

An Algorithmic Approach to Upper Arm Contouring

Eric A. Appelt, M.D.
Jeffrey E. Janis, M.D.
Rod. J. Rohrich, M.D.

Dallas, Texas

Summary: There has been a renewed interest in upper arm contouring given the recent advances and subsequent patient interest in weight loss. Patients undergoing bariatric surgery are often left with a significant amount of redundant skin and laxity of their upper extremity. Some patients within this group have excess fat in their upper arms with relatively good skin tone, while others have a paucity of excess fat with a significant amount of redundant skin. The optimal treatment for each patient can vary. A clinical algorithm is presented that is designed to select the best method for upper arm contouring based on the aesthetic analysis of the upper arm. Case examples are provided demonstrating results that were obtained by following this algorithm. (*Plast. Reconstr. Surg.* 118: 237, 2006.)

There has been a renewed interest in upper arm contouring secondary to recent advances in bariatric surgery that have made it safer and more appealing to both the plastic surgeon and the morbidly obese individual. Brachioplasty was first described by Correa-Iturraspe and Fernandez¹ in the 1950s, but it was associated with frequent complications and suboptimal results.^{2,3} Since then, numerous surgeons have modified the original technique, with a subsequent improvement in outcomes. Specifically, the incidence of axillary scar contracture was decreased with the advent of the T- or L-shaped axillary resection patterns and W or Z incisions crossing the axilla.³⁻¹¹ Cosmetically, the optimal placement of the final scar was found to lie in the brachial sulcus, such that with the patient's arms at the side, the incision is virtually imperceptible.^{3,6,8-9} Only with the patient's arms abducted can the incision be seen, and even so, it is often hidden by the shadow in the sulcus. Less undermining decreased the incidence of seromas and lymphedema.²⁻⁴ Finally, the incidences of scar widening and recurrence of the deformity were decreased with techniques that anchored the fascia of the arm into the axilla (clavipectoral fascia).^{12,13} As a result of these modifications, brachioplasty has become a safer,

more effective operation. However, arm numbness (from transection of several cutaneous nerves of the arm) is still a common complaint among those undergoing this procedure, regardless of the specific technique used.

In addition to the resection techniques, liposuction has been used for upper extremity contouring since the 1980s. This method works well for select patients and has the advantage of leaving small scars that usually do not widen.^{14,15}

Selection of the proper operative technique, based on an anatomic and aesthetic analysis of the rapid weight loss patient, is paramount to achieving optimum results. This article describes an algorithmic approach (Fig. 1) for treatment of these patients, as well as case examples demonstrating typical outcomes.

PREOPERATIVE EVALUATION

The preoperative evaluation of the rapid weight loss patient who desires upper arm rejuvenation is the key to determining the best surgical approach. All patients need evaluation of both the amount of fat present and the amount of skin laxity present. By modifying the senior author's (R.J.R.) original classification system (Tables 1 and 2),¹⁶ these patients can be stratified to help determine which procedure is best suited to achieve optimal results.

Determination of excess fat can be made by the pinch test. Patients with greater than 1.5 cm of fat detectable with the pinch test could potentially benefit from liposuction.¹⁶ However, skin laxity must also be assessed to determine whether the patient is, indeed, a candidate for liposuction.

From the Department of Plastic Surgery, University of Texas Southwestern Medical Center.

