

The Left Main Facts: Faced, Spun, But Alas Too Few

Jeff Brinker, MD, FACC

Baltimore, Maryland

Bypass surgery has been shown to prolong life in patients with significant left main stenosis compared with medical therapy and is the current standard of care. Recent registry data suggest that stenting may offer intermediate-term results similar to surgery, although with a greater need for repeat revascularization. Drug-eluting stents appear to improve the outcomes of stenting. Over 20% of patients with left main disease currently receive stents, and there is need for ongoing randomized controlled trials to validate this approach. It is essential that such patients receive balanced counseling as to revascularization options. (J Am Coll Cardiol 2008;51:893-8) © 2008 by the American College of Cardiology Foundation

It is, at times, both interesting and disconcerting to observe the dialectic process unfold in the medical literature. One current battleground is a small, averaging a bit over a centimeter in length (1), but critically located segment of coronary artery. In itself the debate over revascularization for left main (LM) disease serves as a mini-conflict in the long-continuing cold war over the “best” approach for ischemic vascular disease. It has been termed by some the “last bastion” of bypass surgery while others consider it the “final challenge” to percutaneous coronary intervention (PCI). Hyperbole aside, this segment is unique in several aspects: it arises directly from the aorta and thus exhibits tissue and structural properties at its ostium, which differ from those in the rest of its course; it is subject to a number of unusual disease processes in addition to atherosclerosis, including iatrogenic injury; it serves as the primary thoroughfare for left ventricular blood flow, the interruption of which, even for a short time, can be potentially catastrophic; and, although it is relatively large in diameter, it terminates as a disease-prone bifurcation/trifurcation from which the smaller caliber left anterior descending (LAD), circumflex, and occasionally the intermediate branches arise. Significant LM stenosis occurs in only about 6% of patients undergoing diagnostic coronary angiography (2); however, recent evidence suggests a familial aggregation (3). The presence of significant LM disease signals a poor prognosis with a 3-year survival as low as 37% depending on the degree of stenosis, left ventricular function, and associated coronary disease (4). The importance of coronary artery bypass grafting (CABG) over medical therapy for LM disease was established a quarter century ago by observational and randomized controlled trials (5-7). The magnitude of surgical benefit was influenced by both the degree of LM

stenosis and left ventricular function. The operative mortality was also associated with these factors as well as the immediacy of the need for surgery, gender, and left coronary dominance (8). The survival benefit of CABG extended only to the higher-risk subgroups of patients with symptomatic coronary disease.

Lesions of the LM vary anatomically and functionally in ways that might influence the choice of revascularization and should not be considered as a single class: isolated LM disease is infrequent, accounting for only 6% of patients undergoing surgery with an LM stenosis (9); obstructive disease is not evenly distributed over the course of the LM, with the distal portion involved in about two-thirds of the cases, ostial lesions occurring in about one-quarter, and the remainder localized to the shaft (10); and the clinical import of the LM is derived from its functional distribution, which may be influenced by previously placed bypass graft(s), prior left anterior descending or circumflex branch occlusion, the size and distribution of the right coronary artery, or by the anomalous origin of a coronary artery.

There are few individuals as well acquainted with the LM as are the interventionalists who traverse this region on a regular basis and, on occasion, contribute to the development of stenosis (11) or cause acute injury (12) in it. Efforts at PCI of LM disease began with Grüntzig et al. (13), who described the ease as well as the risk of dilating the left main in his initial series of patients reported in 1979. Despite his cautions against angioplasty in this group, interventionalists have found it difficult to resist the temptation. The initial report of the National Heart, Lung, and Blood Institute angioplasty registry (14) describes 19 patients having LM balloon angioplasty with a procedural success rate of 68% (the highest of any other target site) and no procedural mortality. The death of 2 patients after hospital discharge, however, cast doubt about the safety of this procedure. Further the experience with balloon dilation for LM stenosis confirmed this to be an unsatisfying technique with high

