microspheres, would form a good model from which to draw conclusions about coronary flow change under different loading conditions. A model would be needed in which either an infarct is created to mimic ischemic heart failure or the coronary circulation remains untouched to simulate, for instance, dilated cardiomyopathy. Furthermore, in discussion we clearly mention that “lack of heart failure is a major limitation of our study.”

We also believe that unloading is not the only factor of the cardiac functional recovery, and an excessive unloading of the left ventricle might lead to cardiac tissue atrophy. Therefore, in our article we mention that control of the level of cardiac unloading by assist devices has been suggested as a mechanical tool to promote recovery, and more studies are required to find better strategies for the speed modulation of rotary pumps and to achieve an optimal heart load control to enhance myocardial recovery.

Finally, there are many publications about pulsing rotary blood pumps and it was impossible to include them all. We preferred to reference some of the earlier basic works such as an original research by Bearnsen and coworkers⁵ and another article published by our group,⁶ which is more relevant.

Tohid Pirbodaghi, MSc^a

Shannon Axiak, DVM^b

Alberto Weber, PhD^c

Stijn Vandenberghe, PhD^a

^aARTORG Cardiovascular

Engineering

^bDepartment of Veterinary Anesthesia

University of Bern

^cCardiac Surgery Department

Inselspital University Hospital

Bern, Switzerland

References

1. Pirbodaghi T, Axiak S, Weber A, Gempp T, Vandenberghe S. Pulsatile control of rotary blood pumps: does the modulation waveform matter? *J Thorac Cardiovasc Surg*. 2012;144:970-7.
2. Ando M, Nishimura T, Takewa Y, Yamazaki K, Kyo S, Ono M, et al. Electrocardiogram-synchro-

nized rotational speed change mode in rotary pumps could improve pulsatility. *Artif Organs*. 2011;35:941-7.

3. Ando M, Takewa Y, Nishimura T, Yamazaki K, Kyo S, Ono M, et al. A novel counterpulsation mode of rotary left ventricular assist devices can enhance myocardial perfusion. *J Artif Organs*. 2011;14:185-91.
4. Umeki A, Nishimura T, Ando M, Takewa Y, Yamazaki K, Kyo S, et al. Alteration of LV end-diastolic volume by controlling the power of the continuous-flow LVAD, so it is synchronized with cardiac beat: development of a native heart load control system (NHLCS). *J Artif Organs*. 2012;15:128-33.
5. Bearnsen GB, Olsen DB, Khanwilkar PS, Long JW, Allaire PE, Maslen EH. Pulsatile operation of a centrifugal ventricular assist device with magnetic bearings. *ASAIO J*. 1996;42:M620-3.
6. Pirbodaghi T, Weber A, Carrel T, Vandenberghe S. Effect of pulsatility on the mathematical modeling of rotary blood pumps. *Artif Organs*. 2011;35:825-32.

<http://dx.doi.org/10.1016/j.jtcvs.2012.12.075>

RADIAL ARTERY OR SAPHEOUS VEIN: A GRAFT OF SECOND CHOICE IN CORONARY ARTERY BYPASS SURGERY

To the Editor:

With great interest we have read a recent meta-analysis from Cao and colleagues¹ on patency outcomes comparing the radial artery (RA) and saphenous vein (SV) after coronary artery bypass graft (CABG) surgery. The extracted data suggest superiority of the RA compared with the SV at midterm angiographic follow-up, while considering the increased incidence of string sign associated with the RA as a potential clinical concern. We wish to point out a major issue that needs to be taken into consideration when comparing RA and SV patency rates.

Intraoperative graft management is a crucial determinant for the long-term results of SV patency. We believe the “no-touch” harvesting technique of the SV graft imposes the pivotal role in its patency. This method provides a pedicled graft that has little similarity with a venous graft harvested conventionally, but a patency rate comparable with the internal thoracic artery.² It preserves normal vessel architecture with intact adventitia, preserves vasa vasorum, and maintains

medial blood flow and endothelial integrity. The perivascular fat provides a cushion support that protects the vein against arterial hemodynamics and kinking, as well as providing a source of factors beneficial to graft performance. Superior long-term patency rate can be explained by a slower progression of atherosclerosis in these vein grafts.³ The conventional harvesting technique damages vein structure. Early vein graft failure is associated with distention-induced endothelial denudation. The damage of the outermost layers has adverse long-term effects on graft performance and its patency. Complete “bedside to bench” situations of mechanisms underlying the improved performance of “no-touch” SV graft are reported in a recent review.⁴

Despite the benefits clearly shown by the “no-touch” technique, its use is still limited to only a few centers worldwide, as is often the case with all new interventional techniques. What should be of a real concern, particularly in light of unequivocal scientific evidence on graft quality obtained in such manner,⁵ is the ever-increasing popularity of the SV grafts harvested endoscopically. This contributes to a substantial heterogeneity of the extracted data with questionable comparability. We consider that the information regarding the prevalence of SV grafts harvested endoscopically is of great importance when assessing SV patency.

The existing evidence on “no-touch” SV makes us question why this technique should have been excluded from this article, or at least discussed. An ongoing multicenter randomized controlled clinical trial (SUPERIOR SVG Trial, NCT01047449) aims to provide strong evidence whether the new technique of a pedicled SV graft improves its patency in CABG.

