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Original article

De-escalation of complexity in oncoplastic breast surgery: Case series from a specialized breast center

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ABSTRACT

Introduction: Oncoplastic breast surgery has evolved the surgical treatment of breast cancer over the past two decades. This practice still lacks validation and poses several dilemmas in terms of safety, local and systemic control, timing of adjuvant treatments and cost-effectiveness. Our case series investigates the effects of a reduced surgical complexity on cosmetic results and quality of life.

Methods: We treated 76 consecutive patients affected by early stage breast cancer from January 2016 to April 2017. We employed a decision support system to assist the final shared decision making. The communication process before surgery included new specific information on recent evidence about local control of disease and outcomes after multimodality treatment. In order to estimate the oncoplastic complexity, we created a new score based on scars, bilateral procedures and type and timing of reconstructions. We compared the outcomes of this series to that of a previous one from the same institution.

Results: The medium complexity score (CS) in the current series was significantly lower compared to that of the previous series (medium CS cohort 1 = 3.1 vs medium CS cohort 2 = 1.51; p = 0.001). Complications according to Clavien-Dindo classification did not vary significantly between the two series (p = 0.7). The increased use of primary systemic treatment did not translate into a significantly lower mastectomy rate (cohort 1 = 20% vs cohort 2 = 16%; p = n.s.). There was no significant difference in breast deformities after breast conserving surgery (p = 0.2). The BCCT.Core demonstrated a 67.1% occurrence of "good" results. Quality of life in patients who underwent breast-conserving surgery measured using the Breast-Q demonstrated similar results in the pre-post-op assessment.

Conclusions: This study hypothesizes that a proper information may impact on patient's decisions and may reduce surgical complexity. This reduction likely has no effects on the main surgical outcomes estimated using standard tools. More investigations should be performed on a larger multi-institutional scale to confirm these conclusions.

1. Introduction

Oncoplastic breast surgery has evolved the surgical treatment of breast cancer over the past two decades [1–4]. Although some studies have shown promising results, this technique is still lacking validation and poses several dilemmas in terms of safety, local and systemic control, timing of adjuvant treatments and cost-effectiveness [5–7].

The replacement of simple wide local excisions or mastectomies with therapeutic mammoplasties or complex reconstructions may increase costs and complications.

In this study we hypothesized that a proper information during shared decision making may reduce surgical complexity without impairing cosmetic results and quality of life.

A complexity score has been created to demonstrate surgical de-escalation and comparisons have been made with our previous series [8].

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2. Methods

This is a consecutive series of 76 patients candidate to surgery for breast cancer treated by a single surgeon in Ospedale Cannizzaro (Catania, Italy) from January 2016 to April 2017 (Median age: 50 years (range 37–81) years; Median BMI: 25.3 (range 17–38)).

To suggest the most suitable operation we employed a Decision Support System software tool denominated OncoPlastic Framework (OPF DSS) that was representative of our surgical strategy until year 2016 [8].

Patient's wishes regarding surgery were clustered into three subgroups denominated: “minimal aggressiveness”; “maximum reshape”; “mastectomy” (Table 1). During the pre-operative consultation process patients were informed about the results of our previous series and on recent evidence on oncological and reconstructive management [9–19].

In order to estimate complexity, we modified a score published by Hoffmann in 2009 [20].

A new system based on number of scars, bilateral procedures and number of surgical stages for completion of breast reconstructions was created (Complexity Score; CS). To assess the intent of surgical de-escalation we assigned a score to pre-operative systemic treatment (PST; CS = −1) The CS was calculated either before and after PST (Table 2).

Table 1
Clusters of possible decisions.

Minimal aggressiveness	• Attempt any kind of systemic treatment before surgery if feasible • Scars as little as possible • Minimal asymmetry accepted • Unilateral operations preferred • One stage for breast reconstruction preferred • Avoid autologous reconstructions • Delayed reconstruction if post-mastectomy radiotherapy is required
Maximum reshape	• Bilateral procedures requested • Avoid any kind of asymmetry • Perform contralateral adjustment after any kind of breast reconstruction including autologous tissue based
Mastectomy	• Avoid radiotherapy after breast conserving surgery • Avoid risk of asymmetry for breast of minimal volume with lesions amenable for breast reconstruction • No reconstruction if mastectomy is the only choice

Table 2
Complexity score.

