



## GUIDELINES

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## Viewpoints

### Alar Necrosis after Facial Injection of Hyaluronic Acid

Sir:

**A** 46-year-old man requested aesthetic enhancement of his nasolabial folds. Local anesthetic block of the infraorbital nerves was achieved using 2% lidocaine with 1:100,000 epinephrine. One cubic centimeter of hyaluronic acid gel (Juvéderm; Allergan, Inc., Irvine, Calif.) was injected into both nasolabial folds through a transcutaneous and superior gingivobuccal sulcus approach. Successful effacement of the nasolabial folds was achieved. The patient tolerated the procedure well and there were no immediate postinjection complications.

On postinjection day 1, the patient reported right-sided alar pain during the prior night. The external skin of the right ala appeared dusky with poor capillary return, but the nasal mucosa was intact.

Over the ensuing days, epidermal sloughing was seen from the right nasofacial angle over the right alar region to the soft triangle. The lateral crus of the alar cartilage was not involved. Granulation tissue and epithelium emanated from the sebaceous pores at postinjection day 3 (Fig. 1). The affected area was completely epithelialized without contour abnormality at postinjection week 1. Complete recovery without contour abnormality or skin change was seen at postinjection month 3 (Fig. 1).

Delayed injection necrosis through vascular compression from hyaluronic acid has been described previously.<sup>1</sup> Glabellar injection necrosis has been described and averted with hyaluronidase.<sup>2</sup> This is the first report describing skin necrosis in the alar region.

The vascular supply to the superior aspect of the nose is through the angular artery, whereas the infraorbital artery supplies most of the inferior portion. Both arteries and their respective branches have abundant anastomoses. The angular artery turns sharply in this region and is vulnerable to being clamped shut by extravascular pressure and occluded by actual intraarterial injection. Deep anatomy that may be vulnerable includes the medial and lateral crura of the alar cartilage, extending to the triangular cartilage. Despite the abundant blood supply to the nose, vascular compromise can occur, as evidenced by poor healing in smokers.

The mechanism of ischemia following filler injection may relate to vascular compression by increased tissue pressure, or to intravascular injection; the delayed onset of ischemia in this case likely favors a compressive mechanism.

Hyaluronidase dissolves the peptide bonds in the long-chain proteins within hyaluronic acid, increasing the mobility of the injected viscoelastic and allowing it to disperse more freely as oligoproteins through the tissue. Early injection of hyaluronidase might avert the onset of ischemic necrosis because of compression by hyaluronic acid. The lack of full-thickness alar necrosis in this case may have been predictive of a favorable outcome with observation alone.

Tissue necrosis is a feared complication of filler injections. The glabella and nasal ala may be vulnerable regions because of vascular anatomy. These cases are rare, and treatment recommendations are based on theoretical mechanisms and anecdotal reports. Massage and topical vasodilators have been shown to significantly increase blood flow in internal mammary artery grafts.<sup>3</sup> In the case of hyaluronic acids, hyaluronidase injections offer another treatment option, and their immediate use should be considered for emergency treatment of postinjection ischemia.

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**Fig. 1.** (Left) Epidermal sloughing and granulation tissue seen emanating from the sebaceous pores on postinjection day 3. (Right) The affected area was completely epithelialized without any contour abnormality or skin change by postinjection month 3.

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#### DISCLOSURE

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### Avulsion of the Corrugator Supercilii Muscle through a Closed Rhinoplasty Approach

Sir:

**P**atients presenting for rhinoplasty are generally young and do not need standard procedures for elimination of glabellar skin furrowing. Treatment of muscles

responsible for frowning (corrugator supercilii, procerus, and depressor supercilii) through routine rhinoplasty approaches can be the most ideal approach for reduction, or prevention, of glabellar skin furrowing in these patients. Avulsion of corrugator supercilii and procerus muscles through a closed rhinoplasty approach was initially performed by the first author (A.J.K.-H.) on patients complaining of frown lines. It was performed by continuing subperiosteal dissection of nasal bones over the frontal bone up to 25 mm superior to the nasion and up to 16 mm lateral to the midline on each side. Since 2004, it has been performed on all patients undergoing closed rhinoplasty because of its feasibility, excellent results, and satisfaction of patients. During a 3-year period, the severity of frown lines of 250 patients was rated before surgery and at the follow-up visit 1 year after the operation. Rating was performed on a scale from 1 to 5 by the patient and by the second and third authors, with 5 being the most severe.

Fifty-four men and 196 women were studied. The mean age was  $24.52 \pm 3.836$  years (range, 18 to 36 years). The mean preoperative and postoperative scales of severity of frown lines are listed in Table 1. The mean scale was decreased significantly (by 0.6454) after the operation ( $t = 17.351$ ,  $df = 249$ ,  $p < 0.001$ ) (Fig. 1). In the postoperative period, nearly all patients had some degree of hematoma in the glabellar region that was resolved by 2 weeks. There was no ecchymosis, no depression in the area of avulsion, and no dyskinesia of the muscles.

In the study by Janis et al.,<sup>1</sup> the most lateral and superior extent of the origin of the corrugator mus-

**Table 1. Mean Preoperative and Postoperative Scales of Severity of Frown Lines**

	No.	Minimum	Maximum	Mean	SD
Preoperative	250	1.00	4.67	2.0187	0.86046
Postoperative	250	1.00	3.33	1.3733	0.50274

cle was  $14.0 \pm 2.8$  mm and  $18.7 \pm 2.42$  mm from the nasion, respectively. Miller et al.<sup>2</sup> demonstrated that all supratrochlear branches are located more than 1.6 cm from the midline. Thus, our extent of dissection had no risk of nerve injury and avulsed most of the origin fibers. The transpalpebral approach to the corrugator supercilii and procerus muscles has become a standard procedure for the treatment of glabellar frown lines after its description by Knize<sup>3</sup> and Guyuron et al.<sup>4</sup> Although complete

resection of the corrugator muscle is advocated for a long-lasting and complete improvement in frown lines, its weakening through avulsion of its origin can be all that is needed in young rhinoplasty patients.

Kalantar-Hormozi and Beiraghi-Toosi<sup>5</sup> have proposed “rhinometry” for outcome assessment after rhinoplasty using actual measurements of the nose, but an objective yet simple and practical method for evaluating frown lines is not available. We used a scaling method similar to what Guyuron et al.<sup>4</sup> used for evaluation of results of corrugator supercilii muscle resection through blepharoplasty incision. This method demonstrated a significant decrease of the scale of severity of frown lines following the operation. Avulsion of corrugator supercilii and procerus muscles through a closed rhinoplasty approach is a simple and valuable adjunct to rhinoplasty for treatment of minimal frown



**Fig. 1.** (Above) Preoperative and (below) postoperative views of frown lines.

lines or, potentially, prevention of their progression.  
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### Reliability of the Helical Advancement Flap for Auricular Reconstruction

**Sir:**

**T**he chondrocutaneous helical rim advancement flap, first described in 1967 by Antia and Buch, has been used for its technical simplicity as a single-staged procedure, low risk of complications, and excellent cosmesis.<sup>1</sup> Surgical complications and viability of the helical advancement flap have been studied to a modest degree. Complications such as tip necrosis, hematoma, bleeding, infection, hypertrophic scarring, and contour deformity have been observed in past studies.<sup>2–4</sup> At the time of publication, this was the largest case series of its kind. By examining the results of this cohort of patients, the authors have found the helical advancement flap to be a reliable tool for the reconstructive surgeon.

Seventy-eight cases of helical reconstruction following oncologic reconstruction were reviewed (Fig. 1). The defect location dictates whether tissue will be advanced on an inferiorly or superiorly based pedicle. The anterior incision is made just under the edge of the



**Fig. 1.** The defects were all less than 2 cm in diameter, limited primarily to the skin, subcutaneous tissue, and down to the perichondrium.

helical furrow. The incision is then continued transversely across the rim of the auricle to include the near border of the wound to be closed. On the posterior aspect of the ear, a Burow triangle is completed, with the hypotenuse including the limits of the defect, and the apex of the triangle lying on the posterior aspect of the ear. The flap is then elevated along the length of the anterior incision (Fig. 2).

Forty-seven reconstructions (60 percent) were of the middle helix using an inferiorly based flap, and 31 were of the superior helix. Of the 78 patients, 17 (22 percent) were diabetics. Twenty-four patients (31 percent) were tobacco users, and 12 of 78 (15 percent) were diabetics and tobacco users.

Partial necrosis of the distal end of the flap was observed in two smokers (2.6 percent). One required a revision flap (1.3 percent). Four patients developed postoperative hematoma (5.1 percent), with three



**Fig. 2.** The flap is undermined in the subcutaneous plane back to the apex of the Burow triangle. On verification that the flap is adequate, the Burow triangle is then excised.

cases requiring a return to the operating room for control of bleeding. Remarkably, none of these were currently undergoing aspirin therapy.

Infection developed in two patients (2.6 percent). Both cases were managed effectively with antibiotics. Hypertrophic scarring was noted in five patients (6.4 percent), all of whom responded to three or fewer corticosteroid infiltrations (triamcinolone 25 mg/ml). No contour deformities, including collapse or flattening of the helical rim, were observed.

