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## MINI OPCABG

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Additional information is available at the end of the chapter

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### 1. Introduction

The majority of the worldwide Coronary surgery typically requires exposure of the heart and its vessels through median sternotomy and cardiopulmonary bypass, making it one of the most invasive and traumatic aspects of open-chest surgery.

Trying to decrease the risks of the CABG and its costs, in 1978 we repopularized the Off Pump Coronary Artery Bypass Graft (OPCABG) [1-2] and expand the technique, addressing lesions of the circumflex system (Cx) and applying it to diverse clinical scenarios. We tested several surgical approaches, such as full sternotomy, including left, anterolateral, posterolateral and right anterolateral thoracotomies, as well as partial sternotomy [3].

The video – assisted techniques in the nineties allowed, for the first time, to dissect the left internal thoracic artery (LITA) without opening the pleura cavity. The LITA was anastomosed to the left anterior descending (LAD) through a small left anterior thoracotomy. [4-5-6] and a new method for coronary bypass was create [7].

From 1996, a new series of technological developments allowed, widespread application of the OPCABG and MIDCAB techniques surgeons to perform high quality reproducible anastomoses and demonstrate in the great majority of reports, a decrease in postoperative morbidity [9-16].

In 1997, we performed for the first time an ambulatory coronary bypass through a xiphoid lower sternotomy incision (MINI OPCABG) using 3D technology to assist in the operation [8], shortly after we would continue to expand the operation [17-18].

Here in this chapter we will describe the technique to perform the MINI OPCABG operation today in our institution.

## 2. Anatomical considerations

The work area anastomosis is generally from the fourth intercostal space down (Fig. 1).

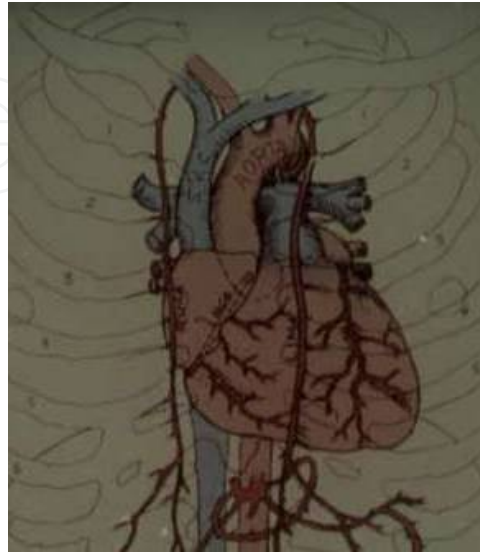


Figure 1.

The relationship between breast and distance to the coronary arteries or the anastomosis potential place can be estimated preoperatively with different imaging techniques. With a simple chest radiograph, you can also estimate the distance from the tip of heart to the midline sternum, important factor in concordance with the anatomical variations of the thorax. In the Fig. 2 you can see an ideal case where you are able to access any territory of the heart with this incision.



Figure 2.

### 3. Technique

The patients are prepared as for standard coronary bypass operation through medium sternotomy.

A skin incision is made from the xiphoid up to the level between the third and fourth intercostal space (Fig 3).



**Figure 3.**

The sternum is open and the left table is lifted to dissect the left mammary artery.

