Anatomical Guides to Precisely Localize the Frontal Branch of the Facial Nerve

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Objective: To define the relationship between the frontal branch of the facial nerve and a series of blood vessels that are encountered during endoscopic forehead procedures.

Design: Anatomical study using 6 fresh cadavers (12 sides).

Results: In 11 of 12 dissected specimens, the blood vessels in the temporal region were found to lie within 2 mm of the frontal branch of the facial nerve.

Conclusions: We believe that a series of veins encountered during endoscopic forehead procedures provide the surgeon with the ability to identify the precise location of the frontal branch of the facial nerve. During endoscopic surgery, these vessels are found in a plane between the deep temporal fascia (below) and the superficial temporal fascia (above). We believe that these vessels can be thought of as arrows pointing superiorly to a frontal branch of the facial nerve as it courses through the superficial temporal fascia.

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Knowledge of and respect for the facial nerve, particularly the frontal branch, are of paramount importance in the safe execution of surgical procedures in the temporal area. The course of the frontal branch as it exits the parotid gland and weaves its way through fascial planes en route to the forehead is well documented in numerous reports. However, with the advent of endoscopic facial procedures, surgeons encounter a new perspective on this anatomy. Despite the abundance of anatomical studies of the facial nerve, few reports are available to guide endoscopic surgeons.

During the course of endoscopic dissection, a series of vessels are seen bridging the superficial temporal fascia (temporoparietal fascia) above and the deep temporal fascia below. These vessels are located in close proximity to a topographical marker for the frontal branch of the facial nerve. In some patients, they appear to mimic the mark on the undersurface of the flap, marching from the zygoma up to the frontalis muscle. Our goal was to define the relationship of these vessels to the frontal branch of the facial nerve.

Methods

A total of 6 fresh cadaver heads were obtained and dissected (12 sides). Five cadavers were of average body habitus, and 1 cadaver was cachectic.

Before the dissection was begun, the frontal branch was mapped out topographically. A line was drawn from the tragus to the lateral canthus. A second line was drawn from the inferior aspect of the ear lobe to the forehead through a point that bisects the first line. This second line closely parallels the path of the frontal branch. The line of Pitanguy is nearly identical; however, it is described in relation to a person’s eyebrow, which is highly variable and sometimes absent.

An initial set of pins were pushed through the marking and left in place (Figure 1). A lateral incision overlying the temporalis muscle was carried down to the deep temporal fascia. Under direct visualization, dissection toward the zygomatic arch was performed. As bridging veins were encountered, a second set of marking pins were placed transcutaneously, with care taken to penetrate through the lumen of the observed vein (Figure 2). Dissection was continued carefully down to the zygomatic arch and out medially onto the frontal bone.

After the veins were marked, the relationship to the frontal branches needed to be established. A wide preauricular parotidectomy incision was made, with extension up onto the temporalis muscle. This incision was connected to the previously made lateral temporalis incision.

A flap was then created overlying the parotid fascia. The main trunk of the facial nerve was located and dissected out to the pes anserinus. The superior division was
traced out along the frontal (temporal) and zygomatic branches.

The location of the previously placed marking pins was noted in relation to the frontal (temporal) branch of the facial nerve (Figure 3). Two sets of pins were placed (first set through topographical mark; second set through veins); therefore, data were obtained relative to both the veins and the topographical mark. Photodocumentation was carried out with a 35-mm camera and a 2.3-megapixel digital camera in macromode.

**RESULTS**

The frontal branch of the facial nerve was identified in all specimens. Although referred to as a branch, it consisted of no less than 2 branches in each cadaver. In 8 of 12 sides, a frontal branch was noted to extend posterior to the temporal hairline. Multiple vessels bridging the gap between the surgical plane of the superficial temporal fascia (above) and the superficial layer of the deep temporal fascia (below) were noted in 11 of 12 specimens (Figure 4). Dissection on 1 side of 1 cadaver failed to reveal any identifiable vessels in this plane. Superior to the zygomatic arch, the frontal branch rose into the superficial temporal fascia and was well protected by it. In other words, the nerve was found to lie within the superficial temporal fascia and was not exposed on the immediate undersurface of it.

The initial set of pins (placed through the topographical line) were noted to lie within 3 mm of a branch of the nerve. The second set of transcutaneous pins (placed into the vessel lumen) were found to lie within 2 mm of a frontal branch in all cases. In most specimens, the pins passed through a nerve branch and into a vessel lumen. A relatively larger vessel was noted in 11 of 12 specimens in the area near the zygomaticofrontal suture.

