



## Left Main Coronary Artery Percutaneous Intervention: Are We There Yet?

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"These patients are candidates for sudden death, the event is unpredictable and the underlying pathology can only be identified by good coronary angiography."

Gotsman MS, Lewis BS, Bakst A. *S Afr Med J* 1973;47:641-4.

Three prominent South African, later-to-be Israeli cardiologists, called it "the artery of sudden death" more than 30 years ago in a description of a 54 year old patient with severe left main obstruction who died after cardiac catheterization [1]. Significant narrowing of left main coronary artery is found in approximately 7 to 10% of all diagnostic catheterization procedures, and studies performed in the late 1970s showed the poor outcome of these patients when treated medically. The Veterans Administration Cooperative Study demonstrated a significant reduction in 3 year mortality, from 29 to 7%, in patients who underwent surgical revascularization for LMCA stenosis, compared to medical treatment. Since then, bypass grafting has been considered the standard of care for patients with narrowing in this vessel [2]. Andreas Gruntzig introduced percutaneous balloon angioplasty in 1977; he believed that the LMCA would be an ideal candidate for percutaneous revascularization and actually implemented this concept by performing LMCA angioplasty in some of his initial patients. This practice was promptly stopped, however, due to the poor results: there was substantial peri-procedural mortality, restenosis was high, sometimes presented as sudden death, and long-term survival was disappointing [3,4]. As a consequence, interventional cardiologists have, in general, avoided percutaneous revascularization of the LMCA that is not protected by a graft, but they never totally abandoned the belief of a safe and efficient non-surgical approach to treat these patients.

The introduction of stents in the 1990s, in combination with high pressure deployment and dual antiplatelet therapy, was associated with a dramatic reduction in restenosis and subacute stent thrombosis in patients who underwent percutaneous coronary artery revascularization. These improved results led to

renewed attempts at LMCA intervention, often on a case-by-case basis. In some institutions LMCA angioplasty and stenting were introduced as the primary method for revascularization, mainly in Japan and South Korea where there are strong social prohibitions against surgery. The largest experience of percutaneous intervention of unprotected LMCA comes from two important registries. The ULTIMA Registry was a multicenter study of LMCA intervention in 279 patients enrolled at 25 high volume, clinical sites in America, Europe and Asia between 1993 and 1998 [5]. Most of these patients were treated with stents (73%). Almost half of these patients were deemed inoperable or at an unacceptable high surgical risk. In-hospital mortality was 13.7% and the 1 year mortality rate was 24.2% (the majority from cardiac cause). In high risk patients the 1 year mortality rate was over 56%. However, in a subgroup analysis of 89 patients considered to be at low risk, the 1 year mortality rate was 3.4%. Among hospital survivors, there was a 2% per month death rate during the first 6 months after discharge. The repeat percutaneous coronary intervention rate was 24% in the whole study population and 20% in low risk patients. The Asian Pacific Multicenter Registry [6] enrolled 270 patients with unprotected LMCA stenosis ( $\geq 50\%$ ) and no evidence of left ventricular dysfunction (ejection fraction  $>40\%$ ). As expected, procedural success was excellent (99%). There were no in-hospital deaths, but three cases of stent thrombosis (1.1%) and three myocardial infarctions. Angiographic follow-up was performed in 237 patients (88%) and the binary restenosis rate was 21%. Mortality during the follow-up period ( $32 \pm 19$  months) was 7.4%. Of the 20 patients who died, 8 died of cardiac causes. Two single-center studies from France and Italy [7,8] performed in low and high risk patients showed double-digit mortality rates and high restenosis rates at 1 year follow-up. It was clear from these studies that while acute success can be very high, long-term restenosis associated with mortality was a major limitation of this technique.

The introduction of drug-eluting stents has revolutionized the way interventional cardiology is currently performed and obviously will have a profound impact on the management of coronary artery

LMCA = left main coronary artery

disease. These stents have been assessed in selected coronary artery lesions and patients with excellent results. An initial report from the Thoraxcenter (Rotterdam, The Netherlands) [9] of 31 consecutive patients with LMCA disease (20 of them unprotected) treated with the sirolimus-eluting stent showed mixed in-hospital findings. Most of these patients were considered to be at high surgical risk, were in the acute phase of myocardial infarction, or underwent bailout stenting for LMCA dissection. Only eight underwent the procedure due to the patient's preference. The in-hospital mortality rate was 60% for patients with acute myocardial infarction, 6% for elective patients and 0% for bailout procedures. Importantly, at 5 months follow-up, there were no deaths or need for target vessel revascularization in those patients discharged from the hospital.

In this issue of *IMAJ*, Teplitsky et al. [10] describe the experience accumulated at their center during a 2 year period, 2001–2003, in 34 consecutive patients. As in previous unselected series, there is a mixed combination of elective and emergency procedures. The majority of these patients had protected LMCA disease (68%) and for obvious reasons those patients who underwent emergent procedure had significantly worse baseline characteristics. In-hospital and 6 month mortality rates (43% and 57% respectively) were significantly higher in those patients who underwent emergent procedures compared to those who underwent elective intervention (0% and 7.4%). Six-month target vessel revascularization rates were similar in both groups (14% and 22%, respectively).

Given the results of this study, what have we learned? First, in a population of patients with LMCA disease, patients who underwent the procedure on an elective basis had an excellent prognosis, whereas patients who underwent emergent intervention had very high mortality rates. Since coronary bypass surgery is seldom used today as a salvage procedure for very high risk patients, the interventional cardiologist is faced with the task of a salvage procedure in severely ill patients. Therefore, the results from this local experience in a small cohort provide important data regarding the dire outcome of these patients. In addition, the use of bare metal stents yielded acceptable restenosis rates as reflected on repeat target vessel revascularization procedures.

Often in medicine we demand simple solutions for complex problems, and the answer is not straightforward in this case. The approach and outcomes vary according to the type of procedure (elective or emergent), surgical risk, and the rationale for the selection of a percutaneous procedure. All these patients have different outcomes with different therapies.

In conclusion, prudent patient selection remains critical for both the interventional cardiologist and the surgeon, in order to truly define those patients who present with a very high surgical risk.

Patients who are acceptable candidates for bypass graft surgery should probably still undergo that proven and effective therapy, especially if the LMCA lesion is just one part of complex multivessel disease. Unfortunately, patients who are good candidates for surgery are usually the ones who will also have a good outcome with percutaneous intervention and vice versa. It is clear that drug-eluting stents, by reducing restenosis to a minimum, will have an impact on the treatment of LMCA disease; however, we should be cautious and wait for the results of well-conducted trials. In the meantime, the evidence so far has shown that percutaneous LMCA intervention, with and without drug-eluting stents, is feasible and associated with acceptable mortality and morbidity. Whether it can (or should) be offered as a routine treatment in low surgical risk patients can only be answered by a well-designed, randomized, multicenter, controlled study.

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*MGM executive advising against investing in *Gone With the Wind*. At the Academy Awards ceremony in 1940, the film walked off with eight Oscars, which reinforced its status as one of the masterpieces of American cinema. The movie has brought in close to \$200,000,000.*