

BREAST AUGMENTATION WITH CONVENTIONAL FAT GRAFTING

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Conventional fat grafting to enlarge the breasts can be performed for cosmetic reasons, for correction of asymmetry, and for reconstruction of a deformity. The absence of an autoimmune response, the ease in accessing donor fat, and the minimal complications associated with fat transfer make autologous fat a virtually perfect material for augmenting breasts. Successful transplantation requires a delicate and less traumatic technique, from fat harvesting and refinement to the injection procedure and even postoperative care.

The first reported use of fat grafts to the breast dates from the end of the nineteenth century, when Czerny transplanted a lipoma to reconstruct a breast defect.^{1,2} But because of the significant fat necrosis that resulted, this technique was not revisited for many years. Bircoll³ initiated a brief revival of breast fat transplantation in the early 1980s following the maturation of liposuction techniques, but this effort was short-lived, because the techniques for fat refinement had not yet matured. Some clinical teams, including Li's team in China,^{4,5} began to research methods for refining harvested fat and other improvements in fat survival.

Centrifugation can be used to purify fat for transplantation. Li's team proposed that centrifugation at 1000 rpm for 2 minutes can provide not only high purity of fat but also more viable adipocytes within the fat grafts.⁴ The glucose transport test (GTET), established by our group, can be used to evaluate the viability of fat grafts before their in vivo transplantation.^{4,5}

With ever-increasing knowledge of the biologic behavior of adipose tissue, methods of fat transfer will continue to be refined, and this autologous material will undoubtedly continue to be used increasingly for reconstruction of breast soft tissue defects.

ANATOMY

Safe and effective fat grafting relies not only on a clear understanding of the blood supply, but also on detailed knowledge of the anatomy of the fascia and fat layers. The breast gland is contained within the superficial fascia. The superficial layer of the superficial fascia, which is the outer covering of the parenchyma, is

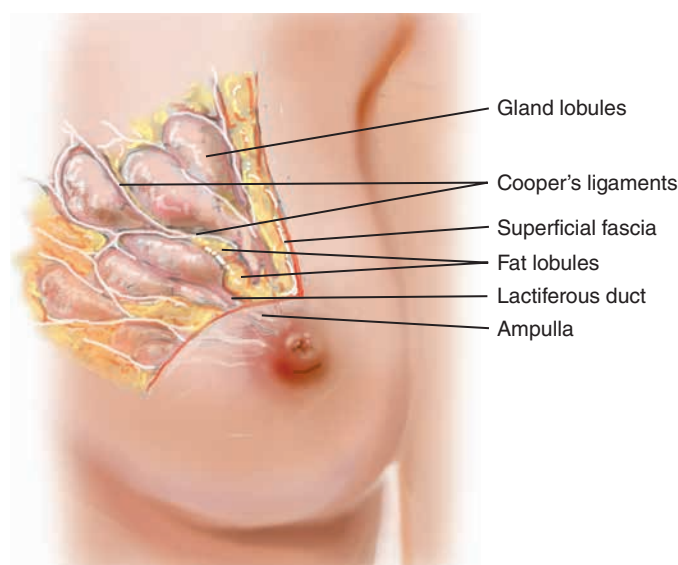


Fig. 54-1 Fasciae and ligaments act as septa within the fat tissue of the breast.

situated close to the dermis. The deep layer of the superficial fascia can be identified on the posterior deep surface of the breast. The superficial layer of the deep muscular fascia covers the pectoralis major, the upper portion of the rectus abdominis, the medial serratus anterior, and the external oblique muscle in the lower central breast. Cooper's ligaments run from the deep muscle fascia through the breast parenchyma, to the dermis of the overlying skin. Fasciae and ligaments act as septa within the fat tissue (Fig. 54-1). Fat grafts are transplanted around these septa.

INDICATIONS

Breast augmentation with conventional fat grafting is indicated under the following circumstances:

- Augmentation of the breasts in patients with micromastia, tuberous breasts, or Poland syndrome but the patient refuses an artificial implant
- Correction of contour deformities of the breast or asymmetry after removal of silicone implants, or a breast lumpectomy, or after reconstructive surgery
- Creation of a thick envelope of breast tissue after placement of a silicone implant

PREOPERATIVE ASSESSMENT

A thorough medical history is essential, including specific questioning about any family history of breast or ovarian cancer. A routine physical examination should be performed, with particular attention to breast masses. It is recommended that women over age 35 have a preoperative mammogram and that women under 35 undergo a breast ultrasound examination.

