The Influence of Residual Below-Knee Reflux and Incompetent Perforating Veins on Venous Function after Stripping Surgery

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Persisting incompetent great saphenous vein (GSV) below the knee and residual incompetent perforating veins (IPV) are often found after selective stripping of GSV from the groin to upper calf. The aim of this study is to evaluate the venous function when the calf GSVs or calf perforating veins are incompetent after stripping surgery. One hundred-thirty-one limbs were treated by stripping from the groin to upper calf with stab avulsion or sclerotherapy of varices. One month and twelve months after surgery, the patients were examined clinically to establish the extent of persisting varices by duplex ultrasonography and air-plethysmography. Venous filling index (VFI) was a little higher in those who had residual calf GSV reflux 12 months later; it was also higher in the group with incompetent perforating veins than the group without. The chief complaints were found to have improved in all groups. The findings suggest that removal of the saphenous vein below the knee is not necessary, but it is important to take care of the incompetent perforating veins. (*English Translation of Jpn J Phlebol 2011; 22: 239-244.)

Keywords: varicose vein, saphenous vein, nerve injury, selective stripping, venous filling index (VFI)

INTRODUCTION

For many years, the standard operation for varices of great saphenous veins (GSV) was the selective stripping, stab avulsion and sclerotherapy of the varicosities.¹⁾ Recently, however, endovenous laser and radio-frequency ablation of GSV have become new standard techniques. In both techniques, the below-knee GSV is usually pres-

erved in order to prevent nerve injury. As a result, reflux in the below-knee saphenous vein often persists after the operation.

The aim of this study was to analyze the influence of persistent below-knee saphenous reflux and incompetent calf perforating veins on venous function after stripping.

MATERIALS AND METHODS

From September 2007 to October 2008, 939 limbs (627 patients) were treated at Hiroshima Teishin Hospital. During this period, 131 limbs (131 patients) with varicosities of one side of the GSV were analyzed for this study.

The patients were interviewed before surgery, one month after the operation, and one year after the operation. The venous filling index (VFI: normal range is lower than 2.0 ml/sec) was measured by air plethysmography, and persistent below-knee saphenous reflux was evaluated by duplex scanning. Persistent reflux was diagnosed when the reflux time was over 0.5 seconds using

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Fig. 1 Distal stripping extends usually to the distal thigh or upper calf level to avoid saphenous nerve injury. The incompetent saphenous vein below knee and incompetent Cockett perforating vein may not be removed. GSV: great saphenous vein; IPV: incompetent perforating vein R(+): Reflux flow was detected in the GSV below the knee. C(+): Cockett perforating vein was incompetent.

Table 1 The data of air plethysmography after stripping

	R(-)				R(+)				Total			
	n	VFI	VFI(1M)	VFI(1Y)	n	VFI	VFI(1M)	VFI(1Y)	n	VFI	VFI(1M)	VFI(1Y)
C(-)	73	4.2 ± 2.5	1.2 ± 0.8	1.2 ± 0.7	43	4.1 ± 2.4	1.2 ± 0.8	1.5 ± 0.9	116	4.2 ± 2.5	1.2 ± 0.8	1.4 ± 0.7
C(+)	10	6.1 ± 4.8	1.4 ± 0.8	1.3 ± 0.7	5	8.2 ± 2.7	2.5 ± 1.6	3.0 ± 1.9	15	6.8 ± 4.2**	1.8 ± 1.2**	1.9 ± 1.4**
Total	83	4.5 ± 2.9	1.2 ± 0.8	1.3 ± 0.7	48	4.5 ± 2.7	1.4 ± 1.0	1.6 ± 1.1*	131	4.5 ± 2.8	1.3 ± 0.8	1.4 ± 0.9

*: $p < 0.05$ vs R(-) group **: $p < 0.01$ vs C(-) group. R: saphenous reflux below the knee; C: Cockett incompetent perforating vein; VFI: venous filling index; (1M): a month after operation; (1Y): 1 year after operation

the milking method in the sitting position. The limbs in which below-knee saphenous reflux was not detected at one year after the operation were classified as the R(-) group, and those with reflux as the R(+) group. The limbs without detection of incompetent calf perforating veins were classified as the C(-) group, while obvious incompetent perforating veins over 3 mm in size were classified as the C(+) group (**Fig. 1**).

