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Is the sleeve anastomosis a risky technique?

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Summary—We report 15 free flap transfers using sleeve vascular anastomoses with minor modifications of the original method. There was partial necrosis of one flap and one other required reoperation due to kinking of the feeding artery and not to the method of anastomosis.

We believe that the sleeve anastomosis is reliable in clinical microvascular surgery if proper cases are selected. Indications for the method are discussed.

In 1978 Lauritzen reported the microvascular sleeve anastomosis but most microsurgeons have avoided using this technique because of a fear of stenosis and thrombus formation (Sully *et al.*, 1982; Wieslander and Rausing, 1984). Since 1979 we have constructed many arterio-venous shunts for dialysis by this technique (Nakayama *et al.*, 1981). From this experience we have made minor modifications to the technique and we now feel confident of its high patency rate. Recently, a small series of free flap transfers has been carried out using the technique and the results have been satisfactory, with no flap necroses (except for one partial necrosis). Our modifications and three representative cases will be shown.

Modifications to the technique

The essential steps in the technique are shown in Fig. 1. Two invaginating sutures are placed 120° apart and tied. It is important that these sutures are passed through only the adventitial tissues in the up-stream segment. The vascular clamps are then turned over and the up-stream segment can be inserted more easily into the down-stream segment, due to the eccentric sutures. One or two sutures must then be added posteriorly, care being taken that they are at the same level as the anterior sutures. If the intervals between sutures are wide, several reinforcing sutures must be added but four sutures are enough in most clinical cases.

Materials and methods

Fifteen free tissue transfers have been anastomosed by the sleeve technique and are listed in Table 1.

Results

In 15 arterial anastomoses and seven venous anastomoses, only one arterial anastomosis (Case 6) was occluded 3 days postoperatively, and successfully reanastomosed. This occlusion was due to kinking and not attributable to the sleeve anastomosis. There was partial necrosis of the flap in Case 1 but other flaps healed uneventfully.

Two representative cases are described in detail below. A third case has already been reported (Nakayama *et al.*, 1986).

Illustrative case histories

Case 4. This 73-year-old female was operated on for a left maxillary cancer 2 years before referral. She had been distressed by a large oro-nasal fistula and by difficulty in opening her mouth. This fistula and scar contractures in the left buccal region were treated by transferring a free radial forearm flap (11 × 7 cm) which was partially lined with the split thickness skin graft. These anastomoses of the lingual artery to the radial artery, and its companion vein to the posterior facial comitant vein, were done by the sleeve technique. The postoperative course was uneventful and the transplanted flap survived completely. The aim of the operation was accomplished (Fig. 2).

Case 11. This 39-year-old male was operated on for his right maxillary cancer 10 years before being admitted for cover of the exposed dura, closure of the oro-nasal fistula and release of the contracted right temporo-mandibular joint. After the resection a combined free flap (latissimus dorsi musculocutaneous flap, 20 × 8 cm, and serratus anterior musculocutaneous flap, 6 × 4 cm) was transplanted. The thoracodorsal artery was anastomosed to the facial artery by the sleeve technique. The postoperative course was uneventful and this large flap survived completely. Defatting and some retouching procedures will be scheduled (Fig. 3).

