

Stenting for Left Main Stenosis

Ready for everyday practice?

BY ANTHONY WHITE, MBBS, PhD, AND RAJ MAKKAR, MD

Significant stenosis of the left main coronary artery (Figure 1) is discovered in about 4% of diagnostic coronary angiograms.¹ Thus, a busy catheterization lab will encounter this clinical situation on approximately a weekly basis and will need to decide on appropriate management. Expert consensus guidelines^{2,3} recommend that management of such cases should include referral for coronary artery bypass graft (CABG) surgery, if the patient is a surgical candidate. This recommendation is based on data from the 1970s and 1980s that established that the treatment of left main stenosis with medical treatment alone led to unacceptable rates of adverse events and furthermore that there was a mortality benefit of CABG treatment compared to medical management.⁴⁻⁶

MANAGEMENT OF LEFT MAIN STENOSIS: TIME TO REVISIT THE QUESTION IN CAREFULLY SELECTED CASES?

Four recent developments in the field suggest that now might be an appropriate time to reconsider our management algorithms in carefully selected cases of left main stenosis (Table 1). In appropriate cases, it may be possible to treat left main stenosis with similar safety and efficacy by placement of drug-eluting stents (DES) as by CABG, thereby relieving the patient of the morbidity (increased risk of stroke and wound infection) and long hospital stay associated with cardiac surgery. The four developments in the field that have made such reconsideration possible are:

(1) The introduction of DES with markedly reduced rates of restenosis compared to bare-metal stents.⁷

(2) Data from multiple registries, including from our institution,⁸⁻¹⁹ a small, randomized trial²⁰ and a meta-analysis²¹ indicating that stenting of the left main with DES is technically feasible with excellent procedural success rates (Table 2).

(3) Excellent long-term outcomes are being achieved in treating large numbers of left main stenosis cases in Korea with DES percutaneous coronary intervention (PCI),²² with

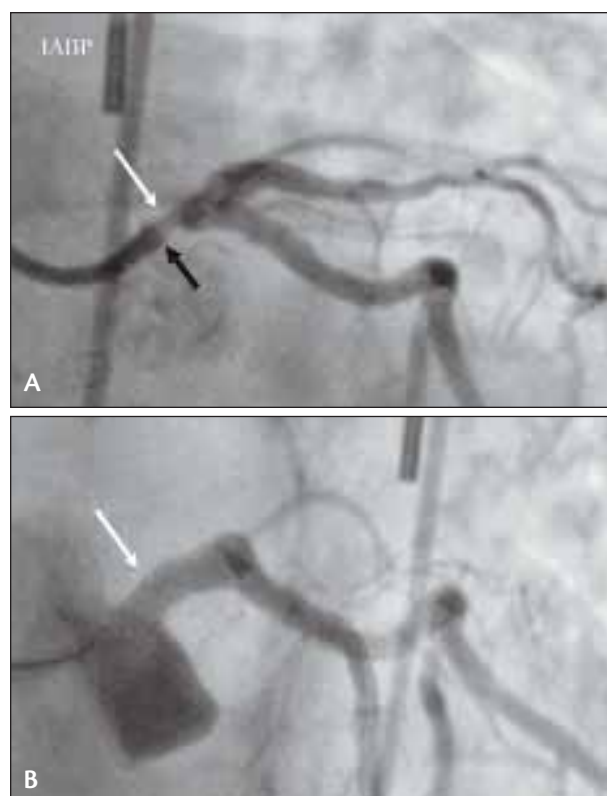


Figure 1. An ostial left main stenosis (white arrow) is visible immediately beyond the distal tip of the diagnostic catheter (black arrow) (A). Note also the presence of an intra-aortic balloon pump (IABP) counter-pulsation device in the descending aorta. Coronary angiography after successful deployment of a single stent in the left main coronary artery (white arrow) (B).

no significant difference in follow-up rates of death compared to patients treated with CABG (Figure 2).

