

ORIGINAL ARTICLE

Unilateral breast reconstruction after mastectomy – patient satisfaction, aesthetic outcome and quality of life

Alexander A. Juhl^a, Søren Christensen^b, Robert Zachariae^b and Tine E. Damsgaard^a

^aPlastic Surgery Research Unit, Department of Plastic and Breast Surgery, Aarhus University Hospital, Aarhus, Denmark; ^bThe Psychooncology Research Unit, Aarhus University Hospital, Aarhus, Denmark

ABSTRACT

Background: An increasing number of women undergo a breast reconstruction (BR) after treatment for breast cancer. The aim of the present study was to evaluate patient-reported esthetic satisfaction, quality of life (QoL), and the association between these, following different types of BR.

Materials and methods: All women who underwent unilateral BR in Central Denmark Region between January 2005 and July 2011 were included. Participants were sent a questionnaire package, which included the Body Image Scale, The Beck Depression Inventory, the Impact of Event Scale, and a study-specific patient-reported esthetic satisfaction scale. Additionally, patients were asked if they experienced a change in QoL owing to the BR. Based on reconstructive method and timing, participants were divided into four groups, three delayed: an abdominal flap group, a latissimus dorsi flap group, an implant ± thoracodorsal flap group; and one immediate BR group.

Results: Of 166 eligible participants, a total of 144 women (87%) completed the questionnaire. The mean follow-up was 3.8 years. Esthetic satisfaction differed significantly between groups [$F(3,139) = 8.55$; $p < 0.001$], with abdominal flap recipients reporting the highest levels of esthetic satisfaction. No between-group differences were observed for the remaining psychosocial measures. Higher satisfaction with esthetic outcome was associated with reporting higher QoL owing to the BR (odds ratio 1.10, $p < 0.001$; 95% CI 1.06–1.15).

Conclusions: Abdominal flap recipients expressed higher satisfaction with their esthetic outcome, compared to the remaining BR types. Higher esthetic satisfaction was strongly associated with reporting an experience of higher QoL.

ARTICLE HISTORY

Received 12 August 2016

Accepted 14 November 2016

Breast cancer is the most common cancer for women in Europe, both in terms of incidence and mortality. The treatment may leave the patient with highly visible scars, a missing breast, and deformity or asymmetry of the breasts. This may cause psychological stress as the patient is confronted with the disease on a daily basis, even after being considered cured in a medical sense [1]. To mitigate these psychological consequences, patients are offered external breast prostheses or surgical breast reconstruction (BR). Many patients, however, do not regain a satisfactory quality of life (QoL) with external breast prosthesis [2]. Currently, approximately 40% of Danish women having received a mastectomy as treatment for breast cancer pursue a BR [3]. In the literature, there is evidence that patients undergoing BR attain a more positive body image, have less intrusive thoughts about cancer recurrence and a higher QoL [4–8]. The BR may be performed using several different surgical methods, either as delayed or immediate procedures. Previous studies have found autologous flaps to yield superior esthetic outcomes compared to implant-based techniques [2,5]. Furthermore, a couple of studies have suggested that there is a correlation between the patient-reported

esthetic outcome and the achieved QoL [1,9]. However, most of these studies are from outside of Europe where the breast cancer treatment guidelines differ, and studies on the outcome of BR from Scandinavian populations are sparse. The aim of the present study was to evaluate the associations of patient-reported satisfaction, esthetic outcome and QoL after different types of BR following mastectomy in a Danish population-based sample.

Materials and methods

Breast reconstruction (BR)

Essentially, there are two ways to perform a BR: the autologous BR, where tissue from elsewhere in the woman's body is used to reconstruct the breast, and the implant-based BR where a breast implant is used. Combinations of the two procedure types are frequently used. Furthermore, the procedure can be performed as either an immediate procedure where the mastectomy and the breast reconstruction is performed during the same surgery, or as a delayed procedure, where the BR is performed months or years after the mastectomy.

