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CASE REPORT

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Novel variations in spatial relations between the facial nerve and superficial temporal and maxillary veins

W. El Kininy[1], S. Davy[1], L. Stassen[1], D.S. Barry[2]

[1]*Department of Anatomy, Trinity Biomedical Sciences Institute, Trinity College, University of Dublin, Ireland*
[2]*Department of Oral/Maxillofacial Surgery, Dublin Dental University Hospital, Trinity College Dublin, Ireland*

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Variations in the relationship of the retromandibular vein to the facial nerve have been widely reported due to their relevance for surgical approaches in parotid, osteotomy and mandibular condyle surgery. In the context of the retromandibular retroparotid approach, remaining deep to the retromandibular vein is advised to decrease the likelihood of encountering the facial nerve during mandibular condyle surgery. In the present report, an unusual variant of the superficial temporal vein lying superficial to the facial nerve is described. This represents a variation of the venous branching pattern within the parotid gland, whereby the superficial temporal vein joins the maxillary vein inferior to its usual communication. These findings are discussed in the context of commonly used surgical approaches to the mandible for condylar trauma or osteotomy surgery. (Folia Morphol 2018; 77, 4: 775–779)

Key words: facial nerve variation, retromandibular vein, superficial temporal vein, mandibular condyle surgery, parotidectomy

INTRODUCTION

The retromandibular vein generally lies medial to the facial nerve [2, 11, 12]. It is formed by the merging of the superficial temporal vein and the maxillary vein within the superior aspect of the parotid gland, at the level of the neck of the mandible. The vein then courses through the parotid gland between the external carotid artery medially and the facial nerve laterally, which gives an important anatomical landmark in parotid and mandibular surgery [11]. The major risk in these surgeries is injury to the facial nerve due to compression, damage or transection on approach, which has significant morbidity for the patient [3]. If damage of the nerve is identified, surgical nerve repair impacts the duration of the operation [3].

The retromandibular vein is used as a landmark during pre-operative magnetic resonance imaging [1, 4, 6], computed tomography [4, 10] and sonography [5] to identify the most likely location of the facial nerve within the parotid gland. In addition, the retromandibular vein is used intra-operatively as an important landmark to reveal the facial nerve branches inside the parotid substance as the vein may be traced superiorly into the gland after its identification. The facial nerve is usually found superficial to the vein [2, 12]. Likewise, the superficial temporal vein has been shown to be a useful indicator during dissection of the upper parotid gland. Its usual superficial and superior location within the parotid gland serves as a guide to the beginning of the retromandibular vein [2, 7].

Address for correspondence: Dr. D. Barry, BSc, PhD, Department of Anatomy, Trinity College Dublin, University of Dublin, Dublin 2, Ireland, e-mail: debarry@tcd.ie; Dr. W. El Kininy, B.Dent.Sc, MFDS RCSI, MB, BCh, BAO, MRCS RCSI, Department of Anatomy, Trinity College Dublin, University of Dublin, Dublin 2, Ireland, e-mail: elkininw@tcd.ie

Table 1. Facial nerve and retromandibular vein variants

Type 1 — Retromandibular vein lay medial (deep) to the facial nerve (65.2%)
Type 2 — Retromandibular vein lay lateral (superficial) to the facial nerve (28%)
Types 3–6 — Constituted subtypes of type 2

Variations in the relationships between the intra-parotid venous structures and the facial nerve are widely described [2, 7–9]. While a universally recognised classification system does not exist, Toure and Vacher (2010) [12] classified six facial nerve and retromandibular vein variants (Table 1).

In the present case-report, we encountered a previously unreported variant of the facial nerve in relation to the superficial temporal and maxillary veins of a cadaveric female. We discuss the importance of this variant in the context of parotid and condylar surgery.

Informed consent was obtained for research prior to donor donation.

CASE REPORT

As part of our cadaveric study of facial nerve variations with respect to extra oral approaches to the mandibular condyle, a standard dissection of both parotid glands was performed in a 58-year-old Caucasian Irish formalin embalmed female cadaver.

