

Management of Post-Mastectomy Radio-Necrotic Ulcers & Osteoradionecrosis

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Abstract

Background: Breast cancer is still the most common indication for chest wall irradiation, despite the advances in RTH techniques complications still occur, and the time of its occurrence vary and could take few months to many years. ORN usually manifests with pain, exposed bone, fistulae and pathological fracture and the proper management needs proper debridement and coverage by thick musculocutaneous flaps. **Objective:** To evaluate different techniques of surgical management of post-irradiation persistent radio-necrotic ulcer & ORN with emphasis on the outcome of each technique. **Patients and methods:** A retrospective study from 2010 to 2015 reviewed 20 patients subjected to post-mastectomy radiotherapy as a treatment for breast cancer in NCI Cairo, and Minia oncology center Hospital, Egypt. Cases were biopsied to exclude local recurrence. The age, sex, type of ulcer, dose of radiotherapy received and the management done for these cases were recorded. **Results:** Only 4 patients responded to conservative treatment in the form of repeated dressings, and 16 patients needed surgical treatment; 5 of them were treated with debridement and coverage with split thickness graft with high rate of complications reaching 80%, the other 11 patients were reconstructed with musculocutaneous flaps, of these 7 patients were reconstructed with LD flaps with 57.14% success rate and minor complications only, the other 4 cases were reconstructed with TRAM flap with 50% success and major loss of the flap in one case that needed salvage by LD flap. Pre-operative comorbidity was found in 6 patients and all of them experienced complications while only 3 of the other 14 who had no comorbidity had postoperative complications. **Conclusion:** Pedicled flaps provide a good choice for reconstruction and provide chest wall support without the use of synthetic mesh.

Keywords

Radionecrotic Ulcer, Osteoradionecrosis, Pedicled Myo-Cutaneous Flaps,

1. Introduction

Breast cancer is the most common indication for chest wall irradiation, subjecting the chest wall including the skin, the ribs, and the pleurae and the mediastinum to post-radiation changes, which may cause complications including deep ulcers with osteonecrosis of the ribs and sternum [1].

In general, the complications of radiation happen in two types, namely acute and chronic injuries. The acute effects include painful ulcers, mucositis and desquamation which usually resolve with supportive care; the chronic problems may occur even years after ending the treatment and includes radiation-induced fibrosis, non-healing ulcers, osteoradionecrosis, and lymphoedema [2] [3] [4].

ORN has been reported with an incidence of 1% - 7%. This incidence is probably lower with improved delivery of treatment and the use of fractionated RT techniques (hyperfractionated and accelerated) [5] [6] [7].

Despite these technical advances damage to the tissues still occur and is usually in the form of delayed healing, chronic ulcers and bone necrosis [8].

The time in the formation of ORN after the completion of RT is variable and it may take a few months or many years requiring long-term follow-up for accurate calculation of incidence. The usual manifestation of ORN includes pain, exposed bone, fistulae and pathological fracture [9] [10].

In doses, over 4000 cGv, permanent changes take place in the bones; however, ORN produced in the doses over 6000 cGv becomes generally more resistant to conservative surgery [11] [12].

The predisposing factors for ORN include the following: trauma, infection, inflammation, overdosed RT application, involvement of the tumor with bone tissue or its occurrence around the bone tissue, and individual sensitivity and endurance characteristics of the patient. The sensitivity of the patient to radiation is an important risk factor in the occurrence of this complication [13] [14] [15].

Pathogenesis of ORN is the development of vascular necrosis stemming from radiation. Cytotoxic effects of radiation on the osteogenic layer cause soft tissue fibrosis, the blockage of endosseous arteries, hypoxic, hypocellular and hypo-vascular bones, and soft tissue. This decreases the recovery capacity of tissues with a decline in the development of matrices and deformation in the bone mineralization leading to diminished healing capacity [16] [17].

The key to successful management of such cases is Radical excision and debridement, followed by proper covering with well-vascularized tissue preferably containing muscle, which provides both relief of the pain and also provides the metabolic factors needed for wound healing [18].

Following radical resection, the reconstruction using thick musculocutaneous flap provides primary closure and structural continuity as well, enough to sup-

port the respiratory mechanism without the need to use a synthetic mesh or rib graft to reinforce the chest wall which should be avoided in such contaminated radiation ulcer [19] [20].

2. Patients and Methods

A retrospective study from 2010 to 2015 reviewed 20 patients [19 female (95%) and only 1 male (5%), Age range (38 - 60)] subjected to post-mastectomy radiotherapy as a treatment for breast cancer in NCI Cairo, and Minia oncology center Hospital, Egypt.

All patients received the same dose and number of sessions 40 Gy for 15 Fr. (hypofractionation dose) and only pathologically proven radionecrotic ulcers & osteoradionecrosis were included while patients with pathologically proven Local recurrence or disseminated disease were excluded.

