94 Breast Reconstruction Following Prophylactic Mastectomy for Smaller Breasts: – The Superiorly Based Pectoralis Fascial Flap with the Becker 35 Expandable Implant

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94.1 Introduction

Immediate reconstruction using tissue expander/implants following prophylactic mastectomy for smaller breasts is a reliable means of providing similar size, shape and symmetrical reconstructions. The superiorly based pectoralis fascial flap allows an immediate reconstruction of the inferior pole and may reduce/eliminate the need for tissue expansion.

Uptake of patients for prophylactic mastectomy ± reconstruction is determined by strict criteria in accordance with national guidelines. Several studies have shown that bilateral and contralateral risk-reducing mastectomy for women with a high genetic risk of developing breast cancer gives a significant survival advantage [1–9] and is cost effective compared to surveillance [10]. However, it is a significant decision which can have implications on body image and psychological welfare [11]. Therefore all women considering it must be presented with all data and available options and be managed by a multidisciplinary team which includes oncoplastic/reconstructive surgeons, genetic specialists and breast care nurses. An assessment of reconstructive options enables the patient and surgeon to discuss the various options available including tissue expander/implant based reconstruction, local flaps +/– tissue expander implants and free flaps. A further discussion with a breast care nurse allows patients to understand the normal pre and postoperative care and recovery following the various reconstructive options. For patients with minimal breast tissue an autologous reconstruction is often not possible and an implant is invariably required. An option for these patients is the superiorly based pectoralis fascial flap which allows immediate reconstruction of the inferior pole following prophylactic mastectomy and is a reliable method of providing similar size, shape and symmetrical reconstructions. Other autologous methods of reconstructions using local autologous tissue and non-autologous tissue have also been described including lipomodelling [3], subpectoral fascia [12], and serratus anterior fascia [13].

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M.A. Shiffman (ed.), *Breast Reconstruction: Art, Science, and New Clinical Techniques*,
DOI 10.1007/978-3-319-18726-6_94

94.2 The Importance of the Lower Pole in Breast Aesthetics

Reconstruction of the lower pole of the breast ensures that the reconstructed breast has a more natural shape and look whereas use of implants purely in the submuscular plane, as was previously the practice, led to high-riding, flat, unnatural breast mounds which did not adequately represent the natural ptosis and position of the inframmamary fold of a breast [14]. Because of this practice has changed to ensure that the lower pole is adequately expanded and many techniques have been used to ensure the lower pole is supported. Furthermore the appearance of breast implants has changed from round to teardrop to ensure the lower pole contour is maintained.

94.3 Lower Pole Reconstruction

In patients with small breasts with minimal breast tissue autologous reconstruction is often not an option and implant based reconstruction can provide excellent results. Traditionally implant/tissue expansion reconstruction was performed in a submuscular pocket but with this approach expansion of the lower pole is not possible during the initial mastectomy as the pocket is limited in terms of size inferiorly. Also repeated expansions may be required which may lead to irregularities as the expansion of the pocket cannot be directly visualized. Often expansion occurs in the areas of least resistance which is often medially or laterally and not uniformly over the lower pole leading to higher risk of implant migration, malpositioning of the inframammary fold and contour irregularities [3, 15–19].

Because of this, practice has shifted and many surgeons now focus on reconstruction which provides a natural appearance of the lower pole with the possibility of one stage reconstructive and little/no need for tissue expansion. The benefits of single stage reconstruction are the reduced need for tissue expander which can increase the rate of skin contracture, flap necrosis and implant loss [20, 21] while maintaining the position, stability and shape of the lower pole. There are several options available to surgeons to allow one stage reconstruction of the lower pole with the superiorly based pectoralis fascial flap one of these.

94.4 Preservation of the Nipple-Areola Complex

Preservation of the nipple areola complex (NAC), although technically possible for all patients with minimal breast tissue and minimal ptosis, is a significant decision to be made and involves careful explanation of the potential oncological risk of preservation versus the improved aesthetic and psychological outcome and is an informed decision made by the patient. Many studies have shown that preservation of the NAC increases patient satisfaction with their breast reconstruction and improves patient's psychological well-being and feelings of sexuality [22–25] with many patients feeling less mutilated and more able to face the illness [26]. Furthermore, nipple preservation often provides superior results compared to nipple reconstruction which can lead to inadequate results with patients reporting concerns over poor projection, poor color match and issues with shape, size, location and feel [27] as well as the additional cost of a further procedure.

