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A thin superficial temporalis artery revealed by total necrosis of an island scalp flap, a case report

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ABSTRACT

INTRODUCTION AND IMPORTANCE: The superficial temporalis artery (STA) counts as one of the most reliable blood supplies capable of supporting the vascularization of the entire scalp. Therefore, total necrosis of a scalp flap based on the superficial temporalis artery is a rare complication.

CASE PRESENTATION: A 43-year-old woman with a history of hypertension and cerebral stroke presented to our consultation for fronto-parietal scalp alopecia. The scar was the result of spontaneous healing of a chemical burn that occurred eight months earlier. We performed the first step of scalp expansion and raised a parietal expanded goblet island flap based on the right STA. In the postoperative period, the flap developed progressive necrosis. Despite the release of tension and stab incisions, the flap failed in a week. An angio-MRI revealed a thin STA on the right compared to the left side. After debridement, the necrosis was superficial, deep galea, and some subcutaneous tissues were viable. We performed a split-thickness skin graft that achieved a total wound closure.

CLINICAL DISCUSSION: An extensive exploration of the vascular supply of the scalp before raising a scalp flap is not a common rule. The anatomical variation that we discovered as a thin superficial temporal artery may have explained the total failure of this flap surgery.

CONCLUSION: Surgeons should keep in mind the possible existence of a detrimental anatomical variation when planning a single pedicled scalp flap.

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1. Introduction

The improved knowledge of vascular anatomy has empowered flap surgery in the scalp region. Five trunks including supratrochlear artery, supraorbital artery, retro-auricular artery, superficial temporal artery (STA), and occipital artery, all branches of the internal and external carotid arteries provide a particularly rich vascular network to supply the scalp.

The STA is one of the most crucial vascular pedicles, the terminal branch of the external carotid originating in the parotid gland behind the neck of the mandible. Above the zygomatic process, the STA divides into two main branches, which are the frontal and the parietal divisions [1–3]. The terminal branches connect anastomoses with the auricular and occipital arteries and the con-

tralateral side. Based on the existence of these anastomoses, it is possible to raise a large scalp flap based on a single STA pedicle [2,4,5]. Anatomical studies have reported some variations in the STA, mainly concerning the point of the division into the frontal and the parietal branches and the diameter of each branch [1,3,6,7]. A true thin STA (less than 1.5 mm diameter) is rare [3]. Ahmed et al. (2018) discovered two cases in 28 cadaver dissections but did not precise if the abnormally was unilateral or bilateral [1]. To the best of our knowledge, there is no report about the clinical implications of these variations. Consequently, only cases requiring microsurgery were reported to perform extensive preoperative investigations, particularly to assess the diameter of the artery for an easy vascular anastomosis [3]. However, the viability of a flap based on the STA is likely to be impacted by some of the anatomical variations, especially the one concerning the diameter at the origin of the artery.

We came across a rare complication of total necrosis of an STA-based scalp flap in a patient in whom a post-operative angio-MRI revealed a thin right STA.

This publication is in line with the recent SCARE criteria [8] to report this rare complication and the related clinical implications as a cautionary observation especially for the community of surgeons involved in the surgery of scalp flaps.

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Fig. 1. A- Initial presentation of the alopecia on the fronto-parietal scalp after tissue expansion, B- Raise of a goblet scalp flap based on the STA, C- Immediate post-operative image, D- Necrosis of the flap.

2. Presentation of case

A 43-year-old woman with a history of hypertension and cerebral stroke presented to our consultation in the department of plastic and reconstructive surgery (Casablanca, Morocco) with a fronto-parietal scalp alopecia that stemmed from a chemical burn two years earlier. In her medical story, she reported hypertension and depression that she was taking medication for. There was no known family genetic disorder. A previous attempt to treat the alopecia with a follicular hair transplant in another centre has failed. We counselled the patient for tissue expansion surgery and scalp flap; she gave her written consent. The surgical team included a professor of plastic surgery, a registrar plastic surgeon, and residents in plastic surgery.

