

# Assessment and planning for oncoplastic and reconstructive breast surgery: a review and a proposed chart

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**Abstract** Assessment for oncoplastic and reconstructive breast surgery (ORBS) can be time-consuming and subjective with a prolonged learning curve. Further, lack of recognition of options may lead to loss of patient choices whether available locally or not. This article reviews and incorporates essential variables into an author-designed chart with components of clinic consultation (“History” and “Examination”) that classify individual cases into one of the three complexities: high, average and low. Based on these complexities, decision-making processes are discussed in order to achieve, safely and realistically, both subjective and objective (anticipated versus achieved) goals of ORBS. This article by summarising literature around common ORBS variables attempts to streamline decision-making process as well as charts out variables to facilitate audit of decision-making and case selection process. Level of Evidence: Not ratable

**Keywords** Breast · Oncoplastic · Reconstructive · Mammoplasty · Perforator · Implant

## Introduction

Assessment and planning for oncoplastic and reconstructive breast surgery (ORBS) often necessitates multiple

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consultations and collation of variables, which can be time-consuming. In addition, application of these anatomical and tumoural variables is largely subjective with a prolonged learning curve, and inadequate assessment may deny patients all available options even if not available locally [1]. This article discusses essential variables leading to essential goals of surgery, which may contribute to minimising these limitations.

It also reviews and discusses the essential variables of the two components of clinic consultation (“History” and “Examination”) for planning ORBS. These variables are incorporated into an organised and simplistic chart (Table 1) in an attempt to streamline consultation factors into risk categories that could help decision-making process leading to baseline-anticipated goals later contrasted with actual-achieved goals of oncoplastic options (Table 2).

## Literature review and proposed chart component discussion

Table 1 charts the essential components of clinical assessment for ORBS that help decision-making process as well as demonstrate to the patient the risk factors. Seven essential components each in the “History” and “Examination” sections are categorised into “relative” complex categories of higher, average and lower complexity that help the author stratify risk-factors that guide planning of safe and realistic options for individual patient. These 14 individual components of “History” and “Examination” are discussed further along with summarisation of current literature.

Table 2 charts the seven common/essential components of the goals of surgery that are discussed further in the text along with literature review. The utility of this chart is in

**Table 1** Table showing common components of clinical assessment for oncoplastic and reconstructive breast surgery and categorising into “relative” complex categories

	Higher complexity	Average (or uncertain) complexity	Lower complexity
<b>History</b>			
S-Secondary therapies, surgery affecting therapies—radiotherapy (RT)	RT in the past or current certain indication	Uncertain indication (pending final post-operative pathology)	No RT in the past or non-indication
S-Surgery from the past including donor sites	Malignant surgery	Benign ( $\pm$ volume deficit)	No past surgery
S-Sicknesses including diabetes, family history	Co-morbidities	Family history only	None/mild co-morbidities
S-Smoking	Current	Ex-smoker > 3 months	Non-smoker
S-Stay in hospital and recovery	Longer	Average $\pm$ overnight	Shorter/day-case
S-Social including work, leisure activities	Heavy	Sedentary	Regular
S-pPsychological status and (s)Expectations of the patient	Low and unrealistic	Average/uncertain (may need psychological assessment)	High status and low expectations
<b>Examination</b>			
S-Shoulder limitation, Spine or chest-wall deformity	Severe	Moderate	None
S-Scars and size (volume) of past tissue removed	Multiple scars, significant defect	Some scars, minimal volume loss	None
S-Skin quality (elasticity, RT, dermal thickness)	Poor	Moderate	Good
S-Size (of tumour, breast, patient/BMI)	>4 cm (pre or post-neo-adjuvant chemotherapy), A-B cup bra	2–4 cm, C-D cup bra	0–2 cm, E and larger cup bra
S-Site/s of tumour	Medial half or inner quadrants	Central	Lateral half or outer
S-Sagging (ptosis)	Grade 3+	Grade 2	Grade 1
S-aSymmetry (including existing a/symmetry)	>2 cm off meridian	1–2 cm	0–2 cm

documenting and auditing contrasting pre-operative patient (subjective) expectations with realistic surgical (objective) possible goals and subsequently comparing the same with actual post-operative outcomes.

**Table 2** Goals of surgery (expected or difficult or impossible)

Goals of oncoplastic and reconstructive surgery	Pre-operative Expected goals (subjective/objective)	Post-operative Achievement of goals (subjective/objective)
S-Size - foot-print especially base-width		
S-Symmetry		
S-Shape including of Nipple-areola complex		
S-Sticking in front (Nipple position and symmetry)		
S-Sensitivity of nipple and colour		
S-Suckling (lactational) function		
S-Scar minimisation		

For example, anticipated symmetry may not be possible in unilateral surgery but scar minimisation may be possible

Table 3 discusses common and the simplest decision-making as well as peri-operative processes for each complexity group of Table 1 in order to plan and achieve, realistically and safely, the goals in Table 2.

