

# Introduction of Microsurgery in Vietnam by a Charitable Organization: A 15-Year Experience

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**Background:** Microsurgical procedures, although equipment- and labor-intensive, allow efficient treatment of selected soft-tissue, bone, and peripheral nerve defects. The precise surgical skills required and the high equipment and institutional costs have been deterrents to initiating programs in developing countries. The authors report their 15-year international effort in facilitating the development of microsurgical techniques in Vietnam.

**Methods:** The authors reviewed their educational, logistical, and operative experience from 11 Operation Smile International missions to Vietnam and the microsurgical procedures performed independently by Vietnamese surgeons at the Central Military Hospital 108 in Hanoi.

**Results:** Over 15 years, Operation Smile International missions to Vietnam performed 108 free tissue transfer operations with 15 peripheral nerve transfer procedures and 143 nonmicrosurgical reconstructive operations. Visiting surgeons with specialized expertise taught facial reanimation, flap prefabrication, and perforator flaps. During this same period, Vietnamese surgeons became facile with microsurgical techniques and independently performed a wide array of these procedures in the institutions visited. Vietnamese surgeons have organized microsurgery divisions within some hospital departments and now teach microsurgical techniques. Repeated missions allowed for patient follow-up, staged procedures, educational exchange, and quality control. Several Vietnamese surgeons have traveled abroad to obtain additional training and have set up training programs in other areas of Vietnam.

**Conclusions:** Charitable organizations can help surgeons in developing countries master complex microsurgical techniques through short-term medical missions, donation of equipment and supplies, and the encouragement of institutional support. A continuing education program, including local conferences, microsurgical laboratory training facilities, and study abroad, can aid this introduction. (*Plast. Reconstr. Surg.* 119: 1267, 2007.)

**H**igh costs and technical expertise required to perform complex invasive procedures pose significant barriers to use in developing countries. Volunteer physicians have addressed some of these needs by setting up practice in developing countries, joining charitable missions, and sponsoring children to be treated in centers of excellence. There is no single solution to the enormous surgical needs of the world; however, volunteer missions allow sur-

geons to maintain their practice at home while taking 1 to 2 weeks to serve in a developing country.<sup>1</sup> As a result, not only have tens of thousands of patients received life-improving surgery, but host physicians have also benefited from educational symposia and hands-on educational training.<sup>2</sup>

In the mid-1980s, retired U.S. Army General John W. Vessey accepted an assignment from the Reagan Administration to facilitate a rapprochement between the United States and Vietnam primarily through humanitarian and cultural programs. It was in this context that Operation Smile International made its first medical mission to Hanoi in 1989. This bridge-building experience saw former enemies come together for the benefit of children with congenital facial deformities. The success of this initial medical mission can be attributed to the hard work of

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physicians, nurses, support personnel, and politicians from both countries.

Professor Nguyen Huy Phan, the former Surgeon General of the Vietnamese Army, stands out for his vision of what microsurgery could add to the Vietnamese health care system and for his leadership in starting this discipline. At his request, Operation Smile agreed to explore the possibility of bringing a microsurgical program to Vietnam. Before 1990, Vietnamese experience in microsurgery was anecdotal and without proven successful results.

This article describes our response to a request in 1989 to facilitate the development of a complex surgical discipline in Vietnam. We hope that the lessons we have learned from this experience will be helpful to others considering volunteer medical missions to developing countries.

## PATIENTS AND METHODS

The surgical and educational programs of Operation Smile International in Vietnam were reviewed. Medical records from 11 microsurgery missions spanning 1990 to 2004 were analyzed for the type of procedures performed, outcomes, and complications. In addition, the independent microsurgical experiences of Vietnamese surgeons at Military Hospital 108 were reviewed and compared with free flap survival rates reported in the literature. Other methods of microsurgical technology transfer were assessed, including the establishment of a functioning microsurgical training laboratory and mission-coordinated symposia. The impact of including surgeons with expertise in selected areas of microsurgery was evaluated.

## RESULTS

### Procedures Performed

Since 1990, 11 Operation Smile International microsurgery missions have traveled to Hanoi and Ho Chi Minh City, performing operations at Viet Duc Hospital (Hanoi), Military Hospital 108 (Hanoi), Hanoi Plastic Surgery Center, and the Center for Traumatology and Orthopaedics (Ho Chi Minh City). Operation Smile International surgeons performed 266 operations, including 108 free tissue transfers, 15 microsurgical peripheral nerve operations, and 143 complex nonmicrosurgical reconstructive cases. Because we were able to see many patients in follow-up, minor revisions or staged procedures were performed in 21 patients (Table 1).