Patient education is vital during consultation, because fat grafts have a variable and unpredictable survival rate. Especially during the initial consultation, it is important to listen to the patient to determine her expectations for the outcome of the procedure. In addition, the surgeon must define the limits of possible surgical improvements. All potential complications should be discussed, particularly fat necrosis and cyst formation. The potential need for additional procedures to refine the result should also be mentioned.

SURGICAL TECHNIQUE

Fat Harvesting

The most common donor sites for fat harvest are the abdomen, the outer thigh, and the inner thigh. With the patient standing, the harvest sites are marked immediately before the operation. The procedure is performed with the patient under general anesthesia. A local anesthetic solution is injected, consisting of 0.9% saline 500 ml, 2% lidocaine 20 ml, epinephrine 1:1000 1 ml, and 3% sodium bicarbonate 5 ml. Liposuction may begin after 15 minutes, when the solution has taken effect and there is good bleeding control. A two-holed blunt-tipped harvesting cannula (3 mm in inner diameter) is connected to a vacuum pump (Fig. 54-2). The fat grafts are aspirated at low negative pressure (-0.5 atm).

The lipoaspirate is washed with 0.9% normal saline solution. Then the collection syringes are sealed and centrifuged at 1000 rpm (72 g) for 2 minutes.^{4,6} After centrifugation, the lipoaspirate will have separated into three layers: the upper layer is composed of oil from the destruction of fat fragments, the second layer is composed of adipose tissue, and the third layer mainly contains the anesthetic solution and blood cell debris. Only adipose tissue from the middle layer is used for fat grafting.

In most techniques currently used for fat grafting, centrifugation is performed to purify fat for transplantation. In Coleman's technique, centrifugation at 3000 rpm for 3 minutes is a standard way to process the harvested fat.⁷ However, our studies have demonstrated that adipocytes within fat grafts had less viability when the speed of centrifugation was more than 1000 rpm; the reduction of viability is directly related to the speed of centrifugation when the speed is higher than 1000 rpm.⁵ The same conclusion was reported by Piasecki et al,⁸ who used a trypan blue viability assay. Centrifugation at 1000 rpm for 2 minutes is therefore what we recommend. After centrifugation, when the oil fraction is above the fat and the bloody fraction is at the bottom, we use a 2 cc or 5 cc syringe to collect fat below the oil fraction.^{4,5}

