Algorithm for Secondary Aesthetic Breast Surgery

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1 Introduction

Breast augmentation is the most popularly carried out procedure in aesthetic surgery worldwide. Approximately 80,000 operations are carried out in the US alone on a yearly basis. Whilst both implant manufacturing and the process of breast augmentation have vastly improved over the past six decades, complication rates remain high. The reasons for complications are multifactorial: they include iatrogenic causes such as poor implant selection, poor surgical technique, and poor process including neglected post-operative care. Other causes are related to the implants themselves and their inherent deficiencies. Patient anatomy whether it be in primary or secondary situations also plays an important part in determining outcome and potential complications. The most comprehensive overview of implant performance and complication rates has been derived from the core studies with Allergan and Mentor implants [1]. There are numerous other studies looking at complications and outcomes from single surgeon or single centre units defining key determinants relating to poor outcome [2–5].

In order to be able to correct poor outcome, it is important to be able to define its nature. Poor outcome may simply relate to 'look' or dissatisfaction thereof. The latter may relate to implant malposition, an unidentified or recurrent ptosis, dissatisfaction with size or a particular type of appearance, i.e. too fake or too natural. It may relate to unmet expectations, perhaps unrealistic at the outset. Other complications might be more tangible: an implant rupture, capsular contracture, infection, and extrusion. The overlay of anatomy on all of these situations is also critical. Those with poor soft tissues, thin skin, little native breast tissue, multiple scars,

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multiple past procedures, as well as little body fat all pose significant reconstructive challenges, with higher complication rates. As with all complications, the best form of treatment is prevention in the first instance. Making the sensible choice at the outset is the key. It is critical that the patient is led by the surgeon and not vice versa, patients will often not understand the limitations of their own anatomy on implant selection, the concept of 'it's not what you want, it's what you can have' is a reflection of this point. Today's approach to breast augmentation should follow the principles of tissue-based planning, where the patient's anatomy is the determining factor around implant choice. Many methods have been described in the literature to help this process, such as the ICE principle [6], the AK method described by Heden [7], the High 5 by Tebbets and Adams [8], and the Y number of del Yerro [9]. Whilst they all differ to some extent, they all attempt to match implant selection to the soft tissue characteristics of the breast, thereby adhering to very similar principles.

Fundamental to all aesthetic surgery is a baseline or norm which serves as a framework around which to plan not only in primary surgery, but also perhaps even more importantly for secondary corrective procedures. In the breast, the aesthetic ideals have been well characterised by the author, with four fundamental parameters as markers for attractiveness: the 45:55 volume distribution between the upper and the lower pole (i.e. the lower pole always slightly fuller than the upper pole), a skyward pointing nipple, a tight convex curve to the lower pole with adequate tension to elevate it off the upper abdomen, and a natural upper pole slope—straight line or very mildly concave [10, 11].

These parameters are especially important when analysing poor outcomes, in order to be able to make the correct decisions in order to be able to restore these parameters to recreate a positive outcome.

2 Causes of Secondary Surgery

In order to maximise outcome and minimise the likelihood of complications and re-operation, the principles for planning focus on several points: patient selection, patient education, pre-operative planning and implant selection, precise surgical technique, and a defined process for post-operative care [4]. These principles highlight the fact that prevention of complications in the first instance is the most effective way to reduce re-operation rates. As previously stated, the causes for re-operation are multifactorial. Examples include the selection of oversized implants, failure to optimise soft tissue cover over the implant, traumatic pocket dissection leading to subclinical haematoma in the peri-implant space, excessive handling of the breast implant, and failure to maintain a strictly aseptic surgical environment. Steps to avoid this have been clearly laid out in the 14-point plan of Adams et al. [12].

Surgical complications in breast implant surgery could also be classified as pre- and intra-operative complications as well as early and late post-operative

complications. Pre-operative and intra-operative complications derive from poor planning (wrong implant selection, wrong choice of the surgical access, incorrect surgical plane) or poor surgical technique (over-dissection of the implant pocket, implant malpositioning, excessive bleeding). Early post-operative complications include haematoma, seroma, infection, implant malposition and pain. Late post-operative complications include infection, seroma, capsular contracture, excessive pectoral animation, implant visibility, implant malposition (descent, double bubble, waterfall deformity), implant rippling, wrinkling and palpability, implant rupture, symmastia, poor scar healing or scar hypertrophy [13]. However, it has to be taken into account that some re-operations are inherently unavoidable and may relate to other patient factors such as pregnancy, weight fluctuations, natural ageing, or hormonal changes within the breast.