The helical advancement flap shows great versatility when considering defects from 1.5 to 3 cm. Our review of an unprecedented 78 cases affirms that the procedure carries an extremely low risk of complications, with no total flap failures. The rate of hematoma formation (5.1 percent) deserves mention. Fibrin sealants or possibly the use of drains or bolsters should be considered. However, hematomas rarely cause flap failure if properly evacuated. Hypertrophic scarring and keloids may be managed with intralesional corticosteroid injections with application of pressure, massage, and radiotherapy for refractory cases. Measures can also be taken to further improve cosmesis, with examples being the Burow triangle to decrease flap tension and use of Z-plasty to minimize undesired notching of the auricle. In addition, edge eversion may be improved with a vertical or buried mattress suture diminishing the risk of notching.<sup>2</sup>

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**DISCLOSURE**

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**Staggered Wedge Technique for Ear Reconstruction**

*Sir:*

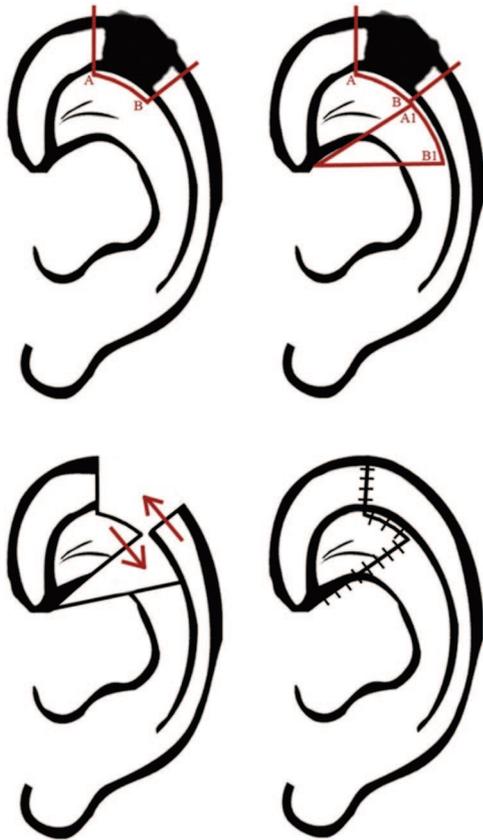
Simple wedge resection is widely used for reconstruction of full-thickness helical rim defects smaller than 1.0 to 1.5 cm.<sup>1</sup> For reconstruction of defects up to 2.5 cm, crescentic or star excisions can be used. However, these techniques can frequently cause skin contraction and ear cupping.

For defects smaller than 2.5 to 2.8 cm, we use a modification of the classic wedge resection, in which a full-thickness Burow triangle is excised superiorly or inferiorly to the helical rim defect. The principle of staggering the wedge, similar to the one of staggering an ellipse,<sup>2</sup> allows a better distribution of elastic forces than other techniques.

The lesion is outlined and the excision margins are decided. The planned defect is converted into a full-thickness rectangle. The width of defect is marked as AB. A Burow triangle of antihelix and concha is planned cranially or caudally to the helical defect. The triangle base is marked as A1B1 and has to be the same length as AB (defect). The triangle has to be isosceles and the bisector of the vertex angle has to be oriented toward a point localized at the root of the helix; this point is at the center of an ideal hemicircumference drawn at the level of the ear upper pole. The triangle is excised full thickness. The helical and antihelical edges are advanced and sutured together. The continuity of the helix and antihelix is reestablished in three layers, resulting in a Z suture line (Fig. 1).

We treated 52 consecutive patients from 2001 to 2004. Surgical margins were 0.5 cm for squamous cell carcinoma, 0.3 cm for basal cell carcinoma, and 0.2 cm for chondrodermatitis nodularis. The defect size after tumor resection with surgical margin control ranged from 12 to 28 mm. Patients had a follow-up period of 6 to 24 months.

All the defects were closed primarily without tension along the suture line. There were no early or late



**Fig. 1.** Staggered wedge technique.

complications. Aesthetic results were satisfactory in 49 patients (94 percent), with an acceptable decrease of auricular size.

Our technique is quite similar to the one described by Ferri, in terms of excising a full-thickness Burrow triangle but lacks the second incision at the helical root level.<sup>3</sup> Aesthetic results of the reconstructed ear are guaranteed by balancing forces on the frontal and sagittal planes. Furthermore, anatomical landmarks and relative proportions are preserved.

The range of defects that can be reconstructed by the staggered wedge technique is usually between 1.0 and 2.5 cm. Larger ears can tolerate larger wedge excisions, up to 2.8 cm in our experience (Fig. 2). Helical defects larger than 2.8 to 3 cm definitively require flap reconstruction such as with the Antia and Buch flap<sup>4</sup> or other modifications.<sup>5</sup>

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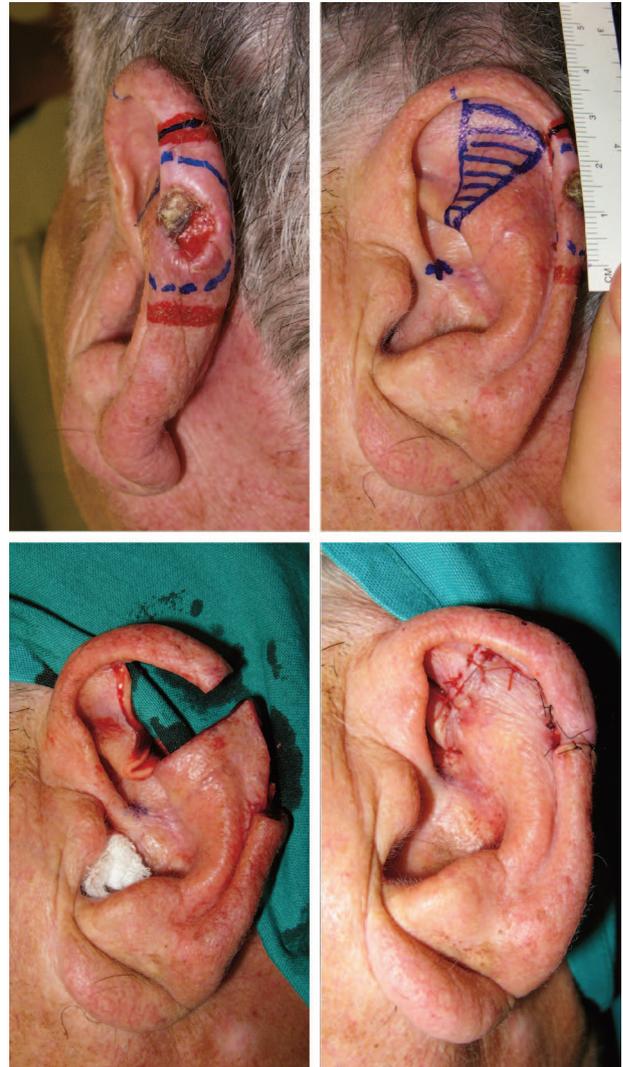
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**Fig. 2.** Defect of 2.8 cm of helix reconstructed with the staggered wedge technique.

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## Repairing the Loss of Areas of the Palpebromalar Region: A Modified Mustardé Skin Flap Technique

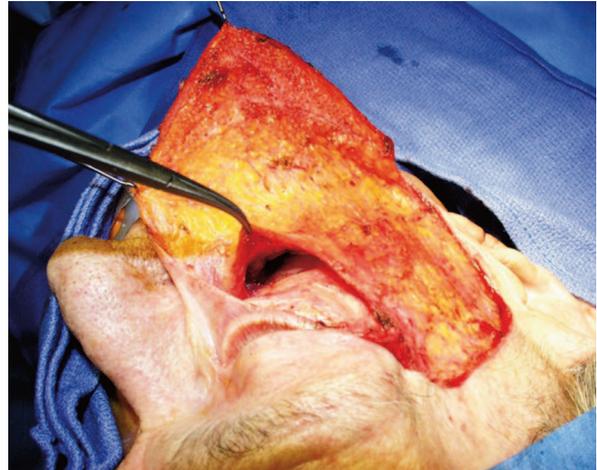
**Sir:**

**F**irst described by Mustardé in 1971, the advancement-rotation temporojugal skin flap has been used largely for the loss of areas of the cheek, the temple, and the inferior eyelid.<sup>1</sup> Reconstruction by a temporojugal flap using a deep plane sub–superficial musculoaponeurotic system (SMAS) flap, as first described by Barton and Zilmer and popularized by Kroll et al., is used when there is loss of temporojugal substances, or even the external canthus, where the SMAS is well-defined and separable.<sup>2,3</sup> However, the role of the SMAS is weak in the palpebromalar region. In effect, the palpebromalar region is the sum of two aesthetic units: the palpebro-orbital region, where the orbicularis oculi muscle plays the role of the SMAS; and the malar region, which is essentially constituted of subcutaneous fatty tissue.<sup>4</sup>

Consequently, we propose our temporojugal skin flap associated with a malar lift adapted for use in the case of loss of the palpebromalar area. This technique is of special interest in elderly patients, where the risk of ectropion is increased because of a defective skin-SMAS system. Our technique consists of the following:

1. Resection of the tumor according to the Mohs' technique.
2. Lesion repair after finding the margins of healthy tissue using biopsy excisions and microscopy: make the incision starting from the inferior eyelid in line with the lacrimal point, then make one upward and outward line starting from the lateral canthus and curving toward the tip of the eyebrow, then toward the temple and descending to 2 cm below the ear lobe. Then, move 1 cm forward perpendicularly.
3. Incision and broad dissection of the subcutaneous fat above the SMAS plane.
4. Rotation of the skin flap upward and inward.
5. Malar lift: separation of the subperiosteum of the malar fat pad and then fixation the periosteum of the margo orbitalis (Fig. 1).
6. Prior placement of the inferior eyelid under tension using lateral canthopexy: remove the inferior canthal lateral tendon from its orbital attachments, totally free the inferior eyelid and create a neotendon, which is then reinserted in the orbital periosteum at the desired position.
7. Subcutaneous fixation of the cutaneous-fat skin flap at the temporal aponeurosis to give anchorage points.
8. Cutaneous closure by separate points.

At the end of surgery, the cutaneous coverage is satisfactory and the stasis of the inferior palpebral region is conserved (Fig. 2).



**Fig. 1.** Malar lift: subperiosteum dissection.



**Fig. 2.** Conservation of the stasis of the inferior palpebral region.

The aim is to achieve a deep plane with vertical traction, which is fixed firmly to the periosteum.<sup>2,3,5</sup> Use of the sub-SMAS is feasible for the loss of substance of the temporal or the external canthus. However, the SMAS is limited to the lower palpebral and malar regions with the loss of central or paracentral substance. With the same purpose as deep dissections, we propose a subperiosteal detachment of the malar region with vertical traction. Associated with a classic lateral canthopexy, the malar lift provides major support for the inferior eyelid. This technique should be used for the reconstruction of large defects of the inferior eyelid and the malar region.

