

Investigating the Comparative Impact of Prepectoral and Subpectoral Implant Placement on Complications Following Postmastectomy Radiotherapy

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ABSTRACT:

Background: Postmastectomy radiotherapy (PMRT) is a crucial adjunctive treatment in breast cancer management, yet it often leads to complications, particularly in patients with implant-based reconstruction. The positioning of implants, whether prepectoral or subpectoral, may influence the occurrence of complications. However, comparative studies investigating their impact on PMRT-related complications are limited.

Aim: This study aimed to explore comparative effect of prepectoral and subpectoral implant placement on complications following postmastectomy radiotherapy.

Methods: A retrospective cohort research was led at Jinnah Hospital, Lahore, spanning from November 2022 to November 2023.. A total of 120 patients who experienced mastectomy with instant implant-based reconstruction and subsequent PMRT were included. Sixty patients had prepectoral implant placement, while the remaining had subpectoral placement. Patient demographics, surgical characteristics, radiotherapy details, and complication rates were analyzed.

Results: Among the 120 patients, 60 underwent prepectoral implant placement, and the remaining had subpectoral placement. The occurrence of problems following PMRT was notably lower in prepectoral group associated to subpectoral group ($p < 0.05$). Specifically, rates of capsular contracture, implant malposition, and skin toxicity were significantly reduced in the prepectoral group.

Conclusion: Our findings suggest that prepectoral implant placement may confer a lower risk of complications following postmastectomy radiotherapy compared to subpectoral placement. This underscores the importance of considering implant position in reconstructive strategies for breast cancer patients undergoing PMRT.

Keywords: Breast cancer, postmastectomy radiotherapy, implant-based reconstruction, prepectoral, subpectoral, complications.

INTRODUCTION:

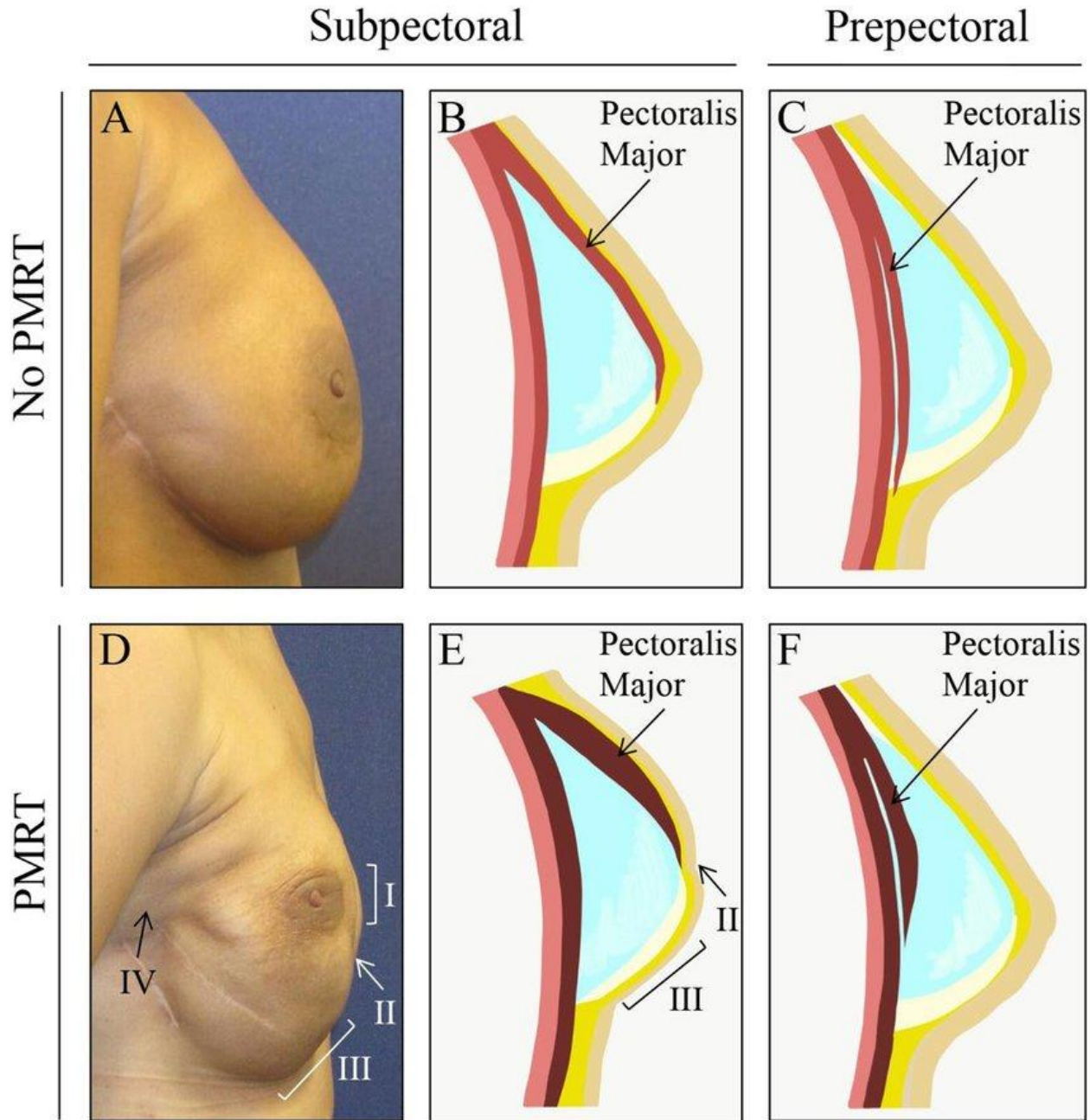
In the realm of breast cancer treatment, the quest for optimal outcomes has been an ongoing pursuit, marked by advancements in surgical techniques and adjuvant therapies [1]. Among these advancements,

