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ISSN: 0015-5659

e-ISSN: 1644-3284

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DOI: 10.5603/fm.96440

Article type: Case report

Submitted: 2023-07-11

Accepted: 2023-09-07

Published online: 2023-10-16

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Articles in "Folia Morphologica" are listed in PubMed.

A rare variations of the cephalic vein drainage: two cases report

Jakub Kaczorowski et al., Rare variations of cephalic vein

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ABSTRACT

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 a routine dissections conducted in the Department of Anatomy and Neurobiology, in two formalin-fixed cadavers, the very rare anatomical variants were found. In 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 83 year-old Caucasian male cadaver revealed that after passing through the deltopectoral groove, the left cephalic vein run 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 the anatomists but for the clinicians and nurses as well. Such knowledge can prevent multiple complications during many invasive procedures including implantation of Cardiac Implantable Electronic Devices, central venous access, arteriovenous fistula creation or even iatrogenic injuries during clavicle or glenohumeral joint surgery.

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

INTRODUCTION

Superficial veins, located in the subcutaneous tissue, play 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 lower risk of postoperative complications in comparison to venous punctures via subclavian or axillary veins [10, 12, 15, 17, 21, 25, 26].

Typically, 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, CV anastomoses with basilic vein by an obliquely crossing median cubital vein in the antecubital region. After leaving the antecubital region, 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 clavipectoral triangle, a triangular space bordered by the clavicle (superiorly) and deltoid muscle (laterally) and pectoralis major muscle (medially). There 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 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.

In order to draw attention to existence of very rare anatomical variants of the course and termination of CV, in this paper we present two 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 Medical University in Gdansk, 27 formalin-fixed adult human cadavers (5 female and 22 male) were routinely dissected (Table 1). 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 June 6, 2016 on the implementation of the "Program of Conscious Donation of Corpses"). Gratitude to the donor cadavers and their families is expressed within the Acknowledgement section. These follow the recently proposed recommendations created by twenty editors-in-chief of 17 anatomical journals aimed at standardizing 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 visualizing the vein of interest the measurements of vessels lengths and diameters were made (with digiMax Calliper (Wiha Werkzeuge GmbH, Germany). Each distance was measured three times and then the average was calculated. Following preliminary examination, images from all the dissected specimens were captured with Cannon PowerShot G1 X Mark II digital camera (Cannon Inc., Japan).

RESULTS

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

Examination of 80 year-old Caucasian female cadaver revealed bifurcation of the right external jugular vein into two vessels: medial and lateral branches (Figure 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 left cephalic vein followed the typical course described above. After crossing the clavipectoral triangle it, however, 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 neither right subclavian nor right axillary vein. The measurements of the length of: 1) the right cephalic vein within the clavipectoral triangle and above till 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) lateral branch of external jugular vein from the point of junction with 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 – 9.3 cm. The length of lateral branch of external jugular vein between the points of junction with right CV vein and the right subclavian vein was 1.5 cm. The CV diameter in the midpoint of clavipectoral triangle was 0.9 cm.

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

DISCUSSION

Although the CV belongs to superficial vein system, in which variabilities are commonly observed, the presence and course of CV is relatively stable. For example, the study of Loukas and coworkers [15], performed bilaterally on 50 cadavers, revealed the presence of CV in 95% of cases. Similar observation were 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 CV being accompanied by an accessory cephalic vein [1, 15].

In comparison to other anatomical variants, the supraclavicular course of 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]. 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 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 has been previously reported, we did not find any case describing the opening of CV to one of the branches of bifurcated external jugular vein.

In the second case (83-year old male), the left CV passed between the clavicle and 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 CV within the clavipectoral triangle (9 and 5 mm respectively) did not differ from previously published data. The study of Yeri and coworkers [25] revealed that the average diameter of CV within deltopectoral triangle was 3.7 ± 1.30 mm (with a range of 1.0-7.5 mm), while Loukas and coworkers study [10] reported the average result of 8 ± 1 mm (with a range of 1 to 12 mm).

Cephalic vein cut-down method in clavipectoral triangle is preferred access for transvenous placement of Cardiac Implantable Electronic Devices (CIED) due to the lower risk of pneumothorax, hemorrhage and leads failure. CIED may be implanted

within the right or left pectoral region. Topography and morphometric parameters determine if vein might be used for the surgery. Two anatomical variants we described may significantly change the way of inserted leads or make it impossible to reach the heart. [17, 20, 21].

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].

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

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

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

Conflict of interest: None declared

ACKNOWLEDGMENTS

The authors sincerely thank to 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. The authors also thank

Leszek Amerski, MSc, for providing expertise in anatomical dissection, as well as Sylwia Scislowska, MA, for help in figures preparation.

