

A Review of Free Flap Failures in the University Hospital, Kuala Lumpur

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Abstract

Sixty-one free flaps performed in 59 patients from April 1983 to April 1995 were analysed. Various factors that might have affected the outcome of the surgery were studied. These included the patient's age, history of smoking, pre-existing medical problems such as hypertension and diabetes mellitus, the type of free flaps, flap infection, use of postoperative anticoagulation, postoperative anaemia and re-exploration. The infection rate was 16.4% and this had a strong correlation with the free flap failure in our study population. Postoperative anaemia could adversely affect the tissue oxygenation of the free flap and delay the re-exploration due to the high anaesthetic risk. Dextran was routinely used for postoperative anticoagulation. There were also rescue attempts using heparin infusion when needed. The overall failure rate was 13.1%. Besides good anaesthetic support, a well-prepared protocol is necessary both for the preoperative planning of free flap surgery as well as salvaging a failure.

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Introduction

Free flaps have been reported extensively, but not much has been written about their failure. We wanted to analyse our failures to get a perspective of our problems with the aim of improvement. We attempted to trace the case records of all the patients on whom free flaps were performed at the University Hospital, Kuala Lumpur, and to analyse the problems and complete failures in cases where the flaps had to be taken down.

Patients and Methods

The operation record books of the Orthopaedic, General Surgical, Otorhinolaryngology and Plastic Surgery services were scanned for any free flaps carried out during the period April 1983 to April 1995. Some free flaps appeared not to have been recorded in the operation record books which could be due to fatigue of the junior staff after a long procedure, some were recorded in an unrecognisable form while others were unavailable or untraceable. Fifty-nine case records were available in total. The data of these patients were analysed.

Results

The first free flap carried out in the hospital was a second toe transfer done in April 1983. The last one, a

free functional muscle transfer, was done in April 1995. Out of 61 flaps analysed, 25 had problems and 11 of these were re-explored. Six were salvaged and one subsequently had necrosis of the cutaneous part, leaving the osseous segment intact. Four were removed without being re-explored. One of these was an intact flap where the patient requested a below knee amputation for speedier recovery-this was not considered a failure. Ten of 12 patients not re-explored survived. There was a total of 8 failures, giving an overall failure rate of 13.1%.

One patient had internal fixation of his femur at the same sitting. This was performed about three weeks after his injury. Unknown to us, he had developed deep vein thrombosis during this time. He unfortunately developed acute pulmonary embolism and expired immediately after the operation despite attempts at resuscitation.

While operating, 2 patients were found to have inadequate recipients. The flaps, which had not been separated from the donor site, were replaced and the procedure was abandoned. One of these patients later had a pedicled procedure, and the other opted for a below knee amputation. If these cases were considered as failures, the number of failures would increase to 10

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giving an overall failure rate of 16.4%.

The ages of the patients ranged from 5 to 77 years with a mean of 35.4 years. Among the patients whose flaps failed, the ages ranged from 6 to 77 years with a mean age of 30.6 years. Hence, advanced age did not seem to be a factor in causing failure.

There were only 3 diabetics and one of them had a flap failure. This failure was due to infection and the diabetes was out of control during the postoperative period. Diabetes was a causative factor in this free flap failure. In total there were 12 patients who had postoperative infection involving the flap including one with venous thrombosis. Five of these were re-explored, 3 were salvaged and 2 failed including the one with venous thrombosis. One other was not re-explored but was also considered a failure. The infection rate was 19.7% and 2 of the 8 failures were due to infection, though only 1 was a diabetic.

There were 3 hypertensive patients and one of the patients had a flap failure. This latter patient was also a diabetic and the failure was due to infection.

Twelve of the patients smoked. Six patients did not have any indication in their records. Only 1 of the patients with flap failure smoked and a history of smoking was unavailable in one other. All the other patients with flap failures were non smokers.

Table I lists the various types of flap performed and the number and nature of flaps which failed. The most common flap was the latissimus dorsi flap and this was mirrored in the number of failures. Each of the other failures was of a different type. Thus, the different type did not seem to be a contributory factor to failure.

Most of the patients were given anticoagulation treatment. One patient was given aspirin alone. One child was infused with 250 ml of Dextran 40 in normal saline per day. Twenty-four patients were given the same Dextran solution at the rate of 1 unit per day and 25 patients were put on 2 units per day. Heparin alone was given to 1 patient. In 4 patients, anticoagulation treat-

ment was not recorded in the case notes and 3 patients did not receive any anticoagulant.

