Harvesting the saphenous vein with surrounding tissue for CABG provides long-term graft patency comparable to the left internal thoracic artery: Results of a randomized longitudinal trial

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Objective: Conventional harvesting of the saphenous vein in coronary artery bypass surgery produces vessel damage that contributes to graft failure. A novel “no touch” technique provides high short- and long-term patency rates.

Method: This randomized longitudinal trial compares graft patency of two patient groups undergoing coronary artery bypass surgery. Conventional: 52 patients had their veins stripped, distended, and stored in saline solution. No-touch: 52 patients had veins removed with surrounding tissue, not distended, and stored in heparinized blood. Angiographic assessment was performed at mean time 18 months after the operation in 46 patients in the conventional group and 45 patients in the no-touch group and repeated at mean time 8.5 years in 37 patients from both groups.

Results: The distribution of the grafts to the recipient coronary arteries regarding their size and quality was similar in both groups. The angiographic assessment at 18 months postoperatively showed 89% conventional versus 95% no-touch grafts were patent. Repeated angiography at 8.5 years showed a patency rate for the conventional group of 76% and 90% for the no-touch group ($P = .01$). The multivariate analysis showed that the most important surgical factors for graft patency were the technique of harvesting (odds ratio = 3.7, $P = .007$) for the no-touch versus the conventional technique and the vein quality before implantation (odds ratio = 3.2, $P = .007$) for veins that were of good quality. By comparison the patency of the thoracic artery grafts was 90%.

Conclusion: Harvesting the saphenous vein with surrounding tissue provides high short- and long-term patency rates comparable to the left internal thoracic artery.

The long-term success of coronary artery bypass surgery (CABG) depends on continued patency of the bypass conduits. The superior patency and long-term results associated with the left internal thoracic artery (LITA) has stimulated the use of arterial grafts in order to overcome the limitations of saphenous vein grafts.¹ Currently there is increasing use of bilateral internal thoracic arteries² and the radial artery (RA)³ to achieve complete myocardial revascularization, although there are problems associated with the use of arterial conduits. The site from which they are removed may become ischemic⁴ and sternal complications may be more common when 2 internal thoracic arteries are used, particularly in insulin-dependent diabetic patients.⁵ The potential for graft spasm is another serious concern that occurs with radial grafts as well as other free arterial grafts.^{6,7} Therefore, the saphenous vein (SV) remains an important conduit for patients undergoing bypass surgery, and improvement of its long-term patency remains a major challenge.⁸

Abbreviations and Acronyms

C	= conventional harvesting technique
I	= intermediate harvesting technique
LAD	= left anterior descending
NOS	= nitric oxide synthase
NT	= “no-touch” harvesting technique
OR	= odds ratio
PDA	= posterior descending artery
RA	= radial artery
RCA	= right coronary artery
SV	= saphenous vein

Several studies show that damage to the vessel during graft preparation influences both short-term and long-term graft patency.^{9,10} The SV is often stripped of its adventitial layer and distended to overcome spasm, procedures that are known to cause vein intima and wall damage.¹¹ We have previously shown that veins harvested with a pedicle of surrounding tissue, the “no-touch” harvesting technique (NT), can be implanted without the need for prior distension.¹²

In 1993 a prospective randomized study was initiated to compare the NT with conventional (C) and intermediate techniques (I). An angiographic follow-up at mean time 18 months after the operation showed a higher patency rate (95.4%) for vein grafts treated by the NT when compared with the C and I.¹³

The aim of this article is to report the long-term follow-up results of the C versus NT.

Methods**Harvesting Techniques**

Group C. The SV was exposed by a longitudinal leg incision, the adventitia stripped off, and side branches ligated. The vein was removed from the leg immediately after dissection, manually distended with saline at 300 mm Hg for 1 minute using a syringe connected to a manometer (Figure E1, a), and stored in saline at room temperature.

Group NT. The SV was exposed by a longitudinal incision and all visible side branches ligated. The vein was then isolated together with a pedicle of surrounding tissue (Figure E1, b) and left in situ until extracorporeal circulation was started to allow continuous heparinized blood perfusion. After removal, the vein was stored in blood obtained from the aortic cannula before cooling. To check for leakage from the distal anastomosis, the proximal end of the graft was briefly connected to the arterial cannula. Accordingly, the graft was neither flushed nor distended manually.

