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Reply: Refinements in Postoperative Free Flap Monitoring

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Letters

An Algorithm for Oncologic Scalp Reconstruction

Sir:

We read with interest your article about oncologic reconstruction of the scalp.¹ We agree that an algorithm is necessary to facilitate the surgical planning after radical oncologic excision. Radical surgical resection is the most important curative action, and every surgeon has to perform it every time.

Many techniques are available today to reconstruct the scalp. We think that where there are full-thickness bone defects or dura defects, microsurgical flaps are necessary, but when there is a soft-tissue defect of the scalp, there is the possibility of covering the loss of substance using a dermal regeneration template, such as Integra (Integra LifeSciences, Plainsboro, N.J.).² Our ex-

perience suggests that in cancer patients there is the possibility of tumor recurrence, and mobilization of local flaps (or the use of free flaps) may compromise the possibility of controlling the local tumor recurrence.

We have operated on 32 patients with scalp defects (mean surface area, 70.1 cm²) using Integra directly over the bone, under local anesthesia. The tumor excision included the periosteum in all cases, and adequate débridement of the scalp wound down to bleeding bone was performed by drilling of the outer table of the cortex. The artificial dermis was grafted as in a classic full-thickness skin graft and a compressive tie-over dressing was placed on the Integra for 5 days.

If clear surgical margins were found, a second operation was performed at an average period of 21 to 22 days after artificial dermis implantation. The silicone layer was removed, and ultrathin autografts, taken usually from the thigh with a dermatome, were applied to the neodermis.

There was full graft take in all cases. We obtained good outcomes from aesthetic and oncologic points of view, with a mean follow-up of 12 months. In eight cases, we noted a recurrence very early under the skin graft or under the Integra.

Using Integra and skin grafts, we provide durable coverage of the scalp, thicker than direct skin grafting on the skull or on granulation tissue, reducing the likelihood of intraoperative or postoperative complications. This technique allows early detection of local tumor recurrence and therefore early tumor removal, with additional resections to obtain clear surgical margins before the final reconstruction is performed with split-thickness skin grafts over the dermal substitute. Our experience suggests that the use of a dermal regeneration template may be considered a successful option for scalp reconstruction after tumor excision.
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Reply: An Algorithm for Oncologic Scalp Reconstruction

Sir:

We thank the authors for their valuable comments. The technique of applying a dermal graft such as Integra before using a skin transplant eliminates some of the downsides of skin graft reconstruction of the scalp, as it results in thicker, more stable soft-tissue coverage, which shows a lower tendency for unstable scars. In addition, the procedure may be performed quickly and under local anesthesia. However, the following considerations have to be added.

The technique of generating a minimally vascularized wound bed that can then be covered by skin grafts is not new. Removing the outer layer of the calvarial bone has been performed for many decades and, unfortunately, the dermal regeneration matrix (Integra) does not eliminate the need for this possibly dangerous procedure.¹ In the cited publication, the authors describe resection down to the bone in all of their cases, but the published figure shows remaining pericranium in large parts of the shown defect.² From our point of view, this not only violates the laws of oncologic surgery but also questions the potency of dermal regeneration of the dermal matrix. Another downside of this technique is the long latency until final coverage of the defect of 3 weeks.

According to one of the most fundamental principles of plastic surgery, the defect of a certain tissue should be replaced with the same type of tissue. In no other region of the body is this of such importance as in the hair-bearing scalp. Consequently, to achieve the ideal functional and aesthetic result, the reconstruction of defects of up to 5 to 6 cm should be performed using local hair-bearing scalp flaps, even if this necessitates performing a technically more demanding operation. Skin grafts, even if combined with a theoretically perfect dermal graft that allows a full-thickness reconstruction of the complex anatomy of the scalp, can never achieve a comparable result (with the exception of bald patients).

The argument that a full-thickness scalp reconstruction is possible with the mentioned technique somehow contradicts the thesis that earlier visualization of recurrences is possible and that burying of recurring malignancy is more unlikely. Thorough preoperative and intraoperative photographic documentation is essential to illustrate rearrangements of local flaps and allows an oncologic follow-up that never proved to be of difficulty in our series, a fact that is clearly proven by our oncologic follow-up data.¹ On the contrary, given a possible local recurrence, reconstruction with local tissue flaps or with free flaps often allows reexcision of the tumor with simple primary closure, an option that is hardly possible after reconstruction with skin transplants because of the minimal elasticity of the resultant scar tissue.

We agree that in cases with a calvarial defect and/or after calvarial reconstruction with autologous or alloplastic material, there is no alternative to free tissue

transfer. Larger soft-tissue-only defects in patients who cannot undergo free tissue transplantation may be appropriate for the suggested technique, although it has been shown that this patient collective is constantly decreasing.^{3,4}

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The Cyrano Nose: Different Treatment Approaches to Management of Hemangiomas of the Nasal Tip

Sir:

We read with interest the article entitled “The Cyrano Nose: Refinements in Surgical Technique and Treatment Approach to Hemangiomas of the Nasal Tip.”¹ We congratulate the authors on their impressive results and their treatment algorithm for this difficult problem.