We put in the subgaleal plane a 300 mL rectangular expander that we filled progressively with sterile saline for two months until up to 20% of its capacity. (Fig. 1). There was no clinical symptom of complication as skin ulceration or skin necrosis. We went for a scalp flap based on the right STA artery and vein. Intraoperatively, the STA was manually palpated. We used no Doppler to localize the artery. A right STA-based goblet island flap was designed encompassing the expanded scalp (Fig. 1). Intraoperatively, we identified the parietal branch of the STA, but no frontal branch. We ligated and divided a communicating branch of the STA with the posterior auricular artery. A security margin of more than 3 cm of fascia

was maintained around the pedicle for venous drainage. We successfully covered all the alopecia of 11 cm in the horizontal plane over 8 cm on the sagittal plane (Fig. 1). On postoperative day 2, the anterior part of the flap became congestive. We applied stab incisions and removed some stitches. Nevertheless, the necrosis progressed to almost all the flap area within a week (Fig. 1). In the assessment of this failure, the patient underwent an angio-MRI that revealed a thin right-sided STA at its origin measuring around 0.11 cm, and the absence of its frontal branch (Fig. 2). The patient did not agree to opacifications; hence, we could not explore better the vascular tree of the STA. We informed the patient about the complication and the findings on the angio-MRI. Then, we performed a surgical debridement of all necrosed tissues. We removed almost all the entire superficial layer of the flap, leaving a plane of fat and galea (Fig. 3), and covered the raw area with a split-thickness skin graft taken from the thigh. The wound healed completely (Fig. 3). Although the alopecia became more evident, the patient showed a good understanding of the situation and was keen on another surgical stage of scalp expansion in the future.

The ethics committee of the Ibn Rochd hospital also gave its approval for the publication of the case.

The present article is registered as a first record of this abnormality with a clinical implication.

The registry number is 6248 [9].

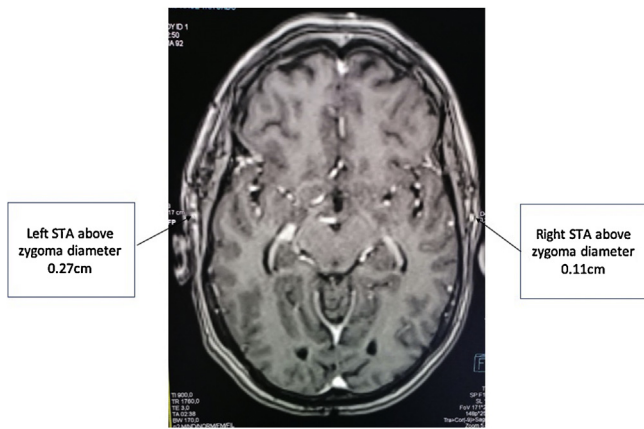


Fig. 2. MRI image of the scalp showing the thin superficial temporal artery on the right side.

3. Discussion

Among the arteries that supply the scalp, the STA is perceived as one of the most important [3,4,7,10]. Many authors have agreed with the STA versatility [2,10,11]. Among authors who practiced scalp replantation surgery, Nguyen et al. (2012) [11] have stressed

that one vessel, mainly the STA was sufficient to keep the entire scalp viable. Therefore, we based our reconstruction plan on this knowledge. In searching for a potential cause of the failure of our procedure, we came across a particular anatomical pattern of unilateral thin right STA and the absence of its frontal branch. This finding is rare, as confirmed by previous anatomical studies and those published by Ahmed AG et al. (2018) [1] and Pinar YA et al. (2006) [3] in cadaver studies, and Medvedev F et al. who studies living subjects through angiogram (2015) [7]. Many authors using the STA island flaps trace the vessel with a hand-held Doppler [2,4]. Previous studies have not provided any recommendation for extra radiological vascular studies except when microsurgery is planned to assess the diameter of the artery for an easy microvascular anastomosis [3,7]. However, to the best of our knowledge, there was no reported case of total necrosis of an island flap based on the STA as we observed in our patient with the anatomical variation. The main complication that surgeons reported was venous congestion [3,10,12]. This complication needs no treatment in some cases. In several cases, suture release or stab incisions were required. The venous drainage of the flap is thought to depend not only on the superficial temporal vein (STV) but also on the facial network. For this reason, many authors recommend keeping at least 2–2.5 cm of fascia around the pedicle during the elevation of the flap [2,5,10]. In our case, we kept about 3 cm of fascia around the pedicle.