A pre-auricular incision was made with extensions to the mastoid process posteriorly and to the neck inferiorly (Lazy S incision). Skin and subcutaneous tissue was lifted and a plane developed subcutaneously, superior to the superficial masseteric aponeurosis system (SMAS) layer.

The dissection through the SMAS was performed onto the parotid gland from the tragus inferiorly. This was followed by blunt dissection into the parotid to identify the main trunk of the facial nerve. The trunk of the facial nerve was followed anteriorly, to identify the branching pattern of the facial nerve. A note was made of the anatomic relationships of venous structures to the facial nerve. Images were captured using a Nikon D50 Digital SLR camera.

The right and left parotid glands were dissected to show potential variations between the facial nerve and venous systems. The left facial nerve showed considerable variation in relation to the venous structures in the parotid substance. The main trunk of the facial nerve exited the stylomastoid foramen and appeared within the parotid between the superficial temporal vein and maxillary vein superior to their junction (Fig. 1A–E). As such, the main trunk of the facial nerve lay deep to the superficial temporal vein prior to turning to course superficial to the maxillary vein (Fig. 1C, D).

After appearing between the two veins, the main trunk divided into upper and lower divisions. The upper division divided into temporal, zygomatic and buccal branches, while the lower division showed another variation (Fig. 1A–D). The lower division did not divide immediately. It travelled for 1.5 cm in an anterior to inferior direction before dividing into another buccal branch. This anastomosed with the buccal branch emerging from the upper division, a marginal mandibular branch and a cervical branch. The cervical branch passed inferiorly to dive deep to a communicating vein and subsequently move inferiorly towards the neck.

The right facial nerve of the same cadaver did not show the same variation (Fig. 2A, C). The retromandibular vein was deep to all facial nerve branches. The main trunk of the facial nerve divided as expected into upper and lower trunks. The upper trunk divided into temporal, zygomatic branches, and buccal branches. This buccal branch anastomosed with another buccal branch from the lower division. The lower division continued inferiorly after giving the buccal branch before dividing into the marginal mandibular and cervical branches.

DISCUSSION

The classification system identified by Toure and Vacher (2010) [12], based on an anatomical study of 132 parotid glands demonstrated that the retromandibular vein was found to be situated medial to the facial nerve in the majority of the cases (type 1, 65.2%, 86/132) and lateral to it in 28% (type 2, 37/132). Types 3 to 6 constituted subtypes of type 2 (Table 1).

The present case-report shows a facial nerve variation that is different and cannot be placed in this classification system. The main trunk lay medial to the superficial temporal vein before becoming superficial to the maxillary vein. Piagkou et al. (2013) [11] described a similar variant, in which the superficial temporal vein was encountered lying over both the facial nerve divisions while the upper division crossed superior to the vein.

It should be noted that this study and the present case-report may also represent a variation in the formation of the retromandibular vein. This is due to the superficial temporal vein joining the maxillary