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### DISCLOSURE

The authors have no financial or commercial interests to disclose.

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## Subcision with a Wire Dissector as an Approach to Human Immunodeficiency Virus Lipoatrophy

Sir:

**H**uman immunodeficiency virus (HIV)-associated lipodystrophy is a condition of altered fat distribution that includes lipohypertrophy of the neck, trunk, and breasts and lipoatrophy of the face and extremities. This condition is a complication of treatment with highly active antiretroviral therapy for HIV. The most prominent feature is facial volume loss affecting the maxillary, nasolabial, and temporal regions resulting in a “sunken-in” appearance of the cheeks and sides. The changes in facial features and body contour can undermine the patient’s self-esteem, which consequently may threaten their compliance with HIV treatment and negatively impact their quality of life.<sup>1,2</sup>

The management of this condition can be challenging. Discontinuation of highly active antiretroviral therapy does not result in improvement of lipoatrophy,<sup>3</sup> and no treatment has conclusively been shown to reverse the side effects of highly active antiretroviral therapy.<sup>4</sup> Several minimally invasive treatment modalities can be applied for treatment of HIV patients.<sup>5</sup> These include soft-tissue fillers<sup>6–8</sup> and fat injections.<sup>9</sup>

Subcision therapy is a relatively new, minimally invasive procedure. Orentreich and Orentreich first formally introduced the “subcision” technique into the dermatologic literature.<sup>10</sup> With their technique, a sharp trocar needle is used for numerous applications such as scars, malar grooves, deep rhytides, acne scars, and cellulite. Subcision with a wire scalpel was introduced by Sulamanidze et al. with similar applications.<sup>11</sup> To prevent retraction after subcision, addition of spacer materials such as fat or poly-L-lactic acid (Sculptra; Dermik Laboratories, Bridgewater, N.J.) was introduced by Graivier.<sup>12</sup>

Applying these principles to facial lipoatrophy, subcision with a wire dissector can release the depressed, sunken-in submalar skin of HIV lipoatrophy. Dermal fillers can be used for volume restoration by injecting them into the subcutaneous pocket created by subcision. The purpose of this study was to report the use of subcision with a wire dissector as an adjunct to filler therapy in the management of HIV highly active antiretroviral therapy-associated lipoatrophy.

This report presents an institutional review board-approved, retrospective review of facial lipodystrophy patients treated by the senior author at the University of Illinois at Chicago Medical Center between July of 2005 and June of 2008. All patients were treated with injection of poly-L-lactic acid (Sculptra). The review focused on patients who initially failed to improve and were then also treated with subcision of the depressed skin. These patients underwent monitoring of their treatment progress with three-dimensional photography and standard digital photography.

The malar depression is marked carefully with three puncture sites to encompass the affected area. Two points are placed at the inferior and lateral margins of the defect. A third site is located 2 cm caudal to the medial canthus. Skin cleansing is performed with 10% povidone-iodine antiseptic solution, followed by 4% topical lidocaine applied for 20 minutes. The skin is then re-prepared and the dermis and subcutaneous tissues aggressively infiltrated with 1% lidocaine with epinephrine 1:100,000 to allow hydrodissection of the skin from the underlying neuromuscular structures.

The Diamond wire scalpel (Innovative Med, Inc., Irvine, Calif.) is a seven-strand braided wire attached to two needles. Another wire scalpel designed for subcision therapy is SurgiWire (Coapt Systems, Inc., Palo Alto, Calif.). Starting inferiorly, the needle sequentially enters and exits the skin on each previously marked spot, until it is delivered back through the initial puncture site. This way, the wire encompasses the abnormally retracted area.

A sawing action is created by pulling the wire ends in a to-and-fro motion, thereby pulling the wire dissector out through the inferior puncture and completely releasing the abnormally retracted skin. Pressure is held for a few minutes to achieve hemostasis.

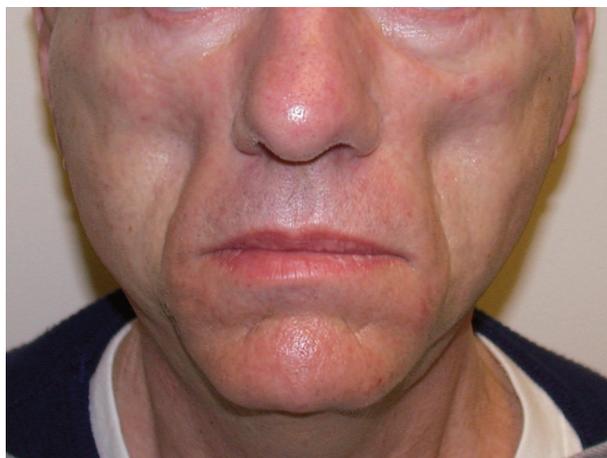
After the subcision, patients receive volume restoration by means of injection therapy of poly-L-lactic acid (Sculptra). One 150-mg vial is reconstituted at least 4 hours before the procedure with 5 ml of sterile water and 1 ml of 2% lidocaine. Approximately 1 to 2 ml of

poly-L-lactic acid (Sculptra) is injected through the malar puncture with a 25-gauge needle. One of the two patients had fat grafting into the treated area for further enhancement.

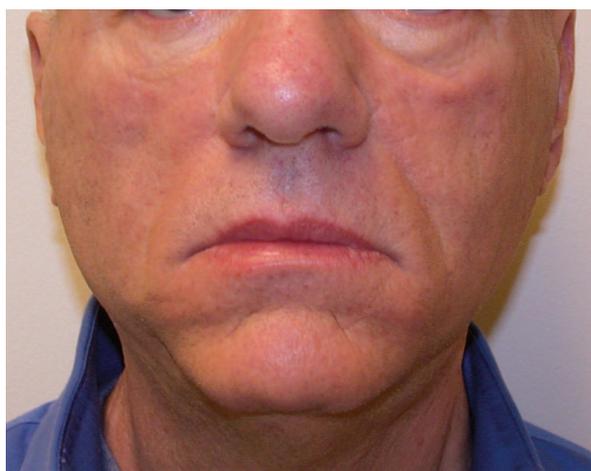
Ten patients were treated with Sculptra. Two of them were also treated with wire subcision, resulting in significant improvement of previously recalcitrant lipoatrophy (Figs. 1 and 2).

The first patient, a 59-year-old man with 16 years of highly active antiretroviral therapy and a stable HIV viral count, had previously been treated with two sessions of Sculptra injections, without improvement (Fig. 1). He was then treated with subcision to release the depressed dermis. After subcision, he underwent additional sessions of Sculptra 1 month apart. The final result was obtained by adding cheek fat grafting 3 months later.

The second “recalcitrant” case that we identified was a 45-year-old HIV-positive man who had been on highly active antiretroviral therapy for 6 years and who had also received unsuccessful filler injections.



**Fig. 1.** Patient 1, with persistent depression after repeated filler injections and before subcision.



**Fig. 2.** Patient 1 after subcision and repeated filler injections.

In an effort to treat the persistent malar depression, subcision was performed, followed by two Sculptra injections, 6 weeks apart. This resulted in resolution of the deformity. This patient’s treatment was complicated by a minor hematoma on the left cheek that resolved without intervention.

Although numerous techniques have been described for the management of facial HIV-related lipoatrophy, the treatment of this condition is still challenging. Several methods for the aesthetic improvement of HIV lipoatrophy have been described.<sup>5</sup> Autologous fat injections are the current standard therapy. The results, although often very satisfactory, are limited by resorption and sometimes by the lack of fat donor sites.<sup>9</sup>

Poly-L-lactic acid (Sculptra) has been approved by the U.S. Food and Drug Administration for restoration of facial lipoatrophy in patients with HIV. It triggers a delayed foreign body reaction coupled with collagen production. The clinical improvement is seen weeks or months after initiation of treatment and reportedly lasts up to 2 years.<sup>13</sup> The most common complication is formation of subcutaneous nodules after treatment.<sup>7,8</sup>

Wire subcision allows minimally invasive subcutaneous dissection and creates a pocket for placement of filler products such as poly-L-lactic acid and fat. This technique completely releases skin depressions seen with lipoatrophy. It had previously been described in aesthetic surgery for correction of depressed scars and deep wrinkles. To our knowledge, this is the first report of subcision as an adjunct to filler therapy for HIV malar lipoatrophy.

We conclude that subcision therapy with a wire dissector can be used as an aid to volume restoration in recalcitrant cases of lipoatrophy of the malar area. It can result in complete release of persistent depressions and thereby sets the stage for successful volume restoration.

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**DISCLOSURE**

*The authors have no commercial or financial associations to disclose regarding any product mentioned in this article.*

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### Update on Radiofrequency Ablation of the Frontal Branch to the Corrugator Muscles to Reduce Glabellar Frown Lines

Sir:

I have been a clinical investigator for GFX (now Relaxed Expressions), a procedure that uses radiofrequency ablation of the branch of the frontal nerve to the corrugator muscles to diminish glabellar frown lines, since the summer of 2007, presented some of my early experience with this technology at national meetings, and participated on the advisory board for this technology. My current experience is with 25 patients, and I am often asked where this technology and technique of reducing glabellar frown lines stands.

In short, it is not ready for prime time. There is no doubt the technique works and it can deliver a lasting result; however, it is unpredictable. Some results are good for 4 or 5 months and some for 12 to 14 months. The principal limitation is that the procedure is very painful. Despite nerve blocks, administration of oral analgesics at times, and much discussion among the

investigators as to the best method of anesthesia, a viable method to maintain patient comfort in a consistent manner has remained elusive. This has been the Achilles heel of this procedure and, in my hands at least, limited its application in the awake patient in the clinic setting. I have had some of my toughest patients tell me they would not endure the procedure again and would instead opt for botulinum toxin type A injections. I have spoken with other investigators, and my experience and conclusions are not unique.

