

Case Report

A CASE OF ABRUPT TERMINATION OF THE FACIAL ARTERY WITH UNUSUAL MULTIPLE ARTERIAL ANASTOMOSES: CLINICAL IMPLICATIONS IN THE HEAD AND NECK

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ABSTRACT

Having up-to-date knowledge of the variability in facial artery topography is an essential starting point in performing certain surgical and radiological procedures on the head and neck (e.g. oromucosal reconstruction flaps, transarterial embolization). We report a unique case with: (1) the left facial artery truncating as an atypical inferior labial artery, (2) the left anterolateral face being perfused by unusual arterial collaterals derived from the right superior labial, left infraorbital and left dorsal nasal arteries, (3) the transverse facial artery not being one of the perfusing collaterals, and (4) the right submental artery piercing the mylohyoid muscle and entering the oral cavity. The embryologic basis of this atypical vascular pattern is discussed. Discovery of a highly atypical facial artery highlights the importance of performing a thorough pre-operative vascular evaluation to prevent iatrogenic injuries and complications before any surgical or therapeutic procedure.

KEY WORDS: Facial artery variation - Infraorbital artery - Labial arteries - Dorsal nasal artery.

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INTRODUCTION

The facial artery (FA) is the major vessel, in hemodynamic balance with its subordinate vessels, providing blood to the face [1]. The typical FA arises from the external carotid artery (ECA) just superior to the greater cornu of the hyoid bone. It travels a short distance in the suprahyoid region before it gives off the submental artery. It curves superiorly onto the

face along the mandible's inferior margin and travels anterior to the masseter muscle. At the angle of the mouth it gives rise to the inferior labial (ILA) and superior labial (SLA) arteries that supply the lower and upper lips, respectively. The FA ascends obliquely toward the medial canthus of the eye where it branches into the lateral nasal and angular arteries. The latter being the terminal branch of the FA.

The present case report describes an individual whose: (1) left facial artery terminated in an unusual inferior labial artery; (2) left anterolateral face, typically perfused by the FA, was instead supplied by branches of the right superior labial, left infraorbital and left dorsal nasal arteries; and (3) the left side face received no collateral branches from the transverse facial artery. Unrelated to the FA variation, the right submental artery pierced the mylohyoid muscle to enter the oral cavity. A search of the English literature failed to produce a description or illustration similar to this case.

Variations in the branching pattern and termination of the FA have been studied [2-4]. Termination of the FA as the ILA was reported by Koh et al. [2] in 5.5% of cadavers dissected. Lohn et al. [3] found it in 3% (6/201) of cadavers. However, Niranjana [5] report no cases in 25 cadavers. Interestingly, Loukas et al. [4] reported a rudimentary FA (classified as Type E) in 1.4 % of 142 cadavers, and the terminal end of the FA is labeled "inferior labial artery" in their illustration of the Type E pattern. Review of these studies reveals that termination of the FA as the ILA is one of the least common variant patterns. Koh et al. [2] and Loukas et al. [4] proposed classification schemes to describe variable distributions and branching patterns but they did not describe compensatory collateral vessels in cases of FA truncation or atresia. However, Hollinshead [6], Soikkonen et al. [1], Ezure et al. [7] and Tubbs et al. [8] reported cases of hypoplastic FAs that were compensated by enlarged collateral vessels including the ipsilateral transverse facial artery (TFA).

CASE REPORT

During routine dissection of a 79-year-old Caucasian female cadaver in a first-year gross anatomy course, multiple anomalies were observed in the distribution of the left and right facial arteries and their branches. The LFA arose from a common trunk with the lingual artery (LA) and gave rise to a typical submental artery in the suprahyoid region. The LFA then curved around the inferior margin of the mandible, anterior to the masseter muscle, and traveled a short distance anteriorly before it ascended towards the inferior labial margin and terminated

as an atypical LILA. The LILA approached the lower lip inferiorly rather than laterally (Fig 1. a, b & d, e) and anastomosed medially with the right inferior labial artery (RILA).

In the present case, the left anterolateral face was supplied by multiple arteries not typically supplying this area. The right superior labial artery (RSLA) crossed the midline of the lip and supplied the entire upper lip. In addition, an unusually long branch of the left infraorbital artery (LIOA) descended to the angle of the mouth and an elongated left dorsal nasal artery (LDNA) supplied the area typically perfused by both the angular and lateral nasal arteries (Fig 1. b & e).

On the right side, the facial artery was normal except for the RSLA (described above) and the right submental artery (RSMA) that pierced the right mylohyoid muscle to enter the oral cavity (Fig 1. c & f).

