

Steal Syndrome Documented by Transit Time Flow Measurement Technique in an “H” Graft

(#1999-53859 ... July 24, 1999)

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INTRODUCTION

Coronary artery revascularization on the beating heart is gaining popularity since the initial report by Benetti et al. [Benetti 1985]. We have performed these procedures in more than 1,200 patients and have successfully used transit time flow measurements (TTFM; Medi-Stim AS, Oslo, Norway) to document graft patency. Properly performed TTFMs are used to revise questionable grafts [D’Ancona 1999]. In 1998, Cohn et al. and Coulson et al. introduced the “H” or “T” graft for elderly patients and redo operations for revascularization of the left anterior descending (LAD) [Cohn 1998, Coulson 1998]. It is still not known if there is a potential steal syndrome via an intact distal internal mammary artery (IMA) after construction of the “H” graft. We herein report intraoperative evidence of “steal syndrome” which was corrected by

ligation of the distal IMA in a patient who had a newly constructed “H” graft.

CASE REPORT

A 78-year-old patient, who had undergone two previous coronary artery bypass grafts using cardiopulmonary bypass, was presented with unstable angina (Canadian Cardiovascular Society class 4). Coronary angiography revealed a severely stenotic saphenous vein graft to the LAD, patent graft to the diagonal, and ungraftable vessels in the right and circumflex systems. Both ventriculography and echocardiography demonstrated an ejection fraction of 30% with anterior and apical akinesia. In light of two previous coronary bypass operations via median sternotomy, he was considered an ideal candidate for an “H” graft to the LAD.

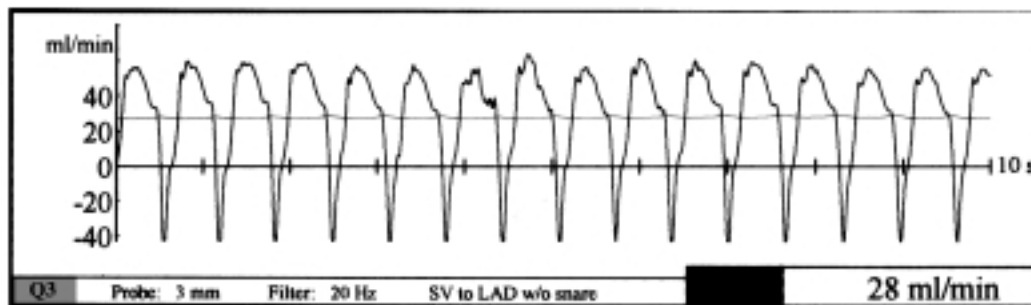


Figure 1. Flow pattern by TTFM demonstrating flow in the “H” graft with a bulldog placed distally on the LIMA. Note that the mean flow is 28 ml/min and is mostly diastolic.

Submitted on July 22, 1999; accepted July 24, 1999.

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Via a left anterior thoracotomy, an “H” graft was constructed in a standard manner, as described by Cohn et al. [Cohn 1998], using a segment of saphenous vein. Following completion of the “H” graft, a bulldog was placed on the left internal mammary artery (LIMA) distal to the “H” graft and TTFM was then measured in the venous bridge segment to the LAD. The flow pattern demonstrated good diastolic flow with a mean value of 28 ml/min (see Figure 1 ☉). After removal of the bulldog, the pattern remained unchanged but the mean flow was reduced to 11 ml/min (see Figure 2 ☉). Final measurements with the bulldog placed proximal to the “H” graft on the LIMA demonstrated reversal of flow from the native LAD into the distal LIMA via the “H” graft with a mean reversed flow of 8 ml/min. The reversed flow is expressed as a negative value (see Figure 3 ☉).

DISCUSSION

Our vast experience with beating heart coronary revascularization has demonstrated that the “H” graft technique is ideal for patients with advanced age or redo status with disease limited primarily to the LAD. Until this report, flow through the intact distal LIMA after creation of the “H” graft was surmised as a theoretical possibility. To our knowledge, this is the first documentation of the potential “steal” syndrome via an intact distal LIMA after construction of an “H” graft. Although it is uncertain that reversed flow is clinically significant, this experience suggests that the distal LIMA should be ligated after creation of an “H” or “T” graft.

REFERENCES

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REVIEW AND COMMENTARY

1. Editorial Board Member SC389 writes:

This is a very timely case report. I would like to have a description of the actual probe placement. 1) Is it necessary to dissect more LIMA to be able to place the probe? 2) Would it also be appropriate to measure the flow in the graft with the proximal LAD occluded to be sure that the flow in the graft was really going distally in the LAD and not just proximally? 3) Is this the approach that the authors take for all redo LAD-only revascularization? In view of their vast experience in beating heart surgery, it would benefit us to know why they did not perform a standard MIDCAB LIMA-LAD anastomosis.