So where does this technology make sense now? Of the last five procedures I have performed, three have been under general anesthesia, bypassing the negative patient experience and allowing me to be a bit more aggressive with the ablations and thus obtain a more long-lasting result. If your practice is principally peri-orbital or facial rejuvenation performed under general anesthesia, radiofrequency ablation of the frontal branch to the corrugator muscles can be an effective adjunctive procedure, performed in a manner that will not cause patient discomfort. Otherwise, with the ubiquitous presence, effectiveness, and popularity of botulinum toxin type A, it is hard to recommend this procedure in a daily clinic setting.

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### DISCLOSURE

*The author has served as a clinical investigator for GFX (now Relaxed Expressions owned by Bioform Medical). He has received travel support from Bioform Medical in the past, but has no financial interest in Bioform Medical, GFX, or Relaxed Expressions whatsoever.*

### Complex Salvage of a Failed Pharyngoesophageal Reconstruction with Impending Airway Disaster

Sir:

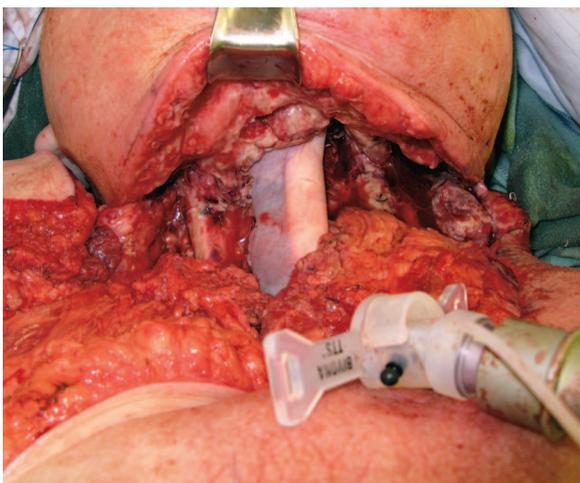
Patients with salvage laryngectomy after radiotherapy often require complex reconstruction and harbor multiple comorbidities, allowing little margin for error, where minor complications can lead to disastrous outcomes.<sup>1,2</sup> Surgical-site infections are the most common complications in oncologic head and neck surgery.<sup>3</sup> Those patients who undergo free flap reconstruction are also at risk for pedicle thrombosis and total flap loss. We present a case of a failed anterolateral thigh free flap reconstruction for a pharyngoesophageal defect caused by necrotizing neck infection. This life-threatening scenario, with exposed great vessels and airway compromise, was salvaged with multiple local/regional flaps.

A 56-year-old woman with poorly controlled diabetes and a 50-pack-year smoking history presented with recurrent laryngeal squamous cell carcinoma. Salvage

laryngopharyngectomy was performed where a near-circumferential pharyngoesophageal defect and neck skin defect were reconstructed with a two-skin island anterolateral thigh flap based on two perforators as described previously.<sup>2</sup> Postoperatively, she developed neck infection without systemic symptoms. Surgical exploration revealed an extensive infection deep in the neck, with necrosis of bilateral sternocleidomastoid muscles that were débrided. A planned second look the following morning revealed murky fluid along fascial planes in the neck and upper chest, further complicated with necrosis and dehiscence of the tracheostoma, and total flap loss. Only 5 cm of residual trachea remained after débridement.

At this point, the patient was in a life-threatening situation, with a large pharyngoesophageal defect, an unsecured airway, and exposed major neck and mediastinal vessels in the necrotizing fasciitis. A careful plan was formed to address each of these issues. The thoracic surgery department was consulted to resect the manubrium and clavicular heads and bring the trachea below the innominate artery. An internal mammary artery perforator flap<sup>4</sup> was tubed to reconstruct the trachea. Bilateral pectoralis major muscle flaps were used to cover the carotid and innominate arteries. Reconstruction of the pharyngoesophageal defect was accomplished with a skin graft that was sutured to the base of the tongue and esophageal remnant (Fig. 1), stented with a Montgomery salivary bypass tube, and covered with the muscle of a pedicled latissimus dorsi myocutaneous flap whose skin paddle covered the extensive neck and chest skin defect.

The Montgomery salivary bypass tube was removed 6 weeks later. Esophagoscopy and barium swallow study confirmed a patent, well-healed neoesophagus.



**Fig. 1.** Skin grafts were used as lining for pharyngoesophageal reconstruction, stented with a Montgomery salivary bypass tube, and covered with a pedicled latissimus dorsi muscle flap. Bilateral pectoralis major muscle flaps were raised to cover the carotid and innominate arteries. The trachea was “lengthened” with a pedicled internal mammary artery perforator flap.



**Fig. 2.** The patient has a well-healed latissimus dorsi skin paddle in the neck and upper chest and a secure airway at 6-week follow-up.

Bronchoscopy revealed a well-healed reconstructed cervical trachea. At 5 months postoperatively, the patient is tolerating a soft diet without airway compromise (Fig. 2).

This case represents a dreadful disaster in head and neck reconstruction. Although the anterolateral thigh flap has many advantages for pharyngoesophageal reconstruction,<sup>2</sup> it is not invulnerable to pedicle thrombosis caused by an overwhelming infection. A second free flap is usually not a viable option. A pedicled latissimus dorsi muscle with a skin graft provided reliable reconstruction in this case, which has not been reported in the English language literature. In such a life-threatening situation, priority should be given to securing the airway and protecting major vessels.

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### A Call for Clarity in TRAM/DIEP Zones

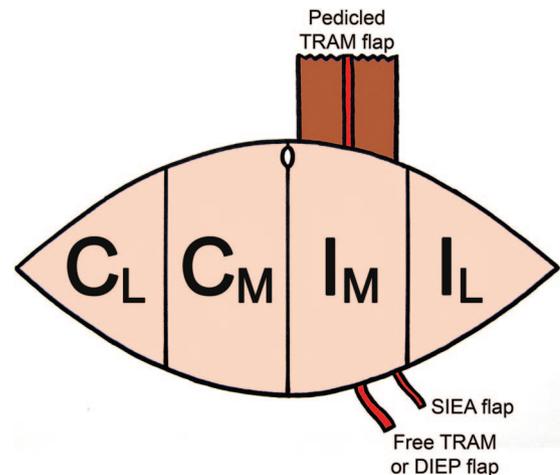
Sir:

As we were preparing an article on the deep inferior epigastric perforator (DIEP) flap, we were confounded by the confusing nomenclature describing the zones of this and related flaps. We feel that an accurate and unambiguous restatement of these zones is long overdue.

The muddle arose in 1983, when Schefflan and Dinner introduced the concept of perfusion zones of the pedicled transverse rectus abdominis musculocutaneous (TRAM) flap.<sup>1</sup> Based on an impression from their early experience with the flap, they named the area overlying the pedicle “zone 1,” the contralateral-medial area “zone 2,” the ipsilateral-lateral area “zone 3,” and the contralateral-lateral area “zone 4.” Evidently, it soon became clear to them that their initial nomenclature did not reflect the true order of perfusion, and in their follow-up article from the same year they switched zones II and III,<sup>2</sup> perhaps using roman numerals to distinguish the new system from the old. Although the use of roman numerals caught on, the new system did not, as the initial nomenclature had already been popularized.

Numerous investigators have repeatedly validated the revised zones and have shown that they apply not only to the pedicled TRAM flap but also to the free TRAM and DIEP flaps. Our group showed that they also apply to the superficial inferior epigastric artery flap.<sup>3</sup> Clearly, the initial nomenclature is misleading with regard to the perfusion of any of these flaps. However, misnomers die hard, and the old system remains in wide use. The terms “zone II” and “zone III,” if used without qualification, are therefore utterly ambiguous. Clarification is sometimes attempted with the term “Hartrampf zones,” which is indeed clear but denies eponymous credit to those who first described the zones and ignores the fact that the initial description is inaccurate; and if the term Hartrampf zones is used for the initial nomenclature, what should be used for the revised nomenclature—“Schefflan-Dinner zones”? However, those authors are associated with the initial nomenclature too.

Rickard suggested that the zones be renamed according to Taylor’s angiosome concept, but this would result in a cumbersome system of up to seven zones, and the same area would assume a different name depending on which source vessel was used.<sup>4</sup> Shoaib and Marucci felt that zones II and III should both be called zone II, because both are adjacent to the axial angiosome, and zone IV should be called zone III, because it is one more angiosome away.<sup>5</sup> However, their sug-



**Fig. 1.** Our proposed zones, applicable to the pedicled TRAM, free TRAM, DIEP, and superficial inferior epigastric flaps.

gestion neglects the fact that zones II and III are clinically distinct. Furthermore, as numerals are also used to describe the zones of an abdominoplasty flap, they are inherently confusing in the context of abdominal territories and should be avoided altogether.

To minimize ambiguity yet maintain simplicity, we propose the use of letters to specify the zones, using I and C (for ipsilateral and contralateral) and the subscripts M and L (for medial and lateral). Thus, the four zones would be (in order of perfusion)  $I_M$ ,  $I_L$ ,  $C_M$ , and  $C_L$  (Fig. 1), and would be applicable to any of the flaps using this tissue. Note that our system departs from previous ones in that it describes location rather than perfusion. No system can represent both without becoming unwieldy, and because the perfusion order has been so thoroughly proven and widely accepted as to be almost self-evident, we feel that location is the more useful descriptor.

We hope that publication of our proposal in *Plastic and Reconstructive Surgery* will spur its use in the literature. The benefits will go both to students who learn about these flaps and to those who, like ourselves, write about them.

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### The Relationship between Hand Dominance and Breast Size Difference in Congenital Breast Asymmetry

Sir:

Congenital developmental asymmetries have a tendency to favor one side over another. The role of hand dominance in relation to developmental asymmetries has been the subject of a few studies.<sup>1</sup> We investigated the possible relationship between hand dominance and congenital developmental breast asymmetry.

We reviewed all patients undergoing surgical correction for congenital breast asymmetry during a 5-year period between 2003 and 2008. Case note review was performed and a postal questionnaire was conducted asking patients about their hand dominance. Breast size difference was classified into two categories: right greater than left, and left greater than right. Statistical analysis using a Fisher’s exact test was performed to assess the relationship between hand dominance and breast size difference.