However, there have always been oncological concerns regarding preservation of the NAC, even in prophylactic cases. Involvement of the NAC by breast cancer is most strongly predicted by multifocal tumors [28], large tumors [29], proximity of tumor to NAC [30], axillary node involvement [31] and nuclear grading [32]. However studies analyzing prophylactic cases have reported very low rates of recurrence (0.16–1.2 %), with the vast majority of recurrences occurring elsewhere in the breast and not in the NAC [33–35].

A major concern when preserving the NAC is the balance between ensuring all breast tissue deep to the nipple is removed whilst maintaining enough tissue to ensure adequate blood supply to the nipple. It is well known that recurrence risk is increased the more breast tissue that is left behind [36]. However, extensive retro-areolar dissection

affects the blood supply leading to increased risk of NAC necrosis [26, 37]. Histologically it is known that breast cancers originate from terminal duct lobular units (TDLUs) [38, 39] and therefore their complete removal is essential in reducing recurrence risk. Love and Barsky 2004 [40] reported that ducts begin approximately 7 mm deep to the nipple skin surface with no ducts reported in the nipple tip [41] and studies have shown that leaving a thin rim of tissue of approximately 2 mm around the nipple will remove 96 % of ducts while retaining blood supply enough to prevent NAC ischemia [41–43]. Therefore by ensuring uniform removal of all breast tissue at the base of the nipple the oncological safety of preserving the NAC can be justified if the decision to preserve it is made by the patient.

94.5 Incision Type

The decision to preserve the NAC directly influences the choice of incision in this procedure. The ideal incision allows ease of access for both mastectomy and reconstruction whilst giving a favorable aesthetic outcome. If the NAC is preserved then for the superiorly based pectoralis fascial flap in small breasts the options include inframammary fold (IMF) incision only, IMF incision with axillary incision for extra access to the axillary tail, periareolar incision only, periareolar incision with lateral or vertical extension.

If the NAC is preserved the inframammary incision provides excellent access for the superiorly based pectoralis fascial flap but makes mastectomy access more difficult [44, 45]. In patients with a short sternal notch to nipple distance of 20 cm or less mastectomy access is not compromised by this method and is the preferred access [33, 46]. Several studies have reported excellent cosmetic results with this incision [41, 46, 47] and have shown that it is ideally suited to implant reconstruction in small non-ptotic breasts [48, 49]. The IMF incision has low complications rates due to preservation of collateral blood supply to the skin flap [46, 50–53], although larger incisions may compromise inframammary blood supply illustrating its suitability to smaller breasts where smaller incisions are required [42, 54–56]. If the chest is long an additional small axillary incision can be used if there is difficulty accessing the axillary tail. If there is a larger NAC and small/moderate volume breast tissue where lift of the areola is required the periareolar incision is preferred with no extension, this has been shown to provide excellent access and cosmetic result [46, 50, 57]. If there is small NAC and lift is required a combination of IMF and periareolar incisions is preferred, this is because of the higher reported risk of NAC necrosis with the periareolar incision alone [46, 57–59] especially in smaller areolar when used from 6 to 12 o'clock [34] or when including greater than 30 % of the areolar circumference [60]. A lateral extension is avoided when NAC is preserved as the scar is always visible and can cause distortion of the nipple which can reduce patient satisfaction [22, 42, 47] and a vertical extension is avoided due to difficulties expanding the lower pole.

If the NAC is removed the incision is placed according to the size and shape of the NAC with the aim being to provide the smallest scar and remove the least amount of skin possible. This is often with a horizontal or oblique incision, both of which provide good access for harvest of the superiorly based pectoralis fascial flap. It is important to try to keep the scar within the limits of the original areolar diameter to improve cosmetic results [61]. If the NAC is removed and there is ptosis then a Wise incision may be a better option although this incision may also increase the risk of skin flap necrosis although this may not negatively influence patient perceptions of reconstructive outcome [62].

In patients with severe ptosis the superiorly based pectoralis fascial flap may not be the best option and those opting for a prosthetic reconstruction may be best suited to an inferior dermal flap which can allow one stage autologous reconstruction in larger breasts [63, 64]. Several authors have shown that this type of flap can provide excellent cosmetic results with well vascularized tissue coverage [65] in the traditionally high risk breast reconstruction patients with high BMI and larger, severely ptotic breasts [64, 66–69].

94.6 Patient Selection

The superiorly based pectoralis fascial flap is best performed in well-defined patient groups depending if the NAC is preserved or not. It is best preserved for smaller breasts but can be combined with other techniques in larger breasts.

