

Morphological variations in Common Facial Vein with variant venous drainage

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Abstract

Background: In depth anatomical knowledge of the facial vasculature is crucial not only for anatomists but also for Oto-rhino-laryngologists, reconstructive and oral and maxillofacial surgeons. The common facial vein (CFV) is a vital component of the facial venous system, which exhibits morphological variations that impact surgical and diagnostic procedures. The present study investigates the CFVs anatomical diversity, focusing on the divergent venous drainage patterns. **Aim:** To describe rare anatomical variations of the common facial vein. **Material and Methods:** The study was conducted in the Department of Anatomy, of a tertiary care establishment (Medical College) in Western Maharashtra, during the period 2023-24. Head and neck region of 20 cadavers (11 males and 9 females) i.e. 40 sides of embalmed cadavers of different age group were carefully dissected, and studied for variations in the formation and drainage pattern of Common facial vein. **Results:** In 34 sides (85%), the common facial vein (CFV) terminated into the Internal jugular vein (IJV) as per standard anatomic description. On one side of the cadaver, the left common facial vein (2.5%) was found draining into the anterior jugular vein (AJV) as well as into the internal jugular vein (IJV). In three cadavers (7.5%), the CFV was found to be draining into the AJV. In two cadavers (5%), the facial vein (FV) was not receiving the anterior division of retromandibular vein and was directly draining into the IJV. **Conclusion:** A sound knowledge of variation in the course and termination of common facial vein is very useful for the clinicians and surgeons who perform procedures like cannulation and vein graft harvesting for endarterectomies of the head and neck region.

Keywords: Anatomical Variation; Common Facial Vein; External Jugular Vein; Internal Jugular Vein

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Introduction

Literature search as well as cadaveric dissection throws up multiple variation of the structures in the human body. This is more so relevant vis a vis the veins of the head and neck region. Commonly, the anterior facial vein starts from the confluence of the supratrochlear and the supra-orbital veins in the middle third of the face. The superficial temporal vein unites with the maxillary vein to form the retromandibular vein (RMV), which then divides into anterior and posterior divisions within the substance of the parotid gland. Normally the anterior division joins with the anterior facial vein giving rise to the common facial vein, which drains into the internal jugular vein. The posterior division, on the other hand, joins with the posterior auricular vein, and continues as the external jugular vein which finally drains into the subclavian vein[1]. Variations of the drainage pattern of the veins of head and neck have been reported earlier as well. Exploring the formation of RMV by dissection is an area not that well documented. Keeping all these variations in mind and also the importance of knowledge of these variations during head and neck surgery there was a felt need to further document these by undertaking this study. Also cannulation of the superficial veins of the head and neck is a preferred route for either intravenous infusion or monitoring of central venous pressure in patients. Furthermore, these segments of veins are also used as a patch for carotid endarterectomies.

Hence a sound knowledge of the normal anatomy of the veins of head and neck and their variations is mandatory for the clinicians to avoid any catastrophe while performing any of the procedures. Hence, the present study was undertaken to document the variations in the venous architecture of the head and neck so as to highlight the formation of common facial vein and its variation in the drainage pattern in cadavers of Western Maharashtra population.

Material and methods

Head and neck region of a total of 20 cadavers i.e 40 sides, were dissected for the purpose of the study. The cadavers were from both sexes and comprises of bodies donated to the department for the purpose of teaching and research. All of the dissections were carried out during routine dissection period for the teaching of undergraduates and variations in the formation and drainage pattern of the CFV were noted and documented.

Inclusion criteria: Both male and female adult cadavers, aged above 60 years were included in the study. The dissection was done on both sides of the neck of voluntarily donated and preserved cadavers.

Exclusion criteria: Cadavers having any neck injury, diseases of neck were excluded from the study.

Observations

Of the twenty cadavers, that is 40 sides including both right and left, 34 sides (85%) showed normal pattern of formation and drainage of the common facial vein that is after formation the common facial vein was seen draining into the internal jugular vein as per standard anatomic descriptions. Six sides showed variations in the termination of CFV. In one of the cadavers, the left common facial vein (2.5%)

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passed under the cover of both sternocleidomastoid and the superior belly of omohyoid and was found draining into the anterior jugular vein (AJV) as well as into the internal jugular vein (IJV) [Fig 1]. In three cadavers (7.5%), the CFV was found to be draining into the AJV after reaching the anteroinferior angle of the posterior triangle