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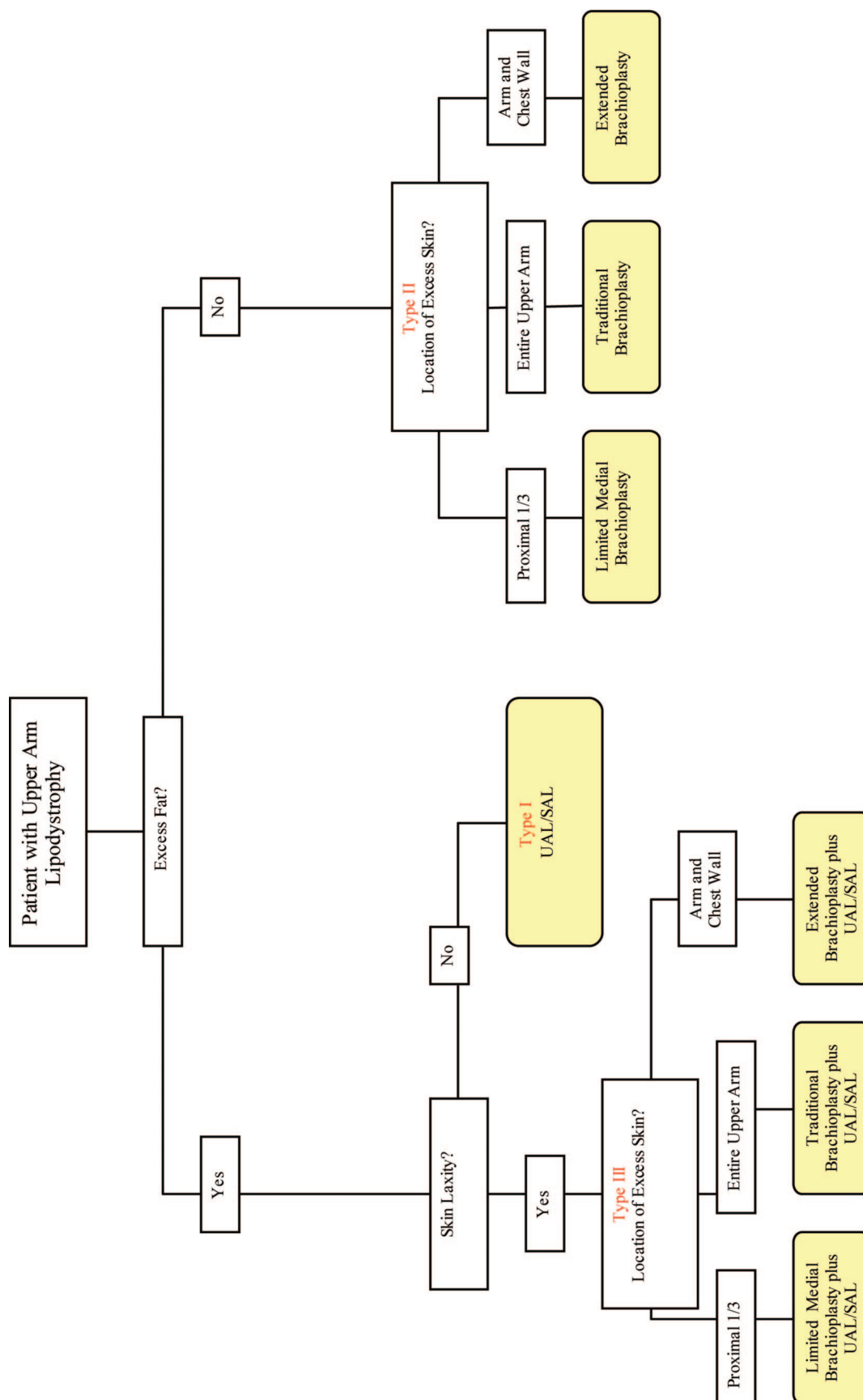


Fig. 1. Algorithm: patient with upper arm lipodystrophy. UAL, ultrasound-assisted liposuction; SAL, suction-assisted liposuction.

Table 1. Old Classification System*

Type	Skin Excess	Fat Excess
I	Minimal	Moderate
II	Moderate	Minimal
III	Moderate	Moderate

*Modified from Rohrich, R. J., Beran, S. J., and Kenkel, J. M. (Eds). Back and arms. In *Ultrasound-Assisted Liposuction*, 1st Ed. St. Louis, Mo.: Quality Medical Publishing, 1998. Pp. 231-252. Used with permission.