94.6.1 In the Smaller Breast for NAC Preservation

Where an IMF incision can be used for a mastectomy in cases with no ptosis access for the flap is simple and this is possibly the best indication for the flap and provides the best outcomes (Fig. 94.1). Where an IMF incision alone cannot be used a periareolar incision with an IMF incision is a good alternative. A lateral incision may also be considered but leads to a visible scar on the breast and is often not necessary. A periareolar scar is particularly good in cases where there is need for a moderate lift in the NAC at the same time. The distance from nipple to IMF should be determined by the size of the implants and the arc length of the implants. In cases where there is minimal volume and significant ptosis other methods of reconstruction may provide better outcomes [3].

94.6.2 In the Smaller Breast Without NAC Preservation

In this scenario the mastectomy and flap can often be accessed through the NAC. An ellipse is placed in a position to minimize skin excision (Fig. 94.2). An IMF incision can be placed to aid

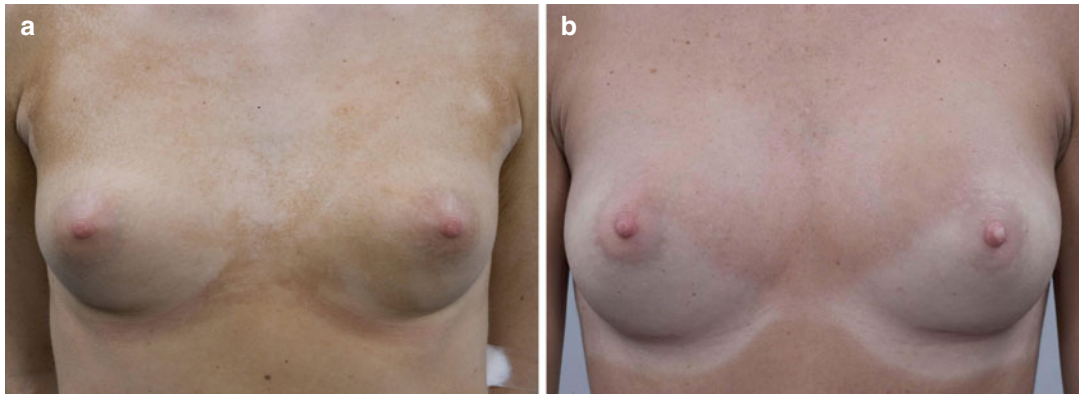

Fig. 94.1 (**a**) Preoperative patient with smaller breast without ptosis. (**b**) Postoperative after inframammary incision for mastectomy with superiorly based pectoralis fascia flap and NAC preservation

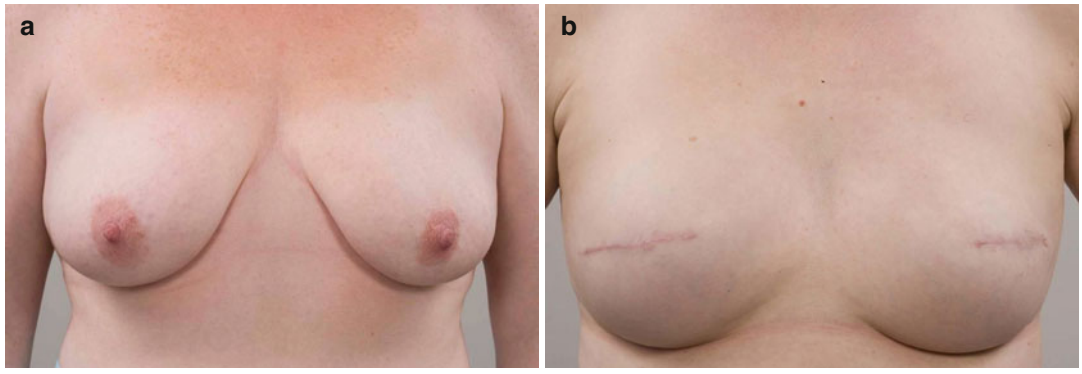

Fig. 94.2 (**a**) Preoperative patient with smaller breasts. (**b**) Postoperative following superiorly based pectoralis fascial flap and without NAC preservation

