Case report
Revisiting closure options for heavily irradiated tissue following Mohs excision: A case report and review of literature

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HIGHLIGHTS

- Current literature lacks a comparison of local flaps vs. tissue transfer success rates for large irradiated tissues.
- Local flaps can provide adequate functional and cosmetic outcomes for closing large irradiated tissue defects.
- A local flap spares the patient from the potential complications of a tissue transfer.

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ABSTRACT

Introduction: Squamous cell carcinoma is a cancer of the squamous cells of the epithelium, often treated with radiation therapy or surgical resection. Patients who undergo Mohs excision on the face are left with defects that require thoughtful reconstruction, especially if previously treated with radiotherapy.

Case presentation: We report a patient who suffered from squamous cell carcinoma of the skin overlying his right cheek. After receiving upwards of 10,000 cGY of radiotherapy, he underwent Mohs excision. Despite conventional therapy protocols, which would normally consist of a free-tissue transfer, a successful rhomboid flap was performed to cover the defect.

Discussion: Conventional reconstruction of a previously irradiated area would consist of using non-irradiated tissue. Data on whether such a large, heavily irradiated defect of the face could be repaired using a local flap is practically non-existent.

Conclusion: This case demonstrates that a local flap can still be successful even with large facial defects and previously radiation therapy, sparing the patient from free-tissue transfer and its possible complications, while leaving the option of a free-tissue transfer available in case of flap failure. This case serves as a reminder that local flaps are still viable options for such defects.

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1. Introduction

Squamous cell carcinoma (SCC) is a cancer of the squamous cells of the epithelium, which are the major component of the epidermal layer of the skin. SCC can occur in many tissue types, including oropharyngeal surfaces (most commonly due to human papillomavirus infections, alcohol use, and smoking) and the skin [1]. Next to basal cell carcinoma, SCC is the most prevalent cause of non-melanoma skin cancer, which is the most common kind of cancer in the United States [2]. The predominant risk factor for cutaneous SCC in middle-aged and elderly individuals is sun-exposure, though there are several other predisposing factors [2].

Cutaneous SCC's are associated with a high risk of recurrence (5% within five years) and metastasis (8% within five years), so rapid treatment and/or removal of cancerous tissue is necessary. Patients who are not suitable candidates for surgery or have inoperable tumors may receive fractioned radiation treatments instead. Radiation therapy generally provides a suitable, if not preferred, functional and cosmetic result [2]. Options for the surgical removal of SCCs with a low risk of metastasis (tumors smaller than 1 cm in diameter, with well-defined borders) include mechanical excision, electrosurgery and curettage, or cryosurgery. However, patients with more high-risk tumors can undergo tumor removal by the Mohs Micrographic Surgery. This technique utilizes horizontal frozen sectioning to fully visualize tissue excision and prevent incomplete...
resection of the cancerous tissue, thereby offering much lower recurrence and metastasis rates [2].

Unfortunately, these surgical techniques often leave patients with substantial deformities, which may be challenging to repair. Resulting facial deformities are particularly difficult to address, as cosmetic considerations for the face are more pronounced than reconstructions of other cutaneous areas where SCC can occur. This is especially important for central facial features like the eyes, nose, and lips. Unlike these central features, imperfections of the cheek are less noticeable, as the borders are much more variable from person to person and less well-defined [3]. Nevertheless, improper cheek reconstructive technique can lead to poor cosmetic outcomes. There are several techniques available for repairing post-surgical cheek deformities including direct closure, full thickness skin grafts, and a variety of free and transposition skin flaps [4]. The rhomboid flap, a type of transposition flap, is a classic technique consisting of a rhomboid-shaped flap with two 60° angles and two 120° angles. Rhomboid flaps are used throughout the face, but are particularly useful for fixing deformities over the cheek and temple region [5,6]. These flaps are ideal for repairing facial defects near corners and free margins as the use of adjacent tissue avoids tension [7].

One variable that complicates the surgical planning in some of these cases is previous radiation treatment of the skin. It has been shown that radiation therapy is sometimes deleterious to flap survival. Differences in the radiotherapy plan (e.g. fractionation, dosage, timing, etc.) may account for these inconsistencies [8]. The role of irradiated tissue in the reconstruction of facial defects remains unclear. For some surgeons its use may be common practice and for others it may still be seen as a less desirable option. Nevertheless the data to support either local flaps or free-tissue transfer for a large irradiated tissue is lacking, and no randomized controlled trial exists to definitively guide management. In particular, the literature is absent for cases regarding defects of the head and neck. We hope that this case report will demonstrate a suitable cosmetic outcome, with the intention of renewing a potentially overlooked surgical option for those who may not routinely use this technique with heavily irradiated tissue.