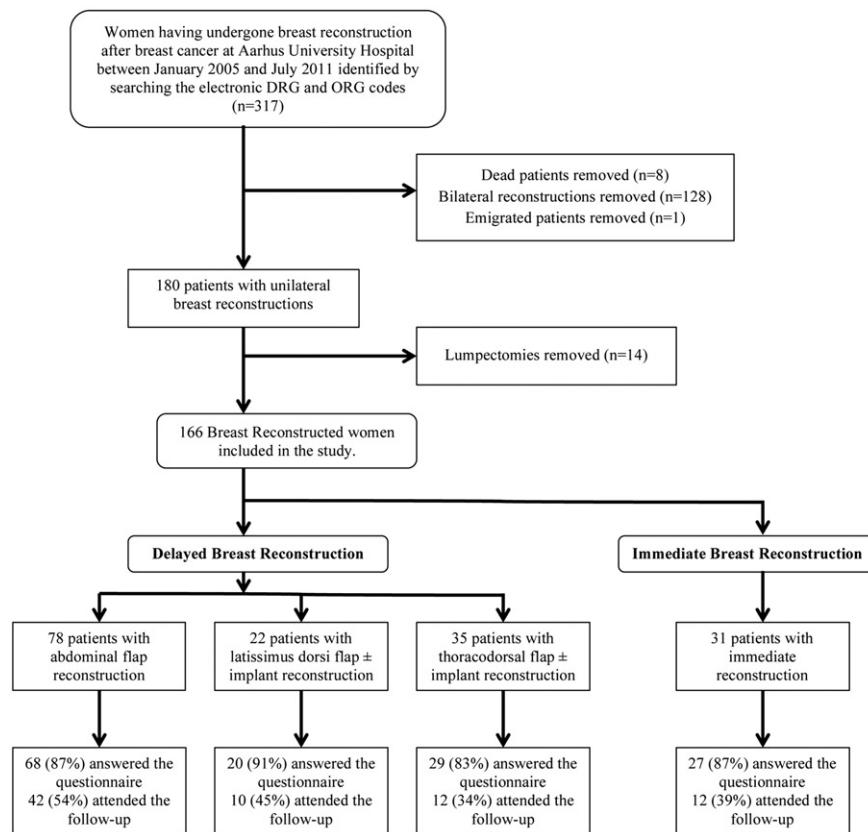


Figure 1. Flowchart of the inclusion process and overview of the different reconstructive procedures evaluated in the study.

The optimal reconstructive procedure for the individual patient depends on the patient's preferences, comorbidity, whether the patient has received or will be receiving radiotherapy, the size of the contralateral breast, and availability of an appropriate donor site for an autologous BR.

Study population and data collection

Using diagnosis-, and procedure-related group codes, all women who underwent unilateral BR at the Department of Plastic and Breast Surgery, Aarhus University Hospital, between 1 January 2005 and 1 July 2011 were identified. Women reconstructed for other reasons than cancer, women receiving bilateral BR, women with known cancer recurrence, and women who had emigrated or died were excluded (Figure 1). Participants were classified into four groups based on the timing and type of their BR. These were: (A) the abdominal flap group; (B) the latissimus dorsi (LD) flap group; (C) the implant ± thoracodorsal (TD) flap group and (D) the immediate group. All patients with immediate BR were placed in group D regardless of reconstruction type. All BRs were performed by consultant plastic surgeons with special training in BR procedures.

Eligible patients were mailed a questionnaire package and an invitation to participate in a physical examination during July 2012. Non-responders were sent a reminder after four weeks. The questionnaire package consisted of three validated instruments, a study-specific scale measuring esthetic satisfaction; and questions evaluating the QoL following BR.

Data on cancer treatment and the reconstructive procedure were obtained from electronic patient files.

Instruments

Body image was evaluated using Hopwood's Body Image Scale (BIS), which is a 10-item breast cancer-specific scale evaluating the impact of a surgical procedure on the patient's body image [10]. The scale consists of items evaluating femininity, self-consciousness, physical and sexual attractiveness, satisfaction with body and scars during the past week. Each item is scored on a four-point Likert scale from 0 (not at all) to 3 (very much). The sum of the BIS items provides a total score (range 0–30, lower scores equals less body image troubles). The scale has high reliability, good clinical validity, is sensitive to change and has previously been used in Danish breast cancer studies [10,11].

Depressive symptoms were evaluated using the validated Danish second edition of the Beck Depression Inventory (BDI-II) [12]. The scale comprises 21 items scored on a range from 0 to 3 (range 0–63, higher score equals more depressive symptoms). A cutoff score of 17 has a 93% true-positive and an 18% false-positive rate for the presence of major depression. Previous studies have found the minimal clinical important difference for the inventory to be four points.

Subjective distress was assessed using the validated Impact of Event Scale (IES) [13]. The IES consists of two subscales: intrusive thoughts and avoidance. Intrusion refers to involuntary thoughts and feelings about the event.