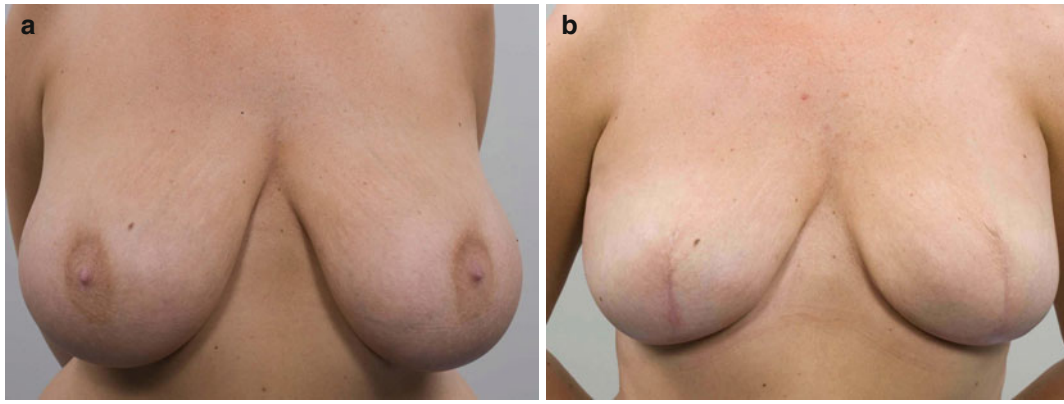

Fig. 94.3 (**a**) Preoperative patient with larger breasts and ptosis. (**b**) Postoperative after inferior dermal flap and implant

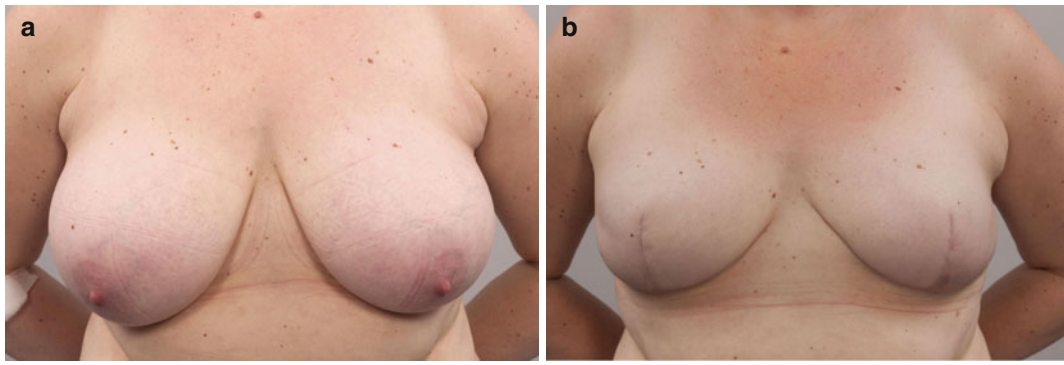

Fig. 94.4 (**a**) Preoperative patient with ptosis. (**b**) Postoperative following the superior based abdominus fascial flap and inferior dermal flap as well as Becker 35 expander implants

in the elevation of the skin flap and give some extra skin recruitment from the anterior chest. The distance at which the IMF incision is placed below the NAC scar needs to be based on the size of the implant and arc length of the implant so that the IMF incision is not visible anteriorly.

94.6.3 In the Larger Breast with Ptosis

In the larger breast with ptosis often the inferior dermal flap is a better means of reconstruction (Fig. 94.3). If the maximum width of this flap is >10 cm then the inferior dermal flap alone is usually sufficient to cover the implant. In cases where this width is less than 10 cm the superiorly based pectoralis fascial flap in combination with the inferior dermal flap is an excellent one stage option. In this scenario implants or Becker 35 expander implants can be used (Fig. 94.4).

94.7 Operative Technique

The breast is infiltrated with 20 mL of Marcaine with Adrenaline and 1 l of normal saline. Following access through the incisions as discussed above the mastectomies are performed in the plane between subcutaneous fat and breast tissue. Where the nipple areola complex is to be preserved the plane at the nipple areola location is not as easily delineated and it is important to make sure that a uniform thickness is maintained. This is easier to perform through a periareolar incision than an inframammary incision. In the

Fig. 94.5 Undermining of the abdominal tissue

latter it is important when performing the mastectomy superior to the nipple areolar complex to maintain uniformity of thickness. During the mastectomy it is imperative that the pectoralis fascia is left intact in its entirety.

Once the mastectomy has been performed dissection continues from superior to inferior through the inframammary fold towards the umbilicus (Fig. 94.5). This dissection is above the rectus abdominis fascia and requires a wide undermining of the upper abdomen. The dissection continues as far as possible inferiorly and should easily provide at least 15 cm of fascial flap (Fig. 94.6). Under lighted retraction the rectus abdominal fascial is incised (Fig. 94.7) and then raised from inferior to superior (Fig. 94.8). This dissection proceeds with ease until the fusion of the rectus fascia, the serratus fascia and the pectoralis fascia. The fusion of these planes is variable and is most constant medially. One is able to raise the fusion of the rectus fascia and the pectoralis fascia in a deep plane without violating the superficial fascial tissue. The medial insertions of the rectus and pectoralis should be maintained at this point. Moving medially to laterally the serratus fascia is then raised in continuity with the rectus abdominis fascia from inferior to superior. The pectoralis muscle is then raised. It is important to leave the lateral portion of the flap attached to serratus anterior laterally and the flap should be raised up to the anterior axillary line. The serratus can be raised to the anterior axillary line and often this gives good definition of the lateral border. The width of the Becker 35 should