During the study period, 88 patients underwent surgical correction for breast asymmetry. The response rate was 64.8 percent (57 respondents), with a mean age of 28 years. The majority of patients (84.2 percent) were right handed. Breast size difference revealed that the left breast was more frequently the smaller of the two breasts (61.4 percent). The relationship between breast size difference and hand dominance is shown in Table 1. Fisher’s exact analysis revealed no statistically significant association between hand dominance and breast size difference ( $p = 0.238$ ).

Breast symmetrization may be disturbed by a number of intrinsic and extrinsic factors. A size difference between similarly shaped breasts may arise as a consequence of dissimilar volumes of primordial breast cells or differential response to hormonal stimulation.<sup>2</sup> The

**Table 1. Relationship between Hand Dominance and Breast Size Difference**

Size Difference	Hand Dominance		Total
	Right	Left	
Right > left	28	7	35
Left > right	20	2	22
Total	48	9	

importance of estrogens in breast development and growth is well established.<sup>2,3</sup> The role of hormonal influences in determining hand dominance has also been reported in the literature. Intrauterine exposure to diethylstilbestrol has been associated with a higher prevalence of left-handedness.<sup>4</sup> Diethylstilbestrol, a synthetic estrogen, has the ability to cross the blood-brain barrier and exert an effect on cerebral tissue that may influence cerebral lateralization.<sup>4</sup> The relationship between hormones and hand dominance is further strengthened by the finding that there may be a possible association between handedness and risk of breast cancer.<sup>5</sup> It has been postulated that the higher incidence of breast cancer in left-handed individuals may be attributed to high intrauterine estrogen exposure.<sup>5</sup>

We have failed to show, in our series, any significant correlation between hand dominance and breast size difference in congenital breast asymmetry. It may be hypothesized that congenital conditions resulting in asymmetry may have some relationship to hand dominance. The factors influencing breast symmetrization and hand dominance are not completely understood. There exists evidence to suggest a relationship between hand dominance and estrogens.<sup>4</sup> This in turn may influence breast development and growth. Larger studies may elucidate whether such a relationship truly exists. DOI: 10.1097/PRS.0b013e3181d51570

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### An Improved System for Large Volume Lipomodeling

Sir:

Lipomodeling is in widespread use due to its successful demonstration by Coleman and Saboeiro<sup>1</sup> and others. One of the time-consuming factors is the



**Fig. 1.** Fat is harvested using liposuction equipment with the fat harvest cannula. The liposuction is performed at low pressure (<300 mmHg).

transfer of 10-cc aliquots to the centrifuge when large volumes are required, such as in breast reconstruction. This can be streamlined by using low-pressure mechanical liposuction and a collection bottle in series with the liposuction tubing.

We use a standard suction drain bottle (Braun) in series with the lipoaspiration cannula to collect the lipoaspirate (Fig. 1). Lipoaspiration is performed at low pressure to reduce barotrauma.<sup>2</sup> The lipoaspirate is collected rapidly in the drain bottle, with the effect of minimizing desiccation while allowing rapid harvesting of fat. At the same time, the “drain bottle” reservoir allows rapid and accurate dispensing of 10-ml aliquots



**Fig. 2.** Syringes are rapidly processed and centrifuged. This particular drain bottle has a rubber concertina, which facilitates filling of 10-cc syringes. Each syringe contains approximately 60 to 70 percent fat after centrifugation.

into syringes for centrifugation (Fig. 2). The system is closed, thereby minimizing the risk of contamination. This means that lipoaspirates are prepared in the minimum amount of time for centrifugation. If the centrifuge cycle is 3 minutes, this produces approximately 30 cc of purified lipoaspirate every 3 to 4 minutes—about as fast as the surgeon can inject it.

Lipomodeling has become an essential tool with a multitude of applications both in primary breast reconstruction and in the treatment of aesthetic sequelae. When used appropriately, mechanical liposuction does not significantly alter the survival of adipocytes compared with manual liposuction.<sup>3,4</sup> Other factors, such as time to transfer and use of rinsing solutions, can be more detrimental.<sup>3,5</sup> The technique used for the injection of fat grafts is of paramount importance. This method provides safe, efficient, sterile, and rapid harvest and transfer of free fat grafts and allows the surgeon to focus on the placement of the fat grafts.

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## Can a Revascularized Thumb Survive with No Digital Arterial Inflow?

**Sir:**

**A** successful revascularization of the thumb distal to the metacarpophalangeal joint was performed following a rope avulsion injury that resulted in an incomplete nonviable thumb amputation. All the structures were transected completely except for the flexor pollicis longus tendon (Fig. 1). The revascu-



**Fig. 1.** Incomplete nonviable right thumb amputation following rope avulsion injury (day 0).



**Fig. 2.** The revascularized thumb 2 days after the patient hit his thumb accidentally (day 14). Note that the thumb had a bluish hue at the pulp and seemed to be recovering.

larized thumb remained viable with normal capillary refill and well-documented arterial Doppler signal distal to the arterial anastomosis on the ulnar aspect and the radial aspect of the thumb. The patient was discharged on day 10 and was kept on aspirin. His spouse, being a doctor, reported a well-perfused thumb and good Doppler signal until day 11 after surgery. At day 12, the patient presented to the emergency department following an accidental injury of his revascularized thumb 6 hours previously. The examination in the emergency room showed a sluggish capillary refill at the tip of the thumb, and no Doppler arterial signal could be identified. The tip of the revascularized thumb had no bleeding after multiple pin pricks. The patient was kept on daily aspirin with no exploration. At day 14, there was fair perfusion to the thumb, including the tip, with slow capillary refill (Fig. 2). There was still no detectable arterial Doppler signal distal to the anastomosis in the thumb. On day 24, the revascularized thumb had good perfusion with normal capillary refill at the tip. Five months after surgery, the patient had a sensate and functional thumb.

Presumably, the success of a replanted digit should be dependent on pedicle patency until adequate neovascularity has developed between the replanted digit and the recipient bed. However, it remains unknown when and how soon this occurs after a successful digital revascularization-replantation. Also, it is not yet known whether and when a digit continues to remain viable after replantation when the arterial supply is no longer available. Several experimental and clinical reports examined the question of when a pedicle, either arterial or venous or both, can be divided and still allow for flap survival.<sup>1</sup>

This pertinent literature suggests that a free flap may survive totally if the pedicle is divided as early as 10 to 14 days after transfer. Although providing significant information on the association between soft-tissue viability and timing of pedicle division, these studies were

conducted on soft-tissue flaps and were not designed to investigate bone survival. Rabbit ear and rat tail replantation models have provided reliable models for human digit replantation; however, investigators have not looked at the association between replant viability and timing and pedicle patency.<sup>2-5</sup> The information gained with this case report is noteworthy of documentation:

1. The case shows that a revascularized digit can remain viable even if the arterial inflow is no longer available as early as 12 days.
2. The arterial anastomosis following an accidental injury may have gradually thrombosed and this may have provided a graded stimulus for arterial revascularization of the replanted digit after day 12.
3. The hand-held Doppler device has been very informative throughout the follow-up with regard to checking the patency of the arterial inflow.
4. An arteriogram would have provided more insight as to whether any arterial flow existed.
5. Waiting 2 to 3 days after the accidental injury to the revascularized thumb gave us the chance to avoid amputation completion.
6. Similar cases should be appraised individually to make a decision for surgical exploration.

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### Costal Cartilage Autograft Harvest: Inferior Strip Preservation Technique

**Sir:**

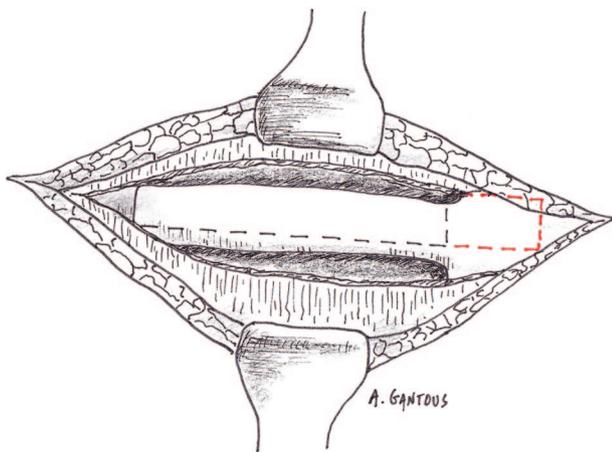
**V**on Mangoldt first described using costal cartilage as grafting material for nasal reconstruction in 1889.<sup>1</sup> Costal cartilage is ideal when a significant degree of augmentation is needed for volume filling and reconstructing nasal skeletal architecture. Indications include saddle nose deformity, congenital nasal deformity, significant underprojection, non-Caucasian race, and revision rhinoplasty.<sup>2</sup>

Disadvantages include donor-site morbidity, increased operative time, and graft warping. Pneumothorax is a serious but avoidable complication with careful elevation of the perichondrium on the rib undersurface. Pain control is the chief disadvantage for patients, and is most apparent during sudden movements, stretching, and when sitting up.<sup>3</sup> Our novel modification of harvest technique, preservation of an inferior cartilaginous strip, minimizes pain, the most clinically significant drawback (Fig. 1).

