Microsurgical Free Flap and Replantation without Antithrombotic Agents

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Microsurgical reconstructions for free flap transfer, digits and limb replantation have been highly successful applications in the past decades. Antithrombotic prophylactic agents, such as low-molecular-weight dextran, aspirin and heparin have been routinely used for the prevention of microvascular thrombosis. Even though these agents are efficacious in microsurgery, some systemic morbidity is still reported. Forty cases of microsurgical reconstruction over the last five years are reported. They include 22 cases of free flap transfer and 18 cases of replantation (19 fingers, 2 toes and one hand). The surgery was performed by the same group of plastic surgeons and no antithrombotic agent was given intraoperatively or during the post operative period. Results show one partial flap loss, two replantation losses due to severe crush injuries of the digits and one toe replantation failure in a two year old. The failure of toe replantation was due to surgical technique and poor post operative immobilization. The result shows that successful microsurgical reconstruction depends on many factors. One of the most important factors is microsurgical technique. Use of antithrombotic agents alone does not appear to play a significant role in the patency of microvascular structures.

Keywords : *Antithrombotic agent, Microsurgical free flap, Replantation*

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Microsurgical reconstruction has been widely used and flap success rates greater than 95 percent are now routinely achieved. Nonetheless, microvascular thrombosis is the main cause of free flap failure[1-5] even in the hands of expert microsurgeons. A thrombosis rate as high as 35 percent[6] has been described for replantation and free flaps transfer performed immediately after injury. Antithrombotic prophylaxis has been shown to be beneficial in these circumstances[7-9]. Multiple antithrombotic agents such as low-molecular-weight dextran, aspirin, and heparin are routinely[1-5] applied despite a lack of consensus about their use. Serious systemic complications from these agents have been reported[10-15]. Reported complications from low-molecular-weight dextran have included acute pulmonary edema[10], adult respiratory distress syndrome (ARDS)[11], osmotic complications in free flap surgery[12] and anaphylactic complication[13,14]. An increasing number of reports of significant morbidity and mortality related to these agents have brought into question their routine use in microsurgery. However, successes of free flap transfer and replantation using antithrombotic agents have also occasionally been reported[4,6]. The purpose of this study was to highlight cases that show that antithrombotic agents may not be the necessary factor for microvascular anastomosis and that other factors are of greater importance for good results in microsurgical reconstruction[16,17]. Microsurgical technique being one important factor.

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Patients and Method

Forty patients were included in this study between January 1998 and December 2002. Patient data is shown in Table 1. Cases included 22 free tissue transfer and 18 replantation cases (19 fingers, 2 toes and one hand).

Surgical techinique

All procedures were performed by the same group of plastic surgeons. Firstly, the authors tried to limit the operative time by two teams performing free flap transfer simultaneously, one team harvesting the donor flap and the other team preparing the recipient site. The tissue was performed under a magnifying glass. Secondly, to preserve the tissue, the donor flap and amputated part were cooled with cooled lactated Ringer's solution. After good preparation of both the recipient and the donor vessels, they were irrigated with lactated Ringer's solution which is the best irrigating solution[18,19] to remove blood from the vessel end. Finally, end to end anastomosis and posterior-wall-first microvascular anastomosis technique[20] was used resulting in high quality anastomosis without damage to the intima of the vessel. The vessel was anastomosed under an operating microscope and irrigated with lactated Ringer's solution to ensure a clear view during suturing without touching the vascular wall. Prior to complete anastomosis of the artery, the blood pressure was increased about 10 mmHg, giving more lactate Ringer's solution systemically with a decreased level of anesthesia. All microvascular anastomoses were perfomed by one plastic surgeon. Anastomosis time for each anastomosis was limited to less than 30 minutes. No patient received any antithrombotic agent.

Results

During the 5 year study period, 44 microsurgery operations on 40 patients were performed. There were 27 male and 13 female patients ranging in age from 2 to 71 years. Twenty two patients had elective free tissue transfer, and the other eighteen patients (19 fingers, 2 toes and one hand) had replantations because of traumatic amputation. Only one free flap showed partial flap loss, and there were two replantation failures (Table1). The one case of free tissue transfer was case No.12 in the table which was penile recontraction using a radial forearm flap. Only two centimeters of the distal part of the flap had partial flap loss. The two replantation cases failed from intravascular thrombosis involving one big toe and one finger. Both cases had severe crush injuries but the toe replantation failure was because of surgical technique. The vessel of the big toe of the child patient was very small, and there was difficulty with the post operative immobilization of the limb. Overall the success rate was 95 percent for free flap transfer and 91 percent for replantation. There was only one complication which was partial flap loss (Table1).

