

Picking the Right Plane: A Comparison of Total Submuscular, Dual-Plane, and Prepectoral Implant-Based Breast Reconstruction

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BACKGROUND

Implant-based breast reconstruction has evolved, with a recent resurgence of prepectoral techniques. Comparative reconstructive outcomes and complications have not been fully elucidated among the total submuscular (TSM), dual-plane (DP), and prepectoral planes of implant placement.

METHODS

All immediate implant-based breast reconstructions from March 2017 through August 2019 were retrospectively reviewed. Cases were divided into TSM, DP, and prepectoral cohorts. Demographics, operative techniques, and reconstructive outcomes and complications were compared among groups. Statistical analysis included one-way analysis of variance (ANOVA) and the Kruskal-Wallis tests for comparison of continuous and ordinal variables, as well as Chi-Square or Fischer's Exact tests, as appropriate, for categorical variables. All statistical analyses were performed using SPSS Statistics Premium v25 (IBM, Armonk, NY).

RESULTS

826 cases (510 patients) were identified and divided into TSM (n=392), DP (n=358), and prepectoral (n=76) cohorts. Average follow-up for all patients was 27 months. The prepectoral cohort had a higher average BMI and rate of prior reduction/mastopexy (Table 1). Overall complications were lowest in the TSM group at 15.8%, though this difference was not statistically significant (p=0.100) compared to the DP (21.5%) and prepectoral (22.4%) cohorts (Table 2). Major infection occurred more frequently in the DP group compared to the TSM cohort (3.1% vs 0.8%, p=0.028*). The prepectoral cohort had a significantly increased incidence of wound dehiscence than the TSM group (3.9% vs 0.3%, p=0.015*), while both the dual-plane and prepectoral groups had higher rates of seroma formation (DP 4.2%, p=0.013*; Prepectoral 5.3%, p=0.042*) and explantation (DP 6.1%, p=0.002*; Prepectoral 10.5%, p<0.001*) compared to TSM (1.3% and 1.8%).

CONCLUSION

Overall reconstructive complication rates were comparable among the cohorts. Compared to those undergoing TSM reconstruction, the DP cohort was more likely to develop a major infection or require explantation, while the prepectoral group had significantly higher rates of isolated dehiscence, seroma formation, and explantation. This suggest that the absence of overlying vascularized muscle may lead to an inherent inability to tolerate wound healing complications, though further research is needed to clarify these observations.

Table 1. Comparison of patient demographics and oncologic characteristics among total submuscular, dual-plane, and prepectoral implant-based breast reconstruction.

	Total Submuscular	Dual-Plane	Prepectoral	p-value
Patient Demographics				
Breasts	392	358	76	-
Patients	248.5	211.5	50	-
Bilateral Surgery Patients	144 (57.8%)	146 (68.9%)	26 (52%)	-
Age (years)	49.6 ± 12.9	49.8 ± 11.1	52.0 ± 8.9	0.249
BMI (kg/m ²)	24.7 ± 5.1	25.3 ± 4.5	28.6 ± 7.2	<0.001
Diabetes Mellitus	15 (3.8%)	9 (2.5%)	6 (7.9%)	0.072
Tobacco Use				
Active	19 (4.8%)	16 (4.5%)	0 (0%)	0.152
Former	110 (28.1%)	96 (26.8%)	22 (28.9%)	0.896
Prior Breast Augmentation	18 (4.6%)	13 (3.6%)	1 (1.3%)	0.381
Prior Reduction/Mastopexy	15 (3.8%)	10 (2.8%)	7 (9.2%)	0.031
Prior Lumpectomy	62 (15.8%)	46 (12.8%)	13 (17.1%)	0.423
Previous Radiation	26 (6.6%)	12 (3.4%)	7 (9.2%)	0.045
Previous Chemotherapy	91 (23.2%)	58 (16.2%)	19 (25%)	0.035
Postoperative Radiation	64 (16.5%)	48 (13.6%)	15 (19.7%)	0.309
Postoperative Chemotherapy	101 (25.9%)	93 (26.1%)	20 (26.3%)	0.996
Oncologic Characteristics				
Mastectomy Indication				0.032
Therapeutic	239 (61%)	190 (53.1%)	50 (65.8%)	
Prophylactic	153 (39%)	168 (46.9%)	26 (34.2%)	
Side				0.556
Left	202 (51.5%)	180 (50.3%)	34 (44.7%)	
Right	190 (48.5%)	178 (49.7%)	42 (55.3%)	
Cancer Stage				0.279
In situ	54 (15.8%)	37 (12.5%)	13 (18.6%)	
I	147 (43%)	164 (55.4%)	27 (38.6%)	
II	103 (30.1%)	74 (25%)	20 (28.6%)	
III	32 (9.4%)	20 (6.8%)	10 (14.3%)	
IV	6 (1.8%)	1 (0.3%)	0 (0%)	
Mastectomy Type				
MRM	2 (0.5%)	3 (0.8%)	0 (0%)	0.656
Total	203 (51.8%)	116 (32.4%)	40 (52.6%)	<0.001
SSM	86 (21.9%)	58 (16.2%)	16 (21.1%)	0.129
NSM	101 (25.8%)	181 (50.6%)	20 (26.3%)	<0.001
Mastectomy Weight (grams)	478.4 ± 317.2	566.0 ± 367.5	639.1 ± 494.9	<0.001