(4) The 1-year results of the randomized SYNTAX trial (SYNergy Between PCI With TAXUS and Cardiac Surgery) indicate that the combined rate of death, myocardial infarct-

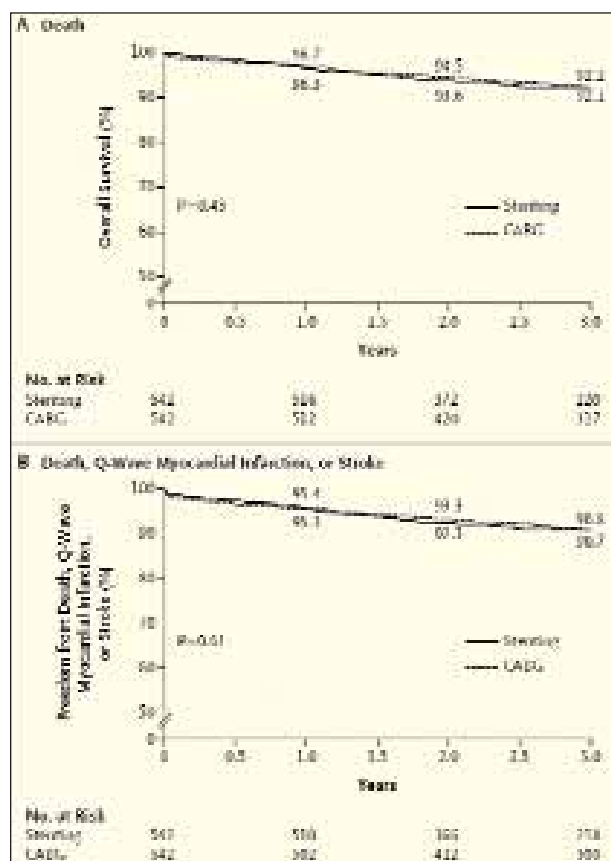


Figure 2. Kaplan-Meier curves for outcomes of patients with left main stenosis, matched by propensity scores, for patients who underwent stent implantation or coronary artery bypass surgery. Outcomes for death (A) or a composite outcome of death, myocardial infarction, or stroke (B) are statistically indistinguishable between the two treatments. These indicate that excellent clinical outcomes are being achieved after PCI of the left main coronary artery in large numbers of patients in Korea. (Reprinted with permission of the *New England Journal of Medicine*.²² Copyright ©2008 Massachusetts Medical Society. All rights reserved.)

tion, stroke, and revascularization at 1 year is similar whether left main is treated with DES PCI or CABG (15.8% vs 13.7%, respectively [Figure 3A]).²³ Further data from this important dataset are keenly awaited. A closer breakdown shows higher rates of stroke and lower rates of revascularization in the CABG group at 12 months (Figure 3B).

THE SYNTAX TRIAL: A LANDMARK TRIAL

The SYNTAX trial, which has completed enrollment,²⁴ contained a prespecified subset of more than 700 patients with left main disease randomized to treatment with either CABG or PCI. The 5-year mortality data are highly anticipated. If 5-year mortality were shown to be equivalent for the