Aggressive treatment of nasal hemangioma is the key to improved cosmetic outcome, and propranolol is now our preferred first-line treatment.² In our experience, propranolol causes not only an almost immediate halt in hemangioma proliferation but also significant regression in 87 percent of patients. It has a good safety profile. Early aggressive treatment often avoids the long-term sequelae of nasal deformity and thus the need for future surgery (Fig. 1).

If surgery is needed to correct a Cyrano nose, we prefer the use of the modified subunit approach.³ It is



Fig. 1. Appearance of the nose before (*left*) and after (*right*) treatment with propranolol. No surgery was needed to correct any residual deformity.

easy to perform, does not cause alar rim retraction, allows good surgical exposure, and, more importantly, enables control of the lateral excess skin of the nasal tip, resulting in a slimmer nose. The disadvantage of the approach is the external scar, which we find improves with time and is hidden in the nasal groove.

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PATIENT CONSENT

Parents or guardians provided written consent for the use of the patient's images.

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Reply: The Cyrano Nose: Different Treatment Approaches to Management of Hemangiomas of the Nasal Tip

Sir:

We thank Dr. Mishra et al. for their comments regarding our approach to hemangiomas of the nasal tip.¹ Their efforts in studying the use of propranolol for hemangioma management provide a welcome addition to the body of literature on the subject.² As surgeons, our mandate is to provide the least invasive and most efficacious care possible to our patients; with further study, propranolol therapy might represent a future paradigm shift.

Of course, at the time of our data collection period (1999 to 2007), the use of propranolol had been neither presented nor published. Furthermore, it can be argued that although propranolol might be emerging as a primary therapeutic option, it is not universally effective, as evidenced by their data that suggest a regression rate of 87 percent. Data are also accumulating to suggest that hypoglycemia is the most concerning adverse association of propranolol and therefore must be screened for and managed appropriately.³⁻⁵ In addition, patients with hemangiomas of the head and neck should be screened for PHACES (posterior fossa malformations, hemangiomas, arterial anomalies, cardiac defects, eye abnormalities, sternal cleft, and supraumbilical raphe) syndrome before proceeding with propranolol therapy, because these children can have cerebrovascular anomalies that may result in cerebral ischemia with propranolol therapy. Finally, despite the great improvement in subcutaneous tumor volume,

there remains significant cutaneous hemangioma involvement, potentially as a result of less β -blocker density in the skin,⁶ that might require treatment with pulsed dye laser in the future.

Regarding the choice of incision, we have acknowledged that there is much controversy in the literature; however, we feel it most appropriate to avoid external scars. Certainly, although other esteemed authors enjoy the subunit approach,^{7,8} in our hands, an open tip approach has produced acceptable results and is preferred.¹ In addition, based on the set of clinical images you have included, there remains bulbosity of your patient's nasal tip, likely a result of tumor producing splaying of the lower lateral cartilages. This problem will likely require correction using an open rhinoplasty approach to remove tumor and reapproximate the cartilages, for which a subunit approach would prove most difficult.

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Finding a Favorable Treatment of Polyacrylamide Hydrogel Injection Complication

Sir:

We read the report on polyacrylamide hydrogel injection by Dr. Ono et al. with respect and interest.¹ In Asia, injectable fillers have been used extensively by plastic surgeons for facial correction and breast augmentation.^{2–5} Along with the advantages, we have also noticed emerging negative results. We agree with the authors on their major points, yet still have something to say about countermeasures against the filler-associated complications.

First, the number of patients is not more than four in either group,¹ which is too small for sampling and is statistically unreasonable, because a larger sample may yield different results. Our results with fillers revealed much lower complication rates. We also find that eyelid, nasolabial groove, and nose corrections have a higher risk than chin and chest augmentation. Additional data need to be collected with a larger sample to support this view.

Second, we rely mainly on physical examination. Accessory tools include molybdenum target radiography, B-mode ultrasound, computed tomographic scanning, and magnetic resonance imaging. With high acuity and accuracy, magnetic resonance imaging enables targeting and provides knowledge regarding injection range, surrounding tissue, and even the capsule. Positron emission computed tomography is also of help, because it reveals not only the local focus but also filler migration. However, its high price constrains its clinical use. In sum, magnetic resonance imaging is currently the criterion standard for probing after injection of polyacrylamide hydrogel.^{3–5}

Third, removal of injection fillers is very difficult in the superficial layers (e.g., eyelid, nasolabial crease, and cheek), where surgery is sometimes contraindicated to avoid scarring of the face. Moreover, multilayer and multifoci injection filler, when complicated by infectious diseases, may result in severe scar, various infection foci, and other unsatisfactory results. In the case of breast augmentation, removal of fillers can have good results, because the injection site is superficial and the skin lesion is mild. Drainage or surgical procedures may yield good results.

Fourth, in China, injection fillers are frequently used in breast, nose, and chin augmentation, among which chin augmentation has a higher complication rate. Removal of the filler will be easy when the interval between injection and operation is short and the design of the operative procedure is simple. The filler is often injected through an alar incision. A short incision line is preferred, to avoid scarring, because wide isolation with scissors, multidirectional curettage, and repeated drainage help remove most of the fillers. A suborbital incision is recommended to take out fillers in the nose. Secondary rhinoplasty should be performed no less than 3 months later.

