Microvascular free flap reconstruction: the Kwong Wah Hospital experience

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The early experience of free flap reconstruction in a regional plastic surgery unit was reviewed. Forty-seven free flap surgical procedures were performed for 46 patients during a 2-year period from 1 January 1995 to 31 December 1996 in a regional plastic surgery centre that specialises in head and neck, and breast reconstruction. Twenty-six free transverse rectus abdominus myocutaneous flaps were performed for 25 breast cancer patients. Head and neck reconstructions were mostly performed after surgical ablation of oral and pharyngeal cancers. A variety of free flaps were used, including fibular osteocutaneous flaps, radial forearm fasciocutaneous flaps, jejunal grafts, and rectus abdominus musculocutaneous flaps. Lateral arm fasciocutaneous and scapular fasciocutaneous flaps were used for three patients who had foot ulceration. The success rate of free flap transfer was 94%. Flap loss was found in three patients who had pedicle complications that were due to traction, kinking, and thrombosis. There was no mortality in the series. The most common morbidity was wound infection. Two thirds of the free flap transfers were uneventful. Seven (15%) patients had major complications that required re-operation. Institutional support was essential for the development of microvascular surgery.

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Introduction

The successful clinical application of microvascular surgery by Chinese replantation and transplantation surgeons in the 1960s has had a tremendous impact on the world.[1] After 20 years of development, microvascular free tissue transfer has been firmly established as the primary method for reconstructive surgery. Technical advances have since resulted in higher success rates, shorter operative times, and fewer morbid donor defects.[2]

The concept of using a reconstructive ladder to repair complex defects has been revolutionised and the tradition of using free flap surgery as the last resort has been challenged. Surgery that uses free flaps taken from the radial forearm, jejunum or fibula, or free transverse rectus abdominus myocutaneous (TRAM) flaps is regarded as the method of first choice of tissue reconstruction involving the head and neck[3] or breast. Replacement of all the missing elements of a defect can achieve a full restoration of function and a better quality of life. Although there is always a risk of failure of free flap surgery, the failure rate can be reduced to 1.2%,[4] and reconstructive surgeons are no longer viewed as 'hole fillers'.[5] Successful tissue transfer of adequate raw material to a complex defect can enable a plastic surgeon to restore any lost function aesthetically.

Reconstructive microsurgery is a very demanding process. It involves not only the surgeon's commitment but also tremendous institutional support in terms of the allocation of operative time and postoperative care.[6] This is a report of the first 2 years' experience of microvascular free flap surgery in a regional plastic surgery unit in Hong Kong.

Subjects and methods

From 1 January 1995 to 31 December 1996, all microvascular free tissue transfers that were performed by the Division of Plastic Surgery, Department of Surgery at the Kwong Wah Hospital were reviewed consecutively. The patients' data were collected using a standard data-entry form. Demographic data, patho-

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Table 1. Pathological data from patients receiving microvascular free flap surgery

Pathology	Patients, n=46 No. (%)
Head and neck	
intra-oral cancer	9 (19.6)
pharyngeal cancer	6 (13.0)
salivary cancer	2 (4.3)
basal cell carcinoma	1 (2.2)
Breast	
carcinoma	24 (52.2)
ductal carcinoma in situ	2 (4.3)
Extremity	
foot ulcer	2 (4.3)
melanoma	1 (2.2)

Table 2. Types of free flap used during microvascular free flap surgery

Type of free flaps	No. of free flaps (%)
Head and neck	
radial forearm	6 (12.8)
jejunum	6 (12.8)
fibular	5 (10.6)
rectus muscle	1 (2.1)
Subtotal	18 (38.3)
Breast	
TRAM*, unilateral	24 (51.1)
TRAM, bilateral	2 (4.2)
Subtotal	26 (55.3)
Extremity	
scapular	2 (4.3)
lateral arm	1 (2.1)
Subtotal	3 (6.4)
Total	47

*TRAM transverse rectus abdominus myocutaneous

logical data (Table 1), operative data (in particular, about the microvascular surgery) [Table 2], complications (Table 3), and follow-up information were included in the analysis.

Tumour resection, defect analysis, and donor flap design and harvest were performed by plastic surgeons. Parent vessels around the defect were carefully dissected for the inset of the flap. Pedicle placement and inset were key elements that ensured the success of the microsurgery.[7] The flap, after the division of its pedicle from the donor site, was transferred to the defect without delay so as to minimise the duration of warm ischaemia. Micro-anastomosis of the artery and the vein were performed with the aid of microscopy using fine micro-instruments and microsutures of 9/O or 10/O nylon. The vessel diameters ranged from 1 to 3 mm. The flap was then re-perfused and observed for at least 30 minutes to check for possible immediate complications such as anastomosis bleeding, artery thrombosis, or the 'no flow' phenomenon.

