

# Off-pump bypass of the left anterior descending coronary artery: 23- to 34-year follow-up

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Supplemental material is available online.

**Objective:** We sought to develop a baseline for long-term survival of patients after off-pump bypass of the left anterior descending coronary artery with the heart beating.

**Methods:** We reviewed results for 241 consecutive patients with significant obstruction of the left anterior descending coronary artery who underwent surgery between November 1969 and the end of 1980. The off-pump operative technique involved elevating and stabilizing a segment of the distal left anterior descending coronary artery with 4 traction sutures. Starting in 1973, an internal thoracic artery became the graft of choice, so that a total of 171 patients received an internal thoracic artery bypass graft, and 70 patients received a saphenous vein graft.

**Results:** The median survival of patients with internal thoracic artery grafts was 23.7 years versus 17.9 years for patients with venous grafts ( $P < .02$ ). Early patency of arterial grafts was 95%, and late patency was 90%. There were 2 (0.8%) operative deaths. Seventy of the 74 patients still alive in 2003 were interviewed by telephone, and 40 (57%) did not require additional invasive treatment, which is consistent with our finding that more than 50% of our patients after bypass of the left anterior descending coronary remained stable without obstruction of the right or circumflex arteries. However, atherosclerosis progressed in 30 (43%) of the survivors, who underwent reinterventions.

**Conclusions:** Off-pump bypass of the left anterior descending coronary artery with an internal thoracic artery can be done on a beating heart safely and results in median survival of patients for more than 23 years.

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This study was undertaken to establish a baseline of long-term survival of patients who underwent off-pump bypass of the left anterior descending coronary artery (LAD). We reviewed 241 consecutive patients operated on from November 1969 through December 1980. The LAD was bypassed with a saphenous vein graft (SVG) in 70 patients and an internal thoracic artery (ITA) in 171 patients. The last year of the study was 2003, providing 23 to 34 years' follow-up.

## Materials and Methods

Of the 241 patients, 183 were men with a median age of 55.2 years (range, 29–77 years). Fifty-eight patients were women with a median age of 56.3 years (range, 40–73 years). The patients' preoperative clinical profiles are summarized in Table 1.

All patients had significant obstruction of the LAD, which was defined as the narrowing of the vessel's lumen equal to or exceeding 50%. Preoperative angiograms showed 157 (65.2%) patients with coronary obstruction limited to the LAD. Eighty-four (34.8%) patients had additional obstructed arteries, including 39 (16.2%) patients with obstructed right coronary arteries (RCAs), 28 (11.7%) patients with obstruction of the circumflex coronary artery (CIRC), and 17 (7.0%) patients with obstruction of all 3 coronary arteries.

**Abbreviations and Acronyms**

CIRC	= circumflex coronary artery
ITA	= internal thoracic artery
LAD	= left anterior descending coronary artery
LITA	= left internal thoracic artery
PCI	= percutaneous coronary intervention
RCA	= right coronary artery
SVG	= saphenous vein graft

**Surgical Technique**

All graft operations bypassing the LAD were performed off pump with the heart beating by using a previously described technique.<sup>1,2</sup> Laparotomy pads placed behind the heart displaced it anteriorly, exposing the distal LAD. Two 3-0 silk sutures were passed under the LAD 3 to 5 cm apart, and a 4-0 silk suture was passed through the adventitia along each side of the elevated coronary segment. Gentle traction of the 4 sutures elevated and stabilized a distal segment of the LAD. If coronary occlusion was not complete without excessive traction of sutures passed under the LAD, a small bulldog vascular clamp was applied to attain a bloodless operative field. An anastomosis of an arterial or venous graft to a linear opening of a stabilized LAD was easily and accurately performed. The beating heart maintained circulation in all patients without conversion to cardiopulmonary bypass.

Beginning in 1973, the decision was made that the ITA would be the bypass vessel of choice. One hundred sixty-five LADs and 3 diagonal coronary arteries were bypassed with a left ITA (LITA), and 3 LADs were bypassed with a right ITA. For convenience, in this text the term ITA indi-

**TABLE 1. Patient characteristics**

Patients	241
Male patients	183
Female patients	58
Angina	175
Unstable angina	33
Impending infarction	22
Left main stenosis	3
Positive stress test result	42
Previous myocardial infarction	76
Congestive heart failure	4
Hypertension	43
Diabetes	9
Hypercholesterolemia	32
Left ventricular dysfunction	
Mild	45
Moderate	16
Severe	3
Family history	39
Smokers	45

**TABLE 2. Operative complications**

	n	%
Patients without complications	191	79.2
Atrial arrhythmias	16	6.6
Ventricular arrhythmias	5	2.1
Perioperative myocardial ischemia	16	6.6
Wound infection	5	2.1
Cerebrovascular accident (transient)	2	0.8
Postpericardiotomy syndrome	4	1.7
Cardiac tamponade	1	0.4
Secondary wound closure	2	0.8
Pericarditis	1	0.4
Total	241	

cates use of either a right or left ITA as a graft. The ITA was used to bypass the LAD in 171 patients, and an SVG was used in 70 patients.

**Patient Follow-up**

Patients' physicians and cardiologists were contacted by mail and telephone, with very little response. Many physicians had died, and those who were retired did not have access to their patients' records. Physicians treating surviving patients were reluctant to provide clinical information because of the privacy rule under the Health Insurance Portability and Accountability Act.

The information in this report was primarily gained from reviewing clinical charts and reports, including 182 postoperative follow-up coronary angiograms. This review of records was augmented by personally interviewing 70 of the 74 patients alive in 2003. Surviving patients were well informed about their clinical status, additional studies, and procedures, including whether their original LAD bypass graft was functioning and which vessels required reintervention.

**Results**

There were 2 (0.8%) operative deaths. One occurred in a 45-year-old woman who had irreversible ventricular fibrillation 2 hours after the operation. Postmortem examination revealed undiagnosed left main coronary artery obstruction. The second death was due to an aortic dissection in a 68-year-old man who had an SVG bypass of the LAD.

Operative complications of the 241 patients are shown in [Table 2](#). Two patients had transient cerebrovascular ischemia. Superficial wound infections occurred in 5 patients. One patient had re-exploration for cardiac tamponade, and another had a wound dehiscence that required secondary closure. Sixteen patients experienced atrial fibrillation, and 16 other patients showed evidence of myocardial ischemia with S-T segment changes and myocardial enzyme increases.

The 16 patients who showed evidence of myocardial ischemia at the time of their operations were reviewed as a

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