**Abbreviations
and Acronyms****BMS** = bare-metal stent(s)**CABG** = coronary artery
bypass grafting**DES** = drug-eluting stent(s)**ITA** = internal thoracic
artery**LAD** = left anterior
descending coronary artery**LM** = left main coronary
artery**PCI** = percutaneous
coronary intervention**ST** = stent thrombosis

acute and long-term risk, especially in patients with acute ischemic presentations and unprotected LM lesions (15). The introduction of bare-metal stents (BMS) addressed some of the concerns about procedure stability and restenosis but was still associated with a high restenosis rate, especially in bifurcation lesions, and high post-discharge mortality (16). Protected LM lesions, however, could be treated with acceptable results (17). Thus, until recently the generally accepted utility of LM PCI has been relegated to situations in which the LM is “protected” by a previously placed graft in a branch vessel, the dependent distribution is small, the surgical risk is prohibitive, or the need emergent. Introduction of drug-eluting stents (DES) has been followed by reports of favorable experiences with these devices in unprotected LM disease, and the technique has been extended to patients who would be otherwise good surgical candidates. It is estimated that PCI is now performed in 26% of LM patients in Europe and 21% in the U.S. (18). In this issue of the *Journal*, Taggart et al. (19) take interventionalists to task over the appropriateness of PCI for LM specifically and for surgically approachable high-risk coronary disease in general. This perspective deserves careful reading and some comment.

The challenges offered by Taggart et al. (19) are summarized as follows: 1) interventionalists influence the therapy of patients with multivessel and LM disease without providing a balanced discussion of CABG; 2) published evidence and existing guidelines support the superiority of CABG for these conditions; 3) the current root cause favoring aggressive PCI is misguided enthusiasm that DES have leveled the playing field with surgery by eliminating the major shortcoming (restenosis) of balloon angioplasty and BMS; this is ill founded, as the risk of stent thrombosis (ST) may outweigh any advantage; 4) the very nature of LM disease is ill-suited for stenting; 5) advances in surgical technique including bilateral internal thoracic arterial grafts have overcome limitations of saphenous vein grafts; and 6) the ethics of a randomized controlled trial comparing CABG with DES for LM disease are questionable because there is a lack of equipoise between the proven “standard of care” and DES.

Consideration of these points might begin with the acceptance of 2 axioms. First, there is no perfect long-lasting revascularization procedure; both grafts and stents may fail early or over time, and new disease may develop proximal or distal to the site of revascularization. Second, traditional heart surgery involves considerable physiological insult and “up front” risk of significant adverse events,

including an operative mortality of between 1% and 4% and a prolonged recovery. Patients are reluctant to face these risks if given a less invasive, albeit imperfect, option. They will accept them, however, if there is no reasonable alternative.

**Counseling Patients on
Revascularization Options**

It is true that interventionalists do not routinely suggest a surgical consultation to patients they feel are candidates for PCI. The majority of such patients are of low to moderate risk, the procedural success rates are high, acute complication rates are low, and this approach is widely considered justifiable given patient preference, the ad-hoc nature of most procedures, and the logistical demands of all involved. For high-risk nonemergent patients, however, it would be in the best interests of all to have an inclusive team approach to ensure that the patient and family are well informed as to therapeutic options. Although interventionalists might consider themselves capable of presenting an even-handed discussion of both PCI and CABG, the perception among many of our surgical colleagues is that a conflict of interest is inherent in such an approach. Interestingly, in a survey of attitudes of interventionalists toward LM PCI, 48% consulted a surgeon in all potential LM PCI, 48% did so in selected patients, and only 4% thought that a surgeon should not be involved in the process. Only 19% thought that LM PCI should be offered to patients who were good surgical candidates; however, 38% said that it was appropriate to do the procedure in patients who request it (20).

CABG Versus PCI for Multivessel Disease

The contention that CABG is superior to PCI for multivessel disease is arguable. The paper by Hoffman et al. (21) is a meta-analysis consisting of 8 randomized trials spanning the transition from balloon angioplasty to stenting, with only 35% of the total receiving stents. There was no survival difference at 1 and 3 years (in which stented patients were represented), but there was a difference at 5 and 8 years favoring CABG; these data, however, were derived from the early studies that did not include stents. Hannan et al. (22) analyzed data from the New York State CABG and PCI registries (pre-DES), showing better survival with the former. This is an important observation, although it suffers the limitations of a nonrandomized retrospective study. The long-term results of 2 pre-DES randomized trials are available: ERACI II (Argentine Randomized Trial of Coronary Angioplasty With Stenting Versus Coronary Bypass Surgery in Patients With Multiple Vessel Disease) (23) and ARTS (Arterial Revascularization Therapies Study) (24) show CABG and PCI to be equivalent in infarct-free survival. Surgery, however, has been consistently shown to be associated with a lessened need for revascularization. Over the 5-year follow-up of ARTS and ERACI II, the BMS group required revascularization about 3 and one-half

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