



Original article

Radiotherapy Effect on Immediate Two-Stage Post Mastectomy Breast Reconstruction

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Abstract

Background and aims. In the field of breast reconstruction, the two-stage tissue expander/implant technique is commonly used. However, radiation therapy, which is often employed in implant-based reconstruction, has well-documented negative effects such as increased risk of implant exposure, infection, capsular contracture, and other surgical complications. This study aimed to compare the outcomes of patients who underwent radiation therapy prior to implant exchange with a control group of non-irradiated patients, focusing on complications, capsular contracture, revision surgery, and the use of autologous salvage. **Methods.** This study included 30 patients who underwent immediate two-stage tissue expander/implant reconstruction. They were divided into two groups: irradiated group of 11 patients and control group of 19 patients. Numerous factors such as complications, capsular contracture, revision surgery, and autologous salvage rates were examined and compared between the two groups. We standardize other factors such as patient age, chronic illness for both groups. **Results.** The irradiated group showed 4.2 times higher of major complications compared to the control group ($p = 0.001$). The rate of grade III and IV capsular contracture was significantly higher in the irradiated group (21.7%) compared to the control group (10%; $p < 0.008$). **Conclusions.** This study concludes that irradiation of the tissue expander after mastectomy is associated with a higher risk of complications. After reviewing another studies, the capsular contracture rate in these patients -which considered the most major complication- with this approach is still acceptable compared to other implant-based radiotherapy approaches. Based on these findings, immediate tissue expander/implant reconstruction can be considered a viable surgical option for patients undergoing post mastectomy radiation therapy.

Keywords: Breast Cancer, Radiation Therapy, Breast Reconstruction, Mastectomy, Radiotherapy.

Introduction

Breast reconstruction using a two-stage tissue expander/implant technique is widely practiced for immediate reconstruction after mastectomy. This approach has gained popularity due to the proven survival benefits associated with post mastectomy radiation therapy. Consequently, more breast reconstruction patients are now undergoing radiation therapy as part of their treatment [1-4]. However, despite the positive evidence supporting the use of radiation therapy in immediate tissue expander/implant reconstruction, there are still concerns about increased complication rates and less-than-optimal aesthetic outcomes for these patients [5-9]. These concerns have been highlighted in various studies, raising important considerations for the management of this specific patient group [4,10].

The timing of post-mastectomy radiation therapy in relation to the surgical procedures may significantly influence the occurrence and severity of these complications. There are three primary points at which post-mastectomy radiation therapy can be administered: (1) before tissue expansion using a deflated tissue expander, (2) to an expanded or partially expanded tissue expander before implant exchange, or (3) to the permanent implant after replacing the tissue expander [4,11,12].

In this study protocol that have been used involves placing a tissue expander at the time of mastectomy and delivering radiation to the partially or fully expanded device before completing the second stage of reconstruction, after 6 months replacing the expander with permanent implant [13-14] (Figure 1). The objective of this study was to evaluate early and late complications in patients undergoing this protocol.



Figure 1: A) Placing a tissue expander at the time of mastectomy and delivering radiation in the affected breast. B) Replacing the expander after 6 months with a permanent implant in the affected breast

Methods

Sample

The study sample are patients who underwent immediate two-stage tissue expander/implant breast reconstruction between January 2016 and December 2021, in the national cancer institute\Misrata and in another different hospitals in private sector. This study includes 30 patients and divided into two groups: irradiated group (received post mastectomy radiation) 11 patients and control group (no post mastectomy radiation) 19 patients. To evaluate capsular contracture, patients had a minimum of 12 months' follow-up from the completion of irradiation.

Study Design

Retrospective data collection from patient's files. No chronic illness among both groups. The outcome measures encompassed late complications only (post radiotherapy), rates of autologous salvage, capsular contracture, and revision surgery.

Treatment Algorithm

All patients in this study underwent either a skin-sparing or nipple-sparing mastectomy, followed by the placement of a total sub muscular tissue expander. Intraoperatively, sterile saline was used to fill 50% to 75% of the total tissue expander volume. The first expansion of the tissue expander was planned for 2 weeks after surgery, unless there was skin flap necrosis. Expansion was completed over a period of 6 weeks. For patients requiring post mastectomy radiation therapy the treatment was administered while the tissue expander was fully expanded and in place, (Figure 2 A and B).

