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# The positioning of the internal thoracic artery extra-pleural and perihilar in coronary artery bypass grafting

## *Trajeto extrapleural, para-hilar da artéria torácica interna esquerda pediculada nos enxertos coronarianos*

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*Abstract*

**The positioning of the internal thoracic artery extra-pleural and perihilar in coronary artery bypass grafting to avoiding anterior aderences and prevent unnecessary damage arterial.**

***Descriptors:*** **Myocardial revascularization. Internal mammary-coronary artery anastomosis. Coronary artery bypass/methods.**

*Resumo*

**Variante técnica relacionada ao posicionamento da artéria torácica interna esquerda pediculada extrapleural e para-hilar, evitando aderências ao mediastino anterior e protegendo o enxerto de possíveis lesões durante eventuais reoperações.**

***Descritores:*** **Revascularização miocárdica. Anastomose de artéria torácica interna-coronária. Ponte de artéria coronária/métodos.**

## INTRODUCTION

The left internal thoracic artery (LITA) is considered the "gold standard" in relation to patency compared to other allografts. The technical improvement and improvement of socioeconomic factors have provided increased survival of patients undergoing coronary artery bypass grafting (CABG), thus making them subject to new thoracotomies for neorevascularizations or corrections of other cardiosurgical comorbidities. The reoperation procedures are at higher risk of complications and accidents, among these, the lesions of grafts.

The position adopted by the LITA in the chest cavity can have a direct influence on the immediate and late

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| Abbreviations, acronyms and symbols | |
|---|---|
| **LITA** | Left internal toracic artery |
| **CPB** | Cardiopulmonary bypass |
| **CABG** | Coronary artery bypass grafting |
| **ICU** | Intensive care unit |

complications. Belatedly, substernal adhesions may include graft, making it vulnerable to various types of trauma during reinterventions.

Any new lesions during thoracotomy led the authors to use a simple, easily reproducible, in which the LITA is positioned in extrapleural and posterior perihilar position, in order to keep it along the mediastinum, protected by the surrounding structures, avoiding most these complications.

The LITA originates from the first portion of the bottom edge of the left subclavian artery in 90% of cases. The phrenic nerve crosses above the emergence of mammary about 70% of cases, the rest intersects the posterior region toward the pericardium [1]. Initially, it rests on the pleural anterior and apical region, directed to the inner chest wall and behind the upper six costal cartilages, inner intercostal muscles and lateral to the sternal border. Across the path, close contact with the parietal pleura is maintained until it is covered in the distal segment by the transverse muscle of the chest. The main branches of the LITA are pericardiophrenic, intercostal and perforating arteries. It ends on the sixth intercostal space, dividing, in most cases, into two terminal branches, the superior epigastric and musculophrenic arteries.

A careful dissection of the artery, preventing heat transfer by electrocautery and bruising, branches ligation causing constrictions and reduced handling are important measures to preserve its patency. Likewise, proper positioning, avoiding kinks, angulations, compression and stretching, is an important addition to its patency [2]. Anastomoses with more appropriate wires and needles and better understanding of the hemodynamic changes resulting from lesions in native vessels have given researchers subsidies to provide an approach that aims to maintain a longer patency of these grafts. These observations have contributed to reducing failures of the procedure and hence the number of reoperations [3].

The reoperations present additional risk for complications. Coltharp et al. [4] reported an incidence of approximately 5% (5/97 cases) of arterial lesions during reoperations in procedures in which the LITA was used previously. Currently, through angiotomographic assessments, we have studied the anterior mediastinum and the location of the grafts over the rib cage, establishing risk criteria, enabling an addressed surgical programming with more mitigated risk [5].

## TECHNIQUE DEVELOPMENT

The techniques used for the detachment of the LITA have evolved substantially with the modernization of equipments that allow its better exposure and, in particular, dissectors that provide more effective and localized energy.

The most widely used technique in dissection of the LITA is the wide opening of the parietal pleura adjacent to its path, freeing the bed with branches ligation and pleuropericardial fenestration anterior to the phrenic nerve, to allow its access to the pericardial cavity.

The LITA dissection by maintaining the pleural integrity is more elaborated and susceptible to greater degree of complications, especially when the artery has limited length, which makes it more vulnerable to stretching during breathing movements and, belatedly, to substernal adhesions.

More recently, it has been reported dissection of the LITA with preservation of pleural integrity through robotics techniques [6]. Although promising, is still impractical in many centers, due to the equipment costs and training reproducibility.

The concern to preserve pleura without compromising the efficiency of the graft is what led us to seek methods that ally safety and proper positioning, thus avoinding immediate and late complications inherent to the technique.

## SURGICAL TECHNIQUE

The technique employed consists of the lateral and careful displacement of the parietal pleura adjacent to LITA exposing its entire path. The artery dissection is performed encompassing all the perimammary tissue “no touch” between two parallel incisions. All branches are clamped, cut and mammary initially kept in bed until the establishment of cardiopulmonary bypass (CPB).

The pericardium was opened longitudinally, the great vessels and the heart are exposed. Thus, the making of purses for installation of CPB is performed, when used, followed by heparinization.