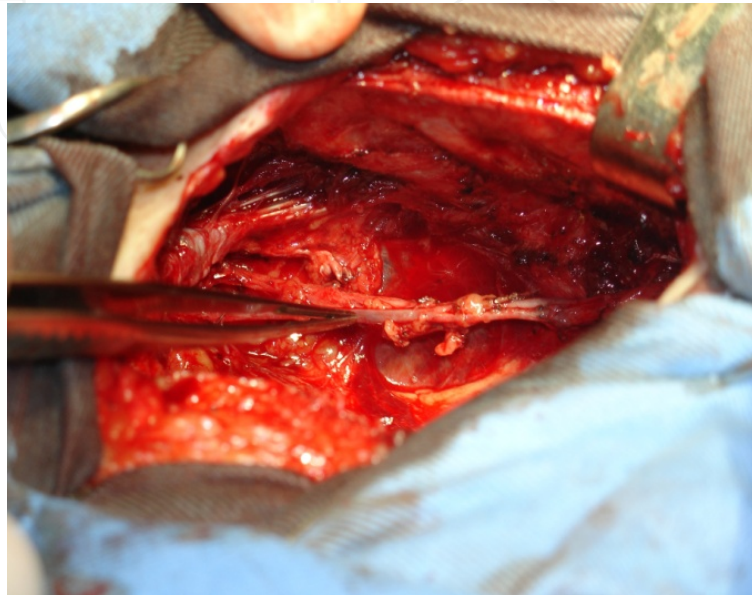
In the majority of the operations, we used a part of a normal Lima retractor. In the last patients we created a new prototype retractor that allows to potential perform a more friendly operation (Fig.4). The left mammary was dissected up to the third intercostal space, in general around 7 to 10 cm. isolated without the veins. It is important that the angle of the superior part where the mammary is attached to the sternum has to be below 20° to avoid any potential kinking. After the dissection was completed, (Fig.5), if the operation is only left internal mammary to LAD, we would heparinized the patient with 3mg/kg to maintain ACT more than 480 sec.

When the ACT is more than 480 sec. and the patient has a normal temperature we would cut the distal part of the left internal mammary 1cm approximately from the distal bifurcation. The mammary distance is measured first with the pericardium intact, if achieved the diaphragmatic reflect of the pericardium it means that the length of the mammary is correct to perform a graft, also in the most distal segment of the LAD. After the pericardium is cleaned to identify the area of the pulmonary artery, the pericardium is open to the apex and towards the right around 5 to 6 cm., initially in that moment in most of the cases the area of the LAD is seen and the potential area of the anastomosis is defined, the distance with the heart, in normal position of the mammary, is measured to be sure there is not any potential kinking do to excess of the conduit. The retractor is changed (in the last 6 cases we used a new prototype system where you only change the angle without changing the piece) (Fig.4), the pericardium

was opened towards the right side of the aorta and a piece is taken avoiding any compression of the great vessels. 2 stitches are put around 2 cm. deep in the left border of the pericardium with a distance of 5 to 7 cm and lifted to position the LAD area. After that a Polypropylene 5-0 is put around the artery in the area we decided to perform the anastomosis, also a mechanical stabilizer is always in position in this place with the opening part towards the head of the patient to avoid any problem of damaging the graft when you need to take it. The anastomosis is performed in a running way with 7 or 8 polypropylene depending on the size of the artery. We didn't use shunt, normally except if the artery has more than 2,5 mm in size and has a very proximal occlusion.or the clinical situation require We used blower only in the moment we needed to visualized correctly the border of the artery, we tried to avoid the use of the blower directed to the mammary, also syringe with warm water is used to help and to maintain the temperature of the heart. When the bypass is finished and before we tied the suture, the stitches of 5-0 polypropylene around the artery where released as well as the clamp of the mammary, finally the anastomosis was tied.



Figure 4.



**Figure 5.**

The mechanical stabilizer was removed, the stitches of the pericardium were released and the flow of the graft was measured being sure there is not any kinking, if the flow and the PR are ok the mammary is fixed with 2 stitches of 7-0 polypropylene in both sides around 1 cm from the anastomosis.

The heparin was reverted with protamine. If the pleura was closed one drainage is positioned avoiding touching the heart and the graft. If the left pleura was opened the drainage is positioned in the left pleural space with two holes in the mediastinum area and one stitch is done between the pleura and the back of the sternum to separate the drainage from the area of the graft to avoid any damage and the sternum is closing in a normal way with less numbers of sutures.