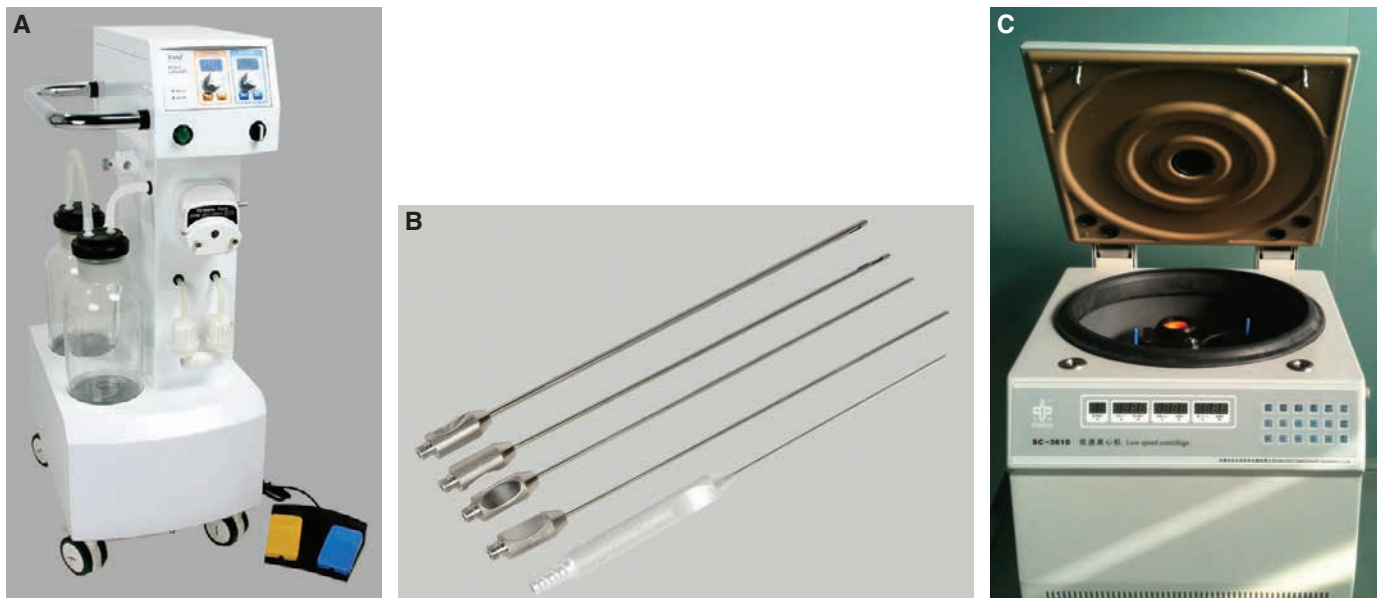


Fig. 54-2 A, Vacuum pump for harvesting fat. B, Blunt-tipped harvesting cannulas. C, Centrifuge.

Fat Graft Injection

The cannula for fat infiltration is a one-holed blunt-tipped cannula with a 3 mm diameter nozzle. It is connected to the 5 cc syringe for fat infiltration. Two small incisions are made in the breast (Fig. 54-3). Through a periareolar incision, the fat grafts are infiltrated into the subcutaneous tissue of the inner half of the breast. Through an inframammary incision, the fat grafts are infiltrated into the subglandular tissue and the subcutaneous tissue of the lateral half of the breast. As the syringe is withdrawn, the fat graft should be injected in small quantities in one place each time, radially from distal to proximal. Blunt-tipped cannulas allow greater dispersion of the grafted tissue in aliquots smaller than 2 mm³ and reduce the chance of intravascular injection. The volume of fat to be transferred to the patient should be overestimated to account for the approximate 30% fat reabsorption after injection. However, it is counterproductive to continue injection when injected fat is coming out from the incision, which could lead to the development of fat necrosis.

After fat grafting, the skin is sutured with nonabsorbable suture material; the site is then gently massaged to evenly distribute the injected tissue. In our experience, approximately 60 to 120 cc (101 cc average) of fat can be injected into the subcutaneous tissue of the breast, and 60 to 90 cc can be injected into the subglandular tissue of the breast.

If necessary, fat grafting can be repeated after at least 3 months. In patients with a significant breast contour deformity, two or three repeat procedures may be required.

