

Total Scalp Reconstruction after Traumatic Avulsion: Case Report with Microvascular Anastomosis of the Facial Artery

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ABSTRACT

Complete scalp avulsion is a severe and rare traumatic injury, usually caused by high-energy occupational accidents, such as those occurring in agricultural or industrial settings. This injury presents a complex reconstructive challenge due to the extensive tissue loss and the need to restore both function and aesthetics of the cranial region. Microsurgery has become the gold standard for replantation of avulsed tissues, enabling optimal recovery when performed timely and with appropriate techniques.

We present the case of a 38-year-old female patient who sustained a total scalp avulsion after an accident at an agricultural processing plant. The flap was properly preserved and underwent microsurgical replantation by performing an end-to-end anastomosis between a scalp artery and the left facial artery. Due to the impossibility of performing venous anastomosis, complementary postoperative management techniques were applied to ensure tissue viability.

The patient exhibited a favorable clinical course with complete flap viability, partial regrowth of hair, and adequate aesthetic and functional integration. This case reinforces the importance of immediate care, specialized surgical management, and a multidisciplinary approach to optimize outcomes in patients with complex scalp injuries.

In conclusion, microsurgery is an essential tool for reconstructing extensive traumatic scalp avulsions, achieving anatomical and functional restoration with satisfactory aesthetic results, even in circumstances where venous anastomosis is not feasible.

KEYWORDS: Scalp avulsion, microsurgery, replantation, facial artery, craniofacial reconstruction.

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INTRODUCTION

Traumatic scalp avulsion is an uncommon but devastating injury involving extensive soft tissue loss and representing a significant surgical challenge due to the anatomical and functional complexity of the region. This type of trauma is

commonly associated with high-energy accidents, such as those caused by agricultural machinery, industrial equipment, or traffic collisions, and may compromise the vascular supply of large segments of the scalp, threatening the viability of the avulsed tissue.^{1,2}

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Successful management of these injuries requires rapid evaluation, proper flap preservation, and meticulous microsurgical reconstruction to achieve tissue reperfusion. Microvascular anastomosis techniques have allowed significant advances in this field, enabling replantation of total scalp flaps with good functional and aesthetic outcomes.³

In this article, we present the case of a patient with a complete scalp avulsion secondary to an accident, successfully reconstructed by microsurgery with an end-to-end anastomosis between a flap artery and the facial artery. Clinical findings, surgical approach, and postoperative evolution are described, highlighting the importance of a multidisciplinary approach and microvascular management in these complex injuries.⁴

CLINICAL CASE

A 38-year-old previously healthy female patient, without significant medical history, was admitted to the emergency department after suffering a work accident at an agricultural processing plant. According to eyewitnesses, the patient was accidentally caught by a grain processing machine, resulting in total scalp avulsion involving the frontal, parietal, temporal, occipital regions and hairline, without evident cranial bone loss.

Upon arrival at the hospital, the patient was conscious, oriented, hemodynamically stable, with a Glasgow Coma Scale of 15. A complete scalp avulsion with exposed calvaria, moderate active bleeding, and a partially viable avulsed flap was observed. The flap was transported with the patient, preserved under relative hypothermic conditions (wrapped in sterile moist gauze and placed in a sterile bag inside a container with ice).

A comprehensive evaluation by the plastic surgery and microsurgery team was performed. Given the flap viability and the patient's stable general condition, urgent microsurgical scalp replantation was planned. During surgery, careful debridement of necrotic edges, thorough irrigation of both donor and recipient beds, and an end-to-end anastomosis between a flap artery and the left facial artery were performed using microsurgical technique with magnification loupes and 9-0 nylon sutures.

Adequate flap perfusion was achieved, with progressive recovery of tissue color and turgor. The patient had a favorable immediate postoperative course, without signs of infection or significant graft necrosis. She was discharged on postoperative day 10 with multidisciplinary outpatient follow-up. At three months, the patient showed complete graft integration, partial hair regrowth, and satisfactory aesthetic and functional recovery.



Figures 1,2: Images prior to the surgical event.

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Figures 3,4,5,6: Immediate postoperative images.