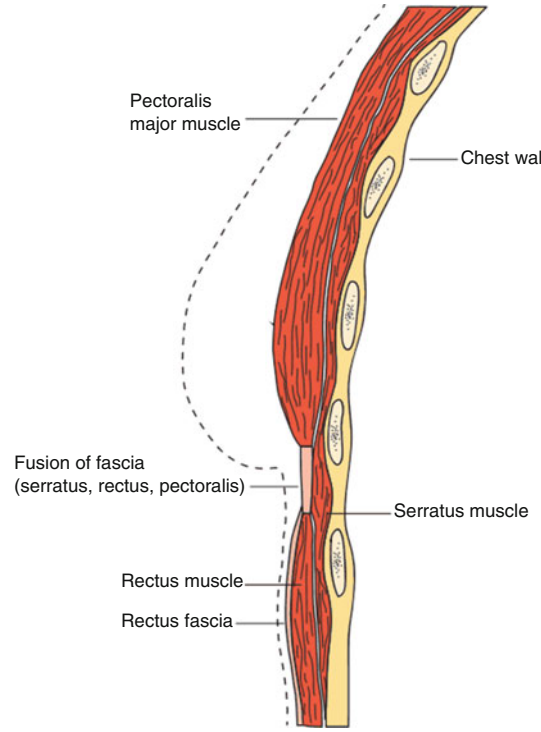

Fig. 94.6 Chest prior to raising the flap

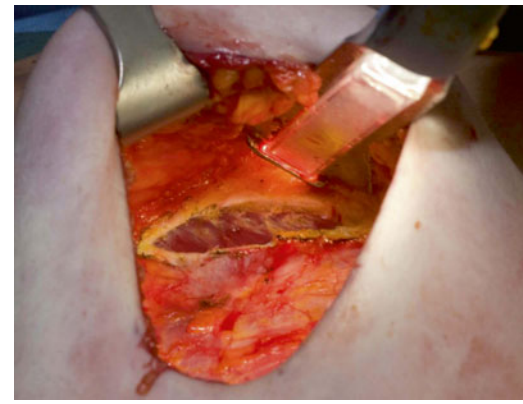

Fig. 94.7 Incision of the rectus abdominus fascia

correspond to the distance from this point to the dissection point medially which is defined by the insertions of the pectoralis muscle.

Following hemostasis the Becker 35 is inserted into the pocket unexpanded. Release of the pocket is then possible to allow the Becker 35 base width to sit flush on the chest wall. It may be necessary to release at this point either the medial

attachments of the pectoralis/fascial flap and/or the lateral serratus fascia (Fig. 94.9). The pocket of the implant comprises upper pole cover by pectoralis major with and inferior pole cover by the fascia. The unexpanded Becker 35 is positioned correctly and the port attached. The tunnel for the Becker has already been made but needs to be secured onto the upper abdominal wall. Once the Becker has been secured in position the superiorly based pectoralis fascial flap is draped over the Becker and secured onto the inframammary fold. At the start we used permanent sutures but more recently have used dissolvable 3.0 Monocryl and have not seen any long term bottoming out of the implants. These sutures need to be placed at the new fold and be attached to periosteum. The Becker is then inflated to the recommended saline volume and the expansion of the pectoralis fascial flap is clearly visualized. The Becker is usually expanded to 100 % volume of breast tissue removed unless the skin is tight or

