Mario Gaudino ORCID iD: 0000-0003-4680-0815

Invited Commentary: Is endoscopic radial artery harvesting open for business?

Authors: N. Bryce Robinson MD¹, James Tatoulis MD², Mario Gaudino MD¹

¹Weill Cornell Medicine, Department of Cardiothoracic Surgery, New York, NY, USA

²Royal Melbourne Hospital, University of Melbourne, Melbourne, Victoria, Australia

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Corresponding author:

Mario Gaudino, MD

Department of Cardiothoracic Surgery, Weill Cornell Medicine

525 E 68th St, New York, NY 10065

Telephone: +1 212 746 9440 Fax: +1 212 746 8080

E-mail: mfg9004@med.cornell.edu

Abstract: With the resurgence of the radial artery in coronary artery bypass grafting, the debate between the optimal harvesting technique continues. Here we comment on a randomized series in which the authors conclude that endoscopic harvesting techniques offer the benefit of improved cosmetic outcomes and decreased neurological complications with comparable graft-related outcomes when compared with open

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harvesting. We conclude that while this study is well designed and conducted, there are several areas of concern including surgical technique and statistical power.

We read with great interest this single-center prospective study by Tamim et. al. comparing endoscopic radial artery harvesting (ERAH) and open radial artery harvesting (ORAH) for coronary artery bypass grafting (CABG).¹ The authors report a randomized series including 50 total patients (n= 25 randomized to both groups). They found no difference in harvest time, length of conduit, wound healing, post-operative complications including major neurologic dysfunction, and graft patency rate at 1 year as determined by CT Angiography (CTA). The only significantly different variables reported between the two groups were incision length, early (defined as in-hospital) minor and major neuralgias, and patient satisfaction with cosmetic appearance, all of which favor the endoscopic harvesting group.

With the introduction of improved harvesting and preservation techniques, the radial artery has seen a renaissance in cardiac surgery. Observational and randomized evidence have shown better long-term patency rates associated with the arterial conduit over the saphenous vein, and centers across the world are now using the radial artery (RA) with increasing frequency.^{2,3} As such, the debate as to the optimal approach for harvesting of the RA during coronary artery bypass grafting is timely and important. Similar to the data reported herein, a number of previously published studies point to improved cosmetics, patient satisfaction, and lower wound complication rates associated with the endoscopic approach, with similar rates of short- and long-term graft patency.⁴⁻⁶ The authors are to be commended for embracing a multiple arterial grafting approach to CABG, with 22% bilateral internal thoracic artery use, with excellent operative and 12 month outcomes and a short length of stay of only seven days. There are, however, a few areas of concern that must be addressed.

First, and most importantly, is the issue of endothelial damage and its potential impact on long-term patency rates. The authors report at 1 year that five patients developed >50% stenosis of the RA graft— 3 in the endoscopic group and 2 in the open group. Of note, in all five patients the RA-coronary anastomosis was to a target vessel with less than 90% stenosis, a known risk factor for graft failure.⁷ Furthermore, 3 of the 5 failed grafts were to the right coronary system, another risk factor for failure. It is difficult to make much of these findings with only one year of follow up, and the authors acknowledge this limitation in their analysis. What the authors fail to discuss, however, is the impact that endoscopic harvesting techniques may have on endothelial function. ERAH occurs in a constricted space, which increases the risk of mechanical injury to the conduit when compared with ORAH. In an comparative analysis published by our group in 2019, ORAH was associated with improved preservation of endothelial function as demonstrated by organ bath functional evaluation.⁸ While future studies are needed to show an association between endothelial damage to the RA and patency rates, there is data showing the adverse impact of endoscopic harvesting on the saphenous vein.^{9,10}

It is also important to note that the foundation of our recommendations relating to the RA are developed from series that used mainly the open approach. The 2016 Society of Thoracic Surgeons Guidelines¹¹, for example, based their statement on studies such as the Radial Artery Patency Study, Radial Artery Versus Saphenous Vein Patency, Radial Artery Patency and Clinic Outcomes, none of which used endoscopic radial artery harvesting.¹²⁻¹⁴ A few small trials have shown no difference in patency rates between ERAH and ORAH. Bleiziffer and colleagues reported equivalent patency rates at 1 year in a 50 patient analysis.¹⁵ Similarly, Burns et. al. reported no difference in patency rates at 5 years between radial grafts harvested endoscopically versus open in a post-hoc analysis of a randomized trial that did not use protocol driven angiographic analysis and only included 66 patients (55.5% of patients in original trial).¹⁶ It is important to note that the rate of RA failure is known to be quite low, and thus all these series are largely underpowered. Future adequately powered randomized assessment of long-term outcomes is needed before a definitive conclusion about long-term patency and clinical outcomes of ERAH can be made.

Second, while Tamim et al study does report important outcomes that are consistent with those in other published material, it appears to be significantly underpowered. In published series, the rate of any (minor and major) neurologic complication following ORAH ranges from 10% to 39%, depending on the definition used.¹⁷⁻¹⁹ Using the highest estimate of neurologic complication rates, a trial with 80% power to detect a 20% difference in postoperative morbidity caused by neurological complications would need to enroll at least 81 patients in each arm. This number becomes even higher when considering the more clinically significant major neurologic complications, an exceedingly uncommon finding following radial artery harvesting in both groups.

Third, the authors report unique technical aspects to their harvesting techniques that would limit the applicability of their outcomes, even if properly powered. In the ORAH arm, the authors performed an incision directly over the course of the RA. Previous series have shown a decreased rates of neurosensory deficits with a more medially directed curvilinear incision, which avoids the superficial radial and lateral cutaneous nerves. During ORAH it is also important that the distal end of the incision is at least 2 cm above the flexion crease at the wrist in order to avoid the most sensitive areas while preserving small anastomotic branches.²⁰ Finally, endoscopic harvesting relies heavily on operator experience. Previous publications have reported significant learning curves, with operators needing between 10 and 20 cases prior to achieving proficiency and timing similar to that seen in ORAH. Thus, ERAH is currently limited to centers with an “expert harvester” available.^{21,22}

Finally, the authors do not report using any of the commonly accepted and validated scoring criterion for objectively quantifying arm dysfunction, nor do they describe employing objective measures of grip strength. In fact, the authors do not define how they differentiated between major and minor neuralgias. Prior analyses have used

comprehensive 100-point questionnaires and measured hand grip using a dynamometer,²³ nerve conduction studies,²⁴ or detailed manual examination.²⁵

Tamim and colleagues conclude that, in experienced hands, ERAH can be performed safely and effectively with no difference in short-term graft-related outcomes. One must be cautious in interpreting these findings, however, in the light of this study being underpowered, with inadequately measured and defined outcomes. At our institution, it is routine practice to harvest radial artery using the open technique. While cosmesis is certainly important, excellent long-term graft patency outcomes is more important. Until more conclusive data is available, it would appear that endoscopic harvesting of the radial artery is not yet open for business.

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Author/s:

Robinson, NB;Tatoulis, J;Gaudino, M

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