**COMMENT**

Endoscopic forehead and midface lifting has proved to be a reliable surgical procedure for rejuvenation of the aging face.\(^1\)\(^2\) It has replaced coronal and pretrichial forehead lifts in our practice. Smaller incisions, decreased risk of alopecia, and results that are equivalent to the aforementioned procedures are among the benefits of endoscopic forehead lifting. Dissection of the midface is an extension of this procedure and provides us with a means of repositioning the malar fat pad. However, a zygomatic subperiosteal dissection has been a concern among surgeons who are wary of the close proximity of the frontal branch of the facial nerve. The details of the procedure have been described elsewhere\(^6\) and are not the focus of this report.

The frontal or temporal branch of the facial nerve diverges from the main trunk below the zygomatic arch within the substance of the parotid gland. We observed that the temporal branch should more accurately be labeled the temporal branches. As it crosses the zygoma,
the nerve was separated into multiple distinct branches, anastomosing with one another as they coursed superiority. This multiplicity of branches is consistent with the findings of other authors\textsuperscript{2,7} and differs notably from those reported by Pitanguy and Ramos,\textsuperscript{8} who described a single branch. Above the zygomatic arch, extension of a ramus posterior to the anterior hairline was not unusual in our experience (8 of 12 sides). This finding is in contrast to that reported by Furnas,\textsuperscript{9} who noted that the area behind the temporal hairline was safe for dissection.

In our specimens, the frontal branches superior to the zygoma appeared to course within the superficial temporal fascia (protected by it). Liebman et al\textsuperscript{10} reported similar results in their analysis of 26 cadaver specimens.

The vessels observed in the dissection bridged the surgical plane between the superficial temporal fascia (above) and the deep temporal fascia (below). The superficial temporal vein is the largest named vessel in the vicinity; however, the vessels that we are describing within the brow have not been specifically named. The presence of a large perforating vessel (the sentinel vein) 1 cm lateral to the frontozygomatic suture line has been noted by others, including Liang\textsuperscript{10} and Ramirez.\textsuperscript{11} In 1998, Trinei et al\textsuperscript{12} mapped out a zone of caution based on the location of the sentinel vein and its proximity to the frontal branch. They found that the nerve was always within a 10-mm radius of this vessel. We noted the presence of this vessel in 11 of 12 specimens; however, we believe that the nerve is much closer (0-2 mm). We also encountered more than 1 identifying vessel during dissection in the temporal area (Figure 4). These other vessels also mark the location of one of the branches of the frontal division.

The clinical importance of this relationship is an improved awareness of the location of the frontal branches. This knowledge should enable a safer dissection and provide important landmarks for less experienced surgeons. The proximity of the nerve vessels highlights the need for bipolar cautery at the base of the vessel (on the surface of the deep temporal fascia). In some patients, a favorable distribution of these vessels will allow surgery to proceed without the need for cautery in the temporal area. The ability to operate around the vessels rather than dividing them with cautery becomes feasible with more experience.

Our findings also confirmed the reliability of the topographical preoperative topographical mark for the frontal branch. In all specimens, we were able to locate a branch within 3 mm of the mark.

In the senior surgeon’s (V.C.Q.) experience with more than 350 cases, short-term (8-12 weeks) postoperative frontal branch paresis has been observed; however, no cases of permanent injury have occurred. Eight patients have been noted to have paresis of one side of the brow after undergoing the endoscopic forehead/midface lift. In 7 cases, the paresis resolved within 3 months. One patient had impaired motion that took 6 months to resolve. We believe that the paresis was related to either thermal injury or excessive traction. Thermal injury occurs when cautery is transmitted along the bridging vessels to the upper flap and into the nerve. Cautery of the vein should always be carried out closer to the vessel’s entry point into the deep temporal fascia to minimize the risk of permanent nerve damage. It is also possible that prolonged dissection and the resulting traction on the flap could temporarily impair axonal flow. For this reason, the placement of a retractor against the flap should be guided by the topographical mark.

CONCLUSIONS

Many facial plastic surgeons performing endoscopic forehead procedures avoid midfacial dissection because of concerns about injury to the frontal branch. In addition to external landmarks, we believe that a series of veins encountered during the procedure provide the surgeon with the ability to identify the precise location of the frontal branch of the facial nerve. During endoscopic temporal surgery, these vessels are found in a plane between the deep temporal fascia (below) and the superficial temporal fascia (above). We believe that these vessels can be thought of as arrows pointing superiorly to a frontal branch of the facial nerve as it courses through the superficial temporal fascia.

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REFERENCES