Previous authors have tried to assess skin laxity by using objective measurements, such as the coefficient of Hoyer^{16,17} or the ratio of the height of the hanging skin to the thickness of the hanging skin.^{6,18} Sacks describes pinching the excess skin between the fingers (this is different from the pinch test used to determine excess fat) and measuring the length of excess skin.⁷ These methods are helpful guidelines but must be tempered with clinical judgment. Redundant tissue must be evaluated in the proximal, middle, and distal aspects of the upper arm, as well as in the lateral chest wall. This is necessary because the amount, distribution, and severity of skin laxity can vary greatly between individuals.

CLASSIFICATION

Type I

Type I patients have a relative excess of fatty deposits in the upper arm but good skin tone and minimal skin laxity. These patients are candidates for upper arm contouring with liposuction alone. Access incisions are made along the radial aspect of the distal humerus and proximally along the posterior aspect of the arm. The excess fat is removed from the intermediate and superficial layers with ultrasound-assisted liposuction followed by suction-assisted liposuction.^{15,16} Long, uniform strokes are key to preventing contour irregularities. Suction-assisted liposuction is used almost exclusively superior to the brachial groove, whereas

Table 2. New Classification System

Type	Skin Excess	Fat Excess	Location of Skin Excess
I	Minimal	Moderate	n/a
Ia	Moderate	Minimal	Proximal
Ib	Moderate	Minimal	Entire arm
Ic	Moderate	Minimal	Arm and chest
IIa	Moderate	Moderate	Proximal
IIb	Moderate	Moderate	Entire arm
IIc	Moderate	Moderate	Arm and chest

n/a, not applicable.

*Modified from Rohrich, R. J., Beran, S. J., and Kenkel, J. M. (Eds). Back and arms. In *Ultrasound-Assisted Liposuction*, 1st Ed. St. Louis, Mo.: Quality Medical Publishing, 1998. Pp. 231-252. Used with permission.

combined ultrasound- and suction-assisted liposuction is primarily used inferiorly. In our experience, better skin retraction occurs when ultrasound-assisted liposuction is used inferiorly, leading to a better aesthetic result.

Postoperatively, the patients are circumferentially covered with nonadhesive foam and placed in compression garments for 2 weeks, to decrease edema and minimize contour deformities. Deep lymphatic massage is also instituted based on the patient's tolerance, to help further decrease contour deformities and resolve edema more rapidly.

Type II

Type II patients have moderate skin laxity with minimal excess fat. These patients are usually older and have had significant weight fluctuations, resulting in fair to poor skin elasticity. These patients are candidates for brachioplasty using excisional techniques. The location of their redundant tissue determines what pattern of resection is performed. Patients with proximal laxity are candidates for limited brachioplasty, patients with laxity of the entire arm are candidates for traditional brachioplasty, and patients with significant laxity of the arm and lateral chest wall are candidates for extended brachioplasty.

Type IIA

The type IIA procedure is performed for patients with only *proximal* upper arm redundancy. Usually these patients will have significant anterior and/or posterior axillary folds. Patients with proximal laxity can be divided into two groups: those with isolated horizontal laxity and those with both horizontal and vertical laxity. Patients with extensive isolated horizontal laxity can be treated with resection of a vertical ellipse, with the scar hidden in the axillary fold (Fig. 2). Patients with both vertical and horizontal excess are best treated with a T-shaped resection along the proximal anterior aspect of the upper arm⁹ (Fig. 3). Closed suction drains are usually not necessary for limited brachioplasty.

