

Modification of an Old Procedure (Vineberg) in the Stem Cell Era – a New Strategy?

Luís Alberto Oliveira Dallan, Luis Henrique Wolff Gowdak, Luís Augusto Ferreira Lisboa, Adriano Márcio de Melo Milanez, Fernando Platania, Luís Felipe Moreira, Noedir Antônio Groppo Stolf

Instituto do Coração – HCFMUSP, São Paulo, SP - Brazil

Introduction

Innumerable patients present with refractory angina despite optimized management whether with drug or surgical treatment. Currently, we are not uncommonly asked about the possibility of reintervention on patients that have already undergone several hemodynamic procedures, with repeated angioplasties and stent placement. Frequently, these patients have also already been operated on once or more times, some of them presenting with still patent although little effective grafts due to the diffuse pattern of their coronary diseases. Many of them show good left ventricular function, with high degrees of myocardial ischemia.

In this context, we have worked on replacing early techniques for more modern and alternative ones, or even on giving a new focus to original techniques^{1,2}, thus providing surgical solutions for previously unmanageable situations.

Objective

To propose a complement to the Vineberg procedure so that the internal thoracic artery is tunneled within the myocardium and also anastomosed distally to the coronary artery. This method seeks to surgically treat patients with severe and diffuse coronary artery disease for whom the chance of failure using direct graft flow is considerable. In view of this possibility, this technique would have the alternative of obtaining indirect myocardial perfusion through anastomoses at the microvasculature, as has already been well demonstrated in the past.

Methods

Two patients underwent surgery using this new technique proposed. Both had severe and diffuse coronary artery disease, with documented ischemia in the left ventricular (LV) anterior wall. Due to the severe degree of diffuse atherosclerosis in

the anterior interventricular branch (AIB) of the left coronary artery (LC), conventional surgical treatment of this region was not indicated. In one of the patients the AIB was apparently recanalized. The ages of the patients were 69 and 60 years, respectively, and both were males. Anterior thoracotomy was performed in both, with skeletonized dissection of the left internal thoracic artery (LITA). In one of the patients, two saphenous vein bypasses for branches of the right coronary and circumflex arteries were also performed. These patients were participating in the institutional stem-cell protocol. After being anesthetized, material was collected for cell preparation. Following LITA implantation, the material was injected in some left ventricular segments according to the protocol, excluding the anterior wall. Extracorporeal circulation (ECC) was used in one patient. Intraoperative flow measurement was performed in both patients at the following timepoints: with in situ LITA (LITA already dissected, but not yet distally sectioned); after distal section of the LITA (with its flow totally free through the sectioned extremity); and after it had been fully anastomosed to the coronary artery (both in the portion anterior to the tunneling and beyond its emergence in LV wall).

LITA implantation was performed with the help of a Swan-Ganz catheter introducer (Edwards LifeSciences). Through the introducer, it was possible to direct the tunneling with the guide wire, so that the LITA could enter into the myocardium in the upper portion of the LV anterior wall, passing under the second diagonal branch (equally affected by atherosclerosis), and emerging near the AIB. Immediately prior to this passage of the LITA inside the myocardial tunnel, two or more collateral branches were sectioned so that they presented significant active bleeding when they were positioned inside the muscle. In the absence of branches developed in the site, punctiform incisions were made in the artery with the tip of a size-11 scalpel blade. In one of the patients a side-to-side anastomosis of the LITA to the first diagonal branch could be performed before it was tunneled. The anastomosis of the LITA to the AIB was performed as usual, with a running suture with 7-0 polypropylene suture (Figure 1).

Results

The patients had a favorable postoperative outcome, with no significant electrocardiographic or enzyme level changes. No deaths occurred in this case series. The mean length of hospital stay was nine (5 to 13) days. One patient presented with fluid collection in the left hemithorax, requiring pleural redrainage, successfully done.

Key Words

Coronary Artery Disease; Myocardial Reperfusion; Myocardial Revascularization.

