Long-term Outcomes of Direct-to-Implant Breast Reconstruction Versus Two-Stage Tissue Expander Implant Reconstruction: A Retrospective Comparative Study

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Implant-based breast reconstruction (IBBR) is the most performed reconstructive technique following mastectomy for breast cancer. It can be achieved either as a direct-to-implant (DTI) procedure or as a traditional two-stage approach involving initial tissue expander placement followed by implant exchange. Comparative data on early and long-term outcomes between these approaches remain heterogeneous.

This retrospective cohort study included 139 patients who underwent DTI or two-stage IBBR at Turku University Hospital between January 2009 and December 2024. Of the 139 patients analyzed, 94 underwent direct-to-implant reconstruction and 45 underwent two-stage reconstruction. Patient demographics, comorbidities, oncologic treatments, and operative details were collected from medical records. Primary outcomes included early and late postoperative complications, unplanned reoperations, and implant revision or removal.

The overall complication rate did not differ significantly between DTI and two-stage reconstruction. Early implant removal within 30 days occurred more frequently following DTI reconstruction. Late reoperation rates were similar between groups; however, patients in the DTI cohort underwent significantly fewer reconstructive procedures overall. Rates of capsular contracture and late implant exchange or removal were comparable.

Direct-to-implant and two-stage implant-based breast reconstruction demonstrate comparable overall success and long-term outcomes. The key distinction lies in the risk profile: DTI reconstruction is associated with a higher risk of early implant loss, whereas the two-stage approach entails a greater cumulative surgical burden. Patient- and treatment-related factors, including radiotherapy, bilateral surgery, BMI, and ASA score, significantly influence complication risk. These findings highlight the importance of individualized, risk-adapted patient selection when choosing the optimal reconstructive strategy.

Avainsanat: Implanttirekonstruktio; Välitön rintarekonstruktio; Kaksivaiheinen rekonstruktio; Postoperatiivinen komplikaatio

Long-term Outcomes of Direct-to-Implant Breast Reconstruction Versus Two-Stage Tissue Expander Implant Reconstruction: A Retrospective Comparative Study

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Running Head: Complications in Single- vs Two-Stage Breast Reconstruction

ABSTRACT

Background:

Implant-based breast reconstruction (IBBR) is the most performed reconstructive technique following mastectomy for breast cancer. It can be achieved either as a direct-to-implant (DTI) procedure or as a traditional two-stage approach involving initial tissue expander placement followed by implant exchange. While DTI offers the potential advantages of fewer operations and faster reconstruction, concerns persist regarding early implant loss, particularly in patients with higher oncologic or medical risk profiles. Comparative data on early and long-term outcomes between these approaches remain heterogeneous.

Objectives:

To compare complication profiles, reoperation burden, and implant-related outcomes between direct-to-implant and two-stage implant-based breast reconstruction, and to identify independent risk factors for postoperative complications.

Methods:

This retrospective cohort study included 139 patients who underwent DTI or two-stage IBBR at Turku University Hospital between January 2009 and December 2024. Patient demographics, comorbidities, oncologic treatments, and operative details were collected from medical records. Primary outcomes included early and late postoperative complications, unplanned reoperations, and implant revision or removal. Statistical analyses were performed using Student's t-test or Mann–Whitney U test for continuous variables and Chi-squared or Fisher's exact test for categorical variables. Multivariable regression analysis was used to identify independent predictors of complications, with statistical significance set at $p<0.05$.

