

Relations of Facial Nerve With Retromandibular Vein in Human Fetuses

Özlem Elvan, MSc,* Yağmurhan Gilan, MD,* Orhan Beger, MD,* Alev Bobuş, MD,* Mesut Tezer, MD,[†] and Mustafa Aktekin, MD[‡]

Abstract: The relationship of facial nerve (FN) and its branches with the retromandibular vein (RMV) has been described in adults, whereas there is no data in the literature regarding this relationship in fetuses. The study was conducted to evaluate the anatomic relationships of these structures on 61 hemi-faces of fetuses with a mean age of 26.5 ± 4.9 weeks with no visible facial abnormalities. The FN trunk was identified at its emergence at the stylomastoid foramen. It was traced till its ramification within the parotid gland. In 46 sides, FN trunk ramified before crossing RMV and ran lateral to it, while in 8 sides FN trunk ramified on the lateral aspect of the RMV. In 3 sides, FN trunk ramified after crossing the RMV at its medial aspect. In only 1 side, FN trunk trifurcated as superior, middle, and inferior divisions and RMV lied anterior to FN trunk, lateral to superior division, medial to middle and inferior divisions. In 2 sides, FN trunk bifurcated as superior and inferior divisions. Retromandibular vein was located anterior to FN trunk, medial to superior division, lateral to inferior division in both of them. In 1 side, RMV ran medial to almost all branches, except the cervical branch of FN. Variability in the relationship of FN and RMV in fetuses as presented in this study is thought to be crucial in surgical procedures particularly in early childhood.

Key Words: Facial nerve, fetus, retromandibular vein, surgery

(*J Craniofac Surg* 2017;28: 1096–1098)

The most important risk during parotidectomy, open surgical reduction of mandibular condyle fractures, face lifting procedures, and face transplants is injuring facial nerve (FN).^{1,2} The location of retromandibular vein (RMV) has been considered a predictor of exposing the FN and its branches as well as localizing the parotid tumors preoperatively. Since therefore, its relationships

with FN and knowledge of normal and variant extracranial course of the FN become more significant.^{1–7}

The FN leaves the cranium from the stylomastoid foramen and supplies the posterior belly of digastric and stylohyoid muscles, and gives off the posterior auricular nerve. Then it enters into the parotid gland on posteromedial surface. It divides into superior and inferior divisions between superficial and deep lobes of parotid. There, it usually runs posterior and superficial to RMV.⁸

The RMV is formed by the union of the maxillary and superficial temporofacial veins, superficial to external carotid artery⁸ and medial to FN and its branches.⁴ It descends in the parotid gland and divides into an anterior branch that unites to the facial vein and a posterior branch that joins to the posterior auricular vein to form external jugular vein.⁸ The relation of RMV with FN is important, especially when it runs superficial to FN and surgical procedures such as hemangiomas, abscess, sialosis, neoplasms, and cysts.⁹

The embryological development of the mentioned structures is also investigated to have a better understanding of the variations. As reported by Touré and Vacher, the RMV is located medial to the FN and lateral to the external carotid artery. The branches of cervicofacial division are located in the deep part of parotid bud and RMV is in close contact with them and temporofacial branches are superficial to the RMV. Growing of the parotid gland caudally and the migration to the superficial part of the parotid gland of the cervicofacial branch of the FN can be the explanations for variations of localization of the cervicofacial branch.⁴

In recent years, studies have been published to draw attention to FN-RMV relationship. Although there are several reports in the literature about them in adult cadavers, we could not encounter any reports regarding fetuses. Thus, we aimed to evaluate the anatomic relationship of FN and its branches with RMV in fetuses to obtain data that would be helpful in surgical procedures.

METHODS

This study was conducted on 61 hemi-faces of 33 fetuses (bilaterally on 28 and unilaterally on 5 fetuses) with no visible external abnormalities in their faces. The mean age of the fetuses was determined as 26.5 ± 4.9 weeks (ranging between 16 and 36 weeks) by foot length. These fetuses were (19 females and 14 males) obtained from the collection of the Anatomy Department of the School of Medicine, Mersin University. The present study was approved by the Ethics Board of the School of Medicine, Mersin University.

Preauricular incision was made from temporal region cranially to the anterior margin of the sternocleidomastoid muscle caudally, meticulously in each patient. The FN trunk was identified at the emergence of the stylomastoid foramen with relation to posterior belly of the digastric muscle. Then, FN trunk was traced anteriorly to its ramification in the parotid gland. The relation of FN trunk and its branches with RMV was identified and noted. The distance from the ramification point of FN to posterior aspect of RMV was measured by using digital caliper.

