



GUIDELINES

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Viewpoints

Unilateral Superficial Musculoaponeurotic System Plication in Facial Reconstructive Surgery

Sir:

The superficial musculoaponeurotic system (SMAS) was first described by Mitz and Peyronie in 1976.¹ It is a fundamental anatomic structure that serves as a reference for tissue undermining and structure for plication in rhytidoplasty, rejuvenation, and reconstruction.²

The SMAS may be plicated for several reasons, including rejuvenation of the aging face via rhytidectomy, facial paralysis and palsy, as well as facial reconstructive surgery. These techniques can produce long-lasting results. In the setting of facial reconstructive surgery, the benefits of SMAS plication include decreasing both wound edge tension and wound defect size.³ SMAS plication shifts the majority

of the wound closure tension from the dermal-subcutaneous junction to the fascia below. By minimizing the wound edge tension, scar appearance is optimized. Moreover, by reducing the wound defect size, less complex reconstructive options can be considered.

In this article, we discuss the anatomy of the SMAS and our experience with unilateral SMAS plication in the setting of facial reconstructive surgery to reduce both wound edge tension and wound defect size.

SMAS plication adds a minimal amount of time (approximately 5 minutes) to a standard wound closure. The additional cost is simply that of two to three sutures. If the wound is under significant tension and tissue restraint, undermine in the tissue plane superficial to the SMAS to avoid injury to the neurovascular structures below. Plicate the SMAS by placing the suture at the leading edges of the surgical defect. Either absorbable or nonabsorbable sutures may be used. To minimize facial distortion, especially that of adjacent free margins, the vector of plication should be selected carefully. To maintain the lift, it may be necessary to use nonabsorbable sutures and/or to anchor the tissue to the periosteum or the deep temporal fascia. Patients should be instructed to avoid forcible movement of the skin, which may remain tight for as long as 3 weeks. In addition, patients should be reassured that the asymmetry resolves over the next several months with excellent aesthetic outcomes.

Between June of 2006 and July of 2007, a total of 30 patients underwent unilateral SMAS plication after Mohs micrographic surgery. Of these, 77 percent (23 of 30 patients) were men and 23 percent (seven of 30) were women. The average age was 63.9 years (range, 36 to 84 years). The wound characteristics (defect location, size, and closures) are described in Table 1. The average defect area was 3.83 cm² (range, 0.63 to 11.02 cm²). Average follow-up was 9.67 months (range, 1 to 15 months).

Fifty percent of closures (15 of 30 closures) were linear; the remaining 50 percent were adjacent tissue rearrangement. There were no hematomas or infections. Some patients noted subtle tightening, lasting from 1 week to 2 months. Only a few patients noted mild facial asymmetry in the early postoperative course, and in all cases, the asymmetry resolved 2 to 3 months postoperatively. All patients were satisfied with the cosmetic results (Fig. 1).

Unilateral SMAS plication before suturing of the overlying tissue provides excellent functional and cosmetic results. By reducing wound tension and wound size, repairs are often less complex than anticipated.

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Table 1. Wound Characteristics and Closures

Patient	Defect Location	Final Defect Size (cm)	Area (cm ²)	Closures
1	Right temple	1.8 × 1.9	3.42	CLC, S-plasty
2	Right medial forehead/suprabrow	1.3 × 1.8	2.34	CLC, M-plasty
3	Left nasolabial fold	2.6 × 1.4	6.76	CLC, M-plasty
4	Right temple	3.5 × 2.5	8.75	Rhombic transposition, Z-plasty
5	Right cheek	1.4 × 0.9	1.26	CLC
6	Left neck	2.0 × 1.5	3.00	CLC
7	Right preauricular	2.0 × 1.7	3.40	CLC, S-plasty
8	Right temple	3.8 × 2.9	11.0	Advancement, Mercedes design
9	Right cheek	3.0 × 2.0	6.00	CLC, S-plasty, M-plasty
10	Left nasal sidewall	0.9 × 0.7	0.63	CLC
11	Left forehead	1.3 × 1.0	1.30	CLC
12	Right preauricular	3.0 × 2.6	7.80	FTSG
13	Left medial forehead	2.8 × 2.8	7.84	CLC, M-plasty
14	Frontal scalp	2.2 × 2.0	4.40	CLC
15	Left occipital scalp	1.2 × 1.2	1.44	CLC
16	Left cheek	1.4 × 1.0	1.40	CLC, M-plasty
17	Right forehead	1.1 × 1.1	1.21	CLC
18	Left cheek	1.5 × 1.0	1.50	CLC, M-plasty
19	Right neck	2.6 × 1.5	3.90	CLC
20	Right upper cutaneous lip	1.2 × 1.1	1.32	CLC
21	Right forehead	2.3 × 1.8	4.14	CLC
22	Left forehead	2.3 × 1.0	2.30	CLC
23	Right temple	2.9 × 1.8	5.22	CLC
24	Right mandibular angle	3.0 × 2.7	8.10	CLC
25	Left cheek	2.6 × 2.0	5.20	CLC, M-plasty
26	Central forehead	1.0 × 0.8	0.80	Rotation, double O- to Z-plasty
27	Right forehead	1.7 × 1.2	2.04	Rotation, double O- to Z-plasty
28	Right temple	1.8 × 1.6	2.88	CLC
29	Right forehead	1.3 × 1.1	1.43	CLC
30	Left neck	2.1 × 1.9	3.99	CLC

CLC, complex linear closure.



Fig. 1. (Above) Immediate postoperative appearance. (Below) Three-week postoperative appearance.

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Vacuum-Assisted Closure for Wound Dehiscence in Head and Neck Reconstruction

Sir:

Vacuum-assisted closure has been widely implemented for complex wounds of the torso and extremities, but it has not been widely used in compli-

cated head and neck wounds. The vacuum-assisted closure system has been advocated for use in scalp injuries, pharyngocutaneous fistulas, and donor-site defects, and as a bolster dressing for skin grafts.¹ Its scope of utility should be expanded to include wound dehiscence following free tissue transfer.

The authors describe a 67-year-old man who presented with T4N0M0 squamous cell carcinoma of the left floor of the mouth and alveolar ridge. The patient underwent neck dissection and composite resection of the left floor of the mouth, alveolus, segmental mandible, and involved skin with fibular free tissue transfer. A 6-cm mandibular reconstruction plate was used to secure a 5 × 5-cm fibular flap to the mandibular defect (Fig. 1). Skin defect was closed with a cervical advancement rotation flap. By postoperative day 10, frank dehiscence was noted that resulted in exposed bone (both native and free flap tissue) externally at the neck and chin (Fig. 2). Wet to dry dressings were applied for the next 7 days, with interval debridements. As minimal granulation tissue was appreciated, a vacuum-assisted closure system was applied to the areas of dehiscence. Within 3 days of use of the device at 125 mm Hg, a dramatic increase in granulation tissue occurred. On postoperative day 25, the patient returned to the operating room for a full-thickness skin graft to the left chin. Use of vacuum-assisted closure was continued on the chin and neck for 4 more days at 100 mm Hg, resulting in wound closure and excellent graft viability.

Vacuum-assisted closure has been widely used since the technology was first introduced by Morykwas et al. in 1997.² It has since been approved for treating infected sternal wounds, chronic pressure and diabetic ulcers, open abdomens, skin graft sites, and contaminated open fracture sites.^{3,4} Use of vacuum-assisted closure in head and neck reconstruction has been less avidly embraced for a multitude of reasons. Complex wounds are frequently associated with intricate contours and orifices of the head and neck.³ In addition,

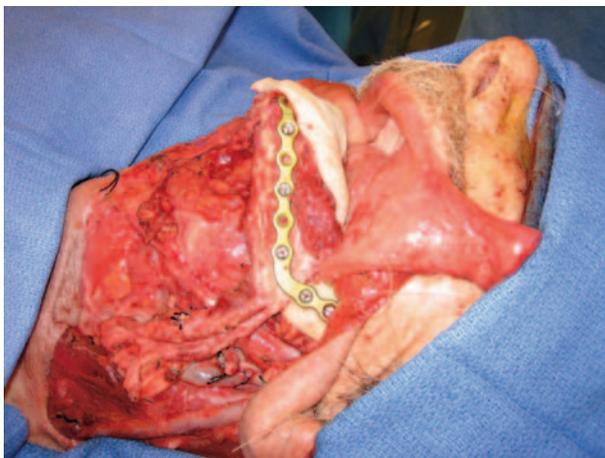


Fig. 1. A composite resection of the left floor of the mouth, alveolus, segmental mandible, and involved skin was performed with fibular free tissue transfer.



Fig. 2. Dehiscence overlying the neck and chin resulted in exposed bone.

the anatomy often makes it difficult to achieve an airtight seal, and poor immobilization may expose the delicate recipient site to increased shear stresses and incidental trauma. Despite these challenges, vacuum-assisted closure has still been shown to improve wound healing in large infected facial wounds, mandibular hardware exposure, split-thickness skin grafts, and pharyngocutaneous fistulas.^{1,3} Despite its apparent efficacy, there is a paucity of studies examining recipient-site wound closure status following vacuum-assisted closure therapy in head and neck reconstruction.

Vacuum-assisted closure has expedited graft healing at the recipient site in similar settings with cumbersome topographical anatomy, such as penile skin graft and perineal reconstruction.⁵ Dehiscence following free tissue transfer is not uncommon, while revascularization and granulation tissue formation are fundamental components needed to ensure graft viability and survival. Use of the vacuum-assisted closure system in head and neck reconstruction should be expanded to include management of wound dehiscence at the recipient site following free tissue transfer.

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DISCLOSURE

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Regional Lymphatic Dissemination of Squamous Cell Carcinoma of the Face

Sir:

Although lymphatic spread of squamous cell carcinoma is well described in the oncology and dermatology literature, reports of local dissemination via lymphatics are rare. We describe an immunocompromised patient with aggressive local spread of squamous cell carcinoma in the head and neck, presumably through the dermal lymphatics.

The patient, a 68-year-old man receiving chronic immunosuppression secondary to renal transplantation for polycystic kidney disease, had a forehead lesion that proved to be a poorly differentiated invasive squamous cell carcinoma with perineural invasion. Over the next 16 months he underwent three resections of contiguous lesions with negative margins. After his third resection, he had a 1-cm scaly lesion on the right side

of his forehead, with a series of nodular lesions extending to his left eyebrow, multiple nodules anterior to the pinna, and extensive dermal lymphatic involvement along the lateral canthus of his left eye extending to the mandibular ramus. No adenopathy was noted on clinical examination or computed tomography scans of his head, chest, abdomen, and pelvis.

After clinical diagnosis of squamous cell carcinoma with dermal lymphatic involvement, the patient received two 3-month courses of radiation to the right side of his forehead and left brow and seven weekly cycles of chemotherapy with Taxotere. He developed a nonhealing radiation wound, which proved to be squamous cell carcinoma with perineural invasion, and several new lesions, one of which had dermal lymphatic involvement on pathologic and physical examinations. Lymph node biopsy and dissection were not performed.

The patient underwent two major hemifacial excisions, with microsurgical reconstruction of his tumor-laden radiation wound (Fig. 1). During his last complicated hospitalization, new lesions appeared on his face and his right leg.

Squamous cell carcinoma is a locally invasive tumor, but metastatic potential exists, particularly when tumors are found on the head or neck, at sites of chronic inflammation, in previously irradiated areas, or in immunocompromised patients. The rate of metastasis is generally reported to be 3 to 10 percent, with reports of up to 30 percent.^{1,2} Tumor spreads via the lymphatics, circulatory system, or interstitium. Regional lymph nodes are the most common site of metastasis (85 percent), but squamous cell carcinoma can also metastasize.