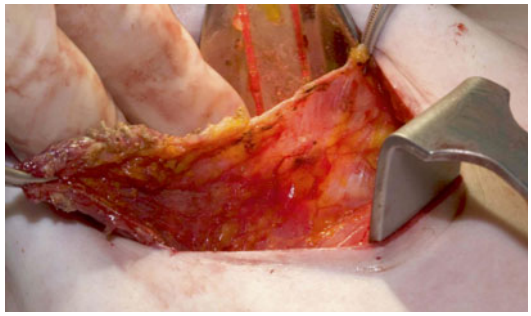

Fig. 94.8 Raising of the superior based abdominus fascia flap from inferiorly

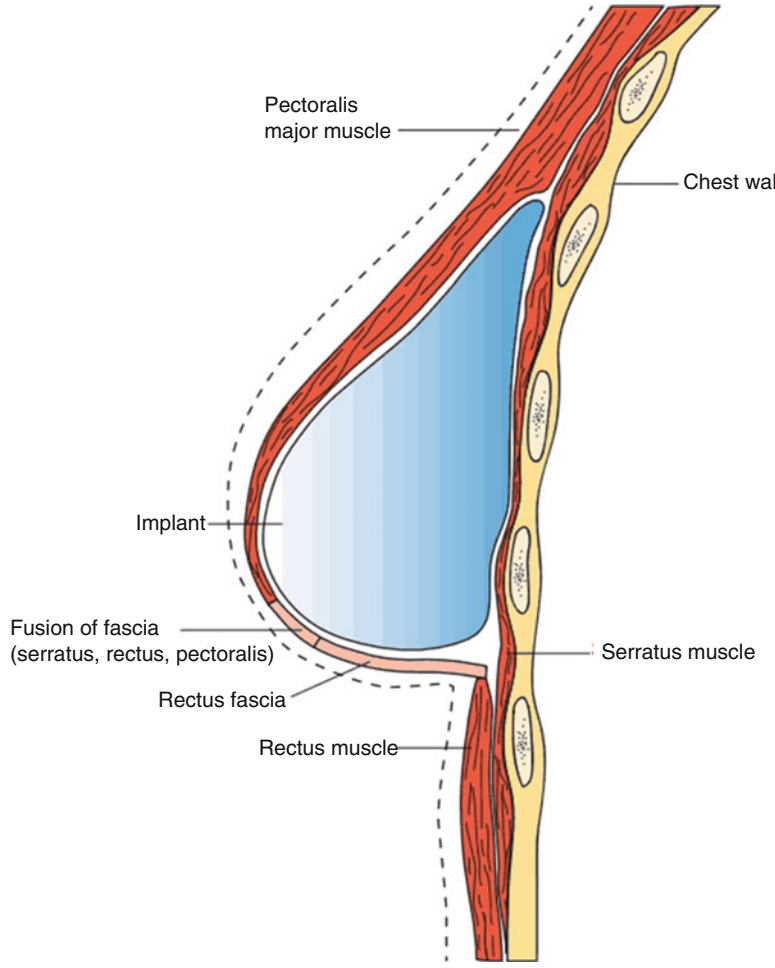

Fig. 94.9 Positioning of the implant under superiorly based pectoralis fascia

the NAC removed in which case there has to be compromise on size or amount inflated, if there are any problems with the inflation then the Becker can be deflated on the ward postoperatively. Following initial expansion it is easy to see any irregularities in the expander/implant and further release or repositioning of the superiorly based pectoralis fascial flap may be required. A 12G drain is then inserted in the breast pocket and another 12G drain inserted above the superiorly based abdominal fascial flap below the skin. In smaller mastectomies we have performed the technique without drains and also with only one drain in the mastectomy pocket. The skin is closed with 3.0 and 4.0 Monocryl. Patients should mobilize as soon as possible postoperatively and time in hospital should be on average 2–3 days. With adequate postoperative care, nursing and physiotherapy support hospital stay could be further reduced.

94.8 The Becker 35

The Becker 35 is a combination teardrop shaped expander and implant launched in 2004 to combat previously reported problems with the current expanders available on the market at the time. Problems with the rounded expanders available included unnatural shape, excessive expansion of upper pole and poor expansion of the lower poles leading to an unsatisfactory anatomical shape. Problems with the available anatomically shaped expanders, such as the McGhan style 150, were that it was made of firm material, it did not allow over-expansion and injection ports were liable to torsion [70]. The Becker 35 is a bi-lumen teardrop shaped expander/implant where the outer compartment is made of soft silicone gel and its shape is designed to provide the appearance of natural breast contour. A major advantage of the Becker 35 is the ability to expand the lower pole to give a natural and aesthetically pleasing expansion. Another advantage is that they allow over-expansion and subsequent deflation postoperatively to ensure symmetry, ptosis and patient's desired aesthetics are achieved. Several studies have shown good aesthetic results with the use of Becker 35 [71, 72].

94.9 Tips and Techniques

The Superiorly based pectoralis fascial flap is most easy to raise in the abdominal portion of the dissection. The plane of dissection is defined better inferiorly. The raising of the skin of the abdomen may also be helpful when needing to recruit skin should the NAC be removed. In raising the flap upwards a mosquito held medially and laterally is helpful. The flap is more easily mobilized from medially to lateral and occasionally the fusion plane of the serratus and rectus provides the first resistance to progress laterally. It is important to prevent perforations in the flap and occasionally some of the serratus muscle at the point of fusion laterally may be present on the back of the flap. Once over the fusion plane the dissection under the serratus fascia becomes relatively straightforward. The strength of the abdominal fascia is stronger than the serratus fascia and when using retractors it is important to be aware that it is easy to perforate the serratus fascia. There is also a point on raising the rectus fascia from inferior where there is resistance at the fusion with the pectoralis fascia and the serratus more medially. Again occasionally it will be necessary to raise some serratus muscle on the back of the flap at this point. Once one has reached the pectoral muscle and the pectoralis fascia dissection is easy.