From the *Department of Anatomy, Mersin University Faculty of Medicine; †Department of Otolaryngology-Head and Neck Surgery, Mersin University Faculty of Medicine, Mersin; and ‡Department of Anatomy, Acibadem University School of Medicine, Istanbul, Turkey. Received September 5, 2016.

Accepted for publication October 24, 2016.

Address correspondence and reprint requests to Özlem Elvan, MSc, Department of Anatomy, Mersin University Faculty of Medicine, Çiftlikköy Campus, 33343 Yenışehir, Mersin, Turkey; E-mail: ofzt@hotmail.com

This study was supported by the Scientific Research Projects Commission (BAP-TP3-1306) of Mersin University, Mersin, Turkey.

The study had been presented in the 7th Asia Pacific International Congress of Anatomists 2016, Singapore.

The authors report no conflicts of interest. Copyright © 2017 by Mutaz B. Habal, MD ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000003415

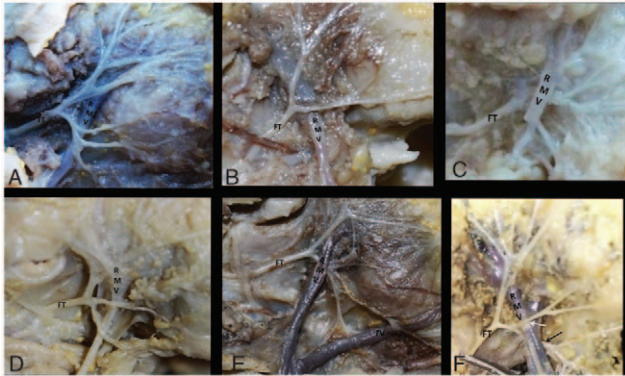


FIGURE 1. The photographs show the positional relationships of FN and RMV on the right side of fetus faces. (A) The whole FN was lateral to the RMV and its ramification was before the RMV. (B) The whole FN was lateral to the RMV and its ramification was on lateral aspect of the RMV. (C) The whole FN was medial to RMV and its ramification was on medial aspect of RMV. (D) The FN trifurcated as superior, middle, and inferior divisions. The RMV located anterior to FN trunk, lateral to superior division, medial to middle, and inferior divisions. (E) The FN bifurcated as superior and inferior divisions. Retromandibular vein located anterior to FN trunk, medial to superior division, and lateral to inferior division. (F) The FN bifurcated as superior and inferior divisions. The inferior division then split into upper and lower divisions. The RMV was anterior to FN trunk and medial to the lower division. Black arrow, the inferior division of cervicofacial division; FT, facial nerve trunk; RMV, retromandibular vein; white arrow, the superior division of cervicofacial division.

RESULTS

- In 46 of 61 hemi-faces, the whole FN was lateral to the RMV and its ramification was 2.24 ± 0.98 mm (ranging between 1.02 and 6.22 mm) before the RMV (Fig. 1A).
- In 8 of 61 hemi-faces, the whole FN was lateral to the RMV and its ramification was just on lateral aspect of the RMV (Fig. 1B).
- In 3 of 61 hemi-faces, the whole FN was medial to RMV and its ramification was just on medial aspect of RMV (Fig. 1C).
- In 1 hemi-face, FN trifurcated as superior, middle, and inferior divisions. The RMV located anterior to FN trunk, lateral to superior division, medial to middle, and inferior divisions (Fig. 1D).
- In 2 hemi-faces, FN bifurcated as superior and inferior divisions. RMV located anterior to FN trunk, medial to superior division, lateral to inferior division (Fig. 1E).
- In 1 hemi-face, FN bifurcated as superior and inferior divisions. Then, the inferior division split into upper and lower divisions. While the RMV was anterior to FN trunk, it was located medial to all branches, except 1, the lower division (Fig. 1F).

DISCUSSION

Taking the RMV into consideration has been reported as a particularly recommended and reliable issue to identify and protect the FN and its branches during the surgical procedures of relevant area.^{1,2,4,5} As known, the most vulnerable nerves are marginal mandibular, frontal, and buccal nerves, respectively. Especially in parotid surgery, the first step is finding the FN trunk before performing the parotidectomy. When there is difficulty in exposing the FN trunk, the marginal mandibular nerve can be traced up to FN ramification. The inferior division of FN may cross the RMV, and it can be traced up to FN's ramification.² On the other hand, when the vein crosses the FN or its branches superficially, surgeon may harm the vein erroneously; therefore possible bleeding of the vein may

increase the risk of FN injury.¹ Other ways of localizing the FN are using mastoid process, posterior belly of digastric muscle, tragal pointer, and tympanomastoid fissure.^{1,3,5} Also, RMV is used as a landmark in radiological procedures. It is used to determine whether the parotid tumor is superficial or deep to the FN.⁴

In the anatomical study of Toure and Vacher on adult cadavers, this relation was classified into 6 types.⁴ Piagkou et al³ presented a variant case and literature review on existing variations of the relationship of the RMV and FN. They also proposed an updated classification of this variant relationship. The incidence of positional variation was reported as 11.83% in that study³ while it was similarly 11.48% in the present study.

