Chronic competitive flow from a patent arterial or venous graft to the circumflex system does not impair the long-term patency of internal thoracic artery to left anterior descending grafts in patients with isolated predivisional left main disease: Long-term angiographic results of 2 different revascularization strategies

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Objective: To compare 2 different surgical approaches to treatment of patients with isolated predivisional stenosis of the left main coronary artery (IOSLM) and to evaluate the effect of chronic competitive flow from a patent arterial or venous graft to the circumflex system on the long-term patency of internal thoracic artery (ITA) to left anterior descending grafts.

Methods: Thirty-two patients with IOSLM were treated at our institutions during a 9-year period: 14 patients received double ITA grafts, whereas 18 underwent ITA graft plus saphenous vein (SV) bypass. All patients were reviewed clinically and angiographically at long-term follow-up.

Results: No patient died during hospitalization. At a mean follow-up of 96 ± 9 months 7 patients had died (6 from noncardiac causes) and 5 had experienced angina/ischemia recurrence, without differences between the 2 revascularization strategies. At control reangiography all ITA and SV grafts were found to be fully patent, without evidence of caliber reduction or string sign in the ITA.

Conclusions: In patients with IOSLM, long-term ITA to left anterior descending artery patency is not jeopardized by chronic flow competition from a concomitant arterial or venous graft to the circumflex system. Notably, the addition of a second ITA graft or of a SV to the first ITA does not lead to differences in long-term angiographic patency. Our results minimize the role of flow competition in this setting and should be kept in mind when choosing the appropriate graft configuration. (J Thorac Cardiovasc Surg 2014;148:1856-9)

Isolated ostial predivisonal stenosis of the left main coronary artery (IOSLM) is a rare form of coronary artery disease with peculiar pathologic and clinical features.[1] From a surgical perspective, IOSLM is a complex scenario in which coronary artery bypass grafting (CABG) has been reported to achieve suboptimal results[1,2] and there is no general consensus on the most appropriate conduits configuration.[3]

Our institutions have traditionally adopted 2 different solutions in this setting: bilateral internal thoracic artery (ITA) grafts at St Luc Bouge and ITA on the left anterior descending (LAD) artery and saphenous vein (SV) on the circumflex system at Catholic University. Both solutions expose the ITA to a high degree of competitive flow; therefore, this patient population offers the opportunity to evaluate the effect of flow competition from different types of concomitant grafts on long-term ITA angiographic status.

PATIENTS AND METHODS

Patient Population

Patients included in our study represent a consecutive cohort of cases referred to our institutions for CABG from January 2000 to December 2008. This time frame was chosen to achieve a minimum follow-up time of 5 years. The main inclusion criteria for our study was preoperative diagnosis of isolated ostial (predivisional) critical stenosis of the left main common trunk, without additional disease of the left coronary system and with clear evidence of wide communication between the LAD and the circumflex (CX) systems at preoperative angiography. Additional exclusion criteria were associated cardiac or vascular procedures at the time of CABG and/or emergent operation.

Our investigation received local institutional review board approval, and each patient gave informed consent to participate. All procedures were performed in accordance with the ethical standards on human experimentation and with the Helsinki Declaration.

Preoperative, intraoperative, and postoperative data for all patients were prospectively collected; all data were then entered into a computerized database. Data are presented as mean ± standard deviation.

Surgery

Patients were submitted to standard on or off-pump CABG. When cardiopulmonary bypass was used normothermic systemic perfusion and

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Abbreviations and Acronyms

CABG = coronary artery bypass grafting
CX = circumflex
IOSLM = isolated ostial predivisonal stenosis of the left main coronary artery
ITA = internal thoracic artery
LAD = left anterior descending
SV = saphenous vein

isothermic intermittent blood cardioplegia were used at both institutions. Among St Luc patients, 5 procedures were performed off-pump and 5 patients received a Y ITA graft, whereas 9 received 2 in situ ITAs. All Catholic University patients were operated on-pump and received single left ITA-LAD and SV to obtuse marginal grafts.