Fig. 1. Microsurgical reconstruction was performed using an anterolateral thigh perforator flap. Six months later, multiple new squamous cell carcinomas of his face and right leg were identified and excised.

size to the liver, lung, brain, and bone.³ Depth of invasion and degree of cytologic atypia are associated with a greater likelihood of metastasis and recurrence. Perineural invasion portends a worse prognosis. Squamous cell carcinoma in the immunosuppressed patient commonly recurs with perineural, dermal lymphatic, and regional lymph node involvement.⁴

A recent study noted that 87 percent of participants had head and neck lesions, with 20 percent on the forehead, 20 percent on the face, and 17 percent on the cheek. Roughly 10 percent of head and neck patients developed delayed regional lymphatic recurrences of previously excised squamous cell carcinoma, and eight patients with midfacial squamous cell carcinoma actually presented with regional lymphatic failure despite normal immune function.⁵

Surgery is the treatment of choice for both local and metastatic squamous cell carcinoma confined to regional lymph nodes,³ with chemotherapy and radiation reserved for diffuse metastatic disease. Patients at risk for local lymphatic spread of their squamous cell carcinoma, specifically the immunosuppressed, deserve early referral to a radiation oncologist, chemotherapist, and surgeon, to eradicate or slow disease progression. DOI: 10.1097/PRS.0b013e318194d1bc

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Use of Platelet Gel in Romberg Syndrome

Sir:

We treated 22 patients affected by Romberg syndrome,¹ hemifacial atrophy, and volumetric deficit with platelet gel mixed with centrifuged fat tis-

sue at the Department of Plastic and Reconstructive Surgery, "Tor Vergata" University of Rome. Patients, ranging in age from 25 to 50 years old, were treated using the Coleman technique.²

The preoperative study included a complete clinical examination, a photographic examination in four projections (frontal, lateral, three-fourths, and axial), and RM of the facial tissue. In addition, in the more complex cases, a high-resolution computed tomography scan was performed, with three-dimensional imaging for a better view of the anatomical structures.³⁻⁵ Postoperative follow-up examinations were performed at 2 and 5 weeks, 3, 6, and 12 months, and then annually.

Platelet-rich plasma was prepared from a small volume of blood (9 cc) taken from a peripheral vein using sodium citrate as an anticoagulant. The current systems for preparing platelet concentrations use various centrifuges (we used a centrifuge kit by Cascade at 1100 g for 10 minutes).

The secretion of growth factor begins with platelet activation. The platelet-rich plasma protocol uses Ca²⁺ to induce platelet activation and exocytosis of the alpha granules.

Platelet gel is a mixture of autologous proteins, containing more than 300,000 to 350,000 platelets/ μ l⁴, whose action consists of stimulating skin fibroblasts when injected at a mixed depth (we used 0.5 ml of platelet gel mixed with 1 ml of centrifuged fat tissue), favoring tissue growth by new synthesis of collagen.

We harvested 120 to 180 cc of fat in the abdominal region using specific cannulas of 1.5 mm in diameter. Maintaining asepsis, we took the plungers from the syringes and closed them with their cap, and then positioned them, flat, in the sterile centrifuge.

The syringes were processed for 3 minutes at 3000 rpm. This procedure obtains highly purified fat tissue, preserving the integrity of the adipocyte walls while separating the fluid fat portion from the serous, bloody part. This purified body fat is put in 1-cc syringes and aseptically reinjected using the specific microcannulas for implanting.

After 4 to 8 months, the patients underwent another lipostructure treatment (Coleman)² to guarantee an optimal three-dimensional reconstruction of the different planes. The implant locations on the face were selected by an accurate study of the necessary corrections (temporal, zygomatic, orbital, buccal, and mandibular regions).

Fat tissue was implanted at different levels in small tunnels that were created by forcing the cannula with precise, controlled movements. Small quantities of fat cells were injected, one or two at a time, in the exiting movement of the cannula in order to create a large grid to favor correct vascular development around each fat cell.

We planned sequential treatments of platelet gel mixed with centrifuged fat tissue followed by the Coleman technique for reconstructing three-dimensional projection of facial contour to restore the su-

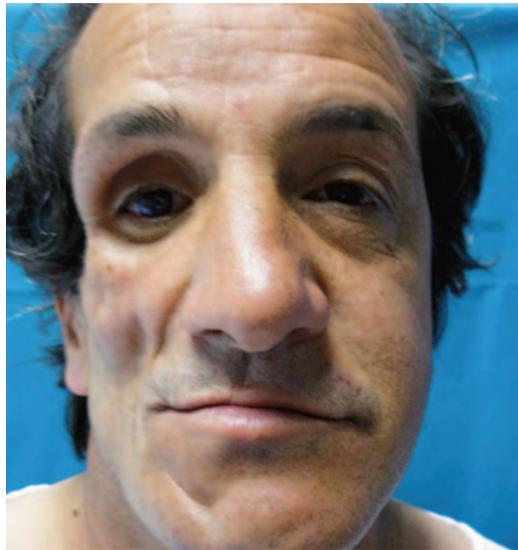


Fig. 1. Preoperative frontal view.

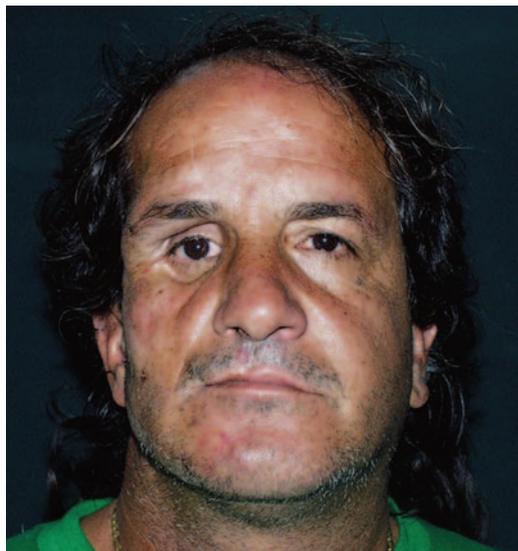


Fig. 2. Postoperative frontal view shows reconstruction of the affected areas.

perficual density of facial tissues. The results we obtained prove the efficacy of combining these two treatments, and the patients' satisfaction confirms the quality of our results (Figs. 1 and 2).

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New Concepts Related to the Tarsus and Orbicularis Oculi Muscle

Sir:

By hematoxylin and eosin staining, the tarsus was reported to be a connective tissue plate running along the palpebral conjunctiva. It remains unknown whether the tarsal plate of the eyelid is a one-plate structure, as its name suggests. The upper-eyelid specimens from the 32 Japanese cadavers were stained using the Azan method to examine the tarsal structure, composed of dense fibrous connective tissue. The tarsus was stained the darkest blue as a plate extending along the palpebral conjunctiva. In addition, the intensity of the dark-blue staining in the eyelid margin increased toward the cutaneous side; thus, the tarsal tissue resembled the head of a golf club (Fig. 1). Therefore, if the tarsal tissue that was stained dark blue by the Azan method could be regarded as the tarsus, it could then be defined as a "composite connective tissue," including the musculature, tarsal glands, eyelashes, and sweat glands. It appeared that the eyelashes hardly shed even during dynamic blinking, because the hair follicles were buried in this hard connective tissue.¹

In general, the musculature that exists in the eyelid margin under the pretarsal orbicularis oculi muscle is identified as Riolan's muscle. Riolan's muscle was located around the meibomian gland ducts in the tarsal connective tissue,^{2,3} exhibited a striated structure similar to that of the orbicularis oculi muscle, and extended from the medial to the lateral canthus. Therefore, the tarsal musculature could be generically referred to as the "intratarsal orbicularis oculi muscle" or the "fourth part of the orbicularis oculi muscle," besides the preorbital, preseptal, and pretarsal orbicularis oculi muscles. Moreover, a part of the intratarsal orbicularis oculi muscle was attached to the muscle fibers surrounding the lacrimal canaliculus (Fig. 2); this component is known as Horner's muscle.⁴

The new concept related to the intratarsal orbicularis oculi muscle, which extends into the tarsus from the medial to the lateral canthus and includes

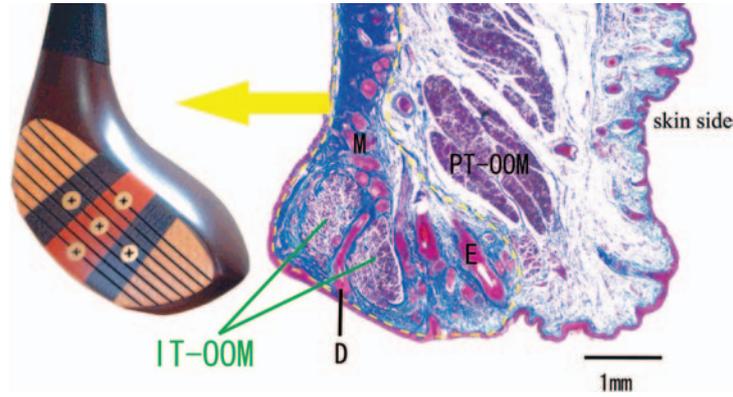


Fig. 1. A midsagittal section of the upper eyelid from a 60-year-old male; the tarsal plate was stained the darkest blue by the Azan method, and the deeply stained connective tissue adjacent to the eyelid margin resembled the head of a golf club. The intratarsal orbicularis oculi muscle surrounded the meibomian gland ducts. (Yellow dashes indicate the outer border of the deeply stained connective tissue.) *PT-OOM*, pretarsal orbicularis oculi muscle; *M*, meibomian gland; *D*, meibomian gland duct; *IT-OOM*, intratarsal orbicularis oculi muscle; *E*, eyelash.

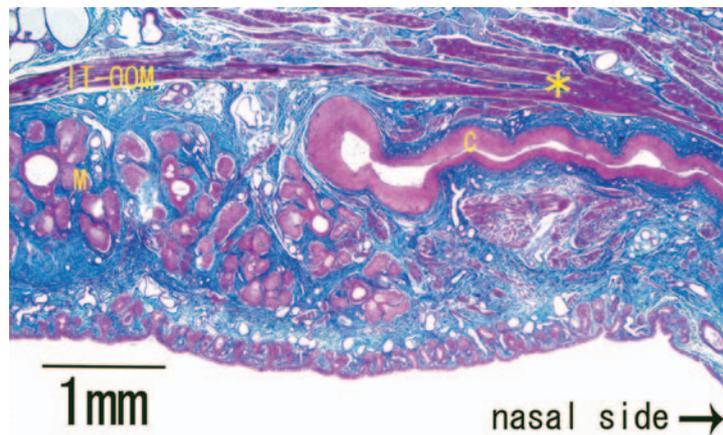


Fig. 2. A cross-section of the upper eyelid from a 74-year-old male; a part of the intratarsal orbicularis oculi muscle was attached to the muscle fibers surrounding the lacrimal canaliculus. *IT-OOM*, intratarsal orbicularis oculi muscle; *M*, meibomian gland; *C*, canaliculus; asterisk (*), muscles surrounding the canaliculus.

Horner's and Riolan's muscles, could facilitate an understanding of the mechanisms underlying the meibomian secretion and lacrimal drainage systems that are stimulated by blinking.
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Chondrodermatitis Nodularis Auricularis: A New Name for an Old Disease

Sir:

Chondrodermatitis nodularis helcis is a degenerative noncystic inflammatory process limited to the ear skin and underlying cartilage. It commonly produces a painful papule or nodule on the helical rim or antihelix of the ear. Central ulceration also occurs and mimics either basal or squamous cell carcinoma. Chondrodermatitis appears to be an idiopathic degenerative process involving the upper dermis of the auricular rim, often with inflammatory nodules on the scaphoconchal portion of the external ear. With this variation in presentation, the alternative descriptive term of chondrodermatitis nodularis auricularis is suggested.

Chondrodermatitis nodularis chronica helcis was first described by Dr. Max Winkler of Luzerne, Swit-

zerland (1875 to 1952).¹ He described eight patients with the classic painful nodule and skin crusting. Winkler treated these patients with the surgical techniques of the early twentieth century. The eponym of Winkler's chondrodermatitis is still used.

We present a series of 55 Caucasian Fitzpatrick type I or II patients with 62 affected ears. There was an equal distribution of right to left ears, but a distinct right to left variation for men compared with women. This difference is fortuitous and cannot be explained by any obvious biologic or environmental factors. Unlike recent studies^{2,3} that claim a preponderance of male patients, our series found that 71 percent of our patients were female (Fig. 1). This is a disease of the older population, with men having a mean age of 58 years and median age of 63 years at the time of treatment. Women sought treatment much later, with a mean age of 72 years and median age of 74 years (Fig. 2). We conclude that environmental and societal factors play a role in the pathogenesis of this entity. The patients were initially referred to us because of failure of non-surgical therapy, including topical and oral antibiotics and topical steroid creams.

