

Comparison of Subpectoral versus Prepectoral Immediate Implant Reconstruction after Skin- and Nipple-Sparing Mastectomy in Breast Cancer Patients: A Retrospective Hospital-Based Cohort Study

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Keywords

IBR · Breast cancer · Skin-sparing mastectomy · Nipple-sparing mastectomy · Prepectoral · Subpectoral

Abstract

Introduction: Implant-based immediate breast reconstruction (IBR) is a common surgical procedure in breast cancer patients. Comparative analysis concerning the placement of implants is still lacking. Hence, we aimed to analyze pre- versus subpectoral IBR in breast cancer patients. **Patients:** A single-center experience with implant-based IBR following skin/nipple-sparing mastectomy was evaluated. Patient demographics, incidence of major complications, and quality of life assessed with BREAST-Q were compared between the pre- and subpectoral cohort. **Results:** A total of 63 patients were included in this analysis of whom 29 underwent subpectoral and 34 underwent prepectoral IBR. Median duration of surgery was prolonged in the subpectoral versus the prepectoral group (104 ± 28 vs. 80 ± 91 min; $p < 0.05$). The mean number of major complications was significantly increased in the subpectoral group (1.41 ± 1.76 vs. 0.47 ± 0.75 per patient; $p < 0.05$). Detailed analysis showed a significantly increased incidence of implant dislocation ($p < 0.05$) and a trend concerning capsular contracture ($p = 0.086$, not significant) and necrosis ($p = 0.092$, not significant) in the subpectoral group. Quality of life was equal in both groups. **Con-**

clusion: The mean number of major complications in the subpectoral group should be considered when IBR is indicated. Prepectoral IBR seems to be a feasible alternative surgical treatment option with less major complications in selected patients.

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Introduction

Implant-based immediate breast reconstruction (IBR) is a common technique for post-mastectomy reconstruction [1]. Recently, the number of IBR performed has increased compared to autologous reconstruction at about 11% per year with a decline in combined implant/flap procedures [2]. One of the main reasons seems to be the better esthetic outcome achieved by IBR with skin/nipple-sparing mastectomy. Both skin- and nipple-sparing mastectomy are oncologically safe in selected patients and lead to a greater acceptance and better experience [1, 3].

For both forms of mastectomy, pre- and subpectoral positioning of the implant is possible. Patients should be selected well for these procedures. While several studies have demonstrated that subpectoral implant positioning may cause prolonged postoperative pain with subjective and objective functional impairment due to surgical mus-

Table 1. Patient characteristics

	Subpectoral group	Prepectoral group	Total, n	p
<i>Patients, n</i>	29	34		
Age, mean \pm standard deviation, years	49.3 \pm 11.9	49.9 \pm 14.8	63	0.872
Body mass index, mean \pm standard deviation, kg/m ²	24.4 \pm 3.9	24.7 \pm 4.6	61	0.762
Smoking status, no/yes, n	23/5	25/9	62	0.420
Diabetes mellitus, no/yes, n	26/2	33/1	62	0.585
Pathology, n				
Type of tumor			61	
Invasive/in situ	17/10	24/10		
T stage (TNM)			53	
Tis	10	10		
T1a	2	3		
T1b	5	2		
T1c	5	6		
T1	1	0		
T2	2	5		
T3	0	2		
N stage (TNM)			63	
Negative (= N0)	24	23		
Positive (\geq N1)	3	9		
Unknown (= Nx)	0	2		
M stage (TNM)			59	
M0	13	25		
M1	0	0		
Mx	13	8		
Estrogen receptor status			58	
Negative/unknown/positive	8/0/17	8/1/24		
Progesterone receptor status			58	
Negative/unknown/positive	12/0/13	10/0/23		
HER2/neu receptor status			44	
Negative/unknown/positive	13/2/5	20/1/3		
Grading			63	
G1	4	3		
G2	14	18		
G3	9	13		
G4	0	0		
Final resection status			60	
R0	26	34		
R1/2	0	0		
<i>Neoadjuvant therapy, n</i>				
Neoadjuvant chemo-/antibody therapy, no/yes	25/4	26/8	63	0.327
Neoadjuvant endocrine therapy, no/yes	28/1	32/2	63	
Surgery prior to current surgery, n				
No/yes	16/13	17/17	63	0.682
Main breast surgery			63	
Indication, n				
Cancer	27	34		
Prophylactic	2	0		
Surgical technique, n				0.402
Skin-sparing mastectomy	15	14		
Nipple-sparing mastectomy	14	20		
Volume of implant, mean \pm standard deviation, ml	292 \pm 101	293 \pm 97		0.975
Placement of implant, n				
Subpectoral	29	0		
Prepectoral	0	34		
Adjuvant therapy, n				
Chemo-/antibody therapy, no/yes	25/4	27/7	63	
Endocrine therapy, no/yes	15/14	14/19	62	
Radiation, no/yes	28/1	31/3	63	0.618

