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Repair of a Scalp Defect with Punctate Skull Fenestration and Skin Grafting

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ABSTRACT

Reconstructing scalp defects can be challenging for a plastic surgeon. For this purpose, different procedures such as primary repair and coverage with skin grafts or flaps can be considered. Sometimes, the external table of the skull can be removed completely to the diploic space. At the same time or after the formation of granulation tissue, the diploic space can be covered with split-thickness skin grafting.

In this article, we have reported the reconstruction of a traumatic scalp defect in a one-year-old baby. There was a large defect in the left temporoparietal area of the scalp. The wound was debrided and irrigated with normal saline frequently. After the wound infection was controlled, instead of covering it with a flap or excising the external table of the skull and skin grafting, we managed this defect by the fenestration of the external table of the skull followed by the formation of the granulation tissue and coverage of the defect with split-thickness skin grafting. The post-op course was uneventful, and the wound was covered completely with the skin graft. We believe that this method of treatment in a child allows us to provide better coverage for the defect when the patient is older and after tissue expansion. We also showed that the punctate fenestration of the skull can provide a granulated tissue bed for skin grafting, as well as the excision of the external table of the skull.

Keywords: Scalp trauma, Skull fenestration, Scalp flaps

Introduction

Scalp defects can be caused by trauma, the excision of tumors, irradiation, and fungal infections. Based on the extent of the defects, different techniques can be used to repair them, including initial repair; repair with skin grafts; and repair with local, regional, and distant flaps (1). When it is not possible to use the flaps, the external table of the skull can be completely removed, and the defect area can be covered with skin grafting. Although free flaps are a possible choice in such situations, they are time-consuming and require microsurgery expertise, especially in pediatric patients.

Case Report

The patient is a one-year-old child who had trauma to the left temporoparietal area due to a motorcycle accident. The trauma happened one day before admission to the hospital. Initial management of the patient was performed at another treatment center, and the patient was then transferred to the Imam Reza Hospital in Birjand, Iran. According to the initial examination of the patient, there was a large laceration of the left temporoparietal scalp with abrasion and contamination of the wound edges. The wound extended from the left temporoparietal area to the posterior of the left auricle, and the skin was separated from the skull like an inferiorly based flap. The wound extended to the cheek area below the left zygomatic arch. The left temporal muscle was detached from its origin in the temporal ridge. The external ear canal was traumatized and connected to the wound by a laceration in the upper part of the cartilaginous canal. The skin of the inferior margin of the wound was thinned and ischemic, and the temporal bone was completely exposed. The child was alert with a GCS of 15. There was no active hemorrhage, and brain injury was ruled out by CT scanning.

Figure 1. Primary wound size

The patient was transferred to the operating room, and under general anesthesia, the wound was debrided and irrigated with a copious amount of normal saline. At the end of the operation, the wound was left open, and only wound dressing was done. This procedure was repeated several times over the following days (Figure 1). The thinned and ischemic lower skin gradually became necrotic, and this area was also debrided over the following days. The left temporal muscle that was detached from the skull was contracted and shortened, and it was impossible to cover the skull with this muscle. The bone was exposed in an area of about 10 x 10 cm without any soft tissue coverage, which was irrigated regularly; wound dressing with Vaseline and wet sponges was also done. There were signs of wound infection with purulent drainage from the ear canal during the first days due to severe crushing of the scalp and contamination with soil and gravel particles. This was controlled after ten applications of daily irrigation, dressing changes of the wound, and intravenous antibiotic therapy. After controlling the wound infection, it was mandatory to cover the skull. Thus, we decided to fenestrate the outer table of the skull at several points. On the fourteenth admission day, fenestration of the outer table was done with an electric micromotor at several points, and the abrasion of the outer table was stopped immediately after bleeding from the diplopic space. The external table of the skull was very thin (a maximum of one millimeter), and we decided not to remove the external table completely to preserve the temporal bone thickness and resistance (Figure 2).

Figure 2. Fenestration of external table of the skull

The next wound dressing changes were done every other day in the operating room under sedation or general anesthesia. Gradually, from the fenestrated points of the external table, the granulation tissue began to grow. Interestingly, granulation tissue also developed from suture lines of the skull, and the entire defect was covered by granulation tissue (Figure 3). This process was completed in ten days. Afterward, the area was covered with a split-thickness skin graft harvested from the anterior thigh. The graft was taken completely (Figure 4).

Figure 3. The wound coverage with granulation tissue

Figure 4. The final result after a month from the skin grafting

Discussion

Scalp defects can be caused by trauma, tumors, irradiation, or fungal infections. According to the general condition of the patient and the condition of the scalp wound and defects, some techniques could be used to reconstruct the defects. In wounds with a defect of less than 5 cm^2, it is possible to repair the wound by primary closure [1]. If the periosteum is not damaged, larger defects can be reconstructed with split- or full-thickness skin grafts. In the case of full-thickness scalp defects, including the periosteum, the defects can be reconstructed with local, regional, or distant free flaps [2]. Tissue expansion is also possible [3]. However, it is used in elective cases.

In the reconstruction of large defects of the scalp, when reconstruction with flaps is not possible, excision

or fenestration of the external table of the skull is another option. The external table of the skull can be removed completely to the diploic space; then, either at the same time or after the formation of granulation tissue, the diploic space can be covered with split-thickness skin grafting. Skin grafting of the diploic space can be done with or without the vacuum assisted system [4, 5]. In some cases, after removing the external table, the diplopic space can be covered with skin substitutes such as AlloDerm [6] or Integra [4, 7], and then concurrent or delayed skin grafting can be done.