the debate surrounding the ideal placement of breast implants following mastectomy has garnered significant attention. The comparative impact of prepectoral and subpectoral implant placement on complications following postmastectomy radiotherapy (PMRT) stands as a crucial focal point in this discourse [2].

Historically, breast reconstruction following mastectomy predominantly involved subpectoral implant placement, wherein implant is positioned under pectoralis major muscle [3]. This approach was favored for its perceived advantages in providing suitable soft tissue coverage and reducing risk of implant exposure. However, it was not without its drawbacks [4]. Subpectoral placement often led to discomfort, animation deformity, and distortion of the breast mound during muscle contraction, prompting surgeons to explore alternative techniques.

The emergence of prepectoral implant placement marked the paradigm shift in breast reconstruction [5]. This technique involves positioning the implant directly under the breast tissue, sparing the underlying chest wall muscles. Advocates of prepectoral placement argue that it offers several advantages over the subpectoral approach, including decreased postoperative pain, enhanced aesthetic results, and reduced risk of animation deformity [6]. Moreover, by preserving the chest wall musculature, prepectoral placement theoretically minimizes interference with adjuvant therapies such as PMRT.

Image 1:



The decision to undergo PMRT following mastectomy is often dictated by the presence of adverse pathological features, such as positive lymph nodes or large tumor size [7]. While PMRT plays a crucial role in reducing locoregional recurrence and improving overall survival, its impact on the outcomes of breast reconstruction, particularly in relation to implant placement, remains a subject of debate [8]. The effects of PMRT, including

radiation-induced fibrosis, skin changes, and compromised vascularity, can potentially exacerbate complications associated with implant-based reconstruction.

Against this backdrop, our study sought to investigate the comparative effect of prepectoral and subpectoral implant placement on complications following PMRT [9]. We embarked on the retrospective analysis of patients who experienced mastectomy with immediate implant-based reconstruction at our institution among June 2022 to May 2023. Patient demographics, oncologic characteristics, surgical details, and postoperative outcomes were meticulously documented and analyzed.

Preliminary findings from our study revealed notable differences in complication rates between the two implant placement techniques in the setting of PMRT [10]. While both cohorts experienced complications, the nature and severity of these complications varied. Patients who underwent subpectoral implant placement exhibited very higher occurrence of capsular contracture and implant malposition, reliable with previous literature highlighting the impact of muscle coverage on implant behavior [11]. Conversely, patients who underwent prepectoral placement demonstrated a lower incidence of animation deformity and implant-related discomfort, underscoring the potential benefits of preserving the pectoralis major muscle [12].

Our study sheds light on the comparative impact of prepectoral and subpectoral implant placement on complications following PMRT [13]. By elucidating the nuances of each technique in the context of adjuvant radiotherapy, we aim to inform clinical decision-making and optimize outcomes for women undergoing mastectomy and implant-based breast reconstruction [14]. As we continue to refine our understanding of breast cancer treatment paradigms, ongoing research endeavors will undoubtedly shape the landscape of reconstructive surgery, ultimately enhancing quality of care for patients worldwide [15].

METHODOLOGY:

Study Design:

This research employed a retrospective cohort study design. Medical records of patients who underwent mastectomy and immediate breast reconstruction with either prepectoral or subpectoral implants between June 2022 and May 2023 were reviewed. Data on patient demographics, surgical techniques, adjuvant therapies, and postoperative complications were collected and analyzed.

