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# Clinical outcomes in breast cancer expander-implant reconstructive patients with radiation therapy

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## KEYWORDS

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**Summary** Immediate expander-implant breast reconstruction (EIBR) with external beam radiation therapy (XRT) is pursued by many breast cancer patients; however, there is still a lack of consensus on the expected clinical outcomes. We performed a critical analysis of postoperative outcomes in EIBR patients with XRT exposure through a retrospective review from January 2007 to December 2013. Patients were stratified into three groups: exposure to pre-operative XRT (XRT-pre), postoperative XRT (XRT-post), or no XRT (control). A subset of XRT patients with bilateral EIBR was assessed using a matched-pair analysis with the patients serving as their own controls. A total of 76 patients were included in the study. Major complications were observed in 6 of 8, 26 of 38, and 14 of 30 patients in the XRT-pre, XRT-post, and control groups, respectively, and were not statistically different ( $p > 0.05$ ). EIBR failure rates were 13.3% in the control group compared to 50.0% in the XRT-pre group ( $p = 0.044$ ) and 26.3% in the XRT-post group ( $p > 0.05$ ). In the matched-pair analysis, 16 of 26 irradiated breasts developed complications compared to only 7 of 26 contralateral non-irradiated breasts ( $p = 0.043$ ). In conclusion, we detected a significantly increased risk of complications in patients with pre-mastectomy radiotherapy. Patients with this history of XRT should strongly consider autologous reconstruction instead of EIBR to avoid the high risk of developing complications and subsequently losing their implant. Increased complications in irradiated breasts when compared to the contralateral non-irradiated breasts in bilateral EIBR patients confirmed the detrimental role of XRT in the setting of EIBR.

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## Introduction

Breast reconstruction is an important final step in the management of breast cancer as it can improve the psychosocial health and functional well-being of patients, and may also improve survival outcomes in patients with invasive breast cancer.<sup>1–3</sup> However, careful consideration must be taken if the patient has had a history of or is planning to undergo radiation treatment. While the benefits of external beam radiation therapy (XRT) have been recognized for the treatment of cancers, XRT may have negative consequences on the outcomes of reconstruction, including breast reconstruction.<sup>4–9</sup> The radiation targets all rapidly dividing cells rather than just cancer cells, leading to side effects that include fibrosis, decreased wound healing and vascular supply, inflammation, and swelling. These complications can lead to poor clinical and aesthetic reconstructive outcomes, especially when implants are used,<sup>10–12</sup> although different studies have shown inconsistent and conflicting results.

Despite these concerns, many women who undergo mastectomies choose the expander-implant breast reconstruction (EIBR) option due to the relative ease of reconstruction with short operating times and rapid recovery periods.<sup>13</sup> Expander-implant is the most common type of breast reconstruction performed, accounting for over 70% of procedures.<sup>14</sup> The purpose of this study is to characterize the clinical outcomes associated with XRT given before, or after, initiation of the reconstruction procedure. This will be done primarily through analysis of complications and failure rates, and secondarily through postoperative follow-up.

In addition, the study explores the complications observed in the breast contralateral to the side of XRT in cases of bilateral reconstruction, which has not been described previously. Furthermore, prior studies on this topic only report on the number of patients with complications, rather than documenting the exact number of complications observed in each patient. The goal of our study is to help patients be better prepared preoperatively by giving them a more exact idea of the rates and number of complications they can expect from their reconstruction.

## Patients and methods

This retrospective study was approved by the Stanford Institutional Review Board (IRB). We searched an institutional database, the Stanford Translational Research Integrated Database Environment (STRIDE),<sup>30</sup> for patients with unilateral or bilateral immediate tissue expander placement at Stanford Hospital and Clinics between January 1, 2007 and December 31, 2013. At Stanford, the standard two-stage reconstruction procedure is used, in which a tissue expander is placed at the time of the mastectomy, followed by definitive reconstruction with an implant several months later. Patients requiring postmastectomy radiation therapy (PMRT) had XRT administered after completion of tissue expansion but before the expander was exchanged for the permanent implant. XRT delivery was not limited to Stanford radiation oncology. Criteria for

exclusion in the study included previous aesthetic or reconstructive breast surgery.

Patient characteristics, treatments, and complications were compared between the XRT and the control groups. The XRT group was stratified into XRT delivered before EIBR initiation as part of breast conservation therapy (BCT), or after EIBR initiation as part of PMRT. Comparisons were made using the independent Student's *t*-test and Fisher's exact test. Univariate and multivariate logistic models were used to determine whether any patient characteristics and treatments were predictors of total complications. Values of  $p < 0.05$  were considered statistically significant.

In addition to comparing the complications between XRT and control patients, we were also interested in evaluating the difference in complications between the radiated and non-radiated breasts in the same patient. Comparisons were made using the paired *t*-test and McNemar's test for matched pairs. Values of  $p < 0.05$  were considered statistically significant.

## Results

### Patient characteristics

A total of 76 patients and 120 breasts were included in this study. Of these, 8 patients (8 radiated breasts) had XRT before EIBR initiation (XRT-pre), 38 patients (38 radiated breasts) had PMRT after placement of expander (XRT-post), and 30 patients (48 breasts) did not receive any radiation (control). The remaining 26 breasts in our study were the contralateral breasts that did not receive XRT in bilateral reconstruction cases. Patient and disease characteristics of the XRT and control groups are summarized in [Table 1](#). The groups were similar in age, body mass index (BMI), smoking status within 3 months of surgery, comorbidities, and adjuvant chemotherapy treatment.

Reconstruction surgery characteristics (described in [Table 2](#)) were comparable between the three study groups. The average time to exchange from placement of the expander to placement of the permanent implant was similar between the XRT-pre and control groups (6.8 vs. 7.1 months,  $p = 0.615$ ), but was significantly longer in the XRT-post group compared to the control (10.8 months vs. 7.1 months,  $p < 0.001$ ).

### Primary outcomes

The total complication rates for the XRT-pre and XRT-post groups were 88% and 73%, respectively. These were further divided into 75% major and 50% minor complication rates for the XRT-pre group, and 68% major and 40% minor complication rates for the XRT-post group. The control group showed lower total, major, and minor complication rates of 60%, 47%, and 37%, respectively. However, there was no significant difference in any of the complication rates for the three groups ([Table 3](#), [Figure 1](#)).

In addition, the average number of complications experienced per patient was similar between the XRT-post and control groups albeit lower in the control group. However, this value (specifically major complications) per patient was significantly greater in the XRT-pre group as

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