Mailing address: Adriano Milanez •

Rua Dr. Enéas de Carvalho Aguiar, 44 - Bloco II 2º Andar, Sala 11 -

05403-000 - Jardim Paulista - São Paulo - SP - Brazil

E-mail: milanez@secrel.com.br

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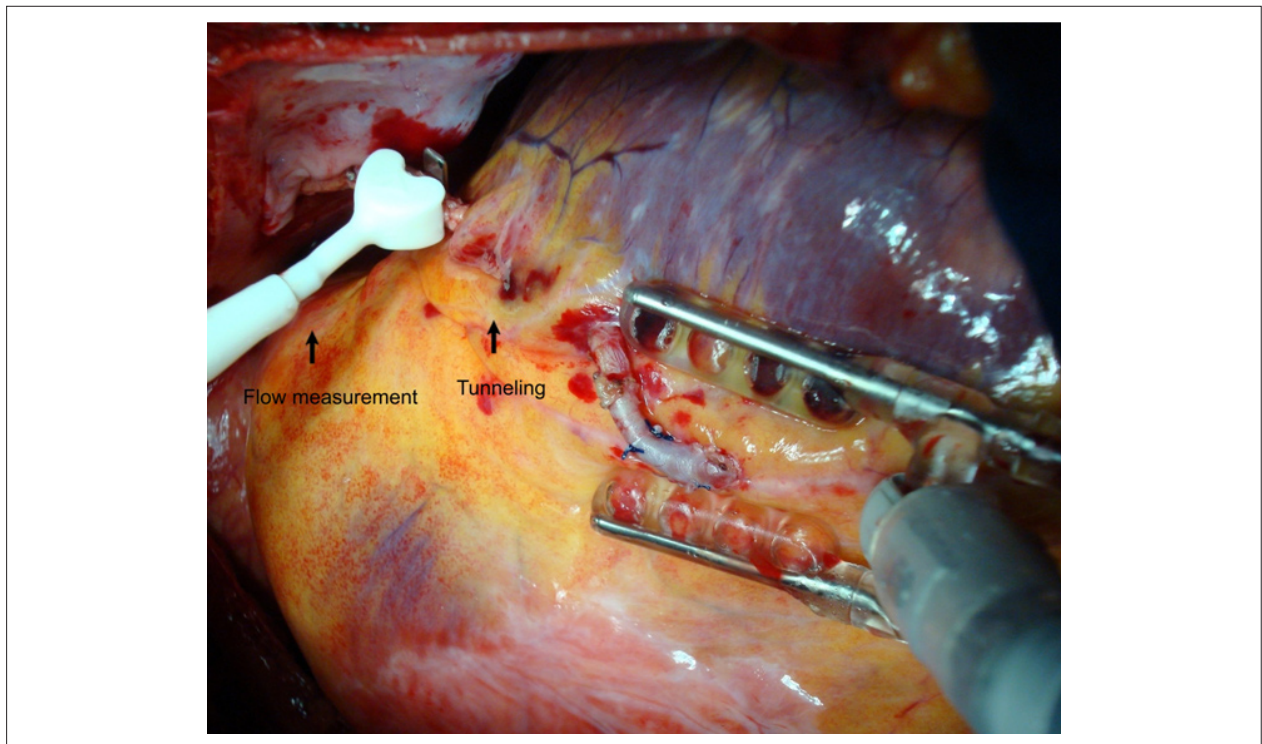


Figure 1 - Intraoperative aspect of the left internal thoracic artery (LITA) tunneled within the left ventricle and distally anastomosed to the anterior interventricular branch (AIB) of the left coronary artery. The flow measurement sensor and the stabilizer for off-pump surgery can also be observed.

Mean intraoperative flow measurements at the different timepoints showed:

- **Flow** – In situ LITA 32 (34-30) mL/min; “free” LITA: 226 (243-210) mL/min; LITA-AIB: 24.5 (27-22) mL/min.

- **Pulsatility index** - In situ LITA: 3.75 (3.6-3.9); “free” LITA: 1.3 (1.2-1.4); LITA-AIB: 4.4 (3.5-5.3) (Figure 2). After a postoperative period of approximately four months, both patients reported improved anginal symptoms (which were frequent prior to hospitalization).

Discussion

The Vineberg procedure³ was the first effective surgical intervention for the treatment of angina in patients with chronic coronary artery disease. In our midst, Lobo Filho et al recently suggested a new technical approach⁴ and demonstrated favorable results of the graft performance by assessing its patency by using current techniques⁵. Innumerable other studies also support the effectiveness of the method in generating new collateral circulation to the ischemic myocardium from the implantation of the internal thoracic arteries, even without their being directly anastomosed to the coronary artery^{6,7}.

We have unremittably sought options for the treatment of this selected group of patients. Within these methods, we point out transmyocardial laser revascularization, gene therapy, and the use of hematopoietic stem cells⁸.

Some patients are in borderline conditions to have their

coronary artery receive a vascular graft. A deeper analysis of the coronary angiography of these patients showed that in a significant number of them the AIB is slightly contrasted, and this impairs the estimate of its real diameter. In such cases, surgery is usually contraindicated in most of the cardiac surgery services.

