was greater. Similar results have since been reported from the randomized prospective trial by Desai and colleagues.²

Second, Mussa and colleagues probably agree that the ultimate goal of optimizing graft patency is improving survival. In well-matched patients undergoing CABG, all of whom received left ITA to left anterior descending coronary artery pedicle (LITA-LAD) grafts, using the radial artery as a second arterial conduit as opposed to vein resulted in improved late survival, especially after the third postoperative year (Figure 1).³ This benefit is similar to or better than what has been reported with bilateral ITA grafting. We suggest that the radial artery is indeed the arterial conduit of second choice, at least in patients in whom the bilateral ITA is contraindicated.

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References

1. Mussa S, Choudhary BP, Taggart DP. Radial artery conduits for coronary artery bypass grafting: current perspective. *J Thorac Cardiovasc Surg.* 2005;129:250-3.
2. Desai ND, Cohen EA, Naylor CD, Fremes SE. Radial Artery Patency Study Investigators. A randomized comparison of radial-artery and saphenous-vein coronary bypass grafts. *N Engl J Med.* 2004;351:2302-9.
3. Zacharias A, Habib RH, Schwann TA, Riordan CJ, Durham SJ, Shah A. Improved survival with radial artery versus vein conduits in coronary bypass surgery with left internal thoracic artery to left anterior descending artery grafting. *Circulation.* 2004; 109:1489-96.
4. Khot UN, Friedman DT, Pettersson G, Smedira NG, Li J, Ellis SG. Radial artery bypass grafts have an increased occurrence of angiographically severe stenosis and occlusion compared to left internal mammary arteries and saphenous vein grafts. *Circulation.* 2004;109:2086-91.
5. Blackstone EH, Naftel DC, Turner ME Jr. The decomposition of time-varying hazard into phases, each incorporating a separate stream of concomitant information. *J Am Stat Assoc.* 1986;81:615-24.
doi:10.1016/j.jtcvs.2005.02.033

Reply to the Editor:

We thank Zacharias and colleagues for their interest in our article concerning current perspectives in radial artery (RA) use as coronary bypass conduits.¹ Their letter raises 2 important issues: (1) comparative patency of RA versus saphenous vein graft conduits and (2) the effect of using RA grafts on survival after coronary bypass surgery.

Concerning the issue of RA versus saphenous vein graft patency, the excellent midterm graft patency rates taken from the symptomatic subgroup reported by Zacharias and colleagues² merely give an indication of graft durability but do not provide definitive information with respect to long-term patency. We are fortunate that prospective, randomized controlled trials specifically are currently addressing this question. Recently, Desai and associates³ reported data from the largest of these trials, the Radial Artery Patency Study (RAPS), and found a significant difference in favor of RA angiographic patency 1 year after the operation. Buxton's group has reported results from a much smaller cohort, part of the Radial Artery Patency and Clinical Outcome (RAPCO) trial,⁴ suggesting no significant difference in angiographic patency between RA and saphenous vein grafts. Forthcoming midterm and long-term patency data from these groups should resolve this important issue.

The effect of RA grafts on survival after CABG has yet to be elucidated in the context of a controlled trial to address the second point. The 8-year time-to-event analysis of propensity-matched groups from Zacharias and colleagues² provides encouraging preliminary support for the thesis that RA conduits might translate to improved clinical outcomes. Again, a definitive answer awaits analysis of long-term clinical outcome data from the ongoing randomized trials.⁴

The best evidence to date, both in terms of conduit patency⁵ and survival,⁶ suggests that the optimal strategy for CABG in most cases is the use of bilateral internal thoracic arteries. The RA, if used in optimal fashion, is probably the conduit of choice if a third graft is required or if bilateral internal thoracic artery grafting is contraindicated.

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References

1. Mussa S, Choudhary BP, Taggart DP. Radial artery conduits for coronary artery bypass grafting: current perspective. *J Thorac Cardiovasc Surg.* 2005;129:250-3.
2. Zacharias A, Habib RH, Schwann TA, et al. Improved survival with radial artery versus vein conduits in coronary bypass surgery with left internal thoracic artery to left anterior descending artery grafting. *Circulation.* 2004;109:1489-96.
3. Desai ND, Cohen EA, Naylor CD, Fremes SE. A randomized comparison of radial-artery and saphenous-vein coronary bypass grafts. *N Engl J Med.* 2004;351:2302-9.
4. Buxton BF, Raman JS, Ruengsakulrach P, et al. Radial artery patency and clinical outcomes: five-year interim results of a randomized trial. *J Thorac Cardiovasc Surg.* 2003; 125:1363-71.
5. Endo M, Nishida H, Tomizawa Y, Kasanuki H. Benefit of bilateral over single internal mammary artery grafts for multiple coronary artery bypass grafting. *Circulation.* 2001; 104:2164-70.
6. Taggart DP, D'Amico R, Altman DG. Effect of arterial revascularisation on survival: a systematic review of studies comparing bilateral and single internal mammary arteries. *Lancet.* 2001;358:870-5.
doi:10.1016/j.jtcvs.2005.03.014

Atrial fibrillation: Isolation or ablation?

To the Editor:

The article "Map-Guided Surgery for Atrial Fibrillation" by Nitta and associates¹ confirms and raises important issues. An adequately performed pulmonary vein isolation (PVI) cures most patients with intermittent atrial fibrillation (AF) but fails as an isolation procedure in patients with non-pulmonary vein (non-PV) foci and in those with continuous AF, in whom the PVs and the circuits they harbor become irrelevant to the maintenance of AF. In these patients the goal shifts from isolating the trigger to ablating the macroreentrant circuits. Although a left atrial (LA) procedure is mandatory, the real question is the following: When do we address the right atrium (RA)?

