

Saphenous vein graft preparation with conventional or Mayo vein stripper method: Which one is better?

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ABSTRACT

Objectives: In this study, we aimed to compare the results graft extraction with the Mayo stripper method versus conventional methods.

Patients and methods: Between January 01, 2005 and January 01, 2006, a total of 610 patients (344 males, 266 females; mean age 70.3; range 55.1 to 82.1 years) who underwent coronary artery bypass grafting (CABG) were included. The patients were divided into two groups as the Mayo stripper method group (Group A, n=300) and conventional method group (Group B, n=310). Saphenous vein grafts were prepared for the patients in Group A using the Mayo stripper method and saphenous vein graft was prepared in Group B patients with one long incision using the conventional method. Pre-, intra- and postoperative data were collected, and the patients were followed for 30 days. Appropriate parts of the saphenous graft samples were examined histologically.

Results: There was no significant difference between the pre- and postoperative data ($p<0.05$). Among postoperative outcomes, pain, edema, hematoma, and discharge were significantly more frequent in Group B ($p<0.05$). Of the patients with hematoma, 86.3% were hypertensive. While no necrosis was observed in Group A, seven patients developed necrosis in the saphenous vein incision in Group B. Of these patients, four underwent surgical revision.

Conclusion: Based on our study results, we suggest that preparation of the saphenous vein graft with the Mayo stripper method can yield better results than conventional methods.

Keywords: Coronary artery bypass grafting, mayo stripper, minimally invasive, saphenous vein graft.

As an alternative to traditional saphenous vein graft (SVG) preparation method, minimally invasive SVG method has been increasingly used owing to its low postoperative bleeding and complication rates.^[1,2] However, endothelial damage during the preparation of SVG has limited its use due to the fact that it can decrease the graft patency rate.^[3,4]

In the present study, we aimed to compare the results graft extraction with the Mayo stripper method versus conventional methods.

PATIENTS AND METHODS

Between January 01, 2005 and January 01, 2006, a total of 610 patients (344 males, 266 females; mean

age 70.3; range 55.1 to 82.1 years) who underwent coronary artery bypass grafting (CABG) at İsviçre Hospital, Department of Cardiovascular Surgery, were included. *Exclusion criteria were as follows:* having an urgent operation, venous insufficiency and lower extremity injuries with concomitant surgery, saphenous veins removed from both legs, peripheral artery disease with total artery occlusion, advanced renal disease with a glomerular filtration rate of <30 mL, and poor left ventricular function with an ejection fraction of $<30\%$. The patients were divided into two groups as the Mayo stripper method group (Group A, n=300) and conventional method group (Group B, n=310). A written informed consent was obtained from each patient. The study

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protocol was approved by the İsviçre Hospital Local Ethics Committee. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Surgical technique

All patients were prepared for the operation following the standard open heart surgery procedures with the same general anesthesia method.

Group A: A total of 5,000 units of heparin were administered systemically before the preparation of SVG. An incision of 0.5 to 1 cm from the front of the tibial medial malleolus was made. The skin and the subcutaneous tissue were dissected with scissors. The saphenous nerve was separated from the lower end of the saphenous vein, and the graft was cut off from the distal and proximal end after tying with a number 0 silk suture with a 0.5 cm gap. To pass the proximal end easily from the saphenous vein stripper tip, the silk suture at the SVG side was left with a 7-8 cm long piece (Figure 1). The stripper was gently advanced through the incision line (Figure 2). Using the stripper only, incisions of 0.5 to 1 cm were made at places where SVG branches were present and the grafts were removed after clipping the branches (Figure 3). The SVG was dilated gently with the solution containing 20 mL of arterial blood, 50 mL of 0.9% NaCl, and 2,500 units of heparin. The branches were tied using 4/0 silk sutures and kept in the same solution.

Group B: The incision was started from the front of the tibial bone medial malleolus and the skin-subcutaneous tissue above the vein with adequate length was dissected. The branches were tied using

4/0 silk sutures. The SVG was prepared with the same method and solution described in Group A. The patients were followed for 30 days in the postoperative period. During this period, the pressure stockings for varicose veins with a pressure of 20 mmHg extending to the inguinal region were used as a conservative treatment in all patients.