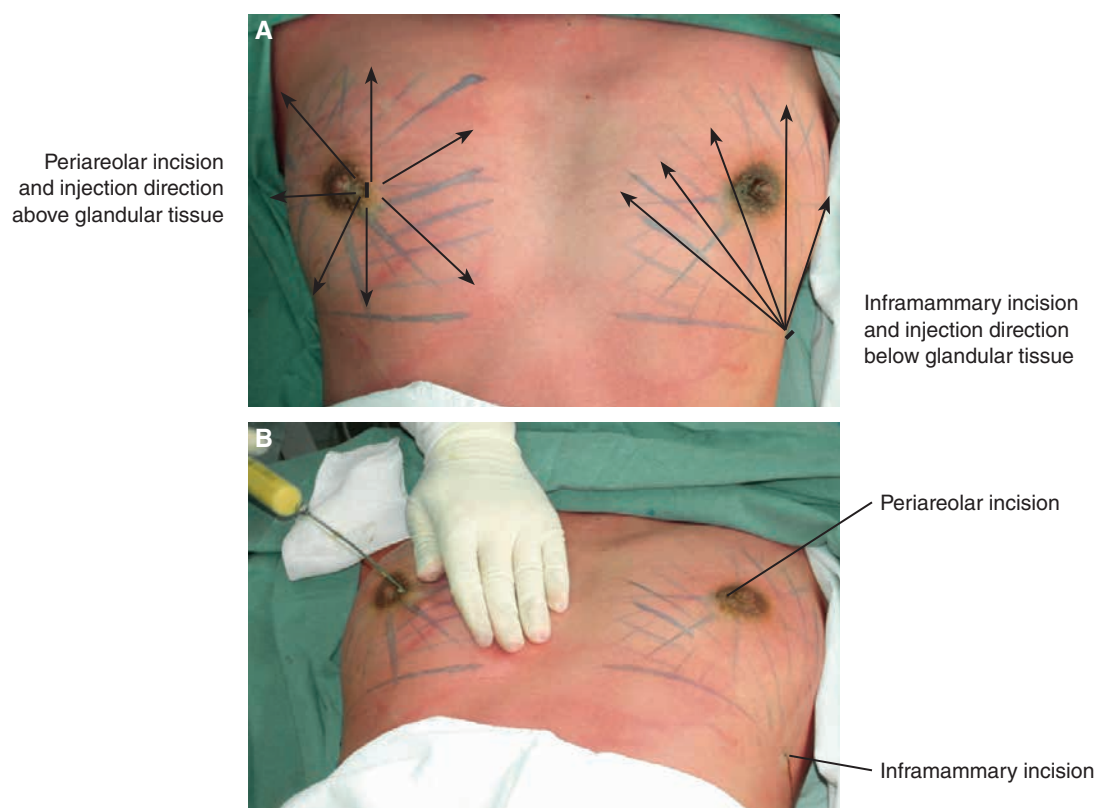


Fig. 54-3 Through a periareolar incision, the fat grafts are infiltrated into the subcutaneous tissue of the inner half of the breast. Through an inframammary incision, the fat grafts are infiltrated into the subglandular and subcutaneous tissue of the lateral half of the breast. **A**, Breast markings and arrows indicating direction in which fat injections are fanned outward. **B**, A periareolar incision and inframammary incision are made.

POSTOPERATIVE CARE

We recommend that the patient wear a supportive surgical bra day and night for 7 days after breast augmentation with fat grafting. In our experience, it is important that for these 7 days the breast should remain in a supported, fixed position with the bra to avoid local accumulation of grafted fat caused by the movement of the pectoralis major muscle. Oral antibiotics are administered for 3 days postoperatively. For donor site care of the abdomen or thigh, the patient should wear a compression garment for 1 month.

RESULTS



Fig. 54-4

This 24-year-old woman underwent one autologous fat grafting procedure for breast augmentation. The amount of fat transplanted was 180 cc in each breast. She is shown 13 months postoperatively. She was very pleased with the result.