Authors’ Response by Hratch L. Karamanoukian, MD:

1) Adequate measurement by the TTFM technique requires good contact between the probe and the vessel. We routinely skeletonize a 2cm segment of the LIMA and use aquagel in order to maintain good contact between the flow probe and the LIMA. It is very important to get an ideal size fit between the probe and the vessel and several different flow probes sizes are available for this reason. Furthermore, it is essential to maintain the flow probe perpendicular to the vessel during TTFM.

2) We routinely snare the proximal coronary artery and obtain TTFM with and without snaring. In this case, the patient had severe stenosis of the proximal LAD, and as well, severe stenosis of the saphenous vein graft to the LAD. When the proximal LAD was occluded, the antegrade flow through the “H-graft” was 11 cc/min. This increased to 13 cc/min when the proximal LAD was not snared.

3) We believe that the standard MIDCAB or LAST operation is preferable over the “H-graft” in the majority of

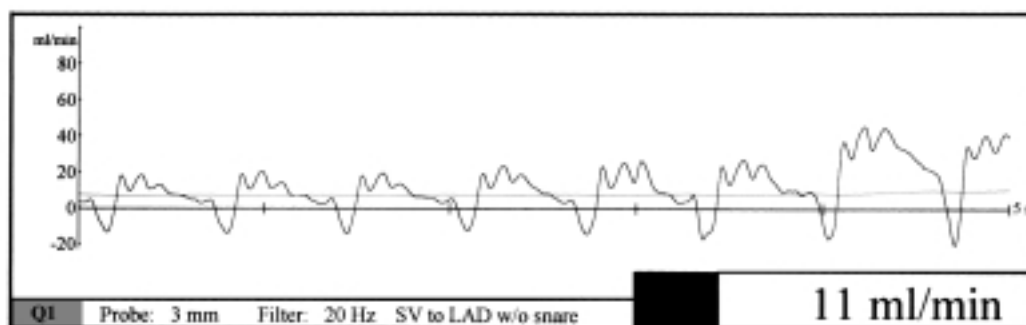


Figure 2. Flow pattern by TTFM after removal of the bulldog from the distal LIMA. Note that flow remains mainly diastolic but is reduced to 11 ml/min.

patients because it requires a single anastomosis and the exclusive use of an arterial conduit. Because the “H-graft” requires two anastomoses, it is theoretically less desirable. However, the minimal dissection required for the “H-graft” operation makes this an ideal operation for high risk patients, especially the elderly redo patients.

2. Editorial Board Member AR11 writes:

Would the authors care to speculate if interposition of a

segment of valved saphenous vein would prevent arterial steal?

Authors’ Response by Hratch L. Karamanoukian, MD:

Theoretically it would. But ligation of the distal LIMA should also prevent the “steal phenomenon.”

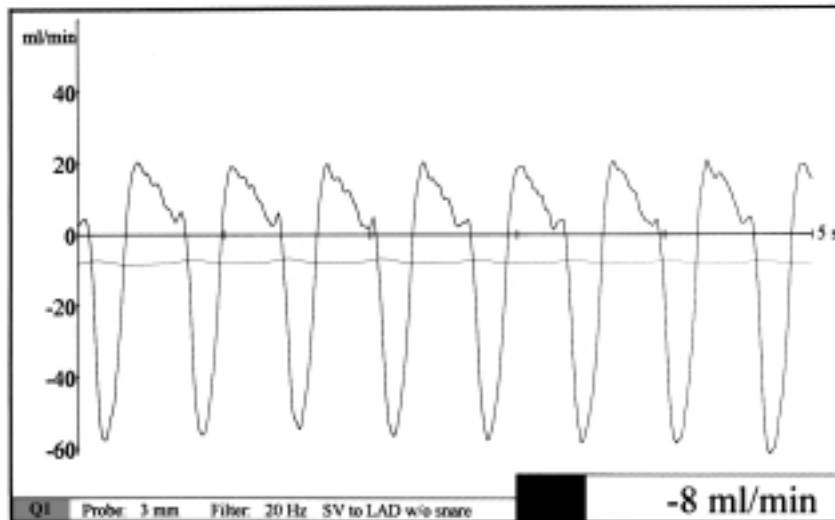


Figure 3. Flow pattern by TTFM with bulldog placed proximally on the LIMA. Note that flow is reversed with mean value of -8 ml/min, indicating steal from the coronary artery into the distal LIMA.