Patency rates of endoscopically harvested radial arteries one year after coronary artery bypass grafting

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Objectives: To improve patients' acceptance of the radial artery as a graft for coronary revascularization, we introduced an endoscopic harvesting technique. The aim of this study was to assess graft quality 1 year after the operation.

Methods: In 50 patients who underwent endoscopic radial artery harvesting for coronary artery bypass grafting, 64-slice computed tomography, electrocardiography, and echocardiography were utilized to assess graft patency and left ventricle function at a 1-year follow-up. In addition, the influencing factors of radial artery graft patency were evaluated. Radial artery patency was compared with a control group from our database.

Results: Any patency of endoscopically harvested radial artery grafts was 78% (39/50) and perfect patency was 72% (36/50) 1 year after coronary revascularization. The implanting surgeon and graft harvester, patient factors, graft properties, medication, and target territory did not influence the patency rates of the radial artery graft. The only significant and strong parameter to predict perfect graft patency was the severity of the target vessel stenosis ($P < .001$). In patients with a target vessel stenosis of 90% or greater, radial artery graft patency was 90.3% (28/31). Patency rates of endoscopically (72%) and conventionally (74%) harvested radial arteries were not different ($P = .822$).

Conclusions: Patency rates 1 year after endoscopic radial artery harvesting are comparable to the open technique. On the basis of our results, we attempt to use the radial artery as a bypass graft only for target coronary arteries with 90% or greater stenosis. We recommend endoscopic harvesting as the technique of choice to harvest the radial artery.

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Since the reintroduction of the radial artery (RA) as a coronary artery bypass graft in the 1990s, harvesting techniques and antispasmodic therapy have been advanced.[1-3] It has been hoped that the RA will maintain greater late patency than has the saphenous vein (SV).[4] Consequently, we offer total arterial revascularization to patients aged less than 70 years. To further improve patients' acceptance of the RA as a bypass graft, we established a method of endoscopic RA harvesting in March of 2004.[5]

To evaluate the graft patency of the endoscopic technique, we consecutively followed up our first series of patients who underwent endoscopic RA harvesting.

Materials and Methods

Patients

Of 1403 patients who underwent coronary artery bypass grafting at our institution between March 2004 and July 2005, 397 received an RA graft. The RA was chosen as a bypass graft in patients aged less than 70 years and in the absence of contraindications such as carpal tunnel syndrome, Dupuytren disease, severe arterial obstructive disease, dialysis, pathologic Allen test or Doppler examination, small RA diameter, or visible calcification. A total of 71

Abbreviations and Acronyms

LITA = left internal thoracic artery
MSCT = multislice computed tomography
NYHA = New York Heart Association
PI = pulsatility index
RA = radial artery
RCA = right coronary artery
RITA = right internal thoracic artery
SV = saphenous vein

patients underwent coronary artery bypass grafting with an endoscopically harvested RA during the above-mentioned time period. Twelve patients were lost to follow-up (10 patients live abroad and 2 patients refused follow-up). Of 59 patients, 6 refused the investigation with a multislice computed tomograph (MSCT), and 3 patients had contraindications for the application of the contrast agent (elevated creatinine or suppressed thyroid-stimulating hormone). Thus, evaluation of bypass patency after endoscopic RA harvesting at 1 year was performed in 50 patients. In these patients, a 12-lead electrocardiogram was recorded and an echocardiographic investigation was performed.

Endoscopic Radial Artery Harvesting

The nondominant arm was chosen for RA harvesting. Preoperative Allen test and Doppler examination were routinely performed to confirm adequate ulnar blood flow.

The RA was harvested through a single 3-cm skin incision. This technique is performed with an endoscope inserted into a retractor and a harmonic scalpel for the dissection of the artery. Transection of the artery is carried out with a pre-tied Endoloop. A detailed description of the technique has been published.[5]

Antispasmodic prophylaxis was carried out by intravenous application of 6 to 12 μg diltiazem/kg/min starting during extracorporeal circulation and continuing for 24 hours after the operation. We also recommended the administration of amlodipine as an antispasmodic agent in an oral dose of 5 mg/d for 3 months after the operation.