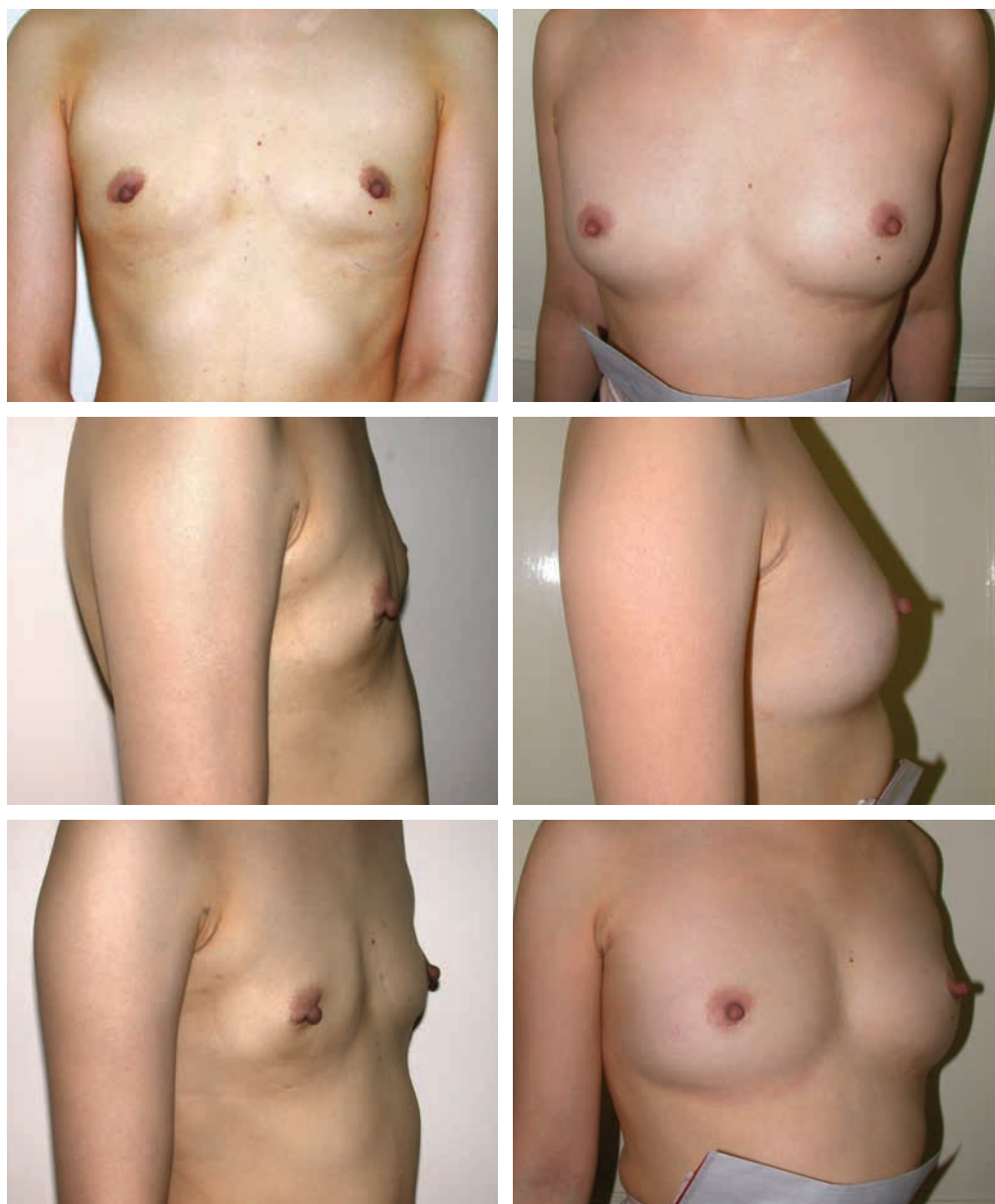


Fig. 54-5

This 27-year-old woman underwent autologous fat grafting twice to increase her breast volume after silicone implants were removed. She had had silicone gel breast implants placed twice; both times the implants had failed and required removal because of capsular contractures. For aesthetic enhancement, she requested augmentation with fat grafting. The amount of fat grafted was 202 cc in each breast for the first injection, and 170 cc for the left breast and 190 cc for the right breast in the second procedure. The results are shown 22 months after the second procedure. The patient was very pleased with the result.



Fig. 54-6

This 23-year-old woman underwent autologous fat grafting twice for breast augmentation. The amount of fat transplanted was 120 cc in each breast in the first procedure and 140 cc in each breast in the second procedure. She is shown 12 months after the second procedure. Her breast contour has been improved significantly. The patient was very pleased with the result.