Fifth, for those receiving heavy doses of fillers, our principles are as follows:

- Preoperative magnetic resonance imaging is indispensable, because the results help categorize the patients. In one category, the filler is located

in a single, intact capsule below the breast. In the other, it is found in many scattered sacs of different sizes: in the breast, below the breast, between the muscle fibers of the pectoralis major, and even on the abdominal wall.

- Timing of its removal is controversial. Some patients may not show any adverse reaction yet still request immediate removal because of increasing anxiety. Generally, we do not operate on those with a single capsule and after labor, but perform frequent follow-up examinations. However, we recommend early removal in the case of contour change or other complications.
- Although it remains unclear whether injection of fillers affects breast feeding, we recommend that the patient feed their children with alternatives, to avoid possible complications, including acute mastitis and undesirable effects on growth and development.
- The operation can be performed through a semi-lunar incision below the inferior border of the breast areola or along the inframammary fold. We choose an areolar approach, because Chinese patients are prone to developing a scar. With the help of magnetic resonance imaging findings, it is not difficult to remove the injectable fillers and the capsule. The surgeon should be alert to contour change if the patient shows a wide range of filler migration. Also, repetitive washing and postoperative drainage are of great importance. Also of note, it is unnecessary to clear away all of the filler between muscle fibers.
- Secondary breast augmentation should be performed at least 3 months after removal. Injection fillers are located mostly above the pectoralis major and below the breast. Placement under the pectoralis major will prevent possible complications from contact of prosthesis and remnant fillers.

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Reply: Finding a Favorable Treatment of Polyacrylamide Hydrogel Injection Complication

Sir:

We thank Dr. Bi and colleagues for their interest and comments on our article regarding complications with polyacrylamide hydrogel injections.¹ They seem to have considerable experience in the use of polyacrylamide hydrogel injection and the treatment of the complications that result from its use.

As they mentioned in the letter, and as we described in our article, the rate of complications caused by polyacrylamide hydrogel injection seems to be lower than the rates associated with other products. However, the fact is that there are still patients with severe complications after polyacrylamide hydrogel injections. Even though the rate of complications is low, we should not overlook this issue. Injections of foreign body materials may possibly cause immunologic reactions and late-onset complications; thus, we should avoid this iatrogenic disease as medical professionals to protect people's health.

The important issue is that there is insufficient information on the long-term safety of this material. Therefore, polyacrylamide hydrogel injection should be used under appropriate informed consent and long-term follow-up as we described. We should provide appropriate information to patients to give them the opportunity to avoid the complications by themselves.

Another issue is that foreign body injections seem to be an easy method, so that even a nonphysician or patient can use the material illegally. Physicians always need to consider these social ramifications provided by aesthetic surgery. We would like to expect that aesthetic surgeons who use nonabsorbable fillers always take into consideration both scientific and ethical factors.

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Factors Influencing Free Flap Management

Sir:

We read with interest Dr. Nahabedian’s discussion of “A Comparison between DIEP and Muscle-Sparing Free TRAM Flaps in Breast Reconstruction: A Single Surgeon’s Recent Experience.”¹ In this article, he discusses free flap management and factors influencing outcome.

The points he raises are all very valuable for any microsurgeon and, in particular, for the starting microsurgeon, whether performing breast reconstruction or any other type of free flap surgery. In particular, it is important to keep a critical eye on one’s own work by continuously auditing one’s results.

Our Taiwan unit, like Dr. Nahabedian, does not use any preoperative imaging other than Doppler imaging of the perforators, nor do we use any perioperative perfusion imaging. Postoperatively, we monitor our flaps only clinically and are of the opinion that early exploration is the key to high salvage success rates.

In addition to Dr. Nahabedian’s views, we would also like to add the need to defer raising a second free flap following complete flap loss. At this particular time point, the microvascular endothelium is likely to be affected by hypoxia-induced inflammatory mediators, free radicals, and growth factors,² which could lead to a second free flap failure. For this reason, we advise waiting for at least 2 to 3 weeks before raising a second flap or using a different nearby recipient vessel. Should the situation occur where immediate coverage is of the essence, such as exposed bone in lower limb injuries or an exposed carotid artery in head and neck defects, we advise using free flaps supplied by cross-leg vessels³ or distant pedicled flaps (such as a pedicled colon flap), respectively.

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Reply: Factors Influencing Free Flap Management

Sir:

I appreciate Liem and Chen’s comments in reference to my discussion¹ of the article by Dr. Serletti’s group.² As they have alluded, my intent was to convey the fact that successful microvascular reconstruction requires a unique and complex skill set, unfaltering judgment, and experience. Despite the fact that we have a variety of tools available to us to assist us preoperatively, intraoperatively, and postoperatively, I still rely on my judgment, experience, and low threshold for reexploration to improve outcomes. It is often stated that good judgment comes from good experience and that good experience comes from good judgment. Dr. Serletti’s and Liem and Chen’s faculty certainly fall within this group.

Regarding the timing of a secondary free tissue transfer in the event of a primary flap failure, I agree with Liem and Chen’s strategy. In the event that a second free flap is necessary, it is prudent to wait until the inflammatory mediators have subsided. When considering a second flap, my algorithm is based on what I can do differently to ensure success. If the free flap loss was attributable to a preventable cause, I will proceed with a second free flap and avoid making the same mistake twice. However, if the free flap failure was attributable to an unpreventable cause, my tendency is to avoid performing a second free flap and to consider other options, such as local or pedicled flaps and, in some cases, a skin graft.