Intraoperative Assessment

Assessment of the bypass grafts was carried out after weaning from cardiopulmonary bypass and establishment of stable hemodynamic conditions with a transit time flowmeter (Medi-Stim ASA, Oslo, Norway). Mean graft flow and pulsatility index (PI) were obtained directly from the flowmeter.

Assessment of the Target Vessel Stenosis

Data concerning the severity of the target vessel stenosis for bypass grafting were collected from the preoperative angiograph, from which native coronary artery stenosis was determined by visual assessment.

Multislice Computed Tomographic Angiographic Analysis

A computed tomographic angiographic scan is routinely performed 1 year after coronary artery bypass grafting. Contrast-enhanced computed tomographic angiographic data (Sensation 64 Cardiac, Siemens Medical Solutions, New York, NY) were acquired with the use of a spiral scan with 32 $\times$ 0.6-mm collimation, 330 ms gantry rotation, pitch of 0.2, and tube voltage at 120 kV. The scanning range included the entire course of venous grafts and the most proximal part of internal thoracic artery grafts at their subclavian origin, if these arterial grafts had been used for bypass surgery.

All bypass grafts were independently evaluated by 2 investigators who were aware of the initial coronary artery bypass grafting procedure. The investigators independently evaluated the contrast-enhanced MSCT scans by assessment of the axial slices, multiplanar reformations, and 3 thin-slab maximum intensity projections. Lumen narrowings were classified by the maximal luminal diameter stenosis seen in any plane. Because localized bypass stenoses were not seen in the present cohort, the bypass grafts were classified as perfectly patent, patent, or occluded. All patients signed an informed consent.

Echocardiographic Analysis

All echocardiographic examinations were performed by an experienced investigator. Echocardiographic scanning was carried out under resting conditions using an image Point Hx ultrasound system with a 2.5-MHz transducer (Hewlett-Packard, Palo Alto, Calif). Measurements of left ventricular dimensions were performed in the long parasternal axis. Left ventricular function and wall motion abnormalities were evaluated by visual assessment.[6]

Control Group

To compare RA graft patency rate after endoscopic harvest (ENDO group) with the conventional open technique (OPEN group), 50 patients who had undergone coronary artery bypass grafting with a conventionally harvested RA in the above-mentioned time period were randomly and retrospectively selected from our database and served as controls. The patient characteristics and type of grafts implanted in the ENDO and OPEN groups are summarized in Tables 1 and 2. Assessment of the target vessel stenosis and antispasmodic prophylaxis were performed in the control group as described above. Assessment of bypass graft patency was performed by MSCT in 33 patients of the control group and by angiography in 17 patients who had been followed up in an external clinic.

Statistics

Data are presented as mean $\pm$ standard deviation or as percentages. Differences between groups were tested with the Student t test for continuous variables and the chi-square test or Fisher exact test for dichotomous variables as appropriate. Eighteen variables (patient characteristics, graft and target vessel properties) were tested for their influence on RA patency.

We performed a logistic regression analysis for patency of the RA after endoscopic harvest. We used forward selection and the likelihood ratio test for model selection. Included were age, gender, and all variables with a P value less than .10 in the univariate tests. Because normal distribution and homogeneity of variances were not given, a P value of less than .01 was considered statistically significant. Data analysis was performed with the Statistical Package for the Social Sciences version 14.0.1 (SPSS Inc, Chicago, Ill).