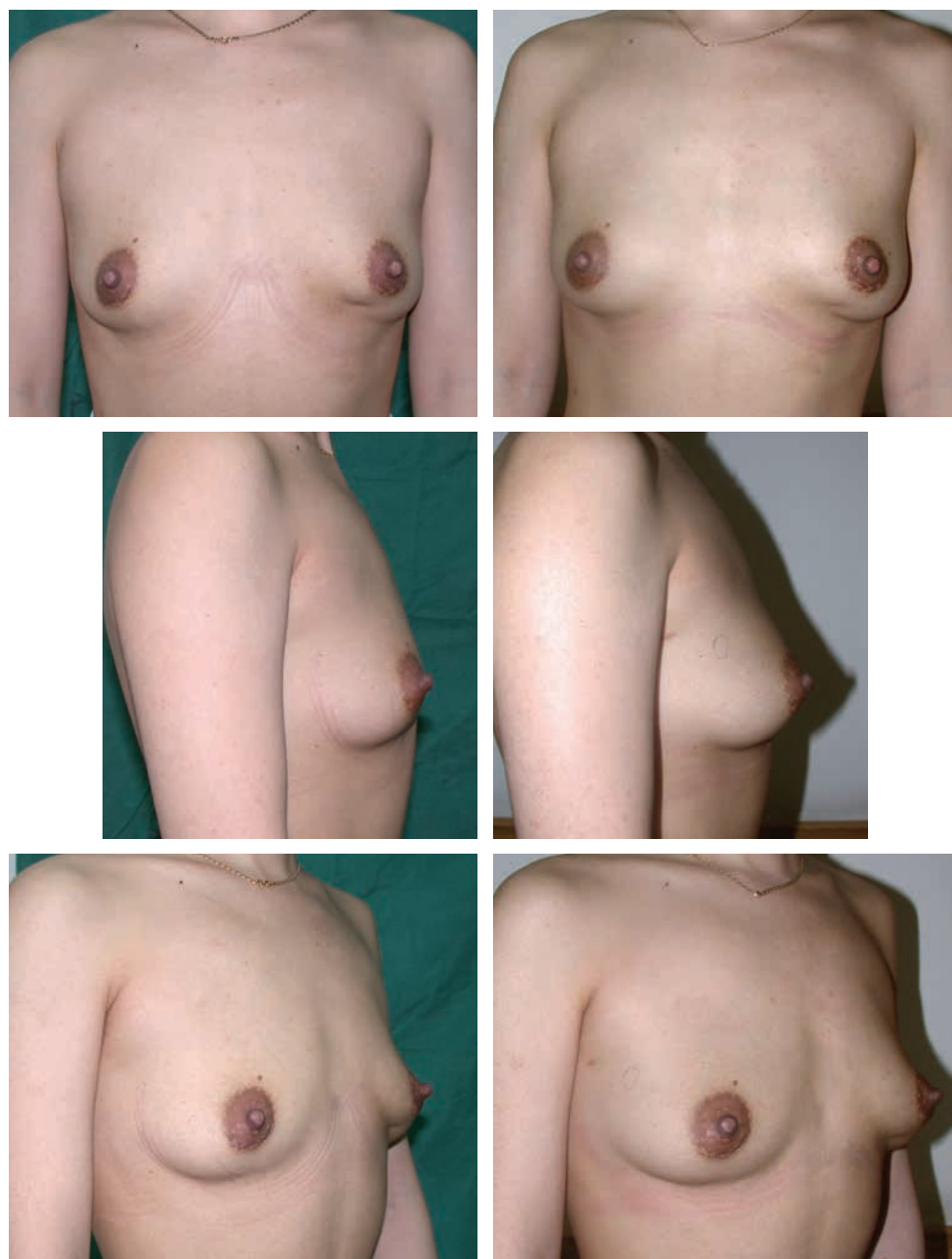


Fig. 54-7

This 31-year-old woman underwent one autologous fat grafting procedure to increase her breast volume after the removal of silicone implants. The implants had to be removed because of a bottoming-out complication. This removal created a deformity in the left breast. The total amount of fat transplanted was 202 cc in each breast. She is shown 12 months postoperatively. The patient was very pleased with the result.

DISCUSSION

Cyst Formation

A cyst, whether thin-walled or thick-walled, is a common histologic type of fat necrosis. Most liponecrotic cysts can be diagnosed accurately based on their characteristics: the timing of cyst formation, its layers, and benign calcifications as identified through mammography (Table 54-1).

Mammographic findings of a liponecrotic cyst appear as an entirely radiolucent round or ellipsoid mass surrounded by a thin or thick fibrous membrane, with or without calcifications. Usually these calcifications appear to have typical benign features.

The exact pathogenesis of a liponecrotic cyst after fat grafting to the breast is poorly understood. It is thought to be the result of an inflammatory response of the host tissue to the fat grafts that have degenerated from an inadequate blood supply. Most liponecrotic cysts are found in the subglandular layer of the breast. It is possible that fat necrosis is caused by injecting too much fat into one area or by the accumulation of injected fat in one area resulting from movement of the pectoralis major muscle.

Grafted fat should be placed in small aliquots with each pass to maximize the surface area of contact between the grafted fat and the recipient tissue. A large surface area of contact between the host tissues with their capillaries and newly grafted tissue promotes nutrition and reduces the number of liponecrotic cysts. We usually try to inject a very small volume (0.2 cc) of fat at each injection point. As previously mentioned, for approximately 7 days postoperatively, the breast should be maintained in a fixed position with a surgical bra to avoid the local accumulation of grafted fat resulting from the movement of the pectoralis major muscle.

