

**THE AMERICAN
SOCIETY
FOR
RECONSTRUCTIVE
MICROSURGERY**

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SPRING 1996

**RECONSTRUCTIVE
MICROSURGERY**

The mission of the American Society for Reconstructive Micro-surgery is to promote, encourage, foster and advance the art and science of reconstructive micro-neurovascular surgery; and to establish a forum for teaching, research and free discussion of reconstructive microsurgical methods and principles among members.

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RECONSTRUCTIVE MICROSURGERY

What's New in Reconstructive Microsurgery

By Saleh M. Shenaq, M.D.



Advances in the field of microsurgery continue to be made. This was manifested by several of the new ideas, innovations, and techniques that were presented during the Eleventh Annual Meeting of the American Society for Reconstructive Microsurgery which was held in Tucson, Arizona, January 14-17, 1996. This column will address a few papers which

were presented during the meeting.

"Local Application of Tissue Factor Pathway Inhibitor (TFPI) Inhibits Intimal Hyperplasia Induced By Arterial Interventions" Authors:

David M. Brown, MD, Norbert M. Mania, MD, E. Neil Pasia, B.A. and Roger K. Khouri, MD Division of Plastic Surgery, Washington University, St. Louis, Missouri

In a model of microvascular thrombosis

a single topical application of tissue factor pathway inhibitor was studied for prevention of platelet adhesion and arterial thrombotic occlusion. Tissue factor pathway inhibitor is a naturally occurring glycoprotein inhibitor of the activated tissue factor-Factor VIIa complex and Factor Xa. In the study which was designed to: 1) determine whether local application of TFPI at the time of arterial intervention could prevent intimal hyperplasia following angioplasty and intimaectomy, and 2) using labeled TFPI, examine the early sequence of events at the site of vascular injury following intimaectomy.

Past President Ralph T. Manktelow, MD (left) and Incoming President James A. Nunley, MD.

The authors used the left rabbit common carotid artery as their model. In their study the authors concluded that local irrigation with TFPI at the time of arterial intervention inhibits intimal hyperplasia following balloon angioplasty and intimaectomy. TFPI specifically and irreversibly binds to the injured vessel wall surface. It induces the formation of a pacifying scab over the thrombogenic surface which prevents platelet aggregation and thrombus formation and inhibits the cascade of events which lead to intimal hyperplasia. Such a study demonstrates the broad scope of microsurgery and the research by its members and its benefits to other surgical disciplines.

"Microvascular Anastomosis with Microstaples and Soluble Intraluminal Stents as Anvils"

Authors: David M. Brown, MD, Norbert M. Kania, MD, E. Neil Pasia, B.A., and Roger K. Khouri, MD, Washington University, St. Louis, Missouri

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Individuals Distinguish the Society

As always, when it comes time to write this column, I take a few moments to reflect on the nature of our Association and the members who comprise it. Sometimes it can be difficult to quantify the group as a whole. More often, it is easier to look at individuals, and from them gain a wider perspective.

Dr. Gunter Germann, MD just completed a trip to Melbourne, Australia, when he got the call to address the state of specialty for the international column. Although tired from traveling and hard pressed to find time aside from that at his clinic, he took up the request and produced a thought provoking and informative piece on reconstructive microsurgery overseas and how it compares to what's happening in the U.S.

Dr. William Shaw, MD had just returned from ISRM in Singapore, only to be drawn into the debate over the use of immediate free TRAM flap vs. pedicled TRAM flaps in our Counter Perspective column. On the other side of the debate, Dr. Stephen Kroll,

EDITOR'S MESSAGE



Saleh M. Shenaq, MD

*Our members are
dynamic and
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MD volunteered to take a careful and studied look at the issue, bringing to our attention points that might have been previously overlooked.

In the Young Microsurgeon's Perspective, Dr. Raymond Dunn, MD writes with the authority of a seasoned researcher, reminding us that innovation, cooperation and adherence to strict scientific principles can lead to significant advances in the specialty.

This energy and sense of commitment, as demonstrated by Drs. Germann, Shaw, Kroll and Dunn, serve to renew my conviction that the members of this Association are dynamic and extraordinarily motivated people. This clearly illustrates the youth and the vigorous and progressive nature of our Society and its membership. On behalf of the Society Council and the Newsletter's editorial board, I would like to say many thanks to each contributor. **RM**

Limb Salvage and Reconstruction: A Multidisciplinary Approach

The American Society for Reconstructive Microsurgery and the Plastic Surgery Education Foundation are co-sponsoring a symposium to be held in Seattle, Washington on May 9th-11th, 1996, in the Four Seasons Hotel. The course is co-chaired by L. Scott Levin, MD, and Thomas E. Trumble, MD, Chairman of the ASRM Education Committee. An international faculty with over 30 experts in specific areas of limb reconstruction will establish principles on the management of extremity reconstruction as well as advanced techniques in the management of complex problems.

The goal of the symposium is to integrate multiple different disciplines that are involved in extremity reconstruction, including extremity trauma, soft tissue reconstruction, disvascular extremity from

chronic disease, treatment of extremity tumors and pediatric disorders. In addition to a series of instructional lectures, free scientific papers will be presented as well to emphasize areas of advanced research in extremity reconstruction. The symposium is endorsed by the American Orthopaedic Association, the American Society for Surgery of the Hand, the American Association of Hand Surgery and the Orthopaedic Trauma Association. Over 50 abstracts have been received for free scientific papers.