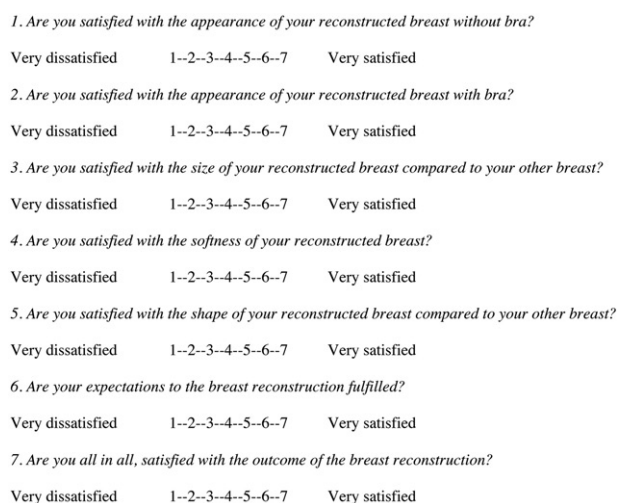


Figure 2. Individual items in the study-specific breast esthetic satisfaction scale.

Avoidance refers to conscious efforts to disattend thoughts and feelings about the event.

As no validated Danish instrument evaluating patient satisfaction with the esthetic result of a BR was available when the study was conducted, a study-specific scale was developed based on experience from a previous PhD thesis at our institution [2]. The scale consists of seven items evaluating the patients' satisfaction with the esthetic result of the BR with and without a bra, satisfaction with the size of the breast, the shape and softness of the breast; as well as the degree to which expectations to the BR were fulfilled and overall satisfaction. All items were answered on seven-point Likert scales ranging from very dissatisfied to highly satisfied. The scale is summated into a total score ranging from 7 to 49, with higher scores representing greater esthetic satisfaction (Figure 2).

In addition, patients were asked if they perceived their overall QoL to have changed, owing to the BR procedure. Each question was answered on a five-point Likert scale: 'Highly diminished' (score 1), 'Diminished' (score 2), 'Unaltered' (score 3), 'Improved' (score 4) and 'Highly improved' (score 5). Answers were dichotomized into an 'improved' QoL category (score 4 or 5) and a 'diminished or unchanged' QoL category (score 1, 2 or 3). The women were also asked whether they felt that choosing a BR was the right choice for them, and if they would recommend a friend in a similar situation to undergo a BR. Answers to these questions were dichotomized with patients answering 'not at all' or 'maybe' (score 1 and 2), and patients answering 'likely' or 'definitely' (score 3 and 4).

Observer evaluation of esthetic outcome

The esthetic result was scored into four categories ('excellent', 'good', 'fair', and 'poor') with regard to overall result with/without clothes, and symmetry with regards to the fill, shape and color of the breast. For women reconstructed with an implant, the degree of capsular formation around the implant was classified according to the Baker classification. The same investigator (AAJ) conducted all the observer evaluations during July 2012.

Statistical analysis

Analysis of differences in characteristics between responders and non-responders were performed with Student's t-test for normally distributed variables and χ^2 -tests for categorical variables. Subgroup analysis was performed using one-way analysis of variance (ANOVA) and Tukey post hoc analysis. The internal consistency of the study-specific esthetic scale was assessed using Cronbach's alpha. A multivariate logistic regression model was performed to test the associations between the patient-reported esthetic outcome and the perceived change in QoL, adjusting for age at reconstruction and the length of follow-up time since the BR. The dichotomized perceived change in QoL was coded as the dependent variable, with the 'diminished or unchanged' QoL category as the reference and the 'improved or highly improved' QoL category as the positive outcome. The design, verification and digitalization of the data from the questionnaire were performed with the Teleform™ software package version 10.5.1 (Cardiff Software, CA). All statistical analyses were performed using the STATA® software IC12 (Stata Corporation, College Station, TX).

Results

Of 166 eligible patients, 144 (87%) returned a completed questionnaire and 76 (46%) participated in the observer evaluation. No statistically significant differences in patient characteristics were found between responders and non-responders (Table 1). Of the responders, 113 (79.0%) patients would recommend BR to others and 120 (83.9%) patients were pleased with their decision to undergo a BR. The most common reasons for seeking a BR was to become whole again, followed by problems with the external prosthesis, regaining femininity and not wanting to be reminded of the breast cancer in daily life.

The mean age at the time of reconstruction was 52.5 years (range 25.5–73.4) and the mean follow-up time was 3.8 years (range 1.1–7.22). For patients with delayed BR, the initial cancer surgery was on average performed 3.8 years (95% CI 3.20–4.36) before BR. No between-group differences were

Table 1. Patient characteristics.