When separated into two groups, elective free flap cases versus traumatic amputation, there are relatively good results with no evidence of secondary microvascular anastomotic thrombosis except in the two cases of severe crush injuries.

Discussion

Microsurgery is a well established procedure nowadays and high success rates have been reported. Microsurgical failure rates vary from 5 to 10 percent for free flap transfer and 15 to 30 percent for replantation[3]. Vascular thrombosis is the major complication which leads to failure in these operations. Antithrombotic agents such as low-molecular-weight dextran, aspirin and heparin have been thought to play a significant role in this success[1-5]. Ninety-six percent of microsurgeons use antithrombotic agents such as dextran, heparin and aspirin alone or combination in free flap transfer and replantation[16]. However, these pharmacologic antithrombotic agents cause many adverse effects such as prolonged bleeding time[1] and abnormal bleeding from the site of surgery, especially in cases with highly rough surfaces. They produce effects by decreasing platelet function, as with aspirin, and increasing blood flow, decreasing blood viscosity and antiplelet aggregation, as with dextran while mitigating the action of thrombin on platelets and fibrinogen as with heparin[2-5]. Their adverse effects can cause morbidity and mortality in patients, with serious side effects from low-molecular-weight dextran have been reported[10-14]. For example, Disa and colleagues reported that dextran did not improve benefit in free flap survival but increased the risk of systemic complications[15].

In the present study, there was only one partial free flap loss and two replantation failures (Table1). The free flap loss was due to a technical problem which showed tension of the suture line. It was salvaged by removing the penile prosthesis, debridement and advancing the flap. The two replantation failures were due to the nature of injuries and a technical problem in the 2 year old's toe replantation due to inability to immobilize as in several other reported cases[6,21]. In the severely crushed finger, the soft tissue and vessel wall were severely damaged. This was probably the cause of failure in these cases. Successful free tissue transfer only with aspirin postoperatively was reported by

Table 1. Result of 40 cases of microsurgery without antithrombotic prophylaxis

Patient number	Sex	Age (years)	Diagnosis	Operation	Operative time (hrs)	Complication	Hospital Stay (days)
1	M	38	Basal cell CA right cheek	Free TRAM flap	8	no	14
2	M	47	Chronic ulcer right foot	Gracillis free flap	7	no	14
3	M	40	Baso-squamous cell CA right face	Radial forearm free flap	7	no	12
4	M	21	Left zygomatic defect (trauma)	Parascapular free flap	7.5	no	14
5	M	47	Chronic ulcer right foot	Median plantar free flap	7	no	14
6	F	17	Post traumatic index amputation	Toe to finger transfer	7	no	10
7	M	70	Recurrent basal cell CA upper lip	Radial forearm free flap	6	no	10
8	M	9	Chronic ulcer right heel	Median plantar free flap	7	no	14
9	F	19	Post traumatic left 4th finger amputation	Toe to finger transfer	7	no	10
10	M	7	Scalp defect	Lattissimus dorsi free flap	6	no	10
11	M	71	Malignant melanoma right foot	Median plantar free flap	7	no	10
12	M	30	Post traumatic penile amputation	Radial forearm free flap (penile reconstruction)	7	Partial flap necrosis	16
13	F	58	Radiation ulcer at back	Lattissimus dorsi muscle free flap	6. 5	no	14
14	M	14	Right side facial pulsy	Gracillis muscle free flap	7	no	12
15	F	56	Squamous cell CA right leg	Fibular free flap	7	no	14
16	M	50	Scar contracture of neck	Radial forearm free flap	6	no	10
17	M	54	Scar contracture of neck	Radial forearm free flap	6	no	10
18	F	50	Radiation ulcer left leg	Lattissimus dorsi muscle free flap	6.5	no	14
19	M	35	S/P ORIF with plates and screws with exposure of tibia and plates, screws left leg	Gracillis muscle free flap	6.5	no	12
20	F	40	Amoeloblastoma of mandible	Fibular free flap	7.5	no	12
21	M	51	Squamous cell CA of buccal mucosa	Radial forearm free flap	6.5	no	14
22	M	36	Electrical burn right hand	Radial forearm free flap	6	no	12
23	M	2	Traumatic amputation of right big toe	Big toe replantation	4.5	no	5
24	M	23	Traumatic amputation of right hand	RT. hand replantation	7	no	3
25	F	2	Traumatic amputation of left big toe	Big toe replantation	5	failure	5
26	F	18	Traumatic amputation of right thumb	Thumb replantation	4.5	no	3
27	M	15	Traumatic amputation of right 2nd, 3rd fingers	Fingers replantation	6	no	3
28	M	19	Traumatic amputation of left 3rd, 4th fingers	Fingers replantation	6	4th finger failure	7
29	M	24	Traumatic amputation of right 2nd, 3rd fingers	Fingers replantation	6	no	3
30	M	16	Traumatic amputation of right thumb	Thumb replantation	4.5	no	3
31	F	36	Traumatic amputation of left 2nd, 3rd fingers	Fingers replantation	6	no	3
32	F	6	Traumatic amputation of left index	Finger replantation	4	no	3
33	M	32	Traumatic amputation of left thumb	Thumb replantation	4.5	no	3
34	M	28	Traumatic amputation of right index	Finger replantation	3.5	no	3
35	M	33	Traumatic amputation of right index	Finger replantation	3.5	no	3
36	F	27	Traumatic amputation of left ring finger	Finger replantation	4	no	3
37	M	31	Traumatic amputation of left index	Finger replantation	3.5	no	3
38	M	28	Traumatic amputation of left index	Finger replantation	3.5	no	3
39	F	17	Traumatic amputation of right index	Finger replantation	4	no	3
40	F	42	Traumatic amputation of left middle finger	Finger replantation	4	no	3