The identification of the transition from intermittent to continuous AF is crucial in determining the pattern of activation and the procedure needed. What was the relationship between the activation pattern and (1) the underlying structural heart disease and (2) the pattern (continuous or intermittent) and duration of AF?

The authors state that intraoperative mapping would be useful in determining the indications for simplified procedures for AF. Only 8 patients had PVI, although 21 had passive RA activation. This indicates that further refinement in technology is required before intraoperative mapping could really indicate the choice of procedure.

The success rates for AF between the 2 procedures are probably similar because the authors have been selective in the choice of patients for PVI. It will be interesting to speculate what the results would have been if these 13 patients also had simple LA procedures. Intraoperative mapping confirmed that most activation arose from the posterior LA, the appendage, and the PVs and justifies the use of LA procedures for such patients. It is useful to know the exact sites of activation in those with predominantly LA activation. Perhaps with further refinement in mapping techniques, it would be possible to develop abbreviated lesion sets even shorter than the ones that currently exist. For instance, it might not be necessary to ablate all PVs if only specific veins are involved.

The finding of activation from the LA appendage justifies appendage exclusion. The effect of this on appendage-sparing procedures needs to be analyzed. Did the authors ablate the appendage, even if it was not the focus of activation? If so, why?

Patients in the study with LA diameters exceeding 60 mm but with viable electrical activity were cured of AF. This suggests that (1) the presence of viable electrical activity is a greater predictor for AF conversion rather than LA diameter and (2) mapping is useful in predicting the probability of AF conversion in these patients.

The mapping time is acceptable, provided mapping reliably indicates the choice of procedure, and will reduce with the advent of more sophisticated systems. If similar maps could be obtained with a single LA electrode, then perhaps preoperative mapping would substantially reduce operative mapping time.

Thirteen of 21 patients with passive RA activation underwent the radial procedure because the pattern of atrial activation could not be completely determined in the intraoperative analysis. Have they really proved their point?

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Reference

1. Nitta T, Ohmori H, Sakamoto S, Miyagi Y, Kanno S, Shimizu K. Map-guided surgery for atrial fibrillation. *J Thorac Cardiovasc Surg.* 2005;129:291-9.

doi:10.1016/j.jtcvs.2005.03.006

Reply to the Editor:

I appreciate the comments by Dr Shanmugam.

All surgical procedures are based on the anatomic or physiologic conditions, and thus so should be the operation for atrial fibrillation (AF). The most challenging but exciting issue in surgical intervention for arrhythmias is that the lesions responsible for maintaining the arrhythmias are not usually visible by use of the ordinary approaches. We found intraoperative mapping to be useful in determining the mechanism of AF and the optimal procedure in each patient. The patients who underwent the simple procedure were selected only on the basis of the results of the analysis in the study. If the patients with right atrial reentry had undergone the simple procedure, the AF would not have been converted to sinus rhythm.

The mapping technique requires further refinement. The pattern of atrial activation could not be determined on the basis of the intraoperative analysis in some patients. In about half of those patients, the atrial activation was complex, and it took several hours to determine the activation pattern through a postoperative offline analysis. Some preoperative examination method should be developed to determine whether the AF is maintained by rapid activation arising from a pulmonary vein (PV) alone or a combination with reentrant physiology and to determine the optimal procedure preoperatively.

A mapping technique would be helpful rather in verifying conduction block across each ablation lesion and in assessing the inducibility of AF. This assessment would be practical and crucial in off-pump AF ablation. The intraoperative mapping would enable a stepwise approach to AF in the off-pump setting, in which the atria could be mapped again after the successful isolation of the PVs to determine the indication for atrial linear ablation and the location of each lesion.

The transition from intermittent to continuous AF might be contiguous and related to the pathophysiology of the atrial

myocardium, such as fibrosis of the myocardium combined with spatiotemporal dispersion of the refractoriness and conduction velocity. These abnormalities might be correlated to the left atrial (LA) diameter, the duration of AF burden, and other clinical conditions. There was an insignificant difference in the LA diameter between the patients with continuous and intermittent AF in our clinical experience. However, we believe the procedure should not be determined on the basis of the clinical findings alone because all those clinical parameters did not directly correlate to the above pathophysiologic conditions.

Most of the patients exhibited coexisting repetitive activations arising from 2 or more PVs. Interestingly, the distribution of the focal activation was dominantly from the right and left superior PVs. Isolating the right or left superior PV alone with an LA cuff would be technically difficult and unsafe. The superior and inferior PVs should be isolated bilaterally from the respect of prophylaxis and the surgical technique.

The focal activation from the LA appendage might be an epicardial breakthrough of the activation arising from the left superior PV, conducting through the pectinate muscle endocardially. The LA appendage should be excised not because there can be a focal firing from the appendage but because the risk of thromboembolism should be reduced by all possible means in the patients who are not cured of AF or whose LA contraction was not sufficient after the operation.

Intraoperative mapping of AF is not as simple as we have experienced in Wolff-Parkinson-White syndrome. The results of the data analysis might not necessarily be useful in each patient but might be helpful in understanding this troublesome tachyarrhythmia and in developing a definitive procedure.

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doi:10.1016/j.jtcvs.2005.03.007

Performance of surgery for congenital heart disease: Shall we wait a generation or look for different statistics?

To the Editor:

We read with great interest the reviews on surgical performance in the December