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Effect of standardised surgical assessment and shared decision-making on morbidity and patient satisfaction after breast conserving therapy: A cross-sectional study

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ABSTRACT

Background: The role of oncoplastic breast conserving therapy (OPBCT) on physical function, morbidity and patient satisfaction has yet to be defined. Additionally, technique selection should be individualised and incorporate patient preference. The study aim was to investigate differences between "standard" (sBCT) and oncoplastic breast conservation (OPBCT) in patient-reported outcomes (PROs) when patients have been assessed in a standardised manner and technique selection has been reached through shared decision-making (SDM).
Methods: This is a cross-sectional study of 215 women treated at a tertiary referral centre. Standardised surgical assessment included breast and lesion volumetry, definition of resection ratio, patient-related risk factors and patient preference. Postoperative morbidity and patient satisfaction were assessed by validated PROs tools (Diseases of the Arm, Shoulder and Hand-DASH and Breast-Q). Patient experience was assessed by semi-structured interviews.
Results: There was no difference of the median values between OPBCT and sBCT in postoperative morbidity of the upper extremity (DASH 3.3 vs 5, $p = 0.656$) or the function of the chest wall (Breast-Q 82 vs 82, $p = 0.758$). Postoperative satisfaction with breasts did not differ either (Breast-Q 65 vs 61, $p = 0.702$). On the individual level, women that opted for OPBCT after SDM had improved satisfaction when compared to baseline (+3 vs −1, $p = 0.001$). Shared decision-making changed patient attitude in 69.8% of patients, leading most often to de-escalation from mastectomy.
Conclusions: These findings support that a combination of standardised surgical assessment and SDM allows for tailored treatment and de-escalation of oncoplastic surgery without negatively affecting patient satisfaction and morbidity.

1. Introduction

The use of oncoplastic breast conserving therapy (OPBCT) has increased during recent years [1,2]. OPBCT facilitates the excision of larger or adversely located tumours with reduced rates of re-excision and conversion to mastectomy [3,4], safe oncologic profile [5–8], and superior aesthetic outcomes [9–11]. Its popularity has motivated efforts for classification and standardisation of techniques, indications, and documentation, in the fashion of clinical algorithms [12–15]. However, there is a lack of well-conducted studies evaluating efficacy, safety and patient-reported outcomes (PROs) following OPBCT [16]. This results in recommendations based on low-level evidence, despite broad acceptance and implementation [17]. This causes concerns for overutilisation with recent discussions calling for rationalisation and de-escalation [18,19].

OPBCT seems to have more complications [20–22], whereas excess tissue removal does not improve oncologic outcomes over

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standard BCT (sBCT) [23]. Therefore, the question of whether extensive dissection and reshaping leads to higher chest wall and upper-extremity morbidity, becomes extremely relevant. While mastectomy has significant effects on long-term morbidity and quality of life (QoL) [24–27], there is only sparse data regarding the impact of OPBCT [28]. These studies have, however, utilised existing classifications for OPBCT [12–15], that do not necessarily reflect the extent of dissection and remodelling of the breast. This suggests that the hypothesis that no correlation exists between physical function and more extensive surgery needs to be tested. Since OPBCT is implemented to meet individualised patient expectations and preferences, it is important to define whether this comes at the cost of additional morbidity and inform patient expectations. At the same time, technique selection is a multiparametric combination of technical possibilities and limitations, tumour biology, patient-related risk-factors, and patient preference. For this, detailed assessment and patient involvement in the decision-making process are crucial.

The study aim was to examine the effect of a patient-centred approach to selection of technique through standardised surgical assessment and shared decision-making (SDM) on PROs regarding morbidity, function and satisfaction, and patient-reported experience (PRE).

