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Correlations between anomalies of jugular veins and areas of vascular drainage of head and neck

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Abstract

The study conducted on 60 human cadavers preserved in formalin, in the Anatomy Laboratory of the "Victor Babes" University of Medicine and Pharmacy Timisoara, during 2000–2006, observed the internal and external jugular veins from the point of view of their origin, course and affluents. The morphological variability of the jugular veins (external jugular that receives as affluents the facial and lingual veins and drains into the internal jugular, draining the latter's territory – 3.33%; internal jugular that receives the lingual, upper thyroid and facial veins, independent – 13.33%, via the linguofacial trunk – 50%, and via thyrolinguofacial trunk – 33.33%) made possible the correlation of these anomalies with disorders in the ontogenetic development of the veins of the neck. Knowing the variants of origin, course and drainage area of jugular veins is important not only for the anatomist but also for the surgeon operating at this level.

***Keywords*:** internal jugular vein, external jugular vein, drainage areas.

Introduction

Literature contains several descriptions of variations in the venous drainage of the neck [1–4].

The external jugular drains the superficial areas of the head, the deep areas of the face and the superficial layers of the posterior and lateral parts of the neck. It arises when the posterior division of the retromandibular vein joins the posterior auricular vein. The internal jugular drains the venous blood from the brain, the orbital region and the superficial areas of the face and neck. It arises at the base of the cranium, in the posterior part of the jugular fossa, descends to the neck within the carotid sheath reaching the back of the medial extremity of the clavicle. Behind the sternoclavicular joint it unites with the subclavian vein to form the brachiocephalic vein.

The superficial veins of the head and of the neck arise from the superficial capillary plexus which, eventually, will form the primary vein of the head. By the enlargement of individual capillaries, the confluence of adjacent veins and the regression of some of the veins in the area where the blood flow was deviated, wide canals are formed.

The factors that control the selection and differentiation of the corresponding canals are still largely unknown [5] with the development of the cranium, the first vessel that can be identified is the ventral pharyngeal vein, which drains most of the mandibular bone and the hyoid arch in the common cardinal vein.

Progressively, as the neck lengthens, its drainage level shifts towards the cranial part of the precardinal vein which later develops into the internal jugular vein.

The ventral pharyngeal vein that receives the tributaries of the face and tongue becomes the linguofacial vein. With the development of the face, the primitive maxillary vein expands its drainage territories to those innervated by the ophtalmic and mandibular branches of the trigeminal nerve, and it anastomoses with the linguofacial vein at the level of the inferior maxillary.

This anastomosis becomes the facial vein which will receive the retromandibular vein from the temporal region and drains into the internal jugular vein through the linguofacial vein.

The origin of the linguofacial vein now represents the inferior part of the facial vein, while the connection between the facial vein and the primitive maxillary vein becomes the deep facial vein.

The external jugular vein develops from a tributary of the cephalic vein and forms a secondary anastomosis with the anterior facial vein. At this stage, the cephalic vein forms a venous loop around the clavicle by which it communicates with the caudal part of the precardinal vein.

The deep segment of the venous loop forms the subclavian vein and receives the final external jugular.

Material and methods

The study of the course and affluents of the external and internal jugular veins was carried out on 60 human cadavers, preserved in formalin in the practical training rooms of the Anatomy Laboratory of the "Victor Babeş" University of Medicine and Pharmacy Timişoara. According to their gender, 20 cadavers were male and 40 were female.

Research was conducted using macroscopic dissection and the charts were compared to the data in literature; similar charts were grouped together in order to be centralized.

Results

The study observed the internal and external jugular veins and their affluents.

The external jugular vein

In 58 of the cases that were studied, the external jugular is formed in the parotid gland mass by the confluence of the posterior auricular vein with the posterior branch of the retromandibular vein (Figure 1).

In two of the cases, the external jugular vein had an interesting course, the facial vein and the lingual vein uniting in a linguofacial trunk and participating in forming the external jugular vein which drains into the internal jugular vein above the upper belly of the omohyoid muscle (Figure 2).

This is an anomaly we have not found anywhere in literature. There is one case described in literature where the facial vein ends as the external jugular vein. The external jugular develops in the 22 mm embryo and anastomoses with the anterior facial vein. During its subsequent development, the jugular vein forms an anterior connection with the facial vein and a posterior connection with the retromandibular vein the anterior connection being the one that disappears later in its development [5–8].

The anomaly we found could represent the persistence of a communication between the primitive linguofacial vein and the developing external jugular vein.

The internal jugular vein

Literature describes anomalies connected to the lingual vein, to the superior thyroid vein, and especially to the facial vein, namely the facial vein that joins the retromandibular vein in the right parotid gland mass [1], the right facial vein that drains in the superficial temporal vein 5 mm above the retromandibular vein, in this case undivided [2], and the anterior facial vein which, instead of forming the common facial vein, is oriented laterally obliquely, deep to the sternocleidomastoid muscle, but superficial to the carotid vessels, crosses the origin of the facial artery and ends in the external jugular vein.

The study of the way in which the lingual, superior thyroid and facial veins drain into the internal jugular, has led to the following results:

- the lingual vein unites with the facial vein forming a linguofacial trunk that drains into the external jugular vein, which will subsequently drain into the internal jugular (two cases);
- the internal jugular vein receives as affluents the lingual and facial veins via a linguofacial venous trunk and independent from the superior thyroid vein (30 cases, Figure 3);
- the internal jugular vein receives as affluents the lingual, facial and superior thyroid veins via a thyrolinguofacial trunk (20 cases);
- the lingual, facial and superior thyroid veins drain independent from the internal jugular vein (eight cases).

Discussions

Although it is commonly accepted that there is a high variability of the superficial venous system of the neck [9], and there are also variabilities of the deep venous system, we continue to believe that in emergency medical practice the vascular access level in discussion remains a main option.

In children [10], especially, establishing a long-term central venous access is a prerequisite during medullar transplant. Most often, long-term central venous access was obtained by blind percutaneous cannulation of the subclavian or internal jugular veins.

Dissection in anatomy labs has proven not only to students that there is a high variability degree of the jugular venous system, but our intent is to expose the matter for those who believe that advanced medical technological progress can waive this site of blood vessel access.

At least in certain few cases the usefulness of the jugular venous approach stays valid, but cautiousness in practical maneuvers is necessary.

We believe that the anomaly discovered and presented by us deserves the attention of researchers.

Conclusions

Knowing all the morphological variants of the course of head and neck veins is of an utmost importance both for the surgeon operating at this level, for the radiologist performing a catheterization, and for the clinician in general.

The external jugular vein is a peripheral vein that does neither generally collapse (the patient being in Trendelenburg's position), nor does it become thrombosed. It may represent the extreme solution when the patient requires a peripheral venous access and the other veins are useless. It can also be used for administering non-sclerosing agents.

In order to avoid any minor or major complications in dealing with these veins, a safe central venous access is preferred, by sectioning the external jugular, a method that can be used both during medullar transplant and in parenteral nutrition and chemotherapy treatment.

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Figure 1 – ***Dissection image; the external jugular vein formed in the parotid gland mass by the confluence of the posterior auricular vein with the posterior branch of the retromandibular vein***

Figure 2 – ***Dissection image; the external jugular vein formed by the facial vein and the lingual vein uniting in a linguofacial trunk and drains into the internal jugular vein above the upper belly of the omohyoid muscle***

Figure 3 – ***Dissection image; the internal jugular vein receives the lingual and facial veins via a linguofacial venous trunk as affluents and independently the superior thyroid vein***

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