There has been a substantial interest from the standpoint of corporate sponsorship for this meeting as well. In order to establish the concept of this meeting as an open forum, the discounted member registration fee has been extended to all members of both sponsoring and endorsing

organizations. Special discounted rates have been offered for residents in orthopaedic surgery, plastic surgery and general surgery to encourage physicians in training to take advantage of this excellent educational opportunity. The deadline to receive a discount for advance registration is April 30, 1996.

All who attend will enjoy the hospitality of Seattle, one of the best received meeting locations in the United States. For those wishing to stay a few extra days beyond the meeting, there is much to see and do in the area. Seattle offers many recreational activities as a result of its location on the Puget Sound, plus easy access to the nearby Olympic and Cascade mountains, and Victoria, British Columbia.

Make your plans to attend today! **RM**

Continuing the Progression

As we wind up the 11th Annual Meeting of the American Society for Reconstructive Microsurgery, I think it may be helpful to reflect on our past and perhaps comment on our future.

Our society was founded in 1983 and the first annual meeting was held on January 18 and 19, 1985. As a new and young society, our membership was limited and consisted primarily of American Society for Surgery of the Hand members who had a dual interest in hand surgery and microsurgery.

For the first nine years, our annual meeting was held in conjunction with the American Society for Surgery of the Hand. It was felt by our leadership and our membership that this would promote the society, increase membership, and increase attendance at our annual meeting. Nevertheless, over the ensuing ten years it became apparent to the ASRM membership that we had a cadre of devoted individuals whose practice primarily centered around microsurgery.

As with any parent and child relationship, it was difficult to sever the ties, but our tenth annual meeting in Marco Island, Florida, was a joint meeting held in combination with the American Association of Surgery of the Hand. This was the ASRM's first attempt to have a meeting at arm's distance from the larger organization, the ASSH. Even with a successful meeting our membership clamored for complete autonomy. Our society voted during the business meeting to have a stand alone meeting the next time.

With this mandate, President Ralph Manktelow forged ahead to hold the first stand alone meeting of the American Society for Reconstructive Microsurgery. Our major concerns at the executive level were; would we attract enough people to make this fiscally possible? Would there be enough abstracts submitted to a stand alone meeting so that the scientific session could have merit? The answer to both was a resounding, "YES!" Our attendance was nearly 250 people, more than enough to assure financial success, and the number of abstracts submitted and the quality of the abstracts was outstanding. Now that the 11th Annual Meeting has come and gone we can say that it was an unequivocal success.

PRESIDENT'S LETTER



James A. Nunley, MD

*Now that the 11th
Annual Meeting has
come and gone,
we can say that it was
an unequivocal
success.*

With this as a background, our 12th Annual Meeting will be held in Boca Raton, Florida, and although the American Association of Surgery of the Hand will be meeting prior to our annual meeting, this will not be a combined meeting but, rather, our second stand alone meeting. I sincerely hope that the membership will continue to support our efforts to maintain the scientific quality, and I hope that all of you will continue to lend your financial support by attending our 12th Annual Meeting.

As we plan for the future of our society we have several new initiatives which I plan to institute this year. I will bring these forward to you in our next mid year newsletter. I would particularly like to remind those of you who are interested in applying for the Godina lectureship that the deadline for submission is May 31, 1996. **RM**



12th Annual Meeting Ahead!

The 1997 Annual Meeting in Boca Raton, Florida, is the members' opportunity to exchange ideas and techniques in an open forum. The Founders and Godina lectureships are designed to stimulate and provoke, and will continue to be a focal point for the meeting. In addition, free paper and poster presentations give members the opportunity to present new techniques and research to a gathering of peers.

ASRM members are invited and encouraged to be a part of this annual exchange of ideas and knowledge. Your participation is ultimately what will make the 1997 Annual Meeting a success!

Godina Memorial Lecturer

Applications are now welcome for individuals interested in presenting the Godina Lecture at the Twelfth Annual Meeting. The lecturer must be a member of ASRM and under the age of 43 when the lecture is given. He or she will receive an honorarium of \$500 and the Godina Memorial Medal.

Members interested should submit a single paragraph outline of a 30 minute lecture, by May 31, 1996 to: President James A. Nunley, II, MD Box 2919 Duke University Medical Center Durham, NC 27719

The Godina Memorial Lecture, as established by the trustees of the Marko Godina Fund, is in honor of Marko Godina, MD who died in 1986 at age 43, in the prime of a very successful career in microsurgery. **RM**

What's New in Reconstructive Microsurgery

(continued from page 1)

The same authors presented an elegant study whereby the search for an easier and faster technique than conventional needle and thread suturing was attempted in order to facilitate the technique of microvascular repair. In their study the authors used stents made of inert triglyceride compound (Witepsol H37), which melts at body temperature. As an anvil to assist in the microvascular repair, these stents were designed such that they fitted snugly inside the lumen of the vessels to be approximated and allow for an eversion of the edges for micro stapling. The rabbit's, common carotid artery (2mm) was used in the study. A micro stapling device was applied as the method of vessel repair. To assess whether the stent causes peripheral emboli after it melts, stented/stapled microvascular anastomoses were also performed in a free flap model using the temporal ear artery. The results of the study suggest that stapled anastomosis had excellent approximation of the intimal edges without significant anastomotic stenosis. There was no observable side effect from the stent material and no evidence of peripheral emboli in the free flap model. This technique appears to be simple and safe when performed by a novice surgeon operating without an assistant. This technique may pave the way for endoscopic microvascular surgery.