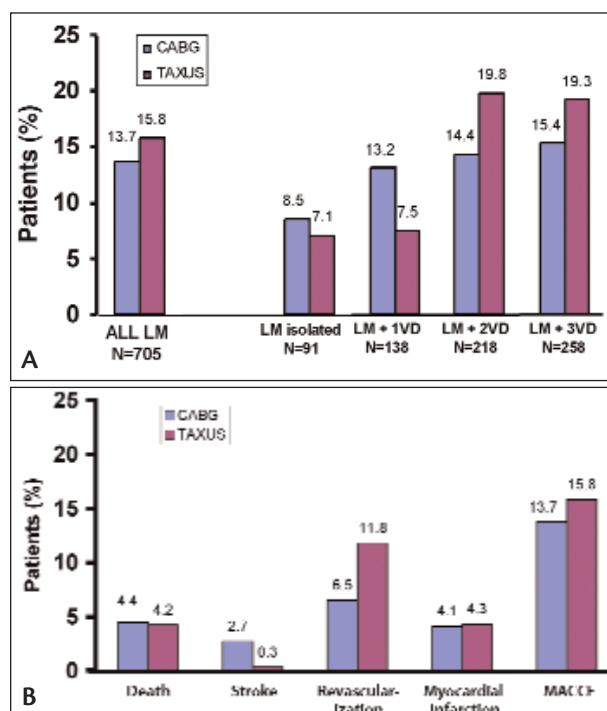


Figure 3. Twelve-month major adverse cardiovascular and cerebral events in the left main subgroup of the SYNTAX study. These data indicate that isolated left main or left main with one-vessel disease are the most favorable situations to consider a PCI approach to left main disease.²³ Abbreviations: LM + 1VD, left main with one-vessel disease; LM + 2VD, left main with two-vessel disease; LM + 3VD, left main with three-vessel disease; MACCE, major adverse cardiac and cerebrovascular endpoints, defined in this study as all-cause death, cerebrovascular accident, documented myocardial infarction, or any repeat revascularization (A). Closer analysis of the components of 12-month MACCE in the left main subgroup of the SYNTAX study shows higher rates of stroke, and lower rates of revascularization in the CABG group. Statistical comparisons are not shown because the left main patients were a subgroup of the main SYNTAX study (B). (Adapted from Serruys P, Mohr FW on behalf of the SYNTAX investigators. *Revascularization in Patients with Unprotected Left Main Coronary Artery Disease: New Data from SYNTAX*. Presented at the Transcatheter Cardiovascular Therapeutics scientific symposium, October 14, 2008; Washington, DC.²⁵)

two treatment strategies, this would likely have a large effect on the treatment decisions of patients and physicians and possibly on the committees that write expert consensus guidelines for recommended management.

It is instructive to look at the situation of multivessel disease as a historical analogy. A number of randomized trials in 2000 and 2001, in the setting of multivessel disease with bare-metal stents,²⁶⁻²⁹ indicated that the choice of revascu-