The best evidence relating to silicone gel-filled breast implants derives from the US Food and Drug Administration (FDA) core studies—10-year follow-up data regarding Natrelle 410 anatomical form-stable silicone-filled breast implants (Allergan Inc., Irvine, California) used in aesthetic and reconstructive breast surgery [14]. The Allergan core study investigated the safety and effectiveness of Natrelle 410 breast implants reporting complications and re-operation rates, reporting the cumulative risk of a subject experiencing an adverse event at any time during the investigation period (10 years). Capsular contracture rates (Baker scale grades III and IV) at 10-year follow-up were 9.2% for augmentation and 14.5% for reconstruction. The confirmed rupture rate was 9.4% without any report of extracapsular silicone gel migration. Other major complications (>5%) were implant malposition (4.7% for augmentation) and asymmetry (6.9%). The seroma rate was 1.6% for augmentation subjects, 0.6% occurring more than 1 year after implantation (late seroma). A single case of breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) was reported.

The 410 Allergan core study concluded that the most commonly reported complication in breast implant surgery is capsular contracture, the risk of this complication increasing over time, even though capsular contracture rates being lower than those observed in the Natrelle round gel (fourth generation) core study, mostly including smooth implants (56.2%) [15].

Similarly the 6-year data about the form-stable Mentor Contour Profile Gel (CPG) implants (Mentor Worldwide LLC, Santa Barbara, California) showed lower contracture rates for the CPG implants when compared with predominantly smooth-surface round gel breast implants [16, 17]. The 10-year data also show a very low rate of implant rippling or wrinkling (0.9% for augmentation, 6.2% for reconstruction).

In summary, the most common indications for secondary surgery are size change, capsular contracture, implant malposition, and implant rupture and these may be classified into three categories: to the surgical procedure, to soft tissue changes and related to the implant [4] (Table 1).

Table 1 Causes of secondary breast implant surgery

Related to the operation
– Selection of incorrect procedure (implant versus mastopexy)
– Postsurgical fluid collection
– Selection of incorrect implant
– Failure to optimise soft tissue cover
– Excessively traumatic pocket dissection
– Overdissection/underdissection of the pocket
– Iatrogenic implant damage
– Overrelease/underrelease of muscle
– Suboptimal surgical instrumentation
Related to soft tissue changes
– Elongation of the lower pole
– Atrophy of tissue
– Stretching and thinning of tissue
– Breast tissue/glandular hypertrophy
– Development of ptosis
Related to the implant
– Rupture
– Malposition
– Rotation
– Capsular contracture
– Malposition
– Rippling
– Palpability
– Implant edge visibility

3 Problem Solving Algorithm

In order to simplify the process of problem solving only two fundamental aspects need to be considered in corrective surgery: the soft tissue component and the implant. These are the only elements that are correctable either on their own or collectively. They also have to be considered on the back of the 45:55 template. The following are a list of changeable elements in either the soft tissues or the implant selection:

3.1 Soft Tissue Component

The plane.
Embellishment with fat.
Soft tissue manipulation mastopexy/tightening/reduction.
Introduction of extraneous support—Mesh/ADM.

3.2 The Implant

Size—downsize/upsize.
Shape—round/anatomical.
Gel—softer, firmer, B-lite.
Texture—smooth, micro/macro textured, polyurethane.
These elements will be considered in more depth.

4 The Soft Tissue Components

4.1 The Plane

This may be a relatively straightforward problem where, for example, a visible implant lying in the subglandular plane may benefit from a plane change to a submuscular plane (dual plane) in order to achieve better cover.

Occasionally a plane change in the opposite direction may be necessary, i.e. from subpectoral to subglandular as, for example, in the case of a double bubble or where there is excessive animation deformity.

A 'third' space exists as a neo-subpectoral pocket described by Maxwell, in which implants already in the subpectoral plane can be placed into a neopocket by creating a space between the anterior capsule adherent to the posterior surface of the pectoralis major by peeling it off the muscle and suturing it to the posterior capsule on the chest wall [18]. This is useful when placing anatomical implants into a breast where the implants have been previously placed in subpectoral pocket in order to minimise the risk of rotation or to determine new boundaries to limit the pocket as in a correction of a symmastia.

4.2 Soft Tissue Manipulation—e.g. Mastopexy

It is not uncommon for an individual to present with dissatisfaction around the appearance of the breasts. Often an untreated or unrecognised ptosis or tissue laxity is not addressed at the original surgery, sometimes it is the patient who has insisted she doesn't want scars or the surgeon who claims he/she can obtain a good result without scars. Therefore, the addition of a mastopexy to correct secondary cases is common, whether this be a lesser circumareolar procedure or a more complete inverted T mastopexy.

