

## Endoscopic Radial Artery Harvest as Conduit for Cardiac Revascularization

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### ABSTRACT

**Background:** The radial artery, a frequently used conduit in cardiac revascularization, is commonly harvested via a curvilinear lengthwise incision on the forearm. With an endoscopic approach the radial artery can be harvested for sufficient length and a more cosmetic forearm wound.

**Methods:** Data were collected from 20 patients undergoing endoscopic radial artery harvest (ERAH) and 264 patients undergoing open radial artery harvest at a community teaching hospital over a 14-month period. Patients were considered for ERAH if they had multivessel disease and a radial artery conduit was planned. The radial artery was harvested utilizing a standard CardioVations Clearglide Accel Endoscopic Vessel Harvesting System™ and Harmonic Scalpel™ by Ethicon, Inc.

**Results:** There was no significant difference in patient populations between those who underwent open radial artery harvest (n=264) and patients selected for endoscopic radial artery harvest (n=20), although ERAH patients trended to be younger (p=0.11). All of the patients had sufficient length of conduit harvested. None of the patients who underwent ERAH had post-operative wound infections, hematomas, or nerve injury in the donor forearm.

**Conclusions:** Patients of similar clinical characteristics undergoing ERAH compared to traditional open radial artery harvest had sufficient length of conduit with a smaller more cosmetic scar on the forearm and no complications. Further studies are needed to assure long-term patency of radial conduits harvested endoscopically.

## INTRODUCTION

The benefit of left internal mammary artery (LIMA) bypass to the left anterior descending (LAD) artery has been clearly demonstrated [Lytle 1985, Loop 1986, Galbut 1990, Fiore 1990, Barner 1992, Cameron 1996]. Controversy exists regarding the benefit of additional arterial bypass grafts. Enthusiasm for bilateral IMA grafting was re-ignited by demonstration of improved long-term benefit by the Mayo Clinic in 1997 and the Cleveland Clinic in 1999 [Lytle 1997, Pick 1997]. However, bilateral IMA grafting has been associated with an increased risk of deep sternal wound complications [Barner 1985, Kouchoukos 1990].

Radial artery conduits may convey the benefits of bilateral IMA without deep sternal wound complications. Our target population for radial arteries is young patients, particularly diabetic females who may be at highest risk for sternal complications. Traditionally this artery has been harvested with a curvilinear lengthwise incision on the forearm of the patient. Our enthusiasm for the radial artery was tempered by the cosmetic consequences of the harvest incision. A positive experience with endoscopic saphenous vein harvesting lead us to extend this practice to the harvest of the radial artery with the prospect of a more cosmetic scar. We hypothesized that with an endoscopic approach the radial artery can be harvested for sufficient length and with minimal complications when compared to patients undergoing open radial artery harvest.

## MATERIALS AND METHODS

Data were collected from 20 patients undergoing endoscopic radial artery harvest (ERAH) and 264 patients undergoing open radial artery harvest at a community teaching hospital over a 14-month period. Candidates for radial artery bypass were all patients less than 70 years of age with stenosis greater than 70% in the circumflex artery distribution, or the LAD if the IMA was not available. A radial artery conduit was also planned for any patient with insufficient saphenous vein. Candidates must have a negative Allen's test or noninvasive palmer arch study on the side of the harvest. All patients were considered for endoscopic radial artery harvest if a radial artery conduit was planned. The radial artery was harvested utilizing a standard CardioVations Clearglide Accel Endoscopic Vessel Harvesting System™ and Harmonic Scalpel™ by Ethicon, Inc.

Our approach to endoscopic radial artery harvest utilizes a standard CardioVations Clearglide Accel Endoscopic Vessel Harvesting System™ and Harmonic Scalpel™ by Ethicon, Inc. The non-dominant arm of the patient is selected for harvest after a pre-operative Doppler evaluation proving a complete palmar arch. The arm is prepped circumferentially and positioned at 90 degrees to the patient. The course of the artery is marked preoperatively. A 2cm longitudinal incision is made below the wrist. The radial artery pedicle is dissected free under direct visualization. The CardioVations Clearglide Optical Vessel Dissector™ is passed bluntly in the subcutaneous tissues above the muscle layer. The radial artery and its two venae comitantes are exposed by dividing the lateral intermuscular fascia using the Harmonic Scalpel™ and the CardioVations Clearglide Ultra-Retractor™. First the ulnar aspect of the radial artery pedicle is dissected with the Harmonic Scalpel from the wrist to the elbow. The radial side is dissected in the final phase to

