

EDITORIAL COMMENT

# Revascularization Strategy for Proximal LAD Disease

## Left Internal Mammary to LAD Artery Still Rules the Roost\*

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Significant proximal left anterior descending artery (LAD) disease may jeopardize up to 50% of the left ventricular myocardium (1) and predicts worse outcomes (2), with a significantly worse 5-year patient survival rate (90% vs. 98%) than downstream LAD lesions (3). In the 1990s, randomized controlled trials (RCTs) showed that all treatment modalities, namely, medical therapy, percutaneous transluminal coronary angioplasty (PTCA), and surgery provided symptomatic relief, but a significantly smaller proportion of patients who received only medical therapy were totally asymptomatic. Left internal mammary artery (LIMA) bypass was associated with a greater event-free probability than either PTCA or medical treatment (4). Novel surgical techniques, such as off-pump coronary artery bypass graft (CABG) surgery and minimally invasive direct coronary artery bypass (MIDCAB) surgery, involving a LIMA to LAD bypass, gained widespread acceptance, keeping pace with the introduction of bare-metal stents (BMS) and drug-eluting stents (DES), which revolutionized percutaneous coronary intervention (PCI) by reducing restenosis rates (5). This necessitated the performance of RCTs to compare PCI with BMSs and/or DES and MIDCAB (2 by our group [6-9]), which consistently associated PCI with significantly higher target vessel revascularization (TVR) rates and correspondingly more major adverse cardiac and cerebrovascular events (MACCE)

(8,9). However, there were similar mortality and periprocedural myocardial infarction (MI) rates. However, these studies included very few patients and had an insufficient number of events for adequate statistical power. Two meta-analyses revealed similar findings, with 1 identifying a higher occurrence of recurrent angina after PCI (10,11). Furthermore, only 1 RCT utilized DES (7). Because RCTs often include a select group of patients, they introduce a degree of bias by excluding those encountered in real-world scenarios. This information can be derived from analyses of data obtained from large registries that incorporate details of patients treated in daily practice. Therefore, the propensity-matched retrospective study comparing PCI and CABG as revascularization strategies for isolated proximal LAD disease presented by Hannan et al. (12) in this issue of the *Journal* provides renewed insight into the era of contemporary DES.

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The investigators obtained data for 6,064 patients with proximal LAD disease (5,340 DES and 724 CABG) from reliable sources, such as New York State's clinical registries for PCI and for CABG. They minimized selection bias by identifying 715 CABG and/or DES pairs using propensity score matching. No differences in all-cause mortality between the 2 revascularization strategies were reported after a median 2.5-year follow-up, which is consistent with findings from previous trials (6-9), contemporary studies (13), and meta-analyses involving the use of DES (14,15). This may be because most enrolled patients were younger and healthier, had better left ventricular function and lesser comorbidities, and commonly underwent elective or (at the most) urgent procedures. Because such low-risk patients experience fewer early and late procedure-related deaths, larger numbers would

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need to be treated to elicit a significant difference in mortality. Moreover, follow-up periods in all but 1 trial (6) and in most studies, including the current study (12), were too short to reveal a survival advantage favoring surgery.

There was a similar trend for the composite endpoint of mortality, MI, and/or stroke, despite the performance of almost one-half of the CABG procedures using a cardiopulmonary bypass (CPB) machine, which accounts for the majority of complications (especially MI and stroke) after conventional CABG. MIDCAB offers an off-pump LIMA to LAD graft through a left anterior small thoracotomy approach, thus avoiding CPB machine use, a median sternotomy, and their potential complications. The only drawback is the procedure's steep learning curve, during which complications that could require conversion to sternotomy are more likely. Despite its challenging operative technique, MIDCAB is associated with low post-operative mortality and morbidity, especially in high-volume centers that regularly perform this operation, where MIDCAB is the preferred surgical revascularization method for isolated LAD disease (16).

The current series confirms repeat TVR as the Achilles heel of PCI, even in the era of DES. Although most repeat TVRs occur within the first post-PCI year (6,15), the repeat revascularization rate remains significantly higher than for surgery, even at 10 years (6,14). The reasons for this may be multifactorial. First, most CABG patients receive a LIMA to LAD graft, which has a patency rate as high as 95% to 98% at 10- to 20-year follow-up (17). Secondly, bypass grafts provide an alternative source of inflow and an outflow point that is commonly located substantially distal to the diseased LAD segment, which protects against future disease development and progression. In contrast, PCI is performed within the diseased segment of the LAD, subjecting the distal vessel to compromised flows in the event of in-stent or in-segment restenosis. At least in the near future, it is

uncertain whether stent technology will supersede a LIMA to LAD bypass graft as the treatment of choice for isolated proximal LAD disease.

The current study failed to provide information on the recurrence of angina and the consequences of repeat TVR. Two meta-analyses revealed that the relative risk of recurrent angina was 2.5 times higher in the PCI cohort compared with the MIDCAB cohort at 2 to 5 years of follow-up (11,15); this probably occurred because of the higher restenosis rates after PCI. This translates to more repeat TVR after PCI, which negatively affects MACCE rates (13). Recurrent angina and repeat TVR reduce quality of life and result in repeated hospital admissions, thus escalating the long-term costs of PCI that offset the initially higher costs of surgery (18). Another drawback of the current study is the lack of description of the lesions' complexity, a primary prerequisite in deciding on the optimal choice of therapy. PCI is extremely challenging in patients with calcified, occluded, or bifurcation lesions and highly tortuous vessels, and, in such cases, is associated with higher rates of procedural failure and suboptimal results. Conversely, CABG procedural success and prognosis is determined by vessel quality at the anastomotic site and the distal coronary tree. A heart team approach would therefore be ideal in deciding the best therapy to be used in patients with borderline lesions and multiple comorbidities.

In summary, although the current study (12) reported no differences in mortality or in the composite endpoint of mortality, MI, and/or stroke between CABG and DES, it did provide further evidence that repeat TVR occurs significantly more frequently after PCI of the proximal LAD than after CABG, even in real-world practice.

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