Also, in secondary surgery where downsizing of the pre-existing implant is common, secondary mastopexy is often required as a tailoring procedure around the smaller implant with tightening and lifting as required.

The inverted T gives a much more comprehensive re-shaping than the simpler procedures and it is important to understand that mastopexy is not simply about

nipple elevation but about re-organisation of the breast as a whole. It was stipulated earlier in the chapter the importance of using the 45:55 as a framework concept around which to plan for secondary cases where form and shape are often highly distorted.

4.3 Fat Transfer

Fat transfer is a powerful tool in the case of secondary surgery. It can be used in many forms and for several indications. Examples include the correction of asymmetries, softening of cleavage gaps, as cover for implant visibility, and correction of specific defects. Patient expectation has to be managed with respect to the use of fat transfer and its survival. On average, patients are advised that approximately 50% of injected fat will survive, they are therefore counselled regarding the possible need to repeat the procedure after some months in order to add a further layer should this be required. Management of the capsule in patients having fat transfer is important especially where tissues are extremely thin. The presence of the capsule can be important as a defined structure for the containment of fat superficial to the implant. Fat can also be used as a preparatory step in the process of restoration. In other words, prior to the insertion of the implant it can be layered into the breast in preparation for placement at a later date once the soft tissue conditions have improved as a result of the fat transfer.

4.4 Mesh/ADM

There are occasions where extraneous assistance is required. In patients who are extremely thin with no fat available, or where the soft tissue quality or skin conditions are particularly poor, local manoeuvres to accommodate implants such as capsulorrhaphies and the like might be deemed insufficient. The use of ADMs in both reconstructive and aesthetic breast surgery is well documented. As well as a supporting role, their minimal thickness may have some use in providing implant cover in desperate situations where nil else is available. However, the cost of ADMs is often prohibitive in the self-pay market, and their benefits have to be balanced against cost.

The advent of various Meshes has been significant in aesthetic breast surgery. Not only are they more affordable, but their ease of use, wide range of indications, and lower complication rates make them a very attractive alternative to ADMs. The author has extensive experience with the use of GalaFlex mesh—P4HB, a biologically derived, biodegradable monofilament polymer. The mesh is broken down over a 2-year period and converted to collagen which in itself carries tensile strength beyond the life of the mesh.

The mesh is incorporated extremely rapidly into the tissues. It is not associated with negative complications such as red breast syndrome or seromas as seem with

ADMs and is an extremely useful adjunct in difficult secondary cases for implant malposition and synmastia.

5 The Implant—Changeable Elements

As mentioned above, there are many aspects of an implant that can be changed. A comprehensive understanding of how different elements of implant characteristics can be of benefit in difficult situations is essential in order to undertake complex revisional surgery.

5.1 Implant Volume—Down Size/Upsize

This is self-explanatory. Volume increase or decrease can be beneficial according to the situation in hand. In most cases the problem is that the implant is too big; this leads to secondary complications such as edge visibility, rippling, unnatural contours, malposition such as bottoming out, tissue thinning, ptosis and double bubble. In such cases downsizing is often part of the solution. This may be accompanied by secondary procedures such as mastopexy and/or fat transfer.

On occasion, underfilling can be a problem and therefore a moderate increase in size may be beneficial.

5.2 Implant Shape

It is very important to understand the difference between anatomic and round implants.

Anatomical implants can be changed in three dimensions independently of each other, the height, the width and the projection. Round implants can only be changed in two dimensions. This versatility can be extremely useful when dealing with complex asymmetries either as primary problems or as secondary complications.

The other key difference between the devices is the volume distribution and the maximum point of projection. The low projection point of the anatomical implant allows for an upward rotation of the NAC and filling of the lower pole of the breast in cases of tissue laxity such as iatrogenic waterfall deformities or pseudoptotic breasts.

Change from one shape to another can solve many issues of volume maldistribution especially where there is excessive upper pole volume. The latter often leads to downward pointing nipples because of the high projection point of the pre-existing round implants. A simple change in shape from round to anatomical can easily solve the matter.

Occasionally change from anatomical to round implant is indicated, especially for recurrent rotation or where the anatomy favours the round implant.