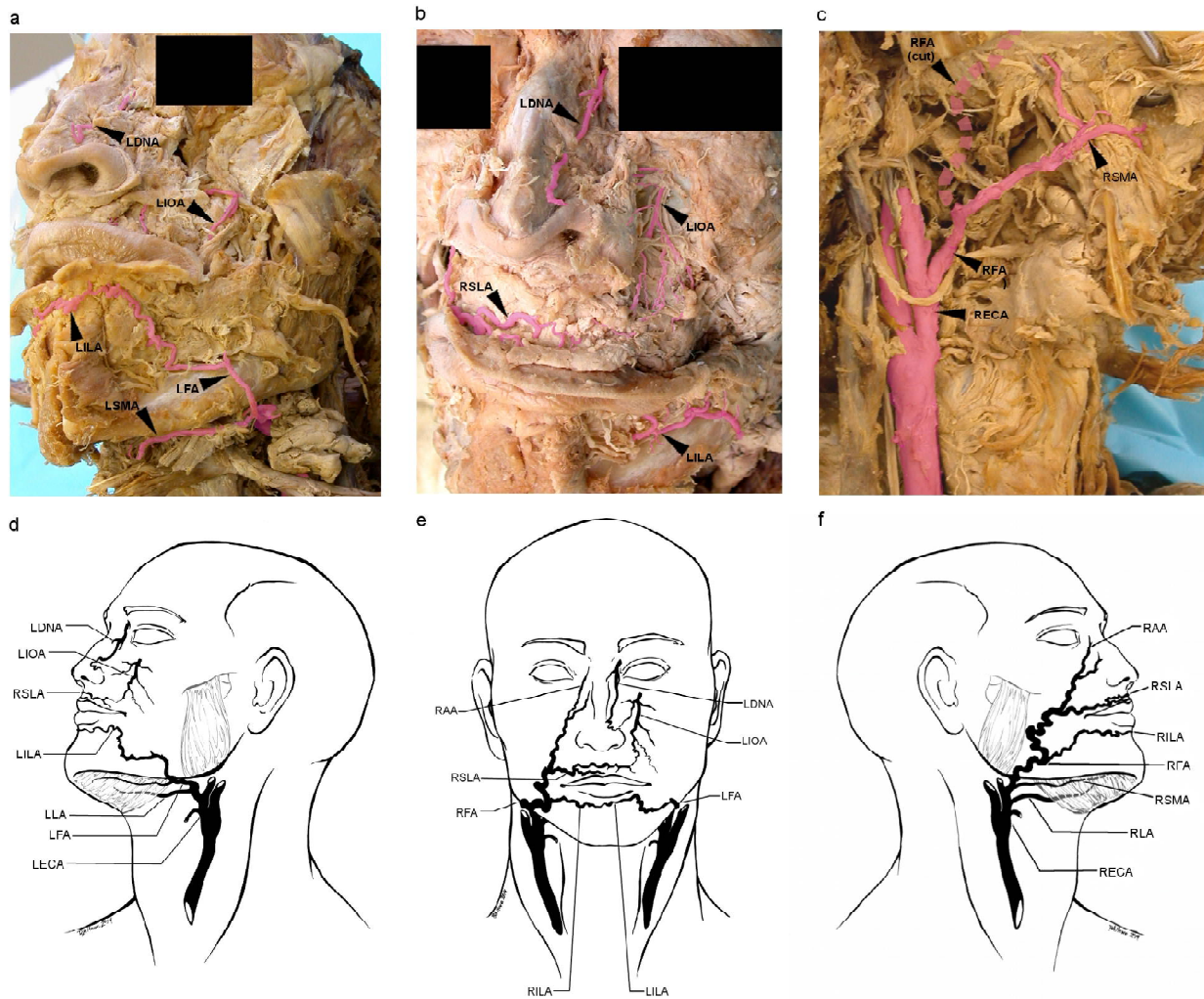
There were no macroscopic pathologies in the face or neck, and the courses of the left and right facial veins were typical.

DISCUSSION

According to Whetzel et al. [9], the anterior and lateral facial regions are perfused by two distinct arterial systems: a Facial Arterial System (FAS) that includes branches of the facial and infraorbital arteries, and a Transverse-Maxillary Arterial System (T-MAS) that includes branches of the transverse facial, submental and zygomatico-orbital arteries. In cases of hypoplastic FAS, the T-MAS is often more robust [10]. Ezure et al. [7] and Tubbs et al. [8] published findings in separate cases where an enlarged TFA was found with an absent FA. Additionally, Hollinshead [6] and Soikkonen et al. [1] described hypoplastic FA cases in which the TFA, dorsal nasal and maxillary branches became prominent.