TABLE 1. Patient baseline characteristics

	ENDO (n = 50)	OPEN (n = 50)	P
Gender (female/male)	6/44	8/42	.564
Age (y) at time of operation	60.1 ± 6.7	59.2 ± 8.2	.548
Concomitant procedures			.695
Aortic valve replacement	n = 2	n = 2	
Aorta ascendens replacement	n = 1		
Mitral valve replacement		n = 1	
Tricuspid repair		n = 1	
Incidence of smoking history	15/50	19/50	.398
Incidence of diabetes mellitus	6/50	10/50	.275
Incidence of hyperlipidemia treated with statins	24/50	34/50	.043
Incidence of peripheral vessel disease	4/50	6/50	.505
Incidence of hypertension			.137
untreated	3/50	0	
treated	37/50	43/50	
Preoperative ejection fraction	56.5% ± 7.8%	54.0% ± 10.8%	.189

ENDO, Endoscopically harvested radial artery; *OPEN,* conventional open radial artery harvest.

Results

Clinical Outcome

All patients are alive at 11.1 ± 1.5 months after the initial operation. In the ENDO group, 33 of 50 patients (66%) are in New York Heart Association (NYHA) class I, 16 of 50 patients (32%) are in NYHA class II, and 1 patient (2%) is in NYHA class III. The mean ejection fraction was 56.5% ± 8% preoperatively and is 57.4% ± 6% at follow-up (P = .294).

In both groups, no cardiac reoperations have been performed. One patient has hemiparesis caused by postoperative apoplexy (ENDO group), and 1 patient underwent lateral thoracotomy for postoperative hematothorax (ENDO group). In 5 patients, sternal revision was performed (ENDO: n = 1, OPEN: n = 4). In 1 patient of the OPEN group, postoperative rethoracotomy was performed because of bleeding. No reinterventions have been necessary on the RA harvesting site in the ENDO group, whereas 1 patient in the OPEN group underwent wound revision. The surgical and catheter interventions performed in this series are summarized in Table 3.

Graft Patency

In the ENDO group, any patency rate of the RA grafts was 78% (39/50), and perfect patency rate was 72% (36/50). Patency rate was 98% (47/48) for the left internal thoracic artery (LITA) grafts, 86% (12/14) for the right internal thoracic artery (RITA) grafts, and 69% (11/16) for the SV grafts after a follow-up of 11.1 ± 1.5 months. Of 14 occluded RA grafts, 11 were completely occluded and 3 showed severe string signs and thus were functionally occluded. Those grafts may maintain any residual minimal flow. In 1 of the 3 patients with functionally occluded RA grafts, angiography was performed, and the computed tomography findings were confirmed. Figure 1 shows an example with 1 occluded and 2 patent bypass grafts.

Compared with the OPEN group, there was no difference in any patency of the RA grafts (ENDO: 78% [39/50] vs OPEN: 76% [38/50], P = .812) and in perfect patency (ENDO: 72% [36/50] vs OPEN 74% [37/50], P = .822) after endoscopic RA harvest. There were also no significant differences between the groups in LITA, RITA, and SV graft patency rates.

Echocardiographic and Electrocardiographic Results (ENDO Group)

A total of 47 of 50 patients are in sinus rhythm, and 2 patients have an implanted pacemaker. One patient has

TABLE 2. Distribution of graft types

	Type of bypass graft							
	RA*		LITA*		RITA*		SVG*	
Target vessel	ENDO n = 50	OPEN n = 50	ENDO n = 48	OPEN n = 48	ENDO n = 14	OPEN n = 22	ENDO n = 16	OPEN n = 8
LAD	0	1/50 (2%)	48/48 (100%)	48/48 (100%)	0	0	0	0
Diag	4/50 (8%)	9/50 (18%)	0	0	0	0	5/16 (31%)	1/8 (13%)
Marg	34/50 (68%)	34/50 (68%)	0	0	2/14 (14%)	1/22 (5%)	1/16 (6%)	2/8 (25%)
CX	2/50 (4%)	1/50 (2%)	0	0	0	0	0	0
RCA	10/50 (20%)	5/50 (10%)	0	0	12/14 (86%)	21/22 (95%)	10/16 (63%)	5/8 (63%)

ENDO, Endoscopically harvested radial artery; *OPEN,* conventional radial artery harvest; *CX,* circumflex artery; *Diag,* diagonal branch; *LAD,* left anterior descending artery; *LITA,* left internal thoracic artery; *Marg,* marginal branch; *RA,* radial artery; *RCA,* right coronary artery; *RITA,* right internal thoracic artery; *SVG,* saphenous vein graft. *There were no significant differences in the distribution of grafts to target territories between the ENDO and OPEN groups.