In case we need to perform more grafts after the left internal mammary was prepared, we put the mammary retractor in the right size of the sternum and take a piece of a right mammary and perform an anastomosis (fig. 6), with a non touch vein or radial artery to perform the others grafts. In this situation after both conduits were prepared the retractor is changed and the heart is exposed opening the pericardium in the same way previously described in the mammary to Lad graft. (fig7)

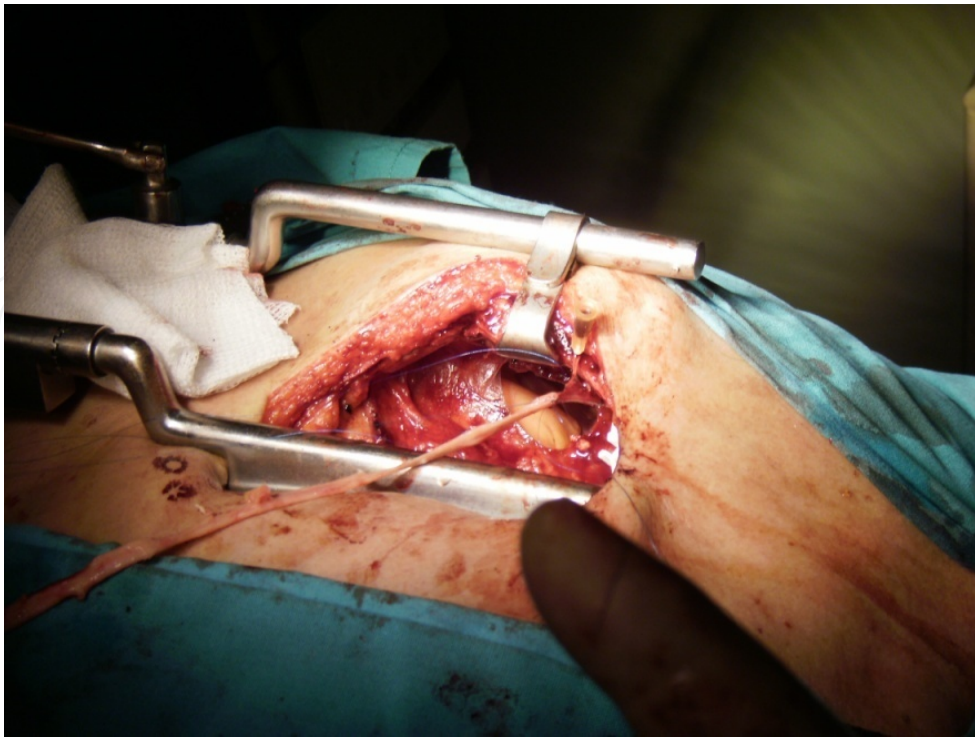


Figure 6.

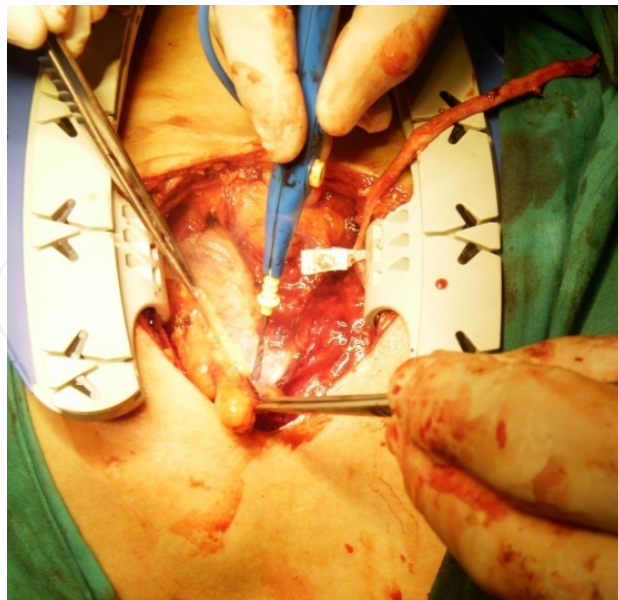


Figure 7.