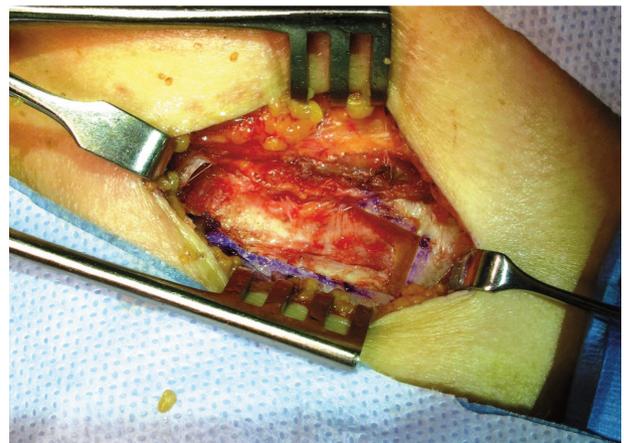
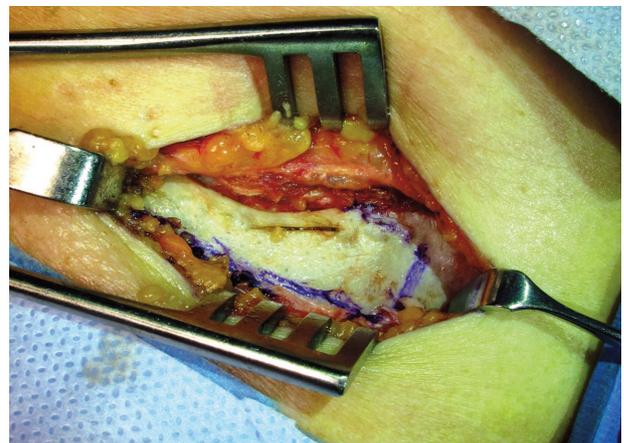
A 3- to 5-cm inframammary incision overlying the sixth rib is made. Subcutaneous and fascial layers are dissected with electrocautery to the external oblique

muscles, which are incised over the identified costal arch. The overlying perichondrium is incised longitudinally along the rib axis. Meticulous subperichondrial elevation is performed anteriorly and posteriorly (Fig. 2). The desired segment of cartilage is excised with a no. 20 blade, with an elevator on the rib undersurface protecting the thoracic cavity. In standard harvesting techniques, a full segmental piece from the osteocartilaginous junction to its junction with the sternum is removed. We preserve an inferior cartilaginous strip in continuity from bony junction to sternum.<sup>4</sup> Subsequently, the perichondrium is inspected to ensure that continuity, hemostasis, and layered closure are performed.

Facial plastic surgeons often face complex nasal defects necessitating costal cartilage grafting. Donor-site pain is the chief drawback of costal cartilage harvest. Our modification of standard rib autografting techniques minimizes morbidity by preserving rib arch continuity, minimizing mobility. This technique provides abundant grafting material and has successfully been



**Fig. 1.** Schematic representation of the inferior strip preservation technique for harvest of autologous costal cartilage. The *outlined area* represents the portion from the superior aspect of costal cartilage to be sharply excised. The *red outline* represents the costal cartilaginous-sternal junction.



**Fig. 2.** (Above) Intraoperative image depicting the portion of costal cartilage to be excised (outlined), whereas the strip of cartilage inferior to the demarcated region will be preserved. (Below) Subsequent to excision, a strip of cartilage is preserved inferior to the graft harvest site in full continuity from the bony junction to the sternum.

used by the senior author in over 70 consecutive cases.

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**DISCLOSURE**

*None of the authors has any commercial associations or financial disclosures that may pose or create a conflict of interest.*

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**Pain Control in the Anterior Iliac Crest following Bone Graft Harvest**

Sir:

For the purpose of repairing the alveolar cleft, we most commonly use the anterior iliac crest as our primary donor site.<sup>1</sup> Pain at this harvest site is a significant source of morbidity for many patients and the most frequently cited complication following bone grafting.<sup>2</sup> There have been reports in other fields of continuous local anesthetic infusion by means of postoperative pain pump directly into the anterior iliac

crest donor site.<sup>3,4</sup> To date, there have been no reports of such techniques for postoperative pain control in the pediatric cleft population following alveolar bone grafting. Through the use of a local bupivacaine hydrochloride infusion pump at the donor site, we have significantly reduced postoperative pain and thus decreased narcotic usage and length of hospital stay in the pediatric population undergoing iliac crest bone graft harvest.

Analysis of 40 consecutive alveolar bone grafts performed by a single surgeon (J.A.G.) between 2003 and 2008 revealed that the first 20 were managed for pain control primarily with postoperative analgesics, whereas the following 20 underwent insertion of a local 0.25% bupivacaine continuous infusion pump (2 cc/hour) at the iliac crest donor site. In addition, each of these pumps was programmed to deliver a bolus of 1 cc/hour when demanded by the patient. The groups were well matched for demographic characteristics, including mean age, sex, and the number of unilateral versus bilateral clefts in each group.

Those patients receiving local bupivacaine infusion by means of the pain pump exhibited a shorter mean length of hospital stay. The mean length of hospital stay in the nontreatment population was 2.9 ± 0.8 days, compared with 1.4 ± 0.5 days in the treatment population. Furthermore, the bupivacaine treatment group also showed lower morphine and codeine requirements postoperatively and lower subjective pain scale ratings postoperatively. All these findings were statistically significant (Table 1).

We have further substantiated the findings of significant positive effects of continuous local anesthetic administration at the iliac crest bone graft donor site.<sup>5</sup> For the first time, we have shown this to be the case in the pediatric cleft lip–cleft palate population. Our findings indicate that local bupivacaine administration, both at the cancellous bone harvest site and anterior to the periosteal and fascioaponeurotic planes, has a significant effect in reducing postoperative narcotic consumption and hospital stay. Furthermore, patients subjectively report lower pain levels when receiving this treatment.

Our current protocol is to place indwelling catheters anterior to the fascial closure, in all patients without contraindications, at the time of bone harvest. Dosing parameters are weight based and have been determined by our department of pharmacology. Patients and their families are given the options of catheter

**Table 1. Postoperative Data for Nontreatment and Treatment (Pain Pump) Cohorts**

Postoperative Data	Nontreatment Group	Treatment Group (0.25% Bupivacaine Pain Pump)	<i>p</i> (t Test)
Mean length of hospital stay, days	2.9 ± 0.8	1.4 ± 0.5	0.0077
Mean daily morphine use, mg/kg/day	0.19 ± 0.03	0.08 ± 0.01	0.047
Mean daily codeine use, mg/kg/day	1.7 ± 0.5	0.68 ± 0.18	0.032
Mean subjective pain rating on evening of surgery*	6.1	2.3	0.0058
Mean subjective pain rating on postoperative day 1*	5.1	1.5	0.014

\*Reported on a scale from 0 (no pain) to 10 (maximal pain).

removal at the time of discharge, self-removal at home, or return to clinic for removal after discharge. From a practical standpoint, placement of the catheter can result in increased drainage from the wound, and may require increased attention from the postoperative nursing staff. However, given the decrease in opioid use and length of hospital stay, this should result in an overall decrease in the nursing burden.

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#### DISCLOSURE

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### Labia Minora Reduction: Guidelines for Procedure Choice

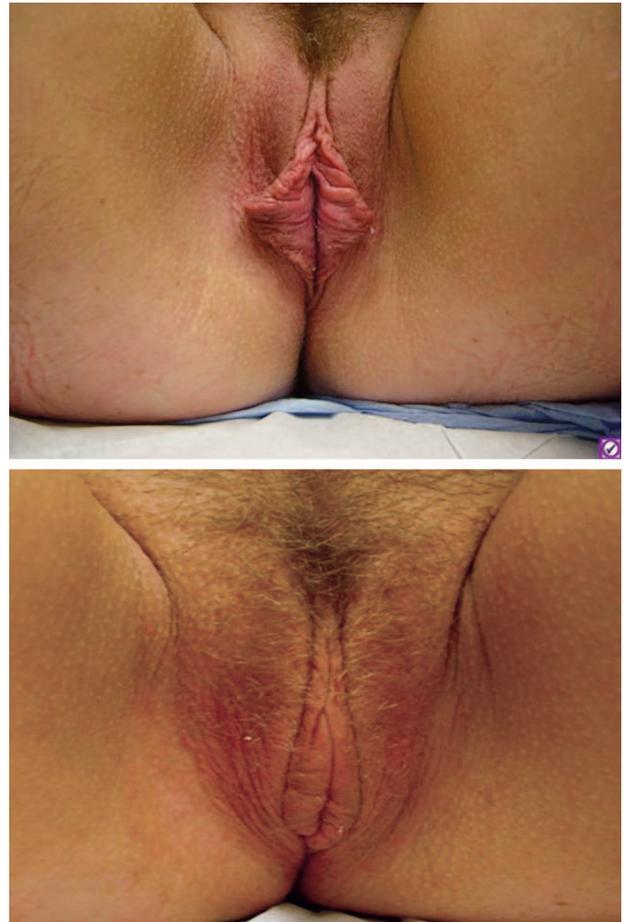
**Sir:**

The number of patients who undergo labia minora reduction continues to rise at an alarming rate. Affected women most commonly complain of social embarrassment and aesthetic concern; however, most women also report some functional limitation, including chronic infections or pain with sexual intercourse.

Perhaps because of significant variation in labial appearance and patient goals, no ideal procedure for

labia reduction has been identified. In our experience, three techniques are useful in labia minora reduction. Each technique carries with it a unique set of advantages that may be more appropriate in one patient over another. It is our belief that frank discussion of aesthetic goals with the patient will aid in identification of the appropriate procedure.

In our series of 12 patients, all women complained of the aesthetic appearance of their labia minora and six of the patients (50 percent) complained of difficulty wearing certain clothing. Four patients suffered pain with sexual intercourse (33 percent) and two patients suffered from chronic irritation and infections (17 percent). In addition to examination of the genitalia, we have found that an open conversation with the patient to identify her ideal labial aesthetic is advantageous. Some patients associate the normally darker, corrugated appearance of the labial edge with an “aged”



**Fig. 1.** This patient with large labia preferred to keep the natural labial edge color and contour. For this reason, she underwent the inferior wedge resection with a superior pedicle flap labia reduction. Preoperative photograph (above) shows significant labial hypertrophy, and follow-up at 5 months postoperatively shows significant reduction in labial girth and width, with preservation of the normal appearing labial edge (below).

appearance and prefer to have it removed. Others, however, prefer to keep this “natural” aesthetic. Because of the wide spectrum of patient desires, we find it important to identify the patient’s aesthetic goals before choosing surgical technique.

The three techniques used most commonly in our practices include the edge excision technique as described by Capraro<sup>1</sup> and Felicio,<sup>2</sup> which simply involves amputation of protuberant tissue, thus removing the dark, corrugated labial edge. A second procedure, the deepithelialization technique, introduced by Choi and Kim,<sup>3</sup> has been found useful for smaller labia in women who prefer to keep the labial edge aesthetic. The third and final technique is the superior pedicle technique with inferior wedge resection as described by Alter<sup>4</sup> and modified by Rouzier et al.<sup>5</sup> In this procedure, an inferior area is delineated for resection and a superior flap is designed for closure, again preserving a natural labial edge aesthetic in larger labia (Fig. 1).