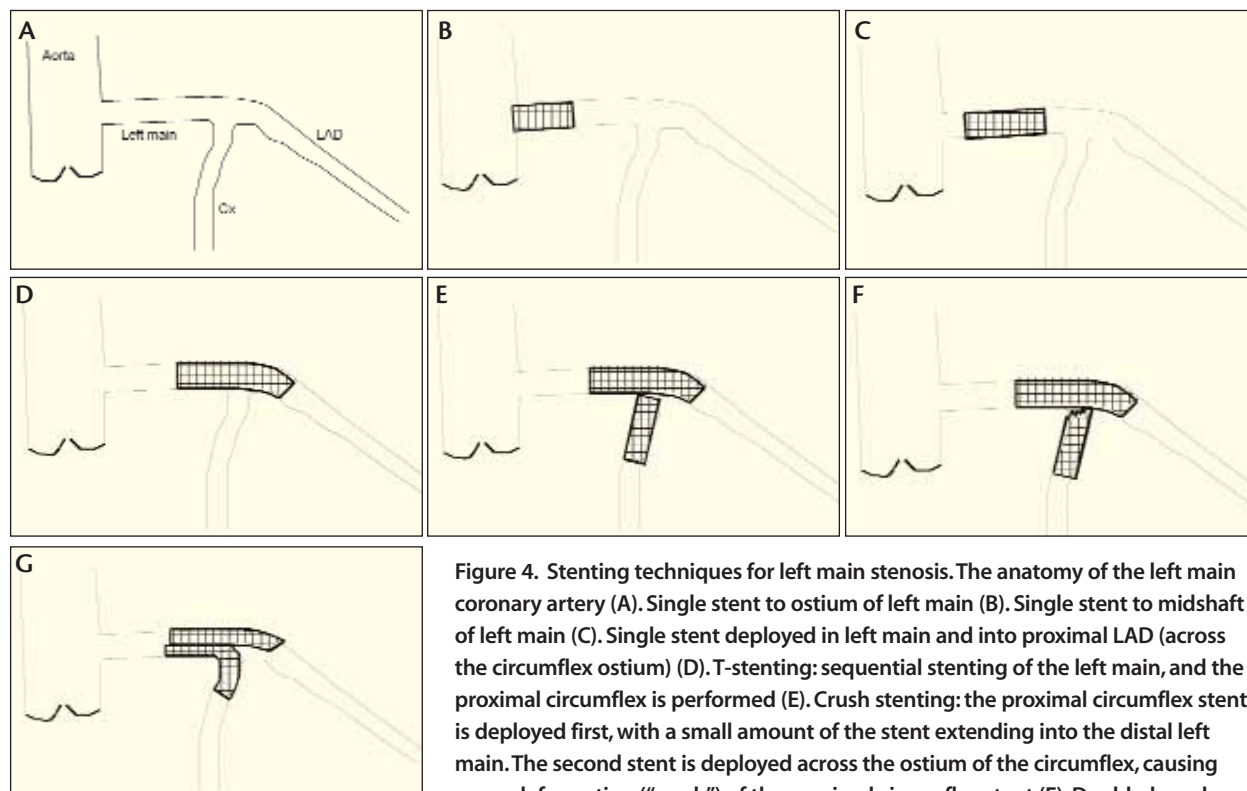


Figure 4. Stenting techniques for left main stenosis. The anatomy of the left main coronary artery (A). Single stent to ostium of left main (B). Single stent to midshaft of left main (C). Single stent deployed in left main and into proximal LAD (across the circumflex ostium) (D). T-stenting: sequential stenting of the left main, and the proximal circumflex is performed (E). Crush stenting: the proximal circumflex stent is deployed first, with a small amount of the stent extending into the distal left main. The second stent is deployed across the ostium of the circumflex, causing some deformation ("crush") of the proximal circumflex stent (F). Double-barrel

stenting: the proximal ends of two stents (one into the LAD, one into the Cx) are precisely aligned within the left main. The stents are then deployed by simultaneous balloon inflation (G). Abbreviations: LAD, left anterior descending; Cx, circumflex.

larization strategy was a tradeoff between a less invasive procedure—PCI—which needed to be "paid for" by an increased chance of repeat procedures compared to CABG. In that context, given the similar mortality of either approach,³⁰ large numbers of physicians and patients "voted with their feet" and we witnessed the great shift from CABG to PCI for coronary revascularization over the past decade. If equivalent mortality of CABG and PCI was also to be demonstrated for left main stenosis in randomized trial(s), a similar shift in treatment patterns would also likely occur.

TECHNICAL CONSIDERATIONS

The angiographic anatomy of the left main lesion is a critically important factor in clinical decisions (Figure 4A). Outcomes of stenting are best if the left main stenosis can be dealt with using a single stent in the ostium or shaft of the left main,¹² although this occurs in a minority of cases (Figures 4B and 4C). If disease of the distal left main is present, there are four stenting techniques available to cover the lesion (Figures 4D through 4G). The technique used depends on a number of factors including presence of disease at the ostium of the circumflex, the angle at which the circumflex takes off from the left main, and operator preference. A detailed discussion of the relative merits of the dif-

ferent techniques is beyond the scope of this article. If restenosis occurs after bifurcation stenting, the ostium of the circumflex is the most common location.

Left main stenting should not be performed without the use of intravascular ultrasound to confirm adequate and accurate deployment.

The possibility of cardiovascular collapse during intervention in this position is a very real one, and the use of intra-aortic balloon pumps or newer percutaneous left ventricular assist devices^{31,32} should be considered.

A NOTE OF CAUTION

DES have clearly reduced the threshold for consideration of a percutaneous approach to treat left main stenosis, and a large amount of global experience now indicates that the procedure is feasible and safe when performed in experienced centers. Nonetheless, we should be wary of the widespread adoption of PCI to treat left main stenosis at this stage. Such cases should not be undertaken "on the fly" or in a haphazard manner. At this stage, left main PCI should only be tackled after careful consideration, by high-volume operators in high-volume centers with surgical back-up on site, and in a setting where outcomes are recorded and analyzed.