TABLE 3. Complications requiring surgical or catheter interventions

Intervention	ENDO	OPEN
Angiography and stent implantation for		
RA graft occlusion	1	3
LITA graft occlusion	1	0
RITA graft occlusion	0	2
SV graft occlusion	1	1
Combined RITA and RA graft occlusion	1	0
Combined LITA and RA graft occlusion	0	1
Lateral thoracotomy after postoperative hematothorax	1	0
Sternal revision	1	4
Rethoracotomy because of bleeding	0	1
RA harvesting arm wound revision	0	1

ENDO, Endoscopically harvested radial artery; *OPEN,* conventional radial artery harvest; *RA,* radial artery; *SV,* saphenous vein; *LITA,* left internal thoracic artery; *RITA,* right internal thoracic artery.

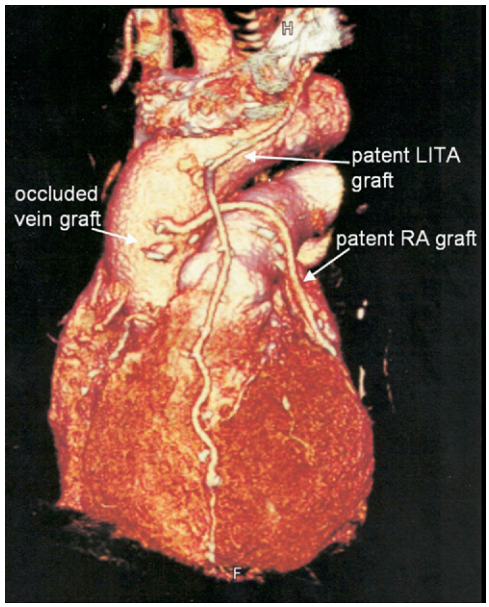

Figure 1. Computed tomographic scan of a 3-dimensional reconstruction with a LITA graft to the left anterior descending artery (patent), an RA graft to the marginal branch (patent), and an SV graft to the RCA (occluded). *LITA,* Left internal thoracic artery; *RA,* radial artery.

multiple premature ventricular complexes, but his bypass grafts are patent. In 39 patients, left ventricular function is normal. Wall motion abnormalities are evident in 11 patients (n = 2 anterior wall hypokinesia, n = 1 posterior wall hypokinesia, n = 1 lateral wall hypokinesia, n = 6 septal dyskinesia and n = 1 diastolic dysfunction). Among the patients with wall motion abnormalities, 2 had an occluded RA graft.

Factors Influencing Radial Artery Graft Patency (ENDO Group)

To reveal factors affecting perfect RA graft patency after endoscopic RA harvesting, we tested the influence of patient characteristics, graft properties, postoperative medication, and target vessel properties (Table 4). Logistic regression revealed the severity of the target vessel stenosis as the only parameter indicating a significant and strong correlation with the patency rate ($P < .001$) (Table 5). In the group of patients with a target vessel stenosis of 90% or greater, 28 of 31 grafts (90.3%) were patent. The patency rate was 2.1 times higher in patients with a target vessel stenosis of 90% or greater. Mean target vessel stenosis had been 88.6% ± 16% in all patients with a perfectly patent RA graft versus 72.9% ± 15% in patients with an occluded graft ($P = .003$). Grafts with a flow rate of less than 55 mL/min seem to be more prone for occlusion (a flow of < 55 mL/min occurred in 13/36 patent grafts vs 11/14 occluded grafts, $P = .007$). However, graft flow was not detected as a significant factor influencing RA graft patency in the analysis of variances. Apparently, the learning curve of the first cases had no influence on patency; among our first 20 cases, only 1 RA graft was occluded.