Free tissue transfers were monitored in the early years by visual inspection and Doppler ex-

**Table 1. Summary of Microsurgery Cases Performed from 1990 to 2004 Showing Free Flaps Performed by Operation Smile International Teams Adjacent to Those Performed Independently by Surgeons at Military Hospital 108 in Hanoi\***

Free Flaps	Microsurgical Cases, 1990–2004	
	OSI	Hospital 108
Scapular	17	100
Fibula	17	48
Radial forearm	14	29
Rectus/free TRAM	13	7
Latissimus dorsi	10	53
Gracilis	10	100
ALT perforator	10	6
DIEP	5	0
Iliac crest	2	38
Other	10	17
Total	108	398
Microneural facial reanimation	15	76
Total	123	474

OSI, Operation Smile International; TRAM, transverse rectus abdominis musculocutaneous; ALT, anterolateral thigh; DIEP, deep inferior epigastric perforator.

\*Other free flaps included lateral arm, temporoparietal fascia flaps, dorsalis pedis, gastrocnemius, deltoid, jejunum, and toe-to-thumb transfer.

amination and later with venous Doppler (Cook Medical, Inc., Bloomington, Ind.) for selected buried flaps. Anticoagulation in most patients was with aspirin (325 mg) the night before and on the first postoperative day.

Major complications included a cardiac arrest successfully resuscitated during induction of anesthesia in one patient, urgent tracheostomy in one patient, and reexploration of a free flap in two patients. One 50-year-old patient who had a successful microsurgical soft-tissue flap for head and neck reconstruction died as a result of a perforated ulcer 3 weeks after surgery. One free tissue transfer was lost (0.9 percent failure rate). Major reconstructive procedures that did not require microsurgery ( $n = 143$ ) included release of burn scars with pedicle flap or skin grafts, resection of vascular malformations, treatment of congenital hand and facial deformities, and treatment of posttraumatic defects.

### Vietnamese Experience

#### Surgical Capabilities

All hospitals visited by Operation Smile International surgeons have developed autonomous microsurgery capabilities. Visits to Central Military Hospital 108 have occurred on 10 of the 11 Operation Smile International missions to Vietnam. A comparison of the results of independently per-

formed microsurgical procedures at Hospital 108 with those from Operation Smile International missions is encouraging.

Military Hospital 108 surgeons have performed a total of 474 independent microsurgical operations, including 398 free tissue transfer and 76 peripheral microsurgical cases using the surgical microscope (Table 1). Their overall failure rate of 6.4 percent is in the range reported by many studies.<sup>3-5</sup> During Operation Smile International missions, Vietnamese surgeons and nurses shared postoperative care responsibilities with the Operation Smile International team. After Operation Smile International's departure, the Vietnamese group assumed full care of the patients and provided any follow-up procedures or surgery needed. For example, in one case of bilateral severe burn scar contracture, the Operation Smile International team performed and taught the release of a severe dorsal hand contracture and resurfacing with a parascapular flap. Within the next year, the Vietnamese surgeons performed a similar procedure on the patient's opposite hand (Fig. 1).

One area for which the Vietnamese surgeons have developed an expertise is facial palsy. They independently performed 76 microneural facial reanimation procedures using a cross-facial nerve graft followed by free gracilis flaps. One patient with an obstetrical facial palsy went on to a modeling career after correction of this devastating deformity.

Many complex deformities were corrected with simpler procedures (Fig. 2). For example, multiple burn contractures were released with skin graft or local flap coverage.

#### Mission Logistics

Microsurgical cases are long and technically demanding and require a dedicated team of sur-

geons, anesthesiologists, and nurses familiar with these procedures. Vietnamese physicians, nurses, and anesthesia providers worked side by side with their visiting counterparts. All volunteers were familiar with microsurgical cases in their home countries and most (approximately 75 percent) had previously participated in charitable medical missions, often with Operation Smile International. The high level of familiarity with Operation Smile International and the high level of microsurgery expertise among team members have contributed to the stability and quality of the microsurgery program since its inception.

Typical Operation Smile International microsurgery missions to Vietnam included 2 days of screening, 1 day for an educational conference, and 5 days of surgery. Most missions have had three operating rooms and a recovery area (post-anesthesia care unit), staffed by six visiting surgeons, six to eight nurses, and six anesthesiologists. The inclusion of these additional nurses and anesthesiologists has facilitated training of the Vietnamese nurses and anesthesiologists in the proper care—preoperatively, intraoperatively, and postoperatively—of these complex patients. Many microsurgical cases allow two teams to operate in two separate fields on the same patient. This has allowed two visiting surgeons to work directly with two Vietnamese surgeons in performing the operation. Many of these cases can last from 6 to 10 hours, so staff redundancy is important to avoid fatigue.

For each mission, we transported 25 large boxes of donated medical supplies. Most of the supplies were either used during the mission or left for later use by Vietnamese surgeons. Microscopes, monitoring and anesthesia equipment, surgical instrumentation, and electrocautery that



**Fig. 1.** Bilateral hand parascapular flap. This patient had severe bilateral dorsal hand contractures secondary to a burn. The right hand was treated on an Operation Smile International mission, and the left hand was treated a few months later by the Vietnamese.