Score	Procedure
−1	Primary systemic treatment
0	Wide local excision
1	Mastectomy
2	Wide local excision and reshape with round block; no c/l adjustment
3	Wide local excision and reshape with comma shaped mammoplasty; no c/l adjustment
4	Therapeutic mammoplasty with inverted T scar mammoplasty; no c/l adjustment
5	Therapeutic mammoplasty with inverted T scar and c/l mammoplasty
6	Mastectomy and breast reconstruction in one stage no c/l adjustment
7	Mastectomy and breast reconstruction in one stage and c/l adjustment
8	Mastectomy and breast reconstruction unilateral in two stages and no c/l adjustment
9	Mastectomy and breast reconstruction unilateral in two stages and c/l adjustment
10	Mastectomy and autologous tissue based reconstruction ±c/l adjustment

Table 3
Matching of populations according to the OPF Decision Drivers.

T- Stage/	Cohort 1	Cohort 2	p	Location*	Cohort 1	Cohort 2	p	Volume	Cohort 1	Cohort 2	p	Ptosis	Cohort 1	Cohort 2	p	Pt. wish	Cohort 1	Cohort 2	p
Multi-centric disease																			
T > 2 cm	3 (5.7)	10(13.1)		Central	3 (5.7)	6(7.8)		Minimal	10 (1.9)	17 (22.3)		Nil	14 (26.9)	18 (23.6)		Min. aggressiveness	31 (59.6)	60 (78.9)	
T < 2 cm	37 (71.5)	45(59.2)		Upper	14(26.9)	15 (19.7)		Medium	16(30.7)	28(36.8)		Moderate	18 (34.6)	36 (47.3)		Max.Reshape	11 (21.1)	3 (3.9)	
LABC	2 (3.8)	4 (5.2)		Lower	4(7.6)	4(5.2)		Large	21 (40.3)	28 (36.8)		Severe	20 (38.4)	22 (28.9)		Mastectomy	10 (19.2)	13 (17.1)	
DCIS<4 cm	2 (3.8)	5 (6.5)		Upper outer	9(17.3)	20 (26.3)		Very Large	5 (9.6)	3 (3.9)									
Multi-centric Invasive/Extensive DCIS	8 (15.3)	12 (15.7)		Upper Inner	6(11.5)	8(10.5)													
				Lower outer	5(9.6)	6(7.8)													
				Lower inner	1(1.9)	0													
				MC/LABC	10(19.2)	17(22.3)													
Total	52	56	0.56		52	76	0.7		52	76			52	76	0.3		52	76	0.006

In order to evaluate the effects of the surgical de-escalation protocol we compared the CS in the current series (cohort 2) to that of the previous report (cohort 1) (8). The two populations were matched for all the decisional drivers included in the OPF DSS (except for patient's wishes) (Table 3) and for stage according to AJCC (Table 4).

We assessed complications using the Clavien-Dindo classification (CDC) modified for breast surgery published by Panhofer [21]. We estimated the occurrence of deformities after breast conserving surgery using the Fitoussi Classification [22,23]. We compared these outcomes with that of our previous series (cohort 1).

Other standard tools were used in this series such as the BCCT.core to evaluate cosmetic results and the Breast-Q to assess quality of life pre/post-op (four domains: satisfaction with breast; psychosocial; physical; sexual well-being) [24–28].

The Italian translation of the Breast-Q for breast conservation was not available at the time of cohort 1.

Statistical analysis was performed using MS Office Professional 2010. Differences in characteristics of patients between groups were tested by exact Pearson chi-squared test for continuous and categorical variables. The medium complexity scores were compared using a *t*-Student test. Linear regression analysis was used to correlate actual complexity scores and decision suggested by the OPF DSS (before and after primary systemic treatment). All statistical tests were two-sided and p-values < 0.05 were regarded significant.

Table 4
AJCC stage in Cohort 1 and Cohort 2.

	Cohort 1	Cohort 2	P
Stage AJCC			
Stage 0	10	19	
Stage I	24	41	
Stage II	16	14	
Stage IIIA/IIIB	2	2	
Total	52	76	0.39

AJCC: American Joint Committee on Cancer.

3. Results

The rebalance of the decision making process significantly increased the number of patients who selected “minimal aggressiveness”.

The medium complexity score in the current series was significantly lower compared to that of the previous series (medium CS cohort 1 = 3.1 vs medium CS cohort 2 = 1.51; p = 0.001). This reduction was significant even after PST (medium CS cohort 1 = 3.4 vs medium CS cohort 2 = 2.4; p = 0.01).