Group I. The SV was dissected as in group C. Instead of manual distention, the vein was left in situ and covered with a sponge moistened in saline-papavarine solution (1 mg/mL) until extracorporeal circulation was started. The vein was then removed and stored in blood obtained from the patient's aortic cannula.

In all groups, the veins were harvested and implanted by the same surgeon (D.S.). While the assistant surgeon took down the

LITA the head surgeon (D.S.) harvested the vein; thereafter they switched their positions.

Study Design

This randomized and longitudinal single center trial was started in 1993 at the Department of Cardiothoracic Surgery and Anesthesiology, Örebro University Hospital, Örebro, Sweden. One hundred fifty-six patients were allocated randomly to 3 groups of 52 patients each according to 3 SV harvesting techniques. The local ethics committee approved the study, and patients gave their informed consent. Exclusion criteria were: age > 70 years, unstable angina, serum creatinine > 120 μ mol/L, preventive use of anticoagulants, coagulopathy, combined procedure, redo CABG, severe peripheral vascular disease, and insulin-dependent diabetes mellitus. Of the 52 patients in each group, 46 patients from group C, 41 from group I, and 45 from group NT underwent the first angiographic follow-up at mean time 18 months after the operation.

All patients in groups C and NT who underwent the first angiographic assessment were offered a further assessment at mean time 8.5 years after the operation. However, 4 patients in group C and 3 in group NT died before completion of the long-term follow up. Five patients in each group declined the long-term follow-up.

Due to limited economic resources, we did not evaluate the patients from the intermediate group. An additional reason for exclusion was that this group had the lowest patency rate at the 18-month assessment¹³ and this technique is not commonly used in CABG. Consequently, long-term postoperative coronary angiography (8.5 years) was performed on 37 patients in both the C and NT groups. Table E1 shows an overview of the design of the study. All patients who declined angiographic assessment were followed clinically.

Surgical Aspects

Cardiopulmonary bypass with moderate hypothermia (28° to 30°C) and cold blood retrograde cardioplegic solution (4°C) were routinely used. Malleable calibrated probes were used to measure the diameter of the target coronary arteries, and the size and quality of recipient arteries recorded. The distal vein graft anastomoses were performed first using 7-0 prolene continuous sutures. All LITAs were prepared as pedicled grafts and all but 1 anastomosed to the left anterior descending (LAD) coronary artery as a single graft in a continuous fashion using 8-0 prolene. The proximal vein graft anastomoses were performed to the aorta with continuous 6-0 prolene sutures after release of the aorta crossclamping. Vein graft characteristics, such as quality and origin (distal, central, and proximal) were taken into consideration and recorded. Graft blood flow rate was routinely measured by ultrasonic transit time (Research flowmeters, Transonic Systems Inc, Ithaca, NY). Measurements were made after weaning from the extracorporeal circulation and when stable hemodynamic conditions were achieved with the mean pressure approximately 80 mm Hg.

Angiography

All contrast injections were performed manually with iodixanol 320 mg/mL (Visipaque, GE Health Systems, Little Chalfont, Buckinghamshire, UK) with at least 2 views of each vessel.

All images were reviewed by one radiologist (H.G.) with over 10 years of coronary angiography experience and who was blinded

to which group the patient belonged. A graft was judged as occluded when the graft was not opaque. Usually, however, a slight bulge could be seen at the aortic anastomosis of the occluded graft. A stenosis was judged as significant when the narrowing of the lumen diameter was over 50% compared with the normal lumen size of the vessel.

Statistical Methods

Patency of graft. An outcome with two states (ie, patency or occlusion) was analyzed with logistic regression models and with Fisher exact test for 2-by-2 tables. The main predictor variable was the 2 different harvesting techniques: conventional and no-touch. Additional predictor variables for the logistic regression were examined individually, and those expected to have a significant relation to the outcome and also having an uneven distribution across the 2 harvesting techniques were selected and used in the final model.

The logistic regression model was analyzed with graft as the unit of analysis with a total of 202 grafts. However, all patients but 1 had more than 1 graft, with a maximum number of 3 grafts per patient. Multiple grafts per patient might introduce dependencies between the observations, a violation of one of the basic assumptions for the ordinary logistic regression model. A special form of the model was therefore used to allow for clustered observations, with each patient forming a separate cluster. The *P* values and confidence intervals were in this way corrected for the problem with correlated observations. This correction was not possible for Fisher exact test; therefore the primary results are those from the logistic regression.