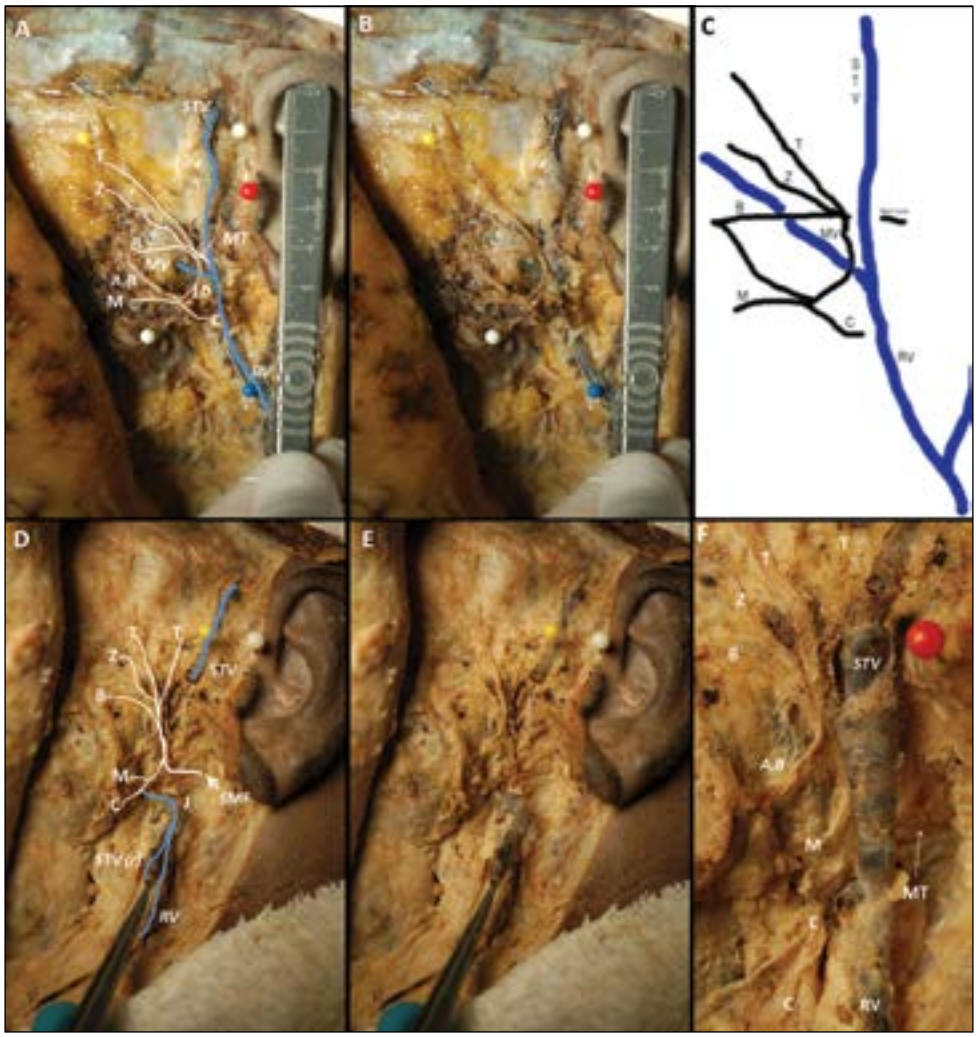

Figure 1. Facial nerve variation. **A.** Labelled left superficial parotid dissection showing the facial nerve variation in relation to the superficial temporal and maxillary veins with scale; **B.** Unlabelled left sided schematic of facial nerve variation; **C.** Schematic of facial nerve variation; **D.** Labelled left superficial parotid dissection showing the facial nerve variation with superficial temporal vein reflected inferiorly; **E.** Unlabelled left superficial parotid dissection showing the facial nerve variation with superficial temporal vein reflected inferiorly; **F.** Enhanced image of left superficial parotid dissection showing the facial nerve trunk deep to superficial temporal vein; A.B — anastomosing branch; B — buccal branch; C — cervical branch; J — junction of STV and MV; M — marginal mandibular branch; MV — maxillary vein; RV — retromandibular vein; RV(r) — retromandibular vein reflected; SMF — stylomastoid foramen; STV — superficial temporal vein; T — temporal branch; Z — zygomatic branch; Pins: Upper white — junction of zygomatic arch and pre auricular dissection line; Lower white — angle of mandible; Yellow — temporal branch crossing zygomatic arch; Red — tragal pointer; Blue — retromandibular vein.

vein in the parotid substance inferior to the tragal point, which is much more inferior than is generally recognised [7]. Considering the aberrant location of the superficial temporal vein, lying lateral to the facial nerve trunk in this case, and not the expected retromandibular vein the potential for injury to the facial nerve is significant. This is especially relevant in the context of parotid and condylar surgeries for clinicians who use the retromandibular vein as a landmark deep to which the facial nerve is not expected to be encountered [11]. In particular, the present report demonstrates that the superficial temporal vein may be the first venous landmark encountered during a retromandibular — retroparotid surgical approach to the condyle.