2. Materials and methods

Women treated with breast conservation for breast cancer (invasive and in situ) or Breast Imaging, Reporting And Data Administration System (BIRADS) 3 (B3) lesions between October 2014 and March 2019 at the Breast Unit of the Uppsala University Hospital by a single surgeon were included. To adjust for known confounders, patients undergoing axillary lymph node dissection (ALND), completion mastectomy, distant metastases, chronic pain syndrome or prior disability of the arm and shoulder, life expectancy < six months for any reason, and patients with incomplete questionnaires, linguistic barriers and invalid or missing contact details were excluded. The study flow chart is presented in Fig. 1.

The standardised assessment algorithm consisted of clinical examination and radiology review according to validated tools [29–31]. The optimal resection volume (ORV) was defined as the volume required to obtain a 1-cm clinical/radiologic margin towards all directions, and subsequently, an optimal resection ratio could be estimated (ORR=ORV/BV) [32]. Lesion biology was considered, as it may affect the decision for wider excision margins. Patient comorbidities were documented. The toolbox is summarised in Fig. 2 and analytically provided in S1.

Following standardised assessment, the surgeon presented the alternatives, and, after structured information on possible risks and complications, operative technique was chosen through SDM, considering desire for BCT, and wish for breast symmetry, shape, and size. Change of patient preference after SDM was documented. All patients planned for wide local excision (WLE) with simple tissue approximation, were offered choice of incision placement, either over the tumour or through a remote site (peri-or circumareolar, mammary fold or the lateral breast crease). These procedures were classified as standard BCT (sBCT) rather than level I OPBCT, since extensive dissection is not required. OPBCT included procedures that required extensive local breast tissue rearrangement and remodelling (therapeutic mammaplasties, reductions, mastopexies) or volume replacement by means of chest wall perforator flaps. The Comprehensive Complication Index (CCI®) was used to report complication outcomes [33].

The excision margins, the pathologic extent of the disease and the actual resection volume (ARV) were obtained from the final pathology report. The ratio between disease extent on pathology and preoperative extent on radiology was calculated. To define the extent of excess tissue resected during surgery, the actual resection ratio (ARR) was calculated (ARV/ORV).

The study was performed in adherence to the Helsinki Declaration and was a project from the OncoPRO Value trial (EPN DNR: 2019–05740, Swedish Ethical Review Authority).

2.1. Endpoints

The primary endpoint was shoulder, arm, and chest wall morbidity, as assessed by the Diseases of the Arm, Shoulder and Hand (DASH) tool [34] and the physical well-being module of the Breast-Q [35]. Secondary endpoints were pre-and postoperative satisfaction with the breasts, assessed by the BREAST-Q BCT module and PRE outcomes.

2.2. Data collection

Participants responded through interview or a safe web link for survey administration. PRE was assessed by asking participants for any other input, if they felt it was relevant and was not included in the PROs. A semi-structured interview was undertaken, loosely based on ‘overall impression’, ‘things that were considered as important’ and ‘things that could have been done differently’. To minimize bias, the interviewer was blinded to the diagnosis, type of surgery and surgical outcomes.

2.3. Sample size and statistical analysis

Studies suggest that mastectomy yields a higher morbidity risk compared to sBCT, with effect sizes ranging from 2.75 to >4, with several studies reporting that more extensive breast conserving procedures have higher morbidity than sBCT [24–26,36–38]. For postoperative morbidity and with 50% prevalence after sBCT (unexposed group), a 20% maximum increase in morbidity after OPBCT (exposed group) was assumed. This corresponded to an odds ratio of 2.33, which, with type I error set to 5% and power to 80%, resulted in a minimum of 95 participants per group. Sample size calculation was performed with the Epi Info™ software, v7.2.3.1. Categorical variables were described as frequencies, with 95% confidence intervals. Continuous variables were summarised with median and range/interquartile range (iqr). The Mann-Whitney test was used for comparisons between different subgroups and the Wilcoxon signed-rank test for comparisons of paired data. Categorical variables were analysed by Fisher's exact test for independent variables and McNemar's test for paired variables. Cluster analysis was performed to define the cut-off value in ORR between sBCT and OPBCT to obtain comparable outcomes. The manuscript was prepared according to the Strengthening The Reporting Of OBservational studies in Epidemiology (STROBE) checklist for cross-sectional studies [39]. Analyses were performed with SPSS v 28 (IBM, Armonk, USA) and Stata v 17 (StataCorp. 2021. Stata Statistical Software: Release 17. College Station, TX: StataCorp LL).

