

Is Hybrid Coronary Revascularization Favored by Cardiologists or Cardiac Surgeons?

(#2002-50132 ... September 20, 2002)

Giuseppe D'Ancona, MD,^{1,2} Thomas A. Vassiliades, MD,³ W. Douglas Boyd, MD,⁴ Harry W. Donias, MD,¹ Kenneth D. Stahl, MD,⁴ Hratch Karamanoukian, MD¹

¹Center for Less Invasive Cardiac Surgery and Robotic Heart Surgery, Buffalo General Hospital, Buffalo, New York, USA; ²Quebec Heart Institute, Ste-Foy, Quebec, Canada; ³Pensacola Heart Institute, Pensacola, Florida; ⁴Cleveland Clinic Florida, Weston, Florida, USA

ABSTRACT

We investigated the present use of integrated coronary revascularization (ICR) by interviewing a sample of United States invasive cardiologists and cardiac surgeons. Both groups still favor left internal mammary artery (LIMA) grafting to revascularize the left anterior descending (LAD) coronary artery. There remains a lack of exposure to and acceptance of ICR, especially for surgeons. We report the findings of this national survey of 180 cardiologists and 160 surgeons, as they may serve as an indicator of the current opinions about ICR and its future applicability as a standard method of coronary artery revascularization. We discuss the limited popularity of minimally invasive hybrid procedures and the importance of further exposing cardiologists and surgeons to ICR.

INTRODUCTION

Since its introduction in the early 1990s, minimally invasive direct coronary artery bypass grafting (MIDCAB) via a left anterior small thoracotomy (LAST) without cardiopulmonary bypass (CPB) has become increasingly accepted as a procedure [Calafiore 1996]. The effectiveness of this operation in the treatment of coronary artery disease (CAD) limited to the left anterior descending (LAD) coronary artery has been proven at midterm clinical and angiographic followup [Calafiore 1998, Diegeler 1999]. Furthermore, MIDCAB, in combination with percutaneous transluminal coronary angioplasty (PTCA) or coronary artery stenting, has been advocated recently to achieve complete myocardial revascularization in patients with multivessel CAD [Angelini 1996, Izzat

Author's note: This article has been originally published online at www.hsforum.com/vol5/issue4/2002-50132. In that original publication the authors and their affiliations were inadvertently listed incorrectly; they are corrected in this printed article. The authors regret this error.

Submitted September 12, 2002; accepted September 20, 2002.

Address correspondence and reprint requests to: Hratch Karamanoukian, MD, Buffalo General Hospital, Center for Less Invasive Cardiac Surgery and Robotic Heart Surgery, 100 High Street, Buffalo, NY 14023; phone: 716-859-2248; fax: 716-859-4697 (e-mail: lisbon5@yahoo.com).

1997]. Although the conceptual framework of the "hybrid" approach to CAD is of interest, its large scale application remains limited. Therefore, we have investigated the present use of integrated coronary revascularization (ICR) by interviewing a sample of United States invasive cardiologists and cardiac surgeons. We report the findings of this national survey, as they may serve as an indicator of the current opinions about ICR and its future applicability as a standard method of coronary artery revascularization.

METHODS

Semistructured surveys were mailed to 250 interventional cardiologists and 250 cardiac surgeons working in academic and community hospitals in the United States.

The aim of the questionnaires was to determine attitudes and perceived benefits of hybrid procedures. Surgeons received one set of questions, and cardiologists another. Surgeons were asked about their experience with MIDCAB procedure, their strategy and conduits of choice to revascularize LAD or non-LAD coronary targets, and their opinion about percutaneous interventions (PCI). Cardiologists were asked their opinion regarding MIDCAB procedure, their favored revascularization conduit for non-LAD targets, their favored therapeutic option for non-LAD targets (saphenous vein graft [SVG] versus PTCA versus stent), and their actual experience with ICR.