## History

*S-Secondary therapies, surgery-affecting therapies—Site (radiotherapy), Systemic (chemotherapy or hormone therapy)*

There is correlation between ORBS and oncological therapies (local and systemic). Increasingly, neo-adjuvant chemotherapy is initial therapy in younger patients, with tumours that are large, high-grade, estrogen receptor-negative (with/without positive HER-2 receptor). Besides comparable survival benefit to adjuvant chemotherapy, neo-adjuvant chemotherapy can downsize tumour and facilitate BCS (breast-conserving surgery) when either mastectomy is a certainty or BCS indication is borderline. Good response may facilitate less extensive oncoplastic options in an existing BCS plan. Further, this approach precludes any delay in systemic therapy due to surgical complications.

**Table 3** Flowchart to support decision-making process based on individual complexity in order to achieve realistic goals and safe outcomes

Concepts and processes for optimising safe outcome		
↓ Higher complexity (non-modifiable risk factors)	↓ Average complexity (modifiable risk factors)	↓ Lower complexity (avoidable risk factors)
Simpler breast-conserving techniques in the presence of other risk factors such as smoking (versus mammoplasty or perforator flap partial reconstruction)	Discuss pros and cons with patient—shared decision making	Dependent on anatomy and pathology, all possible options to be offered (whether available locally or not)
Avoid symmetrising procedure	Allow reasonable time for patient to arrive at a choice	Maintain low risk by maximally optimising peri-operative techniques and processes
Avoid implant or free flap reconstructions if anatomically all choices possible	Minimise patient risk factors—for example, emphasise risk of re-starting smoking to a recent ex-smoker during current anxiety phase)	
Consider delayed breast correction for large breast-conserving surgery such as fat grafting or partial reconstruction	Minimise peri-operative risks such as pain, immobility, length of stay	
Consider delayed breast reconstruction		

Following BCS, adjuvant radiotherapy can cause breast parenchymal fibrosis, volume loss with resultant asymmetry and skin changes [2] with worse outcomes following surgical complications such as haematoma and seroma [3].

Post-mastectomy radiotherapy following implant-based IBR (immediate breast reconstruction) has up to four times higher complications [4]. However, the severity of capsular contracture rate is reportedly less with acellular dermal matrix (ADM) [5] reflecting some animal studies [6, 7]. Chemotherapy independently can adversely affect the type I collagen thereby affecting the remodelling and integration of ADM [8].

Although autologous delayed breast reconstruction (DBR) is an option where post-mastectomy radiotherapy is anticipated, increasingly deep inferior epigastric perforator (DIEP) flap is being recognised to withstand radiotherapy better over latissimus dorsi (LD) flap [9].

Patients with positive axillary nodes currently require axillary node dissection and are at higher odds of requiring adjuvant therapies. Separate axillary incision minimises seroma and infection of breast. Node negative patients may benefit from sentinel node biopsy prior to IBR.

#### *S-Surgery from the past including donor sites*

Elderly patients may not recall benign surgery from distant past, and therefore, leading questions can be informative. Previous breast incisions, volume loss, radiotherapy and duration since surgery may affect available oncoplastic options.

Abdominal scars may preclude pedicled (TRAM) or free (DIEP) flap reconstruction, but ingenious applications are possible [10]. CT angiogram is current gold standard [11, 12] for assessment of abdominal perforator vessels, though MR angiogram may provide better accuracy (without

radiation exposure) [13]. Abdomen as a donor site in premenopausal patients should not preclude or compromise future pregnancies [14] but should be considered cautiously.

#### *S-Sicknesses—personal and family history*

Co-morbidities such as diabetes and medications such as steroids [15] can cause wound healing issues especially in procedures involving multiple scars, e.g., therapeutic mammoplasty (Figs. 1 and 2) or flap-based breast reconstructions.

Patients with gene mutations or with high-risk family history may consider contra-lateral risk-reducing mastectomy, which in conjunction with oncological surgery may either increase or decrease reconstructive options.