**Figure 8.** Patient four coronary grafts next day after operation.(ideal candidate )

If the patient is stable and need Cx graft and it is possible we put any suction cusp in the apex to expose the heart and vessels then using always mechanicals stabilizers we perform the anastomosis. After the Cx we perform the right and the LAD, last [18], if the patient because the clinical conditions require, we completed the mammary to LAD first and then the rest of the operation. Is important to notice that the heart is not touch in any moment only you require to do it when you need to put a suction cusp in the apex.

The incision is closed in the same way (Fig.8). In hybrid procedures, the operation where performed first MINI OPCABG (Mammary to LAD) and after a period of 8 hours we perform angioplasty Stent. In table 1 and 2 we see the characteristics of the patients, and in Fig 9-10-11- the different grafts we already performed in this group of patients.

Patient Characteristics	Value
Number of patients	55
Average age (years)	66.0 ± 8.3
Female gender	9(16.%)
One-vessel disease	24 (43%)
Two-vessel disease	12 (22.%)
Three-vessel disease	17 (31%)
Left main trunk disease	2 (4.0%)
Hypertension	35 (64%)
Lipid disorders	37 (67.0%)
Diabetes mellitus	14 (25%)
Smokers	21 (38%)
Aspirin preoperatively	17 (31%)

**Table 1.** MINI-OPCABG: long term results.



Previous myocardial infarction	21 (38.0%)
Previous catheter intervention	6 (11.0%)
Peripheral vascular disease	5 (9%)
Chronic obstructive pulmonary disease	8 (15%)
Previous renal disease	1 (2%)
Previous stroke	1 (2%)
Critical preoperative state	3 (5.0%)
Moderate to severe left ventricular function	7(13%)
Asymptomatic	6 (11.0%)
Stable chronic angina	17 (31.0%)
Unstable angina	32 (58.0%)
Myocardial Infarction	1 (2%)
Recent myocardial infarct	3 (5%)
Emergency operation	2 (4.0%)
Other than isolated CABG	1 (2.%)
Average Euroscore	3.4 ± 1.4
Previous CABG	2 (4%)
Preoperative Death	0.0 (0%)
Exploration for bleeding	1 (2.%)
New onset atrial fibrillation	1 (2.%)
Pleural effusion	1 (2.%)
Ventilation more than 24 hours	2 (4.0%)

Table 2.

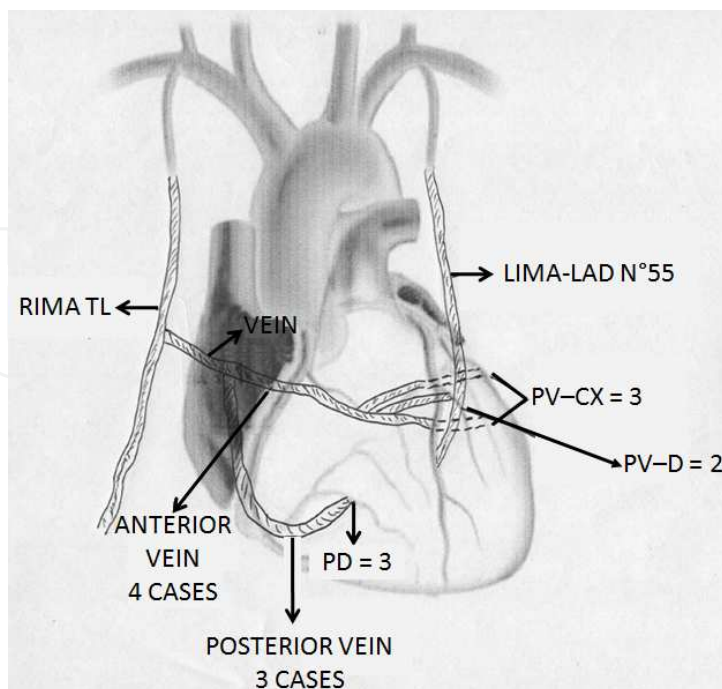


Figure 9.