[Fig 2]. In two cadavers (5%), the facial vein (FV) was not receiving the anterior division of retromandibular vein and thus not forming the common facial vein, hence the facial vein found to be directly draining into the IJV [Fig 3]



Fig 1: FV not receiving tributary from AD RMV and drains into IJV. FV – Facial vein, CFV – common Facial vein, FA – Facial artery, CCA – Common carotid artery, PD RMV – Posterior division of Retromandibular vein, AD RMV – anterior division of Retromandibular vein, RAV – Retro Auricular vein, EJV – External Jugular vein, IJV – Internal Jugular vein, AJV – Anterior Jugular vein, JVA – Jugular Venous arch, CV – Communicating vein, VN – Vagus nerve, SCM – Sternocleidomastoid, PG – Parotid gland, SMG – Submandibular Gland

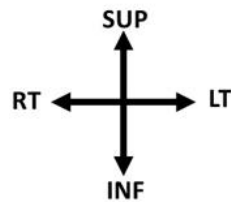
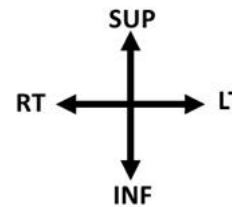
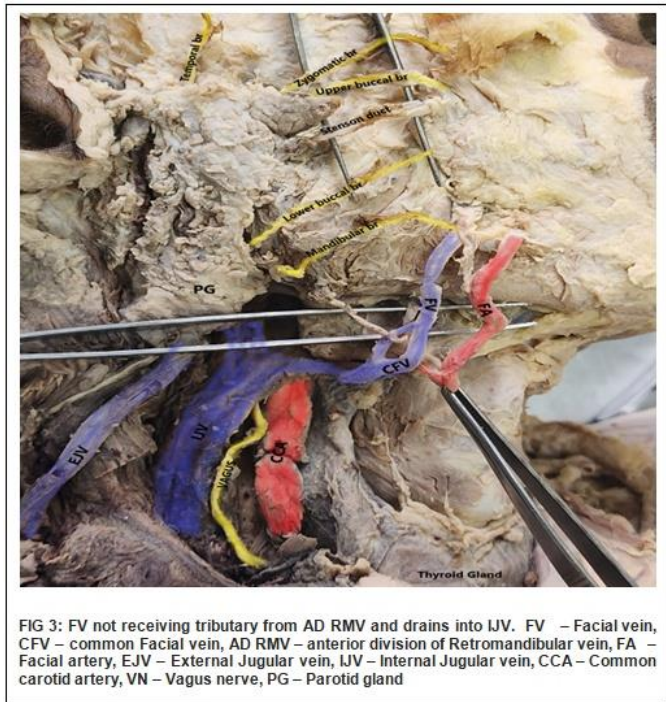


Fig 2: CFV DRAINED INTO AJV. FV – Facial vein, CFV – common Facial vein, FA – Facial artery, CCA – Common carotid artery, PD RMV – Posterior division of Retromandibular vein, AD RMV – anterior division of Retromandibular vein, RAV – Retro Auricular vein, EJV – External Jugular vein, IJV – Internal Jugular vein, AJV – Anterior Jugular vein, JVA – Jugular Venous arch, CV – Communicating vein, VN – Vagus nerve, PG – Parotid gland, SMG – Submandibular Gland



Discussion

Knowledge of variations and persisting communications help in avoidance of injuries to the veins during interventions like EJV cannulation for diagnostic and therapeutic purposes including monitoring of Central Venous Pressure (CVP)[2]. Trans jugular liver biopsy and post systemic shunts have also been tried through this route. In treatment of hydrocephalus, ventriculo-jugular shunts are used as a treatment modality moreover CFV is also used as a patch material for carotid angioplasty[3]. Knowledge of important variations in superficial veins of neck prevents injuries during interventional procedures and neck surgeries[4]. Grafts of these veins are also used for microvascular anastomosis during oral reconstruction surgeries[5].