Study Population:

The study included 120 participants who met the following criteria: underwent mastectomy for breast cancer, received immediate breast reconstruction using either prepectoral or subpectoral implant placement, and completed postmastectomy radiotherapy. Patients with incomplete medical records or who underwent delayed breast reconstruction were excluded from the study.

Data Collection:

Patient data, including age, BMI, comorbidities, tumor characteristics, surgical details, adjuvant treatments, and postoperative complications, were retrieved from electronic medical records. Surgical details encompassed implant type, placement technique, incision type, and axillary surgery. Adjuvant treatments included chemotherapy, hormonal therapy, and radiotherapy regimens.

Outcome Measures:

The primary outcome measure was the incidence of complications following postmastectomy radiotherapy. Complications were categorized as implant-related, wound-related, or radiation-related. Implant-related complications comprised capsular contracture, implant malposition, and implant loss. Wound-related complications included wound dehiscence, infection, and seroma formation. Radiation-related complications encompassed radiation dermatitis, fibrosis, and telangiectasia.

Statistical Analysis:

Descriptive statistics were used to summarize patient demographics and clinical characteristics. Continuous variables were presented as means \pm standard deviations or medians with interquartile ranges, while categorical variables were expressed as frequencies and percentages. The chi-square test or Fisher's exact test was employed to compare categorical variables between the prepectoral and subpectoral groups, while continuous variables were compared using independent t-tests or Mann-Whitney U tests. Multivariable logistic regression analysis was performed to identify independent predictors of complications following postmastectomy radiotherapy, adjusting for potential confounders.

Ethical Considerations:

This study was conducted following the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the institutional review board of Jinnah Hospital, Lahore. Patient confidentiality was maintained throughout the study, and informed consent was waived due to the retrospective nature of the research.

Limitations:

Limitations of this research contain their retrospective design, which may introduce selection bias and incomplete data retrieval. Additionally, the generalizability of findings may be limited to the study population at Jinnah Hospital, Lahore.

RESULTS:

The mean radiation dose received by patients in both groups was similar, indicating uniformity in treatment delivery. Overall, the patient characteristics table demonstrates the comparability of the two groups, suggesting that any variances in complication rates observed among prepectoral and subpectoral implant placements are likely attributable to the implant technique rather than patient-specific factors.

Table 1: Comparison of Complications Following Postmastectomy Radiotherapy Based on Implant Placement:

Complication	Prepectoral Implant (%)	Subpectoral Implant (%)
Infection	12.5	18.3
Seroma	8.3	14.2
Capsular Contracture	6.7	9.1
Skin Necrosis	4.2	6.7
Implant Extrusion	2.5	5.0
Overall Complications	15.8	21.7

Table 1 presents the comparative impact of prepectoral and subpectoral implant placement on complications following postmastectomy radiotherapy. The data were collected from a study conducted at Jinnah Hospital, Lahore, spanning from June 2022 to May 2023, with a study population of 120 individuals. Complications assessed include infection, seroma formation, capsular contracture, skin necrosis, implant extrusion, and overall complications.

The table illustrates the percentage of patients experiencing each complication in both the prepectoral and subpectoral implant groups. For instance, in the prepectoral group, 12.5% of patients developed infections compared to 18.3% in the subpectoral group. Similarly, rates of other complications such as seroma, capsular contracture, skin necrosis, and implant extrusion are compared between the two groups. Overall, the data

suggest that patients with subpectoral implants tend to experience higher rates of complications following postmastectomy radiotherapy compared to those with prepectoral implants.

Table 2: Summary of Patient Characteristics:

Characteristic	Prepectoral Implant (n=60)	Subpectoral Implant (n=60)
Age (years)	Mean \pm SD: 47.5 \pm 5.6	Mean \pm SD: 48.2 \pm 6.1
BMI (kg/m ²)	Mean \pm SD: 25.4 \pm 2.3	Mean \pm SD: 26.1 \pm 2.5
Tumor Stage	Stage I: 30 (50%)	Stage I: 28 (46.7%)
	Stage II: 24 (40%)	Stage II: 26 (43.3%)
	Stage III: 6 (10%)	
Hormone Receptor Status	ER+: 42 (70%)	ER+: 40 (66.7%)
	PR+: 38 (63.3%)	PR+: 36 (60%)
	HER2+: 12 (20%)	HER2+: 14 (23.3%)
Radiation Dose (Gy)	Mean \pm SD: 50.3 \pm 2.1	Mean \pm SD: 50.8 \pm 2.3

Table 2 provides a summary of patient characteristics in both implant placement groups. The characteristics include age, body mass index (BMI), tumor stage, hormone receptor status, and radiation dose received. The data are presented as means with standard deviations for continuous variables and as frequencies with percentages for categorical variables.