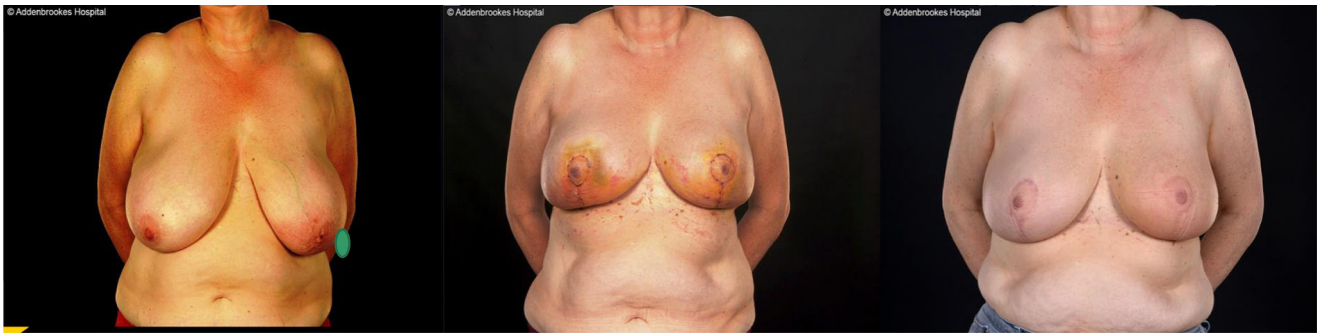
#### *S-Smoking*

Smoking, independently, is a risk factor [15–17] for wound healing besides systemic peri-operative morbidities. Immediate post-operative risks of partial/total nipple/skin necrosis are higher than the non-smoking population [15, 16].

Wound complications may delay adjuvant radiotherapy/chemotherapy; hence, oncological surgery alone may be the safer initial option followed by DBR or symmetrisation [16]. Provision of counselling and support for smoking cessation is therefore imperative.

#### *S-Stay in hospital and recovery*

Many patients prefer shorter surgery with consequent shorter hospital stay and faster recovery. They may not prefer any aesthetically corrective BCS (mammoplasty, etc.) or reconstructive procedure and choose to have oncological



**Fig. 1** Left wide local excision and therapeutic mammoplasty and right symmetrising reduction (wise-pattern). Left therapeutic mammoplasty (wise-pattern based on extended supero-medial pedicle) for lower outer quadrant multifocal tumours (32 and 12 mm being 23 mm apart) following neo-adjuvant chemotherapy. The excision weight was 523 g

and the right symmetrising reduction weight was 616 g. Both breasts were E cups with grade 3 ptosis pre-operatively with acceptable post-operative symmetry in and out of bra. The bottom panel shows post-operative pictures at 2 weeks (*bottom left*) post-operatively and at 4 months (*bottom right*) following radiotherapy

extirpation surgery guaranteeing them shorter hospital stay. For similar reasons, they may prefer implant to other complex reconstructions.

#### *S-Social including work, leisure activities*

Certain surgical options may not be preferred or suitable dependent on patient's family/relationship commitments or business/leisure activities. Active patients even with lower tumour-to-breast ratio may prefer therapeutic mammoplasty with symmetrising reduction.

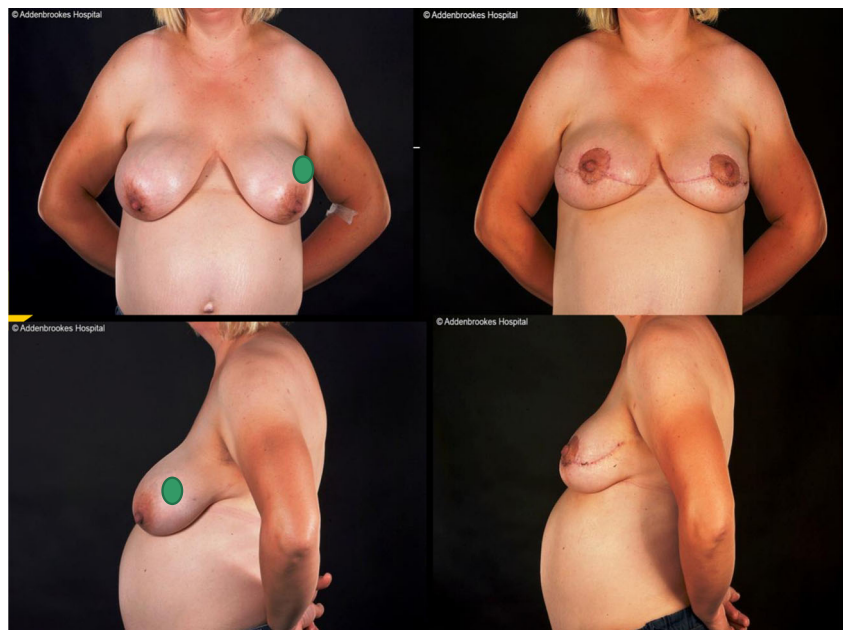
Similarly, autologous reconstruction (LD, TRAM or TUG/gluteal flaps) may not be suitable in patients with heavy physical occupations or leisure activities (e.g.,

rock-climbing, tennis) [18] particularly LD flap on dominant hand-side. Equally, concerns regarding possible implant movement or hyper-animation may influence patient decision. Newer tabbed prosthesis [19] or prepectoral implants with complete acellular dermal matrix (ADM) cover [20] may minimise such movements, but larger series are necessary.