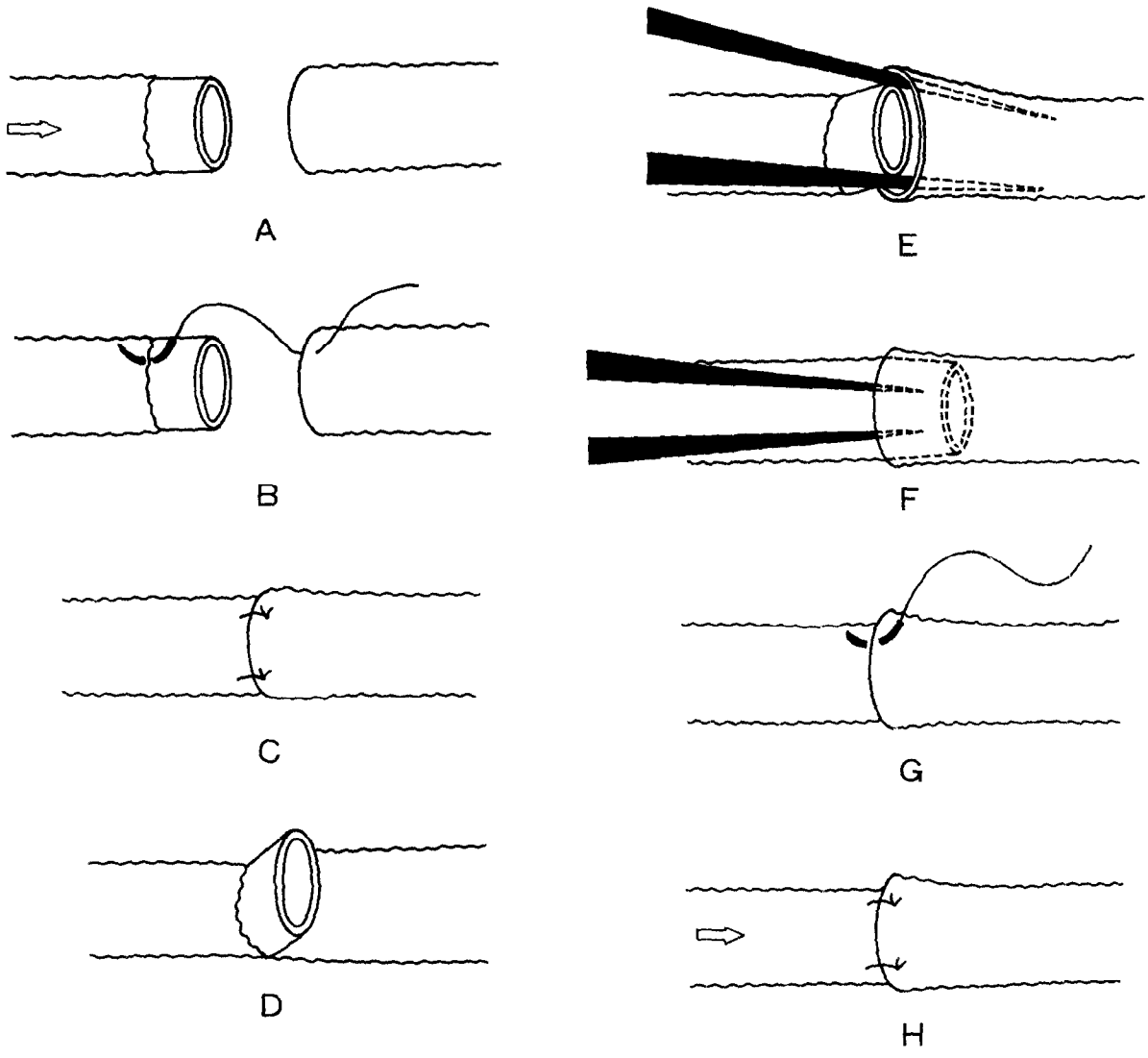

Fig. 1

Figure 1.—Illustration of our modified method. A. Minimal stripping of the adventitia. B. Taking a bit of adventitial tissues only, in the up-stream segment. C. Two sutures are placed 60° apart and tied. D. Posteriorly, the up-stream segment is bent and protrudes. (When a favourable size discrepancy exists, the up-stream segment can be smoothly inserted before suturing the anterior side.) E. Down-stream segment is dilated. F. Up-stream segment is inserted. G. One or two sutures are added. H. The anastomosis is checked to ensure that the invaginated portion has been inserted evenly.