Results

Forty-seven microvascular free tissue transfers were performed for 46 patients. Forty-four of these were immediate reconstructions following resection of a tumour. The sex ratio of male to female patients was 1:2. The median age was 49 years (range, 11-77 years). The patients were predominantly female because of the large number of breast cancer patients. The pathology could be divided into three main categories according to different regions—namely, head and neck, breast, and extremity (Table 1). The most suitable type of free tissue transfer to repair the defect was chosen after surgical ablation (Table 2).

There was no operative mortality and 56.5% (26/46) of patients had an uneventful recovery (Table 3). The success rate of microvascular free flap surgery was 93.6%. Complete losses of free flaps were found in three patients: one had a radial forearm flap for forehead basal cell carcinoma, one had a TRAM flap for breast cancer, and the third had a lateral arm flap for foot ulceration. The losses were due to pedicle kinking, traction, and intra-operative thrombosis, respectively.

Seven (15%) patients required re-operation. Salvage of failing flaps, pedicle exploration, and wound debridement were the major reasons. In operations involving the head and neck region, the common complications were

Table 3. Outcome and major complications from 47 microvascular free flap surgical procedures

Outcome	No. of operations (%)		
	Head and neck, n=18	Breast, n=26	Extremity, n=3
Uneventful	10 (55.6)	16 (61.5)	0
Complete loss	1 (5.6) [radial forearm]	1 (3.8) [TRAM*]	1 (33.3) [lateral arm]
Partial loss	0	1 (3.8)	0
Re-operation	1 (5.6)	3 (11.5)	3 (100)
Major complications	10 (55.6) Seroma, anastomosis, leakage, wound infection	8 (30.8) Fat, umbilical, and skin necrosis; umbilical and wound infection	2 (66.7) Venous congestion, wound infection

*TRAM transverse rectus abdominus myocutaneous

seroma formation, anastomosis leakage, and wound infection; however, they did not cause serious consequences. The complication rate of surgery using free TRAM flaps during breast reconstruction was 31%—umbilical, abdominal, and breast wound infections were the major causes. Free tissue transfers in the extremities were prone to having a high failure rate in this series, and all patients concerned required re-operation.

The operative time, including both the ablative and the reconstructive surgery, ranged from 5 to 15 hours. The availability of surgical expertise determined whether a concomitant two-team approach could be used. The same team usually performed both the ablative and reconstructive surgery. The median duration of warm ischaemia of the free flaps was 90 minutes, and never more than 2.5 hours.

Discussion

Microvascular surgery has challenged the traditional concept of reconstructive surgery and wound management. To achieve the goals of optimal form and function, the use of the more complex technique of microvascular tissue transfer is now the first choice of treatment.[8] It is not surprising that the traditional use of chest flaps has become less popular since the inception of free flap surgery to treat patients with head and neck cancer.

The use of free radial forearm flaps has revolutionised the reconstruction of intra-oral defects by providing a piece of thin and pliable tissue. This technique allows greater tongue mobility, which is essential for successful rehabilitation. The free fibular graft uses an invaluable long bone and enables any segment of a mandibular defect to be reconstructed. This provides not only enough bone stock to achieve anatomical restoration, but also a reliable base on which to attach the osseo-integrated implants during dental rehabilitation. Free jejunal grafts are used to provide a circumferential conduit that restores the continuity of the digestive tract; they have made the use of the tube-pedicled flap obsolete. The use of the free TRAM flap during breast reconstruction is now the standard method of tissue transfer; it achieves good results and is preferred by most breast cancer patients.[9] In addition, most lower-extremity defects are best served by microvascular tissue transplantation. Treatment of osteomyelitis with muscle flap transplantation, for example, provides effective long-term treatment and has a low amputation rate.[10]

During the first 2 years of using free flaps in our unit, there have been 47 free tissue transfer operations, which have had a high success rate (93.6%). The majority of patients with pathology involving the head and neck were elderly, and two required combined free and pedicle flaps to treat extensive defects from oncological resection; there were nevertheless no operative mortalities. Major complications such as anastomotic leakage were managed by timely drainage and by using antibiotics; there were no fatalities. Fifteen percent of the patients required re-operation, which included flap salvage, pedicle re-exploration, and wound debridement. The frequency of re-exploration was 6.4%, which is relatively high when compared with the figure of 3.7% that was reported by a centre that specialises in free flap surgery.[4] Nevertheless, 56.5% of patients in our series had an uneventful recovery.

When microsurgery was being developed in the 1970s, conservatism prevailed.[11] Negative criticism of free tissue transfer highlighted the time-consuming surgery involved, as well as the very demanding skills required, additional training, and intense personal commitment. Extra institutional support is often required to reduce the operative time and to provide special postoperative care. Over the past 30 years, microsurgery has progressed greatly, and nearly every possible physical deficiency can now be treated by using revascularised healthy tissue.

In this series, free tissue transfer was performed with a high success rate (93.6%). The overall complication rate was acceptable (43.5%) and complex microvascular reconstructions were performed safely. The apparent operative time might be shortened by using surgeons with increased experience and/or additional trained personnel.

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