REFERENCES

1. Bergman RA, Afifi AK, Miyauchi R. Illustrated encyclopedia of human anatomic variation: Opus II: Cardiovascular System: Veins. 2014.
2. Darabi MR, Shams A, Bayat P, et al. A Case Report: Variation of the Cephalic and External Jugular Veins. *Anatomical Sciences Journal*. 2015; 12(4): 203–205.
3. Gavriilidis P, Papalois V. A systematic review of the brachial vein arteriovenous fistulas as a viable option for haemodialysis access. *J Vasc Access*. 2021; 22(6): 947–954, doi: 10.1177/1129729820983178.
4. Go J-Y, Han D-J, Kim J, et al. A supraclavicular cephalic vein drained into the subclavian vein. *Surg Radiol Anat*. 2017; 39(12): 1413–1415, doi: 10.1007/s00276-017-1878-z.
5. Grant JP. Anatomy and physiology of venous system vascular access: implications. *JPEN J Parenter Enteral Nutr*. 2006; 30(1 Suppl): S7-12, doi: 10.1177/01486071060300S1S7.
6. Hong JE, Kim BR, Kim J, et al. A cephalic vein drained into one of the double axillary veins through the pectoralis major muscle. *Folia Morphologica*. 2016; 75(2): 268–270, doi: 10.5603/FM.a2015.0082.
7. Iwanaga J, Singh V, Ohtsuka A, et al. Acknowledging the use of human cadaveric tissues in research papers: Recommendations from anatomical journal editors. *Clin Anat*. 2021; 34(1): 2–4, doi: 10.1002/ca.23671.
8. Jun ESW, Lun ALY, Nikam M. A rare anatomic variant of a single-conduit supraclavicular cephalic arch draining into the external jugular vein presenting with recurrent arteriovenous fistula stenosis in a hemodialysis patient. *J Vasc Surg Cases Innov Tech*. 2017; 3(1): 20–22, doi: 10.1016/j.jvscit.2016.12.001.
9. Kameda S, Tanaka O, Terayama H, et al. Variations of the cephalic vein anterior to the clavicle in humans. *Folia Morphol (Warsz)*. 2018; 77(4): 677–682, doi: 10.5603/FM.a2018.0018.
10. Khan RSA, Simms M. Cephalic Vein for Carotid Patching. *EJVES Extra*. 2005; 9(3): 35–36, doi: 10.1016/j.ejvsextra.2005.01.011.
11. Kordzadeh A, Chung J, Panayiotopoulos YP. Cephalic vein and radial artery diameter in formation of radiocephalic arteriovenous fistula: a systematic review. *J Vasc Access*. 2015; 16(6): 506–511, doi: 10.5301/jva.5000413.
12. Kosnik N, Kowalski T, Lorenz L, et al. Anatomical review of internal jugular vein cannulation. *Folia Morphol (Warsz)*. 2023, doi: 10.5603/FM.a2023.0008.

13. Le Saout J, Vallee B, Person H, et al. [Anatomical basis for the surgical use of the cephalic vein (V. Cephalica). 74 anatomical dissections. 189 surgical dissections]. *J Chir (Paris)*. 1983; 120(2): 131–134.
14. Lee W-J, Choi HK, Cho SS, et al. Two different variants of the jugulocephalic vein with supraclavicular course. *Folia Morphol (Warsz)*. 2020; 79(2): 407–410, doi: 10.5603/FM.a2019.0078.
15. Loukas M, Myers CS, Wartmann CT, et al. The clinical anatomy of the cephalic vein in the deltopectoral triangle. *Folia Morphol (Warsz)*. 2008; 67(1): 72–77.
16. Lum C, Ladenheim ED. An interesting clinical case: variant of the cephalic vein emptying into the internal jugular vein. *Semin Dial*. 2013; 26(2): E11-12, doi: 10.1111/j.1525-139X.2012.01102.x.
17. Parsonnet V, Roelke M. The cephalic vein cutdown versus subclavian puncture for pacemaker/ICD lead implantation. *Pacing Clin Electrophysiol*. 1999; 22(5): 695–697, doi: 10.1111/j.1540-8159.1999.tb00531.x.
18. Saaid A, Drysdale I. Unusual termination of the cephalic vein. *Clin Anat*. 2008; 21(8): 786–787, doi: 10.1002/ca.20661.
19. Santos FKY, Flumignan RLG, Areias LL, et al. Peripherally inserted central catheter versus central venous catheter for intravenous access. *Medicine (Baltimore)*. 2020; 99(30): e20352, doi: 10.1097/MD.00000000000020352.
20. Świętoń E, Steckiewicz R, Stolarz PW, et al. Supraclavicular course of the cephalic vein - implications for cardiac electronic device implantation. *Folia Cardiologica*. 2015; 10(3), doi: 10.5603/FC.2015.0034.
21. Świętoń EB, Steckiewicz R, Grabowski M, et al. Selected clinical challenges of a supraclavicular cephalic vein in cardiac implantable electronic device implantation. *Folia Morphol (Warsz)*. 2016; 75(3): 376–381, doi: 10.5603/FM.a2015.0125.
22. Testut L, Latarjet A. *Traité d'Anatomie Humaine*. 8th ed. Gaston Doin & Cie Editeurs 1929.
23. Vannabouathong C, Chiu J, Patel R, et al. An evaluation of treatment options for medial, midshaft, and distal clavicle fractures: a systematic review and meta-analysis. *JSES Int*. 2020; 4(2): 256–271, doi: 10.1016/j.jseint.2020.01.010.
24. Wysiadecki G, Polgaj M, Topol M. Persistent jugulocephalic vein: case report including commentaries on distribution of valves, blood flow direction and embryology. *Folia Morphol (Warsz)*. 2016; 75(2): 271–274, doi: 10.5603/FM.a2015.0084.
25. Yeri LA, Eduardo H, Palmieri B, et al. Cephalic Vein: Detail of its Anatomy in the Deltopectoral Triangle. *International Journal of Morphology*. 2009; 27, doi: 10.4067/S0717-95022009000400013.
26. Ziętek ZM. Unusual variability of the superficial venous system of the upper limb and its consequences for deep venous system. *Folia Morphol (Warsz)*. 2022; 81(1): 254–257, doi: 10.5603/FM.a2020.0147.

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

Figure 1. Schematic drawings and photographs of rare cases of drainage of CV in to the lateral branch of external jugular vein (**A, B**) and CV passing between clavicle (medial 2/3 of clavicle removed) and subclavius muscle (**C, D**). Abbreviations: 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.

