

# Endoscopic Radial Artery Harvesting Reduces Postoperative Pain and Neurologic Complications

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## ABSTRACT

**Background.** Endoscopic radial artery harvest provides better cosmetic result without compromising the quality of the graft. We sought to compare postoperative harvesting site neurologic and vascular outcome.

**Methods.** From 10/2002 until 10/2004, 50 patients were randomized to have their radial artery harvested for coronary bypass either endoscopically (group A, n = 25) or conventionally (group B, n = 25). Radial arteries were preoperatively evaluated by Doppler echocardiography. Neurologic and functional status was assessed by a self reporting questionnaire with a semiquantitative (1-5) scale. Vascular status of the forearm was assessed by control echocardiography.

**Results.** At an average follow-up of  $37 \pm 7$  months, patients undergoing endoscopic radial artery harvesting had less overall neurologic complications (11 versus 17 patients,  $P = .023$ ) and they were less severe ( $0.8 \pm 1.1$  versus  $2.2 \pm 1.2$ ;  $P < .001$ ). Ulnar flow increase was similar among the groups:  $13.1 \pm 5.43$  cm/s in group A versus  $15.9 \pm 4.9$  cm/s in group B ( $P = .147$ ) as well as ulnar artery diameter increase  $0.29 \pm 0.16$  mm in group A versus  $0.29 \pm 0.26$  cm in group B ( $P = .914$ ).

**Conclusion.** Endoscopic radial artery is safe and does not compromise graft quality or forearm and hand circulation postoperatively. Along with providing a better cosmetic result, endoscopic artery harvesting reduces postoperative harvesting site pain and neurologic complications.

## INTRODUCTION

Since the reintroduction of the radial artery (RA) into coronary revascularization in the early 1990s [Acar 1993], total arterial revascularization became a widespread treatment

modality. Tendency toward minimally invasive cardiac surgery has led to the introduction of endoscopic RA harvesting (ERAH) [Terada 1998] in order to improve cosmetic results and minimize local complications as reported with endoscope saphenous vein harvesting [Hata 2002]. We sought to compare postoperative harvesting site neurologic and vascular outcome after ERAH.

## METHODS

### Patients

After obtaining our institutional review board's approval, from 10/2002 until 10/2004, 50 patients (34 male, 16 female) were randomized to have their RA harvested for myocardial revascularization either endoscopically (group A; n = 25) or conventionally (group B; n = 25). All patients had their RAs assessed preoperatively by Doppler echocardiography (echo). Echo assessment included radial and ulnar artery wall morphology, blood flow velocities, as well as palmar arch and digital arteries flow after RA compression. Preoperative patient characteristics are outlined in Table 1.

### Surgical Technique

ERAH was performed with the patient supine with the nondominant arm stretched out on a separate table. A transverse 5-cm incision was made at the level of radial styloid. The RA was identified and a subfascial plane established. A dissector from a Vessel harvesting kit (CardioVations, Sommerville, NJ, USA) was introduced to further establish a working tunnel. Continuous infusion of CO<sub>2</sub> at a flow of 5 L/min was used to pressurize the working tunnel. A 30-degree camera was introduced, and RA was harvested with concomitant veins using the Ultracision ultrasonic scissors (Ethicon Endo-surgery, Cincinnati, OH, USA) up to the level of the cubital fossa. In 5 patients, proximal division of RA was done through a separate 5-cm incision, and in 20 patients it was done by using the 2-0 Prolene (Ethicon, Sommerville, NJ, USA) endo-loop ligature.

Conventional RA harvesting was performed through an S-shaped incision. The RA was harvested with concomitant veins using the Ultracision harmonic scalpel with a hook. Subcutaneous tissue was approximated with interrupted 2-0

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Table 1. Patient Demographics

	Group A, n = 25	Group B, n = 25	P
Male sex	16	18	.762
Hypertension	14	15	1.000
Diabetes	8	6	.754
Hyperlipidemia	19	17	.754
EuroSCORE, log	2.2 ± 1.7	2.3 ± 1.4	.894
Age, y	60.5 ± 9.2	61.2 ± 9.8	.799

Vycril sutures and the skin was closed intradermally with 3-0 Vycril (Ethicon).

All RA grafts were rinsed with a modified vasoplegic solution intraluminally as indicated [He 1996] immediately after harvesting and soaked in the same solution afterward until their use.

Postoperative echo assessment included ulnar artery width and flow measurement. Postoperative harvesting site neurologic complications were assessed by a self-reporting questionnaire designed to depict type of neurologic complication as well as duration and intensity expressed in values from 1 to 5, with 1 being the mildest and 5 the most severe.

### Statistical Analysis

Continuous data is expressed as mean ± standard deviation. The Fischer exact test was used to compare categorical data and the Mann-Whitney U test was used to compare continuous data. *P* value less than .05 was considered statistically significant. Statistical analysis was performed using the SPSS 11.0 statistical software package (SPSS, Chicago, IL, USA).