Results:
Of the 139 patients analyzed, 94 underwent direct-to-implant reconstruction and 45 underwent two-stage reconstruction. Baseline demographics and comorbidities were comparable between groups; however, the two-stage cohort had significantly higher rates of radiotherapy, chemotherapy, and lymphadenectomy (all $p<0.05$). Operative time was longer, and immediate reconstruction and TIGR® mesh use were more frequent in the DTI group, whereas mastectomy specimen weight and final implant size were greater in the two-stage group. The overall complication rate did not differ significantly between DTI and two-stage reconstruction (24.5% vs. 20.0%, $p=0.558$). Early implant removal within 30 days occurred more frequently following DTI reconstruction (18.1% vs. 4.4%, $p=0.034$). Late reoperation rates were similar between groups; however, patients in the DTI cohort underwent significantly fewer reconstructive procedures overall (0.8 vs. 1.4 per patient, $p=0.010$). Rates of capsular contracture and late implant exchange or removal were comparable. On multivariable analysis, radiotherapy, immediate reconstruction, bilateral surgery, higher ASA score, and increased body mass index were independently associated with postoperative complications.
Conclusions:
Direct-to-implant and two-stage implant-based breast reconstruction demonstrate comparable overall success and long-term outcomes. The key distinction lies in the risk profile: DTI reconstruction is associated with a higher risk of early implant loss, whereas the two-stage approach entails a greater cumulative surgical burden. Patient- and treatment-related factors, including radiotherapy, bilateral surgery, BMI, and ASA score, significantly influence complication risk. These findings highlight the importance of individualized, risk-adapted patient selection when choosing the optimal reconstructive strategy.

Level of Evidence: III

Keywords: Implant-based; Immediate breast reconstruction; Two-Stage Reconstruction; Tissue Expander; Prepectoral; Retropectoral; Postoperative Complications

INTRODUCTION

Mastectomy remains a cornerstone of surgical treatment for breast cancer, and breast reconstruction has become an integral component of comprehensive breast cancer care. In recent years, an increasing proportion of patients have undergone reconstruction following mastectomy. (1,2) Breast reconstruction has been shown to provide significant aesthetic and psychological benefits, contributing to improved quality of life among breast cancer patients. (3) Immediate postmastectomy breast reconstruction has gained widespread acceptance, with up to 50% of mastectomy patients opting for immediate reconstruction in selected healthcare settings. While the use of autologous reconstruction techniques has increased, implant-based breast reconstruction (IBBR) remains the most performed reconstructive approach worldwide. This preference is largely attributed to its relative technical simplicity, shorter operative time, and avoidance of donor-site morbidity. (4–7) Immediate IBBR can be performed using two principal approaches: direct-to-implant (DTI) reconstruction or the traditional two-stage implant-based breast reconstruction (two-stage IBBR). The two-stage approach involves initial placement of a tissue expander (TE), followed by a second operation to exchange the expander for a permanent implant. (8) Selection of the optimal reconstructive strategy is multifactorial and is influenced by patient-related risk factors, anticipated adjuvant oncologic treatments, and surgeon experience. (9)

Although the majority of immediate IBBRs are still performed using a two-stage approach, DTI reconstruction has gained increasing popularity and currently accounts for approximately 15% of alloplastic breast reconstructions. (10,11) Proponents of DTI reconstruction emphasize several potential advantages, including a reduced number of surgical procedures, shorter overall treatment duration, and faster recovery. However, concerns regarding higher complication rates, particularly early implant loss, and the potential need for secondary revision procedures have limited broader adoption of this technique. (12–14)

Traditionally, the subpectoral pocket created following mastectomy has been considered insufficient to accommodate a permanent implant, often resulting in inadequate coverage of the lower pole of the prosthesis. The introduction of acellular dermal matrices (ADMs) has expanded reconstructive possibilities by reinforcing and enlarging the implant pocket, thereby facilitating immediate placement of larger-volume implants or tissue expanders.

(15) ADM-assisted DTI reconstruction has also been suggested to yield more natural breast contour and improved aesthetic outcomes compared with two-stage IBBR. (16,17)
Despite advances in surgical technique and materials, the optimal implant-based reconstructive strategy—direct-to-implant versus two-stage reconstruction—remains a subject of ongoing debate. Evidence comparing their long-term outcomes, complication profiles, and factors influencing surgical safety remains limited and inconsistent. (5,18) In particular, data addressing the balance between early implant failure and cumulative reconstructive burden are sparse.
The aim of this study was to compare complication profiles and patient outcomes between direct-to-implant and two-stage implant-based breast reconstruction. We hypothesized that while two-stage IBBR may be associated with lower early complication rates, DTI reconstruction could offer advantages in terms of reduced treatment duration and overall procedural burden in carefully selected patients.