Toure and Vacher reported the incidence of RMV which coursed medial to the FN as 62.5%, and lateral to it as 13.6%.⁴ In the present study in 75% of the patients, FN and its branches were lateral to RMV and the ramification of FN was before RMV similar to type 1 as described in the literature.^{3,4} It is also found that in 13.12% of our patients, FN was lateral to RMV and its ramification was just on the lateral aspect of the RMV. However, such kind of patient is not reported in the literature.^{3,4} Retromandibular vein was lateral to FN in 4.92% of our patients which was described as type 2 and 2d according to Touré and Vacher⁴ and Piagkou et al,³ respectively. The other variations found in the present study were concordant with type 2b and c in Piagkou classification and types 4, 5, and 6 in Toure and Vacher classification^{3,4} (Fig. 1D–F). Alzahrani and Alghathani⁵ reported a patient in whom both the superior and inferior divisions of FN passed through the RMV by forming 2 separate rings. In the study of Babademez et al,¹ the RMV was found at an inferior level with its tributaries. The inferior divisions of FN were running deep to superficial temporal vein and superficial to maxillary vein like a fork, with close contact to RMV.¹ We have not encountered the fork or ring-type variations mentioned as types 3 and 4 in Piagkou et al classification.³

Kim et al¹⁰ reported the relationships between the cervicofacial division of FN and RMV. In 83% of those patients FN were lateral to RMV while 52% were dividing into branches after crossing the vein and 31% were branching before crossing the RMV. In 17% of the patients, the cervicofacial division of FN run medial to RMV and 6% of them were branching after crossing RMV, while in 11%, it was giving branches before RMV.¹⁰ In our study in 8.2% of the patients RMV was lateral to cervicofacial division and in 1 patient it was medial to upper and lateral to lower divisions of cervicofacial division. In 90.2% of the patients, RMV was medial to cervicofacial division.

Retromandibular vein is a crucial structure used as an anatomical landmark when the FN is not visible in some radiological procedures.⁴ The variations and relations of FN with parotid gland and adjacent structures have clinically significant results. In conclusion, to our knowledge, there is not any study in the literature regarding the relations of these 2 structures in human fetuses. Therefore, data of adult cadaveric studies were used for pediatric surgical procedures up to now. To our knowledge, findings of the present study are the first that evaluates the FN-RMV relationship and clearly reveals the positional relations of them in human fetuses. Being aware of various positions of these structures is important to prevent unexpected FN injury or bleeding of RMV for surgeons who must dominate those variations and avoid approaches by rote.

REFERENCES

1. Babademez MA, Acar B, Gunbey E, et al. Anomalous relationship of the retromandibular vein to the facial nerve as a potential risk factor for facial nerve injury during parotidectomy. *J Craniofac Surg* 2012;21:801–802
2. Mohan R, Brown EN, Borsuk DE, et al. Revisiting the anatomic relationship of the marginal mandibular nerve and the posterior facial vein: a cadaveric study. *Ann Plast Surg* 2014;72:467–468

3. Piagkou M, Tzika M, Paraskevas G, et al. Anatomic variability in the relation between the retromandibular vein and the facial nerve: a case report, literature review and classification. *Folia Morphol (Warsz)* 2013;72:371–375
4. Touré G, Vacher C. Relations of the facial nerve with the retromandibular vein: anatomic study of 132 parotid glands. *Surg Radiol Anat* 2010;32:957–961
5. Alzahrani FR, Algathani KH. The facial nerve versus the retromandibular vein: a new anatomical relationship. *Head Neck Oncol* 2012;27:82
6. Astik RB, Dave UH, Gajendra KS. Variant position of the facial nerve in parotid gland. *Int J Anat Var* 2011;4:3–4
7. Smith OJ, Ross GL. A branching pattern of the facial nerve trunk with six initial branches: possible implications for parotid surgery? *J Plast Reconstr Aesthet Surg* 2013;66:288–289
8. Standring S, Borley NR, Collins P, et al. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 40th ed. Elsevier: Churchill Livingstone London; 2008
9. Bialek EJ, Jakubowski W, Zajkowski P, et al. US of the major salivary glands: anatomy and spatial relationships, pathologic conditions, and pitfalls. *Radiographics* 2006;26:745–763
10. Kim DI, Nam SH, Nam YS, et al. The marginal mandibular branch of the facial nerve in Koreans. *Clin Anat* 2009;22:207–214