	Responders (n = 144)	Non-responders (n = 22)	p
Age, years (range)	56.7 (30.2–75.1)	56.3 (40.4–77.5)	0.84
BMI (range)	24.1 (16.3–31.1)	25.4 (19.5–33.0)	0.07
Follow-up, years (range)	3.8 (1.2–7.2)	3.9 (1.1–6.6)	0.71
Radiation therapy ^a	64 (44.4%)	10 (45.5%)	0.93
Chemotherapy	81 (56.3%)	11 (50%)	0.58
<i>Reconstruction type</i>			0.85
Abdominal flap	68 (47.2%)	10 (45.5%)	
LD ± implant	20 (13.9%)	2 (9.1%)	
TD ± implant	29 (20.1%)	6 (27.3%)	
Immediate reconstruction	27 (18.8%)	4 (18.2%)	
<i>Complications</i>			
Major	37 (25.7%)	6 (27.3%)	0.88
Minor	49 (34%)	11 (50%)	0.15

BMI: body mass index; LD: latissimus dorsi flap; TD: thoracodorsal flap.

^aDistribution of patients having received radiotherapy in the four reconstruction type subgroups were as follows: Abdominal flap group, 41/68 = 60.3%; LD ± implant group, 12/20 = 60.0%; TD ± implant group, 8/29 = 27.6%; and Immediate group, 3/27 = 11.1%.

Table 2. Details of the reconstructive procedures performed.

Group and reconstructive procedure	N (%)
<i>Abdominal flap group (delayed BR)</i>	78 (47.0)
Pedicled transverse rectus abdominus myocutaneous flap (TRAM)	41 (52.6)
Deep inferior epigastric perforator flap (DIEP)	30 (38.5)
Pedicled TRAM and implant	3 (3.8)
Free TRAM	3 (3.8)
DIEP and implant	1 (1.3)
<i>Latissimus dorsi (LD) flap group (delayed BR)</i>	22 (13.3)
LD and implant	19 (86.4)
LD	3 (13.6)
<i>Thoracodorsal (TD) flap¹/Implant group (delayed BR)</i>	35 (21.1)
TD and implant	25 (71.4)
Two-stage (expander) implant	9 (25.7)
One-stage implant	1 (2.9)
<i>Immediate reconstruction group (immediate BR)</i>	31 (18.7)
Two-stage expander	23 (74.2)
TD	4 (12.9)
Pedicled TRAM	2 (6.5)
Direct to implant	2 (6.5)

Detailed information regarding the reconstructive procedures performed in each of the four BR groups. Data are presented as number of patients for each group with the group total percentages referring to the whole population and the individual percentages referring to the number of procedures in the specific group. None of the breast reconstructions were performed with the use of acellular dermal matrix.

¹Random fascio-cutaneous flap.

found for age at the time of reconstruction ($p = 0.82$). Follow-up time since reconstruction was statistically significantly different between the groups [$F(2,141) = 5.36$, $p = 0.006$]. The LD flap group had statistically significantly longer follow-up compared to the abdominal flap group (1.07 years longer 95% CI 0.21–1.77, $p = 0.008$) and compared to the immediate reconstruction group (1.16 years longer 95% CI 0.19–2.14, $p = 0.015$). Detailed specifications of the BR procedures in the groups are shown in Table 2.

Patient-reported esthetic satisfaction

The mean esthetic satisfaction score for the total cohort was 37.1 ± 10.8 . The scores differed statistically significantly between groups [$F(3,139) = 8.55$, $p < 0.001$] (Table 3). Tukey post hoc analysis revealed that the abdominal flap group had statistically significantly higher esthetic satisfaction scores compared to the TD ± implant group and the immediate BR group (mean difference 9.63 ± 2.22 , $p < 0.001$ and 8.39 ± 2.28 , $p = 0.002$). No other between-group differences

were found. The internal consistency of the study-specific esthetic satisfaction scale was excellent (Cronbach's alpha = 0.96).

Observer-evaluated esthetic outcome

No difference in the observer-evaluated esthetic outcome was found between groups [$F(3,65) = 1.42$, $p = 0.24$] (Table 3). A moderate, statistically significant, positive correlation between the patient-reported esthetic satisfaction and the clinical evaluation of the esthetic outcome was observed (Spearman's rho = 0.32, $p = 0.008$).

Body image (BIS)

The total BIS scores differed statistically significantly between the different BR types [$F(3,138) = 2.72$, $p = 0.047$], with the TD ± implant group reporting the worst body image. Post hoc analyses, however, revealed no statistically significant pairwise between-group differences, although the TD ± implant group reported borderline statistically significant more body image troubles when compared to the abdominal flap group (mean difference 3.73 ± 3.86 , $p = 0.063$) (Table 3).