"Endoscopic Saphenous Vein Harvest: Technical Refinements" Authors:

Lawrence S. Bass, MD, Nolan S. Karp, MD, New York, New York

The authors sought to refine techniques for endoscopic harvest of the saphenous vein to minimize undermined tissue, tissue trauma and incisions in a cadaveric study. Surgical technique included 1-1.5 cm incisions placed above the ankle and knee with identification of the vein under direct vision. A balloon device is inserted and inflated creating a 3 cm wide cavity over the vein from ankle to knee and knee to groin. After deflation and balloon removal, blunt dissection is performed using a modified liposuction cannula to mobilize the vein. A 4mm 30 endoscope is used for visualization, with retraction provided by a scope sheath as in an endoscopic browlift. Side branches were treated with a small endoscopic clip applier or with bipolar scissors as needed. This modification in the author's opinion provided significant improvements to the currently described endoscopic procedures. Dissection time, wound complications and the width of the dissected cavity are reduced. Such refinements could help in minimizing the morbidity when saphenous vein grafts are harvested for microvascular, vascular and cardiovascular procedures.

"Brain-Derived Neurotrophic Factor and Collagen Tubulization Enhance Peripheral Nerve Regeneration"

Authors: David S. Utley, MD, Sheryl L. Lewin, BA, Elbert T. Cheng, BS, and David J. Terris, MD, Stanford, California

This study investigated the effects of brain-derived neurotrophic factor (BDNF) on the regeneration of peripheral nerves repaired by epineurium coaptation or collagen tubulization. The left sciatic nerve was used as the model in the study. Five techniques were studied: epineurium coaptation (EC alone), collagen tubulization (CT alone), epineurium coaptation with BDNF delivered to the repair site via implantable osmotic pump (EC/BDNF pump), CT with BDNF delivered to the repair site via implantable osmotic pump (CT/BDNF pump), or CT with BDNF covalently cross-linked to the collagen tubule matrix (CT/BDNF linked).

Histologic examination and axonal counting as well as muscle mass from each animal's gastrocnemius and soleus group were analyzed. In their study the authors concluded that BDNF or collagen tubulization improves the rate and the degree to which recovery of sciatic function occurs after nerve injury and repair. Animals whose nerves were repaired using a technique of CT/BDNF linked showed the most favorable recovery compared to all other groups. This study and other similar studies certainly will pave the way for gene therapeutic approaches to nerve regeneration.

"A New Thrombolytic Gene Therapy Utilizing Adenoviral t-PA Construct: An Experimental Model" Author: Eric Rabinovsky, PhD, Houston, Texas

The author presented a model of thrombolytic gene therapy utilizing an adenoviral t-PA construct in a rabbit model. A segment of the rabbit femoral vein was injected through the epigastric branch with the virus construct through a 26-gauge catheter. Initial studies showed that adenovirus is able to infect endothelial cells and express recombinant proteins (beta-galactosidase (b-gal) in a time dose-dependent fashion. Infection of endothelial cells was obtained in as little as one minute. Studies with transfer of AD-t-PA constructs showed that the level of secreted t-PA increased nearly fourfold after 24 hours. This model allows researchers to apply this technique as a therapeutic model for prevention and treatment of vessel thrombosis, both in micro and microvascular surgery. The avoidance of systemic bleeding as a result of the traditional thrombolytic agents such as t-PA, etc. and the potential utility of such therapeutic modality in coronary artery disease is unlimited. This further emphasizes the importance of such studies. **RM**

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Highlights from the 11th Annual Meeting in Tucson



Terence Dickinson, presented the Keynote Lecture during the program.



1996 Scientific Program Chair Ronald Zuker, MD (left) presents the Awards to the top three poster presentations. (From right to left) Gunter Germann, MD, Melinda Haws, MD and Arnado Ruiz-Razura, MD.



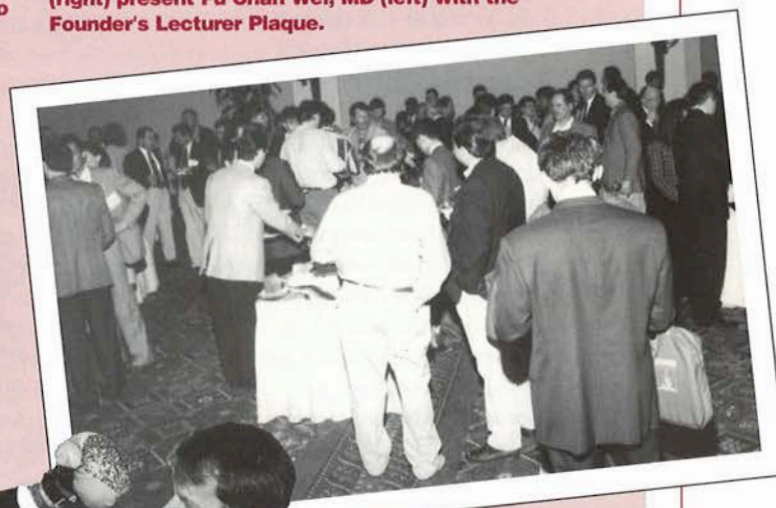
Past President Ralph T. Manktelow, MD dances with Navajo children dancers at the ASRM Reception and Dinner.