In parallel with the increase in the number of women requesting aesthetic surgery of the female genitalia, the number of different techniques for labia minora reduction has increased as well. Labia minora reduction is usually and perhaps most easily performed by simple amputation of protuberant segments and closure of the edge.<sup>1</sup> We have found that a frank discussion with the patient regarding her aesthetic goals will identify a group of women more appropriately treated with a technique that preserves the labial edge aesthetic. For these women, other techniques such as deepithelialization and the superior pedicle technique should be considered.

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*The authors have no financial interests to disclose.*

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**Heparin-Induced Thrombocytopenia Leading to Flap Failure: *Hirudo medicinalis* and Implications**

**Sir:**

**A** major cause of flap failure in reconstructive microsurgery is thrombosis.<sup>1</sup> Recently, Tremblay et al. reported two cases of flap failure secondary to heparin-induced thrombocytopenia; they also described unexplained improvement of the flaps with leech therapy.<sup>2</sup> To prevent potentially life-threatening complications, heparin-induced thrombocytopenia is usually treated with a nonheparin anticoagulant such as argatroban or Coumadin.<sup>3</sup> *Hirudo medicinalis* (leeches) were first used to treat flap congestion in 1960.<sup>4</sup> Medicinal leeches increase blood flow within congested flaps by active feeding, and indirectly by passive bleeding from leech bite.<sup>5</sup> In this article, we report two flap failures in one patient secondary to heparin-induced thrombocytopenia, and that hirudin, a nonheparin anticoagulant secreted by leeches, kept one of the flaps viable because it was treating the heparin-induced thrombocytopenia.

A healthy 44-year-old male motorcyclist sustained a left lower extremity Gustilo grade IIIC fracture and a right clavicle fracture. Hematologic profile on presentation was normal. He underwent successful limb salvage and was placed on aspirin and Lovenox (Sanofi-Aventis, Bridgewater, N.J.) (chemoprophylaxis) postoperatively. After serial washouts and vacuum-assisted closure changes, he underwent open reduction internal fixation and reconstruction with a soleus flap and skin graft on postinjury day 18. Four days later, the soleus flap was necrotic and required débridement, surprisingly with an intact Doppler signal throughout the pedicle (Fig. 1). Ultimately, on postinjury day 29, a microvascular gracilis and skin graft reconstruction was performed; heparin was administered as a bolus (5000 units) intraoperatively and continued as a drip. However, in the immediate postoperative course, the gracilis flap became congested and exploration demonstrated a patent vein and artery. Heparin was discontinued; the flap remained congested and so leeches were started. Leech decompression was discontinued after 7 days because the flap appeared viable. However, shortly after discontinuation of leeches, muscle necrosis ensued (Fig. 2). With no clear cause for flap loss, we initiated a hypercoagulable workup and heparin-induced thrombocytopenia was diagnosed; in our patient, heparin-induced thrombocytopenia manifested as a relative reduction in platelet count and right basilar



**Fig. 1.** On postinjury day 22 (postreconstruction day 4), the soleus muscle flap demonstrates muscle necrosis despite arterial Doppler signal out to the distal tip of the muscle; the *darkened area* represents the area of necrosis.



**Fig. 2.** Gracilis muscle flap necrosis despite intact arterial and venous Doppler signal prompted a hypercoagulable workup that ultimately led to a diagnosis of heparin-induced thrombocytopenia.

vein thrombosis. He was treated with argatroban, underwent a successful cross-leg flap and skin graft reconstruction, and was discharged to home on Coumadin.

To our knowledge, this is the first report in the literature implicating leeches as a potential marker of heparin-induced thrombocytopenia. We observed two flap failures in our patient that we attribute to heparin-induced thrombocytopenia: the flaps had intact pedicles throughout despite muscle necrosis. With the free gracilis, the flap improved with initiation of leech therapy. We feel that this was attributable to inadvertent local administration of the hirudin secreted by the leeches. Hirudin is a potential treatment for heparin-induced thrombocytopenia, as it is an anticoagulant unrelated to heparin.

In summary, heparin-induced thrombocytopenia can cause flap failure by venous congestion. Flap salvage in the presence of leeches should alert the reconstructive surgeon to the possibility of heparin-induced thrombocytopenia, as the secretion of hirudin by leeches is essentially treating the thromboembolic complications associated with heparin-induced thrombocytopenia. More research is required to demonstrate and define the role of

hirudin in heparin-induced thrombocytopenia patients requiring flaps.

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#### **DISCLOSURE**

*None of the authors has a financial interest in or commercial affiliation with any of products or drugs mentioned in this article.*

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**Academic Plastic Surgery Leadership**

**Sir:**

The academic plastic surgeon leader is part of the hierarchy (university linkage) and tends to be identified by position. Peers look to him or her when they do not know what to do, or when they cannot be bothered to work things out for themselves. The academic plastic surgeon leader becomes the focus for answers and solutions; can give direction with emotional stability; has vision and initiative; is strongly motivated; and has ambition, energy, and tenacity. He or she demonstrates desire to lead but not to seek power as an end in itself.

Plastic surgery is very competitive. Where there are leaders, there are followers. To lead involves influencing others. Frequently, plastic surgeons will confuse leadership with authority. Authority is often seen as the possession of powers based on a formal role. Leaders can be seen as people who have the right to direct us. They do not simply influence, they also have to show that crises or unexpected events do not faze them. Leaders may have formal authority, but they rely in large part on informal authority. This flows from their personal qualities and actions. They may be trusted, respected for their expertise, or followed because of their ability to persuade. Leaders have authority as part of an exchange, because if they fail to deliver the goods, to meet people's expectations, they run the risk of authority being removed and given to another by those who have formal authority over them. However, we also need to consider the other side, the followers, who knowingly or unknowingly accept the right of the person to lead, and he or she is dependent on this. The leader also relies on followers for feedback and contributions. Without these, they will not have the information and resources to perform their job. Leaders and followers are interdependent. Leaders can respond adequately because they have a clear idea of what they want to achieve and why. Thus, leaders are people who are able to think and act creatively in nonroutine situations,<sup>1</sup> and who set out to influence the actions, beliefs, and feelings of others. In this sense, being a

leader is personal. It flows from an individual's qualities and actions. However, it is also often linked to some other role such as chief or expert. Not all chiefs are leaders, and not all leaders are chiefs. Chiefs are generally good managers and trained to administer. Leaders are more charismatic and flexible, have creativity, and will innovate. The chief will ask how and when, leaders will ask what and why; chiefs will focus on systems, leaders will focus on people; chiefs will do things right, leaders will do the right things; chiefs maintain, leaders develop; chiefs rely on control, leaders inspire trust; chiefs have a short-term perspective, leaders have a longer term perspective; chiefs will accept the status quo, leaders will challenge the status quo; chiefs have an eye on the bottom line, leaders have an eye on the horizon; chiefs imitate, leaders originate; chiefs emulate the classic good doctor, leaders are their own person; chiefs copy, leaders show originality.<sup>2</sup>

Finally, followers will recognize leaders for their integrity, self-confidence, professional credibility, personal commitment, quality improvement behaviors, cognitive ability, knowledge, and skills.

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**DISCLOSURE**

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**Quality of Reporting in Poster versus Oral Presentations at the American Society of Plastic Surgeons 2008 Conference in Chicago**

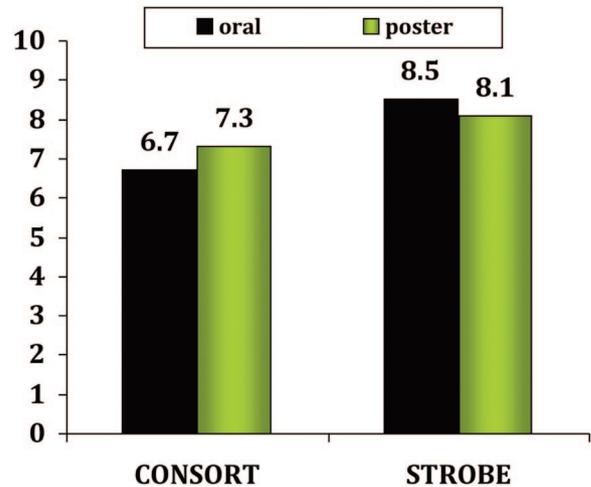
**Sir:**

Conference abstracts are a matter of debate. As such, the validity of a structured method of selecting abstracts for plastic surgical scientific meetings has been

discussed in *Plastic and Reconstructive Surgery* as early as in 2004.<sup>1</sup> Quality of reporting in plastic surgery congress abstracts is likely to influence clinical decision making. Often, poster presentations are thought to have a potentially minor impact and an inferior abstract quality in contrast to oral presentations at plastic surgery conferences. We therefore hypothesized that the quality of reporting in abstracts and the study design presented as oral presentation were higher than for poster presentations at the American Society of Plastic Surgeons 2008 meeting in Chicago.

A total of 65 oral abstracts and 94 poster abstracts from the American Society of Plastic Surgeons 2008 conference were analyzed independently by two researchers for study type and reporting quality of the abstract. Evidence-based criteria have been presumed to enhance the care of all patients by relying on science rather than opinions as stated in *Plastic and Reconstructive Surgery* in January of 2009.<sup>2</sup> However, as far as full articles in *Plastic and Reconstructive Surgery* are concerned, the rate of higher level evidence-based clinical studies remains low in comparison with the medical field.<sup>3</sup> In our abstract quality assessment, we determined the scores of 17 Consolidated Standards of Reporting Trials (CONSORT) criteria for randomized controlled trials, or 22 Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) criteria for observational studies.<sup>4,5</sup> Study design was determined based on evidence-based medicine criteria.