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Refinements in Postoperative Free Flap Monitoring

Sir:

We carefully read the interesting article entitled “Advancement in Free Flap Monitoring in the Last Decade: A Critical Review” by Smit and colleagues published in the January issue of the *Journal*.¹ We appreciated the content concerning the different postoperative monitoring devices available currently, with their advantages, limits, and costs. We do agree with the authors when they indicate in their article that the implantable Doppler system, near-infrared spectroscopy, and laser Doppler flowmetry are the best monitoring devices currently available. However, because of their cost and intrinsic limits, each of these devices should be used by dedicated personnel only in selected cases in which it is demonstrated intraoperatively that there is a significant predictive value of flap compromise and risk of early surgical reexploration.

Microscope-integrated indocyanine green near-infrared videoangiography is a new method for intraoperative assessment of vascular flow through microvascular anastomosis. The intrinsic transit time describes the time from when the dye appears at the arterial anastomosis until it reaches the suture line of the venous anastomosis.^{2,3} As the transit time reflects blood flow velocity within the flap, prolonged intrinsic transit time correlates with a low blood flow and a higher rate of postoperative thrombosis with early anastomotic complications.^{2,3} In 2009, Holm et al.³ published a prospective clinical trial on 100 patients to evaluate the relation between intrinsic transit time and early anastomotic complications in elective microsurgery patients. They demonstrated a significant predictive value of intrinsic transit time related to flap compromise and early reintervention, with an optimal cutoff value of intrinsic transit time greater than 50 seconds indicated as strongly suggestive of vascular compromise of anastomosis. On this basis, we observed that indocyanine green near-infrared videoangiography could be a reliable and safe method for determining the safety of anastomosis in free flaps intraoperatively, thus rationalizing the use of and the indications for current postoperative monitoring devices and optimizing the timing of reexploration.

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DISCLOSURE

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Reply: Refinements in Postoperative Free Flap Monitoring

Sir:

We thank Dr. Pascone and colleagues for their interest in our article entitled “Advancements in Free Flap Monitoring in the Last Decade: A Critical Review.”¹ We agree with them that microscope-integrated indocyanine green near-infrared videoangiography, as described by Holm et al.,² offers the opportunity to assess blood flow velocity within the flap intraoperatively. A prolonged intrinsic transit time indicates the need for further inspection of the flap and its anastomoses during the initial surgical procedure.

An important disadvantage of indocyanine green near-infrared videoangiography, however, is that it only indicates a chance (area under the curve of 0.88) on compromise and is not absolute. Obvious examples of this in the report of Holm et al.³ are flaps with an intrinsic transit time less than 50 seconds that became compromised and flaps with an intrinsic transit time greater than 50 seconds that did not. Furthermore, the technique has only been described by a single unit, with the largest population published consisting of 100 flaps. In this report, a sensitivity of 92 percent and a specificity of 78 percent are reported, which is low compared with other monitoring methods available today. In addition, methods such as the implantable Doppler system, near-infrared spectroscopy, and laser Doppler flowmetry are able to continuously monitor the flow within a flap intraoperatively and postoperatively, whereas indocyanine green near-infrared videoangiography is not. Another disadvantage is that indo-

cyanine green near-infrared videoangiography is invasive. Although indocyanine green only becomes toxic in very high concentrations,⁴ it is still more invasive than the other described techniques.

In summary, for indocyanine green near-infrared videoangiography to become a safe and reliable monitoring method, more research is needed in larger populations and in different settings. Indocyanine green near-infrared videoangiography also needs to be compared with other monitoring methods with regard to efficiency and cost.

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Single versus Double Venous Microvascular Anastomoses

Sir:

We read with great interest an article by Hanasono et al.¹ in which objective data regarding flow through single and double venous anastomoses are presented. According to the article, single is preferred over double venous anastomoses because higher velocity is present in single venous anastomosis of vena comitans and, therefore, there is a lower risk of thrombosis. Our point of view is almost identical to that of Hanasono et al. In our clinical practice, we have performed predominantly single venous anastomosis over double anastomoses and experienced no higher rates of failure than usual.

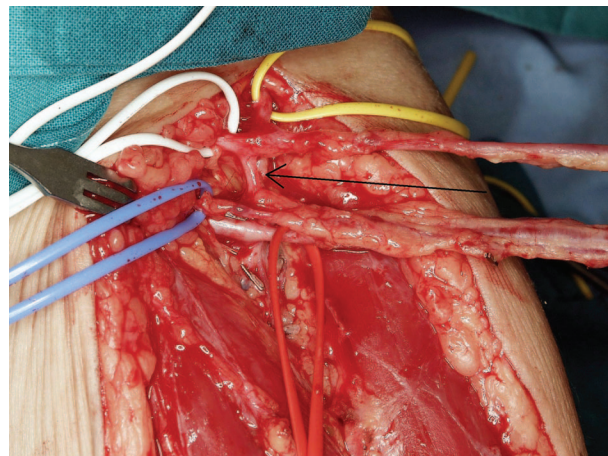


Fig. 1. The black arrow points to the interconnecting vein between the deep and superficial venous systems. The white and yellow rubber bands are around two ends of the cephalic vein, the red rubber band is around the radial artery, and the blue rubber band is around one vena comitans

