ANATOMICAL VARIATION OF THE ANTERIOR JUGULAR VEINS – CASE REPORT

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(Abstract): The venous drainage of the head and neck is carried out by three, symmetrical pairs of jugular veins. Although the most important collecting vessel of these regions are the deeply situated internal jugular veins (iJV), the two superficial veins - the external jugular vein (EJV) and the anterior jugular vein (AJV) – present a significant clinical role due to the high variability of their origin, course, and communications.

Material and method: During the routine dissection of a middle-aged male, formalin fixed human body preserved at the Department of Anatomy – “George Emil Palade” University of Medicine, Pharmacy, Science and Technology of Targu Mures, we found a superficial cervical venous network that was different from the classical description.

Results: The two AJVs joined in the midline at the upper edge of the thyroid cartilage, forming the median vein (MV) of the neck, which runs downward in the midline of the neck, and finally draining into the two subclavian veins via two trunks. On the left side we identified a venous trunk connecting the MV with the linguofacial venous trunk and the middle thyroid vein.

Conclusion: Identifying the venous variations of superficial jugular veins is important for everyday clinical practice, especially during surgical and intensive care procedures involving the anterior region of the neck to avoid bleeding complications. Key-words: VENOUS VARIATIONS, ANTERIOR NECK REGION

INTRODUCTION

Anatomical variations of the venous system are relatively common in the human body and the venous drainage of the head and neck isn’t an exception.

According to the classical anatomical description, the venous drainage of the neck is carried out by two systems: the superficial and the deep veins of the neck, which are not entirely separated by the deep cervical fascia. The superficial veins are the external jugular veins (EJVs), the anterior jugular vein (AJV) and the three thyroid veins (ThV). The deep venous drainage is represented by the internal jugular veins (IJV).

Usually, two AJVs are formed from small tributaries in the submandibular and submental triangles of the neck, draining the blood from the skin and from the superficial tissues of these regions. The AVJs are running downwards as two parallel veins on the anterior margin of the sternocleidomastoid muscles (SCMs). In most cases, the two AJVs are communicating with each other in the suprasternal region via a transverse venous trunk, the jugular anterior arch (JAA) which is an anastomotic arch in the space of Burns’ between the superficial and the deep layers of the superficial fascia of the neck, draining either into the EJVs or into the subclavian veins (SVs) (1-4).

MATERIAL AND METHODS

During the routine dissection of the neck of a middle aged, male, formalin fixed human
cadaver at the Anatomy Department – “George Emil Palade” University of Medicine, Pharmacy, Science and Technology of Targu Mures, we detected an anatomical variation of the superficial veins. No signs of previous surgical interventions or pathologic conditions involving the anterior cervical regions were found.

**RESULTS**

The two AJVs are formed in the submandibular and submental triangles as two separate veins, and after a short convergent segment they join at the level of the thyroid cartilage forming the median vein of the neck (MV). The 115 mm long, and 12 mm wide MV is running downwards on the midline of the neck in front of the larynx, the thyroid gland, and the trachea without collateral connections to other veins. Unfortunately, the suprasternal part of the vessel was damaged, and we could not explore this segment during the dissection, but each SV presented a venous stump, so we assumed that the MV bifurcates and drains into the two SVs (Fig. 1, 2).

Moreover, on the left side there is an anastomotic vein, a communicating branch between the left linguofacial venous trunk, the middle ThV and the MV (Fig. 3).

**DISCUSSION**

Regarding the venous system of the neck, numerous deviations from the classical description have been reported in the literature involving either the formation, course, communication, and terminations of the veins. Comparing the superficial veins, the EJVs show the most diverse variations, the AJVs have a more standard pattern.
Even though it was published almost 80 years ago, one of the most detailed publications of the anatomical variations of the necks' superficial veins remains the study carried out by Ellen Pikkieff: she dissected the anterior cervical region of 96 human cadavers. According to her findings, the two AJVs followed the standard pattern in only 39 cases, but with differences in size. In 13 subjects one of the AJV and in 3 cases both AJVs were missing. The MV was identified in only 6 cases out of 96 subjects. The formation, course, and drainage of these 6 MVs was not uniform: the majority (5 subjects) originated in the submental region, meanwhile 1 MV was the branch of the right anterior facial vein. In 2 cases MVs were localized along the midline of the neck, without any collateral branches, and after a downward course divided into two trunks of similar size as the original veins, and finally joined the JAA. The terminations of the MVs were also different: in 3 cases these veins entered the left SV after passing behind the SCM, in 1 case drained into the right SV joining the right EJV near its termination, and in 2 cases the MV was divided into two large venous trunks forming the JAA (5). Our finding is similar with the MV pattern described by Pikkieff: the MV is formed and is situated in the midline of the neck, presents an anastomotic branch with the deep venous system, and finally divides into two trunks which drain into the ipsilateral SVs.