The pleura was kept intact and the preparation of the path is performed by tracting the left pericardial edge exposing its fat along the pleural reflection that is displaced. The release of the pericardium from the pleura is easily accomplished by countertraction of the pleura, which lies adhered by thin strands of loose connective tissue (Figure 1). The release of the pleura is performed toward the pulmonary hilum and anterior to the phrenic nerve, directed to the pericardium in the aorta. In this region and more posteriorly, the fat side of the mediastinum is loose and is in continuity with the apex of the pleural region.

The proximal segment of the LITA lies on the pleura, which should be carefully moved, freeing up the vase. The region below the subclavian vein is filled by fatty tissue in continuity with the apical pleura and easily divulsed toward the mediastinum, building up a bed for a new path of the LITA. The fat attached to the mediastinum in continuity with the area of pleuropericardial dilatation should preferably be tunneled or sectioned for passage of the graft (Figure 2).

After the distal section of the LITA, its flow is assessed and the end is clamped. The artery is carefully moved through the apicopleural region under the mediastinal fat, so as to position itself along the divulsed region. It is performed an incision in the pericardium in the projection of the left atrium and through this, the LITA reaches the pericardial cavity (Figure 3).

The length of the graft fits easily to revascularizations proposed, including exposure of the intermediate segments for use in sequential anastomosis or in addition to pedicled graft.

At the end of the operation, the LITA lies comfortably on the epicardium, providing a suitable length to bypass of one or more vessels (Figure 4).

This technique allows the pericardium can be approximated together with the all remaining thymic tissue being LITA protected, extrapleural, perihilar, supported on the mediastinum without prior contact with the tissues and the inner surface of the chest wall.

In any angiographic studies, LITA in this position presents proper positioning and flow. An observational assessment is that the preservation of pleural integrity has facilitated weaning from the respirator, reduced length of stay in the intensive care unit (ICU), substantial reduction of pain complaints by patients and the positioning of the LITA is also a better determinant of graft patency during this period.

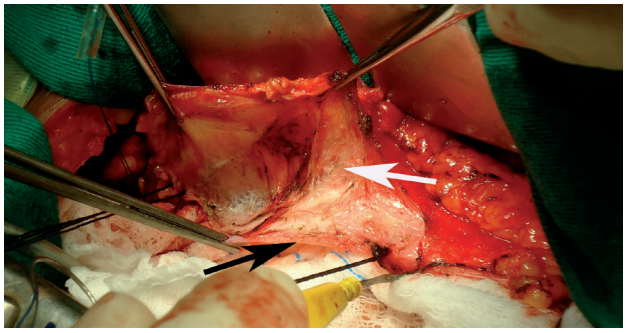

*Fig. 1 - Pleuropericardial divulsion: release of pericardial pleura (black arrow), undoing pleuropericardial adhesions (white arrow)*

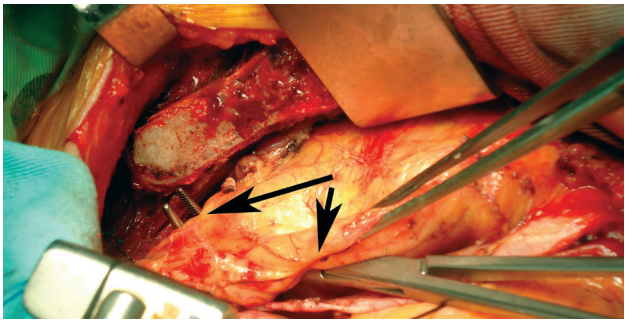

*Fig. 2 - Tunneling of mediastinal fat (arrows)*

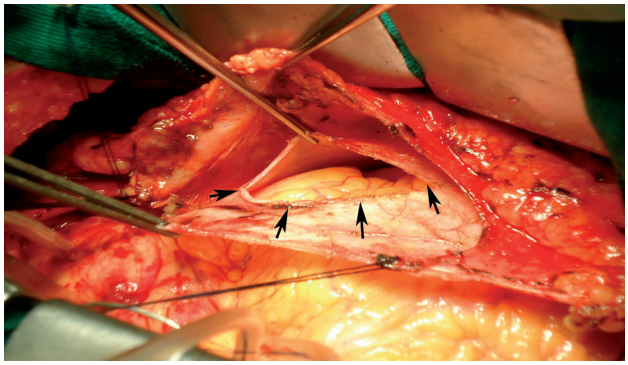

*Fig. 3 - Pericardial fenestration (arrows)*

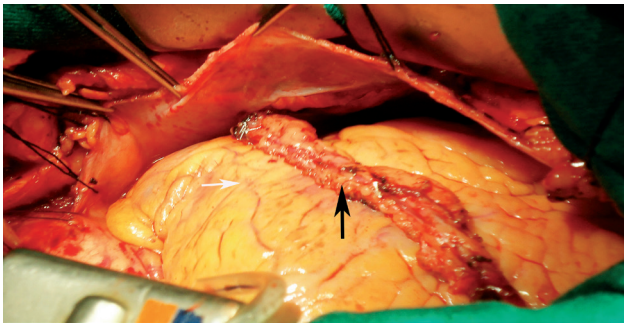

*Fig. 4 - LITA (black arrow) positioned on the epicardial bed (white arrow)*

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