It is mentioned by Hanasono et al. that double venous anastomoses would be beneficial in flaps with dual venous systems, such as the radial forearm, when the flap demonstrates signs of venous congestion. Probably yes, but the question is, are these two systems connected in the flap pedicle? Because we deal with head and neck reconstruction, the radial forearm free flap is still the most raised flap in our department. Superficial and deep venous system anastomoses are almost always high up in the antecubital fossa²; for that reason, during harvest we try to find this single interconnecting vein between two systems and divide the vessels proximally to this vein to include it in the vascular pedicle (Fig. 1). Out of three possible venous anastomoses in radial forearm free flaps, we have been using for the last 10 years only single venous anastomosis, with either cephalic vein or a vena comitans. Before performing venous anastomosis, only one smaller vena comitans is clamped and the cephalic vein and the other bigger vena comitans are left open. After the arterial anastomosis is done and working properly, we observe these two veins and judge which one drains better and/or faster. The weaker draining vein is clamped and the other is anastomosed to the recipient vein. By clamping two veins and leaving only one anastomosed, venous flow joins from both venous systems and blood velocity is greatly increased through this anastomosis, thereby reducing the risk of thrombosis.

For other free flaps with a single venous system (anterolateral thigh, fibula, latissimus dorsi and scapula, and deep circumflex iliac artery flaps), we use single venous anastomosis as well, and we agree with the viewpoint that by performing single anastomosis, blood velocity is increased and there is no need to increase operating time by performing a second venous anastomosis.

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One versus Two Venous Anastomoses in Microvascular Free Flap Surgery

Sir:

We read with great interest the article by Hanasono et al., which very nicely demonstrated flow changes within the vascular pedicles of a free flap in cases where a single or double venous pedicle is used.¹ Although their results are a very useful contribution to the literature, we would like to caution the authors with regard to the conclusions drawn in their article, and offer our experience, which indicates a conflicting conclusion.

The authors conducted a theoretical study that looked only at flow in the venous pedicles of free flaps, with the lower velocity state in flaps with two venous pedicles leading the authors to conclude that “performing anastomoses of both venae comitantes cannot be made” and that “dissection of a second recipient vein and performing an anastomosis of a second vena comitans increases operative time unnecessarily.” We feel that such conclusions cannot be so definitively made in a theoretical study, and do not take into account potential changes in pedicle diameter and flow postoperatively, or changes in intraflap vasculature that may accommodate flow changes.

More importantly, however, is the published clinical evidence that actually suggests the opposite—that *two* venous anastomoses improve outcomes, particularly in deep inferior epigastric artery perforator (DIEP) flaps. Our findings, published last year, compared one versus two venous anastomoses in 564 consecutive DIEP flaps, and demonstrated that the

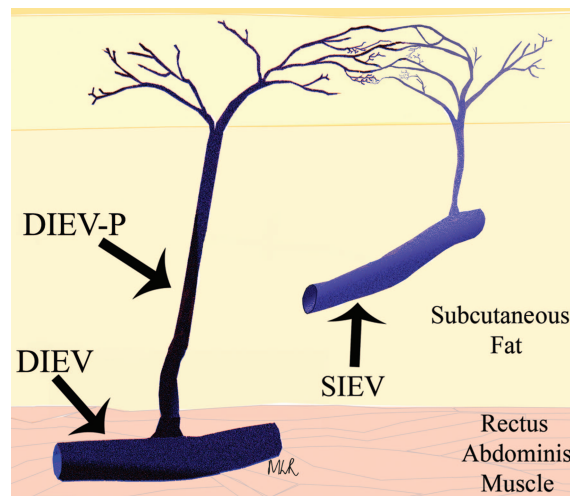


Fig. 1. Representation of the venous anatomy of the anterior abdominal wall, with the subcutaneous tissues drained by both superficial and deep venous systems, the superficial inferior epigastric vein (SIEV) and the deep inferior epigastric vein (DIEV), respectively, through deep inferior epigastric vein perforators (DIEV-P). (Reproduced with permission from Enajat M, Rozen WM, Whitaker IS, Smit JM, Acosta R. A single center comparison of one versus two venous anastomoses in 564 consecutive DIEP flaps: Investigating the effect on venous congestion and flap survival. *Microsurgery* 2010;30:185–191.)

use of two venous anastomoses resulted in a significant reduction in the number of cases of venous congestion to zero (versus seven; $p = 0.006$). All other outcomes were similar between groups and, notably, the use of a secondary vein did not result in any significant increase in operative time.²

Previous experimental studies have also highlighted “supercharging” techniques to improve flap survival, with venous superdrainage shown to be of benefit in reducing reoperative rates.^{3–5} Particularly in the DIEP flap, the use of both the deep inferior epigastric vein and superficial inferior epigastric vein to augment venous drainage of the lower abdominal wall in tegument can better capture venous territories within the flap. Not only do the superficial inferior epigastric vein and deep inferior epigastric vein have different venous territories (Fig. 1), perforator zones within the flap (venosomes) may be better drained through multiple adjacent venous outflow routes.

