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Breast

Creation of a Central Under Flap Pocket Allows Secondary Implant Augmentation of Perforator Flap Breast Reconstruction

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Background: When a single perforator flap does not provide adequate volume or projection for satisfactory breast reconstruction, the addition of an implant may be considered at the time of second-stage revisions. Dissection of an implant pocket beneath the flap may lead to the inadvertent injury of the flap pedicle as the tissue planes have been obscured by tissue ingrowth. The authors present a technique in which the boundaries of the implant pocket are predetermined at the time of flap reconstruction allowing an implant to be inserted at the second stage in ideal position with greater ease of dissection and minimal risk to the flap pedicle.

Methods: Forty patients (80 bilateral perforator flap breast reconstructions) treated with the creation of central under flap pocket technique in anticipation of subsequent sub flap implant augmentation within an 18-month period were assessed retrospectively.

Results: Sixty-eight patients with flaps (85%) went on to receive secondary augmentation with silicone implants. The average percentage increase in volume contributed by the implant was 41%. The undersurface of the acellular dermal matrix was readily identified, and its medial most extent safely determined, allowing the expeditious recreation of the predelineated central under-flap implant pocket. No flap pedicles were injured during the process, and the implants were placed in a favorable position providing maximum projection to the reconstruction. No subsequent development of fat necrosis was identified after augmentation.

Conclusion: The creation of central under flap pocket technique allows for safe, effective, and expedient delayed implant augmentation of perforator flap breast reconstruction. *(Plast Reconstr Surg Glob Open 2018;6:e1734; doi: 10.1097/GOX.0000000000001734; Published online 20 March 2018.)*

INTRODUCTION

The deep inferior epigastric artery perforator (DIEP) flap is the preferred method of autogenous breast reconstruction as it provides an ideal replacement for the surgically absent breast tissue with minimal donor-site morbidity and often an improved abdominal contour.[1,2] Many women carry enough adiposity in their abdominal region to make them excellent candidates for DIEP flap reconstruction. Other women carry more adiposity in their upper buttock making them better candidates for superior gluteal artery perforator flap reconstruction.[3,4] In some cases, we find that patients have an insufficient single donor site for satisfactory reconstruction, particularly those undergoing bilateral reconstruction. When more complex techniques such as stacked flaps are not possible or appropriate, the addition of a breast implant can provide the necessary additional volume and projection.[5–9] We are faced with a dilemma when we are unsure based on physical examination if the patient will have enough donor tissue for successful reconstruction or if the donor site will be inadequate and additional volume and/or projection will be desired. Other women may be reluctant to pursue implant reconstruction, even as an adjunct to autogenous reconstruction particularly if they have had negative experiences such as capsular contracture or infection. Other times the added complexity of a composite or hybrid reconstruction (flap + implant) at

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first stage may not always be technically proper. If the existing breast pocket is modest or the amount of skin provided by the flap in a delayed reconstruction is limited, placement of the implant beneath the flap in the first stage may interfere with pedicle transition from the recipient vascular bed or otherwise risk compression with attendant risk of flap compromise.

A logical alternative would be the addition of the implant at the time of second stage revisions, placing the implant in a sub flap position, augmenting volume and projection. However, this is not without associated risks and challenges. The sub flap plane is not always readily evident, and when dissecting the implant pocket medially to obtain ideal implant placement, there is the associated risk of inadvertently entering the flap pedicle leading to bleeding and the potential for subsequent volume loss and fat necrosis.

The creation of central under flap pocket (C-CUP) technique involves the delineation of a central under flap pocket at the time of the initial reconstruction using a tailored piece of acellular dermal matrix (ADM). This preparation allows the implant to be placed at second stage safely, accurately, and expediently. We review our technique and recent experience using this method to improve our surgical outcomes.