In the present case, the collateral vessels to the anterolateral face with the truncated LFA followed neither of these compensatory patterns. Collateral distribution was both contralateral and ipsilateral from vessels that included the right superior labial artery, the LIOA and the LDNA. There was no contribution from the TFA or the maxillary artery.

Fig. 1: Photographs of dissections and corresponding line diagrams showing truncated left facial artery with multiple compensatory anastomoses of the left mid-face region (a, b, d, e), and the right submental artery piercing the mylohyoid muscle to enter the floor of the oral cavity (c, f). The arteries of interest were colored using Gimp software.



a, d: Truncated left facial artery (LFA: left facial artery, LILA: left inferior labial artery, LSMA: left submental artery, LIOA: left infraorbital artery, LDNA: left dorsal nasal artery, LECA: left external carotid artery, LLA: left lingual artery, RSLA: right superior labial artery, LIOA: left infraorbital artery, LDNA: left dorsal nasal artery).
b, e: Right superior labial artery crossing the midline (RILA: right inferior labial artery, RFA: right facial artery, RAA: right angular artery).
c, f: Right submental artery piercing the mylohyoid muscle (RSMA: right submental artery, RECA: right external carotid artery, RLA: right lingual artery).

Typically, the upper lip is supplied by the SLA arising from its respective FA [11, 12]. Magden et al. [13] reported a unilateral origin of the SLA supplying the upper lip in 29% (4/14) of cases, and Tansatit et al. [14] reported unilateral SLA in 23% (6/26) of cases. Furthermore, Tansatit et al. [14] found 100% of the contralateral FAs were normal. In light of Tansatit et al. [14] findings, one might expect the LFA in the present case to be normal. However, the LFA was not normal and, in fact, was truncated well inferior to the angle of the mouth.

Finally, in the present case, the right FA exhibited variation in the suprahyoid region where the sublingual artery normally supplies the oral

cavity. Bavitz et al. [15] reported that 53% (40/76) of hemisected heads with a small, insignificant or absent sublingual artery possessed a large compensatory SMA branch that perforated the mylohyoid muscle to supply the oral cavity. Fujita et al. [16] found the same pattern in 45% (45/100) of hemifaces. In the present case, the RSMA was similar to those described by these authors. Unfortunately, the right sublingual artery was not identified in our dissection.

The embryological basis for the variations seen in the present case is unknown, but experimental studies [17] on vascular development and blood flow demonstrated that flow-related

shear stresses and pressure gradients contribute to the number and position of arterial side branches, the topology of the arterial tree, and the number of existing collaterals. It is likely that a combination of these and other epigenetic factors contributed to the present variation complex.

CONCLUSION

The facial artery and its branches are important in facial reconstruction. Facial surgeries range from localized operations using single branches of the FA [18] to facial transplantation. Knowledge of variations in the facial artery is necessary to optimize procedure outcomes. Additionally, the FA serves as an important vessel for conducting therapeutic procedures, e.g. transarterial embolization to control bleeding from head and neck tumors [19] as well as administration of intraarterial chemotherapeutic agents [20].

Bilateral and unilateral FA variations range from minor branching deviations to complete absence. In all cases, collateral vessels develop reciprocally to ensure adequate perfusion of facial tissues. While FA termination as the inferior labial artery has been documented, it occurs at a low frequency (3-5.5%). The present report describes a face in which the LFA terminates as an atypical inferior labial artery and the collateral vessels compensating for the truncated LFA (the right superior labial, left infraorbital and left dorsal nasal arteries) form a previously undescribed pattern. In addition, the transverse facial artery, which commonly contributes to facial collaterals, was not a contributing collateral vessel. Discovery of a highly atypical facial artery and associated collaterals highlights the importance of performing a thorough pre-operative vascular evaluation prior to any surgical or therapeutic procedure to identify idiosyncratic patterns that, if unrecognized, could increase the risk of iatrogenic injuries and complications.