5.3 Implant Texture/Surface

The subject of implant texture is a highly pertinent one especially in this age of BIA-ALCL. Whilst an in-depth discussion about texture and ALCL is beyond the remit of this chapter, it is important to understand that to have no texture (only smooth) essentially means eliminating anatomical implants from use. The author does not believe this to be appropriate at this time given the rarity of the condition. As has been illustrated anatomical implants confer certain advantages that round implants are unable to match due to their shape difference. To date, apart from France, texture has not been banned in Europe and a large variety of surfaces are available for use, from smooth to micro/macro textures and polyurethane. The latter is particularly useful in secondary surgeries especially for anatomically shaped implants to prevent rotation. The Introduction of anatomical implants into previously dissected implant pockets which lack stability and are no longer tailor made to the newly selected implants lead to a high incidence of implant rotation. A change of plane can help to create a 'new' pocket, e.g. from subglandular to a subpectoral pocket, or from a subpectoral pocket to a neo-subpectoral pocket; however, pocket stability is difficult to control even in these situations. The Polyurethane surface, on the other hand, is highly adherent to the soft tissues of the breast making rotation a rare event. In addition, Polyurethane has a role to play in cases of recurrent capsular contracture because of its recognised low contracture rate.

For those concerned about BIA-ALCL, round smooth implants may be the preferred choice. In many situations these may be a very reasonable and appropriate choice where the anatomy is favourable. However, round smooth implants are associated with higher complication and re-operation rates. Both inferior and lateral malpositions are more common as is capsular contracture with the use of smooth surfaces which lack grip and positional stability—this too needs to be discussed with patients.

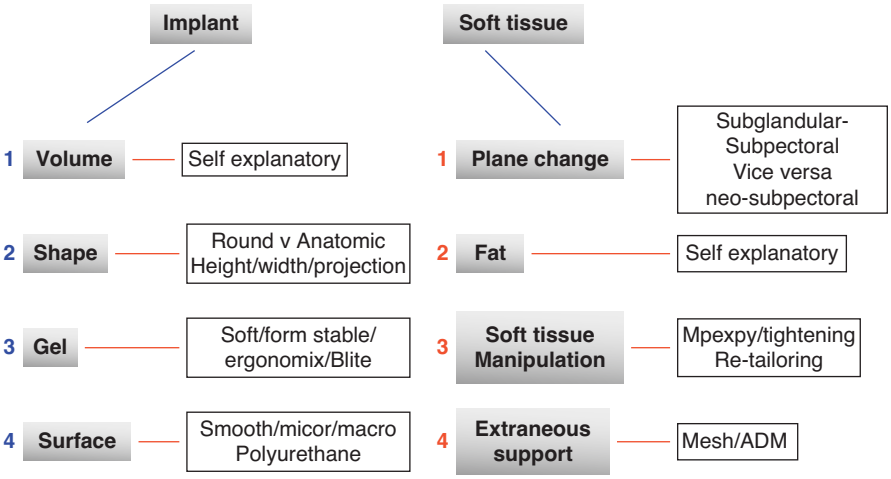
5.4 Implant Gel/Fill

There is a wide variety of gel fill available amongst different implants. The gel type and characteristics are properties that can be selected in order to confer certain advantages in order to solve particular situations. The advent of form stability as part of the fifth generation devices has led to devices containing more highly cross-linked silicone rendering them more robust and with the ability to maintain their shape better. The form stable or 'gummy bear' gel is also seen as safer in terms of rupture as there is much less fluidity to the gel on breaching of the shell. In general, round implants contain softer gels whilst anatomical implants contain stiffer gels. The latter is true because in order to maintain their shape, anatomical implants have to have a more form stable gel. It is also an important property of anatomical

implants—the ability to impart their form on the soft tissues of the breast. A softer gel is more easily compressed by the existing breast tissue whilst a stiffer gel has the opposite effect by imposing its shape on the breast. This form stability combined with the low projection point and volume distribution allows anatomical implants to expand lower poles—either lax or tight and to produce an upward shifting of the nipple-areola complex. The trade-off for the benefits of this increased form stability is a firmer touch.

The latest innovation on gel type is the advent of the B-lite implant; In these implants the silicone gel is bound to air filled borosilicate microspheres rendering the combination approximately 30% lighter than standard silicone gel. The weight reduction is highly appealing to many and especially in secondary cases where the soft tissues are often thin, lax, and lacking in skin thickness and elasticity. The idea of weight reduction in this group is highly desirable. B-lite implants are also the most form stable of all gel types—a property that can be of exploited in trying to solve rippling in thin patients devoid of fat where increased tissue cover is not possible.

The scheme summarises the algorithmic approach to problem solving.



We have devised an abbreviation system based on the above classification, where **I** stands for implant elements and **S** is for soft tissue elements—Each subcategory is allocated a number from 1–4. Therefore, in a case where there has been an exchange of implants from round, smooth to anatomical, textured of the same volume with a plane change from subglandular to subpectoral, the treatment strategy can be summarised as follows: **I (2,4) S (1)**.