Sixty-eight percent of oral presentations and 81 percent of poster presentations were prospective studies ( $p = 0.058$ ). Randomized controlled trials were similarly frequent for oral (5 percent) and poster presentations (4 percent;  $p = 0.832$ ) (Table 1). Thirty-one percent of oral and 21 percent of poster presentations were experimental nonclinical studies. No differences in reporting quality were observed for randomized controlled trials (CONSORT score,  $6.7 \pm 1.2$  versus  $7.3 \pm 1$ ;  $p = 0.498$ ; 95 percent confidence interval,  $-2.62$  to  $1.46$ ) or observational studies (STROBE score,  $8.52 \pm 2.48$  versus  $8.07 \pm 2.29$ ;  $p = 0.387$ ; 95 percent confidence interval,  $-0.58$  to  $-1.48$ ) between oral and



**Fig. 1.** CONSORT score for randomized controlled trials ( $p = 0.498$ ; 95 percent confidence interval,  $-2.62$  to  $1.46$ ) and STROBE score for observational studies ( $p = 0.387$ ; 95 percent confidence interval,  $-0.58$  to  $-1.48$ ) presented as oral or poster presentations at the American Society of Plastic Surgeons 2008 Chicago meeting.

poster abstracts (Fig. 1). Poster abstracts were describing significantly more frequent new operation techniques ( $p < 0.001$ ). Oral abstracts demonstrated a significantly better quality for reporting of participants (53 percent versus 13 percent,  $p < 0.001$ ) and main outcome scores (98 percent versus 69 percent,  $p < 0.001$ ). External funding is generally underreported (0 percent versus 2 percent) for oral and poster abstracts.

We concluded that poster presentations at the American Society of Plastic Surgeons 2008 meeting have levels of evidence similar to those of oral presentations. Reporting quality of poster and oral abstracts is not significantly different for randomized controlled trials assessed by the CONSORT criteria and for observational studies assessed by the STROBE criteria. Thus, the primary hypothesis has to be rejected: poster abstracts were not of inferior quality or of lower evidence-based medicine levels compared with oral presentations at the American Society of Plastic Surgeons 2008 Chicago meeting. DOI: 10.1097/PRS.0b013e3181d51753

**Table 1. American Society of Plastic Surgeons 2008 Meeting Oral and Poster Presentations with Study Details**

	Oral Presentation		Poster Presentation		<i>p</i>
	No.	%	No.	%	
Prospective study	44	68	76	81	0.058
Retrospective study	21	32	18	19	0.058
Randomized controlled trial	3	5	4	4	0.832
Cohort study	0	0	2	2	0.237
Case control study	2	3	0	0	0.087
Case report	2	3	9	10	0.202
New techniques	0	0	16	17	0.001
Experimental	20	31	20	21	0.175
Total	65	100	94	100	

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## The Difficult Airway in Office-Based Anesthesia

**Sir:**

The skills required to anticipate and manage a difficult airway are very important skills that the anesthesia provider must possess. However, it is axiomatic that the night before surgery, the patient *was* breathing *room air* unassisted by any devices. (Note that this discussion excludes the sleep apnea patient who requires a continuous positive airway pressure device.) It is therefore anesthesia providers who may be *creating* the difficult airway by the choice of agents and style of administering them.

Managing patients who present for elective office-based surgery is not the same clinical problem as managing those charging down the hallway from the emergency room with ruptured aneurysms or managing those in labor and delivery with prolapsed umbilical cords. Despite the obvious differences between elective office-based patients and life-threatening hospital-based emergency patients, many anesthesia providers continue to routinely induce their elective office-based patients' anesthesia with a bolus of propofol (1.5 to 2.5 mg/kg).

The size of the propofol bolus is customarily determined by the patient's weight, with consideration given to age, premedication, general physical condition, prescription medications taken, alcohol consumption, recreational drugs taken admitted to (or not), and other subtle factors that come under the heading of clinical judgment or "best guess."

Patients are often premedicated with midazolam and fentanyl before propofol induction. Avoiding

the routine administration of preoperative opioids to patients who are not in pain will better preserve their drive to breathe spontaneously. Incrementally titrating propofol to a bispectral index monitoring value less than 75 and maintaining propofol at a bispectral index monitoring value of 60 to 75 has provided adequate amnesia in patients receiving propofol ketamine anesthesia between December 26, 1997, and March 26, 2002, eliminating the rationale for routine midazolam administration.<sup>1</sup>

A reasonable midazolam substitute has been oral clonidine,<sup>2</sup> provided that a 2.5- to 5.0-mg/kg concentration can be achieved.<sup>3</sup> For patients weighing between 95 and 175 pounds, 0.2 mg (or 200 µg) of oral clonidine 30 to 60 minutes preoperatively has been shown to be effective in reducing propofol requirements for both induction and maintenance with bispectral index monitoring.<sup>4</sup>

Wide clinical requirements for propofol are commonly recognized. Even in experienced hands, the best guess can often be in error. The explanation may lie in the 19-fold interindividual difference in how the drug is metabolized.<sup>5</sup> Induction doses based on body weight may overshoot many patients' individual hypnotic requirement.

Propofol in excess of requirement may produce a loss of airway muscle tone with transient apnea. Bolus propofol inductions may take a patient who was formerly able to maintain their own airway and breathe satisfactorily on room air and create a patient dependent on the anesthesia provider for ventilation and oxygenation. However, if one creates a "cannot ventilate, cannot oxygenate" situation secondary to a bolus propofol induction in the office setting, dire outcomes may result. Unlike a hospital or an ambulatory surgical center wherein alternative airway management services may be available, the office may have only a tracheostomy or a 911 call to offer. A tracheostomy scar is a decidedly unacceptable cosmetic outcome, with substantial medicolegal exposure.

One suggestion could be to avoid creating a difficult airway in the first place with a bispectral index monitored *incremental* propofol induction. With clonidine premedication and trending electromyography as a secondary trace to bispectral index monitoring, an incremental propofol induction rarely consumes more than 2 minutes. One clinical pathway for incremental propofol induction has been published<sup>6</sup> and is available gratis at [www.cosmeticsurgeryanesthesia.com](http://www.cosmeticsurgeryanesthesia.com).

Despite the advantages of avoiding creating a difficult airway, some anesthesia providers still feel "the more drugs they give, the better they feel." Perhaps Pogo was right, "We have met the enemy and he is us." DOI: 10.1097/PRS.0b013e3181d51741

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**DISCLOSURE**

The author is not employed by Aspect Medical Systems, Inc., makers of the BIS monitor, is not a stockholder, and is not a paid consultant.

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**What Is General Anesthesia?**

Sir:

On the surface, this would appear to be a simple, straightforward question, but the evolution of anesthetic agents and newer brain activity monitors have made this question somewhat more challenging. Local anesthesia provides analgesia only in a localized area. General anesthesia, in contradistinction, provides generalized analgesia in addition to generalized hypnosis. A simplified, working equation for general anesthesia may be hypnosis plus analgesia.

Implicit in hypnosis is amnesia. Implicit in (adequate) analgesia is enough relaxation to perform cosmetic procedures. In this author's experience with hundreds of subpectoral breast augmentations and rectus imbrication for abdominoplasties, adequate analgesia has obviated the need for muscle relaxants.<sup>1</sup> The patient safety benefits of propofol-ketamine anesthesia demand not perfection with local anesthesia but merely persistence.<sup>2</sup>

Conscious patients tend to say "ouch" with inadequate local anesthesia. Currently, no monitors exist with which to measure analgesia levels in patients receiving general anesthesia who are unconscious.

In 1996, the U.S. Food and Drug Administration approved the bispectral index brain monitor for measuring levels of hypnosis in patients receiving anesthetic agents. Over the years, bispectral index monitoring has been validated by over 3000 peer-reviewed, scientific articles.<sup>3</sup> Other brain activity monitors have been marketed by Baxter (PSA), GE Healthcare (Entropy), (Everest Biomedical Instruments (Snap), Cerebral State Monitor

(Danmeter), and Schiller Medical (Narcotrend). No monitor maker has produced any literature demonstrating validation or outcomes superior to the bispectral index monitoring device.

Decades-long established science has established the hypnotic portion of general anesthesia, as measured by bispectral index monitoring, occurring below 60 on a 0- to 100-point scale.<sup>4</sup> When a bispectral index monitoring value in this range is obtained with inhalational agents such as sevoflurane, it is obvious that general anesthesia is being administered (i.e., both generalized hypnosis and generalized analgesia are being administered).

Propofol titrated with bispectral index monitoring can produce all three levels of sedation (minimal, moderate, or deep) when combined with local analgesia only.<sup>5</sup> Coadministration of intravenous opioids (or narcotics) adds systemic analgesia that transforms an intravenous sedation technique into an intravenous general anesthesia.<sup>5</sup> Intravenous sedation without opioids does not require end-tidal carbon dioxide monitoring; however, intravenous general anesthesia with opioids does.

How does ketamine fit into the definition of general anesthesia? Although the *Physician's Desk Reference* classifies the agent as a "general anesthetic," the American Association for Accreditation of Ambulatory Surgery Facilities, since its inception (and in deference to one of its founding member's technique<sup>6</sup>) has recognized this dissociative agent as an intravenous sedation drug appropriate for class B facilities. Neither diazepam nor ketamine is a triggering agent for malignant hyperthermia. Diazepam-ketamine does not require an anesthesia machine for its administration. Accordingly, class B facilities do not need anesthesia machines, scavenging, or dantrolene for patient safety.

Bispectral index/propofol-ketamine monitored anesthesia care has been clearly, and repeatedly, published as propofol titrated to a bispectral index monitoring value of 60 to 75, followed by 50 mg of ketamine and local anesthesia only.<sup>7–9</sup> No opioids, nitrous oxide, or inhalational agents are given.<sup>7–9</sup>

Absent the administration of systemic analgesia and relying solely on local analgesia abetted with only a dissociative agent, bispectral index/propofol-ketamine monitored anesthesia is clearly intravenous sedation, appropriate for class B facilities, and is not general anesthesia requiring class C equipment. Not only is the interest of patient safety best served by a class B classification for bispectral index/propofol-ketamine monitored anesthesia care, it is also in the interest of an economically viable office operator.

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#### DISCLOSURE

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