Where perforations occur in the flap it is important to repair these before inserting the Becker 35. Inflation of the Becker with perforations will lead to tears. Where there are excessive tears one must decide whether to place a patch of alloderm substitute such as XCM (Fig. 94.10).

The plication of the lower border of the flap onto the chest wall defines the new breast IMF. There is always a tendency to place this superiorly where there is more cover superiorly under the muscle. It is important to secure the Becker to stop migration. The new skin IMF should be placed lower than the bottom of the Becker and skin recruitment from the abdomen helps to bring more tissue onto the lower pole and reduce skin tension. It is important that the initial incision is placed lower than the original IMF. The arc length is a good indicator of the

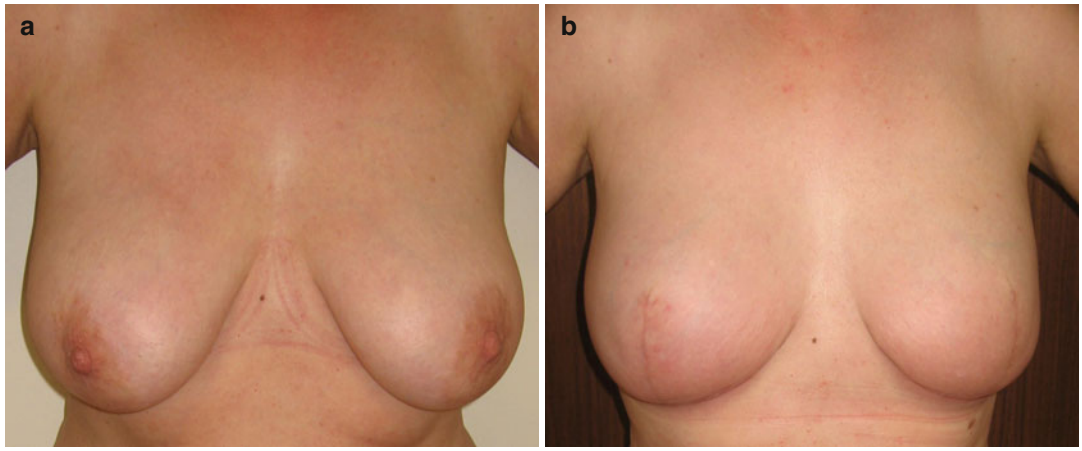

Fig. 94.10 (**a**) Preoperative patient. (**b**) Postoperative after use of superiorly based abdominis fascial flap and inferior dermal flap with small patch of XCM (an alloderm substitute)

minimal distance with a minimum of 2–3 cm of extra distance for skin recruitment added to the thickness of the skin. Where the NAC is removed this distance needs to be added in addition.

When combining the inferior dermal flap and the pectoralis fascial flap the inferior dermal flap is raised first though a Wise incision. Once raised one needs to make a decision as to whether the inferior dermal flap alone can accommodate the implant. If one has raised the inferior flap down to the IMF there will be a few centimeters of pectoralis fascia and serratus fascia that can be raised in the same way as above. Often this is sufficient to give extra coverage. Breaking through the IMF to raise rectus fascia can lead to a disruption of the blood supply to the inferior dermal flap and also makes redefinition of the IMF more difficult.

94.10 Discussion

Patients with minimal breast tissue are often not candidates for autologous only reconstruction and implant based reconstruction remains an excellent option. However with traditional tissue expansion in a submuscular pocket expansion of the lower pole is limited and can produce unsatisfactory results and therefore practice has shifted to reconstructive options which focus one stage reconstruction of the lower pole with minimal or no need for tissue expansion. There are many different options available to surgeons wishing to do this. Many authors have demonstrated excellent results with acellular dermal matrices (ADMs) of human, porcine or bovine origin in small to moderate sized breasts. These ADMs can provide excellent cosmetic results with low rates of capsular contracture and mechanical shift [20, 21, 73–80] and a potentially reduced revision rate [81]. A great benefit is the higher rate of initial fill volume compared to submuscular coverage which improves cosmetic outcome by allowing better utilization of the lower pole mastectomy flap producing a more natural shape and ensuring preservation of the inframammary fold [16, 74, 81–86]. However much of the data on improved aesthetic outcome and lower pole expansion is limited and often anecdotal and therefore accurate conclusions cannot be drawn [87].