**Fig. 2.** This 8-year-old girl had a severe burn contracture, with her foot being in contact with the tibia. A release of the scar band and a skin graft corrected her deformity.

were necessary for future Operation Smile International trips were returned. Operation Smile International has facilitated the donation of a surgical microscope and 15 pairs of 3× to 4× surgical loupes for Vietnamese surgeons in addition to the other microscopes, operating loupes, and microsurgical tools that the host country has acquired.

#### **Educational Program**

A formal educational conference was organized on each mission. As proof of the success of the program, Vietnamese surgeons have had increasing participation in presenting their work, now presenting approximately half of the papers. The scope of these conferences has expanded to include physicians from throughout Vietnam. Since 1990, surgeons at Hospital 108 have developed their own educational program in microsurgery. A microsurgery laboratory was set up with assistance from the Department of Plastic Surgery at Southern Illinois University; over 200 Vietnamese surgeons have received basic training in microvascular and microneural techniques at this facility. In addition, Operation Smile International organized cadaver dissections during the initial years to augment knowledge of flap anatomy.

The highest level of medical certification in Vietnam requires the completion of doctoral studies. Microsurgical related (doctoral) dissertations have been completed in facial reanimation, free fibula transfer, and reconstruction using the parascapular free flap. Operation Smile has facilitated

the visits of seven Vietnamese surgeons to the United States and formal fellowship training for two surgeons at the Chang Gung Memorial Hospital in Taiwan.

#### **Patient Screening**

Patients were prescreened by Vietnamese surgeons who selected cases relevant to the expertise of the visiting team. Operation Smile International anesthesia and nursing staff screened for airway issues and other medical problems at the start of the mission. The final screening involved all visiting and Vietnamese surgeons for a discussion of the diagnosis, potential treatment options, and risks.

Visiting surgeons, all with expertise in microsurgery, have come primarily from the United States but have also included specialists from Australia, Canada, Colombia, China, Korea, Russia, and Taiwan. The disease processes and demographic groups treated by team microsurgeons differ from country to country. The internationally diverse team composition provided a broad educational exchange. For example, in Vietnam, the facial degenerative process of noma (cancrum oris) is sometimes seen; visiting surgeons were able to learn from their Vietnamese counterparts about this disease. We also saw a number of cases of benign jaw tumors such as ameloblastomas, which are common in Vietnam, for which the Vietnamese surgeon became facile with the use of the free fibula flap. Before this time, these tumors

were often resected and reconstructed with a simple wire which, over time, invariably failed. This caused severe facial deformities and difficulties with chewing, oral continence, hygiene, speech, and swallowing. Another common disease process was severe burn contractures of the upper extremities and neck. Because acute burn care is not advanced in many areas of Vietnam, acute burns heal by secondary intention, resulting in severe deformities, which can be nicely corrected with free tissue transfer. We saw a number of cases of the chin being contracted down near the manubrium. In these cases, a free tissue transfer can often produce a nicer result than multiple releases and skin grafts. Hypertrophic scarring and pigmentation disorders are more common in the Vietnamese than in Caucasian populations, leading to modifications of incisions, choice of flaps, and placement of skin graft donor sites.

### DISCUSSION

Despite the large number of charitable medical missions performed in the past 30 years, very little analysis of these programs has been published in the medical literature. Criticism of volunteer medical missions has been reported in both the popular and academic press.<sup>6-10</sup> These articles point to a lack of specialized training among participant physicians, lack of involvement of local surgeons, and a lack of follow-up care and procedures. Most of these concerns have been directed at missions performing cleft lip–cleft palate surgery that have attracted widespread negative attention when procedures have resulted in complications or death.<sup>6</sup>

Most charitable and plastic surgical organizations have responded positively to their critics' concerns. The American Society of Plastic Surgeons commissioned the Volunteers in Plastic Surgery (formerly the Reconstructive Surgeons Volunteer Program) to establish guidelines for volunteer missions among the 12 nonprofit groups it represents.<sup>11</sup> Our Operation Smile International missions to Vietnam have benefited from following Volunteers in Plastic Surgery guidelines. As part of these guidelines, we worked with groups in Vietnam that could help support these missions in terms of both time and resources. Much of our efforts were in the Military Hospital 108, which demonstrated a long-term commitment to learning microsurgery. We also were able to visit three other civilian hospitals.

### Challenges in Technology Transfer

Market forces often help technology transfer of products and services in developing countries.