METHODS

Study Design and Patient Population

This retrospective cohort study included all consecutive adult women who underwent immediate postmastectomy implant-based breast reconstruction at Turku University Hospital between January 2009 and December 2024.
Patients received either direct-to-implant (DTI) reconstruction or two-stage implant-based breast reconstruction (IBBR) with initial tissue expander (TE) placement followed by implant exchange. The type of reconstruction (DTI vs. two-stage IBBR) served as the primary exposure of interest. Patients with incomplete medical records or follow-up shorter than 6 months were excluded.

Covariaties

Clinical and perioperative variables were extracted from electronic medical records. Demographic and clinical covariates included age, body mass index (BMI), comorbidities (diabetes, hypertension, pulmonary disease, depression, lipid disorder), smoking status, herbal supplement use, prior or planned neoadjuvant/adjuvant radiotherapy or

chemotherapy, and axillary lymphadenectomy. Follow-up duration (in months) was also recorded, with a minimum of 6 months for all patients.

Perioperative variables included ASA score, operative time (minutes), bilateral reconstruction, mastectomy weight (g), immediate reconstruction, prepectoral technique, immediate symmetrisation, estimated blood loss (mL), implant size (mL), TIGR® mesh use, and length of hospital stay (days). These variables were selected to capture potential factors influencing postoperative outcomes.

Surgical Technique

All operations were conducted by board-certified plastic surgeons in accordance with established institutional guidelines. The indication for each procedure type was determined by the primary surgeon, based on case-specific discussions held during a prior multidisciplinary team meeting.

In the prepectoral (PP) technique, the implant or tissue expander was positioned within the subcutaneous space superficial to the pectoralis major muscle, immediately beneath the mastectomy flap. When necessary, additional coverage and support were provided using a synthetic mesh (TIGR® Mesh), which was anchored to the chest wall to enhance stability and contour.

In the retropectoral (RP) method, the implant or tissue expander was placed beneath the pectoralis major muscle after partial elevation of the muscle, with mesh utilized for inferolateral reinforcement as indicated.

Reconstruction was performed either as a single-stage direct-to-implant procedure or as a two-stage expander-to-implant approach, depending on patient-specific factors, oncologic requirements, and surgeon discretion. Perioperative antibiotic administration, drain management, and postoperative care protocols were standardized and similar across both groups.

Outcome measures

The primary outcome measure was the occurrence of postoperative complications. Secondary outcomes included specific postoperative complications and long-term (>30 days postoperatively) complications, unplanned reoperations, and implant or scar revisions. Postoperative complications included:

Surgical site infections (SSI): Superficial infections requiring systemic antibiotics or deep infections requiring hospital admission. A positive microbiology swab alone was insufficient to define infection.

Wound dehiscence: Significant wound breakdown delaying healing for more than two weeks and requiring revision. Minor dehiscence not requiring specialist care was not considered a complication.

The evaluated postoperative complications included skin or fat necrosis, hematoma, seroma, capsular contracture, and hospital re-admission within 30 days of surgery.

Skin or fat necrosis was defined as partial- or full-thickness tissue ischemia resulting in devitalized skin or subcutaneous fat, diagnosed clinically and/or requiring debridement.

Hematoma was defined as a clinically significant postoperative collection of blood at the surgical site, confirmed by physical examination or imaging and, when applicable, necessitating evacuation.

Seroma was defined as a postoperative accumulation of serous fluid within the surgical pocket, identified clinically or radiographically and requiring aspiration or drainage.

Capsular contracture was defined as pathologic fibrous capsule formation around the implant leading to firmness, distortion, or pain, consistent with Baker grade III or IV.

Medical complications: Any surgery-related events (e.g., intubation difficulties), respiratory complications, or cardiovascular events, including deep vein thrombosis (DVT) and respiratory tract infections.

Unplanned reoperations were categorized as occurring within 30 days or after 30 days postoperatively. Secondary, non-complication-related procedures, such as excess skin removal, fat grafting, scar revision, and dog-ear revision, were recorded separately.

Implant revisions were defined as early implant removal, within 30 days of reconstruction, while late implant change/removal, occurred more than 30 days after reconstruction, including implant exchange, upsizing, downsizing, or removal for complications (capsular contracture) or aesthetic reasons.