MRM, Modified radical mastectomy; SSM, skin-sparing mastectomy; NSM, nipple-sparing mastectomy; BMI, body mass index.

Table 2. Comparison of operative characteristics and outcomes among total submuscular, dual-plane, and prepectoral implant-based breast reconstruction.

	Total Submuscular	Dual-Plane	Prepectoral	p-value
Reconstructive Techniques				
Reconstructive Modality				<0.001
TE	392 (100%)	240 (67%)	57 (75%)	
Immediate Implant	0 (0%)	118 (33%)	19 (25%)	
Biologic or Synthetic Reinforcement				
ADM	0 (0%)	272 (76%)	35 (46.1%)	<0.001
Mesh	0 (0%)	58 (16.2%)	2 (2.6%)	<0.001
Dermal Flap	0 (0%)	26 (7.3%)	0 (0%)	-
ADM and Mesh	0 (0%)	0 (0%)	4 (5.3%)	-
Initial TE fill (cc)	99.9 ± 82.4	216.4 ± 153.7	227.2 ± 136.6	<0.001
Reconstructive Outcomes				
Time to Implant Exchange or Autologous Reconstruction (months)	5.8 ± 2.6	6.8 ± 4.3	7.5 ± 6.9	0.007
		448.83 ±		0.009
Implant Size (cc)	416.8 ± 135.5	148.6	475 ± 169.7	
Complications				
Mastectomy Flap Necrosis	30 (7.7%)	35 (9.9%)	7 (9.2%)	
Major MF Necrosis	14 (3.6%)	22 (6.2%)	1 (1.3%)	0.085
Minor MF Necrosis	16 (4.1%)	13 (3.7%)	6 (7.9%)	0.244
Infection	16 (4.1%)	29 (8.1%)	6 (7.8%)	
Major Infection	3 (0.8%)	11 (3.1%)	3 (3.9%)	0.040
Minor Infection	13 (3.3%)	18 (5%)	3 (3.9%)	0.498
Seroma	5 (1.3%)	15 (4.2%)	4 (5.3%)	0.026
Hematoma	8 (2.0%)	2 (0.6%)	1 (1.3%)	0.210
Isolated Wound Dehiscence	1 (0.3%)	3 (0.8%)	3 (3.9%)	0.006
Explantation	7 (1.8%)	22 (6.1%)	8 (10.5%)	<0.001
Implant Exchange	5 (1.3%)	8 (2.2%)	2 (2.6%)	0.528
Any Reconstructive Complication	62 (15.8%)	77 (21.5%)	17 (22.4%)	0.100
Follow-up Length (months)	27.5 ± 8.9	27.7 ± 8.5	20.8 ± 7.4	<0.001

TE, tissue-expander; ADM, acellular dermal matrix; MF, mastectomy flap; NAC, nipple-areola complex.