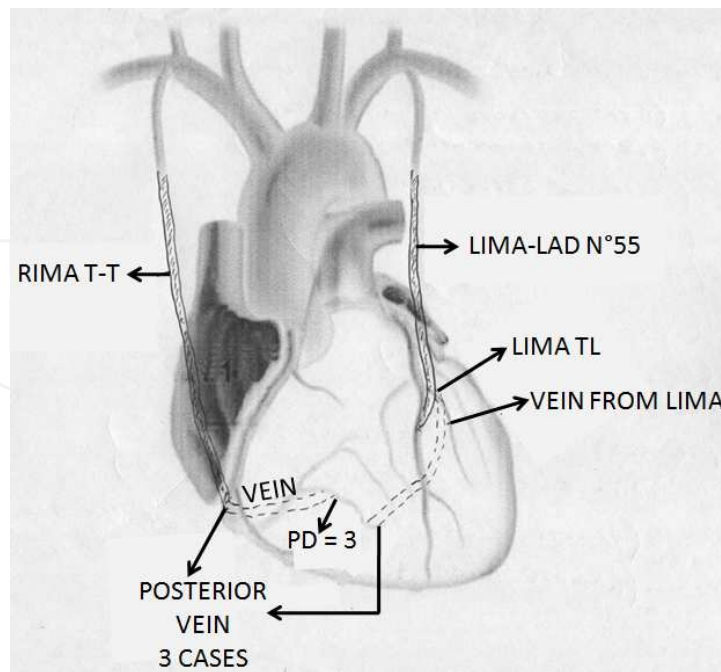


Figure 10.

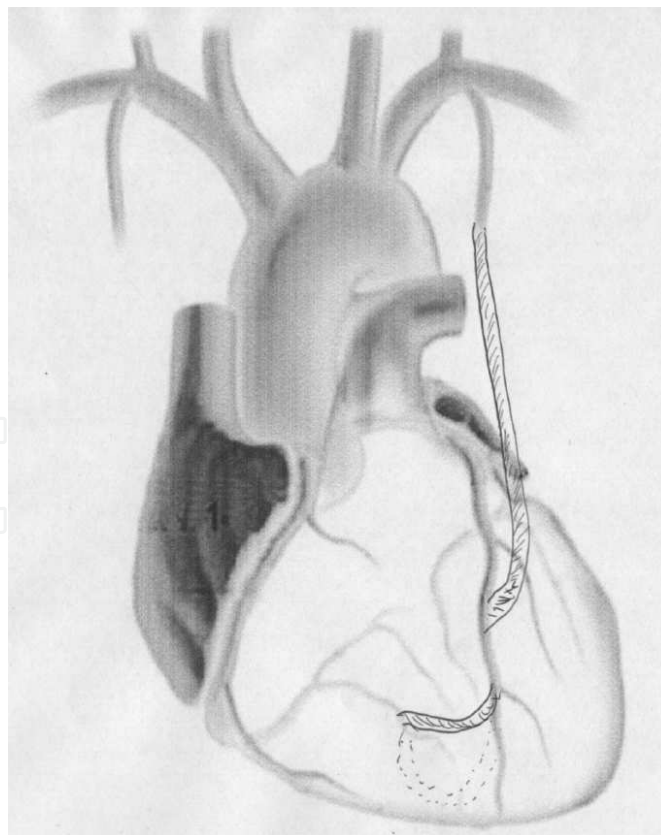


Figure 11.

## 4. Results

We didn't have operative mortality in this series of 55 Patients.

Two Patients in this series received plus the MINI OPCABG operation a PTCA STENT to the CX and RCA after the procedure.