Depressive symptoms (BDI) and Impact of Events Scale (IES)

In the total cohort, 18 (12.6%) patients had a BDI score indicating major depression. No between-group differences were found for the BDI scores [$F(3,139) = 0.98$, $p = 0.40$]. Furthermore, no between-group differences were found for the total IES score [$F(3,138) = 0.67$, $p = 0.57$], nor for the subscales of avoidance [$F(3,138) = 1.22$, $p = 0.31$] or intrusive thoughts [$F(3,139) = 0.19$, $p = 0.90$] (Table 3).

Perceived change in quality of life

A total of 76% of the women reported to experience an improved or highly improved QoL owing to the BR, whereas 24% reported unaltered or diminished QoL (Table 3). Subgroup analyses revealed that the immediate BR group was statistically significantly less likely to report an experience of improved QoL compared to the remaining three

Table 3. Quality-of-life-related outcomes according to reconstructive groups.

Instrument	Abdominal flap	LD ± Implant	TD ± Implant	Immediate Reconstruction	<i>F(d.f.) p^a</i>
Experience of improved QoL ^b	58 (86.6%)	17 (85%)	21 (77.8%)	10 (38.5%)	<i>F</i> (3,136) = 9.81, <i>p</i> < 0.001
Recommend to others ^b	63 (94.0%)	18 (90%)	27 (93.1%)	25 (92.6%)	<i>F</i> (3,139) = 0.13, <i>p</i> = 0.94
Right choice for me ^b	65 (97.0%)	19 (95%)	26 (89.7%)	26 (96.3%)	<i>F</i> (3,139) = 0.81, <i>p</i> = 0.49
	Mean (SD)				
Esthetic satisfaction					
Summated score ^c	40.9 (7.9)	38.6 (9.6)	31.3 (12.8)	32.6 (11.6)	<i>F</i> (3,139) = 8.55, <i>p</i> < 0.001
Observer-evaluated esthetic outcome					
Summated score ^d	19.7 (2.8)	19.6 (4.0)	18.1 (5.5)	21.1 (2.8)	<i>F</i> (3,65) = 1.42, <i>p</i> = 0.24
BIS					
Summated score ^e	16.7 (5.7)	19.1 (7.1)	20.5 (7.7)	16.4 (7.3)	<i>F</i> (3,138) = 2.72, <i>p</i> = 0.047
BDI					
Summated score ^f	6.2 (7.2)	9.0 (9.7)	6.6 (8.6)	5.2 (6.8)	<i>F</i> (3,139) = 0.98, <i>p</i> = 0.40
Major depression	8.8%	30.0%	13.8%	11.1%	<i>F</i> (3,139) = 2.46, <i>p</i> = 0.07
IES					
Intrusion ^g	5.1 (7.6)	6.2 (7.2)	4.8 (6.3)	4.9 (6.1)	<i>F</i> (3,139) = 0.19, <i>p</i> = 0.90
Avoidance ^g	6.1 (7.7)	9.3 (7.6)	6.1 (7.8)	5.3 (6.8)	<i>F</i> (3,138) = 1.22, <i>p</i> = 0.31

BIS: Body Image Scale; BDI: Becks Depression Inventory; IES: Impact of Events Scale; QoL: quality of life; SD: standard deviation.

^aOne-way ANOVA test

^bcalculated from the dichotomized outcome

^chigher score indicates higher esthetic satisfaction (range 7–49)

^dhigher score indicates better esthetic evaluation (range 6–24)

^ehigher score indicate more troubles (range 0–30)

^fhigher score indicate more depressive symptoms (range 0–63), cut off for major depression = 17

^ghigher score indicates more symptoms.

Table 4. Multivariate analysis of perceived improvement in quality of life.

Variable	OR (95% CI)	<i>p</i>
Esthetic satisfaction	1.10 (1.06–1.15)	<0.001
Follow-up time since BR	1.36 (1.01–1.82)	0.045
Age at the time of BR	0.96 (0.91–1.01)	0.118

BR: breast reconstruction; CI: confidence interval.

Follow-up time and age at time of BR measured in years.

groups (*p* < 0.001 for immediate vs. abdominal flap, *p* = 0.001 for immediate vs. LD, and *p* = 0.002 for immediate vs. TD ± implant group). To assess the association between reporting a perceived improvement in QoL and high esthetic satisfaction, a multivariate logistic regression analysis was conducted (Table 4). The model was adjusted for age at the time of BR and the length of follow-up. A statistically significant correlation between perceiving an improvement in QoL and reporting a higher esthetic satisfaction was found, with every one-point increase on the esthetic satisfaction scale yielding an odds ratio (OR) of 1.10 for reporting a perceived improvement in QoL. Increased follow-up time since the BR was statistically significantly associated with reporting a perceived improved QoL, whereas age at the time of BR was not (Table 4).

