



Thoracoscopic In Situ Double Mammary Artery Harvesting.

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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. Use of bilateral mammary arteries is though to be the best conduits that we can offer to our patients during coronary surgery. Here is a step-by-step protocol of how our team achieves an endoscopic bilateral internal mammary artery (BIMA) harvesting for minimally invasive CABGs through a left thoracoscopic approach.

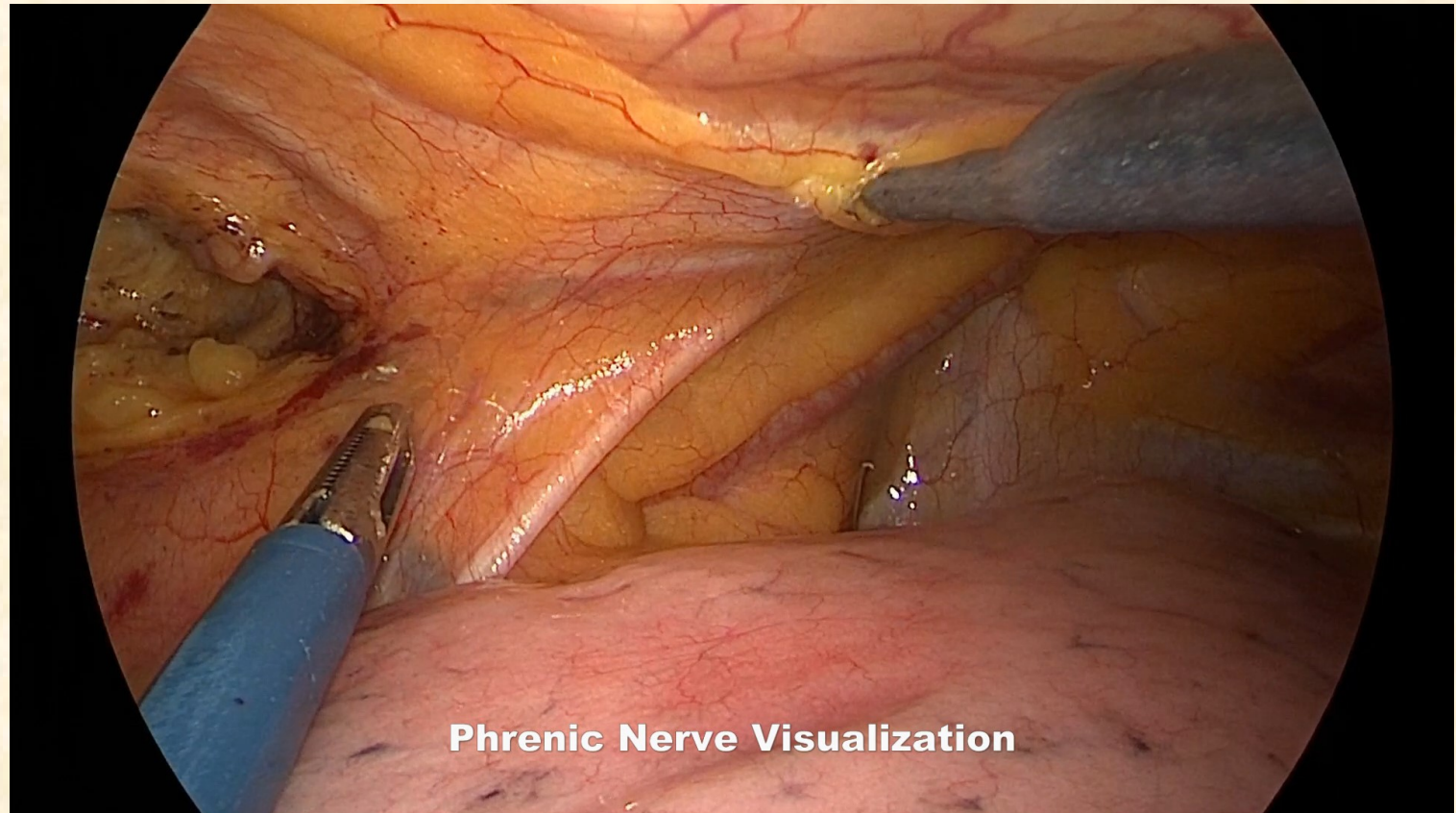
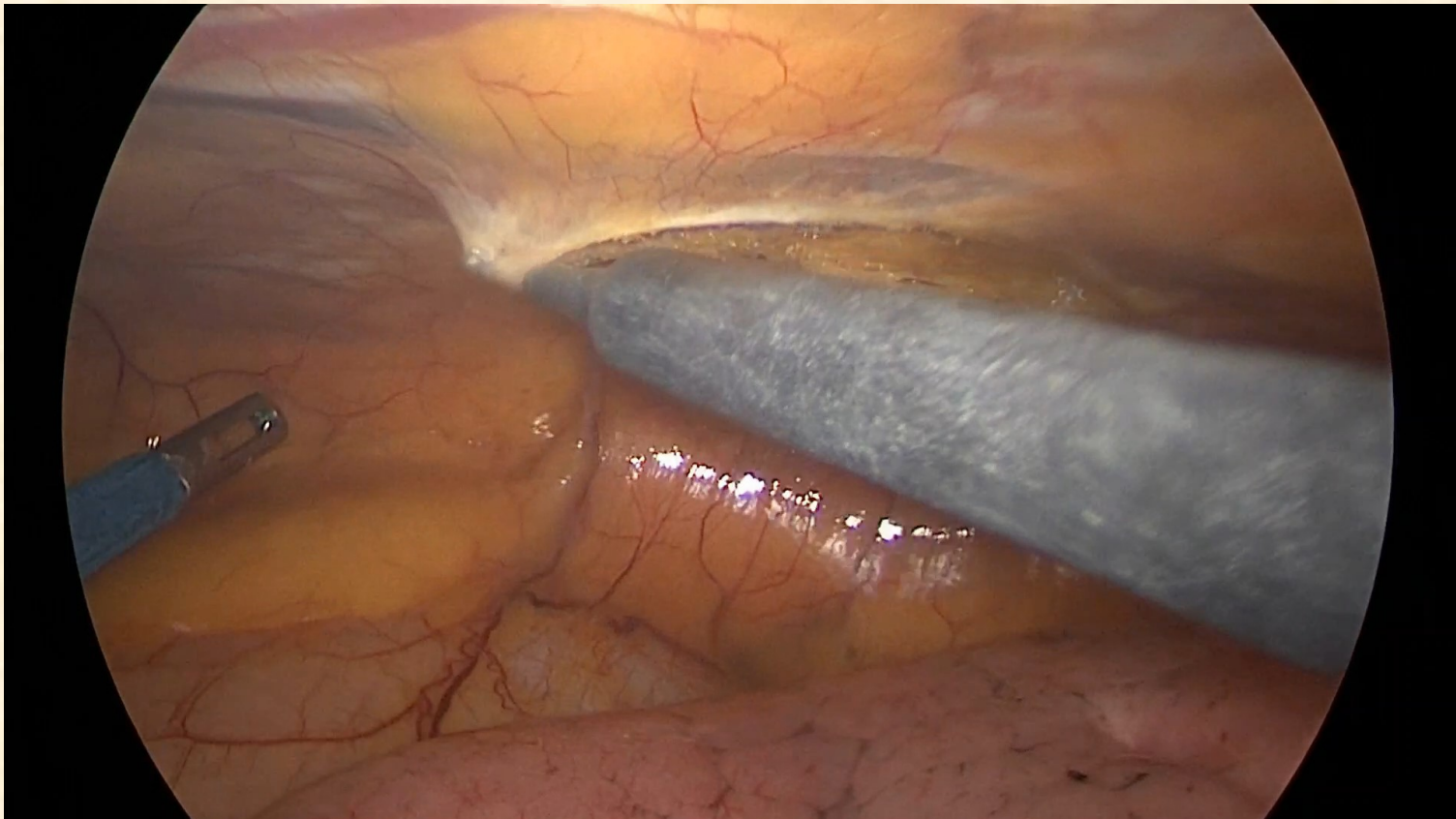
Anesthesia and patient preparation:

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.

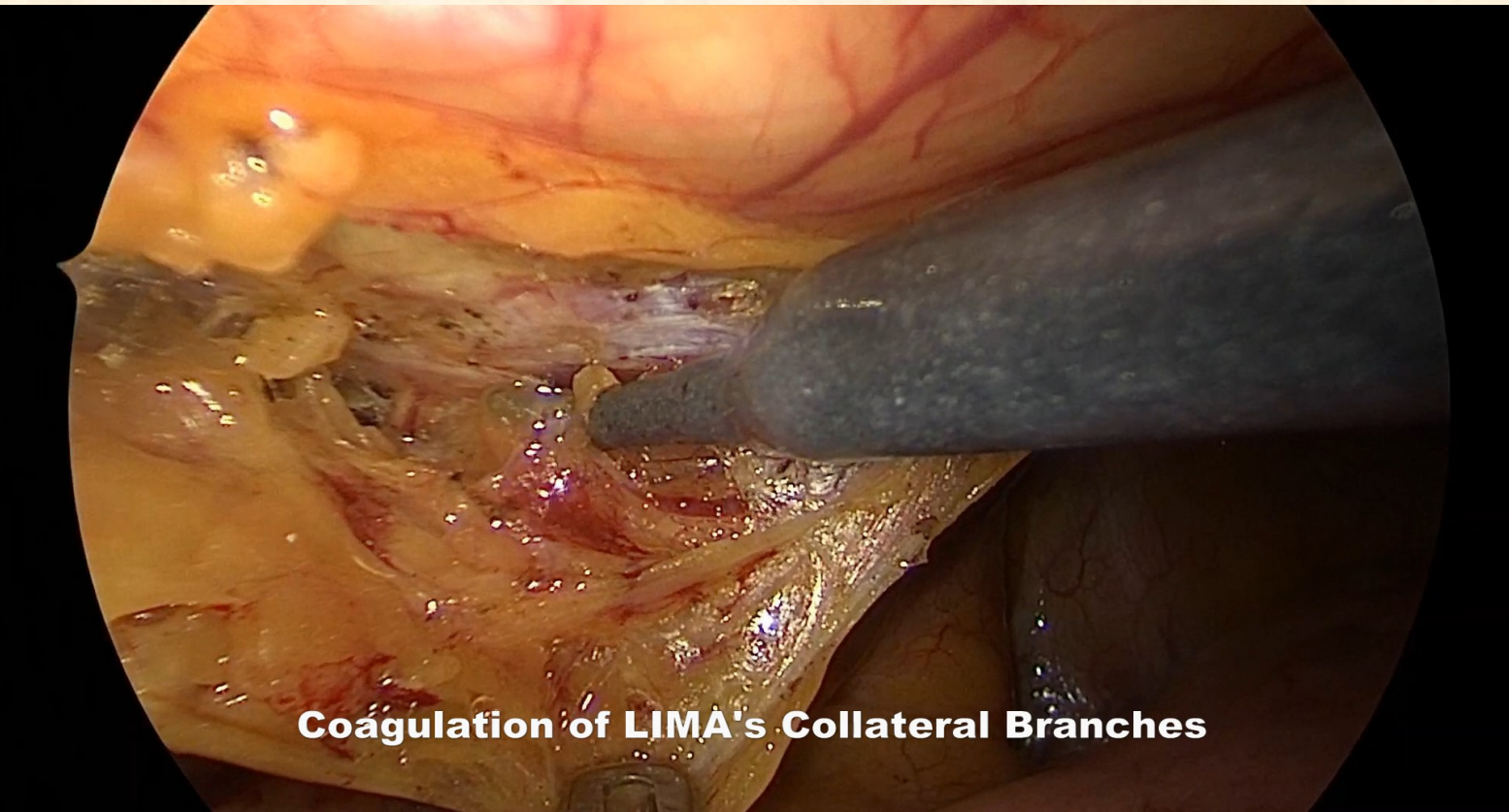
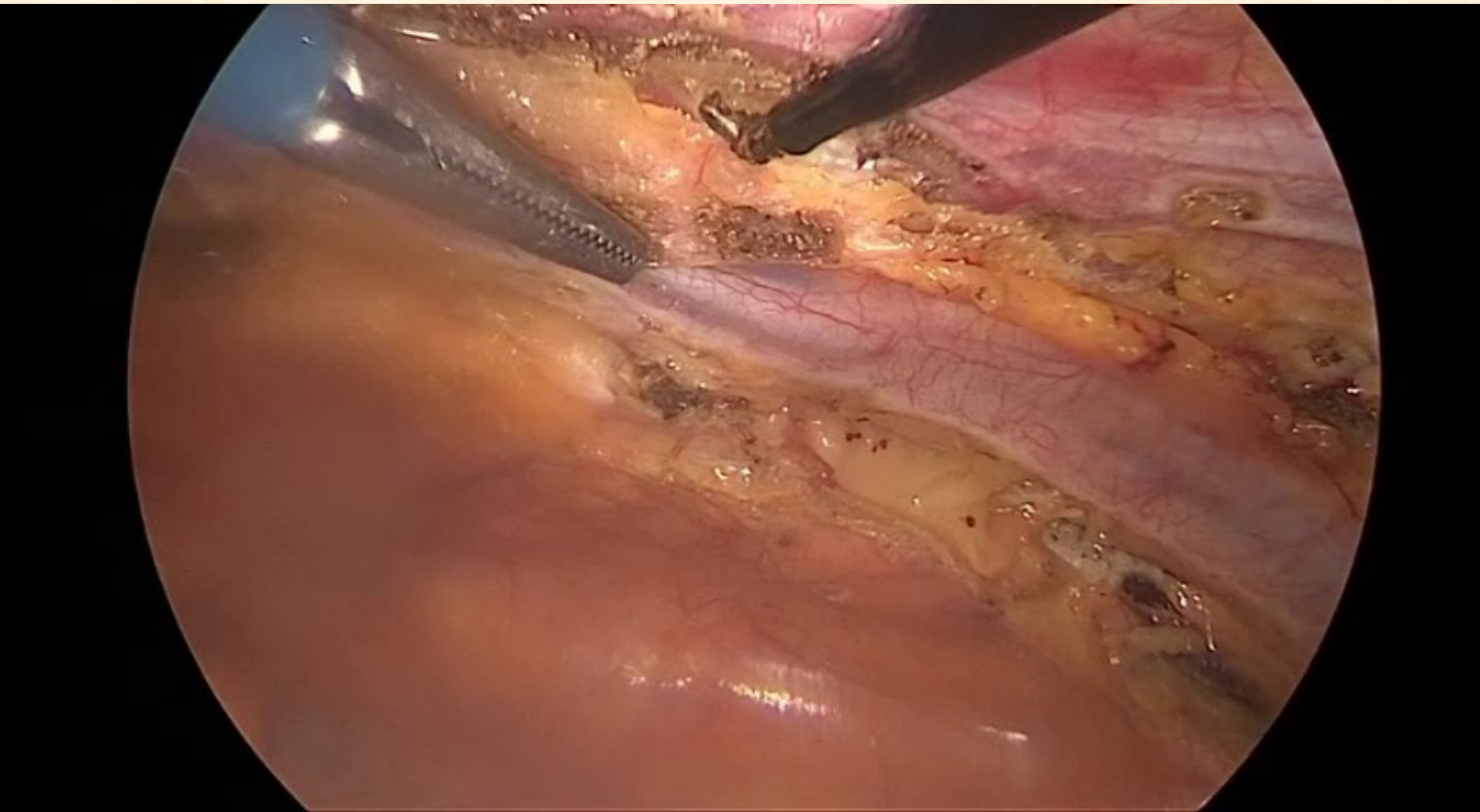


LIMA harvesting:

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



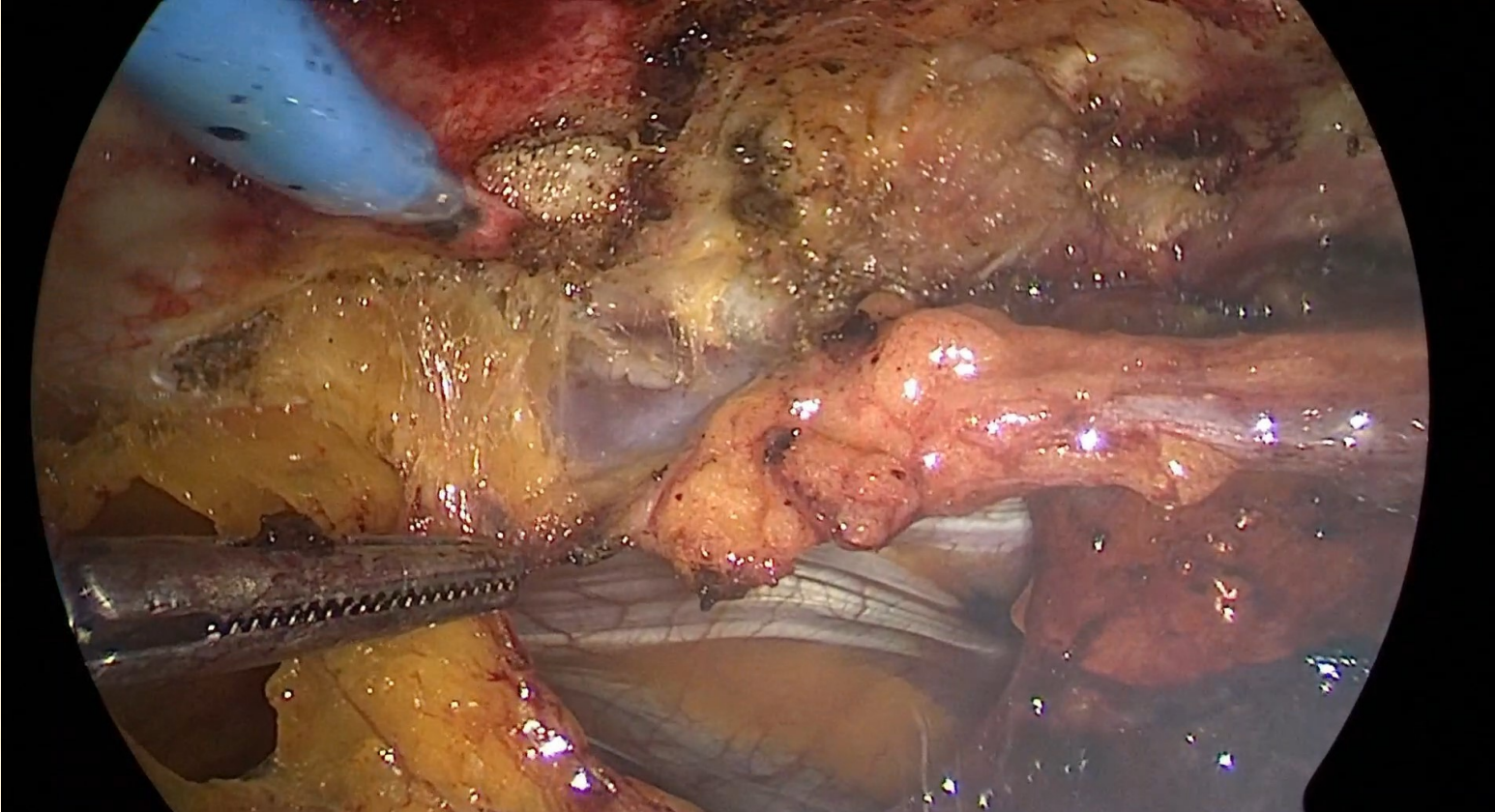
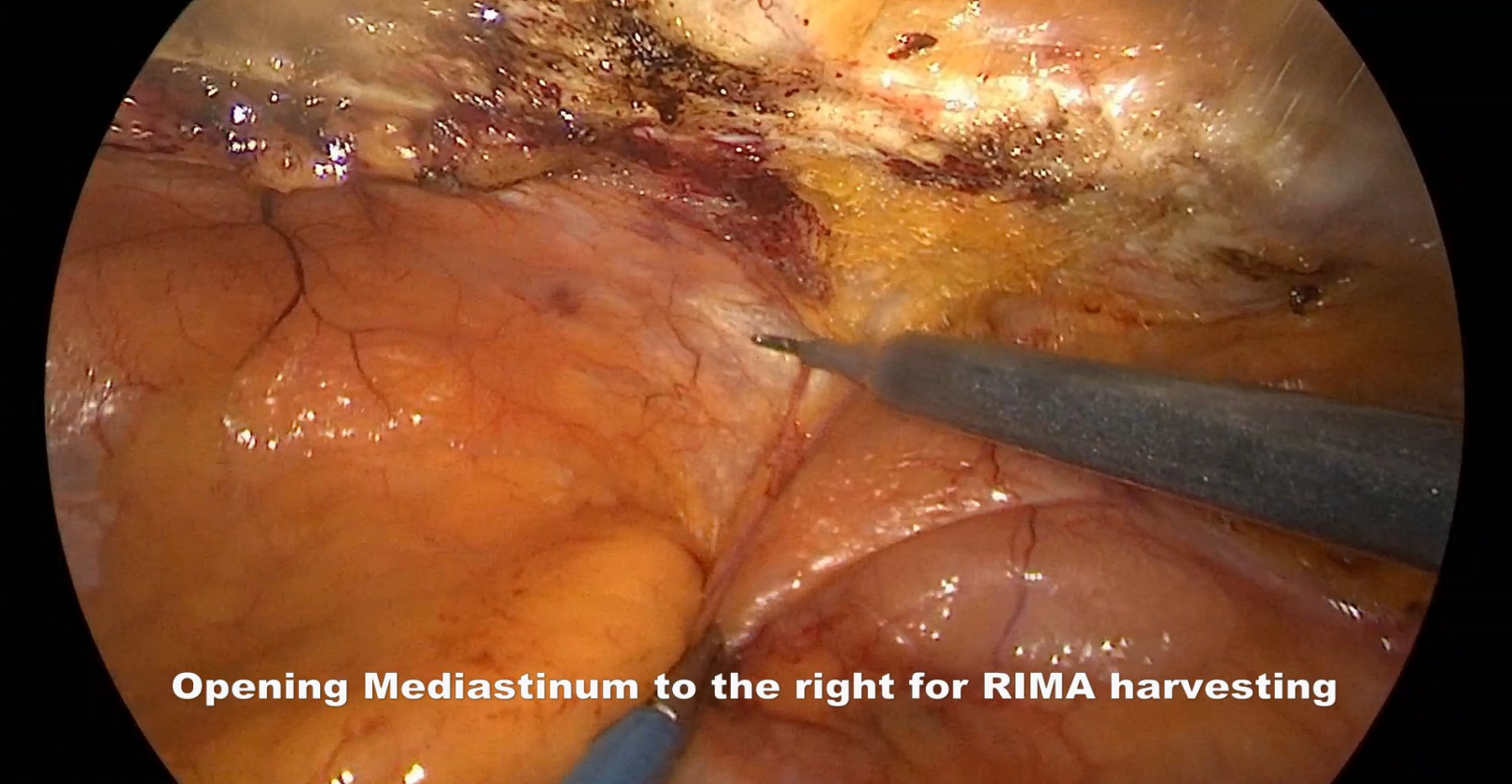
5. Our team harvests the LIMA pediculated. We feel this technic is easier, and allows for less vessel wounds during thermal coagulation and manipulation of the artery. Nevertheless, you can harvest the LIMA skeletonized.
6. Start your dissection on the sternal side of the artery by opening the fascia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

