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Two different variants of the jugulocephalic vein with supraclavicular course

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Abstract

The jugulocephalic anastomosis is a rare anatomical variant which normally undergoes atrophy during embryonic development. We found 2 cases of the jugulocephalic vein variant with supraclavicular course in Korean male cadavers. In a 50-year-old cadaver, the right cephalic vein ascended anterior to the clavicle, and terminated into the external jugular vein as well as to the axillary vein through a classic branch. In a 76-year-old cadaver, the left cephalic vein ascended supraclavicular course without any branch to the axillary vein, and terminated to the external jugular vein. We discussed the embryological explanation as well as its frequency since this jugulocephalic vein variant could cause unpredicted danger during clinical procedures.

Key words: jugulocephalic anastomosis, supraclavicular course, cephalic vein, external jugular vein

Introduction

The cephalic vein (CV) passes between the deltoid and pectoralis major muscles (deltopectoral groove) and through the deltopectoral triangle, where it empties into the axillary vein and continues to the subclavian vein under the clavicle. CV has recently been used in invasive clinical procedures such as cardiovascular implantable electronic device implantation [5, 7, 12, 15, 28] and catheterization [17], since it is remarkably constant superficial structure in the upper arm and axilla [34], has large size enough to facilitate easy cannulation [3, 16, 17], and known to have lower risk of injury to neighboring structures than axillary vein puncture [29].

However, various anatomical variations of the CV have been reported [34]: absent or agenesis and draining into the basilic, subclavian, external or internal jugular veins. A much rare anastomosis is named “jugulocephalic anastomosis”. It, named jugulocephalic vein, courses over the clavicle connecting the CV previous its draining into the axillary vein and the external jugular vein. The prevalence of persistent jugulocephalic vein was estimated approximately 2 – 5 % in a recent review [13]. It should not be underestimated considering that CV and external jugular vein are frequently used in invasive clinical procedures. In this report, we described a persistent supraclavicular jugulocephalic vein variant and discussed the embryology as well as its frequency of the variant based on the literatures published.

Case report

During the routine educational dissection, we found 2 cases of the supraclavicular jugulocephalic vein variants.

Case 1. We found an anatomical variant of the right CV in a 50-year-old Korean male cadaver, whose cause of death was ‘hepatocellular carcinoma’. The right CV was identified in the deltopectoral groove and ascended anterior to the clavicle (supraclavicular course) with the classic CV branch to axillary vein. To identify the accurate drainage of CV we reflected the pectoralis major muscle and clavicle. This supraclavicular course of CV which we call persistent jugulocephalic vein was very distinct and terminated to the external jugular vein between transverse cervical vein and suprascapular vein (Fig. 1A). The external jugular vein

was terminated at the junction between the subclavian and internal jugular vein.

Case 2. We found another variant of the left CV in a 76-year-old Korean male cadaver, whose cause of death was ‘multiorgan failure’. The left CV was identified in the deltopectoral groove and ascended supraclavicular course without any branch to the axillary vein. To identify the accurate drainage of CV we reflected the platysma muscle. The supraclavicular CV was terminated to the external jugular vein (Fig. 1B).

Discussion

A recent paper [13] clearly showed the frequency of variations of the CV with a supraclavicular course as approximately 2.2 % (range 0.3 % - 13.0 %), which could be further divided into 1.1 % (27/2,373 cases; range 0.3 – 4.3 %) in indirect clinical [28, 29, 32] and 4.45 % (49/1,101 cases; range 1.9 -13.0 %) in direct anatomic and surgical [6, 10, 13, 16, 17, 20, 24] evidences. Direct results could be more reliable since clinical reports did not check bilateral CV thoroughly.

Kameda et al. [13] also classifies variations of the CV with a supraclavicular course into four subtypes - 1A, 1B, 2A, and 2B: “1” meaning a course beyond the clavicle and anastomoses with the external jugular vein, “2” with same course but termination to subclavian vein, “A” meaning absence of classic branch to axillary vein, and “B” with classic branch of cephalic vein to axillary vein to infraclavicular course. Based on the classification, Kameda et al. [13] suggested each frequency of subtypes as 0.4, 1.2, 0.4, and 0.2 %, respectively. They suggested single case report related with the variations [1, 5, 14, 15, 21, 23, 25, 33, 35] and we found some more case reports related with this variation: 3 for subtype 1A [2, 8, 12], 3 for subtype 1B [19, 27], and 1 for subtype 2A [9]. The case 1 and 2 belong to subtype 1B and 1A, respectively. As a result, the proportion of the subtypes could be 22.3, 52.1, 19.2, and 6.4 %, respectively.

Type 1 variation of the CV with a supraclavicular course means the well-known embryological variant, the jugulocephalic vein. Historically, Galen of Pergamon claimed that the CV arose from the external jugular vein and encircling the clavicle ran towards the periphery [4]. CV primarily empties into the venous plexus located within the neck. At approximately 22 mm stage of embryonic development, the external jugular vein emerges

from the plexus, receives the CV as a tributary, and initially empties into the internal jugular vein [18, 26]. A small cranial tributary of the primitive cephalic vein in the arm at stage 18-26mm has grown larger in the differentiating tissues of the neck, joins the jugulocephalic vein craniodorsal to the cartilaginous clavicle, which is now surrounded by a venous ring. Thus, the CV acquires a new connection with the axillary vein only at a further stage of ontogeny, while usually the part of the CV running over the clavicle gradually atrophies [22, 23, 31]. If it fails to lose connection with the external jugular vein, then it is called persistent jugulocephalic vein including this case. The persistent jugulocephalic vein usually develops from the embryological developmental failure at the anterior segment. But, there have been a few reports that the CV runs deep to the clavicle and empties into the external jugular vein [3, 11], which could also be explained by embryological basis by developmental failure at the posterior segment. Surprisingly, in many primates except human, the long lateral vein (equivalent to the human cephalic vein) communicated with the external jugular vein, via a vein which ran anterior to the clavicle [30].

Practically, the supraclavicular jugulocephalic vein is often damaged by clavicle fractures, which generally results in a large hematoma [1]. Invasive procedures using the CV including catheterization for pacemaker implantation or cardiovascular defibrillator [5, 7, 12, 15, 17, 28] may be complicated if jugulocephalic vein is present. Accordingly, the presence of the venous valves in a persistent jugulocephalic vein was determined to specify the blood flow direction, which showed the bicuspid valves enabled the blood flow from the CV to the external jugular vein [35]. Further morphological researches would be needed to clarify the nature of the jugulocephalic vein variants, although herein we did not show the morphometric results because superficial veins of the upper limb show a concomitant caliber with the muscular mass and are provided with valves, in smaller number than deep veins, throughout their draining level [34].

Taken together, we showed 2 cases of supraclavicular jugulocephalic vein variants, type 1B and type 1A, respectively. Considering the embryological basis and not-so-rare frequency of the persistent jugulocephalic anastomosis, practitioners should be aware of the possibility of the jugulocephalic vein variant not to encounter unpredicted situations in various clinical procedures.

Conflict of interest: None declared

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FIGURE LEGEND

Figure 1. Photographs of the jugulocephalic vein variants.

- A. The right cephalic vein (3) ran through the deltopectoral groove, ascended anterior to the clavicle (2) with a classic branch (arrow) which continuous into the subclavian vein (4), and then drained into the external jugular vein (1).
- B. After reflecting the platysma muscle, the left cephalic vein (3) ran through the deltopectoral groove, ascended supraclavicular course (2), and anastomosed with the external jugular vein (1) beyond the clavicle.

