

Modified method of scalp fixation promotes survival of complete scalp avulsion replantation

Lei Xu¹, Guangliang Zhou¹, Wen Ju¹, Yujun Zhang¹, Qianheng Jin¹, Lei Li¹, Ruixing Hou¹, and Jihui Ju¹

¹Suzhou Ruihua Orthopedic Hospital

June 08, 2024

Modified method of scalp fixation promotes survival of complete scalp avulsion replantation

Key Clinical Message

A complete scalp avulsion injury is rare but extremely challenging to treat. Due to the dense blood vessel bundles present in the scalp, replantation failure may occur if there is a subcutaneous hematoma. The method of scalp fixation is crucial for replantation to be successful. We successfully treated a total scalp avulsion injury using a modified scalp fixation method, coupled with microsurgical anastomosis, to avoid subcutaneous hematoma effectively and achieved a satisfactory outcome with a follow-up of nine years postoperatively.

Keywords: Scalp fixation, Microsurgical replantation, Complete scalp avulsion, Case report

Introduction

Full-scalp avulsion injuries are often caused by hair being caught in rapidly rotating machinery, frequently accompanied by extensive skin loss and even exposure of the cranial bones^[1-2]. The scalp comprises dense hair follicles, a thick dermis, and nerves and blood vessel bundles. Significant blood loss often occurs in cases of full scalp avulsion injury, which can be life-threatening in severe cases. In recent years, advancements in microsurgery have provided new approaches for treating complete scalp avulsion injuries^[3-4]. In some cases, the success of microsurgical replantation can be negatively affected by subcutaneous hematoma or inadequate drainage. Most of the literature on scalp avulsion has focused on scalp replantation, with few addressing the scalp's fixation in replantation. Replantation failure may occur if there is a subcutaneous hematoma or inadequate drainage due to the dense blood vessel bundles in the scalp. In addition to efficiently preventing scalp separation from subcutaneous bruising, suturing the scalp to the periosteum can stop bleeding by compression and increase the survival probability after scalp replantation. In this study, the author presents a technique utilizing a spider web-like suturing method to secure the scalp, effectively preventing subcutaneous hematoma formation and promoting successful replantation of total scalp avulsion injuries and achieves satisfactory results with a follow-up of nine years postoperatively.

Case History

A 36-year-old female patient suffered a total scalp avulsion injury due to her hair getting caught in the rotating shaft of a machine. The scalp is avulsed from the galea aponeurotic, anteriorly extending from the nasion, the mid-eyebrows, and lower eyelids bilaterally, posteriorly to the occipital scalp, laterally reaching the bilateral auricular roots and zygomatic arches, with an approximate area of 35.0 cm × 40.0 cm. The left auricle is torn and severely abraded, with exposed frontal, parietal, occipital, and temporal bones (Figure 1). The patient was admitted almost 3.5 hours after the trauma.

Methods

The surgery was conducted in two groups: one group managed the scalp by cutting the hair, disinfecting the scalp with iodine, trimming the skin edges, identifying and marking blood vessels, while the other group managed the skull by disinfecting the skin and wound with iodine. After cleaning the wound, carefully identifying the blood vessels, and marking the superficial temporal arteries, veins, and occipital subcutaneous veins on both sides for later use, a spider-web suture technique was used. Starting from the cranial vertex, the scalp was meticulously sutured in place, one layer at a time, with absorbable sutures. The subcutaneous tissues on the left and right temporal sides were sutured and fixed to the periosteum. Under the surgical microscope, the two arteries and four veins were delicately anastomosed using 10-0 non-traumatic sutures, restoring blood circulation to the scalp. The subcutaneous tissues were sutured and fixed to the periosteum of the skull using 4-0 absorbable sutures to ensure close approximation of the skin to the skull and prevent subcutaneous hematoma. Drainage tubes were placed under the scalp and incision sites (Figure 2). Postoperatively, the drainage tubes were removed on the second postoperative day.

Conclusion and Results

Scalp replantation can achieve satisfactory results, while spider-web fixation of the scalp can effectively prevent subcutaneous fluid accumulation, significantly improving the survival rate of scalp replantation. By the tenth day postoperatively, the scalp had fully healed. Viable scalp hair growth was observed two months postoperatively, and at nine years postoperatively, hair growth was dense and nearly equivalent to preoperative levels. Eyelashes grew well, there was no local alopecia, the scalp texture was soft, the protective sensation was restored, and there was no impairment of eyelid opening or closing (Figure 3).

