

Radiation and Wound Healing: Challenges Faced in Reconstructing Irradiated Leg Wound

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ABSTRACT

Radiation therapy being one of the modalities in oncological therapy regimes uses ionizing radiation for controlling tumours through DNA alteration of cancerous tissue resulting in cellular death. Despite recent advances that resulted in a reduced dosage, radiation-related side effects cannot be avoided completely. Surgery in an irradiated area is technically demanding due to altered tissue physiology and unpredictable wound healing. Reconstructive surgeons face the challenge of delayed wound healing following previous radiotherapy. Reconstructive interventions are required to repair irradiated wounds to have a good quality of life for oncology patients.

Keywords: Irradiated Leg Wound, Radiation, Wound healing

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INTRODUCTION

Radiotherapy is used for the treatment of various cancers in spite of having surgical extirpation as a modality of treatment (and chemotherapy, when appropriate) including soft tissues (sarcoma). Radiation is used as a method for destroying cancerous cells but in due process, it damages healthy tissue resulting in acute and long-term side effects. Problems with wound healing are a serious matter. The long-term effects include soft tissue fibrosis, and microvascular damage, leading to a higher risk of developing non-healing wounds that are not amenable to surgical repair. Delivery of radiotherapy in the cancerous field has evolved in such a way the damage can be minimized by reducing its effect on healthy tissue while maximizing the effect on cancerous tissue. However, inevitably some normal tissue will be affected. Wound healing in these patients is underestimated.

Using the case of a 33-year-old female who underwent 30 cycles of radiotherapy post-wide local excision of spindle cell carcinoma in the middle third of right leg, we would like to enumerate the challenges faced in reconstructing an irradiated field.

CASE REPORT

A 33-year-old female presented to us with a wound over the middle third of right leg in medial aspect for two months. The patient was diagnosed with spindle cell carcinoma of middle third of the right leg for which she underwent wide local excision and split-thickness skin graft. This graft healed well in a fortnight and biopsy revealed carcinoma. The patient went to the radiotherapy department where she was given chemotherapy of two cycles and radiotherapy of 30

cycles. After eight days of the last radiation patient developed a wound (Figure 1) which did not heal by conservative management and the patient came to our department for wound management. The patient was admitted and underwent debridement and flap cover with inferiorly based lateral fasciocutaneous flap which failed as the entire flap got ischemic in 7 days (Figure 2). Later flap was debrided and the patient underwent split split-thickness skin graft. There was a loss of the entire skin graft. The patient underwent debridement and VAC dressing (Figure 3). As there was red healthy granulation tissue medial hemisoleus flap cover was performed over which a split-thickness graft was applied which took well (Figure 4). The stapler was removed on day 10 after surgery. The wound took a month to heal. The leg was immobilized for 15 days after which guarded ambulation was allowed. The patient was discharged in 15 days. Regular follow-up done till 3 months.



Figure 1: Post-radiation wound.

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Figure 2: Failed inferiorly based fasciocutaneous flap cover.



Figure 3: Post debridement of inferiorly based fasciocutaneous flap cover & vacuum-assisted closure therapy.



Figure 4: Post medial hemisoleus flap with split thickness graft.

DISCUSSION

Plastic Surgeons have long known that radiation-related ulcers are difficult to heal and even more difficult to reconstruct. Although the statement of Daland¹ that “unless surgeons are able to repair damage from radiation, roentgenologists will not use intensive doses and will not cure as many patients” is true. Radiation has early and late effects. The early effects are radiation dermatitis, Erythema, desquamation, epidermal sloughing & skin necrosis. Long-term effects of radiotherapy include necrosis, fibrosis and carcinogenesis. Unlike other ulcers that get better with local care radiation ulcers progress and become worse with time the underlying ischemia puts in motion. A necrosis and infection cycle that leads to the development of additional ulcers in the surrounding tissue and then finally results in Frank Gangrene. Infection is the most important factor. To trigger this cycle hence early management of ulcers is critically important. It should include debridement of all non-vital tissue and control of infection. As we see in our study where after the failure of the first flap thorough debridement and vacuum-assisted closure dressing were done till the red bleeding bed was achieved (figure 3).

Masters and Robinson encountered poor results with skin grafts and local flaps.² As we see in this study too both locoregional flap and split-thickness skin graft failed. This was also seen by Ross Rudolph.³ Contrary to the older belief that a good vascular bed can lead to acceptable skin coverage with skin graft or local flaps.⁴ It is not so in the present era mostly due to the type of radiation therapy used. Earlier the radiation used to be given by low voltage current which used to concentrate on skin and subcutaneous tissue but present-day

machines deliver radiation to deeper tissues. Hence earlier the ulcers that used to form due to radiation on minimal debridement were used to give a healthy vascular bed. In contrast in current times, there is minimal skin damage but if it occurs the depth is deep leading to a nonvascular bed even after deep debridement.

Skin grafts and local flaps though being unsuccessful for the management of radiation ulcers, good outcomes may be achieved by importing vascularised myocutaneous or omental flaps.⁵ It is a single-stage procedure to bring in a myocutaneous or muscle flap covered with split-thickness skin graft having its vascularity into the wound bed that has already been prepared. As was seen in our study it leads to an excellent result. Free flaps with good vascularity according to some authors provide excellent results⁵ while other authors state the increased chances of vessel thrombosis. Often, the most convenient vessels for revascularization are located within the radiation field. Their use is generally possible if large-caliber vessels are selected and care is taken when dissecting them, especially if the vessel used is an artery.⁶ Although success is possible when vessels used for flap revascularization are within the field, there may be an accentuated chance of thrombosis.

CONCLUSION

Surgical procedures in irradiated skin may affect wound healing, dehiscence, and necrosis. Since non-healing radiation ulcers are

ongoing problems, resistance to conservative or surgical treatment may harbour malignant cells leading to the recurrence of primary cancer or a second, radiation-induced cancer. Irradiated tissue is a major long-term problem for radiotherapy patients and proper reconstruction after eradicating infection & obtaining a vascular bed preferably by well vascularised muscle flap is preferred.

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