3. Results

Out of 283 eligible women, 215 (76.0%) responded (Table 1). Type of diagnosis (cancer or B3 lesions) did not correlate with response rate (71.0% vs 76.6%, $p = 0.506$). All patients with invasive cancer ($n = 156$, 72.5%) received sentinel lymph node biopsy (SLNB); all patients with malignancy received radiotherapy ($n = 193$, 89.8%). Regarding incision placement in the sBCT group, eleven patients (11.6%) chose incision over the tumour. OPBCT was more common in patients with need for larger resections and lesions in adverse locations.

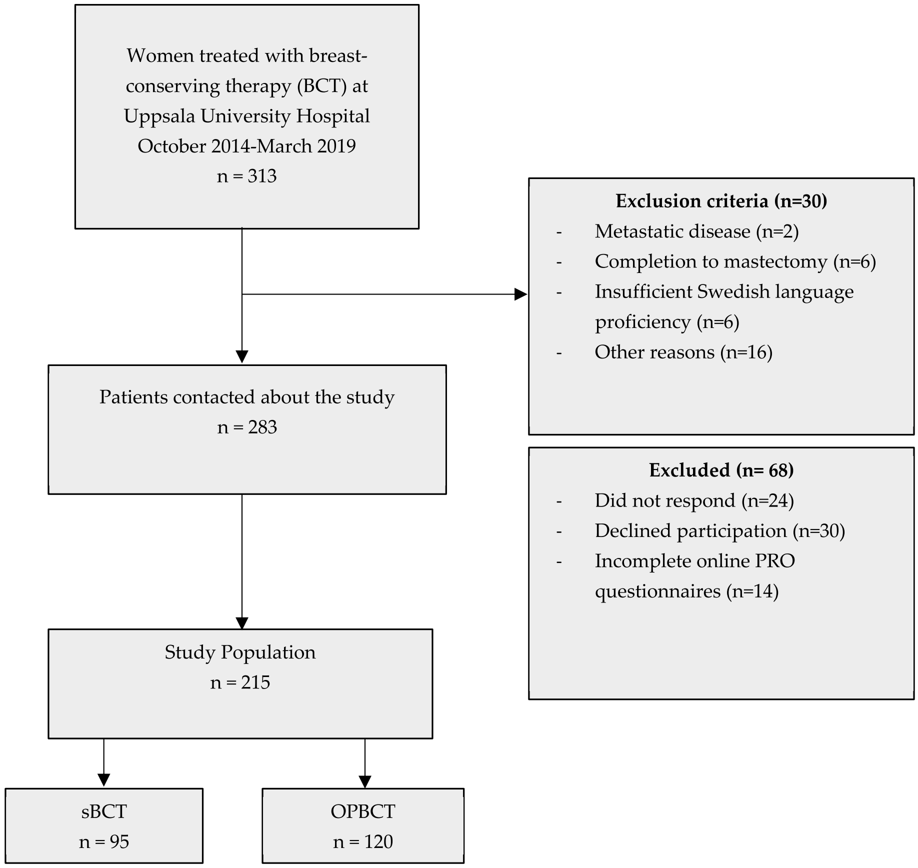

Fig. 1. Study flow chart.