In accordance with these findings, in our control group (conventional RA harvest), patients with a target vessel stenosis of 90% or greater exhibited an RA patency rate of 92% (22/24) versus 58% (15/26) in patients with a target vessel stenosis less than 90% ($P = .006$).

Consequences in Patients with Occluded Radial Artery Graft (ENDO Group)

Among 14 of 50 patients with an occluded RA graft, 11 had no clinical symptoms. We recommended an exercise electrocardiogram to those patients to identify potential ischemia. Only 4 patients followed the recommendation, and all showed no signs of ischemia during exercise. Three patients with an occluded RA graft had angina during exercise. These patients had a target vessel stenosis of 80% to 100%. One of these patients had undergone stent implantation into the right coronary artery (RCA) because his RITA bypass was also occluded, resulting in an improvement of his symptoms. One patient refused angiography, and 1 patient with an occluded RA-RCA graft underwent stent implantation into the RCA.

Discussion

In addition to the favorable features of the RA as a bypass graft, such as optimal length, easy handling because of the thick muscular wall, and availability even in patients with varicosis, the endoscopic harvesting technique offers additional benefits. A scar of only 3 cm at the wrist provides excellent cosmetic results, leading to higher acceptance by

TABLE 4. Factors influencing radial artery graft patency (ENDO group)

Variable	Results			*P* value
Target vessel properties				
Target vessel stenosis ≥90%	Target vessel stenosis	(P)	(O)	<.001
	<90%	8	11	
	≥90%	28	3	
Target vessel stenosis as a continuous variable	Target vessel stenosis 88.6% ± 16% (P) vs 72.9% ± 15% (O)			.003
Target territory	Target vessel	(P)	(O)	.445
	Marg	23	11	
	CX	1	1	
	RCA	8	2	
	Diag	4	0	
Target vessel stenosis at follow-up (CTA data)		(P)	(O)	.334
(28% data missing because of difficulty in stenosis assessment in calcified coronaries)	0%–25%	5	3	
	25%–50%	4	3	
	50%–75%	5	4	
	75%–99%	6	1	
	100%	5	0	
Graft properties				
Graft flow	Mean graft flow (mL/min): 69.6 ± 32 (P) vs 51.6 ± 33 (O)			.084
PI value	PI value: 2.2 ± 0.9 (P) vs 2.9 ± 2.0 (O)			.240
Visible spasm	Visible spasm: 1/35 (P) vs 0/14 (O)			.529
Patient characteristics				
Hyperlipidemia treated with statins	Incidence of hyperlipidemia: 20/36 (P) vs 4/14 (O)			.086
Preoperative ejection fraction	Mean ejection fraction (%): 55.5 ± 8.9 (P) vs 59.2 ± 2.4 (O)			.131
Smoking history	Incidence of smoking history: 12/36 (P) vs 3/14 (O)			.409
Diabetes mellitus	Incidence of diabetes mellitus: 5/34 (P) vs 1/14 (O)			.510
Peripheral vascular disease	Incidence of peripheral vascular disease: 3/36 (P) vs 1/14 (O)			.889
Age	Mean age (y): 60.4 ± 6 (P) vs 59.3 ± 9 (O)			.577
Female gender	Female gender: 4/36 (P) vs 2/14 (O)			.756
Medication				
Application of amlodipine	Duration of amlodipine application:	(P)	(O)	.248
	No	3	1	
	3 mo	16	10	
	1 y	16	3	
Application of norepinephrine	Amount of norepinephrine application:	(P)	(O)	.641
	No	18	9	
	<5 mg	9	2	
	>5 mg	8	3	
Personnel factors				
Graft harvester (n = 4)				.630
Surgeon (n = 9)				.885

P, Patent grafts; *O,* occluded grafts; *PI,* pulsatility index; *Marg,* marginal branch; *CX,* circumflex artery; *RCA,* right coronary artery; *Diag,* diagonal branch; *CTA,* computed tomography angiography.

the patient than a scar of 25 to 30 cm across the forearm, which is permanently visible in everyday life. Minor complications, such as hematomas or wound infections, are also reported to be reduced with the endoscopic technique.[7] However, there is no consensus about RA patency at midterm and long-term follow-up, although most studies report encouraging RA patency. Therefore, we sought to assess the patency of the RA bypass grafts in our first series of patients after endoscopic graft harvesting.