PATIENTS AND METHODS

We retrospectively reviewed the data of 40 patients who underwent bilateral perforator flap breast reconstructions and were treated with the C-CUP technique in anticipation of subsequent sub flap implant augmentation within an 18-month period. Variables including patient age, flap weights, mastectomy weights (in cases of immediate reconstruction), implant size, total reconstructive volume including fat grafting, and flap complications were assessed. Once a patient was deemed a candidate for autogenous reconstruction, the primary surgeon discussed the patient's desires with respect to postoperative volume and projection and estimated by physical examination the volume that would be provided by a single perforator flap alone. In most cases, the predicted flap volume was more than adequate, and the patients were reconstructed in a traditional manner with a single autogenous perforator flap to each breast pocket. Fat grafting was performed at the second stage when indicated. These cases were not included in this review. If the flap volume was estimated to be significantly inadequate, we discussed the risks and benefits of stacked flap reconstruction versus implant placement at the first stage with fat grafting at second stage when indicated. When the surgeon was unsure if the flap volume would be adequate and/or when the patient was not a good candidate for immediate implant augmentation but would consider the placement of an implant at second stage, the risk and benefits of the C-CUP technique were discussed. Those patients who were found to be good candidates and were amenable to the addition of the dermal matrix were consented and treated. The decision to place an implant at the time of second stage revisions was made between the patient and the primary surgeon based on the patient's satisfaction with their initial reconstructive outcome.

TECHNIQUE

A sheet of ADM was selected and trimmed to an appropriate size based on the length of the pedicle. It is important to ensure that the matrix is long enough to extend from the lateral edge of the internal mammary vessel assess site to beyond where the perforator(s) enter the substance of the flap. Because we remove a portion of the fourth or fifth rib cartilage to access the internal mammary vessels, we prefer to create a central projection on the medial aspect of the ADM that will be secured to the periosteum of the cartilaginous rib defect with interrupted vicryl sutures. This central projection is cut to the same width as the rib edge so it can cover the cut edge of the rib as it extends up to the chest wall creating a smooth arc from the vessel bed to the chest wall. This allows the vessels to lie comfortably on the matrix and make a gentle transition to the chest wall without risk of kinking. The remainder of the ADM was tacked down to the chest wall with vicryl suture, and the flap pedicle was carefully draped atop the matrix (Figs. 1, 2). At the time of the second stage, the ADM was easily identified and elevated off the chest wall from lateral to medial. During this dissection, the surgeon knows that the flap pedicle is cephalad to this dissection plane,

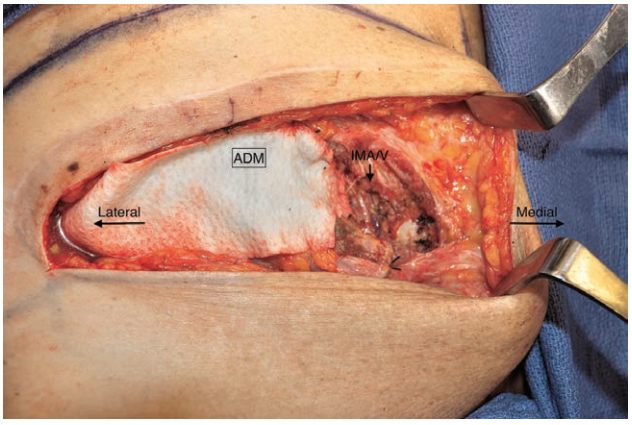

Fig. 1. The ADM is sutured to the periosteum just lateral to the internal mammary access site.

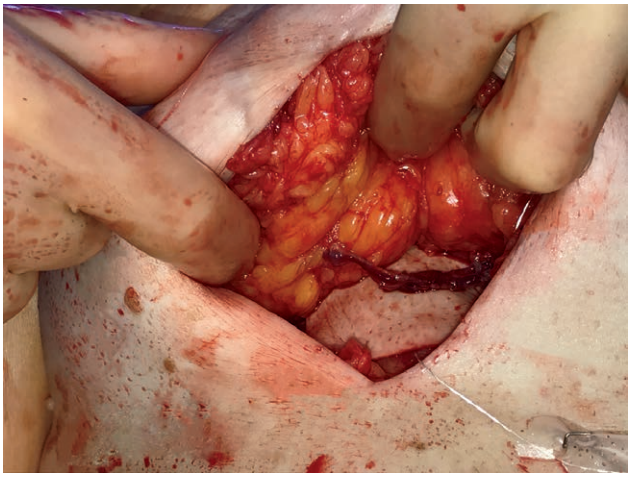

Fig. 2. The flap pedicle is carefully draped atop the ADM after the anastomoses are complete.