Obviously, to put the proposed distal anastomosis of the LITA to the AIB into practice a minimum lumen in the AIB is fundamental, even if it is recanalized. For these patients, precisely, we are proposing a method that can accomplish these objectives: we are offering an opportunity, although possibly not ideal, but one that permits graft function. On the other hand, as a plausible alternative in the case of acute or progressive graft obstruction resulting from a difficult distal flow beyond the anastomosis, there would be the possibility of development of anastomoses between the LITA and ischemic coronary branches, as proposed by Vineberg and confirmed over the years^{6,9}.

The analysis of the intraoperative flow measurement ensures us that this tunneling is not, at least in this initial phase, a constriction that could work as an “intramyocardial bypass”. We also verified that the use of the Swan-Ganz introducer device provided a comfortable tunnel for the LITA to be placed without being compressed, given its easy mobilization within the myocardium after implantation.

After the excitement at the initial results, this therapeutic proposal should be further analyzed with a follow-up and functional tests, as well as with studies providing more clinical evidence, such as randomized clinical trials.

Brief Comments

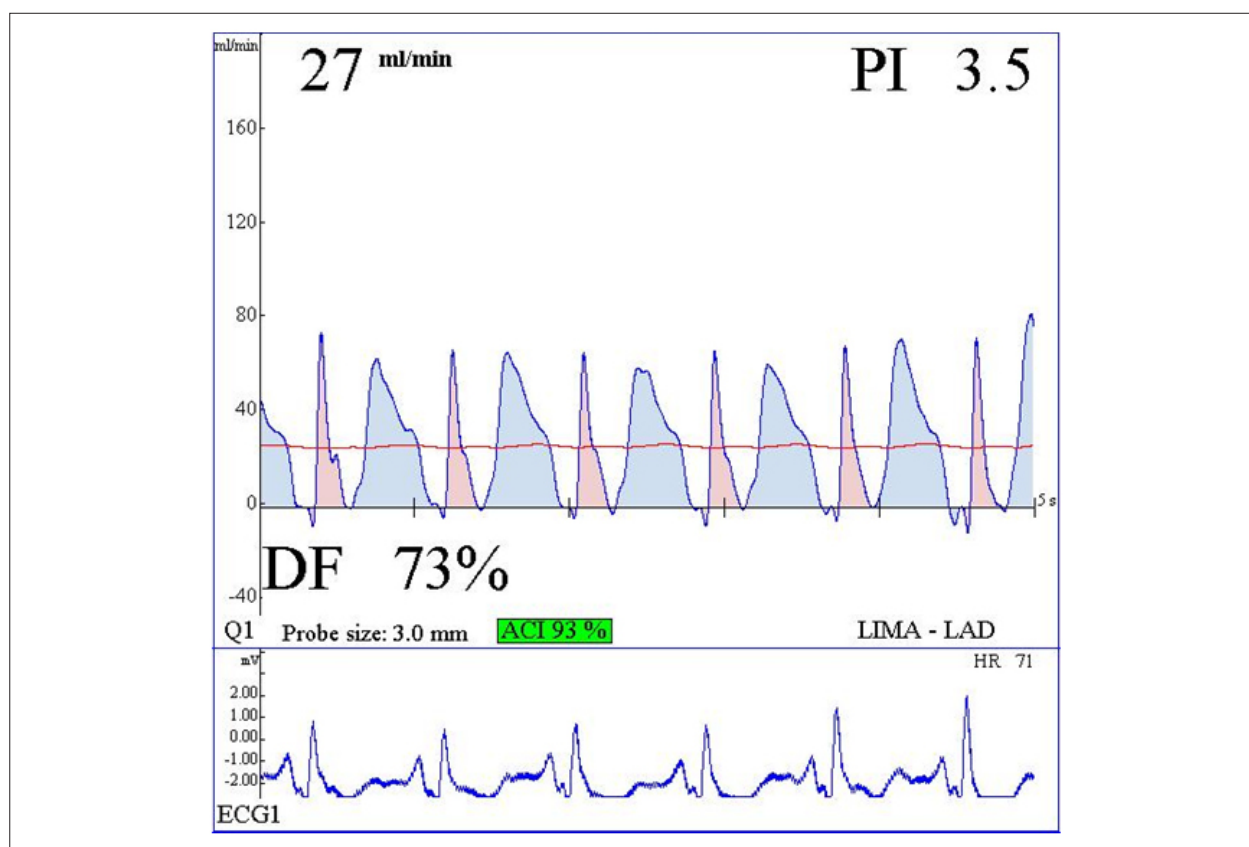


Figure 2 -Intraoperative flow measurement of the left internal thoracic artery (LITA) tunneled within the left ventricle and already anastomosed to the anterior interventricular branch (AIB). Predominance of the diastolic flow (in blue) in relation to the systolic flow (in pink) can be observed.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Sources of Funding

There were no external funding sources for this study.

Study Association

This study is not associated with any post-graduation program.

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