Complications

Overall, 43 (26%) patients had a major complication and 60 (36%) patients had a minor complication (Table 5). No statistically significant differences in major complications between groups were observed. The TD ± implant group had a statistically significantly lower rate of minor complications than patients reconstructed with an abdominal flap (14.3% vs. 46.2%, *p* = 0.006). Neither minor nor major complications had a statistically significant association with the patient-reported esthetic satisfaction.

Discussion

The present study explored the patient-reported outcome of 144 unilateral BRs performed in the Central Denmark Region between 2005 and 2011 at a mean follow-up of 3.8 years. We observed a strong association between higher patient-reported esthetic satisfaction and reporting a perceived improvement in QoL, even after adjusting for possible confounding factors such as age at time of BR, and the follow-up time since the BR. Similarly, Nicholson et al. found that the patients' perception of the cosmetic outcome was associated with a favorable psychosocial outcome [9]. Furthermore, Waljee et al. found a better esthetic outcome after breast conserving surgery to be associated with a perceived higher QoL [1]. In concordance with previous studies [2,5,6,14,15], women reconstructed with an abdominal-based flap were more satisfied with the esthetic outcome compared to women who had a TD flap or implant-based BR. This may in part be explained as the TD flap only provides additional skin to the two lateral quadrants of the reconstructed breast, whereas both the abdominal and the LD flaps add additional skin to all four quadrants and thus yields a more homogenous breast skin envelope. Moreover, it also provides a possible explanation as to why there was not a statistically significant difference in esthetic satisfaction between the abdominal flap group and the LD group. However, the higher esthetic satisfaction in the abdominal flap group may also be a result of the substantially higher rate of minor surgical corrections performed in this group compared to the other groups.

When comparing the patient-reported esthetic satisfaction and the observer-evaluated esthetic outcome, only a moderate correlation was observed. This indicates that patients and clinicians evaluate the esthetic result differently. In support of this observation, two studies have previously shown a considerable discrepancy between what patients and experts

Table 5. Complications after the reconstructive procedure.

Reconstructive procedure	Abdominal flap ^a n = 78	LD flap (±) implant n = 22	Thoracodorsal (±) implant n = 35	Immediate reconstruction n = 31
<i>Major complications</i>				
Seroma requiring surgical revision	–	–	–	2 (6%)
Capsular contracture requiring surgery	1 (1%)	–	4 (11%)	1 (3%)
Hematoma requiring surgical revision	1 (1%)	2 (9%)	–	3 (10%)
Implant rupture/loss/skin perforation	–	2 (9%)	3 (9%)	4 (13%)
Bulging requiring surgery ^b	11 (14%)	–	–	–
Necrosis requiring surgery ^c	10 (13%)	2 (9%)	1 (3%)	3 (10%)
Rotation/displacement of implant	–	–	5 (14%)	–
<i>Minor complications</i>				
Prolonged wound healing	31 (40%)	4 (18%)	2 (6%)	2 (6%)
Clinical signs of infection	13 (17%)	4 (18%)	4 (11%)	10 (32%)
Seroma	3 (4%)	1 (5%)	–	1 (3%)
Minor necrosis/epidermolysis	9 (12%)	1 (5%)	2 (6%)	1 (3%)
Minor surgical correction of reconstruction ^d	36 (46%)	2 (9%)	5 (14%)	7 (23%)

The women may have more than one complication.

^aThree patients had a later addition of an implant in order to gain better symmetry

^beight of the complications were TRAM based and three were DIEP

^c12 complications were at the reconstructed breast, one was at the donor site

^ddog ear revisions, scar corrections etc. including donor site.

believe is important with regard to an excellent BR result [16,17]. However, considering the smaller proportion of patients participating in the observer evaluation of the esthetic outcome compared to the proportion answering questions on their perceived satisfaction with the esthetic outcome (46% vs. 87%), these results should be interpreted with caution.

Several studies have investigated issues related to the timing of the BR and have found immediate BR to be preferable in terms of both cost-effectiveness and healing time [7,18,19]. In contrast, other studies have shown that immediate BR carries a higher complication rate [20]. Our overall complication rates of 26% major and 36% minor complications were in line to the complication rate of 32–52% reported in previous studies [2,4,15]. We observed no increased complication rate for the immediate BR population.

However, consistent with previous studies, immediate BR was associated with lower patient-reported esthetic satisfaction [21]. Patients undergoing delayed BR have experienced living without a breast for some time, whereas those who undergo immediate BR have not. This may cause the delayed BR recipients to compare their BR outcome to not having a breast, whereas immediate BR recipients may be more likely to compare their BR outcome with their removed natural breast. Consequently, the patients undergoing a delayed BR may be more forgiving towards less perfect BR results. The lower level of satisfaction may thus be due to differences in reference point used by women receiving immediate and delayed BR, which was also the key reasoning behind placing all of the immediate breast reconstructions in the same group, regardless of which reconstructive method was used.

