

How To Do An Endoscopic Atraumatic Coronary Artery Bypass (endo-acab) With Thoracoscopic Left Internal Mammary Artery Harvesting.

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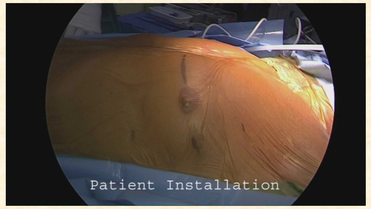
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Abstract:

Minimally invasive procedures for coronary revascularization have been performed for over 20 years; however, their technical complexity, steep learning curves and absence of training programs explain the weak acceptance of these techniques. Here is a step-by-step protocol of how our team achieves an endoscopic atraumatic coronary artery bypass (endo-acab) with a thoracoscopic left internal mammary artery (LIMA) harvesting for patients with a left anterior descending (LAD) coronary disease. This minimally invasive procedure avoids the median sternotomy and is performed without the use of a heart-lung machine (beating heart surgery).

Anesthesia and patient preparation:

1. The anesthesiology team performs classical anesthesia for cardiac patients. Usual intraoperative monitoring is setup; furthermore, our team does not require selective intubation. Post-operative analgesia is best acquired by careful spinal anesthesia prior to surgery.
2. The patient is placed in supine position with a slight left hemi thorax elevation. This allows less conflict with the patients left shoulder during surgery.
3. Insure proper patient strapping and lateral table supports, as table tilting is often necessary during the procedure.
4. Draw your anatomical landmarks and planned skin incisions.



LIMA harvesting:

1. Before trocar insertion, briefly ask your anesthesiologist to stop ventilation to avoid lung damage.
2. Three trocars are necessary for LIMA harvesting.
   a. *Optical port:*
   5mm trocar on the anterior axillary line through the 3rd or 4th intercostal space. Our team uses a 5mm 30° camera.
   a. *Working ports:*
   5 mm trocar in the 2nd intercostal space along the outer third clavicular line.
   10 mm trocar on the anterior axillary line through the 5th or 6th intercostal space.

NOTE: When operating female patients, take care to avoid placing trocars directly though the mammary gland. Furthermore, when time comes for the mini-thoracotomy, respect the sub mammary fold for obvious esthetical reasons.

3. Insufflate CO2 in the pleural space allowing partial left pulmonary collapse and flattening of the left diaphragm (6-8mmHg). This drastically increases surgical exposure while insuring correct ventilation of the left lung. Take the time to inform your anesthesiologist before insufflation in order to avoid blood pressure collapse because of lowered right heart venous return.
4. After careful inspection of the pleural cavity, observe your anatomical landmarks; LIMA, phrenic nerve, subclavian artery and aorta, pericardium and the cardiac silhouette.



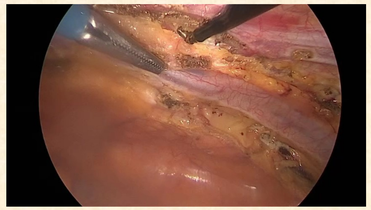


5. Our team harvests the LIMA pediculated. We feel this technic is easier, and allows for less vessel wounds during thermal coagulation and manipulation of the artery. Nevertheless, you can harvest the LIMA skeletonized.
6. Start your dissection on the sternal side of the artery by opening the fascia from top to bottom.
7. Open on the fascia on the lateral side of the LIMA in the same fashion.

NOTE: It is important to start with the fascia on the sternal side in order to avoid having the LIMA falling in front of your field of view.

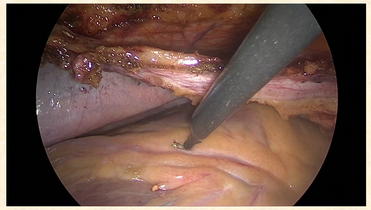
8. Systematically locate collateral branches and coagulate them with a bipolar hook or another energy source you are comfortable with.