LIST OF ABBREVIATIONS

FA- Facial Artery
LFA- Left Facial Artery
LILA- Left Inferior Labial Artery
LA- Lingual Artery

RSLA- Right Superior Labial Artery
LLOA- Left Infraorbital Artery
LDNA- Left Dorsal Nasal Artery
RSMA- Right Submental Artery
FAS- Facial Arterial System
T-MAS- Transverse-Maxillary Arterial System

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REFERENCES

- [1]. Soikkonen K, Wolf J, Hietanen J, Mattila K. Three main arteries of the face and their tortuosity. *British Journal of Oral and Maxillofacial Surgery*. 1991;29:395-398.
- [2]. Koh KS, Kim HJ, Oh CS, Chung IH. Branching patterns and symmetry of the course of the facial artery in Koreans. *International Journal of Oral and Maxillofacial Surgery*. 2003;32:414-418.
- [3]. Lohn JW, Penn JW, Norton J, Butler PE. The course and variation of the facial artery and vein: implications for facial transplantation and facial surgery. *Annals of plastic surgery*. 2011;67(2):184-188.
- [4]. Loukas M, Hullett J, Louis Jr RG, Kapos T, Knight J, Nagy R, et al. A detailed observation of variations of the facial artery, with emphasis on the superior labial artery. *Surg Radiol Anat*. 2006;28:316-324.
- [5]. Niranjana NS. An anatomical study of the facial artery. *Annals of plastic surgery*. 1988;21(1):14-22.
- [6]. Hollinshead WH. *The Face. Anatomy for Surgeons: The Head and Neck*. 1. New York: Paul B. Hoeber, INC, Medical book department of Harper and Brothers; 1954. p. 306-324.
- [7]. Ezure H, Mori R, Ito J, Otsuka N. Case of a completely absent facial artery. *International Journal of anatomic variations*. 2011;4:72-74.
- [8]. Tubbs RS, Salter EG, Oakes WJ. Unilateral agenesis of the facial artery with compensation by a giant transverse facial artery. *Folia Morphol*. 2005;64(3):226-228.
- [9]. Whetzel TP, Mathes SJ. Arterial anatomy of the face: An analysis of vascular territories and perforating cutaneous vessels. *Plast Reconstr Surg*. 1992;89:591-603.
- [10]. Lasjaunias P, Berenstein A, Doyon D. Normal functional anatomy of the facial artery. *Radiology*. 1979;133(3 Pt 1):631-638.
- [11]. Standring S, Borley NR, Collins P, Crossman AR, Gatzoulis MA, Healy JC, et al. *Face and Scalp*. In: Standring S, editor. *Gray's Anatomy*. 40th ed. China: Elsevier; 2008. p. 467-497.

- [12]. Midy D, Mauruc B, Vergnes P, Caliot P. A contribution to the study of the facial artery, its branches and anastomoses; application to the anatomic vascular bases of facial flaps. *Surg Radiol Anat.* 1986;8:99-107.
- [13]. Magden O, Edizer M, Atabey A, Tayfur V, Ergür I. Cadaveric Study of the Arterial Anatomy of the Upper Lip. *Plastic and Reconstructive Surgery.* 2004;114(2):355-359.
- [14]. Tansatit T, Apinuntrum P, Phetudom T. A Typical Pattern of the Labial Arteries with Implication for Lip Augmentation with Injectable Fillers. *Aesth Plast Surg.* 2014;38(6):1083-1089.
- [15]. Bavitz JB, Harn SD, Homze EJ. Arterial supply to the floor of the mouth and lingual gingiva. *Oral Surgery Oral Medicine Oral Pathology.* 1994;77(3):232-235.
- [16]. Fujita S, Ide Y, Fau - Abe S, Abe S. Variations of vascular distribution in the mandibular anterior lingual region: a high risk of vascular injury during implant surgery. *Implant Dentistry.* 2012;21(4):259-264.
- [17]. le Noble F, Fleury V, Pries A, Corvol P, Eichmann A, Reneman RS. Control of arterial branching morphogenesis in embryogenesis: go with the flow. *Cardiovascular research.* 2005;65:619-628.
- [18]. Boutros S. Reconstruction of the lips. In: Thorne CH, Bartlett SP, Beasley RW, Aston SJ, Gurtner GC, Spear SL, editors. *Grabb & Smith's Plastic Surgery.* 6th ed. Philadelphia: Lippincott Williams & Wilkins, a Wolters Kluwer business; 2007. p. 367-374.
- [19]. Chen Y-F, Lo Y-C, Lin W-C, Lin C-H, Chiang H-J, Chen J-F, et al. Transarterial embolization for control of bleeding in patients with head and neck cancer. *Otolaryngology - Head and Neck Surgery.* 2010;142(1):90-94.
- [20]. Shimizu T, Sakakura Y, Hattori T, Yamaguchi N, Kubo M, Sakakura K. Superselective intraarterial chemotherapy in combination with irradiation: Preliminary report. *American Journal of Otolaryngology.* 1990;11:131-136.

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