Given our clinical findings, we would actually advocate the use of two venous anastomoses in DIEP flap surgery and potentially for other free flaps. Perhaps a broader study that includes both thrombotic outcomes and flow measurements combined could further improve our understanding of this important clinical question.

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Reply: One versus Two Venous Anastomoses in Microvascular Free Flap Surgery

Sir:

We thank Rozen et al. for their interest in our article and congratulate them on their article, which contributes additional data regarding the routine performance of either one or two venous anastomoses.¹ In their article, they report a lower rate of venous congestion requiring reoperation in deep inferior epigastric perforator (DIEP) flaps performed with two venous anastomoses ($n = 291$) compared with DIEP flaps performed with one venous anastomosis ($n = 273$) (0 percent versus 2.6 percent, respectively; $p = 0.006$). The mean operative time for both operations was virtually identical ($p = 0.57$). They conclude that DIEP flap breast reconstructions should routinely include two venous anastomoses because of lower flap failure rates and equivalent operative times.

Our findings support the practice of performing a single venous anastomosis in cases where two venae comitantes are present, based on superior blood velocity, theoretically decreasing the chance of thrombosis.¹ Velocity and flow are often confused in

the literature, but they are different. Low blood velocity (measured in centimeters per second), along with turbulence and intimal injury, results in thrombosis. These three conditions are commonly referred to as Virchow’s triad, after the German pathologist Rudolf Virchow, who detailed the pathophysiology behind pulmonary embolism. Blood flow (measured in milliliters per second) represents the volume of blood entering and exiting an organ, or flap in this case. Both are critical to flap survival; in simplified terms, inadequate blood velocity results in thrombosis, whereas inadequate blood flow results in unsatisfactory tissue perfusion.

As we acknowledged in the Discussion section of our article, the question of whether a second venous anastomosis of a separate system of veins, rather than a second anastomosis of a vein draining the same venous system (a second vena comitans), is needed to maintain adequate blood flow (not velocity) in some flaps remains unanswered by the data we have presented.² The DIEP flap is an example of a flap that usually includes two systems of draining veins: a superficial system that empties into the superficial inferior epigastric vein, and a deep system that empties into the venae comitantes of the deep inferior epigastric artery. In their study, the vast majority (92.1 percent) of DIEP flaps that had two venous anastomoses were flaps that included one vein from the superficial system and one vein from the deep system, rather than two veins from the deep system. It is possible, then, that the difference in venous complications they noted was because some of the flaps that had only one venous anastomosis were not satisfactorily drained by a single venous system, which is a problem of flow rather than velocity. Therefore, our findings do not necessarily contradict the findings by Rozen et al. However, given the very low rate of venous complications they experienced in their series (1.2 percent of all flaps), a much larger sample would be required to obtain satisfactory statistical power to clarify the question of whether the problems they observed were problems of inadequate flow or inadequate velocity.

In summary, we support performing a second venous anastomosis of a separate venous drainage system, such as the superficial inferior epigastric vein in the DIEP flap, when signs of venous insufficiency are present, as we suggested in the Discussion section of our article and as Rozen et al. described in the Methods section of their article. The only argument that we can see for performing two venous anastomoses of a single venous system (i.e., both venae comitantes of the deep inferior epigastric artery) is to have a “backup” vein should one of the veins thrombose, for example, because of imperfect technique, distal pedicle or recipient vessel injury, size mismatch, or awkward pedicle geometry with a risk of later kinking or twisting.

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DISCLOSURE

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Some Thoughts on the Posterior Brachioplasty

Sir:

I read with great interest the article “Liposuction-Assisted Posterior Brachioplasty: Technical Refinements in Upper Arm Contouring” by Nguyen and Rohrich.¹ The authors present their own technique of a posterior-type brachioplasty in which they combine liposuction with excision of redundant skin on the posterior aspect of the upper arm. They show excellent results with regard to an improved new arm contour. However, I want to make a few comments on this matter. Brachioplasty can be performed as a single operation or as part of an upper body-lifting procedure.² The frequency of this operation has increased dramatically because of the steadily increasing number of patients who have experienced massive weight loss. Therefore, there is a constant search for new techniques to improve aesthetic results. In massive weight loss patients, short or limited scar techniques seldom work to correct the often pronounced skin redundancy. Thus, the surgeon has to choose between a medially³ or posteriorly located scar on the upper arm. In my practice treating massive weight loss patients, I have experience with both techniques and have elaborated on advantages and disadvantages of both techniques. In my opinion, better contouring of the arm can be achieved with the posterior-type excision, because the hanging skin

pannus is excised directly with this technique, whereas with the medial-type brachioplasty, a dorsally based flap is created and this flap is partly excised. Furthermore, skin quality and thickness are better on the posterior aspect of the arm, facilitating efficient wound closure. However, wound closure in the posterior brachioplasty is more cumbersome and often requires the help of an assistant. A small maneuver can overcome this potential drawback of this procedure (Fig. 1). In contrast, the scar position can be problematic if it lies posteriorly on the upper arm. It is true, as mentioned by Nguyen and Rohrich, that the scar can hardly be seen by the patient in this type of brachioplasty. In contrast, the scar is visible to everybody looking at the patient from behind when wearing short-sleeved t-shirts. The patient in the beginning may not appreciate this fact, but it will be a matter of definite concern in the long run and should be discussed preoperatively in detail. This may be aggravated because of the increased tendency of hypertrophic scars on the posterior aspect of the upper arm (Fig. 2). In my practice I have experienced that patients accept medially located scars better than posteriorly located ones because of the possibility of concealing them better. The most significant drawback of the medial brachioplasty is the chance of developing lymphocysts at the distal aspect of the scar just above the cubita (Fig. 3). This problem appears similar to the vertical thigh lift if in the distal aspects the resection is carried out too deep and lymphatic vessels are severed.