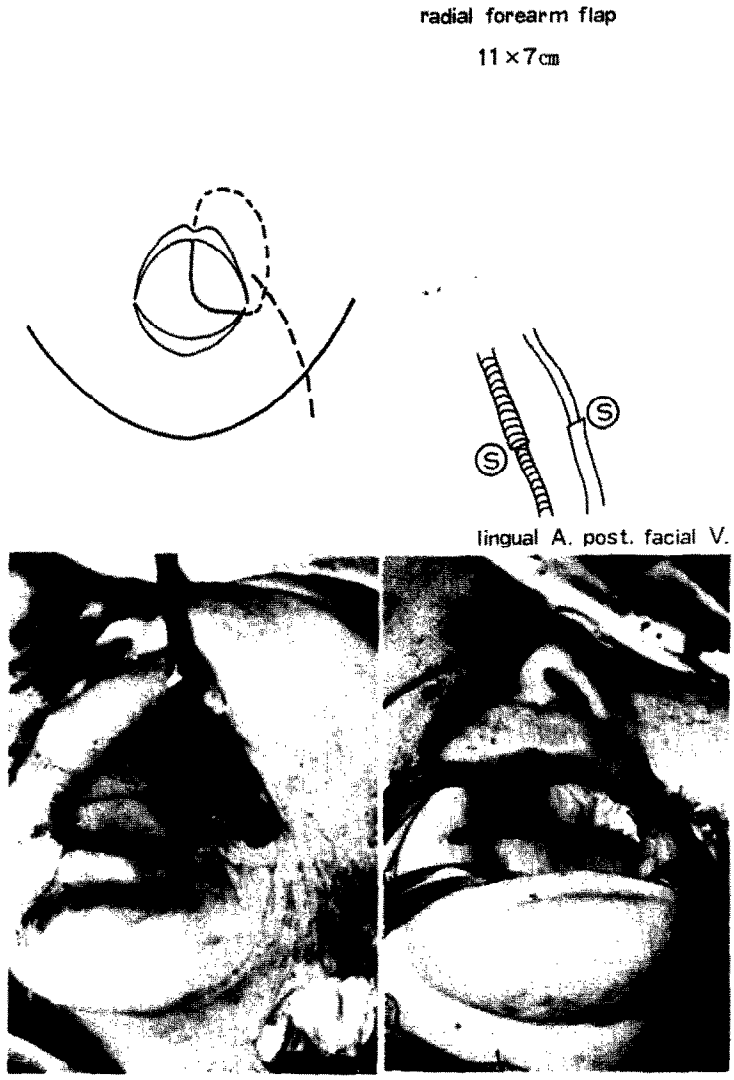

Fig. 2

Figure 2—*Case 4.* Above: Diagram of procedure. Bottom left: Preoperative state. Bottom right: Immediately after the operation.