Our overall "recurrence" rate was 11 percent, with recurrences equal in both sexes. We define recurrence

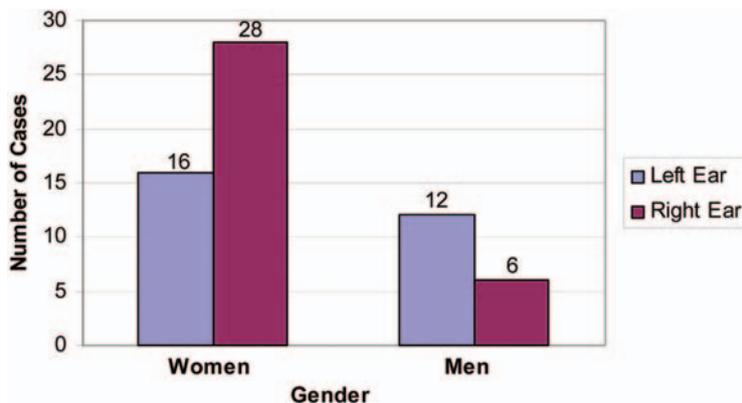


Fig. 1. Ear distribution of chondrodermatitis by sex.

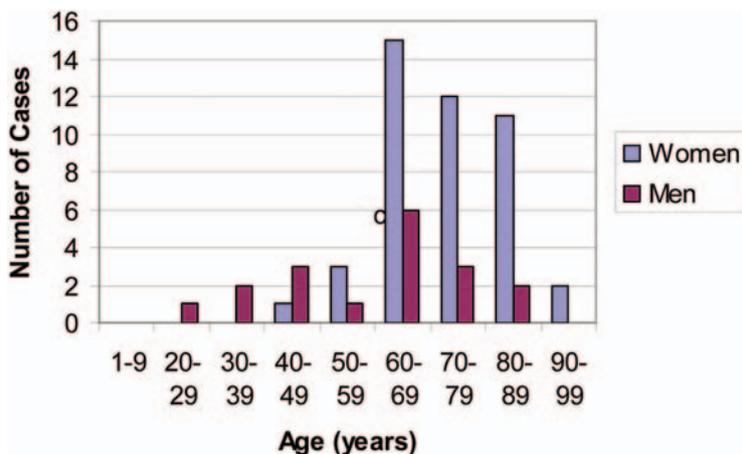


Fig. 2. Age distribution of chondrodermatitis.

as repeated inflammation or infection at the surgical site. Most recurrences resolved with warm compresses and oral antibiotics. Only 30 percent of these required re-excision and closure. Recurrences are due to a surgically induced acute inflammatory process of the resected cartilage.

Surgical treatment included wedge resection and primary closure or circumferential excision of skin and underlying cartilage and immediate reconstruction using a full-thickness skin graft harvested from the ipsilateral posterior auricular sulcus.⁴ Excisions included the inflamed skin and underlying infected cartilage. Patients returned for follow-up at 1 week and thereafter according to their individual needs. Patients who did not return or call with any problems or complaints were assumed to be satisfied with the results of their treatment.

Twenty-two of the affected ears had lesions on the antihelical fold (scaphoconchal angle) or the scapha itself. The presence of this disease in the concha and scapha indicates that other processes are in place beyond just pressure. Because of this variability in the location, we have begun describing this entity as chondrodermatitis nodularis auricularis.

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DISCLOSURE

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Utilization of Aquamid as a Filler for Rhinoplasty in Orientals

Sir:

In Japan, Aquamid (Contura S.A., Montreux, Switzerland) has been used for 5 years, mainly as a facial filler. We have also used this filler for rhinoplasty for 4 years. To the best of our knowledge, there is no precise report concerning the application of Aquamid to the Oriental nose and the subject has not been published in any textbooks. In this article, we discuss the injection technique, analysis for determining the appropriate and satisfactory dose of Aquamid, and related complications encountered, especially for rhinoplasty.

The height of the Oriental nose is lower than that of the Caucasian nose in general. We Japanese have longed for a high nose. Injection therapy is a very easy method of achieving this desire without undergoing an invasive surgical approach. We have treated 1816 patients with this method. Follow-up has ranged from 2 to 3 years. Our longest recorded follow-up is 3.5 years. The average injection dose was 2.126 ml (Table 1). Under local anesthesia, the injection layer is the deep subcutaneous layer on the nasal bone periosteum; after injection, manual manipulation via hand massage is effective in obtaining a favorable contour and lining of the nose (Fig 1).

The rate of complications was 0.11 percent (two of 1816 patients). After treatment, we applied gentamicin ointment to the treatment site and administered oral antibiotics for 3 days. Facial cleansing and the use of cosmetics were authorized for the next morning. During the study, there was one case of infection and one case of ischemic change. The patient with the infection recovered with oral antibiotics. The patient with transient ischemic change showed signs of ischemia when 1% xylocaine with epinephrine was administered as local anesthetic to the patient's nasal dorsum. From the day of treatment to the next day, she felt pain and abnormal sensation in the proximity of the right nasal ala. The color gradually changed to pale with a congestive appearance, and the nose finally became erythemic in appearance (Fig. 2). We postulated that the vasoconstrictive effects of epinephrine and the pressure of the filler on the marginal subcutaneous tissues resulted in vascular compromise. Thus the final outcome was a transient ischemic change. The patient's nose returned to normal 2 weeks after the event.

When used to augment the bridge of the nose, solid implants look and feel unnatural. The skin overlying

Table 1. Relationships between Number and Dosage

Volume	No. of Noses
1 ml	286
2 ml	1049
3 ml	449
4 ml	29
5 ml	3
Average, ml	2.126



Fig. 1. Patient shown before and at 1.5 years after treatment. Three milliliters of Aquamid was administered to the patient's nose.



Fig. 2. We speculate that this ischemic change resulted from congestive or vascular compromise to the right ala and nasal dorsum 5 days after treatment. Only 1 ml of Aquamid was administered to her nose for augmentation. A nerve block was performed with 1% xylocaine with epinephrine. We believe that epinephrine's vasoconstrictive action and the pressure of the filler on the marginal subcutaneous circulation caused the ischemic state.

the implant can appear unnaturally shiny. If the nose sits slightly to the left or right, the solid implant will follow this direction. The flexibility of Aquamid allows this direction to be corrected so that the nose can be

properly centered.¹ In cases of nasal humps, the hump can easily be “masked” by simply injecting Aquamid above and below it.² The silicone prosthesis is suitable for nasal tip and columellar augmentation, so use of the filler is mainly for augmentation of the nasal root and dorsum. In terms of producing a higher nasal bridge, rhinoplasty using Aquamid gel is an innovative way of achieving the same aesthetic result as obtained with the conventional surgical method for a selected group of patients.

Extra precaution must be exercised for Aquamid administrations to the nasal tip, because the nasal skin of Orientals is extremely hard and thick; after treatment the nasal tip will appear to be rounder than anticipated by the patient or go against the patient's wishes for a sharper nasal tip appearance with fillers. On the other hand, administration of an excessive amount of Aquamid to the thin layer of the subcutaneous tissue of pale-skinned and thin patients will result in dark discoloration of the injection site and the gel may become visible through the nasal skin.

We have not experienced any allergic reaction to Aquamid or granuloma lesions as compared with hyaluronic acid treatment.³⁻⁵ Therefore, higher biocompatibility is expected to be guaranteed and complications are rare.

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Treatment of Bilateral Condylar Fractures of the Mandible with Distraction Osteogenesis Device

Sir:

There is some consensus on the indication of open reduction and internal fixation for condyle fractures.¹ If bilateral condylar fractures of the mandible are treated with a closed technique, often malocclusion and limitation of mouth opening take place. If bilateral condylar fractures are treated conservatively, 10 percent of cases require corrective orthognathic surgery.² However, open reduction with internal fixation is technically difficult, leaves a visible external scar, and has the risk of facial nerve injury. In a situation that required open reduction and internal fixation, we treated the patient with open reduction and *external* fixation through an intraoral incision using a distraction osteogenesis device, and obtained a satisfactory result.

A 47-year-old man was referred for treatment of extensive facial bone fractures, including a palatal fracture, a mandibular parasymphysis fracture, and bilateral condylar fractures. The patient had a crossbite caused by the palatal fracture, and his lower incisor was extracted due to the mandibular parasymphysis fracture. He had a subcondylar fracture on the left side and a condylar neck fracture on the right; as a result, there was an anterior open bite and the height of the posterior ramus had been reduced (Fig. 1).

With the patient under general anesthesia and nasotracheal intubation, we internally fixed the palatal

fracture and the parasymphysis fracture through a lower gingival sulcus incision. Then, after minimal subperiosteal dissection was performed through the intraoral incision, the fracture line of the bilateral condyles was examined and aligned as much as possible by manual reduction. For external fixation using distraction osteogenesis devices, we marked the fracture line on the skin and inserted two Kirschner wires into the condylar segment and the ramus, avoiding the path of facial nerves. The distraction osteogenesis devices were installed on both sides and alignment was achieved again through the intraoral incision, with adjustment of the hinge joint and the degree of distraction (Fig. 2). After the fractures on both sides had been reduced accurately, arch bars were applied to the maxilla and the mandible and intermaxillary fixation was achieved with elastic bands.

Three weeks after the operation, the intermaxillary fixation was released. When radiographs showed that the right-side fracture was out of line with mild open bite, we reduced it again by manipulating the right device. After another 2 weeks of external fixation, we removed the distraction osteogenesis devices. The open bite was aggravated temporarily and then improved spontaneously. At 3 months postoperatively, the patient's mouth opening was 3.8 cm, and no clinically significant malocclusion or facial asymmetry was observed.

By manipulating the devices intraoperatively and postoperatively, we maintained maximal bone-to-bone contact and appropriate ramus height. In mandibular condylar fractures that need to be treated with open reduction and internal fixation, the application of open reduction and external fixation through an intraoral incision using adjustable distraction osteogen-

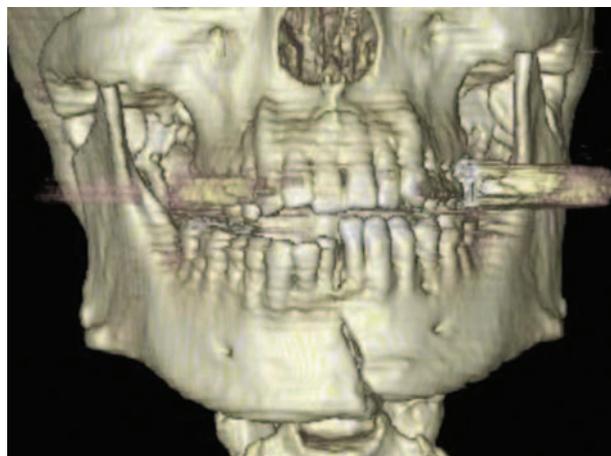


Fig. 1. Three-dimensional computed tomography scan shows mandibular fractures, a parasymphysis fracture, a subcondylar fracture on the left side, and a condylar neck fracture on the right.



Fig. 2. Patient with maximum mouth opening after intermaxillary fixation release at 3 weeks postoperatively. The distraction osteogenesis devices were installed on both sides in the condylar segment and the ramus.

esis devices can give satisfactory results in mandibular motion, symmetry, and occlusion.
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The authors have no financial conflicts to disclose. The treatment of mandibular condyle fracture is the most controversial part of facial bone fractures.

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A Novel Method for Neurotization of Deep Inferior Epigastric Perforator and Superficial Inferior Epigastric Artery Flaps

Sir:

Currently, surgical goals for breast reconstruction tend to relegate breast sensation to a position of secondary importance. Many surgeons admit to not pursuing neurotization for several reasons: “reasonable” spontaneous reinnervation, difficulty in finding the recipient nerve, increased donor-site morbidity, increased complexity, prolonged surgical time, and no difference in flap survival rate.¹ Several studies have demonstrated that patients with sensate breast reconstruction not only have higher satisfaction rates and benefit from injury prevention, but also show improved pressure and temperature discrimination versus their noninnervated peers.^{2–5}

The presence of a readily available, undamaged recipient nerve limits routine innervation. Currently, the nerve of choice is the lateral cutaneous branch of the fourth intercostal nerve. However, this nerve is frequently injured during mastectomy and lies in a different microsurgical field, thereby increasing flap inset complexity.

We present a novel technique for routine neurotization of deep inferior epigastric perforator and superficial inferior epigastric artery flaps with the medial branch of the third intercostal nerve, which is readily found during the dissection of the internal mammary vessels.

The abdominal skin is supplied segmentally by the lower thoracic intercostal nerves (T6 through T12), which terminate anteriorly to provide a lateral branch and a medial branch. After the intercostal nerves enter the rectus abdominis, cutaneous branches join the deep inferior epigastric vascular axis, forming neurovascular bundles. The nerve most proximal to the pedicle is selected for the donor nerve. Here, the accompanying inferior perforator is not used for flap perfusion and is ligated, thereby preventing flow obstruction. The nerve is cut at the fascia to preserve the motor function of the rectus while providing sensation to a major portion of the breast mound.