cle injury requiring physical rehabilitation [4–7], prepectoral placement of silicone implants is known to be associated with capsular contracture [2, 8].

Since placement of the implants in the prepectoral space appears to be a simpler alternative to subpectoral placement, it is becoming increasingly popular [9].

However, comparative studies are limited and results vary. Hence, we aim to report on an analysis of subpectoral versus prepectoral implant-based IBR after skin/nipple-sparing mastectomy in breast cancer patients.

Patients and Methods

In this retrospective study, we analyzed consecutive patients with breast cancer who underwent implant-based IBR after skin- or nipple-sparing mastectomy with either pre- or subpectoral placement of the implant by experienced breast surgeons according to surgical standards.

Patients were treated in the Breast Center of the University Hospital of Cologne and underwent surgery between 2011 and 2013. Patients were followed up for 18 months.

The medical records of all patients were obtained from the comprehensive electronic hospital information system (ORBIS® OpenMed, AGFA HealthCare NV, Mortsel, Belgium) and patient records of the university hospital. The clinical and histological characteristics of each patient and each surgical procedure were also extracted from the patient records.

Postoperative follow-up included data concerning duration of hospital stay and major complications. Patients' quality of life was assessed with the BREAST-Q questionnaire.

Major complications were defined as 'loss of nipple sensation', 'postoperative bleeding with need for revision surgery', 'fistula formation with need for surgery', 'infection', 'pectoralis major problems', 'postoperative bleeding without need for revision surgery', 'necrosis', 'arm pain after hospital discharge', 'capsular contracture', 'cutaneous retraction/thin skin flap', 'implant dislocation', 'secondary wound healing disorder', and 'breast pain after hospital discharge' [10, 11].

Patient characteristics were described using number (percentage), mean \pm standard deviation (SD), or median (interquartile range, IQR), as appropriate. The study was approved by the local ethics committee.

All reported *p* values (Mann-Whitney U test for quantitative data or Fisher's exact test for qualitative data) are 2-sided and considered statistically significant if <0.05 . Statistical analysis was done with the software SPSS Statistics (IBM Corp., Armonk, NY, USA).

Results

A total of 63 patients were included in this analysis. Among the study cohort, 34 patients underwent a prepectoral and 29 a subpectoral immediate IBR after skin- or nipple-sparing mastectomy due to breast cancer. 2 patients received immediate IBR after a prophylactic skin- or nipple-sparing mastectomy with a history of breast cancer in the contralateral breast.

Table 2. Analysis of preoperative mammograms according to the guidelines of Rancati et al. [12]

Subcutaneous tissue thickness	Subpectoral group, %	Prepectoral group, %
Type 1 (≤ 1 cm)	25.0	22.2
Type 2 ($>1-2$ cm)	58.3	37.0
Type 3 (≥ 2 cm)	16.7	40.7

Patient characteristics are summarized in table 1. Concerning age, body mass index, smoking status, and diabetes mellitus, there were no significant differences between both cohorts. Within group 1 (subpectoral reconstruction), 15 patients underwent a skin-sparing mastectomy whereas 14 patients underwent a nipple-sparing mastectomy. In group 2 (prepectoral reconstruction), 14 patients underwent a skin-sparing mastectomy whereas 20 patients underwent a nipple-sparing mastectomy. The mean volume of implant used was 292 (± 101) ml in the subpectoral group versus 293 (± 97) ml in the prepectoral group ($p = 0.975$).

