

# **HOW TO RECYCLE A MISUSED LEFT INTERNAL THORACIC ARTERY:**

## **TIPS AND TRICKS**

Short Running Title: Graft reuse for revascularization

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**ABSTRACT (max 150)**

In this case report we describe how to recycle the Left Internal Thoracic Artery (LITA) when misused but not damaged. 8 years after a Left Anterior Small Thoracotomy followed by LAD stenting for STEMI in 1<sup>st</sup> post-operative day, a 67 years old woman had a NSTEMI with angiographic evidence of intra-stent re-stenosis with a perfectly patent LITA, harvested only from the 4<sup>th</sup> to the 6<sup>th</sup> intercostal space. During redo surgery, LITA was harvested as a pedicle from the anastomosis to the 4<sup>th</sup> intercostal space and primarily from the 1<sup>st</sup> to the 4<sup>th</sup> intercostal space. Special attention was paid at the level of the 4<sup>th</sup> intercostal space where the vessel was stuck to the sternum: a 15 blade was used being scissors or cautery too dangerous. At the end of harvesting, the LITA was full-length available for a new coronary anastomosis on LAD, distal to the previous one.

## **INTRODUCTION**

Left Internal Thoracic Artery (LITA) is the gold standard for Left Anterior Descending artery (LAD) revascularization about long-term patency [1]. When misused but not damaged, LITA can be still considered as a graft, in case of redo surgery. In this manuscript we describe how to recycle LITA after a previous Left Anterior Small Thoracotomy (LAST) operation [2].

## **MATERIALS AND METHODS**

IRB approval, consent statement, clinical trial registration: N/A

A 67 years old woman came to our attention for non-ST elevation myocardial infarction. Her comorbidities were: arterial hypertension, active smoking and diabetes mellitus. Eight years before she had undergone a LAST operation, complicated by ST-elevation myocardial infarction in the 1<sup>st</sup> post-operative day, due to LAD occlusion distal to anastomosis, that was treated with LAD direct stenting. The coronary angiogram showed intra-stent re-stenosis on LAD; the LITA was perfectly patent and looking at the vessel course it was evident that it had been harvested only from the 4<sup>th</sup> to the 6<sup>th</sup> intercostal space (see Supplemental Video 1). During the 8 years after the first surgery the patient developed also circumflex coronary artery disease and severe aortic stenosis. The patient was scheduled for dual Coronary Artery Bypass Grafting (CABG) and aortic valve replacement. We decided to use the saphenous vein for the marginal branch and to recycle the partially harvested LITA for the LAD. After median sternotomy, adhesions were lysed and the pericardium was opened so that we could identify the LITA-LAD anastomosis. The LITA was first harvested as a pedicle from the coronary anastomosis to the 4<sup>th</sup> intercostal space and then primarily from the 1<sup>st</sup> to the 4<sup>th</sup> intercostal space: in this tract the vessel still appeared in its original anatomical position, following its normal course. Special care was used at the level of the 4<sup>th</sup> intercostal space, the LITA hinge point, where the vessel was stuck to the sternum: a 15 blade was used to separate the arterial graft from the internal chest wall, being scissors or cautery too dangerous for the purpose (see Supplemental Video 2).

## **RESULTS**

After harvesting, the LITA was completely undamaged and full-length available for a new coronary anastomosis. First of all, a composite Y-graft between LITA and saphenous vein was achieved. Cardiopulmonary bypass was then started, the ascending aorta cross-clamped and the anastomosis between the saphenous vein and the marginal branch performed. After that, LITA was detached from the previous anastomosis on the LAD and its distal part was cut because of vessel wall thickening; flow was checked and found excellent. After closure of the previous anastomotic site, an incision was made on the LAD two centimeters distally to the previous anastomosis; A 1.2 millimeters coronary probe showed a perfect patent distal LAD and a proximal stop corresponding to the previous anastomotic site. LITA-LAD anastomosis was then performed using a 7/0 polipropilene suture. Finally, the aortic valve was replaced with a bio-prosthesis number 19.

## **CONCLUSIONS**

Partial LITA mobilization (harvesting of a 4-5 cm portion) has been proposed during LAST operation in order to avoid costal cartilage excision and reduce post-operative pain due to intercostal nerves damage [2]. Nevertheless, this procedure shows a few critical disadvantages because the partial harvested LITA can take an uncorrected course. The free segment is usually short and the graft appears as a straight line between the chest and the coronary anastomosis (Figure 1) with possible hypo-perfusion of the LAD due to the acute LITA angle along its course. Moreover, an excessive graft tension is possible during lungs expansion, with potential dreadful consequences.

Redo CABG can present the issue of graft availability. LITA recycling can be a valid option, assuming that two conditions are met: first of all, LITA must be uninjured; secondarily LAD must present stenosis only in the peri-anastomotic area [3]. This procedure is technically

demanding but gives to the patient all the advantages of LITA long-term patency. Follow-up at mid and long term after LITA recycling shows good results [4].

In conclusion, we can affirm that LITA recycling should be considered a good option in redo patients when the former operation was a LAST procedure with partial LITA harvesting and presence of isolated peri-anastomotic LAD stenosis, if the vessel is uninjured certainly. In fact, as described by Calafiore [2], usually the artery has been harvested only for a short segment (4-5 cm) from the inferior border of the third intercostal space up to the superior border of the fifth costal cartilage.

The coronary angiogram must be carefully analyzed before LITA recycling in order to identify the length of previous LITA harvesting: the shorter the harvesting, the easier will be the recycling procedure.

We underline the importance of a complete LITA harvesting during a left mini-thoracotomy approach. A full-length harvested LITA allows also the creation of a composite graft to bypass the obtuse marginal branches and/or the posterior descending coronary artery, for a complete no-touch aorta revascularization through a minimally invasive incision [5].

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## **LEGENDS**

### Figure 1

LITA course and harvesting.

Panel A: normal course of LITA and relationship with internal thoracic wall.

Panel B: LITA partial harvesting, as in LAST operation.

Panel C: full-length LITA harvesting.

LITA: Left Internal Thoracic Artery; LAST: Left Anterior Small Thoracotomy.

### Supplementary Video 1

Coronary angiogram showing intra-stent re-stenosis and a partially harvested patent LITA.

LITA: Left Internal Thoracic Artery.

### Supplementary Video 2

LITA harvesting and recycling.

LITA: Left Internal Thoracic Artery.