Statistical Analysis

Continuous variables are presented as means ± standard deviations, whereas categorical variables are expressed as counts and percentages. Normality of continuous data was assessed using visual methods (histograms), descriptive indices (skewness and kurtosis),

and the Kolmogorov–Smirnov test. Group comparisons were conducted with appropriate statistical procedures: the independent-samples Student's t-test for normally distributed continuous variables, the Mann–Whitney U test for non-normally distributed continuous variables, and Pearson's chi-square or Fisher's exact test for categorical variables, as applicable.

Multivariable logistic regression was performed to identify independent predictors, with results reported as adjusted odds ratios and corresponding 95% confidence intervals. Model fit was considered satisfactory based on the Hosmer–Lemeshow goodness-of-fit test ($p = 0.982$). Statistical significance was defined using a two-tailed alpha level of 0.05. All analyses were completed using IBM SPSS Statistics, Version 31.0 (Armonk, NY, USA).

RESULTS

Demographics, and Oncologic Characteristics

A total of 139 consecutive patients were included in the analysis: 94 underwent direct-to-implant (DTI) reconstruction and 45 underwent two-stage implant-based reconstruction (IBBR). The mean (±SD) age was 54.3 ± 13.0 years in the DTI group and 51.2 ± 12.5 years in the two-stage IBBR group. The groups were comparable with respect to body mass index, comorbidities (diabetes, hypertension, pulmonary disease, depression, lipid disorder), smoking status, and use of herbal supplements (Table 1).

The median follow-up duration for the cohort was 40.9 months, with no significant difference between DTI and two-stage groups (43.3 ± 37.2 vs. 38.5 ± 50.8 months; $p=0.569$, Table 1). The proportion of patients receiving neoadjuvant oncologic therapy did not differ between groups ($p>0.05$). However, patients in the two-stage cohort were more likely to receive adjuvant radiotherapy (48.9% vs. 29.8%; $p=0.028$), chemotherapy (68.9% vs. 34.0%; $p<0.001$), and undergo axillary lymphadenectomy (44.4% vs. 20.2%; $p=0.003$) compared with the DTI group (Table 1).

Operative Details

Operative time was significantly longer in the DTI cohort compared with the two-stage cohort (151.7 ± 73.4 vs. 122.7 ± 81.1 minutes; $p=0.045$, Table 2), while intraoperative blood loss did not differ between groups ($p=0.461$). Immediate reconstruction was more

frequent in the DTI group (73.4% vs. 28.9%; p<0.001), whereas the rate of immediate symmetrisation was similar (p=0.301).

The use of TIGR® mesh was substantially higher in the DTI cohort (66.0% vs. 8.9%; p<0.001). In contrast, patients in the two-stage group had higher mastectomy weights (p=0.020) and larger final implant volumes (p<0.001). The proportion of bilateral reconstructions (p=0.490) and the use of prepectoral technique (P = 0.421) were comparable between groups. Postoperative hospital stay was longer in the DTI cohort compared with the two-stage cohort (1.24 ± 1.12 vs. 0.60 ± 1.16 days; p=0.002, Table 2).

Postoperative Outcomes

The overall postoperative complication rate did not differ significantly between DTI and two-stage cohorts (24.5% vs. 20.0%; p=0.558, Table 3). Early implant removal (within 30 days) occurred more frequently in the DTI group (18.1% vs. 4.4%; p=0.034). Early (<30 days) and late (>30 days) unplanned reoperation rates were similar between groups (p=0.870 and p=0.713, respectively), but the total number of procedures per patient was significantly lower in the DTI cohort (0.8 vs. 1.4; p=0.010). Hospital readmission within 30 days did not differ significantly between the two groups (12.8% vs. 15.6%; p=0.654). There were no statistically significant differences between groups in rates of capsular contracture (P = 0.304) or late implant exchange/removal (P = 0.056). Additionally, rates of overall surgical complications, including superficial and deep wound infection, wound dehiscence requiring revision, fat necrosis, skin necrosis, hematoma requiring reoperation, and seroma requiring aspiration, were comparable between the two cohorts (all p>0.05, Table 3).

On multivariable analysis, radiotherapy, immediate reconstruction, bilateral surgery, higher ASA score, and increased BMI were identified as independent predictors of postoperative complications (all p<0.01, Table 4).