#### *S-psychological status and (s)expectations of the patient*

Basic assessment and understanding of patient's psychological status concerning comprehension, retention and discrimination between surgical options are essential after provision of all written information and sufficient time. The shock of

**Fig. 2** Left wide local excision and therapeutic mammoplasty and right symmetrising reduction (bat-wing pattern). Left wide local excision and therapeutic mammoplasty (for a pre-operative 3-cm tumour which was 6 cm post-operatively but with clear margins) and right reduction performed in bat-wing mastopexy fashion due to D cup breasts, gross ptosis, high set infra-mammary folds, long sternal-nipple distance and thin skin along with high body mass index. A skin-only peri-areolar mastopexy and skin-only mastopexy medial to nipple-areola complex with total excision weight of 149 g on the therapeutic mammoplasty side allowed acceptable results (3 weeks post-operatively) in a difficult case



cancer diagnosis may preclude reasoned decision initially. If deemed necessary, formal psychological assessment may be necessary [21] especially prior to risk-reducing surgery. This may be particularly necessary in non-high-risk family history patients who increasingly request contra-lateral prophylactic mastectomy where decision-making process may be in question [22]. When patient expectations do not meet oncological or surgical safety, it is appropriate to re-discuss options in a subsequent multi-disciplinary meeting (MDT). Breast care nurses during their one-to-one consultation can be better in ascertaining patient's expectations in terms of body image, sexuality and relationship factors influencing patient choice [23, 24].

However, if there is an ambiguity or unavailability of an oncoplastic surgical option locally, UK national oncoplastic guidelines [1] recommend that patient is referred to another centre. The patient, however, loses if the initial surgeon is unable to recognise oncoplastic options due to current unavailability of an organised comprehensive approach to assessment.

## Examination

### *S-Shoulder limitation or spine or chest wall deformity*

Pre-existing spinal deformity or shoulder movement limitation may predispose to possible post-operative morbidity (following LD/abdominal flap). In addition, any existing spinal asymmetry may cause false impression of breast asymmetry. Therefore, during measurements and marking, both clavicles and both shoulder tips should be at the same horizontal plane. Usual involuntary tendency for the ipsilateral shoulder to be withdrawn superiorly during breast palpation (mainly due to post-biopsy tenderness/bruising) could be minimised if explained to patients.

The newer lateral chest wall perforator (LCWP) flaps [25] (Figs. 3 and 4) which utilise the oft-redundant lateral chest wall subcutaneous (non-muscular) tissue flap based on perforators increase the options in small breasts with pre-existing musculo-skeletal limitations. These (essentially replacing mini-LD flaps) can be used for either whole breast or commonly partial (Figs. 3 and 4) breast reconstructions [26] in high tumour-to-breast ratio BCS.

### *S-Scars if any and size (volume) of previous tissue removed*

Previous scar/s may preclude certain oncoplastic BCS or mastectomy reconstruction. For example, previous peri-areolar incision (from therapeutic or cosmetic reductions) including superior half of the circumference may preclude supero-medial/superior pedicle mammoplasty/reduction [27].

Similarly, pre-existing scars during skin/nipple sparing mastectomy may be an additional risk to skin flap vascularity

particularly in direct-to-implant (Fig. 5) IBR [27, 28]. In contrast, an initial reduction/mastopexy (with associated scars) in large ptotic breasts can achieve an optimal skin envelope before mastectomy reconstruction (particularly in risk-reducing setting) though both components are achievable in a single stage [29, 30].

Augmented (implants) breasts with new cancer will have minimal scars, but achieving volume symmetry in BCS or planning BCS or mastectomy can be challenging [31]. Explantation with or without mastopexy may be necessary to avoid capsular contracture following adjuvant RT in invasive disease. However, iatrogenic damage to existing implant or rarely tumour infiltration may result in unplanned explantation. As discussed earlier in the history section, donor site scars are equally important when planning flaps for partial or total breast reconstruction.

### *S-Skin quality (stretch-elasticity, sunburn-radiotherapy, dermal thickness)*

Striae over the breasts following pregnancy or weight loss render the skin thin and ptotic. In some patients, this may necessitate skin-only mastopexy, either wholly or partly (Fig. 2) following BCS (to provide a better shape) with or without contralateral symmetrisation. In contrast, however, skin with limited thickness of the dermis limits oncoplastic options and may contribute to wound complications [16] including following reconstructions (especially implant-based reconstructions). Similarly, striae on large skin island (necessitated in DBR) abdominal wall flap compromises overall aesthetic outcome.