The study results favor midterm patency rates of the RA over the SV in CABG. Although the scientific data are inconsistent on the matter, we believe that the preservation of normal

vein architecture using the “no-touch” technique is crucial for its improved patency. On the basis of long-term follow-up data, we hope to encourage trainee surgeons and established cardiac surgeons to convert to this technique. Further research comparing “no-touch” SV with RA is needed to corroborate evidence on the graft of second choice in CABG.

Tomislav Kopjar, MD
Bojan Biočina, MD, PhD
Hrvoje Gašparović, MD, PhD
Department of Cardiac Surgery
University Hospital Centre Zagreb
School of Medicine University of
Zagreb
Zagreb, Croatia

References

1. Cao C, Manganas C, Horton M, Bannon P, Munkholm-Larsen S, Ang SC, et al. Angiographic outcomes of radial artery versus saphenous vein in coronary artery bypass graft surgery: a meta-analysis of randomized controlled trials. *J Thorac Cardiovasc Surg*. August 4, 2012 [Epub ahead of print].
2. Souza DS, Johansson B, Bojö L, Karlsson R, Geijer H, Filbey D, et al. Harvesting the saphenous vein with surrounding tissue for CABG provides long-term graft patency comparable to the left internal thoracic artery: results of a randomized longitudinal trial. *J Thorac Cardiovasc Surg*. 2006; 132:373-8.
3. Johansson BL, Souza DS, Bodin L, Filbey D, Loesch A, Geijer H, et al. Slower progression of atherosclerosis in vein grafts harvested with “no touch” technique compared with conventional harvesting technique in coronary artery bypass grafting: an angiographic and intravascular ultrasound study. *Eur J Cardiothorac Surg*. 2010;38:414-9.
4. Dashwood MR, Tsui JC. “No-touch” saphenous vein harvesting improves graft performance in patients undergoing coronary artery bypass surgery: a journey from bedside to bench. *Vascul Pharmacol*. August 8, 2012 [Epub ahead of print].
5. Lopes RD, Hafley GE, Allen KB, Ferguson TB, Peterson ED, Harrington RA, et al. Endoscopic versus open vein-graft harvesting in coronary-artery bypass surgery. *N Engl J Med*. 2009;361:235-44.

<http://dx.doi.org/10.1016/j.jtcvs.2012.12.077>

Reply to the Editor:

We thank Kopjar, Biočina, and Gašparović for their interest in our recently published meta-analysis comparing midterm patency outcomes of

radial arteries versus saphenous veins as conduits for coronary artery bypass grafting.¹ The authors advocated the use of the “no-touch” vein harvesting technique, which was previously demonstrated by Souza and colleagues² to result in improved patency compared with conventional harvesting involving stripping of perivascular fatty tissue and distention of the vein under pressure.

A multitude of factors relating to the conduit contribute to determine graft patency, including artery versus vein, skeletonized versus pedicled/“no-touch” approach, effect of harvest technique on endothelial preservation and rupture of the internal elastic lamina, and storage solution. In addition, further factors relating to the target coronary artery strongly affect conduit performance, including coronary diameter, severity of native coronary stenosis, and distal runoff. Any study that aims to compare conduit patency inherently accepts “heterogeneity of the extracted data,” providing an explanation for the incongruous results between studies.¹ To date, a unifying theory of conduit patency determination remains elusive.

The “no-touch” approach incorporates many techniques known to preserve conduit function, including endothelial preservation, mechanical support, and an intact vasa vasorum, although the dominant element responsible for superior vein patency as a coronary artery graft remains speculative. Several issues regarding this technique need to be addressed. First, no data comparing patency outcomes of this surgical approach with radial artery was identified in the current medical literature and hence was not included in our meta-analysis. Second, there is a lack of robust long-term clinical evidence for this technique and very limited data on potential short-term adverse outcomes compared with conventional vein harvesting. Specific concerns include leg wound infection, neuropathy, and increased incidence of bleeding from the pedicled vein graft, none of which

was reported by Souza and associates² in detail. Patients with peripheral vascular disease and diabetes may have an increased risk of wound infection with the “no-touch” technique, particularly when the conduit is harvested from the lower leg. It is interesting to note that patients with these risk factors were excluded from the trial.² Nonetheless, the “no-touch” technique should be acknowledged as a feasible alternative to the current standard practice with the potential to offer improved patency outcomes and should be further investigated in larger trials. Unfortunately, the SUPERIOR SVG Trial referenced in the letter only aims to measure short-term patency outcomes at 1 year.

Another important point raised by Kopjar, Biočina, and Gašparović was their concern regarding the endoscopic vein harvesting technique, which is growing in popularity but lacking strong clinical evidence. Potential benefits of this minimally invasive procedure in regard to reduced wound infection and pain may come at a cost of graft patency and major adverse cardiovascular events.^{3,4} In addition, there have been concerns regarding the shearing of side branches, a significant learning curve, and uncertain cost-effectiveness of the endoscopic technique. We agree with Kopjar, Biočina, and Gašparović that there is an urgent need to systematically review this relatively novel surgical technique in regard to its safety and efficacy.

Christopher Cao, MBBS^{a,b,c}

Con Manganas, MBBS^c

Michael Byrom, MBBS^b

Tristan D. Yan, MD, PhD^{a,b,d}

^aThe Systematic Review Unit
Collaborative Research (CORE)
Group

^bThe Baird Institute for Applied Heart
and Lung Surgical Research

^cDepartment of Cardiothoracic
Surgery

St George Hospital

^dDepartment of Cardiothoracic
Surgery