RIMA harvesting:

1. Once LIMA is harvested open up the mediastinum from the left to the right.
2. Enter the right pleura and localize the RIMA
3. Start your dissection on the external part of the RIMA and not the sternal to avoid having the LIMA falling in front of your field of view.
4. Liberate your artery proximally until you have reached the phrenic nerve.
- NOTE:** The right phrenic nerve is difficult to visualize from the left approach.
5. Liberate your artery distally until you have reached the bifurcation.



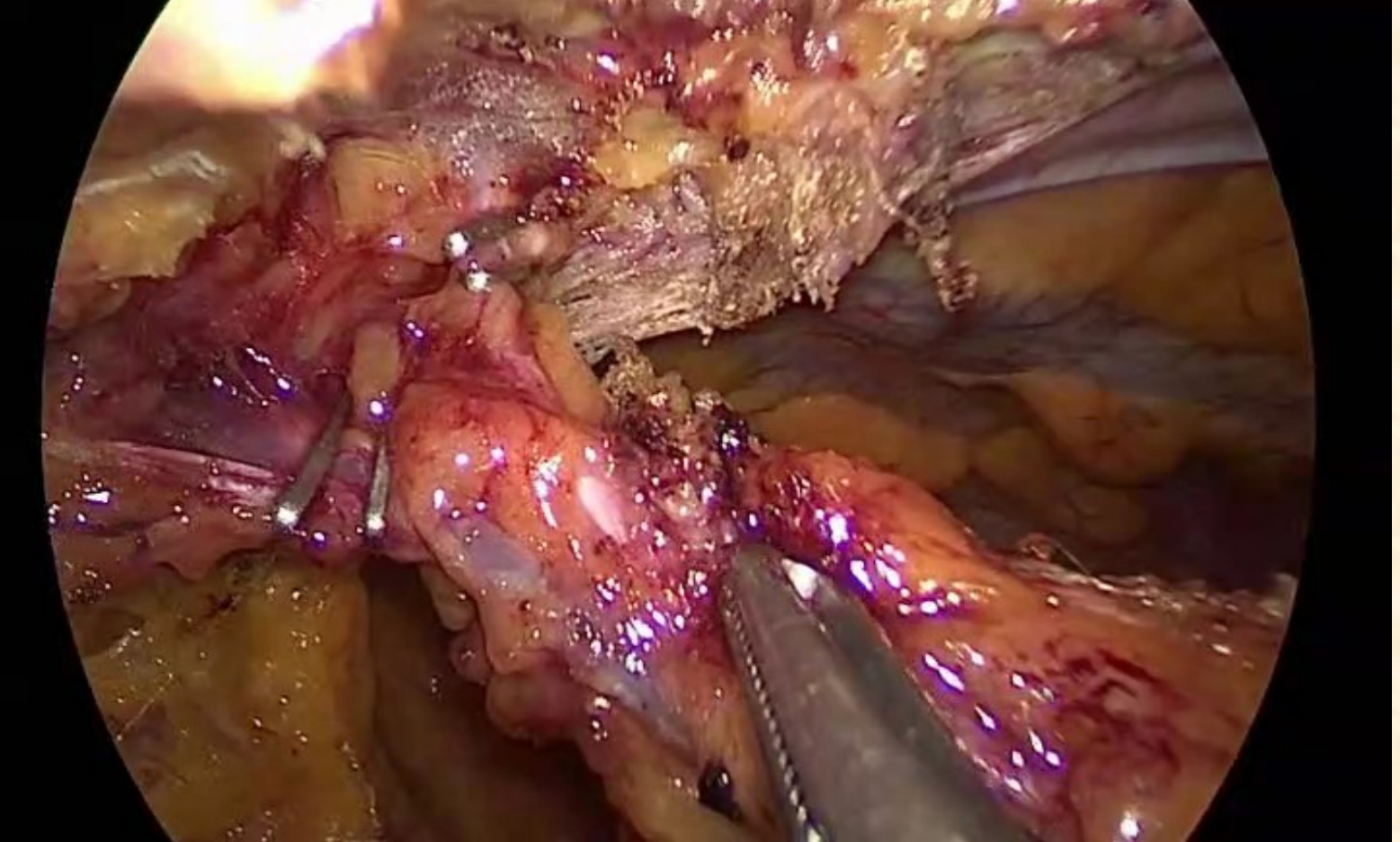
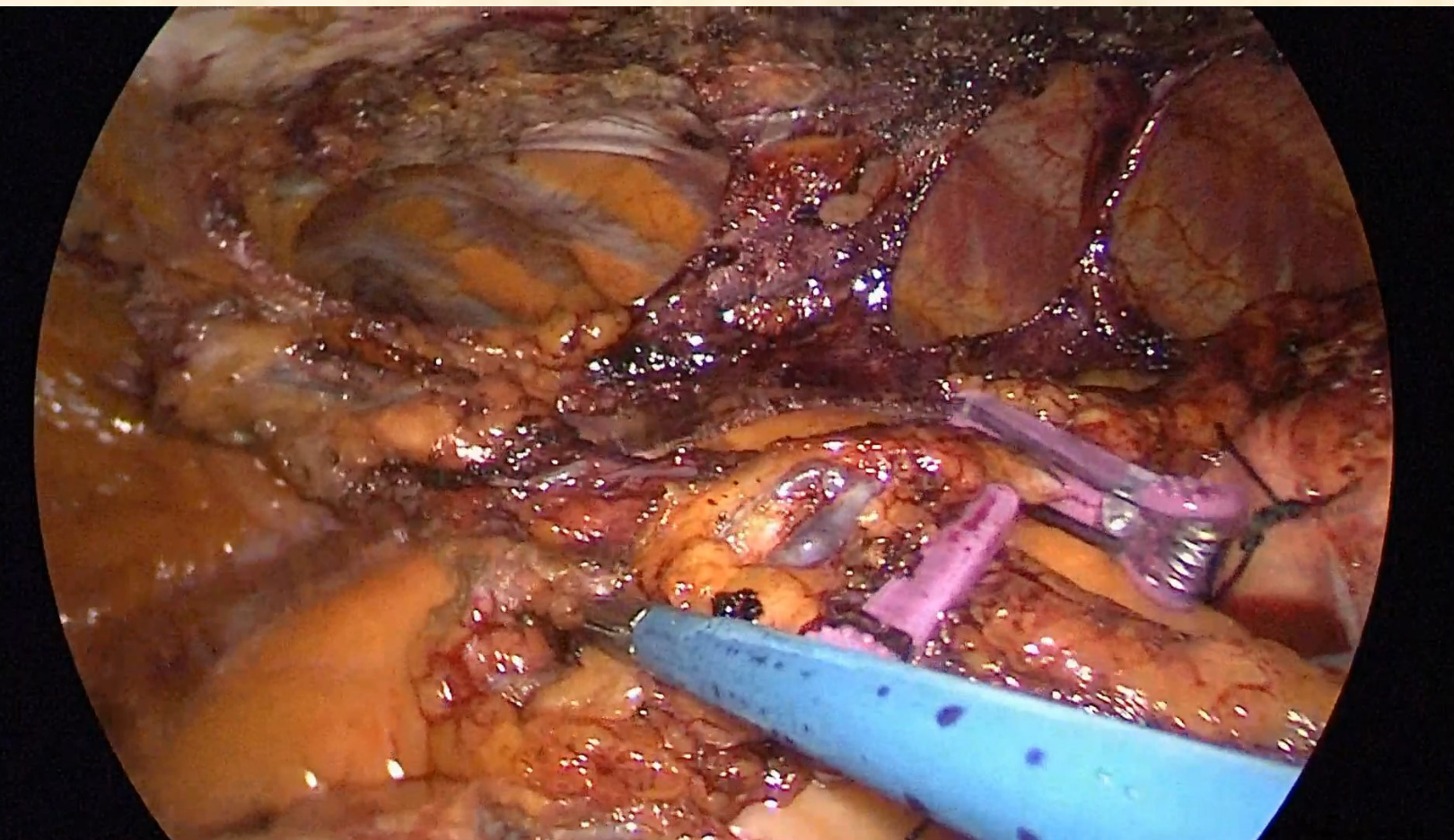
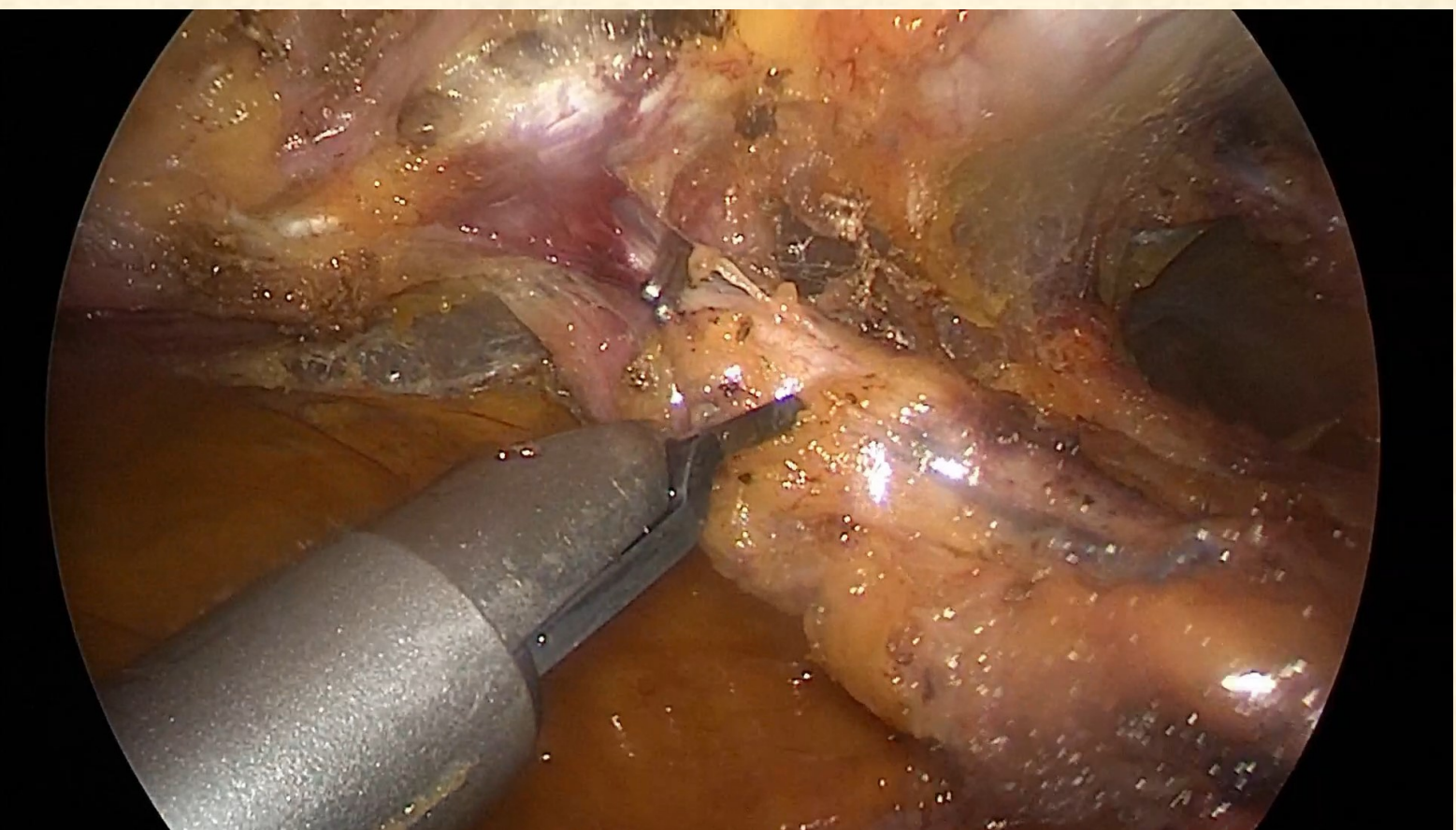
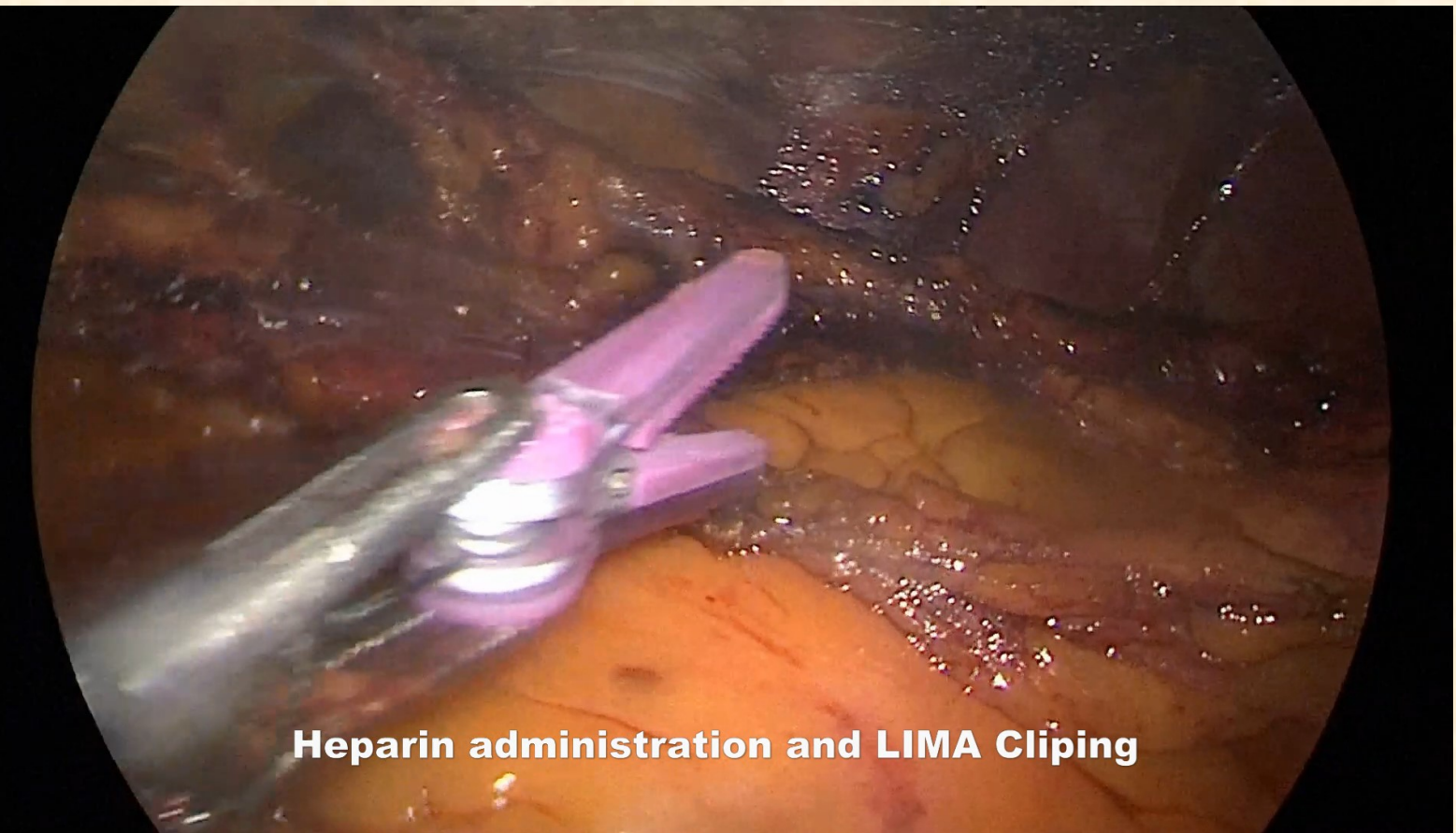
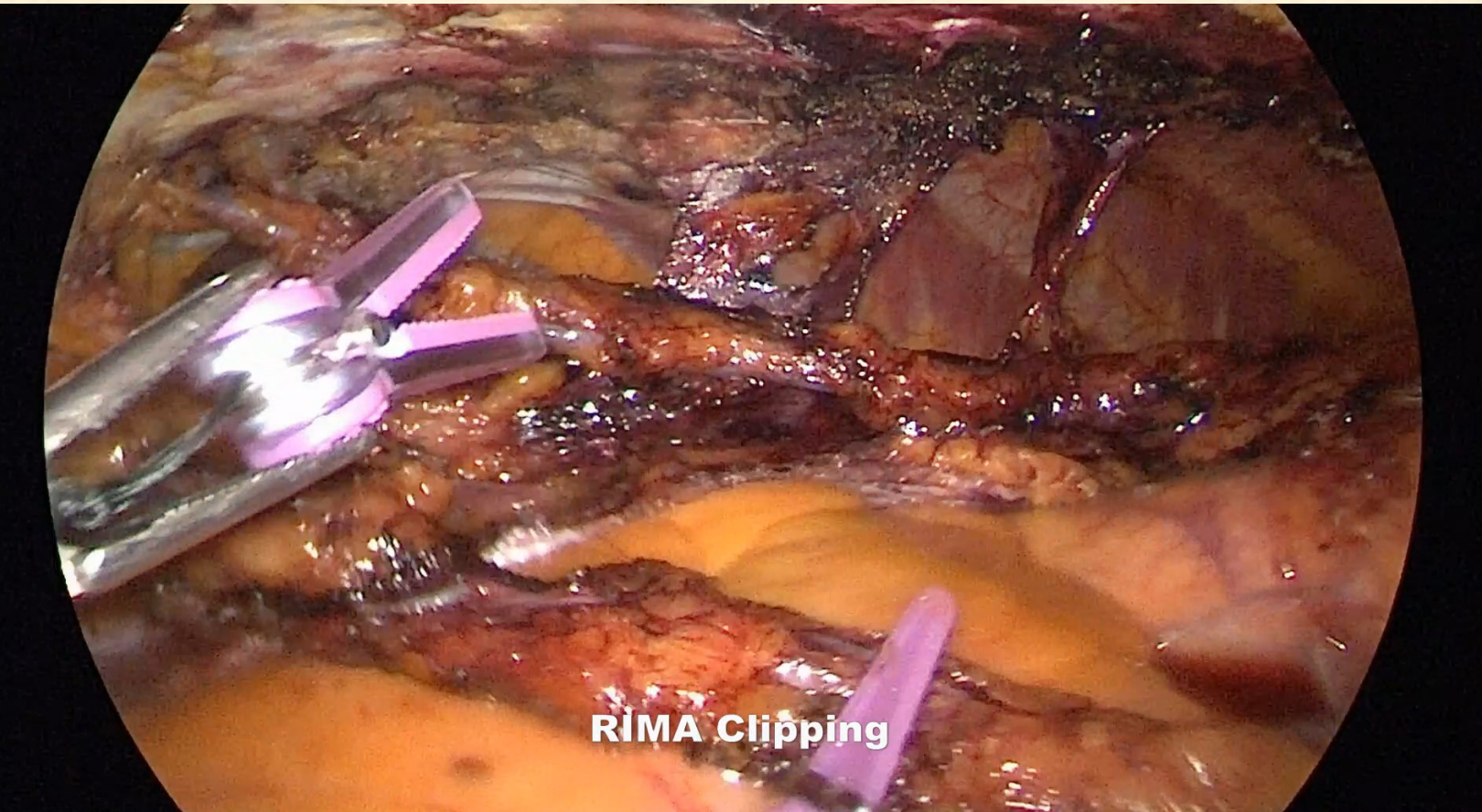
Pericardiac Opening:

1. Open the pericardium and identify target coronary vessels
- NOTE:** Open your pericardium wide up to the origin of the RIMA for smooth in situ use of RIMA.
5. 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).

LIMA and RIMA division:

1. Change your inferior 5 mm trocar with a 10 mm to insert your bulldog clamp.
2. Clamp the LIMA with the bulldog clamp.
3. Clip distal LIMA and divide the LIMA.
4. Clamp the RIMA with the bulldog clamp.
5. Clip distal RIMA and divide the RIMA.
5. Make sure that both RIMA and LIMA can reach the target vessels.

NOTE: After CO2 deflation target vessels will come closer to your grafts.



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 or slightly more lateral depending target vessels. 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 Pectoralis fibers orientation when performing your opening.
 - A soft tissue retractor can sometime be helpful.

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 your LIMA and RIMA anastomoses.
3. Approximate the intercostal pace with a resorbable suture.