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Therapeutic Mammaplasty

R.D. MACMILLAN, MBChB, MD, FRCS,* R. JAMES, MBChB, BA, MEd, FRCS, K.L. GALE, MBChB, FRACS, AND S.J. MCCULLEY, MBChB, FCS(SA), FRCS

Nottingham Breast Institute, Nottingham City Hospital, Nottingham, United Kingdom

Therapeutic mammaplasty is a term for the oncoplastic application of breast reduction and mastopexy techniques to treat selected breast tumours by breast conserving surgery (BCS). It has the potential to increase the indications for BCS as well as achieve more acceptable aesthetic results from it in suitable women. Now an established technique in the range of oncoplastic options for women with breast cancer, it finds common application and is associated with good oncological and quality of life outcomes.
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Therapeutic mammaplasty is a term for the oncoplastic application of breast reduction and mastopexy techniques to treat selected breast tumours by breast conserving surgery (BCS) [1]. Its principle aim is to offer many of the women who would experience a poor cosmetic outcome from standard techniques of BCS an alternative option, and in doing so extend the indications for BCS and improve quality of life.

Therapeutic mammaplasty techniques extend the indications for BCS in two ways:

(1) By achieving acceptable aesthetic outcomes for women with breast cancers who would have unacceptable outcomes with other BCS techniques.
(2) By enabling breast conserving surgery for larger breast cancers.

Thus many women who are treated by therapeutic mammoplasty would otherwise either have a poor outcome from standard techniques of BCS, or have been recommended mastectomy. Poor cosmetic outcome after simple wide local excision is perhaps best predicted by the percentage of breast tissue being removed and the location of the breast cancer but many factors contribute [2]. Quandrantectomy with its wide volume of parenchymal excision-to-breast ratio had poor aesthetic outcomes when compared to tumourectomy and early studies concerning the cosmetic outcome of BCS reported rates of excellent/good outcomes for small breast cancers on the Harris scale between 60% and 86% [3–10].

Therapeutic mammoplasty can achieve more acceptable aesthetic outcomes compared to other BCS techniques:

- By reducing breast size.
- By minimising the significant impact of radiotherapy on women with large breasts.
- By achieving a preferred breast size and shape.

There is a substantial body of evidence confirming the benefits of breast reduction in terms of quality of life. Women with macromastia who undergo breast reduction demonstrate significantly higher levels of self-esteem, improved quality of life across all domains, improved social and psychosexual function and reduced pain following their surgery [11–15]. As it will be difficult to offer reduction mammaplasty safely after radiotherapy, it can easily be argued that therapeutic mammoplasty should be offered to all women with breast cancer being considered for BCS that wish smaller breasts. This would include women with very small breast cancers.

A number of studies have found a significant correlation between large breast size and a worse cosmetic outcome, which becomes increasingly evident over time. In one cohort of 257 patients who had undergone breast conservation and radiotherapy [16], 89 were defined as large breasted on the basis of weight, bra size, cup size and/or tangent separation. All patients were scored on a 1–10 scale for cosmetic outcome by an independent observer and were assessed at 1, 3 and 5 years with a median follow-up of 3 years. Large breasted women had lower scores for cosmesis at each time point, with worse asymmetry and breast retraction being the most frequently noted outcomes. The difference in scores for retraction was greatest at 5 years. In the extensive analysis of cosmetic outcome in the EORTC boost trial, an inferior tumour, a large excision volume, the presence of post-operative breast complications and a boost of radiotherapy to the tumour bed, all negatively correlated with cosmetic outcome [17]. Furthermore, a bra size greater than a C cup resulted in increased nipple asymmetry. The Danish Breast Cancer Cooperative Group (DBCG) followed patients undergoing WLE and radiotherapy for an average of 12 years [18]. Moderate to severe fibrosis was found in 23% of patients and was associated with large breast size, chemotherapy and smoking. Patients with a satisfactory cosmetic outcome (clinician assessment) were characterised by small tumours, and small to medium sized breasts. Overall, clinician assessment of an excellent/good outcome was 50% in 214 women, with breast asymmetry thought to have a strong influence on clinician assessment after WLE. Pronounced breast asymmetry after BCS is significantly correlated with poor psychosocial functioning according to a Michigan study looking at quality of life outcomes after BCS thus confirming others studies that have shown a close correlation between aesthetic outcome of BCS and quality of life [8,19]. Another study found that there was a strong association between breast size and late radiotherapy effects with 39% (34/88) of large breasted women

*Correspondence to: R.D. Macmillan, MBChB, MD, FRCS, Nottingham Breast Institute, Nottingham City Hospital, Nottingham, UK. Fax: XXX.
E-mail: douglas.macmillan@nuh.nhs.uk