The breast is supplied by the lateral cutaneous and medial anterior branches of the second to sixth intercostal nerves, of which the third to fifth lateral and the second to fifth anterior branches supply the nipple-areola complex. The lateral branch of the fourth intercostal nerve has been the traditional recipient nerve. This nerve is frequently cauterized during mastectomies and is difficult to find in delayed reconstructions.

To overcome this problem, we use the medial branch of the third intercostal nerve, located near the internal mammary recipient vessels, which are dissected out in the third interspace, preserving the rib. With this approach, the third intercostal cutaneous and sensory nerve is easily dissected. The nerve is incised at the lateral border of the sternum and coapted to the flap

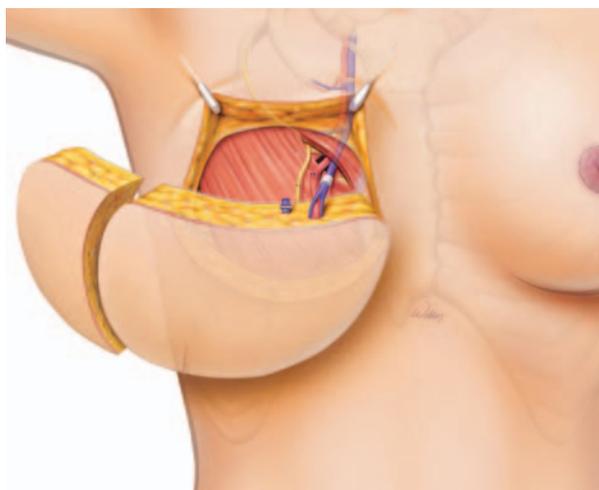


Fig. 1. The recipient vessels are easily dissected out in the third intercostal space with complete preservation of the rib. The nerve is incised at the lateral border of the sternum and then reflected laterally, where it is coapted to the donor nerve from the deep inferior epigastric perforator or superficial inferior epigastric artery flap.

donor nerve (Fig. 1). If the nerves are limited in length, a neurotube may be used. Since the third intercostal nerve is readily visualized during dissection of the IMVA, routine neurotization of the flap can be accomplished in an average time of 15 minutes.

This technique offers the possibility of routine deep inferior epigastric perforator and superficial inferior epigastric artery flap innervation with an undamaged donor nerve that is reliably found in the recipient vessel microsurgical field, without a significant increase in operative time. To objectively assess this technique, a formal sensory evaluation is being performed. We believe this neurotization technique is a beneficial tool that can help reduce the physical and emotional toll of breast cancer on our patients.

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DISCLOSURE

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A Modified Skin Pattern of Reduction Mammoplasty for Wide Local Excision, or Skin-Sparing Mastectomy in Superficial Breast Tumors, Where Skin Excision Is Required

Sir:

The optimal margin for both wide local excision/lumpectomy and skin-sparing mastectomy remains undefined. Nahabedian¹ suggests that a lumpectomy generally requires a 2-mm margin around the tumor whereas a mastectomy requires a much larger margin, often exceeding 1 cm.

In patients undergoing oncoplastic breast surgery, if the tumor is deeply situated within the breast parenchyma or arises in the lower pole of the breast, wide local excision is achieved using the inverted-T breast reduction pattern. In this scenario, an oncologically adequate tumor margin is achieved.

However, what if the tumor is not in the lower pole of the breast and is situated more superficially (close to or adherent to skin)? In this situation, excision of the

overlying skin is required to attain a satisfactory tumor clearance. If the tumor is situated in the lateral aspect of the breast and also close to the skin, the tumor can still be excised with an adequate margin, including the overlying skin, by modifying the keyhole pattern.² The pedicle used depends on the size and site of the tumor and the size of the breast.² In tumors situated superficially in the medial pole of the breast, the pattern can also be modified using the same principles.

A 39-year-old woman was referred for oncoplastic breast surgery with a T1N0 carcinoma of the breast. The lump was situated close to the skin (a skin dimple was present), and the oncologic surgeon required that the overlying skin be excised to attain adequate tumor clearance. The notch-to-nipple distance was 26.5 cm bilaterally, and the distance from the nipple to the inframammary fold was 10 cm on the right and 8.5 cm on the left.

The modified pattern was applied (Fig. 1) and a breast reduction–type resection was undertaken; 350 g of tissue was removed from the right (nontumor) side. A superomedial medial was used. On the left (tumor side), 300 g of tissue was removed and a superior pedicle was used. The patient’s postoperative course was uneventful (Fig. 2).

This modified pattern was also used in a patient who underwent skin-sparing mastectomy using the inverted-T breast reduction pattern. The end result was an S-shaped scar, not an inverted T.

This technique has the advantage of achieving oncologic clearance (including skin) in patients with superficially situated tumors undergoing either wide local excision (lumpectomy) or skin-sparing mastectomy. The disadvantage of the modified skin pattern incision is that the scars on the breast are not symmetrical and the pedicle used may also need to be altered to achieve a satisfactory tumor clearance margin.

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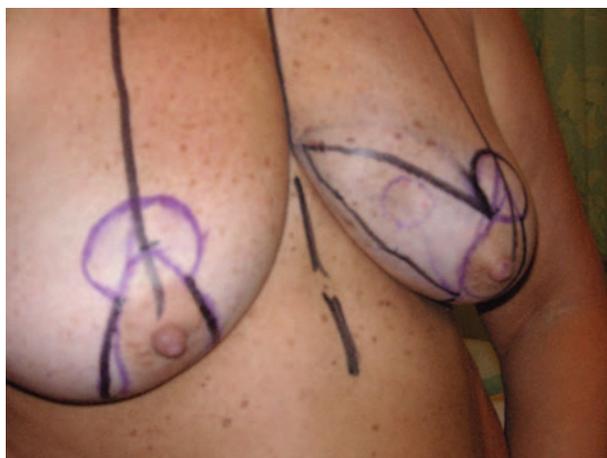


Fig. 1. Patient with a medially situated breast tumor adherent to skin (a skin dimple was present) undergoes an oncoplastic procedure. The inverted-T skin pattern was modified to include the overlying skin to achieve an adequate tumor margin.



Fig. 2. Postoperative result. The medial scar is above the inframammary fold. The resultant scar is S-shaped. The scar on the contralateral side is the usual inverted T.

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Subfascial Breast Augmentation: Thickness of the Pectoral Fascia

Sir:

We read with interest the article by Lin and colleagues entitled “Anatomy and Clinical Significance of Pectoral Fascia” that appeared in the December 2006 issue of the *Journal*.¹ They performed a cadaveric study and the thickness of the pectoral fascia was measured. Their conclusion was that the fascia in the upper quadrants is thicker than that in the lower quadrants. In a previous article, Hwang and Kim² performed a histologic study and described the pectoral fascia as being akin to a well-developed tissue layer at the upper site; nevertheless, inferiorly, the pectoral fascia became thin. They did not measure the thickness of the fascia.

We performed a study of the thickness of the pectoral fascia in 30 consecutive transaxillary subfascial breast augmentations. Once the subfascial pocket was developed, two samples of pectoral fascia measuring 1 × 1 cm per side were taken with assistance using a

lighted retractor. The upper sample was taken at the lateral border of the pectoralis muscle and the lower sample at the level of the areola. The thickness of each sample was measured with an electronic digital micrometer (range, 0 to 25 mm; resolution, 0.001 mm; indication error, 0.004 mm).

The thickness of 120 samples of pectoral fascia from 30 patients was studied. Patient ages ranged between 23 and 41 years (mean age, 33.1 years). The axillary approach was used in 23 patients and the periareolar approach was used in seven patients. The thickness of the pectoral fascia at the upper site varied from 0.106 to 0.229 mm (mean thickness, 0.144 mm) at the upper site and from 0.137 to 0.279 mm (mean thickness, 0.163 mm) at the lower site (Table 1).

The thickness of the fascia in our study was less than that reported by Lin et al.¹ This could be explained by differences in the samples and the fact that theirs is a cadaver study.

We have been using subfascial breast augmentation^{3,4} since its original description by Graf et al.⁵ Many surgeons still believe that the pectoralis fascia is not an anatomical entity. The aforementioned articles and our measurements show that the pectoralis fascia exists and can be dissected. It does not provide a cover as with the pectoralis muscle, but it provides a good dissection plane to place

the implants on the muscle. Our personal experience with subfascial dissection is that it is easier to perform through the transaxillary approach than through the areola. This is supported by the anatomic fact that the fascia is slightly thicker at the upper aspect of the muscle.

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Table 1. Thickness of Pectoral Fascia

Patient	Age (yr)	Thickness of Pectoral Fascia (mm)			
		Upper Right	Upper Left	Lower Right	Lower Left
1	41	0.113	0.142	0.167	0.164
2	28	0.186	0.147	0.164	0.16
3	38	0.127	0.15	0.175	0.154
4	33	0.135	0.116	0.165	0.146
5	30	0.167	0.18	0.16	0.165
6	25	0.142	0.175	0.152	0.154
7	41	0.164	0.112	0.169	0.181
8	30	0.133	0.142	0.173	0.167
9	29	0.138	0.138	0.154	0.158
10	24	0.124	0.104	0.173	0.16
11	23	0.189	0.169	0.169	0.159
12	35	0.15	0.106	0.152	0.166
13	36	0.224	0.229	0.256	0.279
14	46	0.17	0.166	0.155	0.169
15	33	0.167	0.113	0.145	0.154
16	33	0.113	0.14	0.169	0.156
17	31	0.131	0.112	0.156	0.152
18	40	0.133	0.121	0.164	0.171
19	34	0.127	0.166	0.137	0.16
20	37	0.133	0.142	0.152	0.169
21	28	0.15	0.135	0.154	0.16
22	40	0.142	0.145	0.137	0.154
23	29	0.168	0.155	0.164	0.156
24	38	0.145	0.167	0.159	0.154
25	39	0.135	0.168	0.156	0.145
26	38	0.146	0.113	0.169	0.169
27	29	0.147	0.142	0.169	0.169
28	23	0.156	0.113	0.159	0.171
29	29	0.124	0.146	0.145	0.156
30	33	0.135	0.127	0.154	0.154
Average	33.1	0.147	0.142	0.162	0.164

Sensory Nerves in the Lower Pole of the Breast Encountered in Breast (Augmentation) Surgery

Sir:

During my transition and increased use of the inframammary incision in breast augmentation, along with an increased incision length required for proper placement of the Style 410 implant, I have noticed with increasing frequency sensory nerves located in the lower pole of the breast.

These nerves are often located near the center of the incision and need to be sacrificed in order to insert the implant. They most consistently penetrate through the pectoralis muscle fascia and then course toward the nipple and dive into the breast parenchyma in the lower pole of the breast (Fig. 1). Occasionally, if they are more medially or laterally located in relation to the incision, they may be spared, although they may possibly be stretched or traumatized during implant insertion. I had not found any prior specific references to these nerves, although they were recently mentioned in Vanderbilt's reported work¹ and prior work by Sarhadi et al.² Not seeing any prior specific references or titles, I typically name them after the resident who happens to be working with me at the time in the operating room.

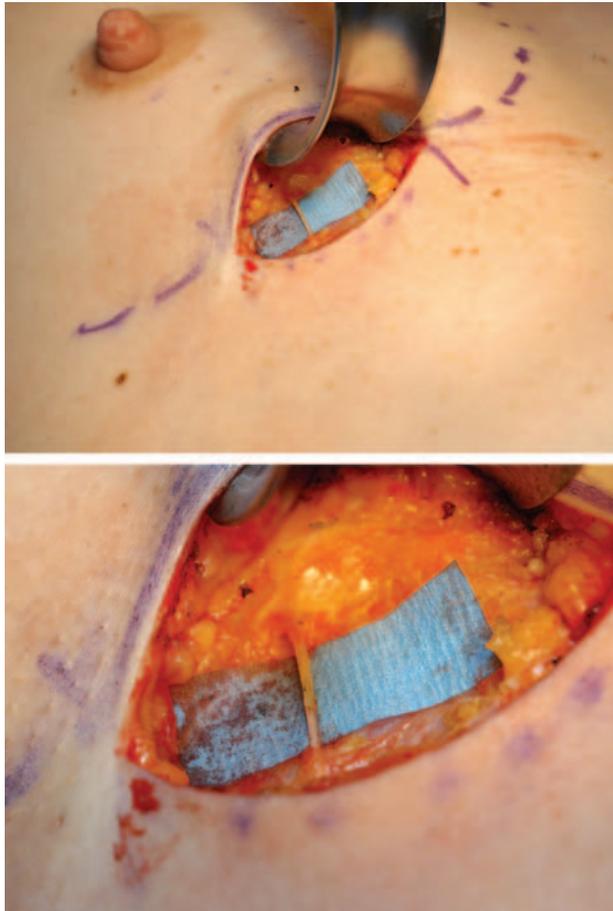


Fig. 1. This is a typical location for the lower pole nerves commonly identified (as shown here) penetrating through pectoralis fascia and then into the breast parenchyma in the lower pole of the breast. They may be identified more medially or laterally and vary a great deal in diameter.