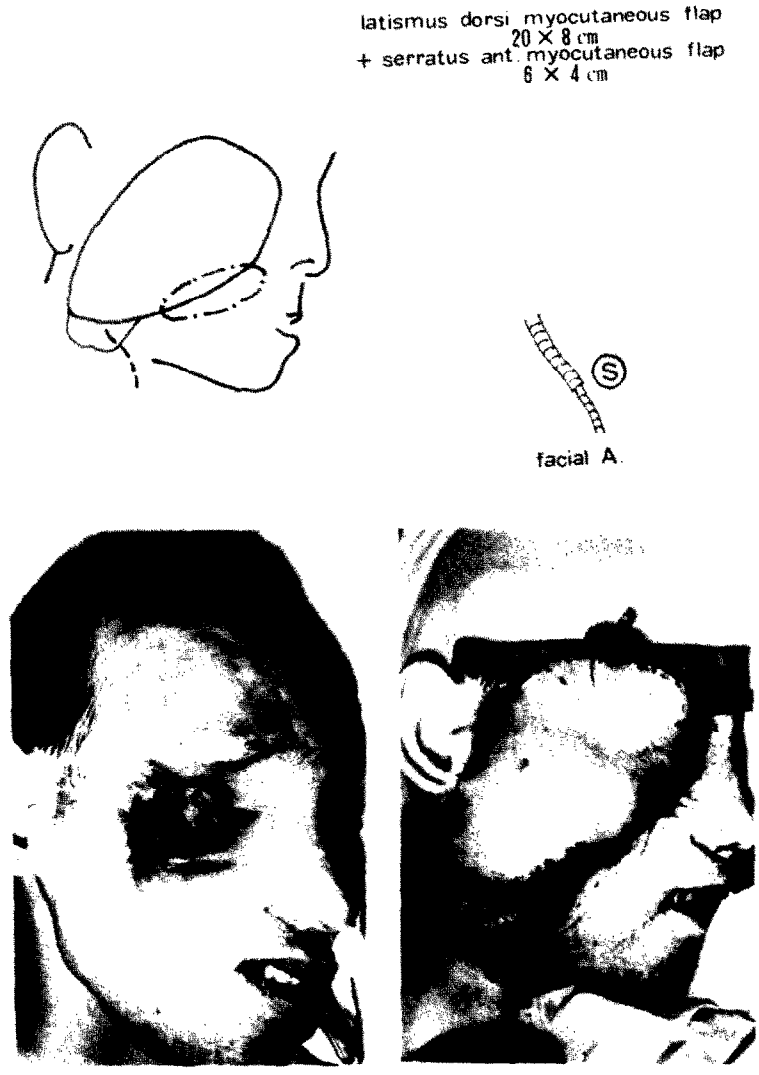

Fig. 3

Figure 3—*Case 11.* Above: Diagram of procedure. Bottom left: Preoperative state. Bottom right: Immediately after the operation.

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No.	*Pt.*	*Sex*	*Age*	*Flap*	*Recipient*	*Note*
1	M.N.	♀	18	latissimus dorsi musculocutaneous flap 27 × 14 cm	facial A. post. facial V.	A. 6 partial necrosis V. 4
2	J.T.	♀	32	groin flap 12 × 10 cm	int. mammary A.	A. 4
3	Y.U.	♀	76	radial forearm flap 8 × 5 cm	sup. temporal A. & V.	A. 4, V. 3
4	T.Y.	♀	73	radial forearm flap 11 × 7 cm	lingual A. post. facial V.	A. 6, V. 6
*5	U.M.	♀	54	radial forearm flap 11 × 10.5 cm + vein graft 5 cm	ext. carotid A.	A. 5
6	S.T.	♂	54	radial forearm flap 12 × 8 cm	sup. gluteal A.	A. 5 kinking
7	M.O.	♀	4	latissimus dorsi musculocutaneous flap 16 × 10 cm + vein graft 8 cm, 4 cm	ext. carotid A. sup. thyroid V.	A. 4, V. 4
8	T.S.	♂	35	latissimus dorsi musculocutaneous flap 20 × 7 cm	sup. thyroid A.	A. 5
9	H.N.	♂	70	radial forearm flap 9 × 7 cm	thoraco-acromial A.	A. 5
10	K.O.	♂	44	hemipulp flap + vein graft 5 cm	dorsalis pedis A.	A. 4
11	I.W.	♂	39	latissimus dorsi musculocutaneous flap 20 × 8 cm + serratus ant. musculocutaneous flap 6 × 4 cm	facial A.	A. 3
12	K.S.	♀	40	radial forearm flap 9 × 6 cm	sup. thyroid A. & V.	A. 4, V. 4
13	S.Y.	♂	11	gracilis musculocutaneous flap 20 × 8 cm	ant. tibial A. & V.	A. 5, V. 4
14	I.W.	♂	40	radial forearm flap 9.5 × 7 cm + vein graft 7 cm	facial A.	A. 5
15	K.K.	♂	29	scalp flap 12 × 2 cm	supf. temporal A.	A. 4

*Case reported in the *British Journal of Plastic Surgery*, **39**, 454.