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showing moderate to severe late radiotherapy changes compared to 6% (34/88) of small breasted women [20]. It has been proposed that larger women experience greater dose inhomogeneity and that this may account for late radiation changes [20,21]. The supposed cause and effect relationship between larger breasts, inhomogeneity and impaired long-term cosmetic outcome has been questioned more recently with the results of the FAST trial [22]. This study on the effects of hypofractionation followed a cohort of patients undergoing breast conservation and radiotherapy planned using 3D dosimetry. Dose inhomgeneity, breast volume and change of photographic appearance over a 2-year period was recorded. Both breast size and dosimetry were associated with late photographic changes on univariate analysis but only breast size was significantly associated with change in appearance on multiple regression analysis. This suggests that larger breast size and not dosimetry is the dominant risk factor for late radiation changes to breast size and shape. It is suggested that this may be a direct consequence of the effect of radiotherapy on adipocytes, which are of course more abundant in the larger breast.

In all cases of therapeutic mammoplasty, breast form is altered and breast size is reduced (both to a widely varying degree). The breast shape and size achieved will have aimed to minimise the adverse effects of treatment on breast form but may in many cases be judged to have enhanced it. In all published series of BCS, aesthetic outcome is reported in terms of the degree to which the outcome is worse than the starting point. The perceived pinnacle of aesthetic outcome is therefore the maintenance of existing breast form or it being slightly worse, and these two categories are usually combined in reports and achieved in approximately 60–85% of BCS for small cancers as described above. A question that is not often asked before breast cancer surgery is what a women thinks of her breast size and shape before surgery. If the answer is negative then maintaining breast form may not be as ideal a result as the surgeon imagines. Such cases are often well suited to therapeutic mammaplasty.

An important outcome for any technique of BCS that aims to offer breast conservation to more women is the rate of local recurrence particularly when it is used for excising cancers that are larger than those traditionally treated by BCS. Large tumour size alone has not been consistently found to predict for increased risk of local recurrence. Evidence from pathological studies suggests that tumour size is not a risk factor for tumour multifocality for cancers less than 4 cm and evidence from clinical studies suggests that tumour size is not a risk factor for local recurrence for cancers less than 3 cm [23]. However, there is little data on which to base a conclusion on the risk of local recurrence for cancers larger than 4 cm and none for cancers over 5 cm. Reported series of therapeutic mammaplasty used to treat breast cancers suggest that in appropriately selected cases with a mean tumour size of approximately 3 cm, rates of local recurrence are within an acceptable and expected range [24–34] (Table I). In the era of neoadjuvant therapy, the use of any technique of BCS to excise invasive cancers significantly larger than 3–4 cm would be exceptional. For DCIS, overviews show no difference in local recurrence rates after BCS and radiotherapy for lesions <2 cm versus >2 cm [35].

Therapeutic mammoplasty may also enhance the success of BCS as judged by:

- Allowing wide margins of excision in cases where this is desirable.
- Achieving lower rates of margin involvement.
- Reducing the risk of a second primary breast cancer.

Once therapeutic mammaplasty has been selected as the technique for BCS, wide margins of excision can usually be achieved at no extra cost to the aesthetic outcome. The reasons why this may be desirable are varied and may often depend upon local philosophy and protocols. In most cases, the benefits of a wider margin will be realised as a lower rate of histological margin involvement and a greater success rate of first therapeutic operation. Given the rates of involved margins reported for invasive cancer (15–20%) and DCIS (30%), this benefit is worthwhile. Most reported series of therapeutic mammaplasty report low rates of incomplete excision (approximately 10%, Table I). It is however important that therapeutic mammaplasty is carefully planned to minimise the possibility of involved margins. As such the wide local

TABLE I. Summary of Data From Studies Analysing Oncological Outcomes Following Therapeutic Mammaplasty