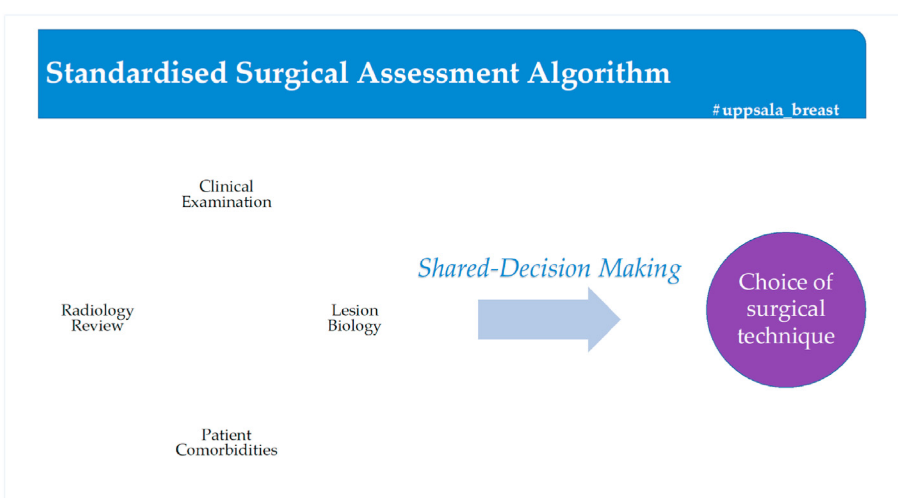

Fig. 2. Toolbox: Standardised surgical assessment algorithm.

Surgical outcomes were similar regarding complications and re-excisions. Pathological examination often depicted a larger extent to that of preoperative radiology by a median of 2.5 times, when considering negative margins, not only for the index lesion, but for any concomitant pathology. The median ratio was numerically higher (3.2 vs 1.6, $p = 0.065$) for OPBCT, mirroring the fact that lesion biology and/or the presence of concomitant lesions such as DCIS, atypia, or large microcalcifications, prompts larger excisions. Specimen volumes and ARR were larger in OPBCT (Table 2).

3.1. PROs

Type of surgery did not affect morbidity as assessed by the DASH and BREAST-Q scores (Table 3). However, surgery per se affected

Table 1
Patient and surgery-related characteristics.

	Entire Cohort (n = 215)	sBCT (n = 95)	OPBCT (n = 120)	p-value
Age (years)[a]	56 (21)	57 (22)	56 (21)	0.687[c]
BMI (kg/m^2)[a]	25.9 (9.9)	27.2 (9.1)	24.1 (8.2)	0.052[c]
Smoking[d]	23 (10.7)	13 (13.7)	10 (8.3)	0.267[e]
Diabetes Mellitus[d]	21 (9.8)	11 (11.6)	10 (8.3)	0.491[e]
Neoadjuvant Chemotherapy[d]	23 (10.7)	14 (14.7)	9 (7.5)	0.088[e]
Side [d]				
Right	110 (51.2)	47 (49.5)	63 (52.5)	0.682[e]
Left	105 (48.8)	48 (50.5)	57 (47.5)	
Quadrant [d]				
Upper Outer	102 (47.4)	53 (55.8)	49 (40.8)	<0.001[e]
Upper Inner	34 (15.8)	12 (12.6)	22 (18.3)	
Lower Outer	20 (9.3)	13 (13.7)	7 (5.8)	
Lower Inner	19 (8.8)	6 (6.3)	13 (10.8)	
Retroareolar/central	23 (10.7)	11 (11.6)	12 (10.0)	
Multifocal/Multicentric	17 (7.9)	0 (0.0)	17 (14.2)	
Lesion extent (mm)[a]	24 (39)	17 (18)	30 (12)	<0.001[c]
Lesion Volume (ml)[b]	90.4 (0.8, 557)	32.1 (0.8, 89)	176.6 (45, 557)	<0.001[c]
Optimal Resection Volume (ml)[a]	115 (634)	45 (98)	214 (365)	<0.001[c]
Breast Volume (ml)[a]	566 (822)	600	520	0.291[c]
Calculated Optimal Resection Rate (%)[a]	8.6 (8.8)	3.2 (4.5)	15.4 (12.8)	<0.001[c]
Histology [d]				
I. Malignant	193 (89.8)	84 (88.4)	109 (90.8)	
Invasive ductal carcinoma	126 (65.3)	60 (63.2)	66 (55.0)	0.327[e]
Invasive lobular carcinoma	20 (10.4)	5 (5.3)	15 (12.5)	
Other invasive	10 (5.2)	5 (5.3)	5 (4.2)	
Ductal carcinoma in situ (DCIS)	37 (19.2)	14 (14.7)	23 (19.2)	
II.B3 lesions (ADH, radial scar, PASH, phyllodes)	22 (10.2)	11 (11.6)	11 (9.2)	
Receptor Status (invasive cancer only) [d]				
ER + HER2-	102 (52.8)	48	54	0.631[e]
ER + HER2+	22 (11.4)	7	15	
ER- HER2+	17 (8.8)	8	9	
ER- HER2-	15 (7.8)	7	8	