Type IIB

The type IIB procedure is for patients with redundancy of their entire upper arm, from the elbow to the chest wall (though not inclusive). There are two groups present in this subset of patients, depending on whether the patient has excessive isolated vertical redundancy in the axilla or a combination of horizontal and vertical redundancy. For patients with isolated vertical redundancy, a horizontal excision can be performed along the brachial groove. The superior aspect of

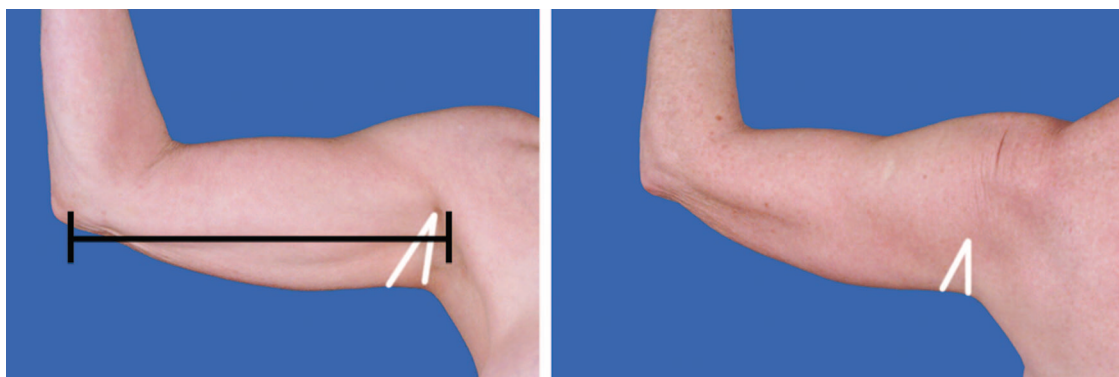


Fig. 2. Type IIa markings for proximal horizontal excess only.

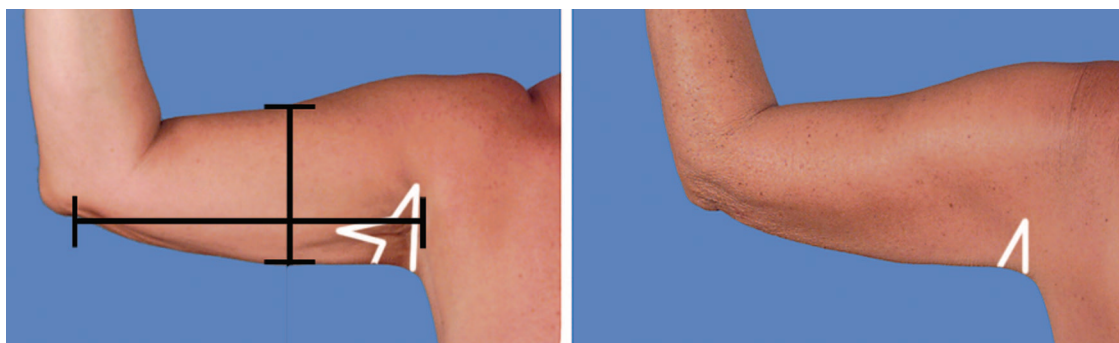


Fig. 3. Type IIa T-shaped resection markings for proximal vertical and horizontal excess.

the horizontal resection is then marked 3 to 4 cm superior to the brachial sulcus. The inferior aspect can be estimated, but the actual extent of resection is decided in the operating room (Fig. 4).

For patients with moderate horizontal combined with vertical excess, an L-shaped excision is performed in the axilla (Fig. 5). The lax arm tissue is displaced medially to determine the extent of vertical resection necessary to correct the ptosis of the arm.^{12,13} The length of the incision distally is dependent on the amount of redundant tissue around the elbow. Occasionally, the incision must extend distal to the elbow. We have found that the best results are obtained when the vertical axillary excision is performed first, followed by the horizontal excision. The vertical incision is temporarily closed, and then the horizontal excision is performed by making the incision along the superior marking and dissecting the flap just superficial to the deep brachial fascia. This flap is then pulled superiorly and marked so as to provide the most aesthetic correction of the deformity, and the resection is then performed. Lockwood believes that anchoring the superficial fascia of the arm to the axillary fascia with permanent sutures decreases the incidence of recurrence and diffi-

culty with scarring.^{12,13} With this technique, we have used polydioxanone suture (absorbable) with good results. The amount of undermining superiorly and inferiorly is kept to a minimum, and the wound is closed over a suction drain.