During the excision or fenestration of the external table, careful attention should be paid to the thickness of the skull bone. Brain damage may occur during the procedure of external table excision or fenestration [8, 9]. The skull bones are formed between the twenty-third and twenty-sixth weeks of embryonic life [10]. After birth, the thicknesses of the skull bones and the diploic space increase. The thickness of the left anterior parietal region of the skull, on average, is 4.90 ± 0.20mm, and the thickness of the diplopic space is 1.1 ± 0.12 mm [11]. It should be noted that only one-third of children under the age of three years will have a diploic space detected by CT scans, while the diploic space is visible in the anterior parietal region of the skull in up to 82% of children aged three to five years [11]. Although there is clinical evidence that the diploic space is formed at an even earlier age, the external and internal table can be split in the operation theater [12].

We preferred to fenestrate the external table in several points, and we did not excise the outer table completely to preserve the bone resistance in the temporal area. The formation of granulation tissue took about ten days. As we pointed out in case presentation, the granulation tissue started to grow from the left coronal suture and the left temporal muscle origin. This contributed to the coverage of the skull bone with granulation tissue. Another option for covering this defect is to use axial scalp flaps to cover the bone and then cover the donor periosteum with skin grafting [13]. However, we preferred to save scalp flaps for later reconstruction and tissue expansion. After ten days, the patient was transferred to the operating room, and the defect was covered with split-thickness skin grafting. The course of recovery was satisfactory, and the split-thickness skin graft was taken completely.

Conclusion

There are many options for reconstructing large scalp defects. Among them is excising the external table of the skull and skin grafting the diploic space. In this paper, we showed that for this purpose, it is not necessary to excise the external table of the skull completely; instead, fenestration of the skull at multiple points can eventually lead to granulation tissue growth and coverage of the skull defect.

Acknowledgments

None.

Conflict of Interest

Authors declare that there is no conflict of interest.

Informed consent

We considered all aspects of anonymity of the patient in this article; meanwhile, informed consent for photography and publication of the pictures was taken from the parents of the presented child.

References

1. Newman MI, Hanasono MM, Disa JJ, Cordeiro PG, Mehrara BJ. Scalp reconstruction: a 15-year experience. Ann Plast Surg. 2004; 52(5):501-6. [DOI:10.1097/01.sap.0000123346.58418.e6] [PMID]
2. Cherubino M, Taibi D, Scamoni S,et al. A new algorithm for the surgical management of defects of the scalp.ISRN Plast Surg. 2013; 2013. [DOI:10.5402/2013/916071]
3. Argenta LC, Watanabe MJ, Grabb WC. The use of tissue expansion in head and neck reconstruction. Ann Plast Surg. 1983; 11(1):31-7. [DOI:10.1097/00000637-198307000-00005] [PMID]
4. Puckett Y, Bui E, Dissanaike S. Management of skin defect following resection of Stage IV scalp melanoma: A case report. Int J Surg Case Rep. 2016; 29:8-10. [PMID] [PMCID] [DOI:10.1016/j.ijscr.2016.10.027]
5. Mühlstädt M, Thomé C, Kunte C. Rapid wound healing of scalp wounds devoid of periosteum with milling of the outer table and split-thickness skin grafting. Br J Dermatol. 2012;167(2):343-7. [DOI:10.1111/j.1365-2133.2012.10999.x] [PMID]
6. Chun YS, Verma K. Single-stage full-thickness scalp reconstruction using acellular dermal matrix and skin graft. Eplasty. 2011; 11:e4.
7. Richardson MA, Lange JP, Jordan JR. Reconstruction of full-thickness scalp defects using a dermal regeneration template. JAMA Facial Plast Surg. 2016; 18(1):62-7. [DOI:10.1001/jamafacial.2015.1731] [PMID]
8. Movahed R, Pinto LP, Morales-Ryan C, Allen WR, Wolford LM. Application of cranial bone grafts for reconstruction of maxillofacial deformities. Proc (BaylUniv Med Cent). 2013; 26(3):252-5. [PMID] [PMCID] [DOI:10.1080/08998280.2013.11928973]

9. Agrawal A, Garg LN. Split calvarial bone graft for the reconstruction of skull defects. J Surg Tech Case Rep. 2011;3(1):13. [PMID] [PMCID] [DOI:10.4103/2006-8808.78465]

10. Tubbs RS, Bosmia AN, Cohen-Gadol AA. The human calvaria: a review of embryology, anatomy, pathology, and molecular development. Childs Nerv Syst. 2012; 28(1):23-31. [DOI:10.1007/s00381-011-1637-0] [PMID]

11. Huang AH, Sun HH, Skolnick GB, Woo AS. Thickness of calvarium and diploic space in children ages 0 to 17 as assessed by computed tomography. Eur J Plast Surg. 2015;38(3):193-8. [DOI:10.1007/s00238-014-1060-3]

12. Vercler CJ, Sugg KB, Buchman SR. Split cranial bone grafting in children younger than 3 years old: debunking a surgical myth. PlastReconstr Surg. 2014;133(6):822e. [PMID] [PMCID] [DOI:10.1097/PRS.0000000000000222]

13. Zayakova Y, Stanev A, Mihailov H, Pashaliev N. Application of local axial flaps to scalp reconstruction. Arch Plast Surg. 2013;40(5):564-9. [DOI:10.5999/aps.2013.40.5.564] [PMID] [PMCID]

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