The outcome parameter of interest in the logistic regression model is the odds ratio (OR) and in this analysis all OR above 1.0 indicates increased chance for patency, and an OR below 1.0, less chance. Before reaching the final model we examined the possibility that the additional predictor variables had significant interactions with the main predictor variable, the harvesting technique. Computations were performed with SAS, version 8.2 (SAS Institute Inc, Cary, NC) and the procedure for the logistic model was GENMOD, with the ALR algorithm.¹⁴

Results

Patient Characteristics

Perioperative myocardial infarction occurred in 2 patients in group C, but there was no death during patient hospitalization in either group. However, 4 patients in group C and 3 in group NT died 5 to 7 years after the first angiography assessment due to cancer. Accordingly, there was no mortality caused by cardiac disease in any group.

The characteristics of the 37 patients in each group who underwent the long-term angiographic assessment are given in Table E2. There was no difference between the 2 groups regarding gender or age. However, we found a greater number of smokers and hypertensives in group NT. Eight patients in group C and 13 in group NT became diabetic postoperatively and required treatment with either oral medicine or insulin. Patients who had serum cholesterol above the normal range (2.6-5.0 mmol/L) were considered to have

hyperlipidemia. Even though most patients received lipid-lowering medicine, 51% of the patients in group C and 63% of patients in group NT had hypercholesterolemia (>5.0 mmol/L).

All patients received aspirin at a dose of 160 mg/d, which was commenced on the day after the surgery; this treatment was advised to be used indefinitely. Currently, 97% of the patients in both groups are taking 75 or 160 mg/d aspirin.

Surgical Data

All patients were operated on by the same surgeon. There was a longer duration on cardiopulmonary bypass and aortic crossclamping time in the NT group than in group C: mean time 139 versus 121 minutes and 72 versus 64 minutes, respectively. The majority of patients in both groups received 3 vein grafts together with a LITA, and the number of distal anastomoses per patient ranged from 2 to 7 with a mean of 4.1 for group C and ranged from 2 to 6 with a mean 4.1 for the NT group.

Twenty-seven percent of the veins from the NT group were considered of poor quality, showing either varicose or fibrotic changes at the time of operation. In group C, 11% of the veins were also considered of poor quality. In both groups, most of the proximal parts of the SV from the thigh were anastomosed to the right coronary artery; the central parts, from the knee area, were anastomosed to the diagonal branches; and the distal parts, from the calf, were anastomosed to the circumflex branches.

Angiographic Assessment

The mean time for the first and the second angiographic assessments was 18 months and 8.5 years, respectively. The results from the 18-month assessment have previously been published,¹³ and the cumulative difference in patency rate between the 2 groups is given in Table E3.

Repeat angiography was performed in 74 (81%) patients at 8.5 years follow-up and there was an equal distribution of the number of patients and the type of grafts among both groups. There were 87 single grafts, 11 double sequential grafts, and 3 triple sequential grafts in group C. In group NT, there were 87 single grafts and 14 double sequential grafts. Four patients in group C and 2 in group NT underwent an angiographic assessment late after the surgery, due to recurrence of angina caused by saphenous vein graft (SVG) occlusion. Thus, the patency rate was 76% (77/101) for group C and 90% (91/101) for group NT (*P* = .01). In group C, 3 double and 1 triple sequential grafts were completely occluded. There was 1 triple sequential graft that was occluded in its distal segment. All sequential grafts were patent in group NT.

The complete data regarding the most important surgical factors affecting vein graft outcome in association with the harvesting technique are given in Table E4. The patent

grafts that had a flow rate below 40 mL/min were 36/50 (72.0%) in group C versus 44/46 (95.7%) in the NT group ($P = .002$). Patent grafts that had flow rates >40 mL/min were 41/51 (80.4%) in group C versus 47/55 (85.5%) in the NT group (not significant).

In the veins considered to be of poor quality before harvesting, the patency rate at long-term follow-up was 4/11 (36.4%) in group C and 24/27 (88.9%) in the NT group ($P = .002$).