Type IIC

For patients who have had massive weight loss, laxity may also be present on the lateral chest wall. For these patients, an extended brachioplasty onto the chest wall, as initially described by Pitanguy,^{19,20} is the procedure of choice. The markings for this technique start by delineating the superior aspect of the anticipated resection 3 to 4 cm above the brachial sulcus. This line marking the extent of superior resection is curved inferiorly into the axilla, where the incision is interrupted by a "Z" to avoid straight line scar contracture (Fig. 6). The marking then continues along the anterior axillary line and ends in the inframammary fold. Sometimes this procedure is performed concomitantly with a mastopexy or reduction mammoplasty. For patients with redundancy around the elbow, it is sometimes necessary to extend the incision past the elbow onto the forearm to remove the excess. However, extension should be avoided, if at all possible, distal to the

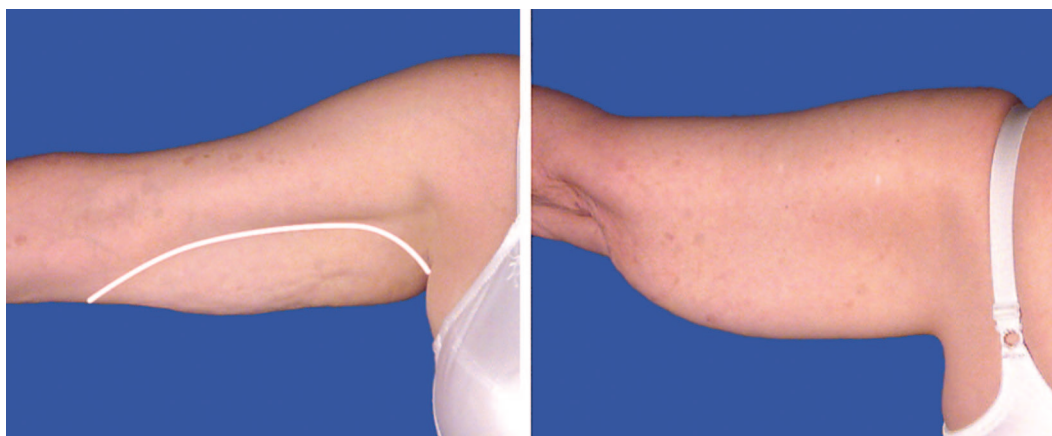


Fig. 4. Type IIb markings for vertical excess only.



Fig. 5. Type IIb L-shaped excision markings for horizontal and vertical excess.

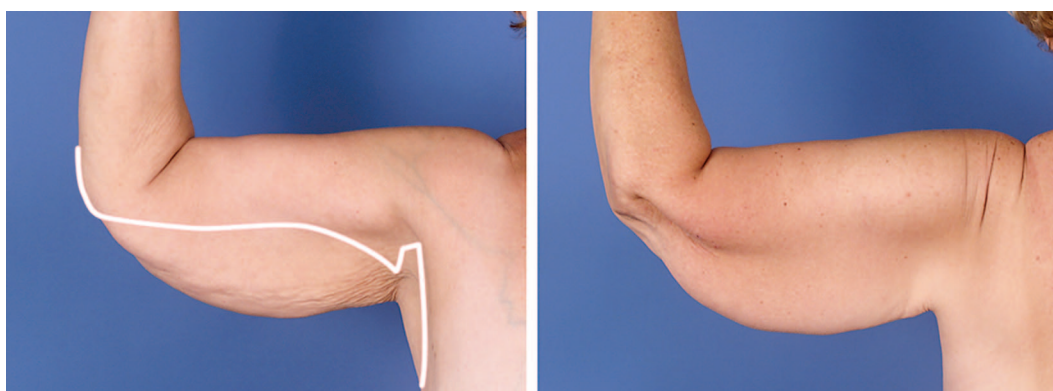


Fig. 6. Type IIc markings for excess along the upper arm and chest wall. A "Z" is made in the axilla to prevent scar contracture.

elbow, because the scar is more noticeable in this location. The wound is closed in layers over a drain.