Follow-up

All cases were submitted to periodical clinical and instrumental examinations. Transthoracic echocardiography and stress test or Tl^{201} myocardial perfusion single-photon emission computed tomography were performed 1 and 6 months after surgery and every year thereafter. Invasive studies were performed in case of abnormal results of these first-line examinations.

For the purpose of our study, all patients were asked to undergo a new clinical assessment and stress test. Control angiography for evaluation of the status of the implanted grafts and the native coronary arteries was proposed to all patients who did not undergo recatheterization within the past 12 months.

Graft Angiography

Angiography of the left ITA was performed through femoral or left radial approach using a 5F or 6F 3DRC or IM angiographic catheter (Cordis Corporation, Bridgewater, NJ). Angiography of the SV was performed using 5F or 6F AL1, JR, or MP angiographic catheters (Cordis Corporation, Bridgewater, NJ). Unfractionated heparin was administered with a target activated clotting time > 250 seconds.

All preoperative and control angiographies were reviewed by 2 experienced observers and graded according to Fitzgibbon classification.[4] Disagreements were resolved by common reevaluation.

RESULTS

Four thousand six hundred twenty-one patients underwent elective isolated multivessel CABG during the study period at the 2 institutions. Out of these 46 (1%) had an isolated proximal left main disease, of whom 32 (70%) fulfilled the selection criteria and were included in our study. Their main preoperative features are depicted in Table 1; the mean percentage of left main stenosis was 74% ± 12%. The perioperative course is summarized in Table 2. There was no perioperative mortality and all patients were successfully discharged from the hospital.

Clinical Follow-up

At a mean follow-up of 96 ± 9 months, 25 of 32 patients were alive (78.1%). Late deaths were due to cancer (4 patients), respiratory failure (1 patient), and stroke (1 patient); only 1 death was cardiac related. The death rate was similar between the 2 groups of patients. (See Table 3.)

Five patients experienced angina recurrence and/or instrumental evidence of ischemia; all of them underwent reangiography: 2 were treated percutaneously, whereas the others had lesions on secondary coronary vessels and were left untreated. In no case the recurrence of ischemia resulted from graft malfunction. The remaining 20 patients were free from angina and had normal stress test or Tl^{201} myocardial perfusion single-photon emission computed tomography. Overall, angina/ischemia-free survival at late follow-up was 62.5%, without differences between the 2 revascularization strategies.

Angiographic Results

All 25 surviving patients underwent control reangiography at a mean follow-up of 86 ± 15 months from surgery. In all of them, the 2 ITAs and the SV grafts were fully patent, without evidence of caliber reduction or string sign in the ITA (Fitzgibbon grade A), independent from the type of complementary graft placed on the CX system. When bilateral ITAs were used, no difference was found in the patency rate of Y versus in situ ITA grafts. The percentage of left main stenosis did not vary substantially between preoperative and follow-up angiography (74% ± 12% vs 76% ± 10%; P = not significant).

DISCUSSION

Isolated ostial stenosis of the left main coronary artery is a rare form of coronary artery disease with peculiar etiologic, pathologic, and clinical features.[1] The surgical approach to IOSLM is still matter of debate: the use of a single ITA-LAD graft, of bilateral ITAs, or of a mixed ITA plus SV configuration have all been advocated.[3]

In any case, surgical revascularization has been reported to achieve suboptimal results: Arima and colleagues[1] reported a disappointing 62.5% patency rate at 10 years in this subset of cases and in the recent SYNTAX-LE MANS study[2] >15% of implanted grafts failed at 15 months' follow-up. The reasons for the poor results of surgery are not entirely understood, but chronic competitive flow very likely plays a role.

It is widely accepted that flow competition significantly reduces the patency rate of arterial grafts. In a classic study, Sabik and colleagues[5] reviewing 2999 angiographic controls established an inverse relationship between competitive flow and ITA patency; since then, several groups (including ours) have confirmed the observation that the degree of target vessel stenosis is a major determinant of long-term ITA graft status.[6-8]

In the setting of IOSLM, chronic flow competition against the ITA-LAD graft can arise from the native coronary circulation (this risk is enhanced due to the