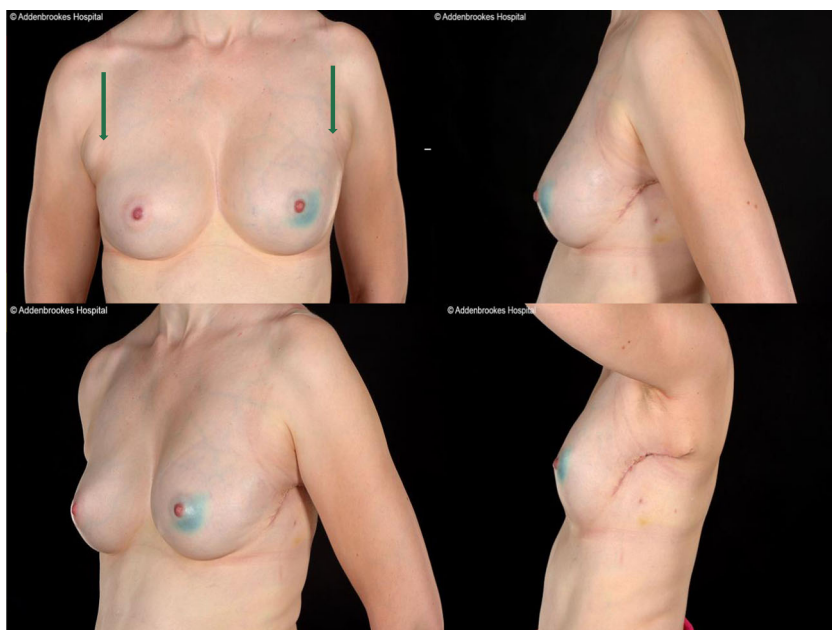
Irradiated skin (mantle radiotherapy for lymphoma or previous BCS or following mastectomy) may have limited elasticity and unpredictable vascularity particularly from recent radiotherapy. There is higher risk of wound dehiscence especially at the T-junction with wise-pattern reduction mammoplasty. DBR in irradiated breast has traditionally been two-stage implant-based reconstruction, but there are increasingly large series of ADM-based single-stage implant reconstructions with either permanent or expandable implant [15, 32, 33].

### *S-Size of breast and patient*

The breast size vis-à-vis tumour size, fluctuating body weight along with existing asymmetry in size, shape and nipple position, influences outcome though patients may be unaware of subtle asymmetry particularly breast shape and nipple position.

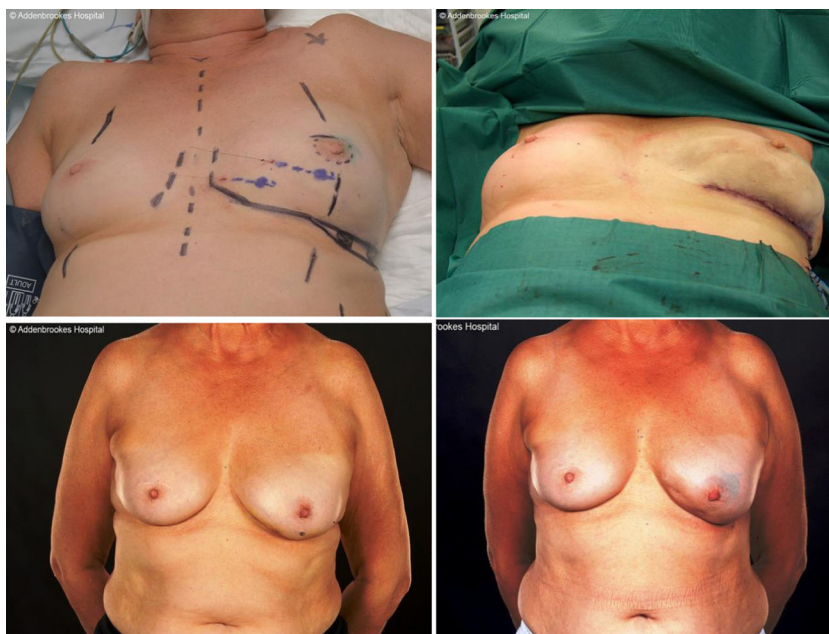
In general, lower tumour-to-breast ratio allows “displacement” (Figs. 1 and 2) type of oncoplastic options following BCS, whilst higher ratio necessitates “replacement”, either immediate (Fig. 3) or delayed (Fig. 4) partial [34] or total reconstruction (Fig. 5). Concurrent or delayed augmentation of small breasts or reduction of large breasts may achieve or maintain symmetry (Fig. 5).