In group C, 8 of the 20 single occluded vein grafts were anastomosed to the diagonal branches, 8 were anastomosed to the circumflex branches, 2 were anastomosed to the right coronary artery (RCA) proximally to the crux area and 2 to posterior descending artery (PDA). All 4 occluded sequential grafts had been anastomosed to the circumflex system. In the NT group, 1 of the 10 occluded grafts was anastomosed to a diagonal branch, 3 to the marginal branches; 4 grafts were anastomosed proximally to the crux area of the RCA and only 1 to the PDA.

Accordingly, 6/22 (27.3%) of the grafts anastomosed to the RCA above the crux area were occluded, whereas there was an occlusion rate of only 3/44 (6.9%) for the grafts anastomosed to the PDA ($P = .05$).

Regarding the quality of open grafts, in group C 12 showed mild diffuse wall changes and 5 significant diffuse narrowing. Four significant localized stenoses were identified in the body of the graft and 3 others showed stenoses at the distal anastomoses. In group NT, 5 showed mild diffuse wall changes and 1 graft showed significant diffuse narrowing. Three significant localized stenoses were identified in the body of the graft and 3 others at the anastomoses. All remaining grafts in both groups were considered normal.

The multivariate analysis with adjustment (Table E5) shows that the 2 most important factors for graft patency are the technique used for vein harvesting ($OR = 3.7$, $P = .007$) for NT, and the quality of the vein before harvesting ($OR = 3.2$, $P = .007$) for the vein of good quality. There were no significant interactions, thus the superiority of NT grafts should prevail for all levels of the additional predictor variables.

Due to the protection given by the surrounding tissue in the NT grafts, kinking did not occur in excessively long grafts (Figure E2).

At 8.5 years, 70 LITAs were evaluated and 7 (10%) were occluded. We found that most of the occluded LITAs were anastomosed to the LAD with 50% to 70% stenosis. The only LITA that was anastomosed to a diagonal branch was partially occluded, showing a small luminal diameter and irregularities.

All 12 patients in group NT who declined the angiographic assessments but underwent a clinical evaluation were free of angina, whereas 4 of 11 patients in group C had recurrence of angina.

Discussion

This is the first randomized clinical trial showing that the harvesting technique of the SV for CABG is an important factor for the long-term outcome of the vein graft. The NT technique provides a significantly better patency rate than veins treated by the conventional technique ($OR = 3.7$ and $P = .007$). Furthermore, its patency was similar to that of the LITA. In agreement with another study¹⁵ we found, in both groups, that the poor quality of the vein before its harvesting and implantation is also an important factor for graft failure. An interesting finding was that veins of poor quality had a significantly higher rate of failure in group C than in group NT ($P = .002$). This result suggests that particular care should be exercised when handling poor quality veins during surgery. It was also observed that grafts with a flow rate <40 mL/min were more often occluded when harvested with C than the NT ($P = .002$). This finding was attributed to a better preservation of the endothelial (nonthrombogenic) layer in grafts harvested with NT.¹⁶

The site for the anastomoses is also an important factor for the fate of the graft, irrespective of the harvesting technique used, as we found that 28% of the vein grafts that were anastomosed to the RCA above the crux region were occluded compared with 7% for those anastomosed distally to this site. This finding is in agreement with a previous study¹⁷ and is attributed to a more rapid progression of coronary disease at the main stem of the RCA.

Today, with decreasing popularity of the SV as a conduit for CABG surgery, the RA has become the second graft of choice in myocardial revascularization. Two recent randomized studies have provided no evidence of its superiority.^{18,19} Therefore, the most prudent choice for a high proportion of patients continues to be the use of a single LITA and multiple vein grafts.

Many strategies have been used to improve the short- and long-term vein graft patency rates. Apart from established adjuvant medical therapy, new pharmacologic agents,²⁰ gene therapy,²¹ and the use of mechanical devices²² are presently undergoing evaluation. Many of these strategies show promise in experimental vein bypass models, but few have successfully been transferred into clinical practice. An important consideration in the improvement of surgical techniques is to prevent vein wall damage during harvesting and implantation.

Although progress is being made regarding the reduction of wound infections following CABG, the vein is generally prepared using the original method of surgery, where it is stripped and distended before implantation. A recent randomized study²³ comparing endoscopic versus open vein harvesting for CABG showed significantly lower wound complications in the endoscopic vein harvested group, but there was no significant difference in the early graft occlusion rate between the 2 groups. The procedure of stripping

and distension reduces the patency rate, not only for venous but also for LITA grafts.²⁴

It would be a great advantage if the NT veins could be harvested via an endoscopic technique. However, to do so would require a device that would allow one to harvest the vein with sufficient surrounding tissue to protect the vein wall and eliminate trauma.