ADH = Atypical Ductal Hyperplasia, BCT = Breast Conserving Therapy, BMI = Body Mass Index, DCIS = Ductal Carcinoma in situ, ER + = estrogen-receptor-positive, ER- = estrogen-receptor-negative, HER2 + = amplification of the human epidermal growth factor receptor HER2, HER2- = no amplification of the human epidermal growth factor receptor HER2, OPBCT = Oncoplastic Breast Conserving Therapy, PASH = Pseudoangiomatous Stromal Hyperplasia.

[a] Median, interquartile range.
[b] Median, range.
[c] Mann Whitney test.
[d] n (%).
[e] Fisher's test.

Table 2
Surgical outcomes.

	Entire Cohort (n = 215)	sBCT (n = 95)	OPBCT (n = 120)	p-value
Complications[c]	42 (19.5)	15 (15.8)	27 (22.5)	0.231[d]
CCI®[e]	20.9 (14.0)	22.6 (12.6)	22.6 (14.0)	0.052[b]
Re-excisions[c]	13 (6.0)	4 (4.2)	9 (7.5)	0.393[d]
Postoperative/preoperative lesion extent ratio[a]	2.5 (1.9)	1.6 (2.0)	3.2 (5.4)	0.065[b]
Minimum non-involved resection margin (mm)[a]	4 (10)	3 (5)	4 (14)	0.589[b]
Specimen volume (ml)[a]	89 (104)	26 (24)	139 (240)	<0.001[b]
Actual/Optimal resection ratio[a]	4 (3.2)	1.8 (3.1)	5.7 (9.5)	<0.001[b]

[a] Median, interquartile range.
[b] Mann Whitney test.
[c] n (%).
[d] Fisher's test.
[e] CCI®: Comprehensive Complication Index.

physical function [median Δ(Postop-Preop)Physical = −3, iqr (18); $p < 0.001$], regardless of type of procedure. Radiotherapy or SLND did not affect these outcomes, however, a significant correlation was found in DASH score in patients who received adjuvant chemotherapy ± trastuzumab (Spearman's rho = 0.865, 95% CI: 0.992, 0.731; $p < 0.001$).

Looking into satisfaction with the breasts for the entire cohort, the difference preoperatively and postoperatively was numerically small, but still significant [median Δ(Postop-Preop) Satisfaction = +0, iqr (21.5); p = 0.024)]. Satisfaction after sBCT was somewhat lower, but the difference was not significant (median Δ = −1, iqr 17; p = 0.387). On the contrary, OPBCT resulted in improved outcomes (median Δ = +3, iqr 25; p = 0.023). Overall, the difference was in favour of OPBCT ($p < 0.001$). No difference was seen in the absolute medians of postoperative satisfaction with the breasts between sBCT and OPBCT on a group level (61 vs 65, p = 0.702). However, women who underwent sBCT had higher satisfaction preoperatively (71 vs 58, p = 0.02). No relation between

Table 3
Patient-reported outcomes (PROs).