DISCUSSION

Breast cancer remains a major public health concern, with approximately over 2.3 million new cases diagnosed globally in 2022. (19) Immediate postmastectomy breast reconstruction is becoming increasingly common. Despite a more frequent use of autologous techniques, conventional immediate implant-based breast reconstruction remains the most frequently performed method globally.

The largest and most robust prospective study comparing DTI to two-stage IBBR reconstruction included 1,427 patients. No significant differences were observed in overall complications, infection, reconstructive failure, revision rates, or patient-reported outcomes, except for greater sexual well-being in the DTI group. However, the study included a relatively small number of DTI patients (n=99 versus 1328 two-stage IBBR patients), plane of reconstruction was not reported, and acellular dermal matrix (ADM) use was inconsistent. (20)

Reported complication and reoperation rates in both groups vary across the literature. A meta-analysis by Basta (21) et al. including 13 studies comparing direct-to-implant with two-stage reconstruction, found that DTI was associated with a higher risk of flap necrosis and a twofold increased risk of implant loss. Conversely, two-stage IBBR has been associated with higher rates of certain complications including seroma and hematoma. (22,23)

In our study of 139 patients, immediate breast reconstructions performed using either single-stage or two-stage implant-based techniques demonstrated similar rates of postoperative complications, including infection, capsular contracture, seroma, and skin necrosis. These findings are consistent with more recent comparative studies from tertiary centers, which have demonstrated comparable reoperation rates and similar or lower complication rates with DTI-reconstruction. (5,8,15,24–27) Comparable complication rates between DTI and two-stage IBBR cohorts indicate that both approaches are safe when appropriate patient selection and clinical judgement are applied.

Patients in the two-stage group had higher mastectomy weights and larger final implant volumes, suggesting that these patients had generally larger breast sizes. In DTI, a larger mastectomy weight has been associated with a higher complication rate, including infections and wound healing complications. (28,29) Two-staged approach could be more flexible in accommodating variations in mastectomy weight and implant size. By allowing

gradual tissue expansion over a longer period, two-stage reconstruction facilitates placement of larger final implants while reducing tension on the skin flaps.

Operative time was significantly longer in the DTI group, in line with previous studies. (30,31) This is likely due to intraoperative evaluation of skin flap perfusion, accurate implant placement, and frequent use of supportive materials such as TIGR® mesh. In contrast, two-stage IBBR involves only the placement of a tissue expander, which is less time-consuming. Conversely, two-stage IBBR offers the possibility for revision at the time of the tissue expander–to-implant exchange, which enables surgeons to adjust implant pocket position, refine the inframammary fold, and modify the soft tissue and skin envelope for better contour and symmetry. In addition, the surgeon can relieve tension on the mastectomy skin flaps, reducing the likelihood of skin flap necrosis. (32,33)

Extended hospitalization in the DTI cohort likely reflects both the technical demands of the procedure and the need for close postoperative monitoring. Higher rates of early implant removal, greater tissue manipulation, and careful observation of flap viability, drainage output, and implant positioning all contribute to longer stays in the hospital.

Despite a higher rate of early implant removal and longer postoperative hospital stays in the DTI cohort, the overall number of procedures per patient was lower compared with the two-stage cohort. From a clinical standpoint, these findings suggest that DTI reconstruction may offer the advantages of reduced surgical burden and overall healthcare costs. This emphasizes the importance of careful patient selection to balance early complication risk with overall efficiency.

Although the use of neoadjuvant oncological therapy did not differ between cohorts, the two-stage group had significantly higher rates of radiotherapy, chemotherapy, and axillary lymphadenectomy. The higher prevalence of adjuvant therapy in the two-stage cohort may reflect a greater prevalence of advanced disease, greater tumor burden, or nodal involvement among these patients. From a surgical perspective, this may necessitate a more cautious reconstructive strategy, favoring a two-stage approach to accommodate anticipated adjuvant therapies, especially radiotherapy. Furthermore, more extensive oncologic surgery and treatment may increase the risk of postoperative complications, affect the timing of reconstruction, and contribute to a higher cumulative surgical burden. In addition, DTI has been more frequently performed in younger, non-smoking patients. (4,34) These findings suggest that patients undergoing DTI reconstruction more often have better baseline health

profile and fewer preoperative risk factors, which may reduce the overall risk of postoperative complications. This underscores the importance of thorough evaluation of patient demographics and appropriate patient selection.