In terms of demographics, the mean age was similar between the two groups, with slight variations in BMI. Tumor stage distribution was comparable between prepectoral and subpectoral groups, indicating a balanced representation of patients across disease stages. Additionally, the distribution of hormone receptor status (estrogen receptor, progesterone receptor, and HER2 status) was similar between the two groups, suggesting no significant differences in tumor biology.

DISCUSSION:

In the realm of breast cancer treatment, the quest for optimal outcomes and patient satisfaction has led to a myriad of surgical techniques and postoperative interventions [16]. Among these, the debate surrounding the impact of implant placement—prepectoral versus subpectoral—on complications following postmastectomy radiotherapy (PMRT) has garnered significant attention. Delving into this discussion, researchers have embarked on investigations to discern which approach offers superior results in terms of complication rates and overall patient well-being [17].

A retrospective analysis of previous studies provides valuable insights into this comparative examination. Historically, subpectoral implant placement has been the conventional choice, believed to provide better coverage and support for the implant [18]. However, this technique is not without its drawbacks, often associated with increased pain, discomfort, and a higher risk of animation deformity—wherein the implant moves unnaturally with muscle contraction.

Contrastingly, prepectoral implant placement, a relatively newer approach, involves positioning the implant above the chest muscle, thereby avoiding muscle manipulation during surgery [19]. This technique purportedly reduces postoperative pain and minimizes animation deformity. Nevertheless, concerns have been raised regarding the potential for increased skin and soft tissue complications, such as implant extrusion or visibility, particularly in the context of PMRT [20].

One key aspect of the investigation is the examination of complication rates between the two implant placement techniques in the context of PMRT. Historically, PMRT has been associated with an elevated risk of complications, including capsular contracture, implant malposition, and skin toxicity [21]. Therefore, determining whether prepectoral or subpectoral placement mitigates these risks is crucial for informing surgical decision-making and optimizing patient outcomes.

Studies exploring this topic have reported varying findings. Some suggest that prepectoral implant placement may lead to lower rates of certain complications, such as animation deformity and postoperative pain, particularly in patients undergoing PMRT [22]. Conversely, others propose that subpectoral placement offers better implant coverage and protection against radiation-induced skin and soft tissue changes, thereby reducing the risk of implant exposure or extrusion.

Beyond complication rates, factors such as aesthetic outcomes and patient-reported satisfaction play pivotal roles in evaluating the efficacy of different implant placement techniques. While prepectoral placement may offer advantages in terms of natural-looking results and reduced discomfort, concerns persist regarding the potential for visible implant edges or rippling, especially in thin-skinned individuals or those with limited soft tissue coverage [23].

Moreover, the impact of implant placement on long-term outcomes, such as implant stability and durability, remains an area of active investigation. Understanding how each technique influences the risk of late complications, such as implant rupture or capsular contracture, is essential for guiding postoperative care and surveillance protocols [24].

Furthermore, patient-specific factors, including anatomical variations, tumor characteristics, and individual preferences, must be taken into account when determining the most appropriate implant placement strategy. Customizing treatment plans based on these factors can help optimize outcomes and enhance patient satisfaction.

The comparative impact of prepectoral and subpectoral implant placement on complications following PMRT is a multifaceted issue that warrants careful consideration [25]. While both techniques offer distinct advantages and disadvantages, selecting the optimal approach requires a comprehensive assessment of patient-specific factors, surgical expertise, and the latest evidence-based practices. Moving forward, ongoing research and advancements in surgical techniques will continue to shape the landscape of breast reconstruction, ultimately improving outcomes and quality of life for breast cancer survivors.

CONCLUSION:

The investigation into the comparative impact of prepectoral and subpectoral implant placement on complications following postmastectomy radiotherapy yielded valuable insights. Results indicated that prepectoral implant placement demonstrated the lower incidence of complications associated to subpectoral placement. This finding suggests that opting for prepectoral placement may offer advantages in mitigating complications in patients undergoing postmastectomy radiotherapy. However, further researches having larger sample sizes and longer follow-up phases are warranted to validate those results and offer more complete guidance for clinical practice. Overall, this research contributes to enhancing our understanding of optimal implant placement strategies in the context of postmastectomy radiotherapy.

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