PROs	Entire Cohort (n = 215)	sBCT (n = 95)	OPBCT (n = 120)	p-value
DASH	4.2 (15.8)	5 (16.7)	3.3 (15.6)	0.656 §
BREAST Q				
I. Physical Well Being				
Physical Well Being Preop	100 (8)	100 (8)	100 (13)	0.406 §
Physical Well Being Postop	82 (24)	82 (24)	82 (28)	0.758 §
Δ(Postop-Preop)Physical	−3 (18)	−3 (18)	−7 (21)	0.660 §
II. Satisfaction with Breasts				
Satisfaction with Breasts Preop	63 (21)	71 (42)	58 (24)	**0.020 §**
Satisfaction with Breasts Postop	64 (24)	61 (25)	65 (23)	0.702 §
Δ(Postop-Preop)Satisfaction	0 (21.5)	−1 (17)	3 (25)	**0.001 §**

All descriptives: median, interquartile range, §: Mann Whitney test.

satisfaction with breasts and age, BMI, complications, or adjuvant therapy was found.

PROs were retrieved a median of 24 months (iqr 17, 38; range 2, 55), without difference of medians between sBCT and OPBCT (medians 24 vs 24, $p = 0.838$). No correlation was found between time interval and locoregional treatment or PROs retrieval and Δ(Postop-Preop)Satisfaction (Spearman's rho = −0.036, 95% CI: −0.179, 0.109; $p = 0.621$) or Δ(Postop-Preop)Physical Spearman's rho = −0.036, 95% CI: −0.181, 0.111; $p = 0.623$).

Cluster analysis showed that, to obtain comparable PROs and surgical outcomes (complications and re-excisions), OPBCT was more often implemented if >7% resection ratio was required.

SDM changed initial reaction in 150 patients (69.8%, 95% CI: 63.2%, 75.8%; binomial test, $p < 0.001$). This effect was more marked in patients that chose sBCT (77.9% vs 62.5%, Fisher's p-value = 0.011) (Table 4a). In particular, SDM led to surgical de-escalation in 98 patients (61.3%), an effect more prominent in the OPBCT group and from mastectomy to BCT. The remaining patients experienced that it enhanced understanding of options and clarified expectations (Table 4b).

3.2. PRE

Approximately 45.3% (n = 97) of responders commented additionally. No difference was demonstrated for type of surgery (BCT vs OPBCT 42.7% vs 45.8%, $p = 0.891$), median age (54 vs 57, $p = 0.643$) or PRO scores. The most usual comments revolved around that “some of the questions did not feel relevant for me” (n = 62, 63.9%), the “small things” one has to come around (n = 62, 63.9%), focusing on sporadic symptoms that they did not consider a real problem. All raised the significance of feeling included, the continuity in care and that discussing PROs a long time after their cancer diagnosis felt more comfortable and relevant, allowing them to be more objective.

4. Discussion

Selection of optimal surgical technique in BCT is challenging. In this study, a pre-operative standardised assessment considering objective parameters by use of validated tools and integration of SDM patient preferences resulted in similar outcomes regarding postoperative morbidity as well as satisfaction with breasts regardless of type of BCT.

Type of surgery did not affect postoperative chest and arm morbidity, as measured by validated tools [40,41]. This is consistent with studies utilising other methods such as Likert items and visual analogue scales [28], Breast-Q [42] or other questionnaires [43]. Despite heterogeneity in methodology, or inclusion of confounders such as axillary dissection [44–47], the conclusions do not suggest association between extent of dissection and postoperative function. No other correlation than adjuvant cytotoxic therapy was found in our study, but, still, OPBCT has repeatedly been shown to yield a higher complication rate [20–22]. Reassuringly, this often has little impact on adjuvant treatment [21,48,49] but may affect morbidity and cosmesis [21]. Patients should bear in mind that breast surgery affects upper limb and chest wall function, and that not significant differences in group comparisons can still be clinically relevant for the individual.