All preparations were made from 1.5 to 2 cm distal part of the grafts and were examined before dilating with the solution. Thus, the effect of pressure-induced trauma on histopathological examination was ruled out. The preparations were taken into 10% formalin and routine tissue examination procedure was performed in the paraffin block. Tissue identification was made using hematoxylin-eosin staining. Endothelial and interstitial structures, fibroblastic activity, leukocyte invasion, edema, and necrosis were examined.

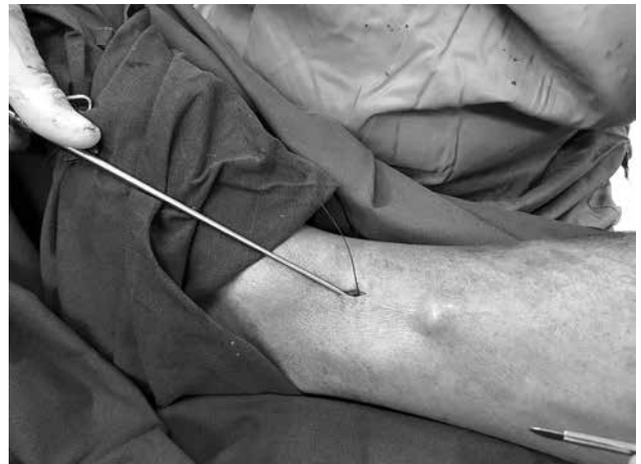


Figure 2. The stripper was gently advanced through the incision line.



Figure 1. First incision.



Figure 3. Harvesting the graft.

Data collection and follow-up

Preoperative data including demographic and clinical characteristics such as age, gender, weight, diabetes mellitus, hypertension, chronic obstructive pulmonary disease were recorded. Postoperative data included the SVG length, number of leg incisions, leg incision length, pain, edema, paresthesia, hematoma, discharge, infection and necrosis. We did not observe any clinical picture that would limit walking in both groups and the postoperative mobilization of the patients was started in the intensive care unit. Pain was evaluated using the Wong-Baker scale.^[05] The patients with suspected deep vein thrombosis were evaluated using Doppler ultrasound.

Statistical analysis

Statistical analysis was performed using the MedCalc version 19.03 software (MedCalc Software Inc., Mariakerke, Belgium). Descriptive data were expressed in mean \pm standard deviation (SD) or number and frequency. The chi-square test was used to compare categorical variables. A *p* value of <0.05 was considered statistically significant.

RESULTS

Baseline demographic and clinical data are shown in Table 1. There was no statistically significant difference in the preoperative data of the groups ($p>0.05$).

Group B patients had more pain in the saphenous vein incision site and administration of analgesic at the incision site was more frequent in these patients ($p<0.05$).

No venous thrombosis was observed in either group. However, a significant increase in the diameter

of the lower extremity causing pain and limitation with movement indicated edema. Accordingly, the rate of edema was higher in Group B patients ($p<0.05$). Paresthesia, tingling, and similar complaints were reported by both groups, indicating no statistically significant difference ($p>0.05$).

Hematoma and discharge from the incision site were found to be independent of the preoperative data of the patients. In Group A, 86.3% of the patients who developed hematoma were found to be hypertensive. Hematoma and discharge were more frequent in Group B, compared to Group A ($p<0.05$).

Discharges in the wound sites were serous. There was bacterial reproduction of tissue materials after necrosis and related infection. In Group A, all patients who developed infection were found to be Gram(+) and, in Group B, 71.3% patients who developed infection were found to be Gram(+), while 28.7% of all patients were Gram(-). While no signs of necrosis were observed in Group A, necrosis was seen in above-the-knee saphenous vein incisions in Group B. Of these patients, four underwent revision surgery.