Figures 7,8: Images 7 days after the surgical event

DISCUSSION

Total scalp avulsion is a rare but potentially devastating traumatic injury, frequently associated with occupational accidents, especially in agricultural or industrial settings where long hair can become entangled in rotating machinery. This trauma causes abrupt and extensive loss of skin, subcutaneous tissue, and galea aponeurotica, with bone exposure and profuse hemorrhage. Proper management requires rapid and multidisciplinary intervention, where microsurgery has proven fundamental to achieve successful functional and aesthetic reconstruction.^{5,6,7}

Historically, these injuries were treated with skin grafts or regional flaps, often resulting in cicatricial alopecia, loss of cranial contour, and complications such as infections or necrosis. However, since Mladick et al. reported the first successful microsurgical scalp replantation in 1971, significant advances have improved patient prognosis.⁸

In the present case, the patient suffered a total scalp avulsion secondary to agricultural machinery injury, with appropriate flap transport and surgical care within the critical 6-hour window, enabling successful microsurgical replantation. An end-to-end anastomosis between a flap artery and the facial artery was performed, a widely documented technique due to vessel accessibility, suitable caliber, and reliable flow. Although ideal reconstruction involves arterial and venous anastomoses, many cases lack suitable veins, necessitating adjunctive strategies such as controlled bleeding, anticoagulant therapy, and intensive monitoring to prevent venous congestion and necrosis.

Reconstructive microsurgery has revolutionized treatment of complex injuries like scalp avulsion, allowing replantation of

native tissues with excellent integration while minimizing additional procedures. It preserves important aesthetic characteristics such as hairline, color, texture, and hair growth direction, which are impossible to replicate with grafts or heterologous flaps.

It is also important to acknowledge the psychological and social impact such injuries may cause, especially in young patients and women. Therefore, a comprehensive approach including psychological support, functional rehabilitation, and dermatologic follow-up is essential to assess hair recovery and treat complications like alopecia or scarring fibrosis.

The patient's postoperative course was favorable with complete flap viability and satisfactory functional recovery. This experience reaffirms that with proper surgical team preparation, favorable flap conditions, and adequate hospital infrastructure, microsurgery is a safe and effective tool in managing extensive traumatic scalp avulsions.

CONCLUSION

Total scalp avulsion represents one of the most complex and dramatic forms of craniofacial trauma, due to the magnitude of tissue damage and its functional, aesthetic, and psychological implications. Successful management requires immediate medical response, precise flap viability assessment, and expert surgical execution, with microsurgery as the cornerstone for effective reconstruction.¹⁰

In the presented case, microsurgical techniques allowed successful replantation of a completely avulsed scalp flap, achieving superior anatomical and aesthetic restoration compared to grafts or regional flaps. End-to-end anastomosis

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with the facial artery proved to be a viable and effective option in contexts where other vessels may be unavailable or suboptimal. Despite the inability to perform venous anastomosis, postoperative management with controlled bleeding and strict clinical monitoring maintained flap viability and prevented major complications.

This case highlights the need for multidisciplinary teams trained in advanced reconstructive surgery, appropriate hospital infrastructure, and early management protocols for avulsed tissue conservation and sterile transport. It also underscores the importance of education and prevention in occupational settings, particularly agricultural and industrial sectors, where personal safety measures such as hair protection can be decisive in avoiding severe injuries.¹¹

From a technical standpoint, microsurgery not only offers precise anatomical repair but also restores essential scalp features such as texture, vascularization, cranial contour, and often hair growth. This is especially relevant in young patients and women, where craniofacial deformities can have profound and lasting emotional impact. Success in reconstruction goes beyond flap survival, encompassing social, emotional, and functional reintegration of the patient.¹²

This case contributes additional evidence to the growing literature supporting microsurgery as the treatment of choice for traumatic scalp avulsions. It reinforces that timely and specialized approaches can yield excellent clinical results even in severe trauma situations. Furthermore, it opens avenues for future research on optimizing microvascular techniques, improving venous return strategies, and comprehensive rehabilitation protocols for patients with extensive craniofacial trauma.^{13,14}

In summary, microsurgical scalp reconstruction is not only a technical advance in modern reconstructive surgery but also a deeply human act that restores patient identity, dignity, and quality of life.