With regards to body image, a main effect of BR type was observed, but no statistically significant differences in the post hoc tests. However, a trend towards better body image for the abdominal flap BR group compared with the TD±implant group was observed, which is in concordance with the literature [22]. In contrast to our results, Al-Ghazal et al. [23] has previously found immediate BR to be associated with a superior body image compared with delayed BR using the same body image instrument as in the present

study. Although the sample size in Al-Ghazal et al.'s study is similar to the present study (n=121), the larger range of their follow-up (6–226 months) may explain the differences in outcome. Furthermore, in a prospective study by Metcalfe et al. [24], women receiving an immediate reconstruction experienced an increased level of body stigma, whereas women undergoing delayed BR experienced a decreased level of body stigma at one-year follow-up.

The depression rate of 12.6% found in our study was comparable to that reported in similar studies [23]. Furthermore, the current subjective distress, as measured by the IES, was comparable to results reported in the literature [14]. No between-group differences were observed for any of the psychosocial measures investigated in the present study. Contrary to our results, some previous studies have found immediate BR to provide psychosocial benefits compared with delayed BR [23,25]. Possible explanations for this difference may be the differences in follow-up time or the higher proportion of two-stage rather than one-stage immediate BR in our population compared to previous studies [23,25]. However, in support of the present results, a prospective study by Metcalfe et al. also found no differences in psychosocial functioning at one-year follow-up [24].

The present study is strengthened by its high response rate and by investigating a population based on the entire cohort of BR performed in the Central Denmark Region in the studied period, rather than a sample of convenience. However, some limitations must be acknowledged. The cross-sectional nature of the study limits the ability to draw conclusions about causality. High patient-reported esthetic satisfaction may thus be an effect rather than the cause of experiencing improved QoL. Moreover, the results regarding the perceived change in QoL may be affected by recall bias. Additionally, while both the IES and the BDI scales are validated in Danish populations, the BIS has not undergone a formal validation in a Danish population wherefore its validity may be negatively affected in the present population. However, the Danish version of the BIS has been forward and backward translated. Furthermore, the presented data was collected four years ago. Additionally, at the time of

conducting the present study, no validated Danish instrument to evaluate patient-reported esthetic satisfaction existed, therefore a study-specific scale was used. Since then, the BREAST-Q, developed by Pusic et al. has been officially translated into several different languages, and is currently the most widely used BR-specific patient-reported outcome measure.

In conclusion, patients receiving an abdominal flap-based BR reported higher esthetic satisfaction with their BR outcome, compared to the other investigated BR types. The apparent lack of differences in other psychosocial outcomes suggests that type of BR may only be marginally associated with the patients' general psychosocial status. Furthermore, we found a strong association between reporting a favorable esthetic outcome and a perceived improvement in QoL following the BR.

Acknowledgments

The authors wish to express their gratitude to the participating patients.

Disclosure statement

The authors have no conflict of interest to declare.

Ethical approval

The Central Denmark Regional Ethics board under the Danish National Committee on Biomedical Research Ethics, assessed the specific study and deemed it as exempt from need of approval and accepted to be carried out (Req. Nr. 217/2011).

Funding

The study was funded by the Faculty of Health Sciences, Aarhus University and 'Direktør Jacob Madsen & Hustru Olga Madsens Fond'. The financial contributors did not have any involvement in the study.