**Fig. 3** Immediate partial reconstruction of left breast with lateral intercostal artery perforator (LiCAP) flap. Wide local excision of 19 mm. Grade 3 tumour in the axillary tail area of a 36 year-old woman would have left a defect if uncorrected especially following boost radiotherapy. However, corrected and overcompensated with LiCAP flap to correct hollowness in axillary tail area (as pointed on the right side) avoids deformity from alternative of parenchymal mobilisation as the nipple-areola complex would have been displaced in an otherwise good shape breasts with no ptosis. The 3 weeks post-operative picture shows *blue discolouration* from patent blue dye for sentinel lymph node biopsy (which was negative)



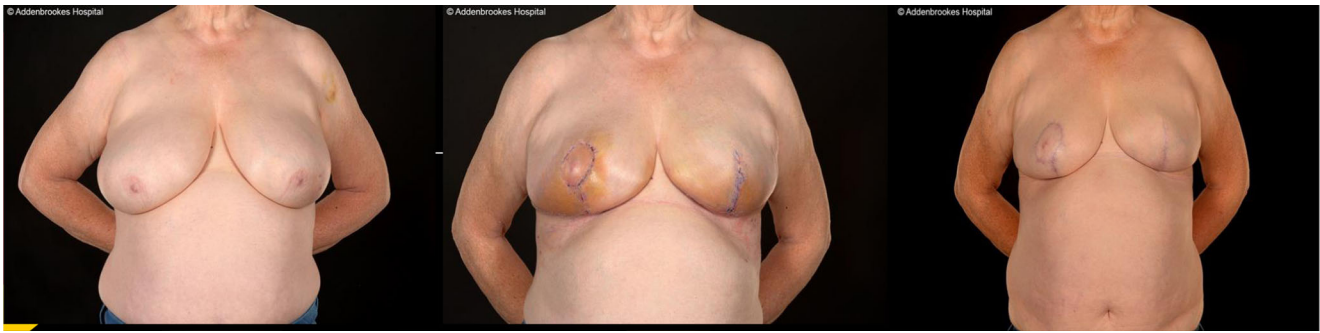
In general, though not strictly, large wide-base breasts are more suitable for wise-pattern mammoplasty (Fig. 1) whilst medium narrow-base breasts for vertical-scar mammoplasty. However, other patterns such as bat-wing (Fig. 2)

mammoplasty may be useful. In small to moderate size breasts with higher tumour-to-breast ratio, a variety of volume replacement flaps are available and increasingly conservative (from muscular to perforator flaps) [35].



**Fig. 4** Delayed immediate partial reconstruction of left breast with lateral thoracic artery perforator (L-TAP) flap. Wide local excision (specimen weight was 82 g) for lower inner quadrant multi-focal (grade 1, 8 mm; and grade 2, 14 mm being 28 mm apart) tumours (shown by two *blue dots* with localising wires in situ) was performed initially. Following confirmation of clear margins, 4 weeks after initial surgery, a second-stage L-TAP flap partial breast reconstruction was performed. Excision alone would have caused unacceptable deformity, whilst other patterns such as

radial with re-centralisation of nipple may have even corrected existing symmetry, but the infra-mammary scar did not disturb the existing footprint of the breast, increase the risks or obviate any reconstruction, if mastectomy was necessitated (higher than average chances of positive margins due to multi-focal tumours). The *bottom panel on the left* is pre-operative, while the right is post-operative picture. The 6 weeks post-operative picture shows *blue discolouration* (bottom right) from patent blue for sentinel lymph node biopsy (which was negative)



**Fig. 5** Left skin-sparing wise-pattern mastectomy with inferior pole dermal sling based direct to (permanent) implant reconstruction with symmetrising reduction. Left skin-sparing mastectomy and inferior dermal-based sling using a permanent anatomical implant (Allergan™

320MM) and symmetrising wise-pattern reduction. Post-operative pictures are *top right* (4 weeks), *bottom left* (4 weeks) and *bottom right* (6 months)

In medium size breasts, post-mastectomy autologous reconstructions with or without an implant are options. However, in large ptotic breasts with inadequate autologous tissue, lower pole dermal sling based implant reconstruction is one option including direct-to-implant [36] (Fig. 5). In large breasts, a recent modification of dermal-based reconstruction (“Goldilocks” mastectomy) involves utilising de-epithelised dermis without prosthesis to reconstruct a breast mound [37].