Past President Ralph T. Manktelow, MD (center) and 1996 Scientific Program Chair Ronald Zuker, MD (right) present Fu Chan Wei, MD (left) with the Founder's Lecturer Plaque.



Shown in the photo at left are Past President Ralph T. Manktelow, MD (right) and the 1996 Marko Godina Speaker, Randolph Sherman, MD.



A good time was had by all at the Welcome Reception.

Daniel Nagle, MD (left) and Julian Pribaz, MD prepare for the Great Debate.



Free Flap Reconstruction of Chronic Venous Ulcers

By Raymond M. Dunn, MD

Background: Chronic Venous Insufficiency and Ulceration represent a disabling illness with an incidence of 5-10%, totaling at least a million Americans. As wound clinics throughout the country can attest, there remain significant limitations in our abilities to effectively treat this illness.

Free flap treatment of recurrent venous ulceration began in the early eighties with reports of work by William M. Swartz, MD, and Oscar Ramirez, MD, followed by empirical efforts by others such as Robert L. Walton, MD, and Saleh Shenaq, MD, plus many individual unreported cases. The results of these efforts were favorable but strict patient selection and outcomes were lacking.

Patient Selection For Free Flap Reconstruction in Chronic Venous Ulcerations: Generally, even patients with recurrent ulceration should undergo a trial of compression therapy with an "Unna's Boot" regimen. During this period patients undergo Duplex scan and PPG evaluations to document the extent of deep venous insufficiency and absence or presence of venous obstruction which represents a relative contraindication to flap repair. Often the Duplex will also identify areas of tibial perforators which may be contributing to the ulceration and tissue damage. Joint evaluation with a vascular surgeon helps define opportunities for venous bypass, valvular repair or endoscopic perforator ligation which may represent primary surgical approaches to many of these patients. It is also important to identify any thrombotic states in any patient under consideration for flap transfer as they may be at risk for thrombotic flap complications (protein S and protein C deficiencies are examples).

Flap Choices/Anatomy: Plans for flap reconstruction should look at the individual anatomy of the patient and deformity as we approach any microsurgical reconstruction. Deformities directly over the malleolus call for a thin flap which will allow the

use of normal footwear post-operatively. In many cases these patients may be overweight and choices in this area may be limited. However, individual anatomy may vary, and even in an obese patient the dorsal thoracic fascia (scapular flap) may not be excessively thick.

All effort should be made to remove the entire area of ulceration and entire lipodermatosclerotic adjacent tissues in a subfascial plane including the ligation of all perforating veins entering the surgical specimen. Ironically, this is the exact operation originally described by Linton except he didn't have a free flap to close the wound!!

Vein valves exist in the microcirculation of the dorsal thoracic fascia, thoracodorsal, and deep inferior epigastric venous trees. We have shown that over 100 valves, ranging from 50 microns to 1.5 mm, would be transferred in a typical scapular flap. Our preliminary muscle anatomy studies show fewer valves in the intramuscular system. Our preferred donor site has been the scapular territory.

Technique and Post-op Care:

Posterior tibial vessels are used preferentially. These often exhibit significant scarring, and careful dissection is necessary to preserve veins for two vein repairs, end-to-side, whenever possible. The flaps are dissected simultaneously with a "beveling" type incision to incorporate a greater amount of healthy subcutaneous tissue from the back to the leg. This excess can also be skin grafted where necessary and achieve the same excellent healing. Post-op care is generally routine as in any lower extremity free flap, with a greater degree of tissue support during the early period of ambulation. We discharge patients with an Unna Boot as incisions are very prone to delayed healing due to swelling and adjacent scarred skin to which the flaps must heal. Often the patient may need a weekly Unna Boot for 2-4 weeks prior to being placed in long term compression stockings.

Outcomes: Larger series such as that by Raymond M. Dunn, MD, and Norman Weinzwieg, MD, FACS, have shown excellent long term ulcer free "cures" in patients carefully selected for this surgery. Post-operative photoplethysmography (PPG) has shown

improved venous refilling times when measured over the flap territories. This suggests that microvalves in the free flaps have maintained their integrity in transfer. The result is a "composite" flap transfer that not only removed the ulcer and damaged skin but also provides new venous competence to the region.

The responsibility now lies with the current generation of "microsurgeons" to develop and apply outcome measures to prove not only the effectiveness of the surgery but that it also is cost effective when compared to standard therapies which may require multiple operations, or result in higher rates of recurrence.

Collaboration: Application of microsurgical reconstructive surgery principles to yet another problem area is a natural evolution of the creative energies of plastic surgery and a testament to the possibilities that exist. It is critically important that we approach this and other new applications with a rigid scientific outlook. We must work with our referring co-physicians and establish clearer guidelines for patient selection while we simultaneously scrutinize our results. **RM**

Raymond M. Dunn, MD, is currently on staff as Associate Professor of Surgery and Anatomy, at the Division of Plastic Surgery, University of Massachusetts Medical Center.

ASRM Positions Available

The following positions will be open for the 1997 year: Secretary, Vice-President and Council Member at Large. Anyone wishing to submit nominations should contact Dr. Ralph Manktelow at:

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MICROSURGERY OVERSEAS

By Gunter Germann, MD

The future of complex reconstructive microsurgical procedures is at stake!! Dramatically decreasing reimbursements and the refusal of insurance carriers to approve coverage for these procedures threaten the future of Microsurgery! This is the impression gained from the most recent meetings of ASRM and ISRM in the beginning of 1996. But is this really true and is it true for every country?