After linear regression analysis we confirmed that the higher was the CS proposed by the OPF DSS tool the higher was the de-escalation of the actual one. This correlation was visible even after PST despite an increased slope (Figs. 1 and 2). As an effect of this strategy, we performed a significantly higher proportion of simple wide local excisions and primary systemic therapies. Less patients requested mastectomies as the first therapeutic option (mastectomy cohort 1 vs. cohort 2: 14.2% vs. 1.7%; PST cohort 1 vs. cohort 2: 7.14% vs. 24.5%; p = 0.02) (Table 5). The increased use of neo-adjuvant chemotherapy and other systemic therapies did not translate into a significantly lower mastectomy rate (Mastectomy rate cohort 1 20% vs Mastectomy rate cohort 2 16%; p = n.s.). This strategy has allowed also a significant reduction of the bilateral therapeutic mammoplasties rate (cohort 1: 15.1% vs. cohort 2 4.7%; p = 0.02).

There was no significant difference (p = 0.2) in distribution of breast deformities after breast conserving surgery in the two series using the Fitoussi classification (Table 6); even the Clavien-Dindo scores for complications did not vary significantly (p = 0.2) (Table 7). After testing cosmetic results with BCCT.Core, 67.1% of the sample scored “good” results; quality of life in patients who underwent breast-conserving surgery measured using the Breast-Q demonstrated similar results in the pre/post-op assessment (see Table 8).

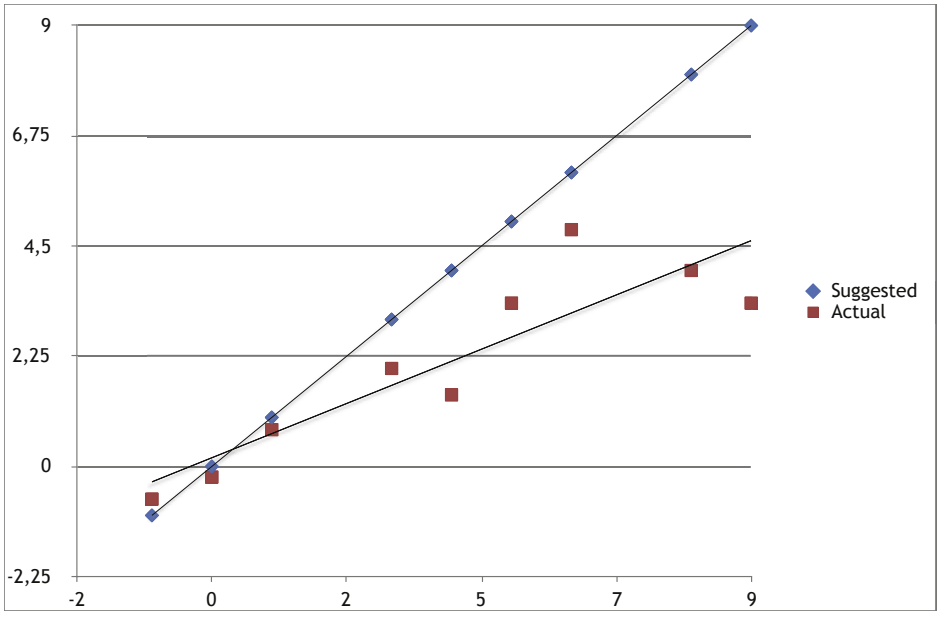

Fig. 1. Linear regression analysis of medium complexity score of actual decision compared to score of decision suggested by the OPF DSS (including PST) OPF DSS: OncoPlastic Framework Decision Support System; PST: Primary Systemic Treatment.

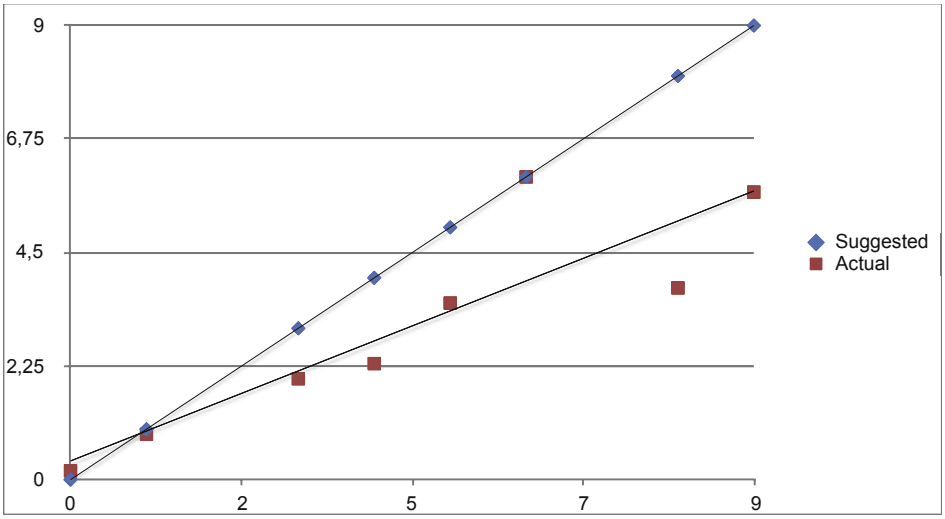

Fig. 2. Linear regression analysis of medium complexity score of actual decision compared to score of decision suggested by the OPF DSS OPF DSS: OncoPlastic Framework Decision Support System.

