel between the cephalic vein and the external jugular vein, corresponding to the jugulocephalic vein present at the early stage of human ontogenesis [14, 24]. In our first case (80-year-old female) we observed the right CV, which, after crossing the clavipectoral triangle, ascended anterosuperiorly to clavicle and drained directly into the lateral branch of the right external jugular vein. Even though single cases of CV drainage into the external jugular vein have been previously reported, we did not find any case describing the opening of the CV to one of the branches of the bifurcated external jugular vein.

In the second case (83-year-old male), the left CV passed between the clavicle and the subclavius muscle, to drain into the left subclavian vein. The same anatomical variant has been previously mentioned only once [22].

In both our cases, the diameter of the CV within the clavipectoral triangle (9 and 5 mm, respectively) did not differ from previously published data. The study of Yeri et al. [25] revealed that the average diameter of the CV within the deltopectoral triangle was 3.7 ± 1.30 mm (with a range of 1.0–7.5 mm), while Loukas et al. [10] reported an average result of 8 ± 1 mm (with a range of 1 to 12 mm).

The CV cut-down method in the clavipectoral triangle is the preferred access for transvenous placement of cardiac implantable electronic devices (CIED) due to the lower risk of pneumothorax, haemorrhage, and lead failure. CIED may be implanted within the right or left pectoral region. Topography and morphometric parameters determine if the vein can be used for the surgery. The 2 anatomical variants we described may significantly change the route of inserted leads or make it impossible to reach the heart. [17, 20, 21].

A peripherally inserted central catheter (PICC) might be an alternative procedure for central venous catheter (CVC). It is still under discussion which technique is better from the clinical point of view. For long-term treatment totally implantable venous-access ports (TIVAPs) may be used. They are suitable for chemotherapy or parenteral nutrition. Both, PICC and TIVAP can be inserted through the CV. This is why its anatomy must enable the catheter to reach the superior vena cava [5, 19].

The CV is also used for creating arteriovenous fistulas in patients who require haemodialysis [26]. The fistula is most typically created on the nondominant upper limb. Due to the fact that most people are right-handed, the surgery is usually done on the left upper limb. The course and morphometric parameters of the vein must enable high blood flow. The anatomical variations described in our second case may significantly reduce the blood flow through the CV, forcing surgeons to choose another vessel [3, 11].

Furthermore, a CV running between the clavicle and the subclavius muscle is more prone to damage by a fractured clavicle, and there is also a higher risk of iatrogenic injury during clavicle and glenohumeral joint surgery, resulting in unexpected haemorrhage or haematoma [23].

Our study demonstrates that awareness of anatomical variations, including sporadic cases of CV course and termination, may be significant not only for anatomist but also for clinicians and nurses. Detection of such anomalies before invasive procedures can reduce the risk of serious complications.

ARTICLE INFORMATION AND DECLARATIONS

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Conflict of interest

All authors declare no conflict of interest.

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