Randomized trial of endoscopic versus open vein harvest for coronary artery bypass grafting: Six-month patency rates

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Objective: We sought to compare the 6-month angiographic patency rates of greater saphenous veins removed during coronary artery bypass grafting with the endoscopic vein harvest or open vein harvest techniques.

Methods: Two hundred patients undergoing nonemergency on-pump coronary artery bypass grafting were prospectively randomized to either endoscopic vein harvest or open vein harvest. Follow-up angiography of all vein grafts was scheduled at 6 months. Graft patency and disease grades were assigned independently by 2 interventional cardiologists. Leg wound healing was evaluated at discharge, 1 month, and 6 months for evidence of complications.

Results: There were 3 conversions from endoscopic vein harvest to open vein harvest because of vein factors. Leg wound complications were significantly lower in the endoscopic vein harvest group (7.4% vs 19.4%, $P = .014$). On multivariable analysis, endoscopic vein harvest emerged as the only factor affecting wound complications (odds ratio, 0.33). Three deaths (2 perioperative and 1 late) occurred in the endoscopic vein harvest group that were unrelated to vein graft closure. Twenty-four and 29 patients in the endoscopic vein harvest and open vein harvest cohorts, respectively, refused the follow-up 6-month angiography. Therefore a total of 144 angiograms (73 endoscopic vein harvests and 71 open vein harvests) and 336 vein grafts (166 endoscopic vein harvests and 170 open vein harvests) were available for analysis. The overall occlusion rates at 6 months were 21.7% for endoscopic vein harvest and 17.6% for open vein harvest. Additionally, there was evidence of significant disease (>50% stenosis) in 10.2% and 12.4% of endoscopic vein harvest and open vein harvest grafts, respectively. By means of ordinal hierarchic logistic regression, endoscopic vein harvest was not found to be a risk factor for vein graft occlusion or disease (odds ratio, 1.15). Significant predictors were congestive heart failure (odds ratio, 2.87), graft to the diagonal artery territory (odds ratio, 1.76), larger vein conduit size (odds ratio, 1.32), and graft flow (odds ratio, 0.90).

Conclusion: Endoscopic vein harvest reduces leg wound complications compared with open vein harvest without compromising the 6-month patency rate. The overall patency rate depends on target and vein-related variables and patient characteristics rather than the method of vein harvesting.

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Endoscopic vein harvest (EVH) for coronary bypass grafting (CABG) has been demonstrated to decrease the incidence of leg wound infection and complications[1-6] compared with the traditional open vein harvest (OVH) technique. However, there continue to be concerns that scope manipulation of the vein might cause trauma to the vessel, which might lead to early stenosis or occlusion. In this regard, EVH has not been shown to compromise the histologic integrity[7-9] or functional properties[10-12] of the endothelial, medial, and adventitial layers. Moreover, the short-term 6-month patency rate of EVH veins, as assessed by means of contrast-enhanced electron beam computed tomography,[13] compares favorably with those historically reported for OVH veins. In a small randomized trial of 35 patients at the University of Montreal,[14] the angiographic 3-month patency rates were similar between the EVH and OVH groups. However, no differences in wound infection rates were observed. In this study we compared the 6-month patency and stenosis rates of vein grafts by using follow-up angiography in patients randomized to either EVH or OVH techniques of saphenous vein harvesting. Multivariable analytic methods were used to determine risk factors for vein graft occlusion and disease, as well as leg wound complications.

Methods

Protocol

Between November 2000 and October 2002, 236 nonconsecutive patients undergoing isolated CABG at Southern California Kaiser Permanente Medical Center in Los Angeles agreed to be prospectively randomized to either endoscopic or open vein harvesting. Exclusion criteria included less than 2 planned vein graft CABGs, emergency operations, history of greater saphenous vein stripping, and redo CABG with previously harvested greater saphenous vein. Those patients deemed not to be EVH candidates because of insufficient subcutaneous tissue to allow insertion of the endoscopic instruments were also excluded. Of the 236 patients, 21 withdrew voluntarily from the study before the operation. Because of the nonbypassable nature of poor targets during the initial assessment on sternotomy, another 15 patients were excluded from randomization because only one vein graft was required. Standard moderate hypothermia (≈32°C) cardiopulmonary bypass was used in all participants. Beating-heart surgery was not performed to avoid introducing technical factors that might compromise graft patency. All saphenous vein bypasses were fashioned as single grafts with direct proximal aortic anastomoses. Because of relatively less experience with the EVH technique in the lower leg, only greater saphenous veins from one or both thighs were harvested for the purpose of this study. In most cases a sufficient quantity of vein conduits was obtained from one thigh only.

Intraoperatively, the severity of each target vessel disease (A, minimal disease; B, presence of significant atherosclerotic changes; C, severe calcified disease) was recorded. The caliber of the coronary artery was assessed by means of gentle single passes with smooth probes for a short distance to minimize any potential endothelial injury. The internal diameter of each vein conduit was also measured directly with varying sized probes, and the number of repairs with fine polypropylene sutures was noted. The presence of significant varicosity or phlebitic changes was also documented. Before sternal closure, vein graft flow rates were obtained by using appropriately sized Doppler flow probes (Transonic Systems, Inc, Ithaca, NY).

Glucose levels were maintained at less than 150 mg/dL both intraoperatively and postoperatively according to a strict protocol. All patients were treated with aspirin and statin drug therapy beginning on the first postoperative day. The study was approved by our institution's investigational review board.

Leg Wound Complications

Leg wound healing was evaluated at discharge, at 1 month, and at the 6-month follow-up coronary angiography session. Patients who subsequently refused to have postoperative angiography were assessed by means of chart review, follow-up with the referring cardiologist, and direct telephone contact. Wound complications were defined as drainage (serous, purulent, or sanguinous), seroma or hematoma formation, positive wound culture for bacterial infection, cellulitis requiring antibiotic treatment, hospital readmission, or documented additional clinic or home health nurse visit for wound care.

Six-month Patency Rates

Follow-up angiography of all vein grafts was scheduled at 6 months after the operation by using the standard percutaneous transfemoral technique. The grafts were selectively catheterized and visualized in 4 projections. A bolus of contrast was injected in the ascending aorta to confirm graft occlusions. All angiograms were reviewed independently by 2 interventional cardiologists who were blinded to the vein-harvesting technique. Graft patency was assigned as patent with unimpaired runoff, patent but with disease producing greater than 50% stenosis of the graft, or occluded. When there was a difference of opinion on patency and disease, the worst-case scenario was used in the analysis. The 2 cardiologists were in agreement 97% of the time.

Surgical Techniques

All patients' legs were circumferentially prepped with povidone iodine solution, and the feet were placed in sterile stockinettes. Before vein harvesting, 5000 units of intravenous heparin was administered. EVH was performed with the Vaso-View system (Guidant Corporation, Menlo Park, Calif), which uses CO_2 insufflation for visualization and dissection. One of 3 physician's assistants, each with approximately 300 EVH case experiences, performed the procedure in every operation. Briefly, a 1.5- to 2.0-cm incision was made medially above or below the knee, depending on the length of vein required. Harvesting was directed toward the groin region for as far proximally as possible. Side branches were divided by using bipolar cauterizing scissors or a bisector. A small puncture was made under endoscopic guidance proximally over the saphenous vein, which was then clamped and divided, and the proximal end was ligated. After removing the vein from the leg, side branches were ligated with 4° silk ties. The incisions were closed with absorbable subcutaneous and subcuticular sutures and then wrapped with an elastic Ace bandage.