There is inconsistency in the literature regarding the role of OPBCT in satisfaction with breasts. While a previous meta-analysis demonstrated higher satisfaction [50], more recent studies report comparable [11,42] or even worse aesthetic outcomes after OPBCT [43]. Differences in methodology, timing of PROs or definitions of OPBCT may account for this. In our study, no postoperative differences were seen on a cohort level (sBCT vs OPBCT). Patient-level results were different; women already satisfied with their breasts and amenable to sBCT, displayed similar postoperative satisfaction with simpler surgery, whereas women with need for larger resections or with lower preoperative scores, would opt for OPBCT more often. This data is more in line with real-world clinical practice, where OPBCT is considered either when sBCT is not feasible or for patients with specific expectations, other than safe oncologic resection only. In our analysis, subgrouping to the OPBCT group involved more than just a simple approximation of the breast tissue. Consequently, a more patient-tailored approach was undertaken than the conventional classification using the 20% cut-off to stratify OPBCT in level I and II procedures, as introduced by Clough et al. [12,13] and others [14]. The analysis showed that implementation of standardised assessment incorporating patient preference led to OPBCT for resections of <20%, as in the cases of small breasts, multicentricity or adverse tumour location. The cluster analysis showed that the ORR cut-off between sBCT and OPBCT for comparable PROs was 7%, agreeing with previous data that cosmesis and patient satisfaction are worse with resections

Table 4a
Change of attitude after shared decision-making (SDM).

		sBCT (n = 95)	OPBCT (n = 120)		p-value
Change of attitude after shared decision-making (SDM)	No	20	45	65	0.011
	Yes	75	75	150	
		95	120	215	

Table 4b
Perceived change after shared decision-making (SDM).

		sBCT (n = 95)	OPBCT (n = 120)		p-value
Perceived change after shared decision-making (SDM)	Shift from Mx	26	54	80	
	Shift from more complex BCT	15	3	18	
	Better Comprehension	34	18	62	<0.001
		75	75	150	

BCT = Breast Conserving Therapy, Mx: Mastectomy.

larger than 10% [51]. Our checklist is similar to the algorithm proposed by McMillan and McCulley [15], but incorporates means to assess volume and resection ratio, patient/tumour characteristics and co-morbidities.

The need for systemisation of indications for OPBCT has been extensively addressed [12–17,52]. These algorithms facilitate documentation, training, and practice, but reality is often more challenging. However, BCT should constitute a paradigm shift from developing algorithms that “seek” appropriate candidates, to techniques adapting on individual patient needs. Optimal technique is a complex convergence of oncological, clinical, functional, and aesthetic parameters, which is more of a continuum than a categorical classification. Choosing best should lead to a procedure that fulfils all these parameters with the minimum of complications and morbidity, and -most importantly-in line with patient preferences. In this sense, OPBCT lies between mastectomy and sBCT and should be compared with both in context and outcomes. In the present study, techniques that are conventionally considered as level I OPBCT [12,13,52] were classified as sBCT, as the extent of dissection is significantly less. In these patients, “smart” incision placement may or may not result in higher satisfaction, despite that being the intuitive hypothesis. However, incision placement per se should not suffice to classify a procedure as oncoplastic.

In this study, the intention was not to develop one more algorithm, but to explore whether a structured patient-centred approach may have a beneficial effect on outcomes. For this, a surgical checklist was developed that aims to include all the factors that a surgeon should consider from a technical point of view, but by the use of validated tools. It seems that this approach combined with SDM, often led to simpler surgery with high satisfaction and positive patient experience, a finding similar with other studies [53–55]. This, together with the fact that 64% of those who reported on PRE felt that PRO items did not always feel relevant, highlights the need of maintaining focus on the patient to obtain optimal results [56,57]. This approach may therefore provide the niche for rationalised de-escalation of oncoplastic procedures, without compromising surgical outcomes or patient satisfaction. A similar approach can also be implemented for radiotherapy, in the light of trials suggesting that it could be omitted or modified in a significant number of patients [58–60]. In reality, this study highlights that surgeon engagement and experience are paramount in the capitalisation of this checklist, so that the most appropriate alternatives are presented to the patient. Afterwards, it is the patient who should consider these alternatives and make an informed decision, allowing for time and space, so that this decision may be revisited before finalised. This suggests that optimal breast cancer care should ensure adequate resources that can meet individualised needs, especially for patients that may need additional consultations.