In Vietnam, rapid introduction of cellular phone technology occurred because of great consumer demand amidst daunting challenges of constructing a comprehensive wired telephone network. Medical technology transfer, in contrast, relies more on the expertise of local providers, a supportive infrastructure, and government support. Transferring a microsurgical program to a developing country is a challenging proposition because of the medical infrastructure, precise instruments, and equipment. Although many patients in these countries desperately need these procedures, both the financial resources and skill level needed to successfully perform them are lacking. Governments in developing countries are more likely to spend scarce health care resources on low-technology/high-return programs such as vaccinations, prenatal care, and sanitation.

Vietnam has undergone a variety of social and political changes since the withdrawal of U.S. troops in 1973 and the Communist reunification of the North and the South in 1975. During the 1980s, a renovation policy (Doi Moi) was introduced to allow expansion of the economy. Introduction of free-market concepts and investment by foreign countries resulted in impressive gains of 7.6 percent annually in Vietnam's gross domestic product in the 1990s. Health care delivery has improved; however, major challenges remain. Nearly 18 percent of Vietnamese live on less than \$1 per day. Over half of the Vietnamese population lacks access to improved sanitation, and nearly a quarter of the population has no sustainable access to an improved water source. Eighteen percent of Vietnamese are undernourished, with a third of children younger than 5 years classified as underweight for their age. In 2000, there were an estimated 95 cases of malaria and 93 cases of tuberculosis per 100,000 Vietnamese.<sup>12</sup>

There are only 50 physicians and 56 nurses for every 100,000 people in Vietnam (compared with 279 physicians and 972 nurses per 100,000 Americans). Total expenditure on medical care as a percentage of gross domestic product is only 5.1 percent (compared with nearly 14 percent in the United States). For a country with a per capita income of roughly \$430, this translates into just \$21 of health care spending per person each year.<sup>13</sup>

Several studies have estimated the minimum financing necessary to provide basic health services in low-income countries. The World Health Organization estimates that their recommended interventions for major communicable diseases (tuberculosis, malaria, human immunodeficiency virus, measles, and opportunistic infections) and

maternal and perinatal health will require \$34 of spending per person per year in exchange rate-adjusted dollars.<sup>14</sup> Importantly, the World Health Organization's \$34 estimate does not include any trauma or emergency services or funding for tertiary hospitals.

Vietnam's current level of health care spending leaves significant unmet surgical needs. It is estimated that approximately 3200 Vietnamese children are born each year with cleft lips and/or palates. These cases are low on the list of medical priorities and often go untreated. Operation Smile International, now using mostly Vietnamese teams, has treated over 9000 cases since 1989. Many other charitable organizations from around the globe also provide medical care. For example, the Ho Chi Minh City Heart Institute, founded by the Alain Carpentier Foundation in 1991, treats pediatric cardiovascular diseases.<sup>15</sup> Vietnam's effective handling of the recent severe acute respiratory syndrome epidemic demonstrates the capacity of its public health infrastructure and its willingness to work with international organizations.<sup>16</sup> The high value placed on education in Vietnam, the work ethic of the Vietnamese, and their desire to have state-of-the-art medical care have also contributed to the effectiveness of microsurgical and other technology transfer.

### The Role of Charitable Medical Missions

If medical missions can, in some small fashion, improve the overall health care of a country, they may also contribute to economic growth. Macroeconomic models suggest that health is a cornerstone not only of individual productivity but also of sustained economic development. For each 10 percent improvement in life expectancy at birth, there is an associated increase in economic growth of at least 0.3 to 0.4 percent per year, holding other factors constant.<sup>14</sup> Econometric studies suggest that health status explains a significant portion of cross-national differences in economic growth, even after controlling for standard macroeconomic variables. Historians have noted that advances in public health have preceded most periods of major economic expansion.<sup>17</sup>

The overall health care needs of Vietnam will continue to grow as the currently young population ages and begins to experience more chronic conditions. Essential, life-saving interventions should continue to receive priority, but surgical procedures should not be overlooked. The sheer magnitude of patients who would benefit from surgical care is humbling to see on each mission.

At the end of each mission, we always wished that we had more resources to treat the many worthy patients and that we could do more in terms of equipment and supply donation. In the near term, continued medical missions will be important to reduce the number of cases of severe deformity present within this rapidly developing country and to train Vietnamese physicians and health workers.

The presence of charitable medical missions cannot be indefinite, and we believe that Vietnam now has a cadre of microsurgeons very capable of performing complex microsurgical procedures. As we look to the future, Operation Smile's commitment to microsurgical training will naturally shift from our success in Vietnam to other deserving countries that await this type of opportunity.

### CONCLUSIONS

Microsurgery is a reconstructive surgical discipline needed throughout the world. Under the auspices of a charitable organization, mastery of microsurgical techniques in some developing countries can be accomplished. This requires a comprehensive program, dedicated volunteers, and a long-term commitment to success. We hope our experience will provide valuable information and insights to others who may consider embarking on charitable medical missions.

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### DISCLOSURE

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this article.

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