Table 1. Reconstruction Data

Reconstruction Data	Values (%)
Immediate reconstruction	56 (70)
Delayed reconstruction	24 (30)
Patient age	34–66
Flap weight (g)	180–710
Flap losses	0 (0)
Flaps with fat necrosis	4 (5)
Received secondary augmentation	68 (85)
Flap percentage total reconstructive volume	67 (53–83)
Implant percentage total reconstructive volume	28 (14–42)
Mean percentage increase by implant	28 (14–42)
Mastectomy weights* (g)	165–580
Flap to mastectomy volume ratio*	1.17: 1

*Immediate reconstructions.

thereby protected by the ADM. Once the point where the ADM is secured to the periosteum just lateral to the internal mammary vessels is reached, the operator knows that this is the medial extent of the pocket and the implant can be inserted knowing that it is in proper position.

RESULTS

Forty patients underwent 80 bilateral perforator flap breast reconstructions (Table 1). Fifty-six reconstructions were immediate (70%), whereas 24 were delayed (30%). DIEP flaps were used in 64 (80%) reconstructions, and superior gluteal artery perforator flaps were used in 16 (20%). Mastectomies were most commonly nipple- and skin-sparing mastectomies performed through vertical radial incisions. Mean patient age was 54 (range, 34–66 years). The internal mammary vessels served as recipients in all cases. Flap weights ranged from 180–710 g. In immediate reconstruction cases, mastectomy weights ranged from 165–580 g. There were no flap losses. Four flaps (5%) developed clinically significant fat necrosis requiring excision of the areas of concern. Sixty-eight patients with flaps (85%) went on to receive secondary augmentation with smooth round silicone implants ranging in size from 120 to 335 g. We calculated the total reconstructive volume as the volume of the flap + implant + grafted fat. The percentage of the total reconstructive volume contributed by the flap alone was on average 67% (range, 53–83%). The percentage of the total reconstructive volume contributed by the implant was 28% (range, 14–42%). In immediate reconstructions, the average flap volume to mastectomy volume ratio was 1.17: 1. The average percentage increase in volume contributed by the implant was 41%. The undersurface of the ADM was readily identified, and its medial most extent safely determined allowing the expeditious recreation of the predelineated central under-flap implant pocket. No flap pedicles were injured during the process, and the implants were placed in a favorable position providing maximum projection to the reconstruction. No subsequent development of fat necrosis was identified after augmentation.

DISCUSSION

Many women will have an adequate donor site for satisfactory breast reconstruction with a single perforator flap. For those women with a leaner build, stacked flaps may be considered; however, their application requires increased operating time and considerable technical expertise. This study focused on bilateral autogenous reconstructions because in unilateral cases where a single donor site is insufficient for reconstruction, we are more likely to recommend a stacked procedure rather than an implant + flap hybrid approach.

Augmentation of perforator flaps at the first and second stage has been well described. Roehl et al.[8] report on 69 patients who underwent 110 free flap breast reconstructions augmented with implants. Of these, 35 patients had immediate implant placement, and 34 had delayed placement. The immediate placement group had a higher rate of late implant-related complications including infection, malposition, capsular contracture, rippling, and rupture as well as a 63% implant revision rate compared with a 26% rate in the staged placement group. They suggest that it may be preferable to perform the augmentation at a later stage to avoid complications and dissatisfaction.

Walters et al.[9] report on 7 patients who underwent delayed implant augmentation of DIEP flap breast reconstruction. They placed the implants exclusively in the subpectoral plane and avoided pedicle injury by "sparing approximately 1 cm to avoid added pressure to the flap pedicle." They note that partial release of the pectoralis muscle was performed as needed as "placing the implant under the pectoralis muscle proved arduous in some cases."

