

MULTIPLE VARIATIONS OF THE SUPERFICIAL JUGULAR VEINS: CASE REPORT AND CLINICAL RELEVANCE

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Summary: The jugular venous system constitutes the primary venous drainage of the head and neck. It includes a profundus or subfascial venous system, formed by the two internal jugular veins, and a superficial or subcutaneous one, formed by the two anterior and two external jugular veins. We report one case of unilateral anatomical variations of the external and anterior jugular veins. Particularly, on the right side, three external jugular veins co-existed with two anterior jugular veins. Such a combination of venous anomalies is extremely rare. The awareness of the variability of these veins is essential to anesthesiologists and radiologists, since the external jugular vein constitutes a common route for catheterization. Their knowledge is also important to surgeons performing head and neck surgery.

Keywords: *External jugular vein; Anterior jugular vein; Multiple veins*

Introduction

The veins of the neck are expanded as two separate venous systems, the superficial or subcutaneous comprised the anterior and external jugular veins draining mostly the subcutaneous tissues and the deep veins comprised the internal jugular veins draining mainly the brain and other structures of face and neck (27). The internal as well as the external jugular veins represent two of the most common routes for the insertion of central venous catheters via percutaneous approach (6, 22). Also, correct placement of central venous catheters may be possible via the anterior jugular venous system (22).

The majority of venous catheters are percutaneously inserted using anatomical landmarks (24). Even simple anatomical variations may cause venous catheterization to be difficult or impossible (15). Anatomical landmarks that are vague or hard to recognize, anatomical variations and inexperience of the operator are among the factors causing complications (4). Apparently, the usage of ultrasound-guided catheterization provides great assistance in cases of superficial jugular veins' variations (13).

Thus, it is important for the anesthesiologist and the radiologist to be familiar with the anatomical variations of these veins. Also, their knowledge is essential to the surgeon performing head and neck surgery, in order to avoid injury of external or anterior jugular vein and subsequent hematoma formation. The objective of this study is to report a case of multiple variations of the superficial jugular system.

Case report

In a male embalmed cadaver aged 63 years old that has been used for educational and research purposes in the Department of Anatomy at the Faculty of Medicine of the Aristotle University of Thessaloniki and after careful preparation of the anterior and lateral cervical region and dissection of the sternocleidomastoid muscle, we came across multiple unilateral variations of the external and anterior jugular vein. Specifically, on the right side three external jugular veins were detected displaying parallel course to its other. The lateral and the medial one presented normal size, whereas the intermediate one was quite smaller. They all drained into the right subclavian vein (Fig. 1). Moreover, on the right side we noticed two anterior jugular veins running in a parallel course and almost of equal size. They both drained with a common trunk into the right brachiocephalic vein (Fig. 2). The cause of specimen's death was unrelated to the present study. No other abnormalities and no history of previous pathologic conditions or surgical procedures were detected in the neck region. In addition, the venous variants were recorded by photographs.

Discussion

The superficial veins of the neck are the external and the anterior jugular veins, whereas the deep vein of the neck is the internal jugular vein (20). The superficial veins of the neck are located deep to the platysma muscle, whilst



Fig. 1: On the right side of the neck three external jugular veins are exposed, displaying parallel course to its other. The lateral (LEJV) and the medial external jugular vein (MEJV) had normal size, whilst the intermediate (IEJV) one was smaller. (LAJV: lateral anterior jugular vein, IJV: internal jugular vein, S: superior, I: inferior, L: lateral, M: medial).



Fig. 2: Two anterior jugular veins of nearly the same size are observed on the right side of the anterior cervical triangle. (LAJV: lateral anterior jugular vein, MAJV: medial anterior jugular vein, LEJV: lateral external jugular vein, IEJV: intermediate external jugular vein, MEJV: medial external jugular vein, IJV: internal jugular vein, S: superior, I: inferior, L: lateral, M: medial).

the internal jugular vein is located within the carotid sheath underneath the deep cervical fascia (14).

The external jugular vein is formed in the lateral cervical region usually from the junction of the retromandibular and the posterior auricular veins, retrospectively to the mandibular angle. It crosses obliquely following an imaginary line that connects the mandibular angle with the midpoint of the clavicle, superficial to the sternocleidomastoid muscle, with which it crosses, and below the platysma muscle until the major supraclavicular fossa where it perforates the deep cervical fascia terminating into the subclavian vein (27, 25). In rare cases the external jugular vein may pass between the sternocleidomastoid muscle head before it drains (27, 11). In 10% the external jugular vein is covered by the platysma muscle throughout its extension, in 40% it borders the

posterosuperior muscle fibers and in 50% it lies posterior to the platysma muscle at an average distance of 1 cm (1). Ultimately, the external jugular vein drains into the subclavian vein (36%), the jugulo-subclavian confluence (60%) or directly into the internal jugular vein (4%) (10). In accordance to Brown the external jugular vein drains into the subclavian vein (56.4%), the jugulo-subclavian confluence (4.5%), the internal jugular vein (30.8%) or both internal jugular and subclavian vein (6.2%) (7).