Most occluded LITA grafts were anastomosed to LAD with stenosis less than 70%. This finding was similar to the results presented by Sabik et al,²⁵ showing a high incidence of LITA occlusion when it was anastomosed to a LAD with stenosis less than 70%. This was considered to be due to competitive flow through the native coronary artery interfering with that of LITA.

Our intention was not to compare the patency rate of NT with the LITA graft and we agree with the general consensus that the use of the pedicled LITA to the LAD is the gold standard in CABG surgery. Nevertheless, it would be interesting to know what would happen to the LITA grafts if they had been anastomosed to target coronary arteries other than the LAD. Indeed, one study shows that the patency of the LITA was reduced when anastomosed to other coronary arteries than LAD,²⁶ and in our study the only LITA that was anastomosed to a diagonal branch showed a poor graft performance. Another interesting question is: What would be the long-term result of the NT vein graft if anastomosed to the LAD?

The key to the success of the LITA is its superior resistance to the development of atherosclerosis. Theories regarding protection against atherosclerosis are mainly directed toward the vasoactive properties of the arterial wall.²⁷ We have previously demonstrated the preservation of nitric oxide synthase (NOS), associated with luminal endothelial cells, as well as the media and adventitia of NT vein grafts.²⁸ Endothelial NOS, in particular, was identified in the NT veins,²⁹ suggesting that the NOS system may be involved in reduced intermediate and late graft occlusion via attenuation of intimal hyperplasia and subsequent atherosclerosis. An intravascular ultrasound study showed a fourfold increase of grafts with considerable intimal hyperplasia and a double increase in grafts with plaque of atherosclerosis in group C than in group NT.³⁰

Termination of vasa vasorum in the SV lumen has been described recently.¹⁶ It is therefore possible that preservation of the network of vasa vasorum in the surrounding tissue of NT SV allows arterial blood from the graft lumen to perfuse retrogradely through the vein wall, thereby decreasing transmural ischemic damage. Also, the surrounding tissue supports the vein graft and prevents it from kinking, and an additional suggestion is that this perivascular cushion acts in a similar fashion to an external stent that has been shown effective in reducing intimal and medial thickening in an experimental vein graft model.³¹

Conclusion

This study revives the position of the SV as an important conduit in CABG surgery. The novel NT technique of SV harvesting provides high short- and long-term patency rates for vein grafts and is comparable to the patency rate of the LITA graft. This technique provides better structural, functional, and mechanical protection of the vein wall, thereby resulting in a nonthrombogenic graft immediately after surgery and long-term improvement due to reduced late intimal and medial hyperplasia. An improvement in vein graft surgery may have a significant impact on graft usage, reduced graft pathology, improved graft patency leading to improved patient care and survival.

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Figure E1. a, Saphenous vein harvested with the conventional technique. b, Saphenous vein harvested with the “no-touch” technique.

Figure E2. Overview of angiographic follow-up.

TABLE E1. Overview of angiographic follow-up

ND = Not done.

TABLE E2. Patient characteristics in the 2 study groups

Patient characteristics	Surgical technique	
	Conventional	"No touch"
Number of patients	37	37
Female/male	5/32	5/32
Age at surgery, mean (range)	57 (45-68)	58 (43-67)
Smoker, n (%)		
Preoperative	7 (19%)	7 (19%)
18 months after surgery	6 (16%)	5 (13%)
Long-term follow-up*	4 (11%)	8 (22%)
Diabetes, n (%)	8 (22%)	13 (35%)
Hyperlipidemia, n (%) (> 5.0 mmol/mL), long-term follow-up†	18 (51%)	22 (63%)
Hypertension, n (%) (above 140/90), long-term follow-up‡	11 (31%)	20 (56%)
Preoperative infarct, n (%)	22 (59%)	20 (54%)
Ejection fraction		
Preoperative mean (range)	64 (44-81)	67 (40-86)
Longtime follow-up mean (range)§	57 (25-82)	58 (40-75)

*Missing data for one patient in conventional group. †Missing data for two patients in conventional group and two patients in "no-touch" group. ‡Missing data for two patients in conventional group and one patient in "no-touch" group. §Missing data for 4 patients in conventional group and 11 patients in "no-touch" group.

