23. Manabe S, Fukui T, Shimokawa T, Tabata M, Katayama Y, Morita S, et al. Increased graft occlusion or string sign in composite arterial grafting for mildly stenosed target vessels. *Ann Thorac Surg.* 2010;89:683-8.
24. Hemo E, Mohr R, Uretzky G, Katz G, Popovits N, Pevni D, et al. Long-term outcomes of patients with diabetes receiving bilateral internal thoracic artery grafts. *J Thorac Cardiovasc Surg.* 2013;146:586-92.
25. Kieser TM, Rose MS, Aluthman U, Montgomery M, Louie T, Belenkie I. Toward zero: deep sternal wound infection after 1001 consecutive coronary artery bypass procedures using arterial grafts: implications for diabetic patients. *J Thorac Cardiovasc Surg.* 2014;148:1887-95.
26. Saso S, James D, Vecht JA. Effect of skeletonization of the internal thoracic artery for coronary revascularization on the incidence of sternal wound infection. *Ann Thorac Surg.* 2010;89:661-70.
27. Serruys PW, Morice MC, Kappetein AP, Colombo A, Holmes DR, Mack MJ, et al. Percutaneous coronary intervention versus coronary-artery bypass grafting for severe coronary artery disease. *N Engl J Med.* 2009;360:961-72.
28. Kapetanakis EI, Stamou SC, Dullum MK, Hill PC, Haile E, Boyce SW, et al. The impact of aortic manipulation on neurologic outcomes after coronary artery bypass surgery: a risk-adjusted study. *Ann Thorac Surg.* 2004;78:1564-71.
29. Lev-Ran O, Braunstein R, Sharony R, Kramer A, Paz Y, Mohr R, et al. No-touch aorta off-pump coronary surgery: the effect on stroke. *J Thorac Cardiovasc Surg.* 2005;129:307-13.
30. Moss E, Puskas JD, Thourani VH, Kilgo P, Chen EP, Leshnower BG, et al. Avoiding aortic clamping during coronary artery bypass grafting reduces postoperative stroke. *J Thorac Cardiovasc Surg.* 2015;149:175-80.
31. Suzuki T, Asai T, Nota H, Kuroyanagi S, Kinoshita T, Takashima N, et al. Early and long-term patency of in situ skeletonized gastroepiploic artery after off-pump coronary artery bypass graft surgery. *Ann Thorac Surg.* 2013;96:90-5.

Key Words: arterial graft, coronary artery bypass graft, chronic kidney disease, off-pump surgery, propensity score

EDITORIAL COMMENTARY

Spending 30 minutes to add years to a patient's life: Why is the last step so difficult?

Antonio Maria Calafiore, MD,^a Angela Lorena Iacò, MD,^a and Michele Di Mauro, MD^b

See related article on pages 315-21.

In this issue of the *Journal*, Kinoshita and colleagues¹ report the long-term outcomes of patients with chronic kidney disease who underwent coronary artery bypass grafting with skeletonized single internal thoracic artery (ITA) or bilateral ITA (BITA) grafts. After propensity matching, BITA grafting was associated with lower risks of all-cause and cardiac-related mortalities, without any increase in early mortality or morbidity. This study is another “brick in the wall” in favor of the use of BITA in routine myocardial revascularization. There are many studies reporting increased long-term survival in high-risk patients when BITA grafting is compared with single ITA grafting. Obese,² diabetic,³⁻⁵ high-risk (log EuroScore I, ≥ 5),⁶ and

elderly⁷ patients, even with reduced ejection fraction,⁸ all have the benefit of a longer survival when BITA grafting is used. Now Kinoshita and colleagues¹ have nicely demonstrated that BITA grafting provides survival advantage even to patients with significant renal impairment.

Nowadays, there is overwhelming evidence that BITA grafting is by far superior to single ITA grafting. Nevertheless, a recent analysis of the Society of Thoracic Surgeons database showed that use of BITA was 3.5% in 1999 and 4.1% in 2009.⁹ Why then are surgeons reluctant to use it routinely?

Lack of specific competence is the first reason. Most surgeons do not know the proper way to use the right ITA; they are not expert on how to deal with T-grafting, Y-grafting, and sequential grafting. They are afraid to use the right ITA over the aorta to reach the LAD or under the aorta to reach the lateral wall. Providing the patients a “standard of care” treatment (left ITA and saphenous vein grafts) removes any technical issue and protects them from any legal complaint in case of complications. Randomized trials are lacking (the Arterial Revascularisation Trial¹⁰ is still ongoing). Propensity matching, however, allows us to include more patients and to provide results more similar to those obtained in the real world. We cannot ignore

From the ^aDepartment of Adult Cardiac Surgery, Prince Sultan Cardiac Center, Riyadh, Saudi Arabia; and the ^bDepartment of Cardiovascular Disease, University of L'Aquila, L'Aquila, Italy.