The anterior jugular vein is formed in the hyoid region by the confluence of the superficial submandibular veins and extends vertically downwards, left and right of the midline of the anterior cervical triangle, along the anterior border of the sternocleidomastoid muscle. Nearby the jugular notch of the sternum it passes between the sternocleidomastoid mus-

cle and the infrahyoid muscles. In size it is usually inverse to the external jugular vein (27, 25). Finally it drains into the subclavian (54%) or into the external jugular vein (46%) (10). The two anterior jugular veins above the jugular notch of the sternum communicate each other by a transverse vein named jugular arch (27).

There is considerable variation in the venous anatomy of the neck between the right and left side, as well as between individuals (26). Some of them are more common and are mentioned in textbooks of Anatomy. Regarding the external jugular vein variations, sometimes there is a vein which is called posterior external jugular vein or vein of Koch that begins from the occipital region or from the facial vein and extends obliquely along the anterior border of the sternocleidomastoid muscle and drains into the middle of the external jugular or the internal jugular or the brachiocephalic vein or the jugular arch. This vein drains the skin and the superficial muscles located posterosuperiorly in the neck (27, 14). Sometimes, the vein of Koch may attain great size, greater than that of internal jugular vein and could be mistaken for it (2). Regarding the anterior jugular vein variations, it is possible instead of the two anterior jugular veins to be only a single one, localized in the midline of the anterior cervical region called median cervical vein (27, 22, 25). Also it is likely that the upper main part of these veins could be replaced by a grid of venules that drain into the jugular arch (25).

However, there are anatomical variations that are very rare. Gupta et al. reported the case of an external jugular vein that split into two channels on the external surface of sternocleidomastoid muscle and reunited just above its junction with the facial vein (13). Brown (7) as well as Pikkieff (19) observed similar cases as the aforementioned case in 6.2%. Two similar cases of partial external jugular vein duplication have been described one by Comert et al. (8) and one by Shenoy et al. (23). Pikkieff described a double external jugular vein as two independent veins emerging from the parotid gland in 7.8%. Double termination of the external jugular vein in the subclavian vein was detected in 2.2%, whereas triple termination in 0.6% (7). The external jugular vein was absent in 3.3% (7) or in 1% (19). Nayak reported multiple variations of the left jugular veins. The facial vein continued down as anterior jugular vein which was of the same size as the internal jugular vein and drained into the subclavian vein deep to the sternocleidomastoid muscle. In addition the anterior jugular vein had a large communicating branch with the anterior division of the internal jugular vein (18).

Fabian et al. reported an anomaly of the jugular veins system bilaterally, with the right anterior jugular vein draining into the confluence of internal jugular and subclavian vein and with the left anterior jugular vein draining into the terminal portion of the internal jugular vein. The right external and anterior jugular veins were considerably small with the external jugular vein being smaller than the anterior (12). Maskey et al. described the formation of a common

venous channel between internal jugular and anterior jugular vein where the facial, the lingual and the submental vein drained (17).

Our case of a triple external jugular vein documented as three independent veins with almost parallel course combined with the presence of a double anterior jugular which drained via a common trunk into the ipsilateral brachiocephalic vein, constitutes a case which to the best of our knowledge has not been detected in the literature.

When performing any invasive procedure it is important to realize that a sound anatomical knowledge of the specific region associated with that procedure is of the utmost importance. Complications that occur during such a procedure is often due to lack of understanding or misunderstanding of the anatomy required to perform the procedure (3). The knowledge of the anatomic variations of the external and anterior jugular veins is important for the surgeons of the head and neck executing surgical procedures, such as thyroid surgery and tracheostomy and the surgeon performing reconstructive surgery such as reconstruction of the internal jugular vein (16) and usage of vein graft during carotid endarterectomy (21), so that during surgical procedures in the region injury of the superficial jugular veins could be avoided. Also their awareness is essential to anesthesiologists and radiologists for the insertion of central venous catheters. The external jugular vein is one of the most commonly used veins for catheterization, because serious complications induced by the use of deep veins can be avoided (22, 9). The anterior jugular vein, especially in cases of enlargement, represents an alternative route. However, when central venous catheter is malpositioned in the anterior jugular vein, various implications may be caused such as vascular stenosis, perforation or endothelial injury (22). The anterior jugular veins of our case are relatively small to allow easy venous catheterization, whereas the three external jugular veins and especially the lateral and medial one are of desirable size for venous catheter access. Therefore, an important part of competency is an updated knowledge base, which is necessary to execute a successful procedure with safety. Recognition of the relevant anatomy to any specific procedure remains the important basis of this knowledge (5).

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