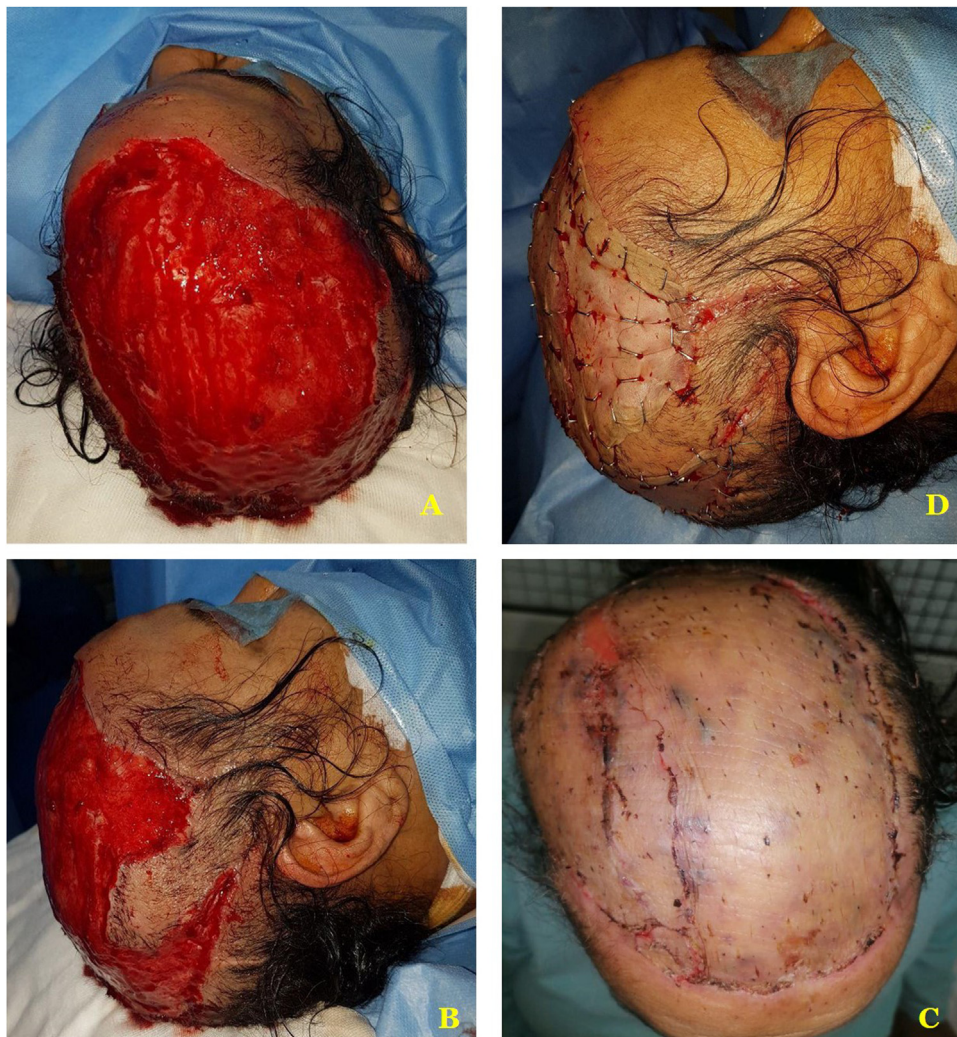


Fig. 3. A and B- Raw area after directed wound healing, C and D- resurfacing with a split thickness skin graft.

Moreover, skin expansion is believed to have a positive impact on vascularity, acting as a delayed flap procedure [13]. We think that the detrimental factor in our case was the STA diameter on the right side, which was too thin to supply this large skin paddle. Unfortunately, this finding was detected in the post-operative time, resulting in an increased area of alopecia.

This case may have ended in legal action by the patient. However, she did not ask for any compensation and showed a deep understanding.

4. Conclusion

This article describes a rare case of total failure of a scalp island flap and postoperative finding of a unilateral thin STA. We hypothesized that the STA calibre played a critical role in the occurrence of the encountered complication.

Based on this hypothesis, we suggest that surgeons be careful when planning an island scalp flap based on a single pedicle; they may ask for radiological exploration in case of doubt.

Future researches should focus on the clinical impact of some STA anatomical variations, especially those concerning the diameter of the artery.

Declaration of Competing Interest

The authors report no declarations of interest.

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Ethical approval

The ethics committee of the Ibn Rochd teaching hospital gave their approval for the publication of this case report.

Consent

Patient consent was received.

Author contribution

Acquisition of data: KSA, AY, JLM.
 Analysis and interpretation of data: KSA, AH, MD.
 Drafting of manuscript: KSA, AY, JLM, AE.
 Critical revision: KSA, AY, JLM.

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