The following are two case examples illustrating the use and principles of the IS system (Fig. 1/Case 1 and Fig. 2/Case 2).

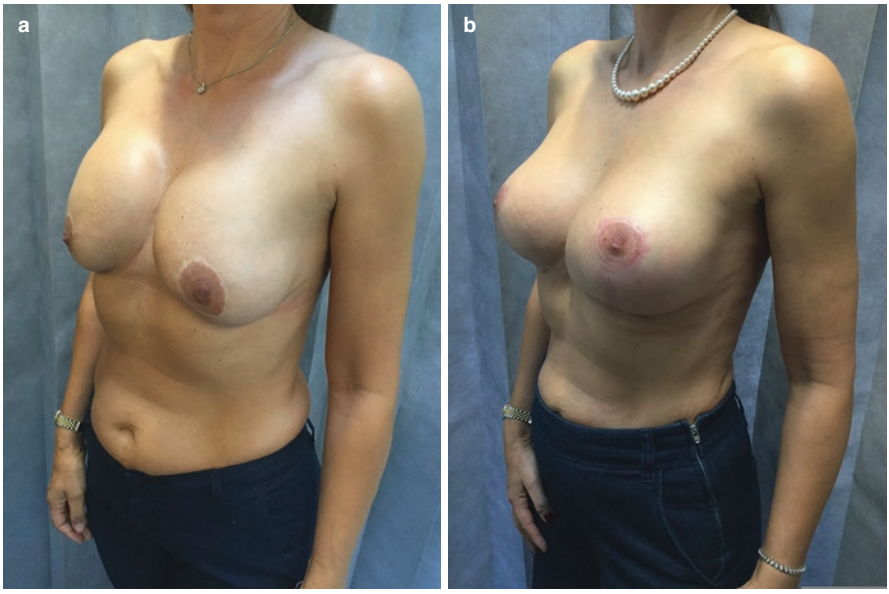


Fig. 1 (**a**, **b**) Case 1. (**a**) Pre-op. Previous augmentation mastopexy. round smooth implant 150 cc, submuscular unhappy with outcome. Poor volume distribution, too full in upper pole, under filled lower pole. (**b**) Post op. She underwent volume change, shape change, surface change and a redo mastopexy. Using the IS (Implant–Soft tissue) system. I (1) volume change—from 150 to 175 cc, (2) Shape change—from round to anatomical, (4) Surface change—from smooth to Polyurethane (prevent rotation). S (3) revision mastopexy only or to summarise I (1, 2, 4), S (3)

Fig. 2 (**a**–**d**) Case 2. Previous augmentation, very unhappy with result, visible, fake looking round textured implants 325 cc, subglandular, rippling, wide cleavage. The plan for surgery was to use a more cohesive gel implant to solve rippling, anatomical shape for a more natural look, polyurethane coated to avoid rotation, to change the plane from subglandular to subpectoral and add fat transfer to the. cleavage gap. The selected implant was an anatomical B-lite Polyurethane coated, from 325 to 345 cc. Post op changes in summary using the **IS system**. Implant changes: (1) volume change, (2) shape change, (3) gel change, (4) texture change. Soft tissue changes: (1) subglandular to submuscular, (2) fat transfer. Using the IS system it can be summarised as follows **I** (1, 2, 3, 4), **S** (1, 2)

6 Conclusion

Revisional aesthetic breast surgery can be extremely challenging and present with many difficulties. It requires systematic analysis of the problem identifying both soft tissue deficiencies and implant short comings. By compartmentalising the issues, what appear to be highly complex problems can be broken down into simpler ones. Ultimately changes to the soft tissues or the implant or, more commonly, both will help resolve many difficulties. Our simple classification system is a way of not only summarising surgical planning and execution, but also ensuring a systematic way of considering all areas of improvement both in terms of the implant and the soft tissues. It is a means of distilling a complex problem into identifiable and changeable elements.

We firmly believe that the best outcomes in breast augmentation can only be achieved through standardised pre-operative planning of the surgical procedure, a complete knowledge of the available devices, the application of an impeccable surgical technique, and appropriately scheduled follow-up.

The pre-operative planning should reflect a balance between the patient's tissue characteristics and the patient's wishes. The best advice to the patient is that the 'sensible' choice is generally the best one; it respects anatomy and soft tissue boundaries enhancing rather than distorting the breast. Inevitably the best time to get things right is the first time, surgery thereafter only becomes more complicated.

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