REFERENCES

- I. Buntic, R. F., Buncke, G. M., & Siko, P. P. (2006). Microsurgical replantation of the scalp. *Plastic and Reconstructive Surgery*, 117(1), 73-78. <https://doi.org/10.1097/01.prs.0000195206.23421.10>
- II. Kim, K. S., & Woo, S. H. (2011). Successful total scalp replantation after avulsion injury: A case report and literature review. *Microsurgery*, 31(1), 70-74. <https://doi.org/10.1002/micr.20822>
- III. Mladick, R. A., Georgiade, N. G., & Georgiade, G. S. (1971). Replantation of avulsed scalp by microvascular anastomosis. *Plastic and Reconstructive Surgery*, 48(5), 564-567. <https://doi.org/10.1097/00006534-197111000-00007>
- IV. Sharma, R. K., & Parashar, A. (2009). Replantation of avulsed scalp: A rare case and review of literature. *Indian Journal of Plastic Surgery*, 42(1), 125-127. <https://doi.org/10.4103/0970-0358.53003>
- V. Narushima, M., Yamamoto, T., Ogata, F., et al. (2010). Microsurgical scalp replantation after total avulsion injury. *Annals of Plastic Surgery*, 65(1), 97-100. <https://doi.org/10.1097/SAP.0b013e3181bda398>
- VI. Hölzle, F., Loeffelbein, D. J., Nolte, D., & Mücke, T. (2008). Microsurgical free flap reconstruction of the scalp: A retrospective analysis of 66 cases. *British Journal of Oral and Maxillofacial Surgery*, 46(7), 576-579. <https://doi.org/10.1016/j.bjoms.2008.03.012>
- VII. Lin, T. S., Jeng, S. F., & Chiang, Y. C. (2004). Replantation of avulsed scalp: Microsurgical reattachment versus free flap reconstruction. *Annals of Plastic Surgery*, 52(3), 258-261. <https://doi.org/10.1097/01.sap.0000108611.23523.ef>
- VIII. Pribaz, J. J., & Weiss, D. D. (1994). Scalp and calvarial reconstruction. *Clinics in Plastic Surgery*, 21(3), 403-416. [https://doi.org/10.1016/S0094-1298\(20\)31044-7](https://doi.org/10.1016/S0094-1298(20)31044-7)
- IX. Disa, J. J., & Cordeiro, P. G. (1999). Reconstruction of the scalp, skull, and dura. *Plastic and Reconstructive Surgery*, 104(2), 511-527. <https://doi.org/10.1097/00006534-199908000-00031>
- X. Swartz, W. M., Banis, J. C., Newton, E. D., et al. (1980). The role of microvascular surgery in scalp and calvarial reconstruction. *Plastic and Reconstructive Surgery*, 66(4), 498-505. <https://doi.org/10.1097/00006534-198010000-00007>
- XI. Nahabedian, M. Y., & Manson, P. N. (2001). Microvascular surgery in the reconstruction of complex scalp and calvarial defects. *Journal of Craniofacial Surgery*, 12(6), 523-531. <https://doi.org/10.1097/00001665-200111000-00002>
- XII. Hallock, G. G. (2009). The role of microvascular free flaps in head and neck reconstruction. *Plastic and Reconstructive Surgery*, 124(6 Suppl), 48e-59e. <https://doi.org/10.1097/PRS.0b013e3181bf8375>
- XIII. Engel, H., Lin, C. Y., Chang, E. I., et al. (2011). Outcomes of microvascular free flap reconstruction for traumatic scalp defects: A 10-year review. *Journal of Reconstructive Microsurgery*, 27(3), 153-159. <https://doi.org/10.1055/s-0030-1267115>
- XIV. Shonka, D. C., Potash, A. E., Jameson, M. J., et al. (2011). Successful revascularization of totally avulsed scalp using microvascular technique: Case report and literature review. *Otolaryngology-Head and Neck Surgery*, 144(2), 296-298. <https://doi.org/10.1177/0194599810391624>