I may be at risk of being guilty of Steve Kröll’s warning of “experience—series—time after time.” (For those who have not heard this, Steve warned me one day to be careful of some presentations, even at national meetings. A presenter when reporting his “experience” may mean *one case*. When he says, “My series,” it may be *two cases*, and *three cases* may be what he finds “time after time”!)

However, in the last 10 patients in whom I have identified these nerve branches, and have been able to preserve them, these patients have either maintained sensation postoperatively or quickly regained sensation over the lower pole of the breast within 3 weeks. Patients in whom the nerve was identified and had to be sacrificed took up to 6 months to regain sensation, although half regained sensation within 3 months. No patients had any accompanying nipple/areola numbness, with the numbness limited to the lower pole of the breast only. Interestingly, in one of our nurses who underwent a Style 410 breast augmentation, it was possible to spare the nerve on the right side but not the one on the left. It was about 2

mm in diameter. She maintained sensation on the preserved side but took 5 months to regain lower pole sensation on the left, where the nerve had to be divided for implant insertion.

I am in the process of studying this more closely, but I was wondering whether this specific nerve or recovery phenomenon has been previously published and I missed it, whether any other surgeons have identified this nerve in the course of their inframammary dissections, whether anyone has ever seen a neuroma in situ or any complications resulting from the sparing of this nerve or knows of any reason why it should not be salvaged if possible, and finally whether any surgeons have identified any patients with long-term numbness similar to that seen in the infraumbilical area following abdominoplasty.

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DISCLOSURE

The author is an Allergan consultant, is involved in both Mentor and Allergan Silicone implant silicone core and adjunct trials, and is an investigator in the core and continued access Style 410 cohesive silicone implant trials.

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Sweat Gland Carcinoma

Sir:

Sweat gland carcinoma was first reported in 1865 but remains poorly understood due to its rarity, heterogeneity of subtypes, and confusing nomenclature.

A 72-year-old man presented with a 15-cm ulcerated, firm, pedunculated lesion of his left axilla that had recently doubled in size after 20 years of relative indolence (Fig. 1). He reported no systemic signs of illness, weight loss, or functional impairment. The results of his neurovascular examination were normal and he had palpable axillary lymph nodes. A computed tomography scan showed no chest wall involvement or pulmonary metastasis. The core needle biopsy demonstrated a malignant epithelial neoplasm.

The mass was excised with 1-cm margins, and axillary lymphadenectomy was performed, followed by a pedicled latissimus dorsi flap and skin graft reconstruction. Pathologic analysis confirmed “hidradenocarcinoma with preexisting hidradenoma” with negative margins. All 35 lymph nodes were negative for malignancy.



Fig. 1. A 15-cm ulcerated left axillary mass doubled in size over the previous year after 20 years of relative stability.

Sweat gland carcinomas are rare, accounting for 0.005 percent of all malignant epithelial neoplasms.¹ Lesions are typically a violaceous nodule, papule, or plaque, although other colors have been reported. Most occur in the head and neck, followed by the extremities; only occasionally do they appear on the trunk.

Age at presentation ranges from 1 to 86 years, with most cases occurring in the fifth to seventh decades of life. These tumors overall occur equally in both sexes, although certain subtypes appear to have a predilection for males or females. Most sweat gland carcinomas grow slowly, with patients frequently having delayed presentation of 5 years or more. Rapid growth often occurs in a previously slow-growing lesion, possibly due to malignant degeneration of an originally benign tumor.

Lymphatic metastasis typically occurs at a rate of 20 to 24 percent. Regional cutaneous metastasis and he-

Table 1. Modified Classification System*

	Synonyms	Notes
Low malignant potential		
Microcystic carcinoma	Sclerosing sweat gland tumor, malignant syringoma, low-grade clear-cell eccrine carcinoma, syringoid carcinoma	Females > males; 75% on face
Adenoid cystic carcinoma	None commonly used	Predilection for scalp
Eccrine epithelioma	Basal cell tumor with eccrine differentiation, adenocarcinoma of the eccrine sweat gland, syringal hidradenoma, atypical syringoma, sweat gland carcinoma with syringomatous features, eccrine basilioma, eccrine syringomatous carcinoma	Predilection for scalp; clinically resembles basal cell carcinoma; tends to histologically invade beyond gross margins
Extramammary Paget's dz	None commonly used	
Mucinous carcinoma	Adenocystic carcinoma, mucinous sweat gland adenocarcinoma, colloid carcinoma	Males > females; high rate of local recurrence
Aggressive digital papillary carcinoma	None commonly used	
High malignant potential		
Malignant eccrine poroma	Epidermotropic eccrine carcinoma, poroepithelioma, porocarcinoma, malignant hidrocantoma simplex, malignant porosyringoma	Some list porocarcinoma as most similar to clear-cell hydrocarcinoma, malignant acrospiroma (next category below)
Malignant acrospiroma	Clear-cell hidradenocarcinoma, malignant clear-cell hidradenoma, malignant clear-cell acrospiroma, malignant hidradenoma, malignant clear-cell myoepithelioma, nodular hidradenocarcinoma	Most common variant; frequently present as relatively large, ulcerated masses, with high risk of lymph node and distal metastasis to bone, lung
Malignant mixed tumor	Malignant chondroid syringoma	Females > males; tends to occur in extremities and metastasizes early
Malignant spiradenoma	None commonly used	Tends to occur in extremities
Malignant cylindroma	None commonly used	Benign counterpart may be inherited in autosomal dominant fashion
Unknown (rare)		
Signet ring cell carcinoma	None commonly used	
Ductal adenocarcinoma	None commonly used	
Apocrine carcinoma	None commonly used	Most reported in axilla, anogenital region
Malignant syringocystadenoma	None commonly used	
Mucoepidermoid carcinoma	None commonly used	
Aggressive digital papillary adenoma	Digital papillary adenocarcinoma	Appears in glabrous skin; tends to recur; 15% metastatic spread

*This system was modified from Cruz DJ. Sweat gland carcinomas: A comprehensive review. *Semin Diagn Pathol.* 1987;4:38-74.

matogenous spread have also been noted.² Local recurrence occurs in 14 to 20 percent of cases.² Most patients survive beyond 10 years and usually die of another cause, although notable exceptions of death within 6 months of diagnosis due to metastasis (to lymph node and lungs) have been reported.³

Controversy remains as to the most appropriate classification system. Table 1 outlines a system reported by Cruz that most readily accommodates the variety of names used in the literature.⁴

Wide local excision and evaluation of lymph node status via sentinel lymph node biopsy or regional lymphadenectomy are recommended. Radiotherapy is reserved for recurrence or metastatic lymph node involvement.² Chemotherapy does not currently have a role in management, although administration of trastuzumab has been reported in a metastatic tumor with *Her-2/neu* gene amplification.⁵

As is typical for sweat gland carcinomas and for hidradenocarcinoma (malignant acrospiroma) in particular, this tumor manifested rapid growth and ulceration after two decades as an indolent, small lesion. Management of these tumors should include wide excision and evaluation for lymph node and pulmonary metastasis. Adjuvant radiation therapy is likely appropriate for cases with lymph node metastasis or high-grade tumors.

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Total Subperiosteal Approach to Suprascapular Nerve Decompression: A Technique to Relieve Entrapment by the Superior Transverse Suprascapular Ligament

Sir:

Chronic shoulder pain and dysfunction secondary to suprascapular neuropathy due to nerve entrapment under the superior transverse scapular ligament can be cured with surgical nerve decompression.¹ The three main approaches to suprascapular nerve decompression are the anterior, superior, and posterior, with the most common technique being variations of a posterior approach.^{1,2} With the conventional posterior approaches, blunt or sharp dissection of the supraspinatus and trapezius muscles and their retraction^{3–5} afford a poor view of the superior transverse scapular ligament. Today, we introduce a new subperiosteal variation of the posterior approach that provides an unobstructed view of the ligament, which facilitates its successful and safe resection.

The total subperiosteal technique was performed on a 62-year-old man with chronic right shoulder pain and confirmed suprascapular nerve compression via physical examination, lidocaine block, and electromyogram. Surgical intervention began with a skin incision made posteriorly, 1 cm cephalad and 7 cm in length, parallel to the spine of scapula. Fiber splitting and dissection of the trapezius as described by Fabre et al.⁵ were deferred in favor of subperiosteal elevation of the trapezius to expose the underlying supraspinatus muscle. Post and Mayer³ and Topper⁴ described blunt dissection with posterior retraction of the supraspinatus muscle, but continuing a subperiosteal approach proves more practical. While preserving the tendinous origin of the supraspinatus muscle at the supraspinatus fossa, subperiosteal dissection of the supraspinatus muscle continued cephalad and laterally, with retraction of the muscle superiorly to expose the suprascapular notch.

A fat pad surrounds the suprascapular nerve as it traverses the suprascapular notch, impeding visualization of the superior transverse scapular ligament.⁴ This structure can be easily retracted by a Woody Woodsen elevator, as suggested by Topper,⁴ and an unobstructed visualization of the suprascapular notch, nerve, and vessels can be obtained. This proves much safer than attempting to locate the ligament with an index finger.⁵ In our case, superior transverse scapular ligament compression of the suprascapular nerve (Fig. 1) was alle-

viated by using a 3-mm narrow rongeur to resect the ligament at its bony attachments (Fig. 2). A nerve hook was used to retract and protect the suprascapular vessels and nerve during resection. The supraspinatus muscle was allowed to recede back into its fossa, and both trapezius and supraspinatus muscles were reattached at the spine of the scapula.

The total subperiosteal technique avoids direct dissection of the trapezius and supraspinatus muscles, which minimizes intraoperative muscle injury. Because of this, rehabilitation can be hastened, resulting in a quicker return to a patient's baseline function. In addition, this technique provides unobstructed visualization of the superior transverse scapular ligament and safe retraction of surrounding neurovascular structures, thereby allowing controlled, safe release of the suprascapular nerve. In cases of isolated infraspinatus muscle involvement, this technique also allows for dis-

tal suprascapular nerve survey for compression at the spinoglenoid notch. Lastly, with increased use and subsequent proficiency in this technique, minimization of total surgical incision length and tissue disruption will occur and augment the overall benefit of reduced muscle fiber disruption.

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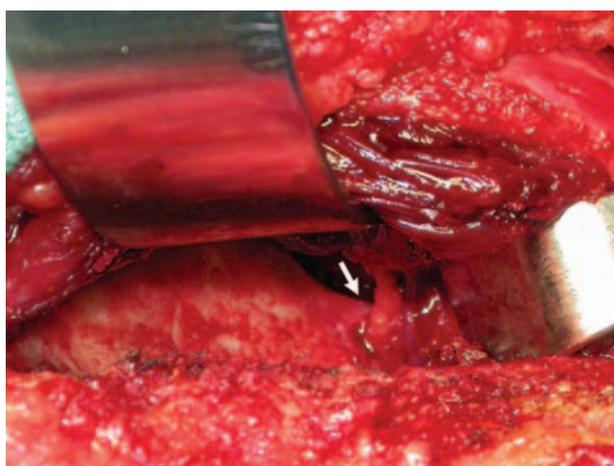


Fig. 1. Cephalad retraction of the supraspinatus and trapezius muscles after subperiosteal dissection exposes the superior transverse scapular ligament (arrow).