The surgical procedure was significantly prolonged in the subpectoral versus the prepectoral group (104 ± 28 vs. 80 ± 91 min; $p < 0.05$). No significant differences were noted concerning the duration of hospital stay ($p = 0.111$). The general major complication rate was increased at 51.7% ($n = 15$) in the subpectoral group compared to 35.3% ($n = 12$) in the prepectoral group ($p = 0.189$).

Analysis of the preoperative mammograms according to the guidelines of Rancati et al. [12] showed that 40.7% of patients with a prepectoral IBR and 16.7% of patients with a subpectoral IBR had a subcutaneous tissue thickness of more than 2 cm (type 3) (table 2).

A detailed analysis showed that the mean number of major complications per patient was significantly higher with 1.41 in the subpectoral and 0.47 in the prepectoral group ($p < 0.05$). Among the major complications noted, necrosis ($p = 0.092$, not significant (ns)) and capsular contracture ($p = 0.086$, ns) showed a trend in favor of prepectoral reconstruction. Implant dislocation was significantly more frequent in the subpectoral group ($p < 0.05$) (fig. 1).

Within the cohort, 13 (20.6%) patients underwent surgery to remove the implant (7 (24.1%) in the subpectoral and 6 (17.6%) in the prepectoral group; $p = 0.550$).

Quality of life was assessed with the Breast-Q questionnaire. Our results showed no significant differences in quality of life between both groups (table 3).

Discussion

In this retrospective study, we analyzed 63 patients with IBR after skin- or nipple-sparing mastectomy. Overall, 29 patients underwent subpectoral IBR, 34 patients

Table 3. Quality of life assessment

	Subpectoral group	Prepectoral group	p
1 Satisfaction with breast (scale 1–4) ^a	3.0 ± 0.75	3.4 ± 0.53	0.227
2 Satisfaction with the implant (scale 1–4) ^a	3.2 ± 0.8	3.3 ± 0.98	0.766
3 Satisfaction with outcome (scale 1–3) ^a	2.6 ± 0.5	2.7 ± 0.4	1.0
4 Psychosocial well-being (scale 1–5) ^a	4.5 ± 0.5	4.4 ± 0.7	0.920
5 Sexual well-being (scale) ^a	3.7 ± 0.9	3.7 ± 1.1	0.967
6 Physical well-being (scale 1–5) ^b	1.9 ± 0.8	1.9 ± 0.7	0.943

^aHigher scores reflect a better outcome.

^bLower scores reflect a better outcome.