Disa and colleagues[15]. The survival rate of free flap transfer and replantatian in the present study were comparable with rates in other studies. The success rate for free flap transfer in children was 96 percent[21], and for adult replantation and free flap transfer was 79 and 89 percent, respectively[22]. The success rate in the present study was 91 percent for replantation and 95 percent for free flap transfer. This success rate in microvascular surgery is no less than in other studies using antithrombotic agents.

O'Brien mentioned that the success of microvascular anastomosis depends on several factors[17-19], such as surgical technique, planning and antithrombotic agents. Results show that a good surgical technique, and good planning are more important than using antithrombotic agents. Antithrombotic agents seem to be indicted only in crush inury cases[7-9].

Conclusion

The success rate of microsurgical reconstruction depends on microvascular patency. Microsurgical technique is the most significant factor for success. The present results show that antithrombotic agents are no more than adjuncts to good microsurgical technique and thus are an unnecessary diversion to be avoided. The success rate of microvascular surgery without antihrombotic agents reported here is the same as in other reported series which used antithrombotic agents.

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การผ่าตัดจุลศัลยกรรมในการย้ายเนื้อเยื่อและต่ออวัยวะโดยไม่ใช้ยาต้านการแข็งตัวของเลือด

เล็ก วีระวุฒิปกรณ์, อภิสิทธิ์ วีระวุฒิปกรณ์

การผ่าตัดจุลศัลยกรรมเพื่อย้ายเนื้อเยื่อและต่ออวัยวะที่ขาด เช่น นิ้วและมือ ซึ่งได้รับความนิยม และประสบผลสำเร็จในอัตราสูง จุลศัลยแพทย์จะใช้ยาต้านการแข็งตัวของเลือด เช่น dextran, aspirin หรือ heparin เพื่อป้องกันการอุดตันของหลอดเลือด ในปัจจุบันยังไม่มีข้อมูลแสดงประสิทธิภาพของยาเหล่านี้ต่อผลสำเร็จของการผ่าตัดตัดต่อหลอดเลือด แต่มีรายงานถึงภาวะแทรกซ้อนต่าง ๆ จากยาเหล่านี้ การศึกษานี้ได้รายงานผู้ป่วย 40 ราย ซึ่งได้รับการผ่าตัดย้ายเนื้อเยื่อ 22 ราย ต่ออวัยวะ 18 ราย เป็นการต่อนิ้วมือ 19 นิ้ว นิ้วเท้า 2 นิ้ว และมือ 1 มือ การผ่าตัดทุกรายใช้แพทย์ศัลยกรรมตกแต่งทีมเดียวกัน ผู้ป่วยทุกรายไม่ได้รับสารต้านการแข็งตัวของเลือดทั้งก่อนและหลังการผ่าตัด การผ่าตัดประสบผลสำเร็จดี แต่มีเนื้อตายบริเวณส่วนปลายในการย้ายเนื้อเยื่อ 1 ราย และมีนิ้วตาย 2 นิ้ว ได้แก่ นิ้วมือ 1 นิ้ว และ นิ้วเท้าเด็ก 1 นิ้ว เนื่องจากเนื้อเยื่อส่วนที่ขาดทั้ง 2 นิ้วช้ำมาก และไม่สามารถทำให้เท้าเด็กอยู่นิ่งได้ ผู้รายงานมีความเห็นว่าความสำเร็จของการผ่าตัดมีหลายปัจจัย ไม่ใช่ขึ้นกับยาต้านการแข็งตัวของเลือดเพียงอย่างเดียว เทคนิคการผ่าตัด น่าจะเป็นปัจจัยที่สำคัญมากต่อผลการผ่าตัดตัดต่อหลอดเลือดทางจุลศัลยกรรม