mobilize the pedicle. The radial artery is ligated at the wrist under direct vision. An Endoloop™ is placed endoscopically to ligate the artery at the elbow and the artery is divided. Following harvesting, hydrostatic dilatation is performed with a solution of verapamil and nitroglycerin in plasmalyte to evaluate for patency and leakage from perforating vessels. Epinephrine solution is then irrigated into the forearm where the radial artery was harvested. Hemostasis is assured, and the wound is closed. The radial artery is harvested prior to sternotomy and performed simultaneously with saphenous vein harvest.

## RESULTS

There was no significant difference in patient populations between those who underwent open radial artery harvest (n=264) and patients selected for endoscopic radial artery harvest (n=20), although ERAH patients trended to be younger (p=0.11) (Table 1). All of the patients had sufficient length of conduit harvested. There was no significant difference in total number of distal arteries bypassed between groups (p=0.932), however there was a significant difference in arterial conduits between groups (0.001) (Table 2). No radial artery conduits were discarded as a result of injury to the artery. None of the patients who underwent ERAH had post-operative wound infections, hematomas, or nerve injury in the donor forearm.

## CONCLUSIONS

All patients of similar clinical characteristics undergoing ERAH compared to traditional open radial artery harvest had sufficient length of conduit with a smaller more cosmetic scar on the forearm and no complications. We noticed no difference in flow rate when the endoscopic radial artery was connected to the IMA in a T-Graft formation. This helped assure that the technique provided an adequate conduit when harvested endoscopically. The technique described is a feasible way to harvest the radial artery and provide the patient with less scarring and a better cosmetic appearance.

While the benefits of ERAH have been described here, there is a learning curve to the procedure and it may add time to the procedure. The harvest is performed simultaneously with endoscopic saphenous vein harvest and done prior to sternotomy. We are always able to complete the endoscopic radial artery harvest in sequence with the saphenous vein harvest thus not significantly adding to the operative time. This added time does not differ in approach compared to the open technique, which also adds to the operative time but does not extend crossclamp time. The techniques learned from endoscopic saphenous vein harvest have been extracted and applied to the radial artery conduit.

Despite the slightly increased operative time, the post-operative healing for the patient is improved. As we are in a time of continual movement toward surgically less invasive approaches and increasing patient pressure to minimize scarring and recovery time, we have found ERAH to be an improved alternative to open harvest when a radial artery conduit is planned.

Further studies are needed to assure long-term patency of radial conduits harvested endoscopically. In our short-term follow-up this has proven to be an acceptable way to harvest the radial artery conduit.

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Table 1. Demographic characteristics comparing ERAH patients with open harvest patients

	ERAH	Open harvest	p-value
Age	57.5 ± 6.1	61.4 ± 10.7	0.11
Gender (% male)	25.0%, 5/20	26.5%, 70/264	NS
BMI	29.3 ± 7.0	30.6 ± 6.0	NS
Peripheral vascular disease	5.0%, 1/20	17.0%, 45/264	NS
Diabetes	25.0%, 5/20	34.1%, 90/264	NS
Immunosuppression	0%, 0/20	4.5%, 12/264	NS

Table 2. Total distal and arterial distal comparison of ERAH to open harvest

	~ Radial Artery N = 1135	Open Harvest N = 264	ERAH N = 20	Total <sup>1</sup>	p-value <sup>1</sup>	p-value <sup>2</sup>
Total distals	2.9 ± 1.5	3.7 ± 1.2	3.7 ± 1.4	3.1 ± 1.4	0.001	0.932
Arterial distals	1.3 ± 0.9	3.2 ± 1.2	2.0 ± 0.2	2.5 ± 1.0	0.001	0.001

<sup>1</sup>Three group comparison (~ Radial Artery, Open Harvest, ERAH)

<sup>2</sup>Two group comparison (Open Harvest, ERAH)