The strengths of our study include a consecutive cohort with a long follow-up time, enabling evaluation of factors such as adjuvant cancer treatment and late complications. In addition, detailed perioperative and complication data were available. This level of detail enhances the internal validity of the study and enables more reliable associations between reconstruction strategy, adjuvant treatments and postoperative outcomes.

This study has several limitations. First, its retrospective design inherently introduces the risk of selection bias, information bias, and incomplete data capture. Although institutional protocols were followed, the absence of randomization limits the ability to control unmeasured confounding variables. In addition, reconstructive procedures at Turku University Hospital were performed by surgeons with varying levels of experience and technical preferences, which may have influenced operative decision-making, technique selection, and clinical outcomes.

The sample size may have limited the statistical power to detect differences in less frequent complications, increasing the risk of type II error. Furthermore, the follow-up period may not have been sufficient to fully assess long-term outcomes, particularly delayed complications such as capsular contracture or implant-related issues. Potential heterogeneity in patient characteristics, oncologic treatments (e.g., radiotherapy), and perioperative management may also have contributed to outcome variability.

Importantly, patient satisfaction and patient-reported outcome measures (PROs) were not systematically collected and therefore could not be incorporated into the analysis. As aesthetic outcomes, psychosocial well-being, and quality of life are central components of reconstructive success, the lack of standardized PRO assessment represents a significant limitation.

Future prospective studies with standardized data collection and validated patient-reported outcome instruments are needed to complement clinical endpoints and provide a more comprehensive evaluation of reconstructive success. Multicenter collaborations would enhance generalizability and allow for more robust assessment of patient satisfaction and quality-of-life outcomes across diverse populations and practice settings. Further research is also warranted to clarify the impact of acellular dermal matrices (ADMs) and mesh

materials on both short- and long-term outcomes. Finally, the development and validation of risk stratification models may facilitate individualized reconstructive planning by integrating patient-specific risk factors, oncologic considerations, and patient preferences into shared surgical decision-making.

CONCLUSIONS

Direct-to-implant and two-stage breast reconstruction have comparable overall success. The critical distinction is a higher early implant loss risk with direct-to-implant versus a greater number of required procedures with the two-stage approach. Radiotherapy, immediate bilateral surgery, high BMI, and high ASA score are significant predictors of complications. These findings underscore the importance of nuanced patient selection and multidisciplinary planning to align surgical technique with individual risk profiles.

Tables

Table 1. Demographics of patients at time of study.

Table 2. Comparison of peri-operative parameters in the two groups of patients.

Table 3. Postoperative complications at follow-up.

Table 4. Multivariable logistic regression was used to assess independent risk factors for complications based on whether One or Two-Stage reconstruction was performed, with adjusted odds ratios provided.

Table 1. Demographics of patients at time of study.

	Direct-to-Implant (n=94)	*Two-Stage (n=45)*	*p-value*
Age (mean ± SD)	54.3±13.0	51.2±12.5	0.195
Mean BMI (kg/m^2)	24.6±4.2	25.8±4.5	0.125
Any comorbidity	31 (33.0%)	12 (26.7%)	0.451
Diabetics	4 (4.3%)	0 (0.0%)	0.304
Hypertension	20 (21.3%)	5 (11.1%)	0.144
Pulmonary disease	4 (4.3%)	3 (6.7%)	0.681
Depression	6 (6.4%)	5 (11.1%)	0.334
Lipid disease	14 (14.9%)	3 (6.7%)	0.268
Smokers	24 (25.5%)	9 (20.0%)	0.473
Herbal supplement	5 (5.3%)	4 (8.9%)	0.471
Neoadjuvant radiotherapy	0 (0.0%)	1 (2.2%)	0.324
Neoadjuvant chemotherapy	2 (2.1%)	4 (8.9%)	0.086
Radiotherapy	28 (29.8%)	22 (48.9%)	**0.028**
Chemotherapy	32 (34.0%)	31 (68.9%)	**<0.001**
Axillary Lymphadenectomy	19 (20.2%)	20 (44.4%)	**0.003**
Follow-up (months)	43.3±37.2	38.5±50.8	0.569

Table 2. Comparison of peri-operative parameters in the two groups of patients.