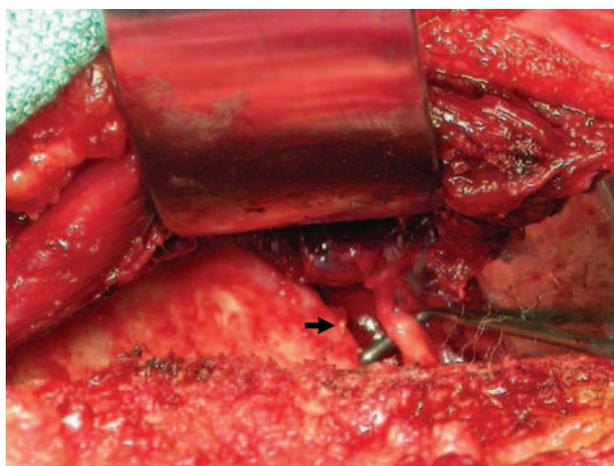


Fig. 2. Suprascapular nerve decompression after removal of the superior transverse scapular ligament at its bony attachment (arrow).

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Reoperative Digital Sympathectomy in Refractory Raynaud's Phenomenon

Sir:

Raynaud's phenomenon is a condition associated with episodic vasospasm of the digital arteries. Current therapeutic modalities provide limited benefit, but more recently, the use of botulinum toxin type A has been demonstrated to be an effective temporary treatment option.¹ Digital artery sympathectomy is the surgical treatment of choice for Raynaud's syndrome patients with digital ulcerations and rest pain when conservative therapy has failed.² However, a number of patients will have recurrent and persistent symptoms even after digital artery sympathectomy, here termed refractory Raynaud's phenomenon. We present the efficacy of reoperative digital sympathectomy in the treatment of patients with refractory Raynaud's phenomenon.

Institutional review board approval for the study was obtained. A retrospective telephone follow-up survey of patients who had failed nonsurgical treatment for refractory Raynaud's phenomenon and were undergoing reoperative digital sympathectomy was completed by

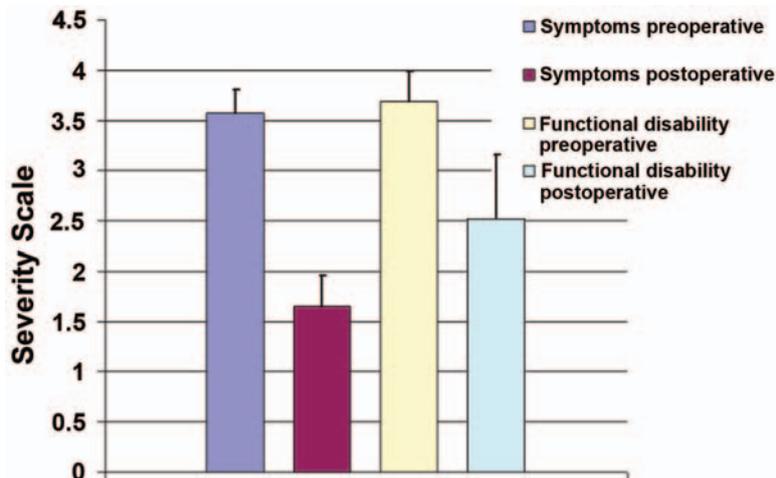


Fig. 1. The Levine Severity of Symptoms and Functional Severity Scale demonstrated improved symptoms and functional disability scores after versus before reoperative digital sympathectomy for refractory Raynaud’s phenomenon.

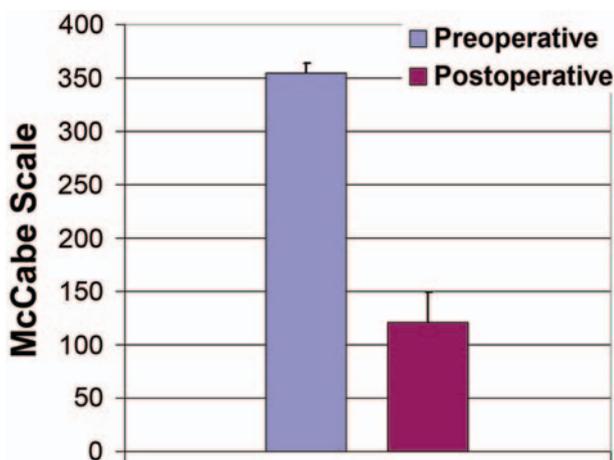


Fig. 2. The McCabe Cold Sensitivity Scale showed improved cold sensitivity scores after versus before reoperative digital sympathectomy for refractory Raynaud’s phenomenon.

the senior author. Severity of symptoms, functional activity, cold sensitivity, healing of ulcerations, and patient satisfaction were surveyed.

Three female patients, aged 34 to 64 years (mean age, 49 years), who had failed nonsurgical treatment for refractory Raynaud’s phenomenon and were undergoing reoperative digital sympathectomy in a total of 16 fingers from 1995 to 2005 were evaluated. Average time to recurrence of symptoms after the initial digital artery sympathectomy was 6 years (range, 2 to 8 years), and the duration of symptoms until reoperative digital sympathectomy was performed was 41 weeks (range, 6 to 104 weeks). After an average follow-up period of 1 year after the reoperation for 16 fingers, all patients reported improvement in symptom severity (Levine Symptom Severity Scale score, 3.5 versus 1.7; range, 1 to 5), functional status (Levine Functional Status Scale score, 3.7

versus 2.5; range, 1 to 5) (Fig. 1),³ cold sensitivity (McCabe Cold Sensitivity Severity Scale score, 354 versus 120; range, 0 to 400) (Fig. 2),⁴ and overall symptoms (abbreviated Wake Forest University Symptom Scale score, 3.7 versus 1.2; range, 0 to 9) in the affected fingers when comparing preoperative versus postoperative status. Fifteen fingers had preoperative ulcerations that completely healed postoperatively after an average period of 3 months. All patients were very satisfied with the results of surgery and would recommend reoperative digital sympathectomy for treatment of refractory Raynaud’s phenomenon.

The treatment of patients who have refractory Raynaud’s phenomenon following a digital artery sympathectomy continues to be a challenging problem for the treating rheumatologist or hand surgeon. McCall et al. introduced reoperative digital sympathectomy in one patient with scleroderma, but to our knowledge, this is the first report that has evaluated the efficacy of reoperative digital sympathectomy for the treatment of patients with refractory Raynaud’s phenomenon.⁵ In this article, we have shown that reoperative digital sympathectomy may provide refractory patients with an improvement in symptom severity, functional activity, cold sensitivity, and ulcerative healing after 1 year of follow-up.

Recurrent disease presented 6 years after initial digital sympathectomy in this series. Recurrent scar tissue formation and perivascular sympathetic regrowth can be hypothesized as the main causes of refractory Raynaud’s phenomenon. The purpose of reoperative digital sympathectomy in this surgical approach is to decompress the digital vessels by excising the re-accumulated scar tissue and to denervate any possibly regrowing sympathetic fibers.

This study presents an efficacious treatment approach for patients with refractory Raynaud’s phenomenon who have failed all conservative treatment approaches, including temporization with botulinum toxin type A, and have

persistent symptoms and nonhealing ulcerations.

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DISCLOSURE

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Botox to the Rescue

Sir:

The serendipitous applications of botulinum toxin in clinical medicine have been interesting. We recently salvaged a pediatric double-toe transfer with this drug.

Our patient was a 4-year-old child who as a 2-lb neonate sustained subtotal loss of the thumb and index and long fingers secondary to ischemia precipitated by an unrecognized tight dressing. The zone of injury and swelling involved the entire hand. When the patient was 2½ years old, one second toe was transferred to the thumb position without difficulty and the radial artery in the distal forearm was used as the donor artery. One year later, a double second toe-to-third toe transfer from the other foot was used to reconstruct the phalangeal segments of the index and long digits. The surgery progressed well and the common digital artery (internal diameter, 0.8 mm) to the second web space

was used as the donor artery. Heparin therapy was started. During the first two postoperative days the pulse oximeter signals decreased every time the child became restless, was spongebathed, or went for a stroll with her parents in the air-conditioned corridor. On the third day (Sunday evening) the digits became white and she was taken back to the operating room for another exploration and revascularization. An intercalated vein graft was used after segmental resection of the donor artery (Fig. 1). Pulse oximeter readings returned to 99 percent.

Two days later, the same sequence of events occurred. The drama and anxiety had intensified within the family, which had been through the initial iatrogenic injury. The graft was explored and replaced with a vein graft of equal diameter. No thrombus was present within the graft, and the previous anastomoses were clean. We were still working within the original zone of trauma, but debrided the donor artery to the level of the proximal palmar arch. It was time to get creative. Aware of Allen Van Beek's use of botulinum toxin type A for vasospasm in patients with collagen disorders, we injected 10 U of botulinum toxin into the proximal palm, the radial and ulnar artery locations of the distal forearm. The digits have remained pink since, and pulse oximeter reading have all been above 98 percent. There have been no systemic side effects. Syndactyly release between the two digits will be performed in 6 months.

We were aware of Allen Van Beek's observation, recently reported,¹ that vasospasm could be prevented by the use of botulinum toxin type A and did not hesitate to use it here while working well within the original zone of previous trauma, which was much more susceptible to vasospasm. The stakes could not have been higher in our patient, who had sustained an iatrogenic injury, which was reconstructed with an elective double-toe transfer. We do not speculate as to the precise mechanism of action of the autonomic or smooth muscle blockade, but are most appreciative of Dr. Van Beek's simple observation several years ago. The take-home message for residents is: read the journals!

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Toe-to-Hand Transplantation after Failed Osteogenesis Distraction: A “Peg-in-Cup” Osteosynthesis

Sir:

Psychosocial dysfunction secondary to inadequately treated congenital hand anomalies¹ can have a dramatic presentation in preadolescence. Furthermore, these patients may desire cosmetic correction to reduce insecurities and raise self-confidence in their juvenile years. Factors complicating surgery may include a patient’s psychological instability, the distorted anatomy from previous operations, and a risk of reduced function at the cost of cosmesis. The following case illustrates these points.

An 11-year-old girl presented with acrosyndactyly of the middle, index, and ring fingers of the right hand, secondary to amniotic band syndrome. At 18 months of age, she underwent separation of the involved digits, resulting in the loss of the middle finger at the level of the proximal interphalangeal joint. At the age of 4, hastened distraction osteogenesis resulted in a tapered bony segment of the middle proximal phalanx. The patient came to our care at the age of 11 after reports of glove hiding of her dominant, malformed hand and increased concerns of depression and social withdrawal. After thorough psychological testing and discussion regarding changes in foot appearance, digital arcade restoration via toe-to-hand transplantation was considered because of the potential psychosocial benefits.

Prior osteogenesis distraction had left the middle proximal phalanx of the affected hand elongated and tapered, complicating bony fixation. Due to the narrow diameter of the medullary canal of the distracted segment, prosthetic joint replacement was not considered.

Plate fixation was unfavorable because of the step-off created by the different bone diameters. Bone shortening to facilitate plate fixation would have left an unacceptable final digit length. Lastly, one Kirschner wire might have passed through both bone segments, but this would not have prevented rotational forces from disrupting the union or allowed early range of motion. Consequently, the “peg-in-cup” osteosynthesis was devised to efficiently use the existing anatomy and minimize soft-tissue disruption, while maximizing bone-to-bone contact.

To create the peg-in-cup, the distal portion of the proximal phalanx was denuded of soft tissue and periosteum for 1 cm, resected transversely with a sagittal saw, and rounded with a rongeur to provide the peg. Next, the joint surface of the proximal phalanx of the second toe was removed with a sagittal saw, and a 1-cm intramedullary tunnel was made using small pineapple burr to create the recipient cup. Opposition of the peg within the medullary canal of the proximal phalanx was secured, while a 28-gauge cerclage wire stabilized the osteosynthesis from rotating in the longitudinal axis (Fig. 1).