The following article tries to answer the question for Germany and its neighbor countries with similar health insurance and social security systems as Switzerland and Austria. To understand the presence and the future of microsurgery in these countries, it

"Private Patient" >\$3,500/month

- ✓ Free choice of approx. 35 insurance companies
- ✓ Sees doctor of his choice
- ✓ Receives bills (reimbursement by insurance company)
- ✓ Hospital of his choice
- ✓ Premium/family/month - \$800 (50% paid by employer or tax deductible)

Figure 1

"Regular Patient" < \$3,500/month (automatically insured)

- ✓ Choice of 3 types of public insurance comp.
 - "White collar" HCO (Health Care Organizations)
 - "Blue collar" HCO
 - Company based HCO
- ✓ Sees doctor of his choice (private practice), sees staff in hospital
- ✓ No billing at all (neither practice nor hospitals)
- ✓ Closest appropriate hospital (exceptions)
- ✓ No difference in quality of care?
- ✓ Premium/family/month—13% income (50% paid by employer)

Figure 2

Germany: Present Situation and Future Perspective

is essential to have a closer look at the health insurance system.

The basic principle of the system is to provide optimal care to all citizens at affordable costs. The patient population can be divided into two groups which are separated by the level of monthly income and their occupation. Employees who earn less than \$3,600/month are automatically insured in "public health insurance organizations" which are vaguely comparable to HMO's (Fig. 1). The premiums are equally shared between employee and employer, and are automatically deducted from the salary and transferred to the insurance agency. This was introduced approximately 120 years ago and the employers are required by law to pay 50% of the insurance premiums. This group of patients comprise

approximately 90% of all patients and have their choice among 25-30 "public health insurance agencies." They have a free choice of doctors in private practice and are not on a "fee for service" basis. All family members are included in the policy. The doctor in private practice sends his bill directly to the insurance agency. In case of inpatient hospital treatment, the hospital is reimbursed on a daily rate, which covers nursing care, operation, materials etc. These patients only have small extra payments on prescriptions, glasses and dental care. In the hospital, they are seen by junior staff members or chief residents. However, major surgery on these patients is still performed by senior staff members or the division chief, so that optimal care is guaranteed. Special policies are available for these patients, if they explicitly wish hospital treatment by senior staff members or division chiefs.

Excepted from the public health insurance systems are people who earn more than \$3,500/month, state employees, and all people working in a free enterprise including artists, writers etc. These patients are called private patients and are on a "fee for service" basis (Fig. 2). They will be billed in private

practice as well as in the hospital and are later reimbursed by their insurance carriers. Currently, approximately 50 insurance companies compete for this group comprising 10% of all patients. This group also has a free choice of doctors in private practice and are seen in the hospital only by senior staff division chiefs.

A second parallel system exists with the workman's compensation system. It covers all treatment and rehabilitation costs for an

Hospital Structure

Level I	Workmen's Comp.	Level II	Level III	Private
University	Spec. Trauma	Medium Size	Basic Care	Small
Major City Hospital	Centers—University Affiliated	City and County Hospitals	Rural Areas	Exclusive
Trauma Centers				Specialized

Figure 3

occupational accident on a "fee for service basis" in private practice, and on a daily rate reimbursement in case of hospital treatment.

There is a distinct difference between private practice and hospitals in our system (Fig. 3). Private practice is mostly limited to conservative treatment or minor surgery in outpatient or day care facilities. Major surgery is almost exclusively performed in hospital divisions. Operative privileges for private practitioners are usually restricted to affiliated hospitals. Hospital doctors can only work on a referral basis for the "public" patients and are not allowed to bill them. They are allowed to see "private" patients directly without any referral. It becomes clear that this patient group is lucrative for private practitioners and hospitals doctors and they compete for these patients, especially in minor surgical procedures (CTS, trigger finger, scar corrections etc.).

The German law specifies that all reconstructive procedures are covered by the health insurance carriers. Since the cost of a hospital bed/day with all services provided is still significantly lower than in the U.S. (approx. \$350-450), it becomes clear that costly operations, such as free tissue trans-

fers require a longer hospital stay compared to the U.S. In Germany, however, immediate inpatient rehabilitation is often included. This is most frequently found in workmen's compensation patients.

Ninety percent of the free flaps performed in our units are "free" for the patient. The average costs for a flap after trauma in this group, including early inpatient rehabilitation, are approximately \$18,000 compared to \$25,000-50,000 in the U.S. The surgical fees for a microvascular tissue transfer for private patients are between \$3,500-6,000. In this small patient group we presently fight a similar "war" as our American colleagues. Since we have no codes for microsurgical procedure, the insurance companies try all methods to decrease the reimbursement. This leads to a "hostile" correspondence and delay of reimbursement in nearly 60% of all cases.

Microsurgical procedures are predominantly performed by Plastic Surgery, but also to a similar degree by specialists in Maxillofacial Surgery, ENT and, though seldomly, Orthopaedic Surgery. The spectrum of operations is comparable to that in the U.S. Residents in larger Plastic Surgery units are trained in microsurgery during their residency. Residents of smaller programs have the option of training courses. To date, obtaining insurance coverage for microsurgical procedures has not been a problem.

