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Use of the frontal branch of the superficial temporal artery and the postauricular vein to overcome anatomic variations of superficial temporal vessels in scalp reconstruction with free tissue transfer: a case report

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Case Report

The superficial temporal artery (STA) bifurcates into frontal and parietal branches. The parietal branch is used as a recipient vessel for scalp reconstruction, but it is absent in approximately 16.3% of individuals. In this case, a 72-year-old woman with an occipital scalp defect lacked both the parietal branch of the STA and the superficial temporal vein. To address this anatomic variation, we used the frontal branch of the STA and the posterior auricular vein as alternative recipient vessels for anterolateral thigh free flap reconstruction. The surgical procedure involved end-to-end microvascular anastomosis of one artery and one vein. Partial flap necrosis occurred postoperatively, but eventually resolved with debridement. The frontal branch of the STA and the posterior auricular vein can serve as reliable alternatives in the absence of the parietal branch. Reconstructive surgeons should be aware of anatomic variations of the STA and adapt their surgical approach accordingly.

Abbreviations: MTV, middle temporal vein; OA, occipital artery; PAA, posterior auricular artery;; PAV, posterior auricular vein; STA, superficial temporal artery; STV, superficial temporal vein

Keywords: Case reports / Free tissue flaps / Scalp / Temporal arteries

INTRODUCTION

The superficial temporal artery (STA) courses within the superficial temporal fascia, which constitutes an extension of the galea and the superficial muscular aponeurotic system of the face, and it typically bifurcates into two branches: an anterior frontal branch and a posterior parietal branch [1]. The superficial temporal vein (STV) originates from a venous plexus on the side and vertex of the skull. It communicates with the frontal and supraorbital veins, the STV of the contralateral side, and the posterior auricular vein (PAV) and occipital vein [2].

The parietal branch of the STA and STV is more commonly used in free flap scalp reconstructions than the frontal branch, primarily due to its proximity to the wound site and the low risk of facial nerve injury. However, a study by Rusu et al. [3], which involved tomography angiograms of 43 patients, showed that the parietal branch of the STA was absent unilaterally in

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16.3% of cases and bilaterally in 9.3%.

When the parietal branches of the STA and STV are absent, the occipital artery and vein may serve as alternatives. However, their distance from the wound site and the abundance of arterial branches typically render them less suitable for free tissue transfer. A deep understanding of anatomical variations and the careful selection of appropriate recipient vessels are essential for successful scalp reconstruction. This report describes a case where the absence of the parietal branch of the STA and STV necessitated the use of the frontal branch of STA and the PAV.

CASE REPORT

A 72-year-old woman arrived at the hospital with a 12×6 cm skin and soft tissue defect on her occipital scalp, caused by a traumatic head injury (Fig. 1A). Initially, she was admitted to the intensive care unit for conservative management of a subgaleal hematoma. She was then referred to the plastic surgery department for wound coverage. One week before scalp reconstruction, surgical debridement was performed to expose the periosteum. Considering the large size of the defect and the need for a long pedicle to connect the flap to the recipient artery and vein, scalp reconstruction with a free anterolateral thigh flap was planned.