Although many agree that placing small implants under flaps can greatly improve the reconstructed breast projection and contour, secondary flap compromise as a result of pedicle injury during delayed implant placement has been reported, and we have encountered that in our own experience as well. Figus et al.[7] comment that "following (radiotherapy), in cases of internal mammary recipient vessels, the effect of dividing flap pedicle may be risky for patient and for flap survival; hence, careful dissection is required in cases of delayed DIEP flap augmentation. In the aforementioned Roehl et al.[8] series, there were 51 delayed implant flap augmentations; 12 of which were in the prepectoral plane (24%). In this group, there was a partial flap loss attributed to inadvertent pedicle injury during delayed implant placement.

The lack of a control group in our study makes it difficult to determine the extent of the protection afforded by the ADM placement; however, the article is written to serve as a suggested method to maximize safety and efficiency for surgeons of various skill and experience levels when augmentation of a flap reconstruction is undertaken. We would not subject the patients to a control group assignment, given the documented levels of risk existing in the present peer-reviewed literature. It is important to note that in our series there were 68 delayed prepectoral implant placements without a single pedicle injury.

Other methods of pedicle protection may include accessing the internal mammary vessels at a higher level (2/3rd rib), thereby allowing the implant to be placed inferolaterally to the vessels, and submuscular implant placement. Although using a higher rib space would make secondary implant placement more straightforward, we

choose a lower rib to avoid the possibility of a visible indentation at the access site, given the difficulty of fixing defects in those areas. Also, in the event of a flap failure, we preserve the higher space for a secondary flap rather than going to an even higher and larger rib space that would most certainly create a visible defect.

As for submuscular implant placement, there are many situations in which delayed subpectoral implant placement is appropriate. We, however, prefer prepectoral placement because we are able to achieve total control of the implant position with the ADM and avoid the potential complications associated with subpectoral placement and muscular division including pain, functional limitation, and animation. Additionally, selection of the subpectoral plane does not guarantee the safety of the vascular pedicle. It is still possible to enter the mammary vessels/primary pedicle as the vessels pass from the access site to the chest wall through the split in the pectoralis muscle. Therefore, extensive medial dissection could allow vessel damage regardless of implant pocket selection. The desire to dissect "just a bit more" to obtain the ideal implant position is met with anxiety where tissue planes are obscured and the vessel position is unclear despite loupe magnification. The ADM secured to the chest wall just lateral to the recipient vessels provides a clear stopping point for dissection and maximizes medial implant position.

Creation of a "hybrid" construct, when appropriate, in the first stage carries the benefit of immediate full volume restoration and lesser operative time and recovery than may be associated with delayed implant placement. Although we have had considerable experience with immediate implant augmentation of perforator flaps with excellent outcomes, there are times when delayed implant augmentation is preferable. These include situations where the added complexity of immediate implant augmentation is unwarranted, and cases where the patient and the operator are unsure if an implant augmentation will be necessary or desirable. In these cases, the C-CUP technique paves the way to straightforward sub flap augmentation at the time of revision.

The cost of the matrix is an important consideration, particularly when considering that in our series 15% of patients did not go on to subsequent flap augmentation. However, this number could be decreased as candidate selection is improved. More experienced surgeons can estimate the volume and projection that will be supplied by the perforator flap and thoughtful discussions between operator and patient provide better understanding of the desired reconstructive outcomes. We would not advocate routinely placing ADM under flaps due to the expense. We suggest considering it when the benefit exceeds the cost concern as a measure of maximizing quality and safety. In the event of pedicle injury and subsequent fat necrosis or volume loss, potential corrective treatments including liposuction with fat grafting, implant exchange, and/or a secondary flap would prove significantly more costly than a sheet of matrix.

The C-CUP technique is a useful adjunct to perforator flap breast reconstruction when secondary implant augmentation is considered likely. The primary implant pocket creation allows for effective delayed implant augmentation with greater ease and more precise implant placement, all with minimal risk to the flap pedicle.

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