Group I	
Interval Trauma-Free Flap 4.4 Days	
Revisions	12.5%
Flap Loss	4%
Consecutive bone corrections	25%
Treatment costs	\$15,000

Figure 4

Group II	
Interval 31.1 Days	
OPs prior to flap	3.5
Revisions	16%
Flap loss	5%
Treatment costs	\$36,000
Consecutive bone corrections	60%

Figure 5

As in the U.S., insurance carriers are not interested in the socio-economic impact of surgical procedures—at least not yet. However, workmen's compensation organizations are deeply interested in the cost efficiency of treatment regimens. To evaluate the socio-economic impact of complex microsurgical procedures and to better establish our position, we started some preliminary studies 3 years ago to study the cost-benefit ratio in lower leg trauma, upper extremity trauma, replantation, and revascularization.

The results of a preliminary study of complex lower extremity defects are present-

Lower Leg Injuries/Resulting Disability		
	Disability	Payment/ year
Ankle fusion	20%	\$4,500
BK Amputation	40%	\$9,000
AK Amputation	60%	\$13,500
Knee fusion	45%	\$10,125

Figure 6

ed in Figures 4 and 5. The treatment cost of delayed reconstruction are more than twofold higher than in the early reconstruction group. Furthermore, considerable savings in disability payment result if limb salvage is successful (Fig. 6).

Interesting results could be demonstrated in microsurgical procedures in the upper extremity. The overall costs for a flap transfer, including compensation payment, averaged \$51,300. In more than 80% of the patients a reduction of the disability rating of at least 10% (\$2,470/year) was achieved (Fig. 7 and 8). Even more obvious are the results of the thumb revascularization. Ten thumbs were revascularized over an 18 month period. All could be salvaged and the disability rating remained below 10%, which does not translate into payment in the German system. Treatment costs averaged \$27,230, but the savings for the workmen's compensation in disability payments totaled \$63,000/year (Fig. 9 and 10). Extrapolated to a remaining working time of 25 years, the savings totaled \$1,583,000.

Microsurgery—Upper Extremity Free Flaps in Trauma	
Age	37 Years
Interval Trauma-Flap	4 days
No. of Flaps	18
Treatment Costs (Av.)	\$33,600
Compensation	\$17,700
Total	\$51,300

Figure 7

Microsurgery—Upper Extremity Free Flaps in Trauma		
	Year	Lifespan/ total
Treatment Costs		\$51,000
Disability rating 40%	\$10,130	\$253,000
Disability rating 50%	\$12,600	\$316,000
Disability rating 60%	\$15,200	\$380,000
Saving 40-50%	\$2,470	\$61,750 (\$1,111,500)
Saving 40-60%	\$5,070	\$126,750 (\$2,281,500)

Figure 8

These data are preliminary, and "outcome scores" were not included in the analysis. Clearly, further prospective outcome studies addressing both quality and overall costs of medical care are needed, and we are currently working on various "outcome" projects. However, the preliminary data emphasize that qualified microsurgical treatment improves the functional and aesthetic outcome, increases patient satisfaction, and is highly cost effective at the same time. Studies in breast reconstruction have already shown that presumably less expensive methods, such as expander/implants, need more operative procedures to achieve the final result than a complex procedure such as a free TRAM. If further studies could demonstrate that the overall complication rate of the microsurgical reconstruction is lower, there is little doubt that this procedure will survive and prevail.

We firmly believe, that only these types of studies will provide the data which are needed to demonstrate the superior results achievable with microsurgery. With the studies already completed and currently underway, we hope to set the cornerstones for a safe and prosperous microsurgical future in our country. **RM**

Microsurgery—Upper Extremity Revascularization	
Age	34
No.	30
No.-Thumbs	10
Treatment Costs	\$17,100
Compensation	\$10,130
Total	\$27,230

Figure 9

Microsurgery—Upper Extremity Revascularization (Thumbs)		
	Year	Lifespan/total
Treatment costs		\$27,230
Disability rating < 10%	—	—
Disability rating 25%	\$6,300	\$158,300 (\$1,583,000)
Savings > 10% - \$25	\$6,300	\$158,300 (\$1,583,000)

Figure 10

Gunter Germann, MD, PhD, is very active in the international microsurgical community, having recently completed trips to the U.S. and Australia. Dr. Germann currently practices at the BG Unfallklinik, in Ludwigshafen, Germany.

Why Use Immediate Free TRAM Flap over Pedicled TRAM Flap?

By William W. Shaw M.D. FACS

Conventional wisdom back in the 1980's assumed that free TRAM flaps would be more risky and difficult than pedicled TRAM flaps, therefore, even less appropriate for immediate reconstruction at the time of mastectomy. Experience in the last few years at major centers (NYU, UCLA, Birmingham, MD Anderson, Washington Univ, St. Louis, etc.) as well as many groups in community hospitals have proven that the opposite is true. Today, nearly every one who has done both pedicled and free TRAM flaps prefers the free flap, particularly for immediate reconstruction for the following reasons:

1. **Better Blood Supply.** The inherent superiority of the inferior epigastric artery system over the superior muscle pedicle is well documented. The more vigorous arterial perfusion and less obstructive venous drainage result in a harder flap with larger usable volume and less fat necrosis. It also expands the suitability of TRAM flaps to patients generally thought to be unsuitable for pedicled TRAM flaps, such as those with smoking history, obesity, chest wall radiation, or upper abdominal scars.
2. **Less Abdominal Muscle Loss.** Today, the amount of rectus abdominis muscle taken with the free flap is very small or none at all in the case of perforator flaps. In all cases, the upper half and the lower

quarter of the muscle are preserved and remain innervated. While, completely objective documentation of abdominal muscle function is difficult to obtain, the subjective results support the observation that there is better preservation of abdominal muscle functions in free flaps compared to pedicled flaps, particularly in bilateral cases. Also, without the need to dissect the upper rectus muscle and the skin tunnel, the free flap patients seem to have less discomfort post-operatively. Most patients are now discharged from hospital 3 to 5 days later.