Refs.	Study	N	Mean age (years)	Follow-up (months)	Specimen weight (g)/ mean tumour size (mm)	Close/+ve margins	Re-excision/ completion mastectomy	LR	Metastasis	DFS	OS
Clough et al. [24]	Paris 2003	101	53	46	222/32	10.9%	NS/5.9%	9.4%	17%	83%	95.7%
Kaur et al.[a] [25]	Milan 2005	30	49	<24	200/39.8	16.6%	NS	NS	NS	NS	NS
McCulley and Macmillan [26]	UK 2005	50	47	36	236/24	8%	0/8%	2%	0	0	100%
Munhoz et al.[a] [27]	Sao Paulo 2006	74	NS	22	NS	1.35%	0/1.35%	0	NS	NS	NS
Losken et al. [28]	USA 2006	53	47	40	236 (NS)	13.2%	7.5%/5.7%	2%	0	98%	100%
Rietjens et al.[a] [29]	Milan 2007	148	50	74	198/22	8.8%	?/0.1%	3%	12.8%	NS	92.6%
Giacalone et al.[a] [28]	France 2007	31	51	<24	190/>15	22.6%	0/13%	NS	NS	NS	NS
Caruso et al.[b] [30]	Italy 2008	61	45.3	68	NS	8% close intra-op. final: 0%	0/0	1.6%	9.8%	98.2%	91.8%
Meretoja et al. [31]	Finland 2010	90	57	26	NS	16%	0/16%	0	3.3%	NS	88.9%
Fitoussi et al. [32]	Paris 2010	540	52	49	187.7/29	18.9%	2%/9.4%	6.8%	12.0%	87.9%	92.9%
Chakravorty et al.[a] [30]	UK 2010	146	59	28	67/21	6.8%	2.7/4.1%	2.7%	1.3%	NS	NS
Grubnik et al.[a,c] [33]	South Africa 2013	251	56	50	237/15.4	2%	0.4%/1.6%	4%	NS	94.6%	96.4%
Schaverien et al. [34]	UK 2013	48	58	26	119/28, 11 multifocal	2%	2%/0	0	2%	98%	98%

NS, not stated.

[a]Series comparing oncoplastic surgery with a control arm of standard WLE.

[b]Intra-operative margin assessment using frozen section.

[c]Close margins defined as <10 mm on histology; these patients underwent re-operation.

Fig. 1. Wise pattern reduction mammaplasties: pre-operative image with the tumour site marked on the left breast.

Fig. 2. Wise pattern reduction mammaplasties: post-operative appearance.

excision is performed prior to, and as a separate specimen to the reduction. Other excision specimens may be orientated as to how they relate to it.

Examples of other scenarios in which a wide margin of excision may be viewed as beneficial are those cases that have risk factors for margin involvement. Such cases would include DCIS, young women, lobular cancers, large cancers and re-excision surgery for involved margins. In addition, whilst neoadjuvant therapy may conventionally be given to allow a small excision volume and a simple wide local excision technique, the ability to perform oncoplastic techniques such as therapeutic mammaplasty may change the focus of surgical planning. Surgery may be tailored to the degree of response to chemotherapy and perhaps the nature of the original disease such that in some cases such as those with a partial clinical/imaging response or multifocal disease, a wide excision may allow better appraisal of pathological response and residual scattered disease foci.

Breast reduction reduces risk of breast cancer in percentage terms, proportionate to the weight of breast excised. It is therefore reasonable to assume that bilateral therapeutic mammaplasty will reduce not only the risk of a new ipsilateral cancer but also a contralateral breast cancer [36].

There are many descriptions of using reduction mammaplasty techniques to treat breast cancer since the 1980s with supporting clinical and oncological safety [24–34]. Most emphasise the use in large breasted woman. Although this remains a core group of patients, these techniques are as or even more applicable for the smaller and moderate size breast. What remains important for the option of a mammaplasty procedure is the existence of some breast ptosis. Broadly, suitable women can be divided into three categories. The first consists of women who need or desire a breast reduction. Such cases will usually have a wise pattern reduction and are suited to very wide local excisions (Figs. 1 and 2). The second consists of women who have a smaller but ptotic breast, who are accepting of an alteration to breast shape and the associated scarring but do not necessarily wish to be significantly smaller. Such cases will usually have a small vertical reduction and the procedure is more akin to a mastopexy (Figs. 3 and 4). The third consists of women who do not

Fig. 3. Bilateral mastopexies with a small vertical scar reduction: pre-operative image with the tumour site marked on the left breast.

Fig. 4. Bilateral mastopexies with a small vertical scar reduction: post-operative appearance.

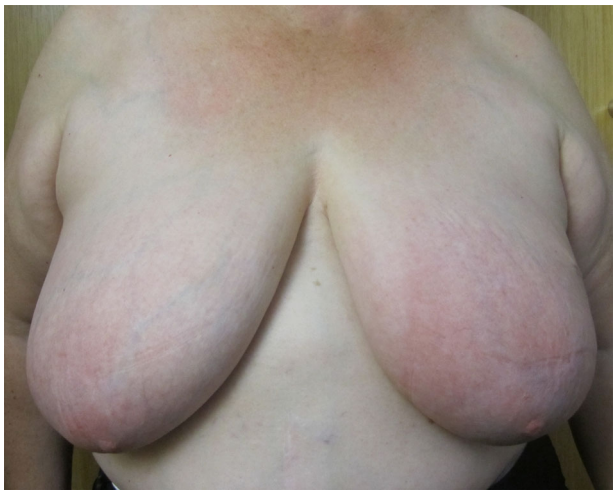

Fig. 5. Bilateral melon slice mammaplasties in a high risk patient: pre-operative image.