Discussion

Complete scalp avulsion is a rare and life-threatening injury typically resulting from the entanglement of long hair in rotating machinery, such as agricultural or industrial equipment. Various treatment methods for scalp avulsion include thinning the scalp into medium-thick skin flaps and replanting them in situ^[5]. However, the success rate of this method is relatively low. For cases with exposed cranial bones, skull perforation can be performed, and skin grafting is done after granulation tissue formation. Another approach involves using the greater omentum for free transplantation to the head, with skin grafting on the greater omentum^[6-7]. However, these methods may result in alopecia deformities. With the advancement of microsurgical techniques, utilizing vascular anastomosis for full scalp replantation is considered the best method for treating scalp avulsion injuries. This approach ensures blood supply to the scalp and promotes hair regrowth, typically avoiding alopecia deformities.

The scalp receives a generous supply of blood from various arteries located in the subcutaneous layer above the galea, including the superficial temporal, occipital, supraorbital, and supra-auricular arteries. If postoperative drainage is inadequate, leading to the formation of a subgaleal hematoma, it can cause separation of the scalp and ultimately result in the failure of scalp replantation. Therefore, preventing scalp separation is key to ensuring scalp replantation's success. In this work, we have refined the technique for fixing the scalp, presenting a novel method that secures the scalp sporadically using a spider-web-like design. First of all, spider web anchoring of the scalp efficiently prevents displacement of the scalp during or after surgery, which could lead to vascular rips, breaks, anastomotic distortion, and the production of large subcutaneous hematomas after surgery. It also makes intraoperative vascular anastomosis easier. Second, it makes it easier for the recipient site and the replanted scalp to come into close contact, which promotes the development of a shared blood supply. Finally, it lessens subcutaneous oozing, successfully stopping hematomas from forming under the scalp. As a result, the enhanced scalp fixation technique can significantly increase the success rate of replantation.

Conflicts of interest

There are no conflicts of interest.

Authors' contributions

All authors were involved in this surgery. Lei Xu, Guangliang Zhou, Wen Ju, Yujun Zhang, Qianheng Jin, Lei Li collected and assembled the data. Lei Xu drafted the manuscript. Jihui Ju and Ruixing Hou critically revised the manuscript for intellectual content. All authors read and approved the final manuscript.

Consent

Written patient consent has been signed and obtained from the patient.

Founding

This study was mainly supported by a grant from the Suzhou Science and Technology Development Plan (Medical Innovation Applied Research) Project (SKY2023107, SKY2023108, SKYD2022073) and Suzhou Key Disciplines (SZXK202127).

References:

1. Lin J, Wei P, Wang Y, Song Q, Yang Z, Xu Y. Experience in microsurgical treatment of complete scalp avulsion. *Ann Plast Surg* 2023;90(4):331-333.
2. Staley CK, Hallock MM, Younggren BN. Complete scalp avulsion. *J Emerg Med* 2011;40(1): e19-e20.
3. Jennings M, Willet J, Cook S, Harbison J, Caplash Y, Solanki NS. Total scalp avulsion: Practical tips for successful replantation. *ANZ J Surg* 2022;92(4):880-881.
4. Madsen CB, Poulsen L, Bakholdt V, Sorensen JA. Microsurgical replantation of a traumatic total scalp avulsion. *BMJ Case Rep*2023;16(1): e252570.
5. Fijałkowska M, Antoszewski B. Complications after scalp suturing posttraumatic avulsion. *J Craniofac Surg* 2018;29(7): e670-e672.
6. Wu PF, Qing LM, Tang JY. One-stage reconstruction of huge scalp defect with a free vascularized greater omentum. *Ann Plast Surg*2019;82(1):128-129.
7. Browning FS, Eastwood DS, Price DJ, Kester RC. Scalp and cranial substitution with auto-transplanted greater omentum using microvascular anastomosis. *Br J Surg* 1979;66(3):152-154.

Hosted file

Image.docx available at <https://authorea.com/users/450049/articles/1084318-modified-method-of-scalp-fixation-promotes-survival-of-complete-scalp-avulsion-replantation>