Embryological consideration: Venous development of head and neck region undergo a complex pattern and become apparent only after the development of skull. During embryonic period, superficial head and neck veins develop from superficial capillary plexuses which will later form primary head veins. Larger veins are formed by the enlargement of individual capillaries, confluence of adjacent ones and regression of some from where the flow has been diverted[6]. Ventral pharyngeal vein (VPV) is the first identifiable vein of the face and neck. The ventral pharyngeal vein drains the mandibular and the hyoid arches and opens

into the common cardinal vein. As the neck elongates (10 mm embryo stage), the termination of VPV is transferred to the cranial part of the pre-cardinal vein which later becomes the internal jugular vein[7]. The ventral pharyngeal vein receives the linguofacial vein, which drains the face and tongue. The primitive maxillary vein which drains the territory of the ophthalmic and the mandibular divisions of the trigeminal nerve anastomoses with the linguofacial vein to form the anterior facial vein. The retromandibular vein draining the temporal region, opens into the linguofacial vein to form a common trunk known as the common facial vein, which ultimately drains into the internal jugular vein. EJV develops from venous plexus in the neck region connecting caudally with cephalic vein and cranially with RMV and anterior facial vein at 22 mm stage of embryo[8]. In the upper limb, the preaxial vein becomes the cephalic vein. The external jugular vein develops as a tributary of the cephalic vein from the tissues of the neck and anastomoses secondarily with the anterior facial vein. The cephalic vein forms a venous ring around the clavicle, from which it is connected to the caudal part of the pre-cardinal vein. The deep segment of this venous ring forms the subclavian vein and receives the definitive external jugular vein[9]. In the normal course of development, the external jugular vein has an anterior connection with the facial vein and a posterior connection with the retromandibular vein.

Table 1: Shows the variations found in the previous studies and the present study (CFV – Common facial vein, AJV – Anterior jugular vein, IJV – Internal jugular vein, FV – Facial vein, AD RMV – Anterior division of retromandibular vein)

Author name	Place of the study	Sample size	Undivided RMV	FV draining in IJV	Absent RMV	CFV drained into AJV & IJV	CFV drained into AJV	FV not receiving AD RMV
Bertha A and Suganthi R[10] (2011)	Vellore	35	☐	X	X	X	X	X
Rao YL et al.[11] (2018)	Karnataka	1	☐	☐	X	X	X	X
Arquez HF and Torres SIG[12] (2018)	Spain	34	X	X	X	X	X	X
Balachandra N et al.,[13] (2012)	Raipur	1	☐	☐	X	X	X	X
Patil J et al.,[14] (2014)	Karnataka	1	X	X	☐	X	X	X
S Ghosh et al (2022)[15]	West Bengal	26	☐	☐	X	X	X	X
Present study (2023)	Pune	20	X	X	X	☐	☐	☐

The variations found in the present study have not been reported so far as revealed during search of literature on CFV. There have been many reported variations in the drainage pattern of the facial vein. One of the common variations is the drainage of the facial vein into external jugular vein; incidence of which varies from 5% - 9% [16]. Many different variations in the termination of the facial vein have been reported. Bertha A and Suganthy Rabi reported a case in which facial vein was seen terminating into the subclavian vein [10]. Shilpa Bathla et al. reported a case in which facial vein bifurcated into two divisions at the base of mandible posterior to the facial artery, one division terminated into the anterior jugular vein while other one into the external jugular vein [17]. Peuker et al reported a case in which the facial vein was draining into the superficial temporal vein [18]. Choudhary et al reported a case in which the retromandibular vein was seen continuing as the external jugular vein without dividing into an anterior and posterior division. The facial vein and posterior auricular vein were draining into the external jugular vein [19]. Abhinitha et al reported an interesting case in which external jugular vein was absent and the retromandibular vein was wide in caliber. Its anterior division joined the facial vein to form the common facial vein, which then drained into the anterior jugular vein instead of the internal jugular vein. The posterior division drained directly into the internal jugular vein [20]. Nayak reported a case in which the anterior division of the retromandibular vein was absent while the anterior jugular vein was a continuation of the facial vein. There was a large communicating vein between the anterior jugular vein and the anterior division of internal jugular vein. The lingual vein was seen draining into this communicating vein [21].

Limitations

Limitations of the number of cadavers and consequently a smaller sample size detracts has its generalization of the study findings to the population at large.

Conclusion

In the present study, we found normal anatomical venous drainage on 34 sides (85%) and six sides showed variations in their termination. A rare variation which was documented in the study was that the left common facial vein was found draining into the anterior jugular vein (AJV) as well as into the internal jugular vein (IJV). Further, the CFV was found to be draining into the AJV after reaching the antero-inferior angle of the posterior triangle and in two cadavers, the facial vein (FV) was not receiving the anterior division of retromandibular vein and thus not forming the common facial vein. Herein the facial vein was found to be directly draining into the IJV. The authors feel that large sample size studies with meticulous dissection and exploration of infratemporal fossa and the parotid region be carried out in future to document additional variations of the superficial and deep veins of the neck region.

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