Discussion

Lauritzen and his colleagues have reported the high patency rate of the sleeve technique in their experimental work (Lauritzen, 1978; Lauritzen and Bagge, 1979; Lauritzen and Hansson, 1980; Lauritzen *et al.*, 1980) but many microsurgeons express anxiety about stenosis and thrombus formation. Our thoughts on the matter are as follows.

Stenosis

We cannot agree with Lauritzen that the decreasing flow rate after sleeve anastomosis is only temporary. We have previously reported a comparison of the flow in anastomosed carotid arteries of rabbits using different techniques (Nakayama and Soeda, 1984). In this experiment, the carotid arteries which were anastomosed by the sleeve technique had only 66 to 71% of the flow of the arteries on the other side which were anastomosed by the end-to-end technique. Wieslander and his colleagues also reported that sleeve anastomosis reduced the flow by half in the central artery of the rabbit's ear (Wieslander and Aberg, 1980; Wieslander *et al.*, 1984). These data indicate that stenosis and a decreased flow rate are inevitable when vessels of the same calibre are anastomosed (Nakayama and Soeda, 1981). The correlation between decreased flow and flap survival is interesting but is still an unsolved problem; we surmise that a minor or moderate decrease did not affect survival of the flaps which are presented here. However, the possible detrimental effects on large voluminous flaps are undeniable.

Thrombus formation

Sully *et al.* (1982) criticised the sleeve technique. Using rabbits, they anastomosed femoral arteries by their modified method and concluded that the minor advantages did not outweigh the overall patency rate. This conclusion does not coincide with our impressions and, with Lauritzen (1983), we suppose that their low patency rate is due to their modifications. In these, the invaginated up-stream end was sutured, taking a full thickness bite, and fixed in the lumen of the down-stream vessel. The intraluminal suture exposure and the fixed up-

stream end are probably the causes of the low patency rate in their experiment. The secret of a good patency rate using the sleeve technique is no intraluminal suture exposure and *a freely movable invaginated up-stream end*. If these requirements are fulfilled, the sleeve anastomosis produces good results (Krag and Holck, 1980; Hyland *et al.*, 1981; Krag *et al.*, 1981, 1982).

We consider that the sleeve anastomosis is a safe and reliable technique if faithfully executed in selected cases. The indication for this technique is a favourable size discrepancy between donor and recipient vessels (small calibre up-stream end to large calibre down-stream end). In such a case stenosis is unlikely. When vessels are of equal size stenosis and decreased flow may exist but they did not harm the survival of the flaps in our series. The sleeve anastomosis is therefore comparable with end-to-end anastomosis in this situation. When an unfavourable size discrepancy (large calibre up-stream end to small calibre down-stream end) exists, this technique is too risky and is inapplicable. When a vein graft is interposed, at least one end should have a favourable size discrepancy.

When the indications are appropriate, the sleeve technique is not only reliable but is easier to carry out than a traditional anastomosis. Fewer stitches save 10 to 15 minutes of operating time. Moreover, in a deep hole, when space is limited or when the vessels are at an awkward angle, the insertion of the precisely located stitches at narrow and equal intervals required for a traditional end-to-end anastomosis can be difficult, while the fewer stitches at wide and irregular intervals in the sleeve anastomosis are more easily executed. If circumstances require, the sutures in the posterior wall can be inserted first without turning the vascular clamps.

In anastomosing vessels with a favourable size discrepancy, we have found the sleeve anastomosis to be more reliable than end-to-end anastomosis. In four cases (Case 9, a recently transplanted radial forearm flap anastomosed to the superior thyroid artery and two digital replantations), the vessels became thrombosed after end-to-end anastomoses and were successfully revised by the sleeve technique.

The sleeve technique is a useful addition to the armamentarium of the microvascular surgeon. The aim of this report is not to suggest that it is better than end-to-end anastomosis for each method has its place and should be used in appropriate circumstances.

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