Disclosures: Authors have nothing to disclose with regard to commercial support. Received for publication May 3, 2015; accepted for publication May 5, 2015; available ahead of print June 20, 2015.

Address for reprints: Antonio Maria Calafiore, MD, Director, Department of Research, Consultant, Department of Adult Cardiac Center, Prince Sultan Cardiac Center, Riyadh, Kingdom of Saudi Arabia (E-mail: am.calafiore@gmail.com).

J Thorac Cardiovasc Surg 2015;150:321-2

0022-5223/\$36.00

Copyright © 2015 by The American Association for Thoracic Surgery

<http://dx.doi.org/10.1016/j.jtcvs.2015.05.018>

that propensity-matched studies from single centers and meta-analyses of propensity-matched studies uniformly support the use of BITA grafting to improve long-term survival.^{8,11-14}

The second reason is the fear of a higher incidence of sternal wound infection. This is nowadays based more on heuristics than on rationality. There is a wide body of evidence that ITA skeletonization minimizes wound infections.¹⁵⁻¹⁷ This finding has solid anatomic bases. Since the studies of de Jesus and Acland,¹⁸ it has been evident that the appropriate technique of ITA harvesting is crucial to preserve sternal vascularization. Most of the side branches of the ITA arise as a trunk. If it is cut before the bifurcation, inversion of the blood flow allows maintenance of sternal revascularization from other sources (perforating branches to pectoralis muscle and intercostal branches). This aspect has been confirmed by functional studies.¹⁹⁻²² Moreover, aggressive blood sugar control in patients with diabetes is further reducing the incidence of sternal wound infections even in this subset of patients. Skeletonization has another added value by providing extra length of the conduit²³ and higher internal diameter,²⁴ both characteristics that can allow a higher number of ITA anastomoses. In addition, a recent propensity-matched study from our group²⁵ reported a better 17-year survival in patients with skeletonized BITA grafts than in patients with pedicled BITA grafts.

Skeletonized BITA harvesting is more time consuming, but it increases the benefit of BITA. Surgeons in general think that they need to be concerned about late outcome only for patients who have a long life expectancy, because any benefit appears after 10 years or more. The article from Kinoshita and colleagues¹ demonstrates again that even patients with significant comorbidities can receive an advantage from revascularization with BITA grafting.

Skeletonized BITA grafting should be the criterion standard for myocardial revascularization, and we as surgeons have to comply with this assumption to maintain our high professional level in an era of increasing rates of percutaneous coronary interventions despite guidelines, randomized studies, and registries. Let us use just 30 minutes of our time to do the right thing: a short time in our own lives against years added to the lives of our patients.