In Group B, the incision was single and continued after the graft length, which was also longer compared to Group A. In Group A, stripper incisions were made intermittently and the cut was 0.5-1 cm per incision. The length of the graft in Group B and A was significantly different ($p<0.01$). A significant difference in the incision length was found between Group A and Group B ($p<0.01$). Postoperative patient data are shown in Table 2.

According to the preparations in both groups, we found no microscopic endothelial damage or

Table 1. Baseline demographic and clinical data

	Group A (n=300)			Group B (n=310)			t or χ^2	p
	n	%	Mean \pm SD	n	%	Mean \pm SD		
Age (year)			68.2 \pm 13.1			69.5 \pm 12.6	1.24	0.221
Gender							2.07	0.149
Male	178			166				
Female	122			144				
Weight (kg)			79.2 \pm 13.3			81.1 \pm 14.6	1.67	0.0937
Diabetes mellitus	138	46.0		126	40.6		1.78	0.182
Hypertension	78	26		92	29.6		1.02	0.311
COPD	44	14.6		53	17.1		0.67	0.411
Peripheral artery disease	11	3.6		7	2.3		1.05	0.304
Renal failure	23	7.6		25	8.1		0.33	0.855

SD: Standard deviation; χ^2 : Chi-square; COPD: Chronic obstructive pulmonary disease.

Table 2. Postoperative data

	Group A (n=300)			Group B (n=310)			t or χ^2	p
	n	%	Mean \pm SD	n	%	Mean \pm SD		
Pain	81	27.0		122	39.3		8.73	0.003*
Edema	53	17.6		95	30.6		13.9	0.0002†
Paresthesia	75	25.0		89	28.7		1.06	0.301
Hematoma	32	10.6		74	23.8		18.5	0.0001†
Discharge	49	16.3		80	25.8		8.2	0.0042*
Infection	5	1.6		28	9		16.16	0.0001†
Necrosis	-	-		7	2.3			0.015‡
Saphenous vein graft length (cm)			33.1 \pm 4.4			35.3 \pm 5.1	2.2	0.0001†
Number of leg incision (cm)			6.4 \pm 0.8			1		0.0001†
Leg incision length (cm)			5.3 \pm 0.2			35.3 \pm 5.1	101.8	0.0001†
Mobilization (gün)			1.1 \pm 0.3			1.11 \pm 0.2	0.48	0.627

SD: Standard deviation; χ^2 : Chi-square; * p<0.01 ; ‡ p<0.05; † p<0.001.

edema in the either group. The vascular histological structure was completely preserved, and no prominent leukocyte infiltration or necrosis was observed in the interstitial tissue or lumen. A healthy graft sample is shown in the preparation of both groups (Figures 4a and 4b).

DISCUSSION

Although use of the arterial grafts has increased in recent years, SVG is still used in many cases frequently and, although different results have been reported, the arterial graft and SVG patency rates are similar.^[6]

Currently, minimally invasive surgical techniques (MICT) are used to prevent morbidity of the extremity incision. It reduces morbidity and does not cause cosmetic problems.^[7] There are publications reporting

that the use of MICT has overcome the problems such as body mass index, cost, and trained staff requirement, and is quite effective.^[7,8] However, morbidity due to skin retraction may be seen. When the extremity incision criteria were considered, we found that the length of the wound was significantly less than the conventional method in cases where the stripper was used. The difference in the length of the incision also resulted in a lower risk of edema and hematoma. Based on these findings, the Mayo stripper group had lower edema and hematoma than the conventional method.

The sharp changes in the saphenous trace cause flap formation in the incision line and the resulting flap results in insufficiency of blood supply in the wound line; thus, it causes necrosis during tissue healing.^[14] Necrotic wound treatment requires surgical revision and is associated with prolonged hospitalization and