Closed suction drains are used in all patients undergoing traditional or extended brachioplasty. The drains remain in place until the output is less than 30 cc in a 24-hour period. The arms are

circumferentially covered with nonadhesive foam and compression garments are placed. Patients should wear these garments for at least 4 weeks postoperatively. This amount of time is longer than that when liposuction alone is used. After the garments are discontinued, the suture line is supported with paper tape, and compression ban-

gages are wrapped around the arm for an additional 4 weeks.

Type III

Type III patients have both lipodystrophy and redundant lax skin in the arm (pinch test, >1.5 cm). Liposuction for arm contouring will not provide enough skin retraction to obtain a good aesthetic result. Excisional techniques, on the other hand, have a higher incidence of complications in this patient population, because the amount of excess fat provides bulk that results in greater tension across the incision. Furthermore, the weight of the flap pulls on the incision postoperatively.

Several options are available for these patients. First, further weight loss can decrease the amount of subcutaneous fat, subsequently downstaging these patients. Second, patients with moderate, but not severe, skin laxity can be treated in a staged fashion beginning with ultrasound- and suction-assisted liposuction.^{15,16} These patients must understand that liposuction likely will not provide enough skin retraction and that a revisional brachioplasty (using excisional techniques) will likely be required to give the best aesthetic result. Lastly, these patients can be treated with combined single-stage liposuction and resection.^{8-9,14} Liposuction is performed first, as previously described. After

completion of the liposuction, markings are made and the resection of redundancy is performed. Performing the liposuction as part of the procedure can shorten the length of the brachioplasty incision. Postoperatively, these patients are cared for in the manner previously discussed.

CASE REPORTS

Case 1 (Fig. 7)

The patient was a 38-year-old woman who was unhappy with the size of her arms. She reported no recent changes in weight. Physical examination showed that she had excess fat but minimal laxity of her upper arm.

She was classified as a type I patient who would benefit best from ultrasound- and suction-assisted liposuction of the upper arm. This was performed with removal of 350 cc of fat on each side. Her 9-month results are shown (Fig. 7). Her postoperative course was uncomplicated, and she was pleased with the results.

Case 2 (Fig. 8)

The patient was a 58-year-old woman who had undergone numerous other cosmetic procedures. She complained of “floppy” upper inner arms and desired a more youthful appearance. She reported stable weight but increased laxity of her upper arms as she aged. On examination, she had a mild amount of laxity of her upper proximal arm. There was only horizontal laxity on examination, with no excess fat as determined by the pinch test.