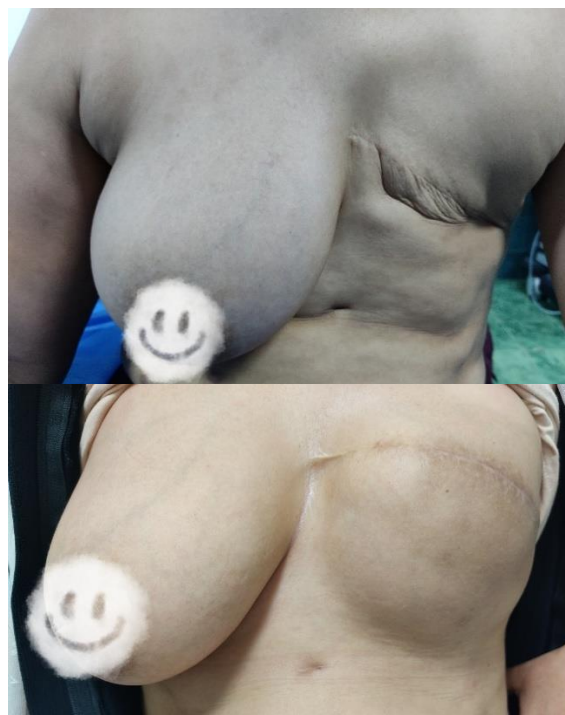


Figure 2. A & B: First Stage of breast reconstruction, the expansion of the tissue expander in the affected breast over a period of 6 weeks

Six months after the completion of irradiation, the second-stage reconstruction was performed. This involved the removal of the tissue expander, followed by capsulotomy or capsulectomy if necessary, and placement of a permanent implant, (Figure 3).



Figure 3. Second Stage of breast reconstruction, the placement of a permanent implant in the affected breast

Complications and Revision Surgery

To assess the impact of post mastectomy radiation therapy on complications, early complications occurring prior to radiation (such as mastectomy flap necrosis, hematoma, infection, seroma, and wound dehiscence) were excluded in the two groups. Additionally, late complications following irradiation were evaluated, including tissue expander exposure, inadequate soft-tissue envelope, seroma, wound dehiscence, infection and Inadequate soft-tissue envelope to accommodate a permanent implant during the second-stage procedure after tissue expander removal. Capsular contracture was assessed using the modified Baker classification. Reasons for revision surgery included capsular contracture, implant malposition, volume asymmetry, and pain.

Statistical Analysis

Statistical analysis was conducted using the t-test that was utilized to compare means of the two groups, Fisher's exact test to assess the statistical significance of the association. A two-tailed value of $p < 0.05$ was selected to indicate statistical significance.

Results

During the study period, a total of 30 patients underwent immediate two-stage tissue expander/implant reconstruction. Among them, 11 patients received post mastectomy radiation therapy, forming the irradiated group. Additionally, 19 nonirradiated patients represent the control group. Specifically, there were no significant differences observed in terms of age or comorbidities.

In the period between 1st stage and 2nd stage, the proportion of overall late complications in the irradiated group (32.9%) was significantly higher compared to the control group (8.3%; $p < 0.01$).

Autologous salvage was performed in 1% of control patients and in 14% of irradiated patients, prior to the second stage. The radiation therapy was associated with a significant increase in inadequate soft-tissue envelope, infection, wound dehiscence exposed tissue expanders and hematomas.

After the 2nd stage (after 6 months' follow-up) the analysis revealed a significant increase in the rate of grade III to IV capsular contracture in the irradiated group compared to the control group ($p = 0.008$). The rate of major complications requiring surgery was significantly higher in the irradiated group compared to the control group (16% versus 5%; $p < 0.001$).

Discussion

The findings of this study reveal a higher incidence of complications following radiation therapy, leading to the need for autologous salvage and an increased occurrence of capsular contracture among irradiated patients.

The control group exhibited a lower frequency of invasive disease compared to the post-mastectomy radiation therapy group, when considering the potential for more aggressive tumor excision and the higher requirement for axillary surgery in the irradiation group, so the differences in late complications between the two groups also may be related to the immediate effects of surgery.

Moreover, we observed a statistically significant increase in major complications (16% in irradiated patients versus 5% in controls) associated with radiation therapy. Sub analysis revealed that tissue expander exposure and inadequate soft-tissue envelope were significantly associated with post mastectomy radiation therapy. While our major complication rate compares favorably to smaller studies, it is higher than the rate reported by Anderson et al11. (5%). They attribute this difference to modern devices, techniques, and the utilization of intensity-modulated radiotherapy in a portion of their patients.

In our study, 76% of irradiated patients successfully completed second-stage reconstruction, which is comparable to the rate reported by Lin et al12. (80%).

We observed a higher rate of grade III to IV capsular contracture in irradiated patients (27%) compared to 10% in controls. Despite this, our contracture rate is favorable when compared to Nava et al13. where he reported a (53%) contracture rate in a subgroup analysis of 50 patients receiving post mastectomy radiation therapy to an expander, Peled et al14. reported a much lower rate when radiation therapy was administered before implant exchange, but it is important to note that they used a cellular dermal matrix that may reduce radiation-related complications.

It is important to know the limitations of our study, including its retrospective design, small sample, the type of implant used in reconstruction was not from the same brand. Furthermore, relatively short follow-up, the absence of aesthetic outcome evaluation, standardized photographs were not available for all patients, but we believed that the most important ones are the type, technique and the dose of radiotherapy that have been received by patients was not fully known.

Conclusion

In our study, we present patients who underwent a two-stage tissue expander/implant reconstruction with preimplant exchange radiotherapy. We compared this group with a nonirradiated cohort. Our findings indicate that the incidence of complications related to the tissue

expander remains within an acceptable range, despite the administration of post mastectomy radiation therapy.

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