In conclusion, scar position has to be discussed critically with the patient when planning upper arm contouring, especially in massive weight loss patients. The above-mentioned disadvantages of both techniques



Fig. 1. During wound closure in posterior brachioplasty, both forearms can be fixed to each other by a regular clamp after wrapping them in sterile gauze. This maneuver facilitates simultaneous wound closure in a two-team approach without the need for further assistance.



Fig. 2. Hypertrophic scar 11 months after posterior brachioplasty (right), which is very conspicuous to the observer from behind in an otherwise very good contouring result (left).



Fig. 3. Lymphocysts, such as in this case, are much more common in a medial-type brachioplasty, and they sometimes respond very slowly to conservative measures.

show that the search for the ideal upper arm contouring procedure is ongoing.

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DISCLOSURE

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Reply: Some Thoughts on the Posterior Brachioplasty

Sir:

We thank Dr. Huemer for his interest in our technique of liposuction-assisted posterior brachioplasty.¹ Brachioplasty, with the growing massive weight loss patient population, is a procedure being performed with increasing frequency, and historically carries a high percentage of poor outcomes. Dr. Huemer provides excellent depictions of the most common complications of poor scar appearance and fluid collections.

With appropriate patient analysis and selection, our technique provides the option of an efficient procedure with reproducible results for practitioners struggling with such adverse outcomes. Although the choice of scar position is a matter of surgeon preference, we consider the posterior incision to be dependable for many reasons, including those mentioned by Dr. Huemer of improved contour and closure. We find that patients seeking upper arm contouring who meet criteria for liposuction-assisted posterior brachioplasty are willing to accept potentially visible incisions for better contour results. This

is particularly true in the massive weight loss population. The elliptical markings make the procedure simple. This prevents overresection, a potential cause of hypertrophic scar formation as shown in Figure 2. This also avoids ischemic flaps and dehiscences as illustrated in Figure 3. The use of superficial liposuction is an essential aspect of this procedure that augments the outcomes and avoids complications as exemplified in Figure 3. The liposuction assistance improves the ease of resection, minimizes blood loss, and preserves lymphatics and nerves.

We agree that Dr. Huemer's arm positioning facilitates closure without an extra assistant. In addition, we find that the use of a padded crossbar on which to rest the attached hands not only protects the patient's face but also prevents extreme positioning of the extremities.

We are appreciative of Dr. Huemer's comments and images that highlight the considerable risks of an increasingly popular procedure with numerous variations. Our goal was to present a simple, safe, and reliable procedure for appropriately selected patients.

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DISCLOSURE

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Is Adherent Scar Always Nonpliable?

Sir:

We read the article by Perry and colleagues¹ with great interest and agree that objective assessment of skin scars is crucial for planning their treatment. The article is a review aimed “to explore the current range of noninvasive objective assessment tools available for cutaneous skin scarring” described in the literature since 1937. The authors classify the reviewed tools according to four physical characteristics of skin scar (i.e., color, surface area, height/depth, and pliability) and state that the skin's “elas-

ticity, extensibility, firmness, and tensile strength constitute the collective definition of pliability.” They add that “scars are required to glide and stretch with normal skin to facilitate normal physiologic function” (Fig. 1).

In reality, gliding and stretching are two different biomechanical properties, and we agree with those who consider and measure separately the adherent condition (capacity to glide) and the scar firmness and inflexibility (capacity to stretch).² For instance, pathologic scar might be adherent in one point and at the same time globally supple. This occurs, for example, in surgical linear wounds where the pathologic scarring may not affect the entire incision but occurs mainly at a depth.

Unfortunately, scar pliability and adherence are sometimes analyzed with the same items³; in fact, the tools considered in the article by Perry et al. are aimed to assess scar stretching but not specifically to measure scar gliding.