Table 5
First therapeutic decision.

	Cohort 1	Cohort 2	P value
First therapeutic option			
WLE	33	42	
Mx	6	1	
PST	3	14	
Total	42	57	0.02

WLE: Wide local Excision; Mx: Mastectomy; PST: Primary systemic treatment.

Table 6
Distribution of deformities after breast conserving surgery according to the classification of Fitoussi. No differences.

	Cohort 1	Cohort 2	P
Type 1	19	26	
2	2	5	
3	0	5	
4	1	1	
	21	37	0.2

Table 7
Stratification of complication according to CLAVIEN DINDO modified for breast surgery.

	Cohort 1	Cohort 2	p
Clavien Dindo			
No complications	33	54	
1	12	13	
2	3	7	
3a	4	2	
Total	52	76	0.2

Table 8
Quality of life in patients who underwent breast conserving surgery measured using the Breast-Q (four domains pre and post op).

	PRE-OP	POST-OP
Satisfaction with breast	48	46
Psycosocial	64	64
Physical	59	57
Sexual wellbeing	57	57

4. Discussion

4.1. The scientific basis of oncoplastic surgery

A significant scarcity of evidence still characterizes oncoplastic surgery and poses several dilemmas in terms of applicability and fairness. Information of safety issues, local and systemic control of disease, timing of adjuvant treatments, post-operative surveillance and, finally, cost-effectiveness is still poor [5–7].

A systematic review by Schaverien [5] described low-level evidence (no randomized controlled trials) and poor completeness of reporting of selected key criteria comparing studies on oncoplastic surgery and historical trials on breast conservation. Haloua et al. [6] confirmed that oncoplastic surgery is relying on poorly designed and underpowered studies. It seems surprising that another review from De La Cruz [7] although still based on a very heterogeneous collection of studies stated oncoplastic procedures to be safe.

In presence of conflicting conclusions, breast surgeons should be prepared to offer oncoplastic surgery relying on controversial evidence. This may expose patients to more complex operations and may influence the public health care system.

Recently a few well conducted case series hypothesized that bilateral therapeutic mammoplasties (BTM) do not have a higher complication rate compared with standard BCS, and do not impact on timing of adjuvant medical treatment except a slight but significant delay in starting adjuvant radiotherapy [29,30].

The results of the International TeaM multicenter prospective cohort study are generally in keeping with these conclusions. O'Connell and Potter observed a 23.3% rate of complications (only 2.8% required re-operation). Median time to adjuvant therapy in this study was 54 days [31]. Oncoplastic surgery, in general, may reduce the need for secondary surgical procedures [32]. However, it may increase the completion mastectomy rate [33].

4.2. Oncoplastic de-escalation

The concept of oncoplastic de-escalation is not new. In a series from Krishna Clough, the reduction in the number of bilateral procedures over time is evident (percentage of bilateral procedures 2003 vs 2017: 100% vs 32%) [34,35]. This is associated with an increase in the use of primary systemic therapy (percentage of

patients undergoing primary systemic treatment 2003 vs 2017: 16% vs. 30%) and a decreased mean size of the tumor (2003 vs 2017 32 mm vs. 23 mm) at final histology. The effects of this strategy may lead to a reduction of the complication rate (2003 vs 2017: 20% vs. 8.9%). Despite performing less surgery a decrease in the actuarial 5-year LRR (2003 vs. 2017: 9.4% vs. 2.2%) is demonstrated thanks also to modern adjuvant therapies.

The effectiveness of systemic treatment in local disease control and the new conservative resection margin policies ("no-ink on tumor") are part of the modern biological paradigm of breast cancer treatment and may reduce the surgical burden [36–44] whereas oncoplastic surgery may potentially increase it.

In view of these considerations, the original purpose of this strategy should be reconsidered. Oncoplastic procedures (either in the conservative and mastectomy setting) should closely follow the standards of breast oncological surgery and in general, evidence at the highest level. Patients should be fully involved in the decision making process and clear information should be provided including uncertainties and risks of more complex procedures.