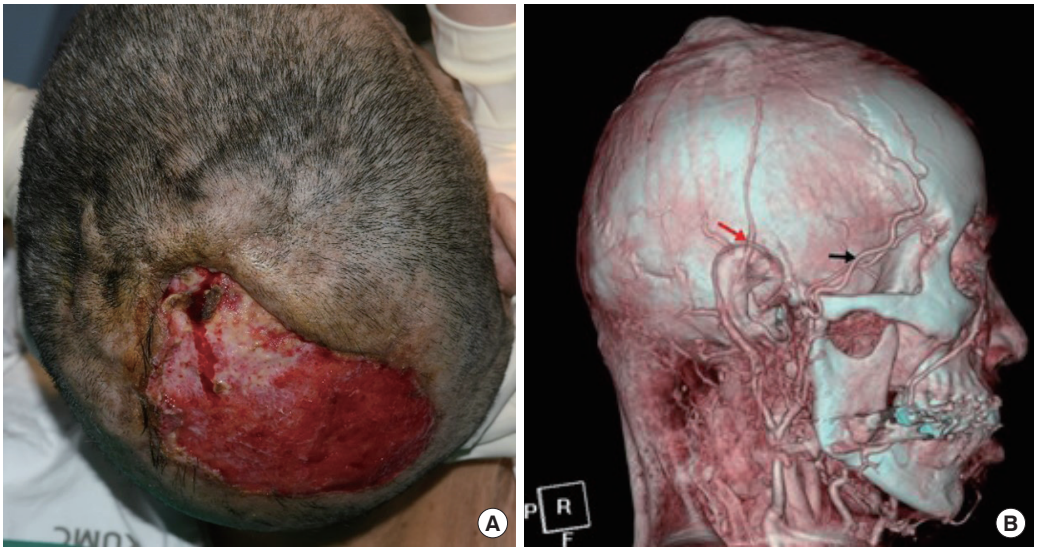

Fig. 1. A 72-year-old woman presented a 12×6 cm skin and soft tissue defect on the occipital scalp resulting from a traumatic head injury with absent parietal branches of the superficial temporal artery and superficial temporal vein on her right temporal scalp. A preoperative image and computed tomography angiography show (A) a 12×6 cm occipital scalp defect and (B) absence of the parietal branch of the superficial temporal artery (black arrow), along with compensatory enlargement of posterior auricular vein (red arrow).

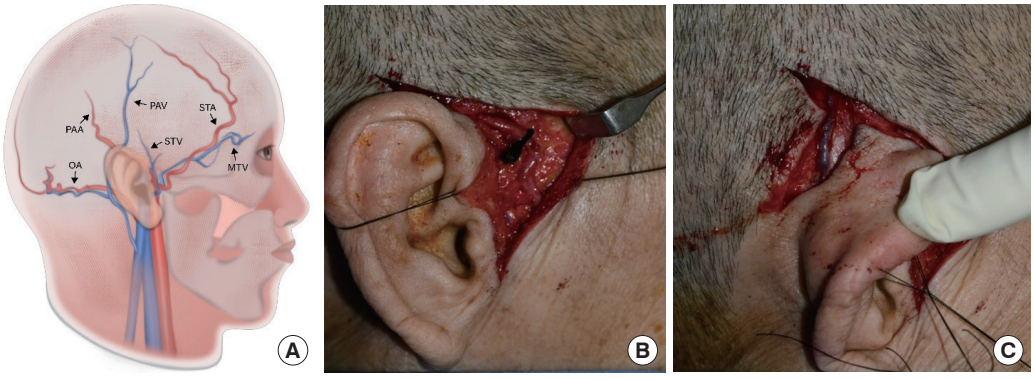

Fig. 2. Recipient vessels and schematic diagram. (A) The PAV had a larger caliber than the STV and the MTV was situated beneath the superficial layer of the deep temporal fascia. (B) Posteriorly rotated frontal branch of the STA. (C) Compensatory enlargement of the PAV. STA, superficial temporal artery; STV, superficial temporal vein; PAV, posterior auricular vein; PAA, posterior auricular artery; MTV, middle temporal vein; OA, occipital artery.

A preoperative evaluation of the recipient vessel was conducted through computed tomography angiography, which revealed the absence of the parietal branch of the STA and hypotrophy of the parietal branch of the STV on the right side, which was in close proximity to the wound (Fig. 1B). Furthermore, we observed compensatory enlargement of the PAV, which coursed superiorly (Fig. 1B). However, the posterior auricular artery (PAA) and the frontal branch of the STV were relatively small for use as recipient vessels (Fig. 2A). Although the middle temporal vein was adjacent to the frontal branch of the STA, it was located beneath the superficial layer of the deep temporal fascia, making it impractical for use. Due to these anatomical variations, the decision was made to utilize the frontal branch of the STA and the PAV as alternative recipient vessels.

A preauricular skin incision was made for recipient vessel dissection, and meticulous dissection was carried out through the temporoparietal fascia and into the subcutaneous layer. The frontal branch of the STA was identified, and approximately 2–3 cm of the artery was dissected to allow sufficient length for rotation to the root of the helix (Fig. 2A). Special care was taken to avoid injury to the facial nerve during this process. Following this, a 2 cm postauricular incision was made, and the PAV was meticulously dissected to achieve a 2 cm length in the subcutaneous layer, thereby minimizing pedicle tension during the insetting procedure (Fig. 2B and C).

A 15×6 cm anterolateral thigh free flap was harvested from the left thigh. End-to-end microvascular anastomosis was performed using a 9-0 nylon suture (Fig. 3A), and adequate flap perfusion and drainage were confirmed (Fig. 3B). On the second postoperative day, venous congestion was observed at the inferior border of the flap. After removing a few stitches, improvement was noted. The patient exhibited neither facial nerve weakness nor any significant complications following the surgery (Fig. 4).