3. **Greater Freedom of Design.** Without the tethering from the muscle pedicle one has greater freedom to inset the breast to achieve the best aesthetic result. Without the skin tunnel, the inframammary fold is well preserved. There is no pedicle fullness to worry about at the costal margin. The more vigorous flap also allows for primary trimming and contouring of the flap, as needed.
4. **Reasonable Time and Morbidity.** In experienced hands, free TRAM flaps can be done in 3-6 hours, not much longer than pedicled TRAM flaps. In immediate reconstructions, the thoracodorsal vascular pedicles are already exposed, it takes only a few more minutes of preparation to be ready for anastomoses. The time spent doing the tedious upper muscle pedicle dissection and the skin tunnel is similar to the time needed to ligate the

inferior epigastric pedicle and to do the two vascular anastomoses. At the January 1996 Atlanta Breast Symposium, Drs. Hartrampf and Beagle performed simultaneously a pedicled and free TRAM flap respectively with no significant difference in operating time. The success rate and morbidity data for free flaps are also very favorable compared to pedicled TRAM flaps. Our experience at UCLA with about 400 free TRAM flaps had a success rate of 99.5%, which is as good as any series of pedicled TRAM flaps. At a personal and subjective level, after doing pedicled TRAM flaps for about 6 years before switching to free TRAM flaps routinely, I worry more post-operatively about pedicled TRAM flaps than free flaps. The skin color is often more pale or blue. I always worry if there was any twist or compromise to the muscle pedicle. Finally, if there is a flap problem, I am less sure about what to do.

In summary, TRAM free flap is a straightforward and highly successful method of breast reconstruction. The advantages of better blood supply, less muscle loss and greater freedom of design make it the preferred choice for most surgeons comfortable with both pedicle and free flap techniques. Very importantly, the free flap allows for a less restrictive patient selection while providing for more versatility to achieve best aesthetic results. The indications for pedicled TRAM flap are becoming increasingly limited: 1) well selected patients with less rigorous concern of abdominal muscle function, 2) paramedian or other lower abdominal surgical scars that might have damaged the inferior epigastric pedicles, 3) rare situations that would make thoracodorsal or internal mammary recipient vessel dissections difficult, or 4) lack of well trained reconstructive microsurgeons in the geographic area. **RM**

A Word About CPT Coding

The ASRM Coding and Reimbursement Committee would like to remind the members of the Society we stand ready to assist them in answering CPT coding questions. Furthermore, we would like to hear from the membership regarding changes in the CPT codes for microsurgery. Such changes can include simple changes in nomenclature and additions or deletions of codes.

A note of caution, however, is appropriate. It should be borne in mind prior to embarking upon the introduction of a new CPT code, one must be certain a similar

code is not available for use in the CPT nomenclature. Furthermore, any new codes that are added will necessarily reduce the amount of payment that is to be perceived for microsurgical codes globally. This is necessitated by the congressional mandate to maintain budget neutrality in Medicare spending.

There are many excellent coding courses throughout the country and in this time of shrinking reimbursement, it may be wise to attend such seminars. Our committee thanks you for your support and stands ready to assist you. **RM**

William Shaw, MD, serves as Professor and Chairman, Division of Plastic Surgery, at the UCLA School of Medicine.

The Case for Choosing the Pedicled TRAM Flap

By Stephen S. Kroll, M.D.

Asking me to argue against the free TRAM flap for immediate breast reconstruction is like asking Bill Clinton to write an article condemning income taxes. As most readers know, I prefer the free TRAM flap for most of my breast reconstructions, especially in immediate reconstruction because in most cases the thoracodorsal vessels, which are my recipient vessels of choice, are already exposed by an axillary dissection. The free TRAM flap has a better blood supply and less donor site morbidity than the conventional TRAM flap, and patients prefer it because there is less postoperative pain. There are certain situations, however, where a conventional (pedicled) TRAM flap, in my opinion, would be preferred.

The most common situation where a conventional or supercharged TRAM flap is the best choice is in the patient with previous heavy irradiation. The reason for this is that in such cases the free TRAM flap is slow to develop collateral circulation, and therefore may remain dependent on the flap pedicle for an extended period of time, or

even indefinitely. If a late vascular occlusion occurs, the flap can become partially necrotic even many weeks after what had appeared to be a successful transfer. I have seen this happen twice, in situations where a non-irradiated patient would probably not have suffered any untoward effect. I therefore lean toward the use of a pedicled flap for previously irradiated patients, with supercharging should the blood supply to the pedicled flap be marginal.