Patency rates published in the literature range from 51.3% (204/398) after 1.6 ± 1.4 years[8] to 99.0% (100/101) after 2.9 ± 2.3 years.[9] Most studies lack a prospective randomized design and must be interpreted with caution.[10] A prospective randomized study showed no superiority of the RA over the SV graft when anastomosed randomly to the largest available coronary artery.[11] In contrast, the prospective randomized Radial Artery Patency Study trial showed a significantly lower occlusion rate for the RA

TABLE 5. Results of the logistic regression analysis (ENDO group)

	Regression coefficient	Standard error	Wald	*df*	*P* value	Exp(B)
Target vessel stenosis	2.516	0.766	10.795	1	.001	12.375
Constriction	−2.197	0.609	13.035	1	0	0.111

df, Degrees of freedom.

versus the SV graft at 1-year angiography.[4] A recent prospective randomized trial also showed superior patency of the RA (95%) over SV (79%) grafts at a 5-year follow up in 101 patients. In this study, all grafts were anastomosed to the circumflex territory with a target vessel stenosis greater than 75%.[12] A recent review article from Manabe and Sunamori[13] describes a graft patency of 78.5% when the RA was anastomosed to the left circumflex territory and of 74.1% when anastomosed to the RCA territory. These data are comparable to our results with perfect patency rates of 67% (left circumflex territory) and 80% (RCA territory) with an overall rate of any patency of 78% and a perfect patency rate of 72%. Concerning mortality after coronary artery bypass grafting, Zacharias and associates[14] found a significantly better cumulative 0- to 6-year survival in patients with RA versus SV grafts.

To our knowledge, we are the first to describe a prospective investigation of the patency rate 1 year after endoscopic RA harvest in a cohort of 50 patients. Some studies report early results. Miles and colleagues[15] describe no readmission for postoperative angina that would have required recatheterization in their first 50 patients after endoscopic RA harvesting at a 30-day follow-up. Yoshizaki and colleagues[16] describe patent RA grafts in 5 patients who underwent endoscopic RA harvesting and postoperative angiography. In the series of Massetti and colleagues,[17] 15 of 15 RA grafts were patent postoperatively, also assessed by angiography. The perfect patency rate of 72% 1 year after endoscopic RA harvesting in our series seems comparable to patency rates after conventional RA harvest published in the literature; however, no randomized data are available. To explore whether the RA patency is influenced by the endoscopic technique, we compared our data with a retrospective control group of patients who underwent conventional open RA harvest during the same time period. We could not demonstrate a difference between perfect RA patency after endoscopic (72%) versus open RA harvest (74%, $P = .822$), whereas the 2 groups did not differ in baseline characteristics and target territories. Presumably, the use of the harmonic scalpel versus electrocautery may influence the patency more than the endoscopic or conventional technique. Endoscopic and conventional harvesting systems are available with the harmonic scalpel or with electrocautery. A study from Onorati and colleagues[18] indicates better flowmetry and PI of the RA harvested with the harmonic scalpel versus electrocautery, whereas Cikirikcioglu and colleagues[19] and Shapira and colleagues[20] found no alterations in vasoreactivity or endothelial integrity for either technique.