## RESULTS

No patients had to be converted from endoscopic to open procedure. There were no perioperative deaths. Average follow-up for both groups was 37 ± 7 months. Two patients from group A and 2 from group B expired during follow-up. An additional 3 patients from group A were lost to follow-up, which provided an 86% complete follow-up. Total number of patients experiencing any neurological complications was 11 (44%) in group A versus 17 (85%) in group B (*P* = .023) (Table 2). The most frequently reported complications were: hand paresthesia (9 in group A versus 14 in group B; *P* = .256) and forearm/hand pain (1 in group A versus 4 in group B; *P* = .349). Other patients in both groups experienced other sensations or a combination of symptoms (hand/finger weakness, discomfort along the incision lines, other sensation abnormalities, etc). Average duration of neurologic complications was 7 ± 2 months. At the point of follow-up, one patient in group A was still experiencing neurologic deficit versus 3 in group B (*P* = .349). There were no infections in either group. No patients experienced hand/forearm claudications. Forearm vascular compensation was similar in both groups (Table 2).

## DISCUSSION

Our study demonstrates the safety and efficacy of ERAH in reducing postoperative harvesting site neurologic complications in frequency, duration, and severity. Vascular outcomes were similar using either harvesting technique.

We observed neurologic complications in 44% of patients after ERAH. That rate is slightly higher than those previously reported that range from 20% to 39% [Patel 2004; Shapira 2006]. This is probably due to the fact that we did not practice endoscopic vein harvesting prior to starting the ERAH program. That lead to somewhat prolonged harvesting times in early cases due to time necessary for familiarization with the endoscopic equipment despite the previous experience with the open harvesting technique. Thus, we would strongly support the recommendations of Patel et al about the necessary number of procedures needed prior to starting ERAH [Patel 2004].

The number of postoperative neurologic complications in the open harvesting group was 85%. Although high, this rate confirms the findings of Saeed et al that some form of neurologic deficit as a complication was more frequent than expected [Saeed 2001].

The distribution and severity of neurologic complications we observed was similar to those previously reported [Denton 2001; Ikizler 2005]. Although no difference was reported between complication rates with respect to tools used in RA harvesting (electrocautery versus ultrasonic), we decided to use ultrasonic scissors because of previous experience with the technique.

The severity of neurologic complications was milder in the ERAH group as reported by patients in our study. This differs from the findings of Shapira et al who report similar rates for both motor and sensory components postoperatively [Shapira 2006]. However, they speculate such findings were somewhat biased by different length of follow-up between groups, favoring conventional harvesting group.

Average duration of postoperative complications was 7 months, which is comparable to data from Patel et al who report absence of almost all major and minor neurologic complications at 6 months, and Shapira et al who report the similar at 8 months [Patel 2004; Shapira 2006].

There were only a few patients who developed permanent sensory dysfunction (1 in group A versus 3 in group B, respectively), which is comparable with reported results [Shapira 2006]. Since there was no significant difference in duration of neurologic deficits between groups and a low rate

Table 2. Postoperative Neurologic and Vascular Outcome

	Group A, n = 23	Group B, n = 20	P
Neurologic complications	11	17	.023
Severity, 1-5	0.8 ± 1.1	2.2 ± 1.2	<.001
Ulnar artery flow increase, cm/s	13.1 ± 5.43	15.9 ± 4.9	.147
Ulnar artery diameter increase, cm	0.29 ± 0.16	0.29 ± 0.26	.914

of permanent dysfunction was noted, we cannot determine whether the self-reported severity was due to the perception of the severity of surgery performed at the forearm judged by the appearance of the scar.

Although they have been reported, postoperative infections and bleeding complications after any type of RA harvesting are very rare and range from 0.2% to 1.5% [Royse 1999; Meharwal 2001]. We did not observe any and contribute that to meticulous hemostasis techniques as well as the forearm anatomy and blood supply itself.

Standard modality of preoperative RA assessment included Doppler echo evaluation for both RA quality as well as collateral forearm/hand supply [Ruengsakulrach 2001]. We observed similar patterns of compensatory ulnar blood flow increase as well as ulnar artery diameter increase as previously reported [Pola 1996; Gaudino 2005]. We recorded no acute or chronic ischemic complications.

Limitations of our study include lack of quantitative evaluation of neurologic deficits. Neurophysiologic examination would probably overcome this issue as reported by Ikizler et al [2005]. Also, we did not assess cosmetic results and related patient satisfaction since it was clearly registered previously in favor of ERAH [Shapira 2006]. Furthermore, we were not able to contact all patients for follow-up visit due to a few of them moving out of the country. Power calculation of the sample size was not performed because the initial plan was to include all ERAH patients in this study. However, due to some financial issues we had to terminate the study at 25 patients in each group.

In conclusion, despite still inconclusive reports on the superiority of ERAH over conventional RA harvesting [Aziz 2006], we find ERAH to be a safe method that reduces the frequency and severity of postoperative neurologic harvesting site complications. Duration of neurologic deficit, frequency of permanent deficits, and vascular compensation is similar between groups.

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