We performed during the last 15 years this type of MINI OPCABG operation with the variables in 55 patients with good long term clinical results (Fig. 13-14).

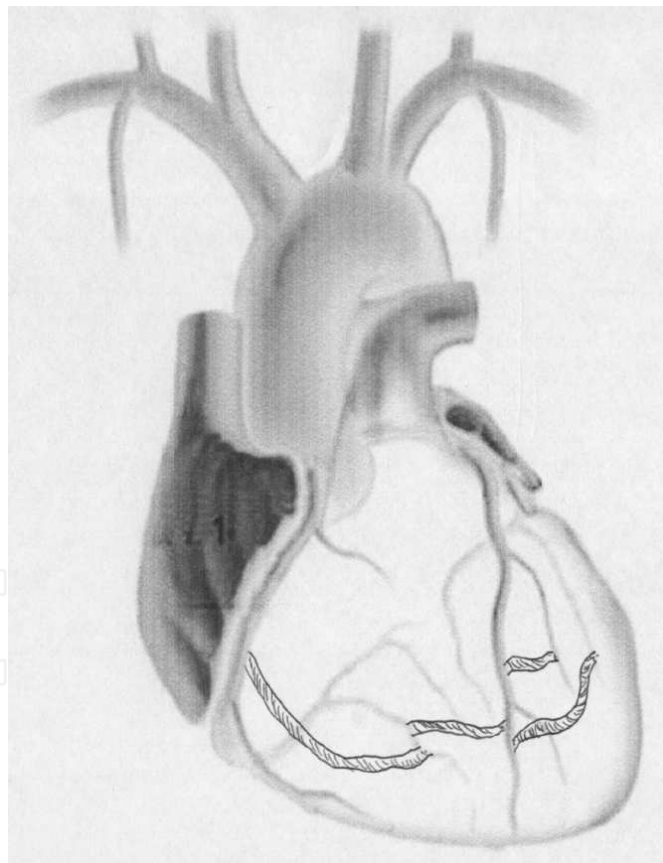


Figure 12.