TABLE 1. FACTORS THAT PROMOTE CONSIDERATION OF PCI TO TREAT LEFT MAIN STENOSIS

Institutional/Operator Factors

- Busy catheterization lab and an experienced, busy operator
- On-site surgical back-up
- Availability of intravascular ultrasound to check position and deployment of the stent within the left main coronary artery

Angiographic Factors

- Ostial or shaft left main stenosis (without involvement of the bifurcation)¹²
- Lack of involvement of other coronary arteries with disease

Patient Factors

- Patient understands the concept that long-term dual antiplatelet medications are necessary, and they are financially and medically able to comply
- Older > younger
- Preserved left ventricular function
- CABG would carry high risk of complications (eg, severe lung disease, very elderly, redo surgery, etc.)
- A symptomatic patient who is not expected to live very long for other reasons, such as disseminated cancer (compassionate indication) or refuses to consider undergoing CABG

TABLE 2. PUBLISHED GLOBAL DATA RELATING TO OUTCOMES IN MORE THAN 2,000 PATIENTS FOLLOWING DES IMPLANTATION TO TREAT LEFT MAIN STENOSIS

Center(s)	Type of Study	Period of Study	No. Patients With DES	% In-Hospital Mortality	Follow-Up Period	% Mortality at Follow-Up
Poland ²⁰	Randomized – DES vs CABG	2000–2004	52	0%	12 mo	1.9%
Milan, Italy ⁸	Registry – DES vs CABG	2002–2004	107	–	12 mo	2.8%
Cedars-Sinai Medical Center, Los Angeles, CA ^{9,33}	Registry – DES vs CABG	2003–2007	120	–	362 d	–
Bologna, Italy ¹⁰	Registry – DES vs CABG	2002–2005	94	–	12 mo	11%
Spain ¹¹	Registry – DES vs CABG	2000–2005	94	–	12 mo	5.2%
Korea ²²	Registry – DES vs CABG	2000–2006	784	–	12 mo	3.7%
Milan, Italy ¹⁴	Registry – DES vs BMS	2002–2004	85	0	6 mo	3.5%
Seoul, Korea ¹⁶	Registry – DES vs BMS	2003–2004	102	0	12 mo	0%
Scripps Clinic, California ¹³	Registry	2003–2004	50	0	276 d	10%
Florence, Italy ¹⁵	Registry	–	101	–	6 mo	12.8%
Germany ¹⁷	Registry	2002–2004	200	1.5%	32.2 mo	–
Multicenter: Italy, Holland & Korea ¹⁹	Registry	–	147	0	886 d	3.4%
Rotterdam, Holland ¹⁸	Registry	2003–2004	110	–	660 d	11.8%

BMS, bare-metal stent; CABG, coronary artery bypass graft surgery.

A patient's preference will always be for the less-invasive procedure, but at this point in time, we are still obliged to make conservative recommendations to our patients and explain that CABG is the current accepted treatment for left main stenosis.

CONCLUSION

Left main stenosis is a dangerous coronary lesion associated with high rates of adverse events if left untreated. Stenting of left main stenosis with DES, particularly if there is no involvement of the distal left main and its bifurcation, is technically feasible, with high acute procedural success rates. Furthermore, a body of observational literature now suggests that there is no large difference in clinical outcomes from those following treatment with coronary artery bypass surgery. Long-term follow-up of patients in the randomized SYNTAX trial will be an important advancement in our knowledge of the optimal approach to this lesion.

Is stenting for left main stenosis ready for everyday practice? The answer depends very much on the situation. If there is no involvement of the bifurcation of the left main and the operator is experienced, PCI may be a reasonable initial approach. Furthermore, an argument can be made on the basis of the presented 1-year follow-up left main subset SYNTAX data that cases of isolated left main, or with involvement of only one other vessel, may be particularly suited to consider a PCI approach (Figure 3). However, although stenting of the left main is a reasonable management strategy in very carefully selected cases, at this time, coronary artery bypass treatment will likely continue to be advised for the majority of our patients with this lesion. ■

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