Smaller studies, case presentations reported the presence of the MV identified either during routine anatomy dissections, either using different minimal invasive surgical techniques (percutaneus tracheostomy) (4-6). Furthermore, the MV can be involved in more complex variations: in a case presentation by Premavathy et al the two AJVs joined at the level of the 3rd tracheal ring to form a midline vein that later showed a right deviated course, joined the right EJV and finally drained into the right jugulo-subclavian junction (7).

According to the classical anatomical description, the AJVs communicate via small anastomotic branches with the EJV or the internal jugular venous system. Instead of these thin veins, some studies reported more evident venous connecting trunks: a dissection study carried out by Deslaugers on 50 cadavers found large vessels connecting the ipsilateral AJV and EJV in 13 cases, while a similar study realized by Olabu et al on 53 cadavers described this connection only in 1 case (8-10). Maskey et al reported the presence of a venous trunk between the right internal jugular vein and AJV, this anastomosis representing the drainage for the facial vein and the lingual vein (11).

There are relatively few studies about the
connections of the MV, only Pikkieff reported 2 cases out of 6, where the MVs located in the midline anastomosed with other veins (right anterior FV, right superior thyroid vein) (5). In our case the MV also has a connecting trunk with the internal jugular venous system.

Being familiar with the superficial venous network is important not only to anatomists. Mapping the superficial jugular system became more and more important for everyday medical practice, especially during surgical interventions in the anterior neck regions and/or intensive care, as different procedures (tracheostomy, catheter insertion) are frequently performed here. Percutaneous dilatational tracheostomy (PCT) has overtaken classical surgical tracheostomy in the management of the intensive care patient. In a meta-analysis of death directly caused by PCT insertion, hemorrhage was the most common cause of death and the puncture of aberrant superficial veins (the presence of MV, communicating veins between the two AJVs) has been listed as one of the risk factors (12). Hatfield et al. evaluated 30 patients before PCT by ultrasound, in 8 of the patients the AJVs were considered vulnerable because of their location (midline or near midline veins) or their size (diameter greater than 4 mm) (13). In a case report, Sooby et al. describe a large MV identified during the procedure, which is a similar anatomical variation of the superficial veins of the neck to ours (6). Both authors emphasize the utility of an ultrasound scan prior to PCT in order to identify anatomic variations of the superficial veins, which could cause complications during the procedure.

The AJVs and their variants are not only superficial vessels that should be avoided during different interventions, but they have other clinical importance too. In case of unilateral...
brachiocephalic vein occlusion, AJVs can develop a collateral circulation between the deep jugular system and the SVs, so AJV can serve as an alternative site for central venous catheter insertion, as reported in a case presentation by Schummer. In other instances, the AJVs or the JAA can be responsible for catheter malposition, so identifying any aberrant vessels can be crucial in the intensive care (14).

In a recent study by García-López and Rodríguez-Villegas, reflectance photoplethysmography (PPG) was used to measure the jugular venous pulse to detect right atrial and central venous pressure instead of the invasive catheterization method. It is a novel non-invasive method for measuring these parameters and to identify different cardio-vascular abnormalities. Their study involved 20 healthy participants; the PPG sensor was placed at the middle inferior region of the neck, an area usually containing the AJVs and the JAA. The jugular venous pulse obtained from the AJVs were compared with other clinical measurements, and positive results were obtained: the PPG method is suitable for acquisition of optimal jugular vein pulse from the AJVs without restricting patients to uncomfortable postures or invasive methods (15).

CONCLUSION Different anatomical variations of the superficial veins of the anterior region of the neck are quite common and display a great variability. Identifying these aberrant vessels can be crucial in avoiding certain complications during surgical and intensive care procedures.

REFERENCES

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