RESULTS

One hundred sixty surgeons (64%) completed the survey. For 152 (95%) of them, left internal mammary artery (LIMA) graft is the graft of choice to revascularize the LAD. Of the 160 respondents, 128 surgeons (80%) perform <5 MIDCAB/year. SV to non-LAD targets is the conduit of choice for 120 surgeons (75%). Opinions about PCI and ICR are more homogeneous. The majority of the surgeons (140, 87.5%) object to PCI, reporting that "stents have poor patency rates." Only 16 surgeons (10%) believe that long-term patency of non-LAD targets treated with PCI is better than patency of SV grafts to non-LAD targets. Only 16 surgeons (10%) are in favor of ICR.

Cardiologists' participation was higher, with 180 (72%) of them returning the completed survey. Surprisingly, only 2 car-

Table 1. The Hybrid Revascularization Survey: Opinions of 160 Interviewed Surgeons

| | No. Surgeons |
|--|--------------|
| LIMA graft of choice to LAD | 152 (95%) |
| Perform <5MIDCAB/year | 128 (80%) |
| SV graft of choice to non-LAD targets | 120 (75%) |
| Stents have poor patency rates | 140 (87.5%) |
| Patency of stents to non-LAD targets is better than SV's patency | 16 (10%) |
| In favor of ICR | 16 (10%) |

diologists have referred patients for MIDCAB or robotically assisted minimal access procedures with ICR. The large majority of the respondents (178, 99%) chose LIMA as the graft of choice to revascularize the LAD. One hundred forty cardiologists (78%) believe that non-LAD targets should be revascularized with arterial conduits during coronary artery bypass grafting (CABG). Half of the respondents (90, 50%) believe in ICR and 122 (68%) believe that current stents have better patency rates than SV grafts to non-LAD targets. Although only 2% of the cardiologists have already used ICR, 90 (50%) of them are looking forward to ICR procedures using coated stents.

Results of the surgeons' and cardiologists' surveys are summarized in Tables 1 and 2.

DISCUSSION

The recent introduction and popularization of off-pump coronary surgery has galvanized interest in developing new strategies to achieve complete myocardial revascularization using alternative and less invasive surgical approaches. The concept of ICR, as first introduced by Angelini et al [1996], seems to fully satisfy the issues of completeness of revascularization and minimal invasiveness. In this regard, PTCA and coronary stenting are effective treatments for multivessel CAD. In spite of a nonnegligible rate of restenosis observed especially in LAD interventions, PCI has become standard treatment for multivessel CAD, thanks to its relative effectiveness in decreasing symptoms, maintaining low morbidity rates, and maintaining costs when compared to traditional CABG [BARI 1996]. No survival benefits of CABG over PCI exist at midterm follow-up [BARI 1996].

The major benefit of surgical intervention lies in the long-term patency of the LIMA to the LAD coronary artery. Although the MIDCAB operation theoretically provides long-lasting revascularization of the LAD with the LIMA, its application cannot be extended to the majority of surgical candidates with multivessel CAD. MIDCAB and PTCA (or stenting) have major limitations if used alone but may acquire higher therapeutic potential when adopted simultaneously. Our survey finds that surgeons present the major obstacles to wider application and acceptance of ICR procedures. Two particular surgical issues are highlighted by our survey results. First, only a small number of surgeons are exposed to

MIDCAB procedures and may not acquire enough surgical expertise to easily perform this operation. Second, the majority of surgeons (90%) remain skeptical toward PTCA or stenting patency rates and believe vein grafts are still the best treatment for non-LAD revascularization.