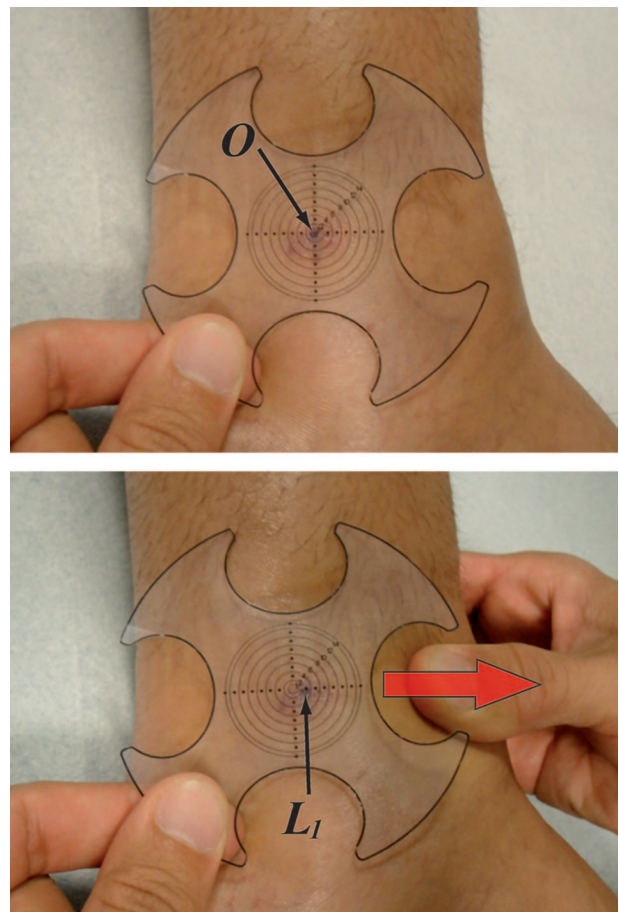


Fig. 1. The Adheremeter. Scar adherence (marked with a black fine-line pen) in original position O at rest (above) and at maximal lateral excursion L_1 (below) when pulled with maximal force within a comfort range for the patient. The red arrow indicates the pulling direction. In this example, maximal lateral excursion of the adherence (from O to L_1) is 3 mm.

Recently, we validated in postsurgical scars a cheap and easy-to-use device to objectively measure scar gliding, dubbed the Adheremeter (Fig. 1).⁴ This device measures adherence of postsurgical scar, defined as the restriction of scar mobility with respect to underlying tissue at the worst adherent point when pulled in four orthogonal directions. To our knowledge, no other instruments have been validated to assess degree of scar adherence, and only one scale has been developed for adherent scars (the Skin Glide Grade scale, which subjectively grades the amount of scar restriction).⁵

Because there is not currently a consensus on this topic, we think it would be relevant for the readers if Perry and colleagues could express their expert opinion on the following points: (1) the relationship between scar capacity to glide (adherence) and to stretch (pliability), and (2) the best tools with which to assess scar adherence of different type and origin in a clinical setting.

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DISCLOSURE

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Reply: Is Adherent Scar Always Nonpliable?

Sir:

We thank Dr. Ferriero and colleagues for their interesting comments highlighting the intriguing and complex subject of skin scarring and tissue “pliability.” Because of the complicated individual nature of skin scarring and the continuum of scar types, accurate assessment of the biomechanical properties of the skin remains a complex task to perform clinically. Difficulty arises from the fact that without laboratory analysis of the affected scar, it is not possible to accurately determine the exact effect of the scar tissue present. For example, when a scar is less mobile than normal skin, it is not feasible to classify adherence to one particular point seen against adherence between various cutaneous layers, as this cannot be visualized with the naked eye. Subjectively, this could secondarily restrict extensibility or elasticity; therefore, the capacity of a scar to glide and to stretch individually remains a deceptive measure to quantify exactly. We believe that, as it can be difficult to clearly establish on clinical examination the effect of the scarring present, the collective term of pliability is consequently best applied currently.

Biological elasticity and maximum distention are the most important biophysical parameters of pliability assessed using objective devices in establishing what maintains the normal appearance of skin.¹ Various noninvasive mechanical instruments have been discussed in our review² article that record skin deformation with a component of adherence during loading and after force release, charting the skin’s recovery and permitting treatment modality evaluation to be obtained. In addition, Ferriero et al.³ have reported their validation study of a new four-way horizontal orthogonal tension device to determine restriction of scar mobility from the worst operator-determined adherent point along the length of the lesion. The new Adheremeter device would be a suitable addition to clinical practice because of its simplicity of use and low cost. The tool correlated moderately well to the Vancouver Scar Scale and the nonvalidated pliability subscale, demonstrating a sensitivity to change, a good to excellent interrater reliability, and an excellent intrarater reliability (when assessed on normal skin). Despite being adaptable to different anatomical sites, the authors acknowledge the difficulty in regions of greater con-

vexity or concavity, and further studies are warranted in different pathologic scar types.

The Adherometer presents a welcome simplistic device for examining the tension component of pliability with relation to adherence. However, in our opinion, researchers and clinicians still need to select the most appropriate device for the scar type and specific concept of pliability that they wish to assess formally.

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Correction: *Mastering Rhinoplasty: A Comprehensive Atlas of Surgical Techniques with Integrated Video Clips, 2nd Edition*

In the Review of *Mastering Rhinoplasty: A Comprehensive Atlas of Surgical Techniques with Integrated Video Clips, 2nd Edition*, published in the May 2011 issue of the *Journal (Plast Reconstr Surg.* 2011;127:2119–2120), the number of pages is listed incorrectly. The book has in fact 449 pages.

REFERENCE

- Guyuron B. *Mastering Rhinoplasty: A Comprehensive Atlas of Surgical Techniques with Integrated Video Clips, 2nd Edition* (Review). *Plast Reconstr Surg.* 2011;127:2119–2120.