Perforating vein incompetence was evaluated with duplex scanning using the milking method and compression of the popliteal vein.²⁾ Using an interview sheet, the patients were asked whether they had any complaints such as dullness of the foot, swelling, night muscle cramps, itching, cosmetic problems, pain or local heat. Statistical analysis was performed using a t-test for evaluation of VFI, and symptoms were analyzed by chi-square statistics.

RESULTS

Of 131 limbs, 83 limbs were classified as the R(-) group, and 48 were classified as R(+). The VFI data of each group at one month after operations and one year later are shown in **Table 1**. The comparison between the groups is shown in **Fig 2**. The mean VFI before the operation of the R(-) group was 4.5 ± 2.9 ml/sec, and that of R(+) was 4.5 ± 2.7 ml/sec. There was no significant difference between the two groups. At one month later, there was again no significant difference between the two groups (1.2 ± 0.8 ml/sec in the R(-) group vs. 1.4 ± 1.0 ml/sec in the R(+) group). However, after one year, there was a significant difference (1.3 ± 0.7 ml/sec in the R(-); 1.6 ± 1.1 ml/sec in the R(+); $p < 0.05$).

Regarding the C group, 116 limbs were classified as C(-), and 15 limbs as C(+). The preoperative mean VFI was

Fig. 2 Venous filling index (VFI) was lower in all groups post operatively. One year after stripping, VFI was significantly higher in the R(+) group than the R(-) group. It was higher in the C(+) group than the C(-) group pre- and post-operatively. *: $p < 0.05$ **: $p < 0.01$

4.2 ± 2.5 ml/sec in the C(-) group, and 6.8 ± 4.2 ml/sec in the C(+) group. At one month later, it was 1.2 ± 0.8 ml/sec in the C(-) group, and 1.8 ± 1.2 ml/sec in the C(+) group. At one year later, it was 1.4 ± 0.7 ml/sec in the C(-) group, and 1.9 ± 1.4 ml/sec in the C(+) group. The mean VFI in the C(+) group was significantly higher than that in C(-); ($p < 0.01$).

Five limbs were in both plus groups, i.e., the R(+) and the C(+) group. The mean VFI of these five limbs was considerably higher (8.2 ± 2.7 ml/sec) than that of the other groups before surgery, and one month and one year after surgery. The preoperative venous dysfunction of both plus groups did not improve to the normal range after stripping surgery. Nevertheless, the symptoms shown by these five patients, such as stasis or edema of the legs, were no more severe than those of other groups.

We considered that the influence of incompetency of the perforating vein was greater than below-knee saphenous reflux. To investigate this, the symptoms between the C(+) group and the C(-) group were compared (Table 2). Preoperative swelling was seen in the C(+) group more than the C(-) group ($P < 0.01$), but for other symptoms, i.e., fatigue, muscle cramps, itching, cosmetic problems, pain, and local heat, there was no significant difference between the two groups.

DISCUSSION

When varicose veins are treated, the reflux segment is initially mapped with duplex scanning. The patterns of the reflux map have been reported by Koyano, et al.³⁾ Selective stripping, which preserves the competent segment of the saphenous vein, is recommended to avoid postoperative injury to the nerve which lies just beside the below-knee saphenous vein.⁴⁾ Some authors persist in total stripping that corrects venous incompetence below the knee;^{5,6)} others have said that even if reflux is detected in the below-knee saphenous vein, we can preserve the incompetent below-knee saphenous because it is often corrected by just above-knee stripping.^{7,8)} This was a controversial point of debate during the 25th meeting of the Japanese Society of Phlebology.⁹⁾ The incompetent below-knee saphenous is usually preserved because of the unacceptability of postoperative nerve injury. We wanted to ascertain the influence of preserved incompetent vein on venous function after above-knee stripping surgery, and to address the problems with and inadequacy of the present operation.