Because bony fixation was necessary at the level of the proximal interphalangeal joint on the patient’s dominant hand, failure to accommodate the new transplantation was a concern. Several authors have stated that replantation at this level—proximal to the insertion of the flexor digitorum superficialis—can be detrimental to overall hand function due to reduction in range of motion and grip strength.^{2,3} However, by achieving a stable osteosynthesis and precise joint orientation, the patient was able to incorporate her new digit successfully into the repertoire of daily hand activity. Moreover, the patient and mother reported decreased anx-

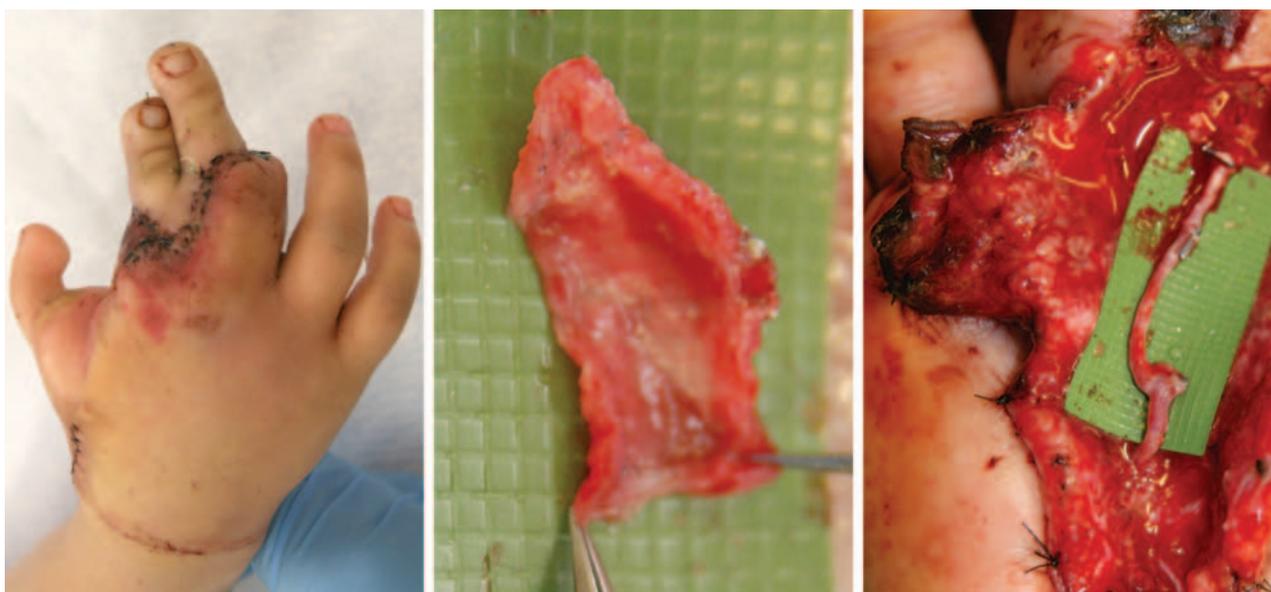


Fig. 1. (Left) The appearance of the white digits on postoperative day 4. (Center) The intact anastomoses and no evidence of thrombosis within the first vein graft. (Right) The second vein graft in situ.



Fig. 1. (Left) Posteroanterior and (right) lateral postoperative views of peg-in-cup osteosynthesis. A single 0.28 Kirschner wire is visible.

iety and betterment in the patient's mood shortly thereafter, corroborating postoperative reports^{4,5} of other children and their parents after toe-to-hand transfer.

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Intraneural Lipoma of the Ulnar Nerve

Sir:

A 9-year-old girl presented with exertional discomfort of the right hand due to two slowly enlarging masses. There was no history of trauma, paresthesias, numbness, or weakness.

Clinical examination revealed two discrete masses, one proximal to the flexor wrist crease measuring $5 \times 1.5 \times 0.5$ cm and a second measuring $7 \times 4 \times 2$ cm in the hypothenar eminence (Fig. 1). The masses were soft and mobile, with well-defined borders and no overlying skin changes. The Tinel sign was absent. An Allen's test demonstrated the ulnar artery of the hand to be patent, but with delayed filling.

Magnetic resonance imaging was consistent with a lipoma in the volar aspect of the right wrist and hand with displacement of the flexor digitorum superficialis tendons. Magnetic resonance angiography revealed radial displacement of the ulnar artery.

At exploration, the mass appeared to be a large, multilobulated lipoma originating from within the ulnar nerve, with splaying of fascicles and attenuation of the hypothenar musculature. The ulnar artery was displaced radially. Resection yielded a 14-cm multilobulated mass with no residual lesion (Fig. 2). All nerve and fascicle groups, the ulnar artery, and the palmar arch were left intact.

Gross pathologic examination revealed an encapsulated, lobulated mass of homogeneous adipose tissue. Microscopic findings showed mature fibroadipose tissue consistent with the diagnosis of a benign intraneural lipoma.

Postoperative evaluation at 2 weeks showed normal median and ulnar nerve function, with only mild weakness of the abductor digiti minimi. Follow-up at 1 month showed increased range of motion, improved ulnar sensation, and persistent, mild, residual small-finger weakness on abduction.

Masses originating in the median and ulnar nerves are exceedingly rare.^{1,2} The nomenclature for such masses has been based primarily on pathologic descriptions, such as lipoma, intraneural lipoma, lipofibromatous hamartoma, fibrofatty proliferation, and fatty infiltration.^{1,3,4}

Intraneural lipofibromas have been divided into



Fig. 1. Gross appearance of the right wrist and hypothenar eminence masses of the right hand, measuring $5 \times 1.5 \times 0.5$ cm and $7 \times 4 \times 2$ cm, respectively. Intraoperative markings demonstrate the location and extent of the lesion. A single incision was made directly over the lesion and crossing the flexor wrist crease, as shown.

three major entities based on pathologic descriptions and clinical/anatomical behavior: true intraneural lipomas, lipofibromas, and peripheral nerve hamartomas with macrodactyly.³ True lipomas are soft, noninvasive, encapsulated tumors that displace adjacent structures. These lesions can be readily dissected from surrounding tissues and histologically contain fibrous and fatty tissue, but lack neural elements.

Distinct from true lipomas, lipofibromas contain fibrous, fatty, and neural elements. Confined within the nerve sheath, lipofibromas are often impossible to separate from nerves without extensive interfascicular dissection or complete nerve resection. Nomenclature varies and includes the pseudonyms fibrofatty proliferation, intraneural lipoma, and lipomatous hamartoma.

Hamartomas represent a third entity of benign tumors, similar to lipofibromas histologically in that they both contain fibrous, fatty, and neural elements. Some authors propose nomenclature that combines associations with macrodactyly: lipofibromatous hamartoma with or without macrodactyly.^{1,2} Patients present in childhood with swelling of the wrist or hand and varying degrees of compressive symptomatology. Magnetic resonance imaging is typically diagnostic but cannot delineate the degree of fascicular involvement.⁵

Operative exploration is indicated for progressive mass enlargement, overt compressive symptoms, and histopathologic confirmation. Depending on the anatomical relationship of the lesion, surgical treatment may involve biopsy and ligamentous decompression, limited interfascicular dissection, complete resection with nerve grafting, complete resection, and, occasionally, compensatory tendon transfer.



Fig. 2. With the mass completely removed, the splayed, intact fascicles of the ulnar nerve are visible. The incision was closed directly without removing excess skin.

In summary, benign, fibrofatty tumors of the hand and wrist are indeed rare. Associated symptoms are directly related to tumor size and anatomic location. The natural history is continued growth and potential exacerbation of symptoms without spontaneous regression.⁴ Surgical intervention should be considered in patients with large or indeterminate masses. Treatment by excision should be considered early in the disease process.

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The Role of Antibiotic Prophylaxis in Abdominoplasty: A Review of the Infection Rate in 300 Cases Treated without Prophylaxis

Sir:

Abdominoplasties are routine plastic surgery procedures with a variety of minor and major complications. Few scientific publications have reported on their postoperative follow-up, but second to seroma, infection seems to be the most frequent complication.¹ However, use of prophylactic antibiotics in clean surgery remains controversial. The administration of prophylactic antibiotics makes surgeons feel comfortable that they have done all they can to protect their patients against infection, but in most conditions, this action is not evidence-based. The widespread administration of antibiotics will inevitably lead to organism resistance. Can the use of prophylactic antibiotics in abdominoplasty be justified?

Since we are unaware of any published study investigating the role of antibiotic prophylaxis in abdominoplasty, a 7-year retrospective audit was conducted on all abdominoplasties ($n = 300$ between April of 1998 and July of 2006) performed in our department. All patients underwent full abdominoplasty as the only primary procedure. No perioperative antibiotic prophylaxis was used.

Since the umbilicus and genitalia may harbor potential pathogens, preoperative microbiology samples were taken as indicators. Postoperative wound controls were performed on a weekly basis until complete healing was settled. In case of wound drainage or signs of local infection, microbiology samples were taken. Oral antibiotic treatment was only started when local signs of infection were obvious.

Thirty-one patients had postoperative wound drainage from which microorganisms were cultured. A course of antibiotics was needed in only 24 patients (8 percent), and all responded well to treatment. The remaining seven patients had increased wound drainage without signs of local wound infection, so they received no antibiotic treatment. Their positive wound swabs were attributed to bacterial colonization rather than infection. *Staphylococcus* appears to have been the most common infectious pathogen isolated. The majority of patients had no growth on their preoperative umbilical (87 percent) and genital (88 percent) swabs analysis. There was no correlation between preoperative and postoperative cultured microorganisms in those patients who developed wound infection.

A literature review of complications in abdominoplasty revealed three studies that seem most applicable to this one. Grazer and Goldwyn showed a postoperative wound infection rate of 7.3 percent in a survey study of 10,490 abdominoplasty cases.² Stewart et al. showed a wound infection rate of 3 percent in their series of 278 patients, but no information was provided on how these data were achieved and whether antibiotic prophylaxis was given.³

Chaouat et al. reported a wound infection rate of 7 percent in a retrospective case study of 258 abdominoplasties performed at St. Antoine Hospital, in Paris, France.¹ Patients were given antibiotic prophylaxis in

the form of either a single intravenous dose of amoxicillin or a 6-day postoperative course of penicillin G with metronidazole.

A statistical comparison of these studies seems inappropriate given the unavoidably heterogeneous variables. Nevertheless, we would argue that our study produced comparable results in terms of wound infection rate in abdominoplasty in the absence of antibiotic prophylaxis when compared with Chaouat et al.'s study, which uses antibiotic prophylaxis. Our study suggests that abdominoplasty can be safely carried out without an increased risk of wound infection in the absence of antibiotic prophylaxis.

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A Modified Model for Rat Sciatic Nerve Ischemia/Reperfusion Injury

Sir:

A number of different models of unilateral ischemia/reperfusion injury in rat sciatic nerve have been developed. In one method described by Mitsui et al.,¹ the abdominal aorta, the right iliac and femoral arteries, and all identifiable collateral vessels supplying the right sciatic-tibial nerve are ligated for 3 hours and then reperused for different time intervals. In another

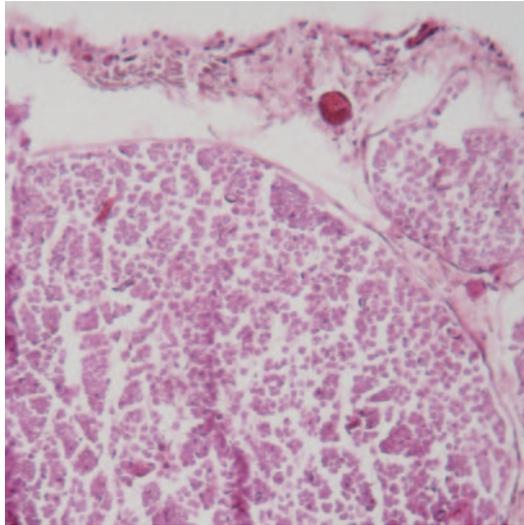


Fig. 1. Transverse section of the rat sciatic nerve after 7 days of reperfusion shows epineurial and endoneurial edema (hematoxylin and eosin stain).

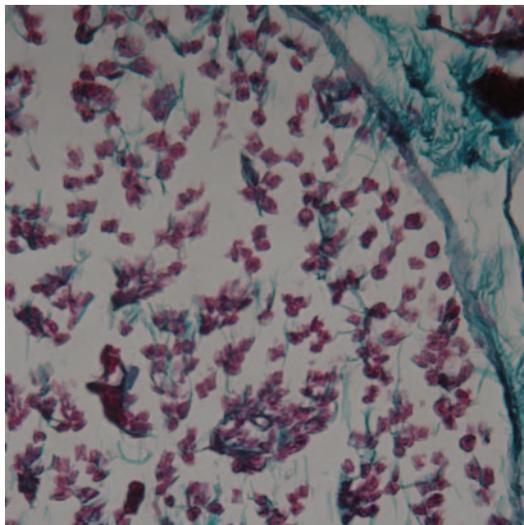


Fig. 2. Transverse section of the rat sciatic nerve after 7 days of reperfusion shows epineurial and endoneurial edema and demyelination (trichrome Gomori stain).

model introduced by Saray and his colleagues,² only the femoral artery and vein—just distal to the inguinal ligament—are clamped for 3 hours, followed by reperfusion. The first method is time-consuming and requires advanced surgical techniques and instruments, and the second one, albeit easy to perform, does not produce severe injury.³ The aim of this study was to develop a practical model producing serious neurologic deficits that was still technically feasible. For this purpose, clamping of the femoral artery as well as the ipsilateral common iliac artery was used to induce sciatic nerve ischemia/reperfusion.