References

- Kinoshita T, Asai T, Suzuki T. Off-pump bilateral skeletonized internal thoracic artery grafting in patients with chronic kidney. *J Thorac Cardiovasc Surg.* 2015; 150:315-21.e3.
- Benedetto U, Montecalvo A, Kattach H, Amrani M, Raja SG, Harefield Cardiac Outcomes Research Group. Impact of the second internal thoracic artery on short- and long-term outcomes in obese patients: a propensity score matched analysis. *J Thorac Cardiovasc Surg.* 2015;149:841-7.e2.
- Calafiore AM, Di Mauro M, Di Giammarco G, Teodori G, Iacò AL, Mazzei V, et al. Single versus bilateral internal mammary artery for isolated first myocardial revascularization in multivessel disease: long-term clinical results in medically treated diabetic patients. *Ann Thorac Surg.* 2005;80:888-95.
- Dorman MJ, Kurlansky PA, Traad EA, Galbut DL, Zucker M, Ebra G. Bilateral internal mammary artery grafting enhances survival in diabetic patients: a 30-year follow-up of propensity score-matched cohorts. *Circulation.* 2012; 126:2935-42.
- Kajimoto K, Yamamoto T, Amano A. Coronary artery bypass revascularization using bilateral internal thoracic arteries in diabetic patients: a systematic review and meta-analysis. *Ann Thorac Surg.* 2015;99:1097-104.
- Kinoshita T, Asai T, Suzuki T, Kambara A, Matsubayashi K. Off-pump bilateral versus single skeletonized internal thoracic artery grafting in high-risk patients. *Circulation.* 2011;124(11 Suppl):S130-4.
- Kinoshita T, Asai T, Suzuki T, Kuroyanagi S, Hosoba S, Takashima N. Off-pump bilateral skeletonized internal thoracic artery grafting in elderly patients. *Ann Thorac Surg.* 2012;93:531-6.
- Galbut DL, Kurlansky PA, Traad EA, Dorman MJ, Zucker M, Ebra G. Bilateral internal thoracic artery grafting improves long-term survival in patients with reduced ejection fraction: a propensity-matched study with 30-year follow-up. *J Thorac Cardiovasc Surg.* 2012;143:844-53.e4.
- ElBardissi AW, Aranki SF, Sheng S, O'Brien SM, Greenberg CC, Gammie JS. Trends in isolated coronary artery bypass grafting: an analysis of the Society of Thoracic Surgeons adult cardiac surgery database. *J Thorac Cardiovasc Surg.* 2012;143:273-81.
- Taggart DP, Altman DG, Gray AM, Lees B, Nugara F, Yu LM, et al. Randomized trial to compare bilateral vs. single internal mammary coronary artery bypass grafting: 1-year results of the Arterial Revascularisation Trial (ART). *Eur Heart J.* 2010;31:2470-81.
- Lytle BW, Blackstone EH, Sabik JF, Houghtaling P, Loop FD, Cosgrove DM. The effect of bilateral internal thoracic artery grafting on survival during 20 postoperative years. *Ann Thorac Surg.* 2004;78:2005-12.
- Kelly R, Buth KJ, Legare JF. Bilateral internal thoracic artery grafting is superior to other forms of multiple arterial grafting in providing survival benefit after coronary bypass surgery. *J Thorac Cardiovasc Surg.* 2012;144:1408-15; discussion 2012-4.
- Yi G, Shine B, Rehman SM, Altman DG, Taggart DP. Effect of bilateral internal mammary artery grafts on long-term survival: a meta-analysis approach. *Circulation.* 2014;130:539-45.
- Pettinari M, Sergeant P, Meuris B. Bilateral internal thoracic artery grafting increases long-term survival in elderly patients. *Eur J Cardiothorac Surg.* 2015; 47:703-9.
- Saso S, James D, Vecht JA, Kidher E, Kokotsakis J, Malinovsky V, et al. Effect of skeletonization of the internal thoracic artery for coronary revascularization on the incidence of sternal wound infection. *Ann Thorac Surg.* 2010;89:661-70.
- Kieser TM, Rose MS, Aluthman U, Montgomery M, Louie T, Belenkie I. Toward zero: deep sternal wound infection after 1001 consecutive coronary artery bypass procedures using arterial grafts: implications for diabetic patients. *J Thorac Cardiovasc Surg.* 2014;148:1887-95.
- Fouquet O, Trief F, Desulauze P, Mével G. Does a skeletonized internal thoracic artery give fewer postoperative complications than a pedicled artery for patients undergoing coronary artery bypass grafting? *Interact Cardiovasc Thorac Surg.* 2015;20:663-8.
- de Jesus RA, Acland RD. Anatomic study of the collateral blood supply of the sternum. *Ann Thorac Surg.* 1995;59:163-8.
- Lorberboym M, Medalion B, Bder O, Lockman J, Cohen N, Schachner A, et al. 99mTc-MDP bone SPECT for the evaluation of sternal ischaemia following internal mammary artery dissection. *Nucl Med Commun.* 2002;23:47-52.
- Kamiya H, Akhyari P, Martens A, Karck M, Haverich A, Lichtenberg A. Sternal microcirculation after skeletonized versus pedicled harvesting of the internal thoracic artery: a randomized study. *J Thorac Cardiovasc Surg.* 2008; 135:32-7.
- Parish MA, Asai T, Grossi EA, Esposito R, Galloway AC, Colvin SB, et al. The effects of different techniques of internal mammary artery harvesting on sternal blood flow. *J Thorac Cardiovasc Surg.* 1992;104:1303-7.
- Cohen AJ, Lockman J, Lorberboym M, Bder O, Cohen N, Medalion B, et al. Assessment of sternal vascularity with single photon emission computed tomography after harvesting of the internal thoracic artery. *J Thorac Cardiovasc Surg.* 1999;118:496-502.
- Calafiore AM, Vitolla G, Iaco AL, Fino C, Di Giammarco G, Marchesani F, et al. Bilateral internal mammary artery grafting: midterm results of pedicled versus skeletonized conduits. *Ann Thorac Surg.* 1999;67:1637-42.
- Takami Y, Ina H. Effects of skeletonization on intraoperative flow and anastomosis diameter of internal thoracic arteries in coronary artery bypass grafting. *Ann Thorac Surg.* 2002;73:1441-5.
- Di Mauro M, Iacò AL, Acitelli A, D'Ambrosio G, Filippini L, Salustri E, et al. Bilateral internal mammary artery for multi-territory myocardial revascularization: long-term follow-up of pedicled versus skeletonized conduits. *Eur J Cardiothorac Surg.* 2015;47:698-702.