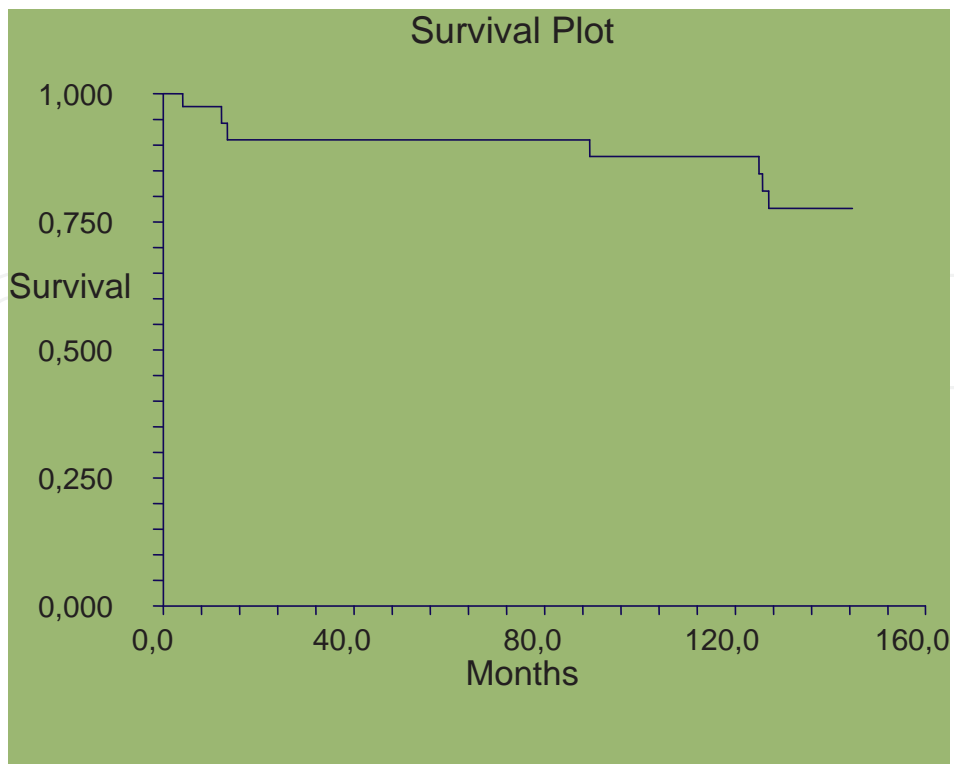


Figure 13.

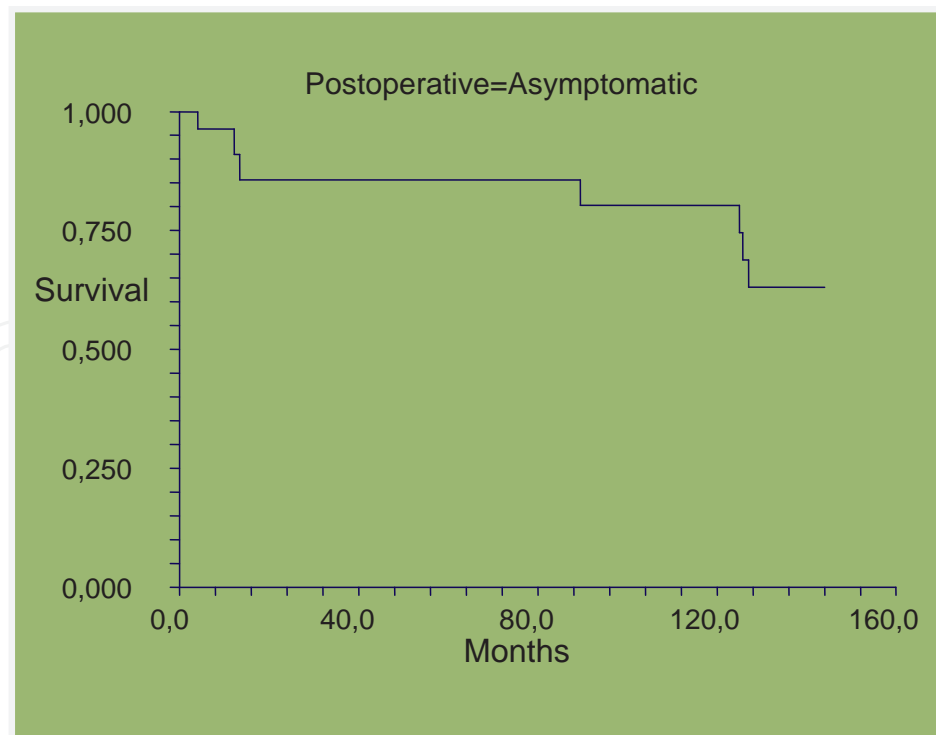


Figure 14.

## 5. Conclusions

More experience and better technology is needed to expand this operation in multiple vessels and also to create intracoronary connections in some situations (Fig.12). Also for the Hybrid technique is mandatory to create a more friendly retractor and others instruments that facilitate the mammary to Lad operation.