2. Case report

We are presenting the case of an 81 year old male with SCC of the right cheek. Our patient was first seen in 2004 and was given the diagnosis of SCC in situ, also known as Bowen’s disease, which is analogous to early stage or intraepidermal SCC. The tumor carries no risk of metastasis at this stage [9]. This was treated by radiation therapy; a 4.5 cm field was treated in 23 fractions over the course of 33 days. The total radiation dose administered was 5060 cGy (centigray units). On follow-up it was determined that treatment was successful, though there was no way to detect the location of the margins of the tumor. In 2007, our patient suffered a relapse in the margins of the previous lesion, proven again by biopsy to be SCC in situ. After discussing surgical vs. radiotherapy options, the patient opted to try another round of radiation. Treatment was instituted at the area of the margin and more medially as well, this time receiving 25 fractions over 36 days. The total radiation dose was 5000 cGy, and once again the cancer was determined to be in remission on follow-up.

Unfortunately, the patient suffered a second relapse, which was found when he presented to our office in late 2011. A biopsy revealed invasive, well-differentiated SCC extending to the peripheral and deep margins. Upon reviewing the previous radiotherapy treatments that he had received to that area and taking into consideration the high dosage of radiation received, it was determined that additional radiation therapy would not be possible without a high risk of focal necrosis. At this point the patient was referred for surgical consultation, with the recommendation that the high dosage of radiation he received be taken into consideration when evaluating the surgical approach. Several options were considered including conservative excision with healing by secondary intention, wide local excision with local flap, and free-tissue transfer. Ultimately it was decided to perform a wide local excision and local (rhomboid) flap, with the understanding that due to the previous radiation there would be a very high-risk of wound dehiscence and ultimately flap failure. The patient underwent Mohs surgical excision of the cancerous lesion. A 2.5 × 2.3 cm ovoid section of skin was excised with underlying subcutaneous tissue extending to a depth of 1.2 cm. Using frozen sections, cancer-free margins of 2–4 mm were obtained.

The Mohs excision left a large ovoid deformity in our patient’s face requiring complex closure. As planned, a modified rhomboid flap (as described by Quaba & Sommerlad) was used to fill in the deformity (Fig. 1) [10]. There were no complications in the operating room and the flap was successfully performed, closing the defect with the appropriate amount of tension (Fig. 2). The patient was seen 25 days following his surgery. His right cheek was healing well, without complications. Follow-up pictures can be seen in Figs. 3 and 4.

3. Discussion

Here we present the case of a patient who suffered from SCC of his right cheek who ultimately — despite receiving upwards of 10,000 cGy of radiotherapy — required Mohs excision of the lesion for definitive treatment, leaving him with a sizeable defect. Conventional reconstruction of a previously irradiated area would consist of the use of non-irradiated tissue such as free-tissue transfer, ideally a radial forearm free flap. Factors that were taken into consideration were the patient’s health status for an extensive and lengthy operation, ability to recover from such a procedure with the risks associated with an extended hospital stay (typically 5–7 days), and the extreme complication of flap failure. Instead of performing a free-tissue transfer such as a radial forearm free flap, which would have provided healthy non-radiated donor tissue to the defect, we opted to use a rhomboid flap to repair this defect, using skin that had received the aforementioned high doses of

![Fig. 1. The defect remaining after successful Mohs excision of the tumor. The markings demonstrate the modified rhomboid flap as planned.](image-url)
radiotherapy. This treatment decision was made based on all the above factors, with the main caveat that in the event of local flap failure in the situation of such extensive history of radiation to the area, the option of free-tissue transfer would still be available as a salvage operation with the consideration that the defect size may be larger in the case of local flap necrosis. This would expand our flap options from a radial forearm flap to a possible anterolateral thigh flap to account for defect size. This successful reconstruction demonstrates that the rhomboid flap technique can provide adequate cosmetic and functional outcomes, even for a defect as large as the one that this patient presented with despite his history of two previous courses of radiation therapy.

One important factor that was considered in this case was the consideration of excessive skin tension that could add to the risk of skin necrosis. Irradiated tissue is known to lose a considerable amount of elasticity, which would add not only to skin tension but may have added significant force to the negative vector of the lower lid, causing ectropion. In an effort to prevent this, we additionally performed a lateral canthoplasty and midface suspension (using a SMAS flap) which prevented ectropion formation [11]. In addition, part of the success of this technique is likely attributable to the excellent vascular supply to the face, allowing for better results with a local flap.

A recent study by Howell et al. (2013) elaborated on the currently available best evidence regarding the closure of abdominal wounds following abdominoperitoneal resection (APR) involving previously irradiated tissue. The authors concluded that closure of these wounds using a myocutaneous flap may reduce wound-related complications, but also posited that a randomized control trial would be beneficial [12]. Literature concerning reconstruction of such deformities of the head and neck using local flaps is limited.
4. Conclusion

The success of the technique used to close the defect in our patient demonstrates that local flaps (such as the modified rhomboid flap used in this case) can provide adequate cosmetic and functional outcomes, even for a heavily irradiated defect as large as presented here. A local flap spares the patient from free-tissue transfer and its possible complications, while leaving the option of a free-tissue transfer available in case of flap failure. We hope that this case report will serve as a reminder of the possibility of achieving adequate cosmetic results by using local flaps, even for unhealthy or irradiated tissues.

Conflict of interest

No conflict of interest.

Financial disclosures

No financial disclosures.

Patient consent

Patient consent to use of medical data and photographs was obtained and is on file at West Hills Medical Center Office in Los Angeles.

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