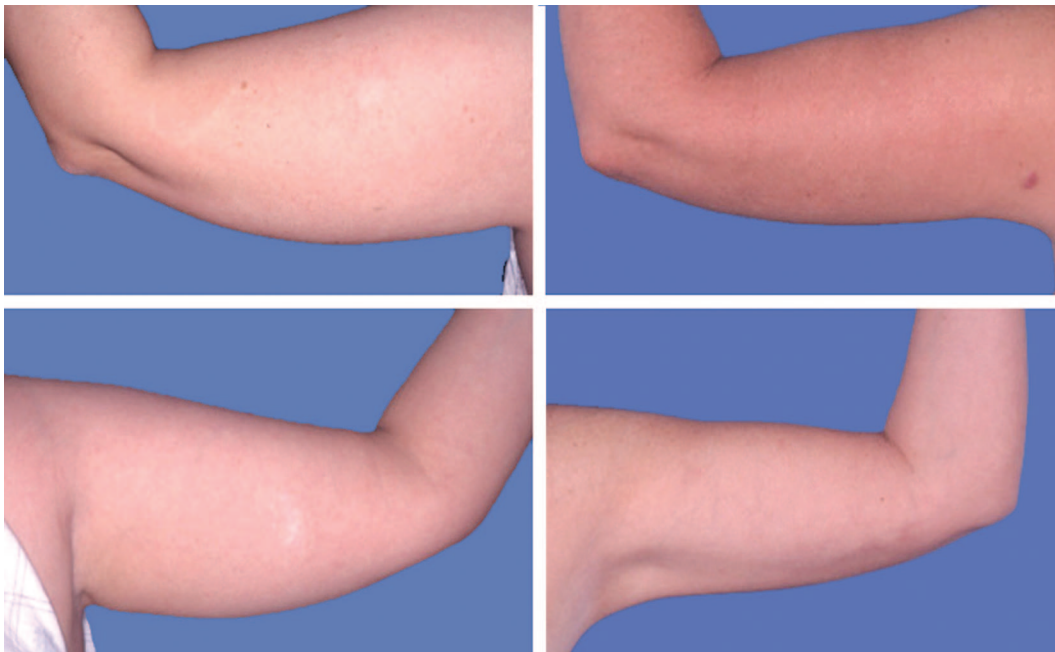


Fig. 7. (Left) Preoperative views of a 38-year-old female type I patient with excess fat and minimal skin laxity. The patient was treated with ultrasound- and suction-assisted liposuction. (Right) Nine-month postoperative views.



Fig. 8. (Left) Preoperative views of a 58-year-old female type IIA patient with horizontal proximal skin excess. She was treated with proximal vertical resection. (Right) Ten-month postoperative views.

This patient was classified as a type IIA. A vertical upper arm brachioplasty was performed. Her 10-month postoperative result is shown (Fig. 8). Her postoperative course was uncomplicated, and she was pleased with the results.

Case 3 (Fig. 9)

This patient was a 46-year-old woman with numerous complaints, including lax upper arms. She reported that in her thirties she had fluctuations in her weight of up to 100 pounds. After her abdominal lipodystrophy was treated, a separate procedure involving her upper arms and a medial thigh lift were performed. On examination, this patient had laxity of her upper arms to the elbow and moderate excess fat.

This patient was classified as a type III. She was initially treated as a type IIB patient, and a traditional brachioplasty was performed. Her 7-month postoperative result is shown (Fig. 9, center). She was dissatisfied with her scars and revision was performed after her incisions had healed completely (Fig. 9, below). Ultrasound- and suction-assisted liposuction was performed at the same time as her scar revision, with much improved results.

Case 4 (Fig. 10)

This 57-year-old woman presented after gastric bypass surgery. She had lost 180 pounds and had signif-

icant upper arm laxity with minimal excess fat extending onto the chest wall and distally onto the forearm.

She was classified as a type IIC patient who would benefit most from an extended brachioplasty. Because her laxity extended to her elbow, the incision was extended distal to this point to remove the excess fat. Her results are shown (Fig. 10). She was pleased with the postoperative result and did not desire scar revisions.

DISCUSSION

Brachioplasty is a procedure that is avoided by many surgeons because of the historically high complication rate. However, more patients are presenting to our clinics desiring correction of this deformity. By properly selecting the procedure based on the type of deformity, an optimal aesthetic result can be obtained.

Previous articles in the literature have focused on modifying the original technique to decrease the potential complications. The majority of these articles describe only one method of brachioplasty for all patients. We believe, as do Teimourian and Malekzadeh,⁹ that the best results are obtained by altering the procedure based on the anatomic analysis of the arm. The upper extremity rejuvenation surgeon should



Fig. 9. (Above) Preoperative views of a 46-year-old woman with excess fat and skin redundancy of both arms. She was classified as a type III patient, but was initially treated as a type IIb patient and underwent horizontal traditional brachioplasty. (Center) Seven-month postoperative views. Hypertrophic scarring resulted from excess weight pulling on the incision. Scar revision and ultrasound- and suction-assisted liposuction were performed secondarily. (Below) Two-month postoperative views after scar revision.

possess knowledge of a variety of techniques to provide the best possible result for the patient.

The algorithm presented in this article is meant to provide a guideline to help select an appropriate technique to use for upper arm contouring. None of the surgical methods described in this article are new. The algorithm is a compilation of techniques that can be used for upper extremity contouring that, when properly selected, can give the most aesthetic outcome.