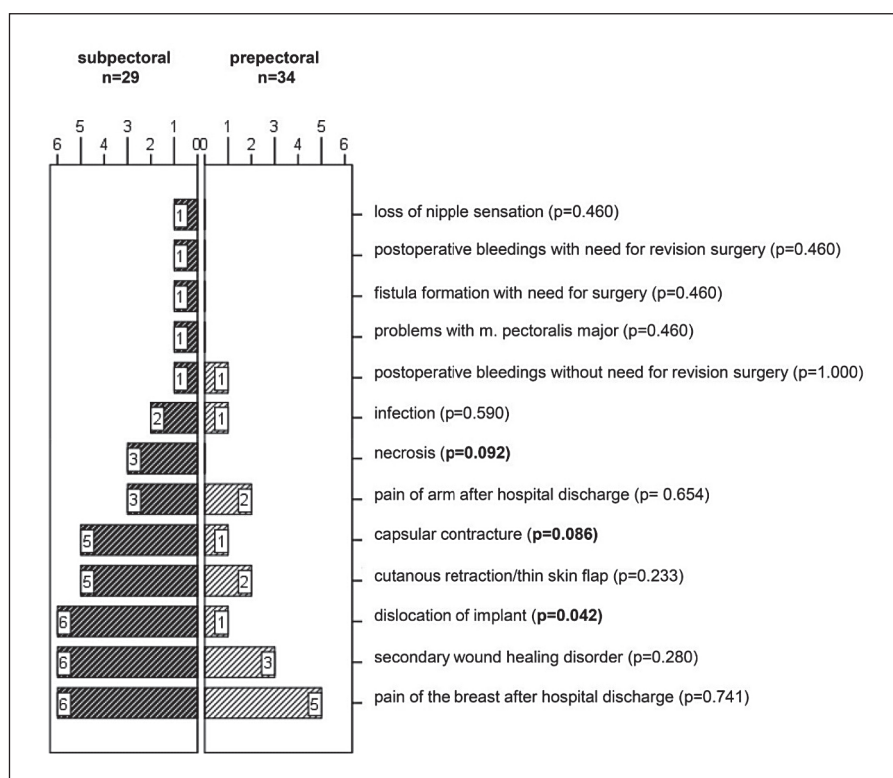


Fig. 1. Detailed analysis of major complications (absolute number, p values).

underwent prepectoral IBR. Studies that compare the clinical outcome of subpectoral versus prepectoral IBR patients are limited. The aim of this analysis was to examine the incidence of major complication as well as quality of life according to the positioning of the implant. When comparing the duration of hospitalization between both groups, we were unable to detect any differences, which is in line with previously published studies [13].

As we already know from other published data, major complication rates in IBR differ between studies. While Salgarello et al. [14] reported a rate of 8.3% of major complications with loss of implant, Eltahir et al. [15] showed a complication rate of 15.7% in the cohort of patients with IBR. Both studies included patients with both subpectoral and prepectoral IBR. In further published studies in which

subpectoral reconstruction was analyzed, complication rates varied between <10% [16, 17], 10–20% [18–21] and >20% [22–26].

However, one of the few comparative analyses of prepectoral versus subpectoral implant placement after conservative mastectomy showed no significant differences in complication rates [16]. In contrast to the previously mentioned studies, Bernini et al. [17] reported a lower implant exchange rate and a decreased Baker grade III/IV capsular contracture rate but a higher rate of implant loss in the prepectoral group.

Certainly, the definition of major complications seems to have an influence on the detected rate. In our cohort, we were able to show that the mean number of major complications was significantly increased in the subpec-

Table 4. Advantages/disadvantages of prepectoral reconstruction

Author	Year	Subpectoral group, n	Prepectoral group, n	Advantages and disadvantages of prepectoral reconstruction
Bernini et al. [17]	2015	35	34	lower implant exchange rate (0 vs. 12%) decreased Baker grade III/IV capsular contracture (0 vs. 12%) superior esthetic outcome (objectively and subjectively) higher implant loss (5.1 vs. 0%)
Casella et al. [16]	2014	39	34	no significant difference in complication rate
Current analysis		29	34	significantly higher mean complication rate in subpectoral group ($p = 0.042$) higher rates of implant dislocation in subpectoral group ($p = 0.042$) trend toward decreased rate of capsular contracture ($p = 0.086$, not significant) and necrosis ($p = 0.092$, not significant) in prepectoral group

toral group ($p < 0.05$). Furthermore, a detailed analysis showed a significantly increased incidence of implant dislocation ($p < 0.05$). Although capsular contracture is known to be a typical complication of prepectoral reconstruction [27], the current analysis showed a trend toward capsular contracture ($p = 0.086$, ns) and necrosis ($p = 0.092$, ns) in the subpectoral group. Nonetheless it has to be stressed that these results were not statistically significant. Table 4 shows all discussed data and gives an overview of the various studies.

In modern breast cancer surgery, quality of life questionnaires have become an important tool for the evaluation of surgical results. 2 studies by Baker et al. [13] and Walia et al. [28] analyzed the different groups via Breast-Q which evaluates satisfaction and quality of life. Baker et al. [13] examined short-term outcomes of subpectoral and prepectoral IBR. There was no significant difference in the mean Q score ($p = 0.81$) between the groups. Walia et al. [28] compared quality of life in patients with prepectoral versus subpectoral tissue expander placement and

came to the conclusion that Breast-Q scores were not significantly different between study groups. This is in accordance with the results of the present study since we found no significant differences in both the quality of life and the satisfaction domains.

Conclusion

Although the mean number of complications is significantly higher in the subpectoral group, this does not seem to have an impact on quality of life or patient satisfaction. This should be taken into consideration when implant-based IBR is indicated.

Disclosure Statement

The authors have no conflict of interest to declare.

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