	Direct-to-Implant (n=94)	*Two-Stage (n=45)*	*p-value*
ASA Score (mean ± SD)	1.82±0.76	1.93±0.47	0.417
Operative time (min, mean ± SD)	151.7±73.4	122.7±81.1	**0.045**
Bilateral Reconstructions	24 (25.5%)	14 (31.1%)	0.490
Resection weight (g, mean ± SD)	435.9±253.2	579.2±360.3	**0.020**
Immediate Reconstruction	69 (73.4%)	13 (28.9%)	**<0.001**
Prepectoral technique	56 (59.6%)	30 (66.7%)	0.421
Immediate Symmetrisation	17 (18.1%)	7 (15.5%)	0.301
Blood loss (ml, mean ± SD)	151.7±73.4	118.5±170.1	0.461
Implant Size (cc, mean ± SD)	303.5±113.6	386.2±117.4	**<0.001**
Tigr Mesh Use	62 (66.0%)	4 (8.9%)	**<0.001**
Hospital stay (days, mean ± SD)	1.24±1.12	0.60±1.16	**0.002**

Table 3. Postoperative complications at follow-up.

	Direct-to-Implant (n=94)	*Two-Stage (n=45)*	*p-value*
Patients with complications (medical included)	23 (24.5%)	9 (20.0%)	0.558
Complications			
Superficial wound infection (received antibiotics <30 days)	14 (14.9%)	5 (11.1%)	0.609
Deep wound infection (revision in local anaesthetics or general)	6 (6.4%)	2 (4.4%)	1.000
Wound dehiscence (need for revision -local/general)	10 (10.6%)	4 (8.9%)	1.000
Fat necrosis (need for operation)	3 (3.2%)	1 (2.2%)	1.000
Skin necrosis	9 (9.6%)	2 (4.4%)	0.503
Hematoma (need for operation)	3 (3.2%)	0 (0.0%)	0.551
Seroma (requiring aspiration after drains removal)	8 (8.5%)	4 (8.9%)	1.000
Reoperation <30 days	16 (17.0%)	7 (15.9%)	0.870
Implant removal <30 days	17 (18.1%)	2 (4.4%)	**0.034**
Capsular contracture	4 (4.2%)	0 (0.0%)	0.304
Implant Changes/Removal >30days	5 (5.3%)	7 (15.6%)	0.056
Reoperation at follow up, more than 30 days post operatively	19 (20.4%)	8 (17.8%)	0.713
Mean number of extra operations	0.8±1.2	1.4±1.3	**0.010**
Re-admissions <30 days	12 (12.8%)	7 (15.6%)	0.654
Reoperation for dog-ear / scar revision	4 (4.3%)	0 (0.0%)	0.304

Table 4. Multivariable logistic regression was used to assess independent risk factors for **complications** based on whether technique was used, with adjusted odds ratios provided.

	Odd Ratios	*95% Confidence Interval*	*p-value*
Radiotherapy	14.8	2.38-92.06	**0.004**
Immediate Reconstruction	13.9	2.39-81.02	**0.003**
ASA score	5.73	1.86-17.67	**0.002**
Bilateral Reconstruction	4.66	1.22-17.87	**0.025**
Implant Size	1.01	1.00-1-01	0.055
Operative time	1.00	0.99-1.01	0.815
Blood loss	1.00	0.99-1.00	0.987
Age	0.98	0.93-1.03	0.419
Hypertension	0.94	0.18-4.78	0.941
Pulmonary disease	0.91	0.10-8.53	0.936
Tigr Mesh	0.90	0.23-3.45	0.878
BMI	0.83	0.69-1.00	**0.041**
Depression	0.78	0.13-4.50	0.779
Prepectoral	0.69	0.22-2.14	0.521
Smoking	0.43	0.80-2.12	0.297
Axillary Lymphadenectomy	0.33	0.50-2.07	0.238
Diabetes	0.10	0.20-4.75	0.240

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