Although results of pioneering groups using MIDCAB are encouraging [Calafiore 1998, Diegeler 1999], this operation has a steep learning curve. In MIDCAB surgery, suturing may be hampered by limited space of the surgical field, and mobilization of the LIMA graft may be technically demanding. These difficulties may be aggravated in the presence of intramyocardial, tortuous, calcified, and diffusely atherosclerotic LADs. Good candidates for MIDCAB may be difficult to find, and in most instances, patients with good LAD targets are treated with PCI. It has been demonstrated that for limited type-C lesions of the LAD, 1-year survival and major adverse clinical events are similar with MIDCAB and PTCA [Mariani, 1997]. Those patients refused for invasive cardiac treatment may not be good candidates for MIDCAB because of an inadequacy of coronary targets. As shown in our survey, 80% of the interviewed surgeons perform fewer than 5 MIDCABs per year. This data reflects the lack of adequate referral for MIDCAB.

How Can Surgeons Gain Broader Exposure to MIDCAB? How Can They Master This Challenging Technique?

ICR may be the answer. The popularity of hybrid procedures is limited most strongly by the recent success of off-pump coronary artery bypass (OPCAB). Patients with multivessel CAD who are presently being treated with OPCAB could be treated, in the majority of cases, using a different approach—a hybrid procedure. By applying this alternative approach, surgeons would have the opportunity to master MIDCAB and broaden its application. But for those who do not believe in the long-term patency rate of PCI, OPCAB remains a strong competitor.

How Can We Convince 90% of the Represented Surgeons That PCI May Lead to Acceptable Long-term Patency Rates?

The results of randomized trials have clearly shown the superiority of CABG versus PTCA in reducing recurrency of angina and reintervention rates [BARI 1996, Hlatky 1997]. These comparisons were done before the introduction of

Table 2. The Hybrid Revascularization Survey: Opinions of 180 Interviewed Cardiologists

| | No. Cardiologists |
|--|-------------------|
| LIMA graft of choice to LAD | 178 (99%) |
| Arterial conduits for non-LAD targets | 140 (78%) |
| In favor of ICR | 90 (50%) |
| Patency of stents to non-LAD targets is better than SV's patency | 122 (68%) |
| Have already performed ICR | 2 (1%) |

stents, which have improved long-term results compared to routine PTCA [Serruys 1994]. The ERAC II randomized trial has shown that multivessel stenting has a significantly lower incidence of major procedural adverse cardiac events when compared with conventional CABG (1.8% in PTCA patients versus 11.4% in CABG patients). However, the 6-month incidence of target lesion revascularization was 13.7% in the stent group and 4.8% in the CABG group [Rodriguez 1999]. But the recent introduction of coated stents and vascular radiation therapy will further improve the long-term outcome of multivessel CAD patients undergoing percutaneous revascularization. In this regard, a 100% 1-year patency rate was reported using sirolimus-eluting stents in a small non-controlled registry [Sousa 2001]. These results are also confirmed in a larger double-blinded randomized trial in Europe and Latin America (RAVEL), which found at 6 months that restenosis was reduced from 26% in patients receiving placebo to 0% in those receiving sirolimus-eluting stents [Teirstein 1996]. Various medicated stents are currently in clinical trials, particularly new “intelligent” polymeric-coated stents that may release drug combinations at different rates and on different timelines. If the present data continue to be supported by ongoing placebo-controlled randomized trials, cardiologists will soon be able to offer to all patients a minimally invasive and durable revascularization technique. Some of the classic contraindications to PCI, such as multivessel CAD, left main stenosis, small diameter coronary arteries, and long atherosclerotic lesions will be easily approached and treated with drug-eluting stents with minimal restenosis rates. The threshold for surgical intervention will be lowered further, and surgeons will find themselves able to treat the sickest patients who have been refused for PCI.