The second situation where I might prefer a pedicled TRAM flap is in a patient who refuses to allow blood transfusions (e.g., a Jehovah's Witness). Although blood loss is usually minimal during mastectomy and immediate reconstruction, if thrombosis subsequently occurs and there is a need to revise the anastomosis, it may well be necessary to transfuse the patient before the anesthesiologist can safely put the patient to sleep. The use of a pedicled TRAM will reduce the probability of the surgeon finding himself in the dilemma of facing impending flap loss but being unable to do anything about it because of an inability to transfuse the patient.

The final situation where I would choose a conventional TRAM flap is in the patient who has no suitable recipient vessels in the axilla. Although it is possible to use the internal mammary vessels as an alternative, I would probably use a pedicled TRAM instead. Although the internal mammary artery is consistently usable, the vein is sometimes too small for my taste. A pedicled TRAM is a safe alternative, and one can almost always find a vein somewhere in the axilla to supercharge with if that becomes necessary.

In summary, although my first choice for the overwhelming majority of patients is a free TRAM flap, the pedicled TRAM flap still has a place for selected patients. It also remains the method of choice for surgeons not trained in microsurgery, or in settings where microvascular surgery is impractical or impossible. **RM**

Stephen S. Kroll, MD is a Professor of Plastic Surgery at the University of Texas MD Anderson Cancer Center, in Houston.

Video Reviews

by Timothy S. Loth, MD



Tissue Expansion and Microvascular Reconstruction in the Pediatric Patient with Hemifacial Microsomia

Author: Sharon Ann Clark, MD, and Louis Morales, Jr., MD

Intended Audience: Plastic Surgeons, Oral Surgeons, ENT

Length: 25 minutes

Rating: 4 fingers

Summary: This videotape presents autologous tissue reconstruction of hemifacial

microsomia using a free serratus anterior muscle with vascularized rib. It demonstrates the preoperative planning of reconstructing this difficult problem. The mandibular defect is reconstructed with the vascularized rib which is supported by the serratus anterior muscle. The serratus anterior muscle provides bulk to the face.

The video tape emphasizes the following techniques or points for a successful result:

1. The concomitant orthodontic contribution to the problem.
2. The technical aspects of the elevation of the free serratus anterior and rib together as one unit to correct both bony and soft tissue deficits.

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Video Rating Scale



5 Finger Replant
Excellent



4 Finger Replant
Good



3 Finger Replant
Fair



1 Finger Replant
Poor

Video Reviews

continued from page 11



Reconstruction of the Esophagus

Authors: Chicarilli and Price

Intended Audience: Plastic

Surgeons, Head and Neck Surgeons, ENT Surgeons

Length: 20 minutes

Rating: 4 fingers

Summary: This video tape demonstrates the technical aspects of raising the forearm flap and its tubing to reconstruct the cervical esophagus.

The videotape emphasizes the following technical points:

1. The elevation of the correct size skin flap.
2. The tubing of the forearm flap.
3. It demonstrates the recipient site defect.
4. The technical aspects of positioning the flap with relationship to the vessels in the neck.



Video Atlas of Microsurgical Composite Tissue Transplantation Tape Four: Section 2

Author: Donald Serafin, MD

Intended Audience: Microsurgeon at any level of training

Length: 63 minutes

Rating: 5 fingers

Summary: This series of audiovisual tapes is based upon Dr. Serafin's text, Atlas of Microsurgical Composite Tissue

Transplantation. Each tape is divided into a number of sections, which describe the harvest of free tissue flaps. Each section has a similar format consisting of indications, advantages and disadvantages of each flap, the pertinent anatomy, surgical anatomy on a live model and a cadaver dissection, including pedicle length and vessel diameter. In addition, there is a useful concluding section on pearls and pitfalls for each particular flap. Tape Four has an excellent description of deltoid neurosensory fasciocutaneous flap, pectoralis major and minor flaps, serratus anterior flap, and the "workhorse" latissimus dorsi flap. The tape is well illustrated and nicely organized.



Fascial/Fasciocutaneous Flaps Tape Eight

Author: Donald Serafin, MD

Intended Audience: Any microsurgeon or residents involved with microsurgery

Length: 46 minutes

Rating: 5 fingers

Summary: Thorough discussion of medial arm, lateral arm, radial forearm and ulnar forearm flaps is achieved in this videotape. The same successful format is employed in this tape as in the previous ones. Cadaver dissection, combined with the live models and schematic diagrams, help to illustrate harvest of the aforementioned flaps. **RM**



Microsurgery Calendar

May 9-11, 1996

ASRM/PSEF

Limb Salvage and Reconstruction:

A Multidisciplinary Approach

Seattle, WA

Contact: PSEF

(847) 228-9900

August 22-24, 1996

AAHS Cumulative Trauma

Disorders of the Upper Extremity: III

Pittsburgh, PA

Contact: AAHS

(847) 228-9758

Sept 30-Oct 3, 1997

ASSH 51st Annual Meeting

Nashville, TN

Contact: Gail Gorman

(303) 771-9236

November 9-13, 1996

ASPRS/PSEF/ASMS Annual

Scientific Meeting

Dallas, TX

Contact: ASPRS

(800) 766-4955

January 8-11, 1997

AAHS 27th Annual Meeting

Boca Raton, FL

Contact: AAHS

(847) 228-9758

January 12-14, 1997

ASRM 12th Annual Meeting

Boca Raton, FL

Contact: ASRM

(847) 228-9717

February 13-17, 1997

AAOS Annual Meeting

San Francisco, CA

Contact: AAOS

(847) 823-7186

RECONSTRUCTIVE MICROSURGERY

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