References

- Waljee JF, Hu ES, Ubel PA, et al. Effect of esthetic outcome after breast-conserving surgery on psychosocial functioning and quality of life. *J Clin Oncol*. 2008;26:3331–3337.
- Christensen BO, Overgaard J, Kettner LO, et al. Long-term evaluation of postmastectomy breast reconstruction. *Acta Oncol*. 2011;50:1053–1061.
- Bodilsen A, Christensen S, Christiansen P, et al. Socio-demographic, clinical, and health-related factors associated with breast reconstruction—a nationwide cohort study. *Breast*. 2015;24:560–567.
- Alderman AK, Wilkins EG, Kim HM, et al. Complications in post-mastectomy breast reconstruction: two-year results of the Michigan breast reconstruction outcome study. *Plast Reconstr Surg*. 2002;109:2265–2274.
- Edsander-Nord A, Brandberg Y, Wickman M. Quality of life, patients' satisfaction, and aesthetic outcome after pedicled or free TRAM flap breast surgery. *Plast Reconstr Surg*. 2001;107:1142–1153. Discussion 1154–5.
- Alderman AK, Kuhn LE, Lowery JC, et al. Does patient satisfaction with breast reconstruction change over time? Two-year results of the Michigan breast reconstruction outcomes study. *J Am Coll Surg*. 2007;204:7–12.
- Al-Ghazal SK, Fallowfield L, Blamey RW. Comparison of psychological aspects and patient satisfaction following breast conserving surgery, simple mastectomy and breast reconstruction. *Eur. J. Cancer*. 2000;36:1938–1943.
- Eltahir Y, Werners LL, Dreise MM, et al. Quality-of-life outcomes between mastectomy alone and breast reconstruction: comparison of patient-reported BREAST-Q and other health-related quality-of-life measures. *Plast Reconstr Surg*. 2013;132:201e–209e.
- Nicholson RM, Leinster S, Sassoon EM. A comparison of the cosmetic and psychological outcome of breast reconstruction, breast conserving surgery and mastectomy without reconstruction. *Breast*. 2007;16:396–410.
- Hopwood P, Fletcher I, Lee A, et al. A body image scale for use with cancer patients. *Eur J Cancer*. 2001;37:189–197.
- Lyngholm CD, Christiansen PM, Damsgaard TE, et al. Long-term follow-up of late morbidity, cosmetic outcome and body image after breast conserving therapy. A study from the Danish Breast Cancer Cooperative Group (DBCG). *Acta Oncol*. 2013;52:259–269.
- Beck A, Steer R, Brown G. Manual: beck depression inventory. 2nd ed. San Antonio, TX: The Psychological Corp. Harcourt & Brace; 1996.
- Horowitz M, Wilner N, Alvarez W. Impact of Event Scale: a measure of subjective stress. *Psychosom Med*. 1979;41:209–218.
- Tonseth KA, Hokland BM, Tindholdt TT, et al. Quality of life, patient satisfaction and cosmetic outcome after breast reconstruction using DIEP flap or expandable breast implant. *J Plast Reconstr Aesthet Surg*. 2008;61:1188–1194.
- Colakoglu S, Khansa I, Curtis MS, et al. Impact of complications on patient satisfaction in breast reconstruction. *Plast Reconstr Surg*. 2011;127:1428–1436.
- Temple CL, Cook EF, Ross DC, et al. Development of a breast reconstruction satisfaction questionnaire (BRECON): dimensionality and clinical importance of breast symptoms, donor site issues, patient expectations, and relationships. *J Surg Oncol*. 2010;101:209–216.
- Beesley H, Ullmer H, Holcombe C, et al. How patients evaluate breast reconstruction after mastectomy, and why their evaluation often differs from that of their clinicians. *J Plast Reconstr Aesthet Surg*. 2012;65:1064–1071.
- Roth RS, Lowery JC, Davis J, et al. Quality of life and affective distress in women seeking immediate versus delayed breast reconstruction after mastectomy for breast cancer. *Plast Reconstr Surg*. 2005;116:993–1002. Discussion 1003–5.
- Guyomard V, Leinster S, Wilkinson M. Systematic review of studies of patients' satisfaction with breast reconstruction after mastectomy. *Breast*. 2007;16:547–567.
- Mortenson MM, Schneider PD, Khatri VP, et al. Immediate breast reconstruction after mastectomy increases wound complications: however, initiation of adjuvant chemotherapy is not delayed. *Arch Surg*. 2004;139:988–991.
- Davis GB, Lang JE, Peric M, et al. Breast reconstruction satisfaction rates at a large county hospital. *Ann Plast Surg*. 2014;72(Suppl 1):S61–S65.
- Wilkins EG, Cederna PS, Lowery JC, et al. Prospective analysis of psychosocial outcomes in breast reconstruction: one-year postoperative results from the Michigan Breast Reconstruction Outcome Study. *Plast Reconstr Surg*. 2000;106:1014–1025. Discussion 1026–7.
- Al-Ghazal SK, Sully L, Fallowfield L, et al. The psychological impact of immediate rather than delayed breast reconstruction. *Eur J Surg Oncol*. 2000;26:17–19.
- Metcalf KA, Semple J, Quan ML, Vadaparampil ST, Holloway C, Brown M, et al. Changes in psychosocial functioning 1 year after mastectomy alone, delayed breast reconstruction, or immediate breast reconstruction. *Ann Surg Oncol*. 2011;19:233–241.
- Fernandez-Delgado J, Lopez-Pedraza MJ, Blasco JA, et al. Satisfaction with and psychological impact of immediate and deferred breast reconstruction. *Ann Oncol*. 2008;19:1430–1434.