Postoperative management of liponecrotic cysts in the breast can be done through needle aspiration or surgical extirpation. If breast sonography identifies a cyst that has occurred 1 month postoperatively, and its volume has remained constant in the follow-up period, this may indicate the formation of a cyst secondary to necrotic fat and warrants needle aspiration in the early postoperative period. Open extirpation of the cyst can also be a good option. During the operation the capsule of the cyst can be found and excised, including the calcifications within the capsule. Most calcifications are found within the cyst capsule through the evidence of mammography and histologic evaluation (Fig. 54-8).

Table 54-1 Comparison of Fat Necrosis and Breast Cancer

Characteristics	Fat Necrosis	Breast Cancer
Time of occurrence	Most necrotic cysts occur 1 to 3 months after surgery	Does not appear at a fixed time after fat grafting
Layer	Usually develops in the subcutaneous or subglandular plane, seldom in the glandular layer	Develops in the glandular layer, not the fatty layer
Mammography	Typical cysts have an entirely radiolucent inside with a thin or thick high-density fibrous membrane; calcifications identified as benign	Clusters of pleomorphic microcalcifications
Sonography	Are seen as lumps in the subcutaneous or subglandular plane, seldom in the glandular layer; cysts have a hypoechoic inside and equal-echo outside	Seen in the glandular layer