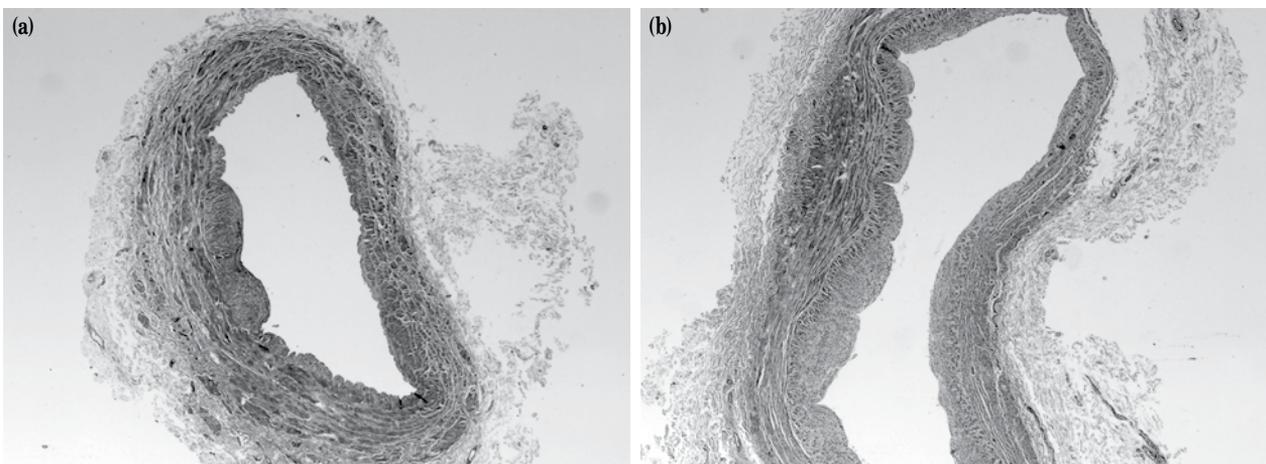


Figure 4. (a) Group A graft sample (b) Group B graft sample (H-E \times 100).

higher cost.^[7] Considering infection in the wound site and its treatment, necrosis was observed in the long segment incision. In our study, seven patients in the conventional group developed necrosis and four of them required surgical repair. However, none of the patients in the Mayo stripper group had necrosis.

As another MICT alternative, endothelial dysfunction due to traction damage was detected in SVGs which were removed by skin bridges made with multiple 10 to 15 cm small incisions. In SVGs, endothelial dysfunction and traction-related endothelial damage, stimulation of myointimal proliferation and persistence of the patient's atherosclerotic disease affect short or long-term graft performance.^[9-11] The SVG bypass occlusion rate reaches up to 10 to 20% at one year and 50% at 10 years. Histopathological and tissue level damage examinations reveal the endothelial damage and inflammatory cell infiltration. In accordance with this finding, our study showed that the pull and stretching movements of the grafts did not cause any significant damage at tissue level using the Mayo stripper method. Considering both the procedure and ischemic time, histological examination of the tissue samples did not show any damage to the vein tissue.

This situation yielded the same results for both working groups. In other words, conventional SVG method resulted in less damage at tissue level and the lateral branches were not damaged due to traction in the grafts which were removed by the Mayo stripper. Nevertheless, long-term graft patency rates still remain controversial.^[12]

Furthermore, tissue and saphenous nerve sensation is another problem. In the classical method, the saphenous nerve is directly fixed and, thus, damage can be prevented during tissue dissection. Technically, it can be more difficult to protect the saphenous nerve in the Mayo stripper method, as the ring proceeds subcutaneously. However, our study showed that the numbness and tingling symptoms in both groups were found at similar rates and no statistically significant difference was found between the groups. In the large series studies using minimally invasive vein harvesting technique, it was also reported that the morbidity was reduced and the infection, hematoma and edema rates were lower.^[13-15]

Nonetheless, there are some limitations to this study. All patients were followed for 30 days and, therefore, we were unable to determine the effect of long-term follow-up on histological data analysis and duration of graft patency as assessed by conventional or

multislice computed tomography. In addition, the lack of long-term follow-up precludes the evaluation of wound site morbidities. A different study may be able to answer the loose ends.

In conclusion, minimally invasive surgical approaches are more common in cardiovascular practice. Preparing the SVG with the Mayo stripper is a method which should be preferred owing to its potential of forming lesser wound areas and less complications in selected cases.

Declaration of conflicting interests

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