Among these patients; One patient presented with Acute erythematous reaction, 3 patients (15%) presented with moist desquamation, 3 patients (15%) presented with Osteoradionecrosis (**Figure 1**), and 13 (65.0%) patient presented with Radio-necrotic ulcers.

Among these patients, 6 patients (30%) had a past history of medical importance, 2 of them (10%) were diabetic, 2 were hypertensive (10%), one patient (5%) was hypertensive and cardiac and one patient (1%) was smoker. The remaining 14 patients (70%) had no comorbidity.

3. Results

Only 4 patients (20%) (Who presented by mild form e.g. erythema and desquamation) responded to conservative treatment. In the form of Daily dressing, local antibiotics, local anti-inflammatory & antibiotics after culture and sensitivity test. 16 patients (who presented by radionecrotic ulcer and osteoradionecrosis) showed no signs of healing. And daily dressing continued for varying periods (2 - 3 weeks) until wound bed became clean and ready for coverage by flaps.

5 patients underwent debridement and split skin graft (these patients had the ulcer limited to skin and subcutaneous only), 11 patients underwent excision of ulcer and reconstruction with myocutaneous flap. among them, 7 patients were



Figure 1. A 53-year-old female presented with post-mastectomy radiation-induced osteoradionecrosis.

reconstructed with LD flap and 4 patients were reconstructed with TRAM flap.

In the 5 patients (25%) treated with debridement and application of split skin graft, only 1 patient (20%) had 100% take, while 4 patients (80%) of them had complications one of them had total rejection (treated by regular dressing and the and application of another thiersh graft after 2 weeks), the other three had partial loss and just daily dressing was done for nearly 3 - 4 weeks until healing happened.

In the 7 patients (35%) reconstructed with LD flap (**Figure 2**); 6 patients had complete survival; 4 of them (57.14%) of them the flap survived without any complications; while 1 patient (14.29%) had postoperative donor site hematoma and was evacuated without any flap complications, another 1 patient (14.29%) had mild wound infection and was treated conservatively. And only 1 patient (14.29%) had a partial loss of the flap for which debridement and regular dressing was done till healing by secondary intention.

In the 4 patients (20%) reconstructed with TRAM (**Figure 3**); 2 patients (50%) had a complete survival, while the other 2 patients (50%) had complications; one of them (25%) had partial necrosis and needed debridement and secondary sutures, and the other patient (25%) had complete flap loss and was salvaged by LD flap after regular dressing until wound was clean.

Among the whole 20 patients: 6 patients had pre-operative comorbidity and all of them examined post-operative complications, while in the 14 patients who

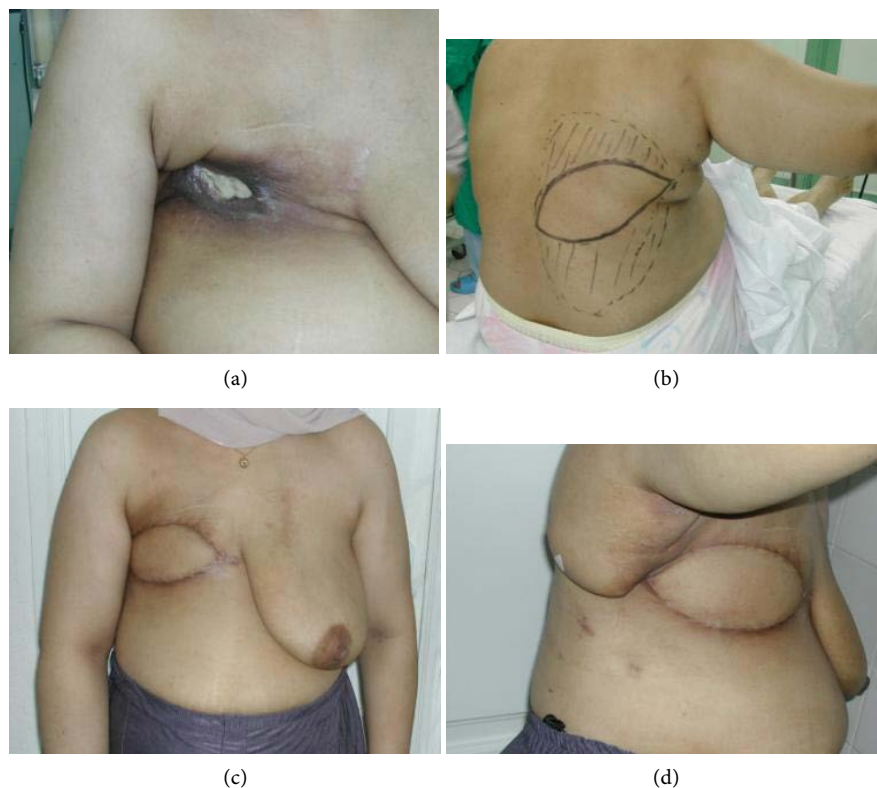


Figure 2. A 50-year-old female presented with radio-necrotic ulcer (a) preoperative view, (b) intra-operative planning, (c) and (d) final result [3 weeks post-surgery] follow up.