There are concerns regarding the potential increase in complications, particularly risk of infection and seroma formation, in ADM use [16, 82–85, 88–93] with the NMBRA outcome finding complications with ADMs worse than that of the target standard set (NMBRA audit). However definitive data on complications is limited with several studies also finding no increase in complication rates [74, 77, 94] and some factors such as larger breasts or high BMI are major factors in complication risk [83, 92, 95]. Some authors have suggested that using porcine [75] or bovine [96] ADMs may reduce the risk of complications while also providing a cheaper option [88] but

not enough literature is available on the subject to make accurate conclusions. Complication risk increases when ADMs are used with partial muscle coverage meaning complete muscle coverage may be required to overcome this but with the additional risk of a high riding implant [95, 97]. A significant factor when considering use of ADMs and the potential increase in complication risk is that the development of complications following reconstruction significantly impacts the patients perceptions of cosmetic results [22, 57, 98]. Another aspect to consider with ADMs is the high cost of the product, with no studies proving definitive correlation between increased financial cost and improved outcome [87].

Another option other than ADM which can act as a sling to stabilize and define the lower pole and which utilizes an identical surgical technique is titanium mesh which is a lightweight material with excellent biocompatibility [99]. This has been shown to provide excellent cosmetic results whilst retaining the contour of the lower pole and the definition of the inframammary fold [100, 101]. It may also provide a cost benefit over ADMs with the product itself costing significantly less. However data is limited on its application particularly when used with tissue expanders.

Resorbable synthetic meshes can also be used in the same way and at a much lower cost than ADMs. They have the advantage of being strong and flexible whilst also allowing rapid revascularization [102] although their biocompatibility may be less than the titanium mesh [99]. Preliminary studies have shown excellent results [15] and further research is required to determine firm conclusions.

There are many types of ADM's and the authors have used XCM which is a sterile biologic tissue matrix derived from porcine dermis which allows revascularization and provide strength and adequate coverage to reconstruct the lower pole. Its use has been limited to the scenarios where autologous cover has been impossible technically. It is preferable to use the autologous method wherever possible.

Dermal autografts taken from either the abdomen or the contralateral breast following mastectomy can also be utilized as slings for lower pole coverage in single stage reconstructions in the same way as other options. They have been shown to have similar rates of complication and comparable cosmetic outcomes compared to ADMs [103]. The main advantages over ADM is cost and utilization of autologous tissue which avoids use of cadaveric and animal tissue which some patients are uncomfortable with and which should revascularize and be incorporated into the graft well [103–105]. However the primary disadvantage is the use of a donor site which leads to further scarring and potential complications.

Aside from cost the superiorly based pectoralis fascial flap remains an alternative to these options as it has the advantage of being autologous and vascularized without the need for donor site scars or additional implanted devices.

The choice of Becker expander is made to give flexibility . It is entirely feasible to place a permanent implant at the initial operation however it is not possible to fix the permanent implant in position and we have found that the implant has a tendency to migrate upwards in one stage reconstructions. Further advantages of the Becker are that it allows deflation of the expander portion should there be any issues with vascularity of the mastectomy skin flap postoperatively and it allows further expansion of one side preferentially to aid symmetry postoperatively.

Potential disadvantages of the superiorly based pectoralis fascial flap are the donor site harvest and potential for seroma formation. Our patients have not described any additional pain following this as compared to other reconstructions and the donor sites appear to heal well. Another potential disadvantage is that the inframammary fold has to be reconstituted. The fixing of the Becker we feel is now more important than the fixing of the skin and although we used permanent stitches initially for the recreation of the IMF we do not feel this as essential and dissolvable stitches do not seem to result in bottoming out. Although the authors were concerned about bottoming out they became more concerned about superior migration and the tension of these permanent stitches forcing the implants higher up the chest.

To date this procedure has only been performed in the prophylactic group of patients and only been performed bilaterally. It may be of use in unilateral reconstructions and for oncological cases and further studies are required to determine this. The chief determinant of whether it can be used in this scenario is the oncological decision of whether the pectoral fascia is removed.

Removal of the pectoralis fascia used to be standard mastectomy practice however several studies have shown no oncological benefit [105–109]. It is unclear how much protection to radiotherapy the superiorly based pectoralis fascial flap would give in this setting and the long term results. When used in this setting the reconstruction must be considered an immediate delayed reconstruction with the anticipation that an autologous reconstruction may be required at a later date with patients consented appropriately.

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