The anticoagulation treatment, when given, was continued for 1 to 7 days. Three patients who started on Dextran alone were later given heparin when problems arose. All 3 patients had venous congestion and all 3 flaps were successful although 1 required debridement of the tip of the flap. None of the failures received heparin.

The relationship between the day the problem was noted, re-exploration and whether the flap failed is given in Table II.

It can be seen that 3 of the flaps that failed were not re-explored at all. Out of the 12 flaps that were re-explored, only 4 were explored on the same day that the problem was noted. Another 3 were re-explored the following day. This could be due to difficulty in getting emergency operating time, a reluctance to go in immediately after the problem had been noted or due to other problems. For example, case 8 should have been re-explored on the same day, but he had a haemoglobin of 4.5 mg/dl and it was considered dangerous to give him an anaesthetic under those circumstances.

Of the 43 patients who had a record of the postoperative haemoglobin level, 19 patients or 44.2% had a haemoglobin level of less than 10 mg/dl. Ten patients or 23.3% had a level that was less than 8 mg/dl.

Of the 38 patients whose transfusion records were available, 20 or 53% did not receive any transfusion at all. Three of these patients had a postoperative haemoglobin level of less than 8 mg/dl. This shows a reluctance to transfuse blood during the free flap surgery.

The following is a detailed description of all the patients who eventually suffered a flap failure: as summarised in Table III.

Discussion

Following the review of cases, it is evident that many different styles and methods were used in the management of these patients. It has been shown that using a protocol for patient management can improve results. In this situation there is no doubt that a more standardised management would be of help if it were possible to implement such a system.

For patients who have concomitant major fractures and who are recumbent for prolonged periods of time, a Doppler study of the venous channels of their lower limbs could avoid the disaster of a pulmonary embolism which killed one of our patients.

The problem of poor recipient vessels may again be reduced by the use of Doppler to search for a good recipient artery. The recipient vein may be a problem which cannot be definitely predicted, although if the

TABLE I: TYPES OF FLAP PERFORMED

	Performed	Failed
Latissimus dorsi	17	
Toe wrap/pulp/nail	10	
Radial forearm flap	7	
Second toe	7	
Free fibula	7	
Lateral arm flap	5	
Scapular and parascapular	2	
Rectus abdominis	2	
Iliac crest (DCIA)	2	
Gracilis	1	

TABLEII: RELATIONSHIP BETWEEN THE DAY THE PROBLEM WAS NOTED, THE DAY OF EXPLORATION AND THE DAY OF EXCISION

Patient	Day problem was noted	Problem	Day of re-exploration	Outcome
Case 1 ARJ	Day 7	Infection/arterial	Day 8	Excised day 8
Case 2 DPSD	Day 14	Infection	Day 24	Survived
Case 3 MCO	Day 3	Infection	Day 4	Survived
Case 4 VE	Day 3	Arterial/venous thrombosis	Day 3	Excised day 3
Case 5 VM	Day 2	Venous thrombosis	Day 2	Survived
Case 5 NH	Day 1	Oedema/venous thrombosis	Day 9	Excised day 9
Case 6 KH	Day 2	Venous congestion	Day 2	Excised day 6
Case 7 LKF	Day 2	Severe swelling	Not re-explored	Excised day 20
Case 8 MY	Day 10	Skin flap necrosis	Day 25	Survived
Case 9 WS	Day 3	Infection	Not re-explored	Survived
Case 10 SK	Day 0	Poor recipient		
Case 11 BP	Day 0	Pulmonary embolism	Day 0 in recovery	Patient died
Case 12 YYK	Day 5	Venous congestion	Not re-explored	Survived
Case 13 YYC	Day 27	Infection	Notre-explored	Survived
Case 14 PK	Day 2	Venous congestion	Day 8	Survived
Case 15 SD	Day 7	Infection	Not re-explored	Survived
Case 17 KSM	Day 4	Infection	No	Survived
Case 18 CKY	Day 4	Cellulitis	No	Survived
Case 19 CSH	Day 27	Infection	No	Survived
Case 20 CHJ	Day 6	Infection	No	Survived
Case 21 VN	Day 4	? Nature	No	Piecemeal in ward
Case 22 YTC	Day 5	Infection	Day 5	Excised day 6
Case 23 MA	Day 3	Mild venous congestion	No	Survived
Case 24 LLS	Day 3	Infection	Day 4	Survived
Case 25 TC	Day 3	Infection	No	Piecemeal in ward

limb involved has had multiple trauma, one should be prepared to take a very long vein graft. Probably in these cases it would be wise to begin with the exploration of the recipient site, no matter how tempting it is to start immediately with the two-team approach to save time. One could then abandon the procedure with less morbidity to the patient.