Figure 3. Left Radionecrotic ulcer treated with debridement and contralateral TRAM flap (a) preoperative view; (b) intraoperative picture after debridement and (c) post-operative picture.

Table 1. Outcome results in relation to comorbidity.

		No comorbidity	Comorbidity	Total	
Outcome	Good Response	Count	11	0	11
		% within PH	78.6%	0%	55%
	Complication	Count	3	6	9
		% within PH	21.4%	100%	45%
Total	Count	14	6	20	
	% within PH	100.0%	100.0%	100.0%	

had no preoperative comorbidity, only 3 of them experienced complications and 11 patients were successfully treated with no post management complications (Table 1).

4. Discussion

Indications for chest wall irradiation after mastectomy includes 4 or more in-

volved axillary lymph nodes, tumor size 5 cm or larger, positive excision margins, the presence of 2 or more of the following minor risk factors (1 - 3 involved axillary lymph nodes, Grade 3, lymphovascular invasion) [21] [22].

All tissues of the chest wall and mediastinum are subject to post-radiation changes, including the skin, the ribs, and the pleurae. Radiation to the chest wall sometimes causes deep ulcers with osteonecrosis of the ribs and sternum bone. The reconstruction of these irradiation chest ulcers must provide pleural and structural continuity to support the respiratory mechanism and a primary closure following radical ulcer resection [1].

4 patients were treated conservatively (one presented with acute erythematous reaction and 3 with moist desquamation) by topical applications (aloe vera, local antibiotics, and anti-inflammatory), daily dressing and regular follow up and healed in 8 - 10 weeks according to severity.

Topical treatments especially aloe vera were mentioned as one of the most commonly used agents for the treatment of radiation-induced dermatitis and has been reported in the literature as early as 1935 [23].

Others recommended the use of topical agents to reduce severity of reactions and even recommended its use from the 1st day of radiotherapy until 3 weeks after its completion as a prophylaxis against acute severe dermatitis [24].

Split skin graft was used after debridement in 5 patients who had ulcers limited to skin and subcutaneous tissues. but they had high complication rates with one complete rejection and 3 partial losses that need further management

Kurul *et al.* (1997) investigated the outcomes of 200 previously irradiated patients who underwent skin grafting or flap reconstruction. They reported that the complication rate with skin grafts was significantly higher than that with skin or muscle flaps [10].

Another study by Akira Saito denoted that Split-thickness skin grafting provides a simple one-stage reconstructive option for skin and soft tissue defects, but its use in the irradiated wound is controversial [25].

In this study 11 patients were treated using pedicled flaps (7 patients had LD flap and 4 treated with TRAM flap), these patients had good results with no or minor treatable complications that provide adequate tissue covering and good support to the chest wall without the need to use synthetic mesh for chest wall reconstruction.

In 2014, Masaki Fujioka reviewed the practices and surgical results for radiation ulcers over the past 30 years & concluded that the most crucial step is complete resection and debridement of radiation-affected area, including necrotic skin, fat, muscle, and sometimes bone, followed by coverage with well-vascularized tissue. He also denoted that a synthetic mesh or rib graft to reinforce the chest wall should not be used for contaminated radiation ulcers, but a thick musculocutaneous flap alone should be transferred [26].

Another study used LD flap without the use of either an artificial prosthesis or autologous rib to reconstruct the chest wall defect and showed no complications

regarding respiratory impairment or pleural complications by Clinical and radiological follow-up and concluded that myocutaneous flaps are satisfactory to cover the chest wall defect and provide satisfactory stability to the chest wall [27].

In our study, the rate of complications was higher with TRAM than with LD flaps which also were confirmed by an older study that investigated TRAM for coverage of chest wall defects after radiotherapy [28].

5. Conclusions

Despite the progress in radiation techniques, complications in the form of radionecrotic ulcers and osteoradionecrosis still happen, and these usually don't heal with conservative measures (unless superficial).

Biopsy and histological examination must be performed immediately to rule out a recurrent tumor, and adequate debridement is the most crucial procedure followed by coverage with well-vascularized tissue.

Pedicle flaps provide a good choice for reconstruction and provide chest wall support without the use of synthetic mesh and the choice of flap varies with the location and size of the wounds.

Pre-existing co-morbidities constitute a major risk factor for occurrence of post-reconstruction complications.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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