4.3. The effects of a rebalanced information process

In our original pathway we clustered the final surgical decision into three subgroups (8) assuming that each of these was equivalent in terms of outcomes. The new information burden offered to patients in this series confirmed that all these options are likely to be equal in terms of oncological outcomes. Unlike the previous cohort, in the current series we highlighted that the risk of local recurrence is very low after BCS; bilateral procedures are longer operations that may reduce the need for further surgery but controversies remain regarding proper delivery of radiotherapy boost following these techniques [8–13]. We informed patients who were suitable for BCS that requested a mastectomy that breast reconstructions could be associated to physical morbidity. For those patients requiring autologous breast reconstruction, we advised that this technique works very well and provides long lasting results but is associated to a significantly higher risk of complications [18]. In comparison, implant-based reconstructions have a quicker recovery but quality of life tends to decline [19]. In the present series, this rebalance led to a significant reduction in the number of patients requiring the option "maximum reshape". Similarly, the decision to undergo primary systemic treatment as the first therapeutic option increased significantly. In order to estimate the surgical complexity we modified a validated score published in 2009 by Hoffmann [20]. Although not validated, our system could be representative of surgical complexity associated with oncoplastic procedures. In order to estimate the intent to reduce the surgical impact, this assessment included pre-surgical systemic treatment (score-1). This index has demonstrated a significant reduction of surgical complexity both before and after PST in comparison to our old series and the higher was the proposed complexity in the past, the higher the de-escalation with the new protocol.

However, despite every effort, the mastectomy rate after PST did not differ significantly in the comparison between the two series as confirmed in some recent trials [4–45]. Less complexity is confirmed by a significantly lower incidence of bilateral therapeutic mammoplasties. We believe that bilateral procedures should be advisable only when breast-conserving surgery cannot be performed without leaving major residual asymmetries and this hypothesis will be tested by the ongoing MIAMI trial [47].

The issue of bilateral therapeutic mammoplasties was explored by the recent TeaM cohort that did not demonstrate an increased risk of complications associated to bilateral operations (multivariate analysis), however the impact of a double procedure in terms of cost-effectiveness and quality of life remains unknown. as well as the correct timing of contralateral adjustment (simultaneous vs delayed).

Even if more simple surgery was performed, and contrary to what expected, the distribution of Clavien-Dindo scores did not vary in comparison with the old series. This could be due to the limited number of patients in the two cohorts and to the relatively low complication rate associate to more complex techniques. The TeaM cohort demonstrated a 2.8% rate of complication requiring re-operation. This is similar to what reported in our series where CDC score 3 patients were 2.7% [48].

In theory, surgical de-escalation may affect deformities after breast conservation. We investigated this outcome using the Fitoussi classification [22]. No significant differences between cohort 1 and 2 were demonstrated confirming that some tumors can be treated with minimal surgery without impairing final results.

A standard tool for objective evaluation of cosmetic results was not used during for the previous series [24], however scores from BCCT.core compare well with that reported by other series [49]. Quality of life of patients who underwent breast-conserving surgery was assessed using four domains of the Breast-Q. We noticed relatively low scores and minimal changes in the pre/post op evaluation. These scores appear unfavorable if compared with that of other series in northern european countries, and United States [50,51]. One explanation for this could be the poor social conditions of patients referred to a public hospital in southern Europe.

We acknowledge that more extensive surgery with BTM may have an impact on patients quality of life, however after thorough discussion the team involved in this study felt that any improvement in QoL is not a specific goal of breast cancer surgery. However this possibility was discussed with patients in the pre-operative consultation.

One of the strengths of this study is the use of standardized tools. Thanks to the OPF DSS, we proved that the two populations were matched for the main decision drivers except for the patient's wishes that were influenced by the improved information burden. The other tools employed allowed a comparisons between the two cohorts despite being treated in a slightly different timeframe and with series from different institutions. Scoring the suggested decision and comparing it to the real one has provided a quantitative demonstration of the surgical de-escalation.

This study has also several limitations. The first one is related to its observational design and the limited number of cases. Secondly the CS we propose is not validated. Indeed, the definition of "complexity" is qualitative and not directly correlated to incidence of complications and re-admissions, operating times, in-patients stay and sequelae. Moreover, despite we estimated a reduction of more complex procedures and a propensity to prescribe more PST, we failed to obtain less complications and a reduced mastectomy rate.

5. Conclusions

Our hypothesis that a proper information burden has an impact on patient's decisions and may reduce surgical complexity estimated as number of scars, bilateral procedures and number of surgical stages for completion of breast reconstructions is confirmed by this observation. This reduction likely has no effects on the main surgical outcomes estimated using standard tools. A new strategy may arise from this study. More investigations should be performed on a larger multi-institutional scale in order to confirm these conclusions.

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