### Author details

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### References

- [1] Benetti, F J. "Direct coronary surgery with saphenous vein bypass without either cardiopulmonary bypass or cardiac arrest." *J Cardiovasc Surg* 26, no. 3 (May-Jun 1985): 217-222.
- [2] Buffolo, E, J C Andrade, J Succi, L E Leão, and C Gallucci. "Direct myocardial revascularization without cardiopulmonary bypass." *Thorac Cardiovasc Surg* 33, no. 1 (Feb 1985): 26-29.
- [3] Benetti, F J, G Naselli, M Wood, and L Geffner. "Direct myocardial revascularization without extracorporeal circulation. Experience in 700 patients." *Chest* 100, no. 2 (Aug 1991): 312-316.
- [4] Benetti, F J, C Ballester, y A Barnia. «Uso de la Toracoscopía en cirugía coronaria para disección de la mamaria izquierda.» *La Prensa Médica Argentina* 9 (1994): 81-87.
- [5] Benetti, F J, and C Ballester. "Use of thoracoscopy and a minimal thoracotomy, in mammary-coronary bypass to left anterior descending artery, without extracorporeal circulation. Experience in 2 cases." *J Cardiovasc Surg* 36, no. 2 (Apr 1995): 159-161.
- [6] Benetti, F J, and C Ballester. "Coronary revascularization with the arterial conduits via a small thoracotomy and assisted by thoracoscopy, although without cardiopulmonary bypass." *Coronary Revasc* 4, no. 1 (1995): 22-24
- [7] Federico Benetti :Method for coronary bypass United States Patent Patent Ñ 5,888,247

- [8] Benetti, F J. "Minimally invasive coronary surgery (the xiphoid approach)." *Eur J Cardiothorac Surg* 16, no. Suppl 2 (Nov 1999): S10-S11.
- [9] Angelini, G D, F C Taylor, B C Reeves, y R Ascione. «Early and midterm outcome after off-pump and on-pump surgery in Beating Heart Against Cardioplegic Arrest Studies (BHACAS 1 and 2): a pooled analysis of two randomised controlled trials.» *Lancet* 359, n° 9313 (Apr 2002): 1194-1199.
- [10] Nathoe, H M, et al. "A comparison of on-pump and off-pump coronary bypass surgery in low-risk patients." *N Engl J Med* 348, no. 5 (Jan 2003): 394-402.
- [11] Sabik, J F, et al. "Does off-pump coronary surgery reduce morbidity and mortality?" *J Thorac Cardiovasc Surg* 124, no. 4 (Oct 2002): 698-707.
- [12] Mack, M J, et al. "Comparison of coronary bypass surgery with and without cardiopulmonary bypass in patients with multivessel disease." *J Thorac Cardiovasc Surg* 127, no. 1 (Jan 2004): 167-173.
- [13] Calafiore, A M, et al. "Myocardial revascularization with and without cardiopulmonary bypass in multivessel disease: impact of the strategy on early outcome." *Ann Thorac Surg* 72, no. 2 (Aug 2001): 456-462.
- [14] Al-Ruzzeh, S, et al. "Off-Pump Coronary Artery Bypass (OPCAB) surgery reduces risk-stratified morbidity and mortality: a United Kingdom Multi-Center Comparative Analysis of Early Clinical Outcome." *Circulation* 108, no. Suppl 1 (Sep 2003): II1-8.
- [15] Plomondon, M E, et al. "Off-pump coronary artery bypass is associated with improved risk-adjusted outcomes." *Ann Thorac Surg* 72, no. 1 (Jul 2001): 114-119.
- [16] Stevens, L M, et al. "Single versus bilateral internal thoracic artery grafts with concomitant saphenous vein grafts for multivessel coronary artery bypass grafting: effects on mortality and event-free survival." *J Thorac Cardiovasc Surg* 127, no. 5 (May 2004): 1408-1415.
- [17] Benetti, Federico J, and Maximo Guida. "Minimally Invasive Coronary Artery Bypass Grafting." Chap. 11 in *Minimally invasive cardiac surgery*, by Daniel J Goldstein and Mehmet C Oz, edited by Daniel J Goldstein and Mehmet C Oz, 147-156. Totowa, New Jersey: Humana Press, 2004
- [18] Benetti, F et al Xiphoid Lower Sternotomy Approach for multivessel revascularization of the Left internal Mammary to the left anterior descending Artery and Righth Internnal mammary as inflow to the others vessels. The Heart Surgery Forum 2009-1131 13(1), 2010 (Epub February 2010) Doi :10.1532/ H SF 98.20091131