DISCUSSION

Scalp reconstruction is a complex surgical procedure that involves various techniques, including skin grafts, tissue expansion, and free tissue transfer [4-6]. Free tissue transfer is typically chosen when the defect is substantial in size and the surrounding soft tissue quality is compromised [7].

Due to their proximity, the STA and STV are generally preferred as recipient vessels [8,9]. However, alternatives such as the facial artery and vein, or the occipital artery and vein, can be considered in cases of significant size mismatch or vascular

Fig. 4. Postoperative image of recipient site 3 weeks later.

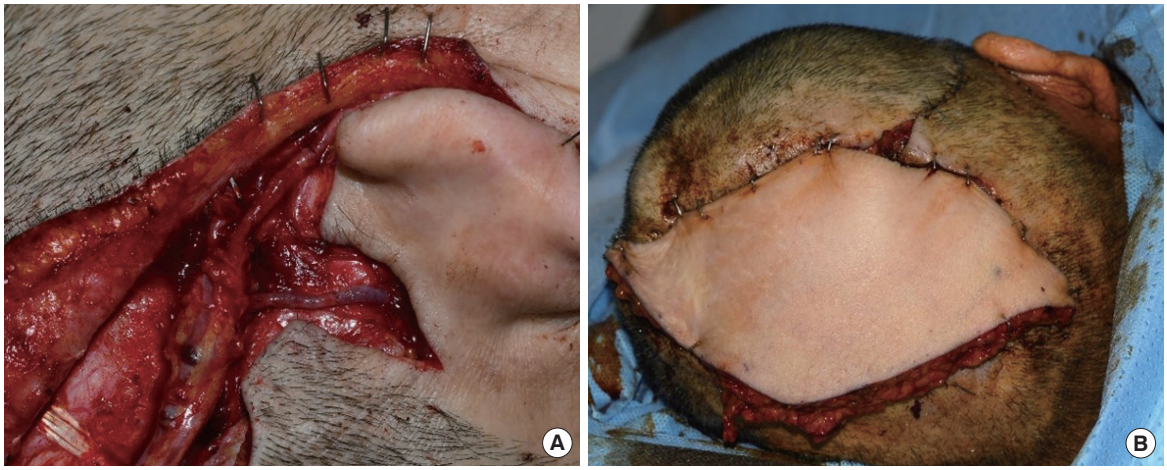

Fig. 3. Intraoperative images. (A) End-to-end anastomosis. (B) Flap insetting.

variations. Nevertheless, vein grafts pose an inherently high risk of flap failure [10].

The STA and STV typically bifurcate into frontal and parietal branches, but the absence of the parietal branches constitutes a known anatomic variation. Studies by Rusu et al. [3] and Marano et al. [11] reported this absence in 16.5% and 2% of cases, respectively. In such cases, the PAA or occipital artery, along with the PAV, takes over the vascular territory usually supplied by the parietal branch [12]. A study by Nokovitch et al. [13] reported that the common temporoparietal trunk of the STV was found in all cases, and the STV systematically preceded the STA in the preauricular area. The diameter of the STV presented major variations among individuals, with a median diameter of 1.3 mm, and the parietal branch of the STV usually had a caliber sufficient for anastomosis.

The frontal branch of the STA typically runs close to the facial nerve, which generally makes it a less favorable choice due to the risk of nerve damage. However, in our case, careful dissection allowed us to preserve the facial nerve while obtaining a sufficient length (2–3 cm) of the frontal branch for posterior rotation and anastomosis. Similarly, the PAV's small diameter can pose challenges. Interestingly, in our case, the PAV exhibited compensatory enlargement, resulting in a diameter of 1.5 mm that was suitable for this procedure. Therefore, our case demonstrates the feasibility of utilizing the frontal branch of the STA and the PAV for scalp reconstruction, even when the parietal branches of the STA and STV are absent. To the best of our knowledge, there are few previous reports of using the PAV as the recipient vein in free flap reconstruction. Sinclair et al. [14] reported a case where the parietal branch of the STA and PAV were used at the superior aspect of the helical rim to address defects in the temporal region. However, there are no documented cases similar to ours, where the frontal branch of the STA and PAV were used for reconstructing posterior scalp defects. This highlights the novelty of our approach in addressing complex reconstructive challenges.

Preoperative angiography is crucial for reconstructive surgeons to identify anatomical variations and optimize the success of scalp reconstruction. If both parietal branches are absent, the STA frontal branch and the PAV can serve as viable alternative recipient vessels.

NOTES

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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Ethical approval

The study was approved by the Institutional Review Board of Korea University Anam Hospital (IRB No. 2024AN0025).

Patient consent

The patient provided written informed consent for the publication and use of her images.

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