TABLE E3. Ratio of patency to total number of grafts for the 2 surgical techniques with follow-up after 18 months and 8.5 years

	Conventional		"No touch"		<i>P</i> -value for group difference*	
	18 months	8.5 years	18 months	8.5 years	18 months	8.5 years
No of patients	46	37	45	37	91	74
Graft type:						
Single	95/107 (89%)	67/87 (77%)	103/109 (94%)	77/87 (89%)	.15	.07
Sequential	18/20 (90%)	10/14 (71%)	15/15 (100%)	14/14 (100%)	.50	.10
Total	113/127 (89%)	77/101 (76%)	118/124 (95%)	91/101 (90%)	.10	.01

*Fisher exact test.

TABLE E4. Vein graft characteristics in the 2 randomized study groups (number of patent grafts divided by total number of grafts, 174 single and 28 sequential vein grafts)

Vein graft characteristic	Conventional	"No touch"
Number of grafts, n	101	101
Graft flow $\leq$ 40 (mL/min), coronary artery diameter (mm)		
$\leq$ 1.5	27/38	36/37
$\geq$ 2.0	9/12	8/9
Graft flow $>$ 40 (mL/min), coronary artery diameter (mm)		
$\leq$ 1.5	19/26	37/41
$\geq$ 2.0	22/25	10/14
Artery quality		
Good	65/84	76/86
Mildly calcified	10/14	8/8
Moderately calcified	1/2	7/7
Occluded	1/1	0/0
Venous quality		
Good	73/90	67/74
Poor	4/11	24/27
Venous part		
Distal		
Coronary system		
CX	19/26	29/31
DIAG	1/1	3/3
LAD	0/0	0/0
RCA main stem	3/3	1/1
PDA	6/6	2/2
Medial		
Coronary system		
CX	7/7	4/4
DIAG	18/26	23/24
LAD	0/0	0/0
RCA main stem	0/0	1/4
PDA	3/3	4/5
Proximal		
Coronary system		
CX	1/6	0/1
DIAG	2/2	4/5
LAD	0/0	1/1
RCA main stem	7/9	4/5
PDA	10/12	15/15

CX, circumflex artery; *DIAG*, diagonal artery; *LAD*, left anterior descending artery; *PDA*, posterior descending artery; *RCA*, right coronary artery.

TABLE E5. Patency of single and sequential grafts in 2 study groups analyzed with logistic regression models without and with allowance of additional explanatory factors other than harvesting technique

	No of grafts (patency/total)	No adjustment*			Multivariate adjustment†		
		Odds ratio	95% CI‡	P value§	Odds ratio	95% CI‡	P value§
Technique							
Conventional (reference)	77/101	1.0	—	—	1.0	—	—
“No-touch”	91/101	2.7	1.2-6.2	.019	3.7	1.4-9.6	.007
Graft type							
Single (reference)	144/174	1.0	—	—	1.0	—	—
Sequential	24/28	1.3	0.5-3.6	.58	1.0	0.3-2.9	.97
Graft flow (mL/min)							
≤40 (reference)	80/96	1.0	—	—	1.0	—	—
>40	88/106	1.0	0.5-2.1	.99	0.8	0.4-1.7	.58
Coronary artery diameter (mm)							
≤1.5 (reference)	119/142	1.0	—	—	1.0	—	—
≥2.0	49/60	0.9	0.4-2.2	.81	1.1	0.4-2.9	.91
Venous quality							
Poor (reference)	28/38	1.0	—	—	1.0	—	—
Good	140/164	2.0	0.8-5.0	.12	3.2	1.4-7.5	.007
Venous part							
Distal (reference)	64/73	1.0	—	—	1.0	—	—
Medial	60/73	0.6	0.3-1.5	.29	0.6	0.2-1.5	.26
Proximal	44/56	0.5	0.2-1.4	.18	0.5	0.2-1.5	.21

The effect parameters are odds ratios supplemented with 95% confidence intervals. (Odds ratio higher than 1.0 indicates higher probability for patency compared with that of the reference category, below 1.0 indicates lower probability.) *No other variables in the model but the analyzed factor. †All variables in the table simultaneously analyzed. ‡CI = 95% confidence interval. §P value for testing that odds ratio equals 1.0 (ie, no effect compared with the reference category).