High BMI in addition to increased risk of peri-operative morbidities is an independent risk factor for both reduction/mammoplasty [16] and implant-based reconstructions (both ADM and non-ADM) [15, 38]. Further, weight loss may render the breast more ptotic with thinner skin (generally with striae) with its potential implications as discussed in the preceding section [16].

#### *S-Site of tumour in the breast*

Upper outer quadrant is the commonest site for breast cancer and generally the simplest to manage with either curvilinear or a radial incision with or without nipple-areolar complex re-centralisation. Lateral fold approach is an option provided there is no compromise in oncological resection. Further upper/lower outer tumours, if likely large enough to leave a defect or cosmetic deformity, may necessitate LCWP flap (Fig. 3).

Upper inner quadrant tumours are challenging and options include incision at peri-areola or curvilinear incision as away from cleavage as possible. For lower half of the breast, peri-areolar, lateral/infra-mammary fold or lower vertical scars are options. However, loss of volume can lead to bird’s beak deformity that may be preventable by local tissue re-arrangement, mammoplasty or LCWP flap (Fig. 4). Mammoplasty pedicle options are quite dependent on tumour location and matter of extensive discussion. Central tumours often necessitate excision of the nipple-areola

complex with options ranging from simple parenchymal mobilisation through mammoplasty to replacement flaps [39].

Tumour site acquires relevance in skin sparing (incision vis-à-vis skin involvement, if any) especially in nipple-sparing (or subcutaneous) mastectomy [17].

#### *S-Sagging (ptosis)*

Large ptotic breasts have higher risk of NAC necrosis following reduction mammoplasty [16]. Those with sternal notch to nipple distance of >26 cm have higher incidence of skin flap necrosis following skin sparing mastectomy [40], and alternative techniques such as skin-only mastopexy may be necessary for a safe outcome (Fig. 2).

Small to moderate breasts with minimal ptosis are generally suitable for implant-based (with or without ADM) reconstruction whilst large ptotic breasts for either BCS (mammoplasty) or dermal sling-based implant reconstructions (Fig. 5) [36] as discussed previously. However, ptosis due to predominant volume loss (post-partum or weight loss), resulting in redundant skin, may necessitate either mastopexy only BCS (Fig. 2) or two-staged mastopexy implant-based reconstruction [29, 30]. It is difficult to match natural ptosis with any reconstruction especially implant-based reconstruction.

#### *S-aSymmetry*

Besides often obvious asymmetry in size, appraisal of differences in breast shape and nipple position helps planning minimisation of post-operative asymmetry. It is important to discuss these subtle asymmetries with the patient for contrasting expectations versus realistic possible outcomes.

If the affected size is larger, size asymmetry in reduction mammoplasty can provide better post-operative symmetry.

However, if the affected side is smaller, then either contralateral reduction or an ipsilateral replacement flap may be necessary.

Gross shape asymmetry (e.g., tuberous deformity) may necessitate extensive surgery including implant-based reconstructions with or without lipofilling. Lipofilling has been shown to be technically safe in some large series [41], and the usage in cancer extirpative surgery is increasing [42].

Asymmetry of nipple position can be subtle, and even if symmetrical, nipples may not be aesthetically positioned and could be either medial or lateral to the breast meridian. It may be possible to correct para-median nipple positions during mammoplasty/reduction, but inherent above-average nipple mobilisation adds additional risk to nipple vascularity.

## Goals of surgery

### *S-Size (base side-ways/width and stand/height measurement)*

Post-operative breast size should be aesthetically proportional to patient's frame/torso. The goals of cosmetic surgery might not be possible or equivalent to goals in cancer surgery. For example, (cosmetic) augmentation disproportionately larger to a woman's petite frame may be possible, but there will be limitations in achieving a similar breast size following reconstruction.

Most surgeons regard larger and wider breasts suitable for wise-pattern mammoplasty whilst narrower and smaller breasts suitable for vertical-scar mammoplasty. However, the aim of therapeutic mammoplasty is to achieve reduction of skin and parenchyma at the same time as BCS. Therefore, instead of a default template (Figs. 1 and 2), mammoplasty should be tailored according to the individual breast morphology as discussed already (skin thickness, elasticity, ptosis).

Similarly, during implant-based reconstruction, the size or the volume of prosthesis is dependent on firstly width and secondly height of the breast footprint. In autologous reconstruction, the pliability of the autologous tissue may allow moulding and volume adjustment within the undisturbed (in immediate) or recreated (in delayed) breast footprint and envelope.