The usual postoperative course includes edema and ecchymosis. The ecchymosis usually

resolves in 3 to 4 weeks, but edema can sometimes take up to 6 months to resolve. If it is present after use of compression garments and continuous Ace bandages has been discontinued (8 weeks), the edema can be treated by Ace bandage compression for 3 hours a day, usually in the morning. Patients can usually return to work after 2 weeks. However, with liposuction or limited proximal brachioplasty, patients may return to work as early as 1 week postoperatively.

Regardless of the procedure used, scars from brachioplasty are often wide or hypertrophic and

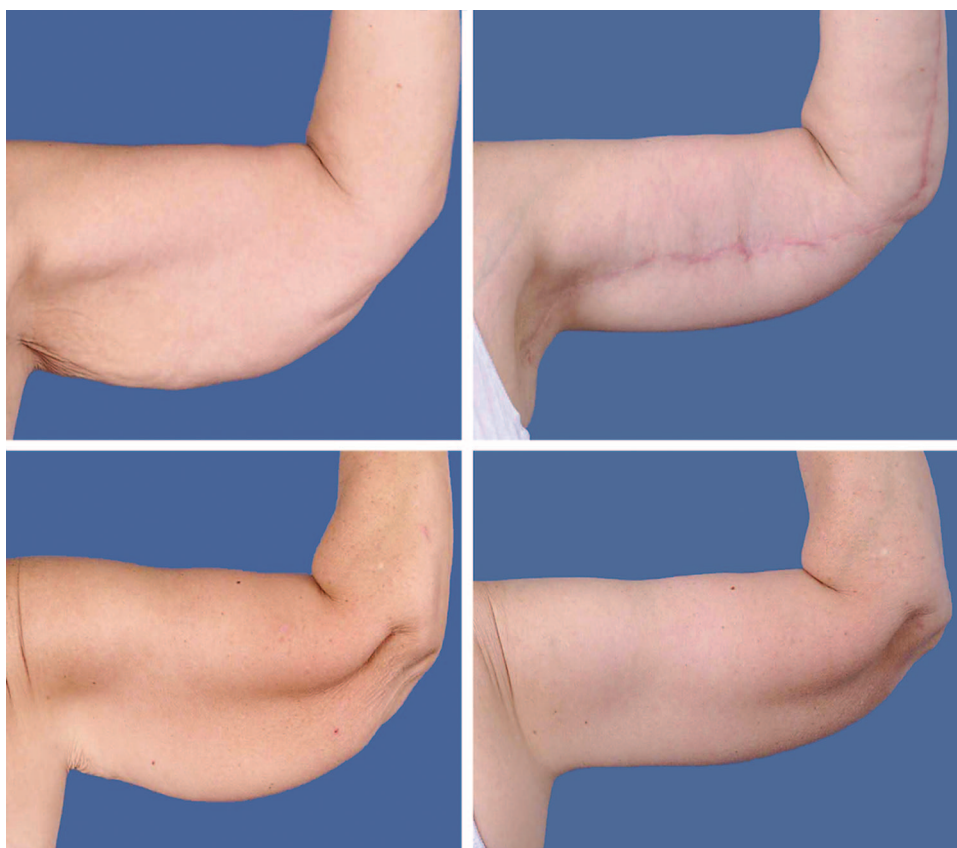


Fig. 10. (Left) Preoperative views of a 57-year-old type IIc patient with horizontal laxity extending to her elbow. She was treated with an extended brachioplasty. (Right) Nine-month views.

frequently require revision. All patients scheduled for these procedures should be counseled about the limitations of brachioplasty and the possible need for scar revision, especially in patients needing a resection that mandates the use of a long horizontal incision.

Rod J. Rohrich, M.D.

Department of Plastic Surgery
University of Texas Southwestern Medical Center
5323 Harry Hines Boulevard, E7.210
Dallas, Texas 75390-9132
rod.rohrich@utsouthwestern.edu

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