Descriptions of both the transparotid and retroparotid approaches to the mandibular condyles stress the importance of remaining superficial to the retromandibular vein [11]. Both surgical approaches rely on conventional knowledge of normal anatomy of the facial nerve and its relationship to the retromandibular vein. In particular, the retroparotid approach relies heavily on the knowledge that the facial nerve lies superficial to the retromandibular vein [11].

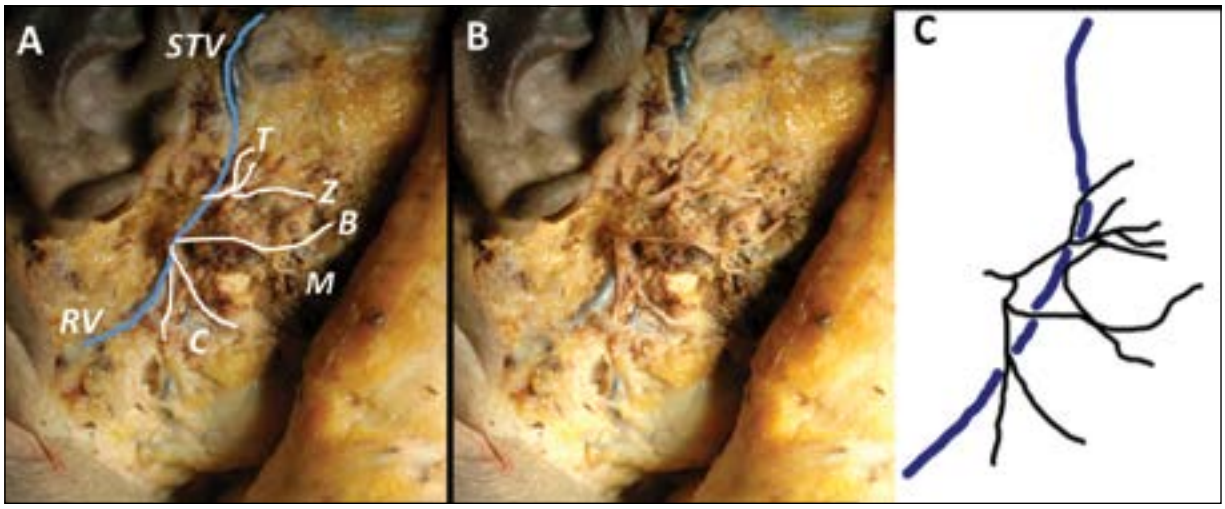

Figure 2. Normal facial nerve anatomy; **A.** Labelled right facial nerve dissection showing no variation with the retromandibular vein deep to the facial nerve; **B.** Unlabelled right facial nerve dissection showing no variation with the retromandibular vein deep to the facial nerve; **C.** Schematic of right facial nerve superficial to retromandibular vein; B — buccal branch; C — cervical branch; M — marginal mandibular branch; RV — retromandibular vein; STV — superficial temporal vein; T — temporal branch; Z — zygomatic branch.

We present a case where the arrangement of the intra-parotid venous structures is such that the superficial temporal vein would not likely be confused with the retromandibular vein. The anatomical variant would not be appreciated through a small 1–2 cm incision during mandibular condyle surgery. As such, the facial nerve, which lies deep to the superficial temporal vein, is at great risk and the level of damage likely in our case, would be damage to the main trunk, resulting in hemifacial weakness.

Potential variations of the facial nerve and its relationship to the venous structures within the parotid gland should be considered during surgery. Mandibular condyle access surgeries provide limited views of the structures involved. Hence, there is more likelihood of damage, as opposed to the wide front (Lazy S) views provided by parotid dissections, especially if variations exist.

CONCLUSIONS

In the present report, the main trunk of the facial nerve lies medial to the superficial temporal vein, yet lateral to the maxillary vein. In addition, the maxillary and superficial temporal veins merge in the substance to the parotid and not at the superior border of the parotid as previously recognised. This has particular surgical significance during retromandibular-retroparotid approaches to the mandibular condyle, as the retromandibular vein may not be the first venous structure encountered.

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