### *S-Shape*

The foremost goal of any ORBS procedure is a good shape. For a good aesthetic outcome, good shape of an individual breast is more important than the size. However, for bilateral procedures, achieving both shape and size symmetry are important though challenging (Fig. 5) especially when the surgery is unilateral whether BCS or reconstruction (particularly an implant-based reconstruction which even if symmetrical initially will lag behind the progressive ptosis with time in the contra-lateral breast). Therefore, it is important to point out to the patients that good symmetry achieved in the short-term may not persist long-term. This is nigh-certain with BCS followed by radiotherapy and mastectomy with implant-based reconstruction. Explanation

of this ptosis phenomenon will allow patients make an informed choice regarding surgery to the unaffected breast.

The third dimension of projection is usually dependent on the permutation and combination of the initial two measurements in both mammoplasty and reconstructions (especially in implant). Estimated projection in implant reconstruction is an important variable for symmetry, if unilateral. Magnitude of projection is relevant in a small breast with thin skin to avoid unnecessary skin stretch and compromise vascularity.

### *S-Symmetry*

Following BCS, medium- and long-term radiotherapy effects lead to firmer, smaller and less ptotic breasts versus the contralateral unaffected breast. As discussed above, this usually leads to long-term effects on shape asymmetry and may or may not lead to global volume asymmetry. If resultant volume loss causes asymmetry, contra-lateral reduction is an option at a later stage though increasingly the modern practice is towards concurrent symmetrisation (Figs. 1 and 2). Similarly, a concurrent symmetrising procedure (reduction or augmentation) during IBR is an option (Fig. 5). As discussed above (in the shape section), many patients choose concurrent symmetrisation to avoid another surgery, hospital admission, and a particular wish to have a sense of closure in terms of treatment of breast cancer and associated therapies.

### *S-Sticking in front = nipple position and symmetry*

It is important to plan a shape that allows for optimal position of nipple on the mound. Any mammoplasty technique will incorporate nipple positioning during marking/planning. However, planning such in reconstruction is more difficult. Sub-optimal ratio between upper and lower pole of breast mound may occur due to displacement of scar (in skin-sparing mastectomy) or nipple (in nipple-sparing mastectomy) especially when reconstruction includes expansion process.

### *S-Sensitivity of nipple*

Partial loss of nipple sensation is inevitable in mammoplasty or nipple-sparing mastectomy, whilst total loss of nipple sensation is common. Many patients report restoration of sensation that initially could be abnormal and para-aesthetic. Septum-based reductions can preserve nipple sensation [43], but application of such technique for mammoplasty following BCS in cancer may not be possible.

### *S-Suckling (lactational) function*

A small prospective study found lowered breast feeding rates following reduction (and augmentation) though possibly related to patient profile and acceptance [44]. However, a systematic



review of the effect of reduction on breast-feeding in the first post-partum month did not show any difference compared to non-reduction population [45] though there may be subtle differences between pedicles [46]. However, data is unavailable in therapeutic mammoplasty in cancer setting.

Regardless, oncological principles especially with tumours close to nipple-areola complex take priority in BCS over any planned reduction mammoplasty. Therefore, in young women who have not started or completed family, and wish to preserve breast-feeding function, simple BCS may be the only option. Some data suggests that radiotherapy can reduce lactation in less than 50 % patients including lactational volume [47]. Therefore, extensive surgery such as mammoplasty may reduce lactational ability further especially when combined with contra-lateral symmetrising reduction. It is imperative that the patient makes informed choice between aesthetic vis-à-vis functional outcomes.

### *S-Scar minimisation*

Factors such as shape and size are important to surgeons, but occasionally, dominating concern of the patient remains the extent of the scar. Dependent on the type, there will be limited options for scar pattern in mastectomy. In BCS, scar pattern depends on tumour location, breast size, shape, ptosis, etc. (as already discussed). However, if the goal of parenchymal reduction is achievable with any scar pattern, then utilising a pattern with minimal scar becomes prudent.

## Conclusions

This review discusses the pros and cons of a wide range of scenarios with possible ORBS options in an organised manner. Although not exhaustive, this organised approach may allow rapid yet comprehensive oncoplastic assessment minimising inadvertent exclusion of any common variable. As a decision-making tool, it should enable senior trainees/inexperienced consultants establish baseline facts and differentiate between options helping arrive at a shared-decision with the patient. It could also be utilised as an audit tool to ensure quality of oncoplastic assessment whilst ensuring availability of all possible options to all patients in any centre.

Further to this article, the aim is to validate this chart retrospectively in a large cohort of post-operative patients managed by different surgeons followed by prospective validation study.

### Compliance with ethical standard

**Conflict of interest** The author Amit Agrawal declares that there is no conflict of interest in the preparation of this manuscript.

**Ethical standards** For this type of article formal consent from a local ethics committee is not required.

**Patient consent** Patients provided written consent for the use of their images.

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