CONCLUSION

Present changes in the referral pattern for CABG are forcing us to reshape our therapeutic strategies. Although the long-term benefits of complete surgical myocardial revascularization are well known, an increasing number of patients of advanced age and multiple comorbidities are simply not good candidates for this operation. MIDCAB combined with catheter-based therapies could be used in the future to reduce therapeutic invasiveness, achieving at the same time a durable myocardial revascularization. Although ICR presently provides a less invasive approach for select patients with multivessel CAD, its future applicability could be extended to a majority of surgical candidates. The mid to long-term results of ICR should be evaluated with the new stent technology available (coated stents), and until then, MIDCAB procedures must be standardized for wider applicability. Innovations in the surgical field should be evaluated in order to facilitate MIDCAB and ICR procedures. In this regard, new technologies such as robotic endoscopic surgery and mechanical anastomotic devices could be used in the future to further ease the performance and reduce surgical trauma

of MIDCAB. The amounts of chest wall retraction, rib and costal cartilage sacrifice, and incisional pain remain important issues in MIDCAB surgery. Recent advancements in robotic endoscopic surgery allow left internal thoracic artery (LITA) mobilization via 3-mm and 5-mm port access with minimal chest wall trauma. The final goal is the adoption of totally endoscopic robotic closed-chest coronary bypass that will be the least invasive surgical procedure to revascularize the LAD with the LITA [Stahl, 2002].

REFERENCES

- Angelini GD, Wilde P, Salerno TA, Bosco G, Calafiore AM. 1996. Integrated left small thoracotomy and angioplasty for multivessel coronary artery revascularization. *Lancet* 347:757-8.
- The Bypass Angioplasty Revascularization Investigation (BARI) Investigators. 1996. Comparison of coronary bypass surgery with angioplasty in patients with multivessel disease. *N Engl J Med* 335:217-25.
- Calafiore AM, Giammarco GD, Teodori G, et al. 1996. Left anterior descending coronary artery grafting via left anterior small thoracotomy without cardiopulmonary bypass. *Ann Thorac Surg* 61(6):1658-63; discussion 1664-5.
- Calafiore AM, Vitolla G, Iovino T, Iaco AL, Mazzei V, Commodo M. 1998. Left anterior small thoracotomy (LAST): mid-term results in single vessel disease. *J Card Surg* 13(4):306-9.
- Diegeler A, Matin M, Kayser S, et al. 1999. Angiographic results after minimally invasive coronary bypass grafting using the minimally invasive direct coronary bypass grafting (MIDCAB) approach. *Eur J Cardiothorac Surg*. 15(5):680-4.
- Hlatky MA, Rogers WJ, Johnstone I, et al. 1997. Medical care costs and quality of life after randomization to coronary angioplasty or coronary bypass surgery. Bypass angioplasty revascularization investigation (BARI) investigators. *N Engl J Med* 336:92-9.
- Izzat MB, Yim APC, Mehta D, et al. 1997. Staged minimally invasive direct coronary artery bypass and percutaneous angioplasty for multivessel coronary artery disease. *Int J Cardiol* 62(suppl D):S105-9.
- Mariani MA, Boonstra PW, Grandjean JG, et al. 1997. Minimally invasive coronary artery bypass grafting versus coronary angioplasty for isolated type C stenosis of the left anterior descending artery. *J Thorac Cardiovasc Surg* 114:434-9.
- Rodriguez AE, Santaera O, Grinfeld L, et al. 1999. Argentine randomized study optimal coronary balloon angioplasty and stenting versus coronary bypass surgery in multiple vessel disease (ERAC II): acute and mid term outcome. *Eur Heart J* 20(suppl):137.
- Serruys PW, de Jaegere P, Kiemeneij F, et al. 1994. A comparison of balloon-expandable-stent implantation with balloon angioplasty in patients with coronary artery disease. *N Engl J Med* 331:489-95.
- Sousa JE, Costa MA, Abizaid AC, et al. 2001. Sustained suppression of neointimal proliferation by sirolimus-eluting stents: one-year angiographic and intravascular ultrasound follow-up. *Circulation* 104:2007-11.
- Stahl KO, Boyd WD, Vassilides TA, Karamanoukian HL. Hybrid robotic coronary artery surgery and angioplasty in multivessel coronary artery surgery. *Ann Thor Surg* 2002;74(suppl):1358-62.
- Teirstein PS. 2001. Living the dream of no restenosis. *Circulation* 104:1996.