The study stems from a well-defined single-centre cohort with high response rate. The interviewer was blinded to the patients' history, thus minimising the risk of influencing responses. The most important, however, is that the study findings suggest that “standardisation” of a structured oncoplastic assessment with integrated SDM provides the niche for tailored treatment. This approach has the potential to refine the available algorithms, but also to treat patients that do not directly “fit” the algorithms. Moreover, the “decision-making tool” is a simple checklist, based on readily available and validated instruments, such as standard radiology, easy but accurate volumetric methods, clinical parameters and freely available SDM and PROs, ensuring ease of implementation without extra resources. Despite spontaneous concerns about recall bias on baseline PROs for patients that responded in retrospect, not only is there strong association and agreement between contemporary and retrospective values [61], but retrospective implementation has shown to be more feasible and appropriate in relation to baseline values [62]. At the same time, the impact of cancer diagnosis has deleterious effects on self-perceived quality of life, suggesting that PRO retrieval directly after a breast cancer diagnosis is subject to this inevitable bias [63,64]. While no correlation between time interval (treatment to PROs) was seen in this study, one should be aware of the fact that this may not always be the case. Finally, a “one-out” PROs report in different time intervals, as a snapshot in time, may yield limitations, whereas longitudinal follow-up might provide the dynamic of these outcomes. It is important to consider that, not all patients receive the same adjuvant treatment, which may conceal a bias even when retrieving PROs at predefined time points postoperatively. Finally, there is great value in PRE, where patients felt that, reflecting in hindsight allowed them to be more objective and that not all PRO items felt relevant. It seems that, whilst systematisation is a basic principle in scientific research, methodological frames need to be developed to weigh in these considerations in future research.

5. Conclusions

«Standardisation of surgical assessment», instead of «standardisation of indications » seems to yield higher potential for personalised treatment. A multifaceted approach including detailed assessment, judicious planning and patient engagement is necessary for optimal outcomes. This study suggests that the combination of standardised surgical assessment and SDM can lead to de-escalation of complex surgery without compromising outcomes. A prospective cohort study and a randomised controlled trial (OncoProValue trial) are planned to investigate the potential of this approach.

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Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Data availability statement

Data may be made available on reasonable request after the completion of the long-term follow-up. Contact andreas.karakatsanis@surgsci.uu.se.

CRediT authorship contribution statement

Iliana Aristokleous: Software, Investigation, Writing – original draft, preparation, Writing – review & editing, Visualization, Project administration. **Johanna Öberg:** Software, Investigation, Data curation, Writing – original draft, preparation, Writing – review & editing, Visualization, Project administration. **Eirini Pantiora:** Software, Investigation, Writing – original draft, preparation, Writing – review & editing. **Olivia Sjökvist:** Software, Investigation, Writing – original draft, preparation, Writing – review & editing. **Jaime E. Navia:** Software, Writing – review & editing. **Maria Mani:** Validation, Writing – review & editing, Funding acquisition. **Andreas Karakatsanis:** Conceptualization, Methodology, Software, Validation, Formal analysis, Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

All authors declare no competing interests within the scope of the present work. A.K. reports travel grants by ESSO, EUSOMA, UEMS and Endomag; institutional grants by Endomag; consultation for Resitu AB; honoraria by Elsevier.

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Appendix A. Supplementary data

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