Fig. 6. Bilateral melon slice mammaplasties in a high risk patient: post-operative appearance.

necessarily wish a breast reduction or alteration in breast shape but see the option of therapeutic mammaplasty as preferable to alternative options, particularly mastectomy and reconstruction. Such cases will have a mammaplasty that minimises overall scarring and maintains breast shape and volume as much as possible. Such women may choose to have a unilateral mammaplasty and accept some degree of overall asymmetry. It is a principle of oncoplastic breast surgery that a good breast form is of a higher priority than overall symmetry.

Of course, any surgical technique has its limitations and can be associated with problems and complications. In this regard, the following issues are relevant:

- Involved margins.
- Delivering radiotherapy boost.
- Fat necrosis.
- Wound problems.
- Asymmetry.
- Mammography.

It is probably realistic to consider therapeutic mammaplasty as a one-off opportunity for BCS. In other words, the wide local excision is planned to achieve wide margins and if these are unexpectedly not achieved then usually a completion mastectomy is required. This will be due to the disease (usually DCIS) being considerably more extensive or multifocal than pre-operative investigations had suggested. In such cases, the now smaller opposite breast makes symmetry easier be it from total reconstruction or with an external prosthesis. Occasionally, re-excision may be possible when a single margin is involved and easily

TABLE II. Summary of Data From Studies Analysing Complications and Aesthetic Outcomes Following Therapeutic Mammaplasty

Refs.	Study	N	Complications (immediate vs. late)	Re-operation for complications	Delay in adjuvant radiotherapy	Acceptable aesthetic outcome[a]
Clough et al. [24]	Paris 2003	101	20% (11% vs. 9%) ~higher rate in pre-operative radiotherapy	4%	5%	88% fair to excellent at 2 years 82% at 5 years
Kaur et al.[a] [25]	Milan 2005	30	NS	NS	NS	NS
McCulley and Macmillan [26]	UK 2005	50	16% (6% vs. 10%)	2%	0	96%
Munhoz et al.[a] [27]	Sao Paulo 2006	74	24.3%, 17.6% vs. 6.8%, +4% extra biopsies	8.1%	NS	93.2%
Losken et al. [28]	USA 2006	53	22% (22% vs. 0) +26% extra biopsies, all benign	0	0	95% acceptable at 6-month follow-up
Rietjens et al.[a] [29]	Milan 2007	148	10.8%, 10.1% vs. 0.7%	0	0	NS
Giacalone et al.[a] [28]	France 2007	31	28/31 = 90.3% (74.2% vs. 16.1%)	NS	NS	NS
Caruso 2008* [30]	Italy 2008	61	9.8% (9.8% vs. 0%)	0	0	NS
Meretoja et al. [31]	Finland 2010	90	16% (16% vs. 0%)	8.9%	NS	84%
Fitoussi et al. [32]	Paris 2010	540	16.3% (11.5% vs. 4.8%)	3.3%	1.9%	90.3%
Chakravorty et al.[a] [30]	London 2010	146	NS	0	NS	NS
Grubnik et al.[a^] [33]	South Africa 2013	251	23.9% 3.2%/20.7%	NS	NS	96% acceptable result
Schaverien et al. [34]	UK 2013	48	39.6%	2%	2%	95%

[a]Results usually use the Harvard score for subsets of aesthetic outcome measures; volume, symmetry, shape, nipple position and radiation changes.

identifiable. Clips are used to mark margins intra-operatively and these will also assist with radiotherapy planning. It is occasionally possible that with extensive parenchymal re-shaping, some margins are widely apart in the breast. As such, the ability to boost a localised area of breast tissue may be compromised. Such cases require multidisciplinary discussion taking into account the disease, the margins and the overall value of a boost when margins are widely clear.

Surgical problems relate mainly to case selection and planning and in general low rates have been reported [24–34] (Table II). The patient group is very different from that seen when breast reduction and mastopexy is offered on a purely cosmetic basis and case selection and aesthetic goals are necessarily different. The emphasis in therapeutic mammaplasty is on safe, predictable outcomes for women who are likely to have just finished or are just about to embark on a course of chemotherapy or other treatments. Many women will have risk factors for surgery that are not reversible in the time frame that treatment dictates and ultimate aesthetic outcomes often need some compromise, albeit still better and more acceptable than alternatives. In particular the higher risk patient and the fatty breast require very careful planning to avoid fat necrosis. Fat necrosis to some degree is a consequence of all BCS but is more likely with therapeutic mammaplasty and may present as lumps or coarse calcifications on mammography. In some high-risk cases, simplified mammaplasty techniques may be indicated (Figs. 5 and 6). Ultimately, however, therapeutic mammaplasty requires a detailed knowledge of breast reduction and mastopexy techniques and with this complications are minimised.

Therapeutic mammaplasty represents an excellent and established option in the spectrum of oncoplastic breast surgery that can be offered to many women with breast cancer.

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