We reported at the 27th Japanese Society of Phlebology in 2007 that, in our previous study,¹⁰⁾ the preserved incompetent vein did not have an influence on venous function at one month after surgery. We considered that although air plethysmography is sensitive to above-knee reflux, it is not sensitive to below-knee reflux.¹¹⁾ Consequently,

Table 2 Complaints before and after operation

		fatigue	swelling	muscle cramp	itching	cosmetic	pain	local heat
C(-)	pre OP	79/116 (68%)	45/116 (39%)	67/116 (58%)	44/116 (38%)	75/116 (65%)	48/116 (41%)	16/116 (14%)
	post OP	28/116 (24%)	11/116 (9%)	16/116 (14%)	11/116 (9%)	1/116 (1%)	4/116 (3%)	1/116 (1%)
C(+)	pre OP	7/15 (47%)	11/15 (73%)*	6/15 (40%)	7/15 (47%)	8/15 (53%)	4/15 (27%)	5/15 (33%)
	post OP	4/15 (27%)	2/15 (13%)	2/15 (13%)	1/15 (7%)	0/15 (0%)	0/15 (0%)	0/15 (0%)

*: p < 0.01 vs C(-) group

one month is not long enough to assess using air plethysmography whether the below-knee reflux influences venous function or not. Still, in the present study, the VFI of the R(+) group was significantly higher than that of the R(-) group one year after surgery.

On the other hand, the analysis of incompetent perforating vein shows a significant difference between the C(+) and the C(-) group. In the R(+)C(+) group, the mean VFI was over the 2 ml/sec that is considered to be the normal range. There was not a great difference among the symptoms of all groups that show subjective venous function. Preoperatively, more patients of the C(+) group complained of swelling than the C(-) group, but there was no difference postoperatively. Preoperative symptoms with venous stasis improved in all groups postoperatively, with improved quality of life (QOL) being obtained.

As mentioned above, some authors persist in total stripping that corrects venous incompetence below-knee, and the VFI of the R(+) group was significantly higher than that of the R(-) group at one year after surgery in the present study. However, the result does not suggest that total stripping is necessary to correct the venous function with below-knee venous reflux. The risk of nerve injury is a more serious concern than the small improvement of the VFI data at one year after surgery. The saphenous nerve injury is not a complication that causes severe motion disturbance, but it is irreversible and causes very unpleasant complaints.

To correct venous reflux under the knee, intraoperative foam sclerotherapy may be more effective than total stripping. However, foam sclerotherapy with stripping sometimes causes phlebitis that is painful for a long time after surgery, and results in persistent pigmentation. Because residual reflux of the below-knee saphenous does not reduce QOL level, foam sclerotherapy with stripping for all below-knee saphenous veins is not recommended. Below-knee incompetence should be followed up, and it is important to suggest that the patient wear elastic stockings.

Incompetent perforating veins are often detected in moderate and severe cases of varicosities. Ligation is tried for incompetent perforating veins detected preoperatively, but it is difficult to ligate all of them with such a small skin incision. Incompetent perforating veins are sometimes corrected with simple above-knee saphenous stripping, and it is unnecessary to use ligation for all of them.¹²⁾ In the present study, it is considered that resection of the incompetent perforating veins was important for maintaining an adequate level of VFI. According to the

understanding that regional reflux of vein does not have an influence on VFI, it is reasoned that the varices with incompetent perforating veins exerted high pressure on the deep vein, leading to high VFI. Although this does not lead to recurrence or symptomatic conditions at present, it is considered to have an influence on recurrence, and should be followed up.

CONCLUSION

Perforating vein incompetence was found to have more influence on the VFI than below-knee GSV incompetence. In both groups, the symptoms were remarkably improved. The operative method with above-knee stripping and stab avulsion of varicose vein or sclerotherapy is adequate and effective, but it seems to be important to control the incompetent perforating veins.

DISCLOSURE STATEMENT

None of the authors have any conflict of interest to disclose.

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