Nevertheless, we had expected superior RA patency rates and thus aimed to identify factors influencing patency after endoscopic RA harvesting. Personnel factors such as the graft harvester or the graft implanting surgeon, as well as the learning curve, did not influence the RA patency. Furthermore, patient gender and age also did not influence the patency. Visible spasm of the RA after the harvest occurred in 1 case, and this graft was patent after 1 year. Intraoperatively assessed graft flow and PI tended to be better in RA grafts that were patent after 1 year, but this difference was not significant. It was not possible to evaluate a PI threshold value to predict graft occlusion. With regard to flow rate, grafts with a flow of less than 55 mL/min seemed to be more prone for occlusion ($P = .007$). Calcium-channel antagonists show proven antispasmodic effect on the RA,[21] with dihydropyridine derivatives such as nifedipine or amlodipine being the most potent calcium antagonists. Therefore, we recommend the oral administration of amlodipine for at least 3 months after the operation. The length of amlodipine application (3 months or 1 year) did not correlate with RA patency in our series. Although the RA is more prone to vasoconstriction in the presence of norepinephrine,[22] the postoperative amount of norepinephrine application did not affect RA patency as well. In our series, we could not demonstrate an impact of diabetes mellitus, smoking history, peripheral vessel disease, or hyperlipidemia on 1-year RA patency. This might be, at least in part, attributable to the low incidence of these risk factors in our patient population (Table 1). Also, the coronary territory to which the RA was anastomosed had no influence, which has also been described by Tatoulis and colleagues.[23] In our cohort, the only significant and strong predictor of 1-year RA perfect patency was the severity of target vessel stenosis (Table 5). In the group of patients with a target vessel stenosis of 90% or greater, RA graft perfect patency was as high as 90.3% (28/31). With a target vessel stenosis of less than 90%, perfect patency was only 42% (8/19), indicating that RA grafts are prone to occlusion in the presence of competitive coronary flow. In our retrospective control group, this relation was also present, because perfect patency was 92% (22/24) in RA grafts anastomosed to target vessels

with a stenosis of 90% or greater versus 58% (15/26) when target vessel stenosis was less than 90% ($P = .006$). In our series, this effect was distinct. Desai and colleagues[24] speculate "that progressive auto-regulated adaptive narrowing of the RA conduit in the setting of competitive flow" may be the mechanism of graft occlusion. Royse and colleagues[25] defined 70% coronary stenosis as a "cut-off" point. Below this degree of stenosis, the long-term patency of the RA was found to be significantly decreased. In accordance with our findings, Desai and associates[4] described a significantly lower RA patency even when target vessel stenosis is less than 90% and recommend RA grafting to severely stenotic targets (>90%) to improve patency in a recent article.[24] Fortunately, most of our patients with an occluded RA graft have no clinical symptoms, indicating that the rate of silent occlusion is high. Freedom from angina or dyspnea does not implicate RA graft patency.

In our cohort, the patency rates of LITA grafts (98%, 47/48) and RITA grafts (86%, 12/14) were satisfactory, whereas SV graft patency was less than expected (69%, 11/16). This may be because the SV was chosen as the graft of third choice after the LITA and a second arterial graft in this patient population.

Conclusions

Patency rates 1 year after endoscopic RA harvesting are comparable to those of a control group with conventional harvest and to reports in the literature. In view of the advantages of the endoscopic technique, we recommend this approach as the technique of choice to harvest the RA. The target coronary artery for RA grafts must be selected with caution. On the basis of our results, we attempt to use the RA as a bypass graft only for target coronary arteries with stenosis of 90% or greater. A high intraoperative RA graft flow and low PI are not appropriate parameters for the prediction of RA patency.

Limitations

The present study is a consecutive 1-year follow-up of our first series of patients undergoing endoscopic RA harvesting. We compared patency rates with those of a control group selected retrospectively from our database and literature data. However, to prove the superiority of either technique, a prospective randomized study is needed. The resolution of the computed tomography angiography limits the differentiation between a complete graft occlusion and a functional occlusion with a minimal residual flow. The target vessel stenosis was visually assessed. However, this method may be affected by the individual investigator. Because our study population consisted of only 50 patients, only large effects were identified.

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