Bridger et al¹ studied the difference between two groups of patients undergoing free flaps, one group over 70 years of age and the other group below 70 years of age. They concluded that there was no significant difference between the complication rates of the two groups, despite the significant increase in the number of concomitant medical problems. Thus, advancing age should not preclude one from choosing a free flap as a management option.

Gu et al² have shown that smoking adversely affects free tissue transfer by delaying anastomotic healing. Many of the patients were treated as emergency cases and stopped smoking after their accident. However, it would be a good idea to request elective patients to stop smoking if possible.

Infection has been shown to have a strong connection to microvascular anastomotic failure, both at local as well as at distant sites.³⁻⁶ Thus one should choose the timing of the operation carefully to avoid dealing with an infected

recipient site. Perhaps other alternatives should be explored if the recipient is already overtly infected.

In cases where the recipient site is clean, or relatively clean, there may be some benefit from giving prophylactic antibiotics, as the consequences of infection are severe.

From this review we concluded that re-exploration should be done more often and as early as possible than what was done for these patients. We should assume that the patient will require re-exploration in the first 24 hours and all the factors that will allow for this should be optimised.

Monitoring should be improved in all aspects. Firstly the surgeon and his team should be monitoring the flap at regular intervals for the first 24 hours. The nurses should not have to use their judgement to assess the flap independently unless they are specially trained. A small skin paddle should be used whenever possible when a muscle flap is being performed, for ease of monitoring.

It was previously thought that a haemoglobin level of 10 mg/dl and a haematocrit level of 30% (the "10/30 dictum") were necessary for optimal free flap survival. Human studies⁷ and animal experiments,⁸ however, have shown that moderate normovolaemic anaemia is not harmful to the survival of myocutaneous flaps and does not inhibit wound healing. However, transfusion is rec-

ommended for patients with haemoglobin of less than 8 mg/dl. Twenty-three per cent of our patients fell under this category.

It is definitely harmful to have the haemoglobin level so low as to prevent anaesthesia from being given for re-exploration and it may be that such a low haemoglobin could adversely affect the blood flow through a flap, apart from endangering the life of the patient. It may be wise thus, to remind our anaesthetic colleagues to monitor closely the blood loss and perhaps a haemoglobin level check could be done before the patient leaves the theatre, so that any cross-matched blood may be given if required. It would also prevent excessive transfusion, bringing the haemoglobin levels over the desired level.

We could also request for a senior anaesthetist who is familiar with free flaps, to give the anaesthesia for all the free flaps, wherever possible. These are, after all, major operations.

Anticoagulants have been shown to be definitely helpful. As early as 1978, Ketchum⁹ showed that *in vitro* patency rates of femoral arteries of cows which had been denuded of intima had a control patency rate of 10% compared with a patency rate of 85% with Dextran. Since then, many different regimes have been used by different microsurgeons; many give low molecular weight Dextran infusions with a bolus dose of heparin 2500 U to 5000 U intravenously with the release of clamps.

In our study, there were rescue attempts with heparin infusions but we did not try to reduce venous congestion using leeches. This should be looked into, as it is a useful method used by other centres. Other rescue drugs such as transdermal nitro-glycerine, local flap perfusion with heparin or streptokinase have also been described and need to be studied before being included in a "rescue protocol".

Our hospital has come a long way since the first second toe transfer in 1983, as far as free flaps are concerned. We are doing more free flaps and involving two or more disciplines as more and more people are aware of their uses. We are venturing into the technically more demanding flaps. Hence, there is a need for better record

keeping, a more standardised approach, better understanding of flap failure, and how to prevent and salvage flap failure when it occurred. Our journey to bring flap surgery from the sublime to the routine is in still progress. Failure rate is falling and will continue to do so as our experience increases. This has been the experience of other centres¹⁰⁻¹⁴ and we hope to continue that journey towards excellence.

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