9. Liberate your artery proximally until you have reached the phrenic nerve.
10. Liberate your artery distally until you have reached the bifurcation.
11. Open the pericardium and identify target coronary vessels
12. Once the entire LIMA is freed, ask your anesthesiologist to administer 2000-5000 units of Heparin in order to reach 250-300 seconds of ACT (activated clotting time).
13. Divide the LIMA between a hemostatic clip distally and a small bulldog clamp.
14. Try to keep the distal portion of the artery attached to the pleural cavity by a thin portion of fascia in order to easily retrieve it through you thoracotomy and avoid twisting of the vessel.





Minithoracotomy:

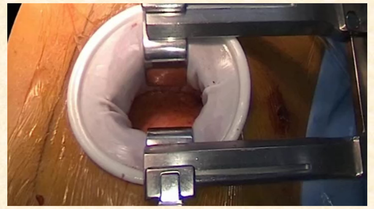
1. Visualize the LAD and estimate the appropriate intercostal space needed for your thoracotomy. The thoracotomy should be directly above the desired portion of the LAD. In the majority of cases, this corresponds to the 4th intercostal space.
2. Perform the thoracotomy.
   - The incision should be between 5 to 8cm.
   - The incision is generally made between the sternum and the nipple without reaching the sterno-costal cartilage. It may be extended laterally around the nipple for a wider field of view and an easier intercostal retraction.
   - Try to respect the Grand Pertoralis fibers orientation when performing your opening.
   - A soft tissue retractor can sometime be helpful.

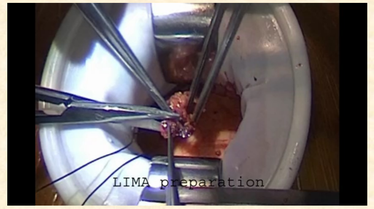
Coronary Anastomosis

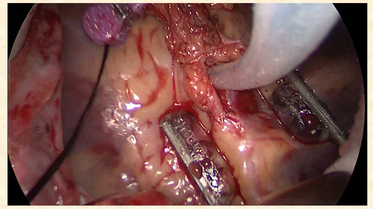
1. Correctly localize the LAD and its target zone. Ensure sufficient quality of the vessel for an optimal anastomosis.
2. Recover the LIMA and prepare its distal extremity for the anastomosis.
3. Our team uses the Medtronic OctopusTM Nuvo Tissue Stabilizer inserted through the caudal 10mm trocar incision. It is secured using a camera stabilization metallic arm.
4. Occlude the LAD using a proximal 5/0 suture around the vessel tightened with a tourniquet.

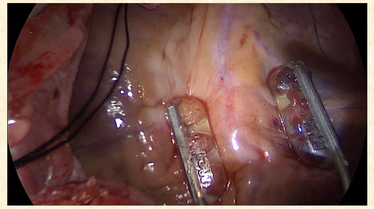
NOTE: Take the time to inform your anesthesiologist before occlusion and observe the patient's response (hemodynamically and electrocardiogram).

5. Incise the LAD and insert the appropriate shunt. Undo the tourniquet to allow proper blood flow in the vessel.
6. Perform your vascular anastomosis using à 8/0 polypropylene suture.
7. Remove the shunt before tightening your suture.
8. Release the bulldog clamp and assess the anastomosis for bleeding. Perform hemostatic stitches if needed.
9. If satisfied with your bypass, neutralize your heparin.
10. Our team approximates the pericardial edges









Closure:.

1. Place a 28Fr drain in the left pleural cavity through the caudal 10mm trocar incision.
2. Insure full ventilation of the left lung without traction of you LIMA to LAD anastomosis.
3. Approximate the intercostal pace with a resorbable suture.
4. Close the Grand Pectoralis fascia with a resorbable running suture.
5. Close the subcutaneous layer with a resorbable running suture.
6. Close the skin incisions with a resorbable running suture.