For this pilot study, 12 Sprague–Dawley male rats weighting 150 to 200 g were randomly divided into two

groups: the sham-operated group and the ischemia/reperfusion group. All animals were anesthetized with ketamine (50 mg/kg) and xylazine (4 mg/kg) and subjected to laparotomy. In the ischemia/reperfusion group, the right common iliac artery and the femoral artery—just distal to the inguinal ligament—were clamped for 3 hours using two Yasargil aneurysm clips providing 125 g (1.24 N) of force. By using a thermal pad, the deep rectal temperature was monitored by a rectal probe inserted 5 cm into the rectum and maintained at $36.5^{\circ}\text{C} \pm 1^{\circ}\text{C}$. All procedures were carried out for the sham-operated group, but arterial clamping was excluded. After 1 week of reperfusion, each animal's behavioral score was assessed based on gait, grasp, paw position, and pinch sensitivity; the score for each index was based on a scale of 0 (no function) to 3.0 (normal function), except for pinch sensitivity, the score for which ranged from 0 to 2.¹ Then, the sciatic nerve was fixed in situ for 30 minutes using 4% formaldehyde in phosphate buffer (pH adjusted to 7.4), and then trifurcation of the sciatic nerve was removed, the nerve was embedded in paraffin, and sections were stained with hematoxylin and eosin and trichrome Gomori for light microscopy studies.

The median behavioral scores were 5 and 11 in the ischemia/reperfusion and sham groups, respectively, and were significantly different ($p < 0.05$, Mann-Whitney *U* test). The pathologic markers for ischemia/reperfusion, including epineurial and endoneurial edema and demyelination in trichrome Gomori staining, were observed in the ischemia/reperfusion group but were absent in the sham-operated group (Figs. 1 and 2).

Our results show that common iliac artery and femoral artery clamping induces ischemia/reperfusion injury in the rat sciatic nerve. This method offers the obvious advantage of producing an easily inducible, moderate to severe neurologic deficit compared with current methods. However, a more comprehensive study containing several groups of different reperfusion intervals and quantification of pathological changes is needed to make the method practical for use in experimental studies.

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Successful Repair of Symptomatic Extremity Muscle Herniation with Synthetic Mesh

Sir:

Muscle herniation in the extremities is the result of an acquired fascial defect, causing pain or discomfort on physical exertion of the affected limb in symptomatic cases. The treatment options for symptomatic extremity muscle herniation in the lower limb are well documented in the literature and include conservative management (activity limitation, compressive stockings, and so on), wide fasciotomy, direct approximation of the fascial defect, tibial periosteal flap, partial muscular excision, and patch repair with autologous fascia lata or synthetic mesh.¹ To date, however, the use of synthetic mesh to correct symptomatic extremity muscle herniation has been reported only in a single case by Siliprandi et al., who utilized Mersilene mesh (Ethicon, Inc., Somerville, N.J.) to achieve symptomatic relief and cosmetic correction of anterior tibialis muscle herniation in a lower extremity.² Based on the success of this isolated case report, the authors' goal was to expand the clinical experience in the literature with synthetic mesh repair of lower extremity muscle herniation, in addition to reporting its novel use in a case of upper extremity muscle herniation.

Three patients with symptomatic extremity muscle herniation secondary to trauma were treated. Two defects were located in lower extremity and the remaining defect was in the upper extremity (Table 1). Repair was achieved using a single layer of Prolene mesh (Ethicon) as an inlay, secured in place under minimal tension with 2.0 Prolene (Ethicon) in an interrupted fashion. Skin closure was performed in two layers. Postoperatively, the patient was immobilized for 1 week, at which time passive range of motion exercises were initiated (Figs. 1 and 2).

Presented in this report are the repairs of three cases of symptomatic extremity muscle herniation using synthetic patches of Prolene mesh. This permanent mesh is nonreactive and durable. Much like the repair performed using harvested fascia lata, the synthetic mesh repair is robust and under no tension, which theoretically decreases the rate of hernia recurrence.³ Potential disadvantages are an increased risk of infection with a synthetic, nonabsorbable foreign body and the risk of adhesions between the mesh and the underlying structures. To minimize the latter, we utilized a short period of immobilization coupled with early range-of-motion exercises.

All patients had complete resolution of their preoperative symptoms (at rest and during activity), in addition to no visible bulging at follow-up, which ranged from 12 to 26 months. In addition, with this technique there is no donor-site morbidity and shorter operative times due to the obviated need for graft harvest. We believe that this technique is a favorable option for the treatment of symptomatic extremity muscle herniation, particularly for larger fascial defects, where the donor-site morbidity of sizeable fascial harvests can be substantial.⁴ In addition, we have shown that this technique can be effectively utilized for symptomatic extremity muscle herniation in the forearm, a novel application.

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DISCLOSURE

None of the authors has any commercial associations or financial interests in any of the products used in or results derived from this research project.

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Table 1. Summary of Cases

Case	Age (yr)/Sex	Location	Size	Etiology	Outcome
1	55/male	Right lateral thigh	20 × 8 cm	Fasciotomy	Symptom-free at 18 months
2	30/male	Left anterior tibialis	10 × 5 cm	Open tibial fracture	Symptom-free at 26 months
3	55/male	Right volar forearm	5.5 × 16 cm	Open radial and ulnar fractures	Symptom-free at 12 months



Fig. 1. Preoperative view of symptomatic forearm herniation. The visible mass is tender, located over the proximal third of the flexor surface on his right forearm, and accentuated by elbow flexion and forearm pronation.



Fig. 2. Follow-up (postoperative) view at 6 months after mesh repair. The patient had complete resolution of his preoperative pain and bulging, and is shown with the forearm in a flexed and pronated position.

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New Technique for Ligation of Branches in Microsurgery

Sir:

Although microsurgical operations require teamwork, some operations, such as digital replantation, may be accomplished successfully by one microsurgeon. Branch ligation is performed more easily than other steps, such as microanastomosis. Two ties are placed at the junction of the branch and main vessel and at some distance from first knot; then the branch is cut between the two stitches. However, the surgeon may encounter some problems with branch ligation during clinical or experimental procedures if the branches are mistakenly cut before ligation during vessel dissection.

If it is long, the branch stump may be located easily and can be ligated after occlusion of blood flow with a single clamp in the main vessel. In a narrow surgical space, such as the finger, extra tissue dissection is needed to place a clamp on the main vessel. Another method is to catch the stump with forceps to occlude blood flow and then place a stitch at the junction of the branch and main vessel. In this technique, two stitches are placed and cross each other at a 90-degree angle. The first stitch is passed at the junction of the branch and main vessel, and the thread is neither knotted nor cut. The second stitch, using the same thread, is passed under a 90-degree angle in conjunction with the previous one, and the two stitches are tied using the same thread. Furthermore, the branch is obliterated by cross-contraction of the vessel wall. A short branch stump, however, causes difficult manipulation during stitch placement and may easily slip out of the forceps tips. Using two stitches in branch ligation is more traumatic to the vessel wall than the previous method. We have described a new method for branch ligation in microsurgery practice.

In our method, we do not use clamp placement or stitches to occlude blood flow to ligate the branch. The nondominant hand holds the branch until placement of the first knot, while the dominant hand is used for all manipulation. After the branch is occluded with forceps tips, thread is passed behind the branch using the other hand. A loop is made with the surgeon's free (dominant) hand. A single clamp is placed at the end

of the thread to provide contra-contraction during tying. Subsequently, traction is applied to the thread at any region between the loop and microsurgical needle. In this technique, the loop encounters contra-contraction by single clamp due to its weight. It is decreased gradually and the first knot is placed at the branch–main vessel junction. Now the nondominant hand, which was holding the branch stump, can be released safely and the clamp can be removed from the end of thread. A second knot is placed in the classic manner using two hands, and the ends of the thread are cut with scissors (Fig. 1).

Many modifications have been published relating to microsurgical difficulties, such as vessel diameter discrepancy.^{1–3} As far as we know, there are no published reports of modification of branch ligation in the

literature. We suggest that by using our method, branches and branch stumps can be ligated easily without the need for assistance. Furthermore, ligation of short branch stumps using our technique causes the least amount of trauma to the vessel wall in comparison to other methods.

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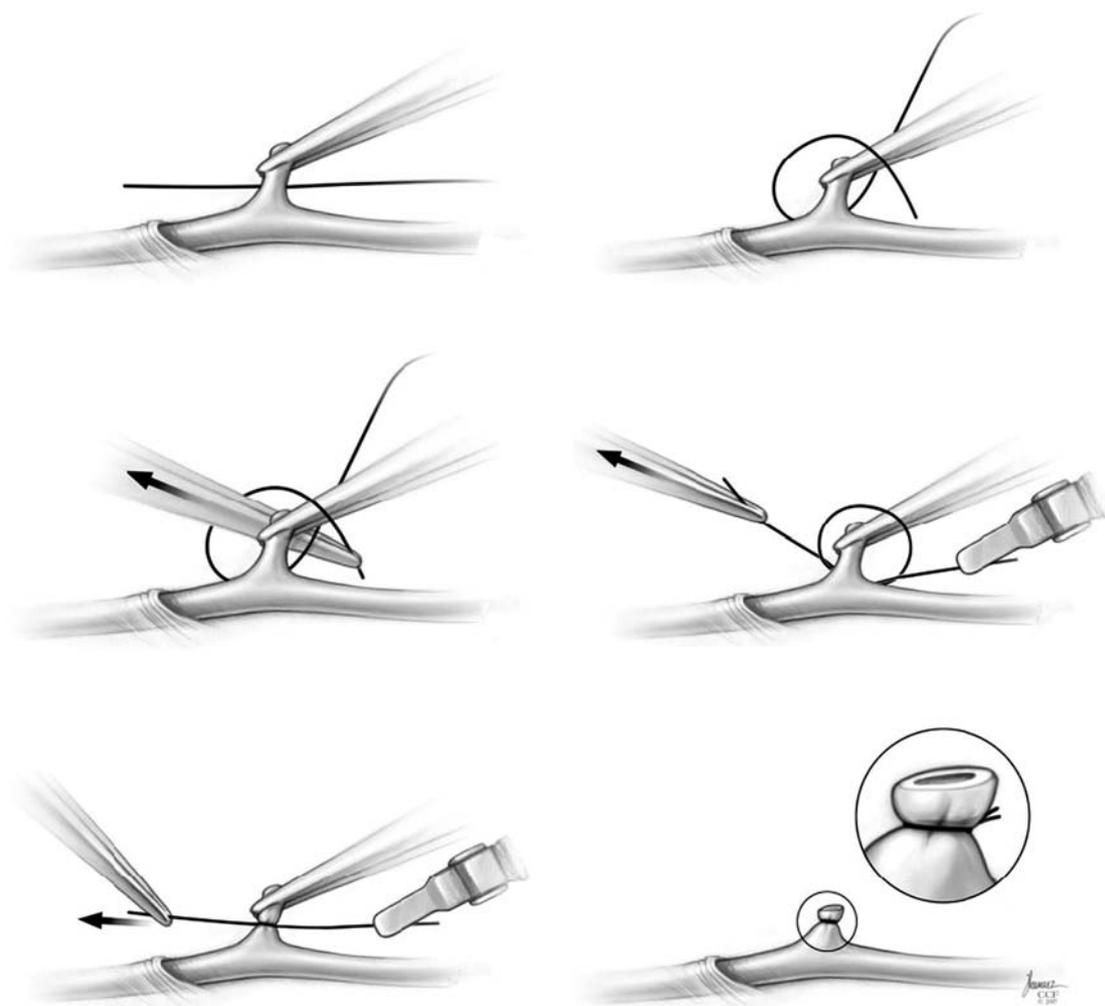


Fig. 1. (Above, left) Occlude the branch stump with the forceps tips, and pass the thread behind the branch. (Above, right) Make a loop around the branch stump. (Center, left) Catch the end of the thread and pull it to the opposite side from the inside loop. (Center, right) Place a single clamp at end of the thread and decrease the loop diameter by pulling the thread to the opposite of the single clamp. (Below, left) Place the first tie. (Below, right) Complete the branch ligation.

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