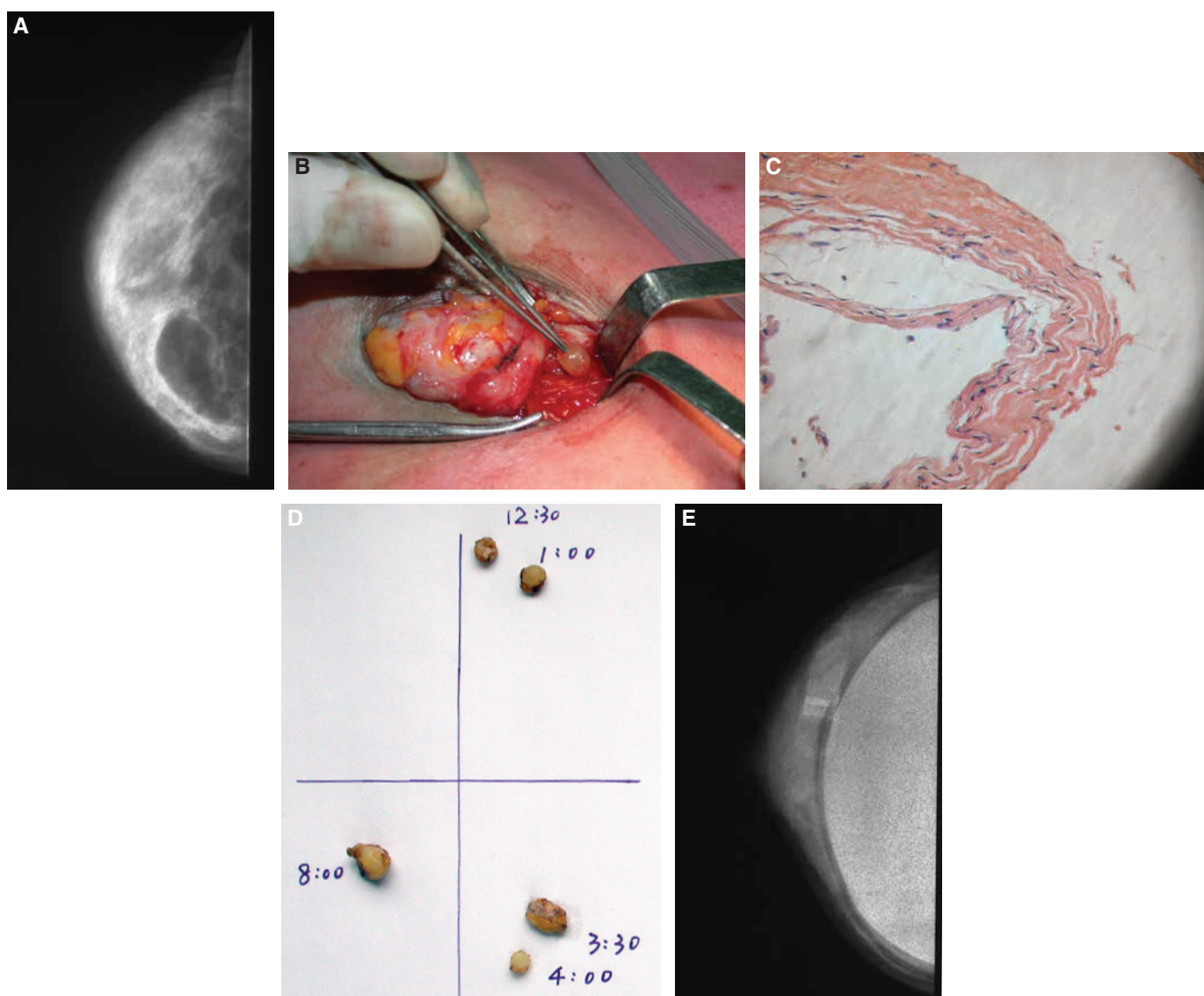


Fig. 54-8 A, In this patient, a mammogram 49 months after autologous fat transplantation showed multiple masses in the subglandular layer of her left breast. B, During surgical exploration, a cyst was found and removed completely. C, Histologic evaluation confirmed the clinical findings and showed a collagen capsule. D, All cysts were removed from the left breast (positions shown). E, A mammogram 1 year after removal of the cysts showed no further calcifications. (From Zheng DN, Li QF, Lei H, Zheng SW, Xie YZ, Xu QH, Yun X, Pu LL. Autologous fat grafting to the breast for cosmetic enhancement: experience in 66 patients with long-term follow up. *J Plast Reconstr Aesthet Surg* 61:792-798, 2008.)

Patient Dissatisfaction With Aesthetic Results

Autologous fat grafting to the breast is a useful procedure for cosmetic enhancement in many patients who desire such a procedure. However, no standardized rating scales are available to evaluate outcome. Sometimes, because of graft resorption or necrosis, the clinical results are not satisfactory to the patient. Other complications affecting the aesthetic result include the formation of calcified and noncalcified masses. Before the operation, the surgeon must explain clearly what the patient can expect from the procedure and must not create unrealistic expectations. The patient should be advised that additional procedures may be required to achieve the desired breast contour.

PEARLS FOR SUCCESS

- Consideration of high-risk patients and baseline mammography should guide patient selection for autologous fat augmentation.
- Sterile technique must be strictly followed.
- Fat must be harvested at low negative pressure.
- Fat grafts should be processed with low-speed centrifugation and injected into the recipient areas with low volume for each pass through multiple tunnels, multiple planes, and multiple points.
- After surgery, the patient should wear a supportive surgical bra 24 hours a day for 7 days to reduce the relative movements between the gland and the pectoralis major muscle as much as possible.

References

1. Czerny V. Plastic replacement of the breast with a lipoma. *Chir Kong Verhandl* 2:21, 1895.
2. Illouz YG. Body contouring by lipolysis: a 5-year experience with over 3000 cases. *Plast Reconstr Surg* 72:591-597, 1983.
3. Bircoll M. Cosmetic breast augmentation utilizing autologous fat and liposuction techniques. *Plast Reconstr Surg* 79:267, 1987.
4. Zheng DN, Li QF, Lei H, Zheng SW, Xie YZ, Xu QH, Yun X, Pu LL. Autologous fat grafting to the breast for cosmetic enhancement: experience in 66 patients with long-term follow up. *J Plast Reconstr Aesthet Surg* 61:792-798, 2008.
5. Xie Y, Zheng D, Li Q, et al. The effect of centrifugation on viability of fat grafts: an evaluation with the glucose transport test. *J Plast Reconstr Aesthet Surg* 63:482-487, 2010.
6. Xie Y, Zheng DN, Li QF, Gu B, Liu K, Shen GX, Pu LL. An integrated fat grafting technique for cosmetic facial contouring. *J Plast Reconstr Aesthet Surg* 63:270-276, 2010.
7. Coleman SR, Saboeiro AP. Fat grafting to the breast revisited: safety and efficacy. *Plast Reconstr Surg* 107:775-785, 2007.
8. Piasecki JH, Gutowski KA, Lahvis GP, et al. An experimental model for improving fat graft viability and purity. *Plast Reconstr Surg* 109:1571-1583, 2007.

