



Robert Bosch Krankenhaus

Technique For Concomitant Closure Of The Left Atrial Appendage As Part Of Robotically Assisted Direct Coronary Artery Bypass

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Introduction

Atrial fibrillation is an increasingly relevant comorbidity in cardiac surgical patients¹ and has been the focus of many efforts in adapting therapies to better mitigate negative long-term outcomes through ablation and/or closure of the left atrial appendage (LAA). LAA closure in itself provides a significant reduction of stroke risk and consequently mortality in patients who undergo cardiac procedures. Furthermore, eventually stopping oral anticoagulants after LAA closure reduces the incidence of associated bleeding complications. In the growing field of robotically assisted coronary surgery, minimally invasive strategies have posed a challenge in exposing and closing the LAA.

Methods

We present a technique whereby, following robotically assisted preparation of the left internal mammary artery using the DaVinci Xi , a small left sided thoracotomy is used to perform a direct bypass on the left anterior descending branch of the left coronary artery (MIDCAB). Using the same incision, the LAA is clipped using an Atriclip Flex V Device under transesophageal ultrasound guidance, thus negating the need for additional ports or incisions in the pericardium as described in the current literature. We give a detailed step-by-step description of the technique. Our patients were adults with indication for coronary bypass surgery and appropriate coronary anatomy/constitution to facilitate a minimally invasive robotically assisted approach as a stand alone procedure or part of a hybrid revascularization strategy. They also presented known atrial fibrillation (paroxysmal, persistent or permanent). Preoperative evaluation was based on individual medical records as well as imaging using echocardiography to evaluate dynamic cardiac morphology but also native computed tomography scans to display chest wall morphology and anatomic relations between the heart and surrounding structures.

Results

This procedure was performed on a first series of six patients between 2023 and 2024 in our center which were deemed as adequate. The average duration of surgery was 137 min, there were no intraoperative complications and complete closure of the LAA was confirmed intraoperatively in all patients. The average ICU stay was one day. There were no postoperative complications and all patients were successfully discharged after an average of 6 days.

Surgical Technique

The patient is placed in a supine position with the left shoulder slightly elevated. Left ventricular function and the presence of thrombi in the LAA are checked via transesophageal ultrasound (TEE) at this time. Three small equidistant incisions are made through the 2nd, 4th and 6th intercostal spaces with focus on the middle incision correlating roughly to the midpoint of the sternum. The left internal mammary artery (LIMA) is prepared in a skeletonized fashion from its most proximal point in close relation to the phrenic nerve to its bifurcation shortly proximal to the xyphoid process.

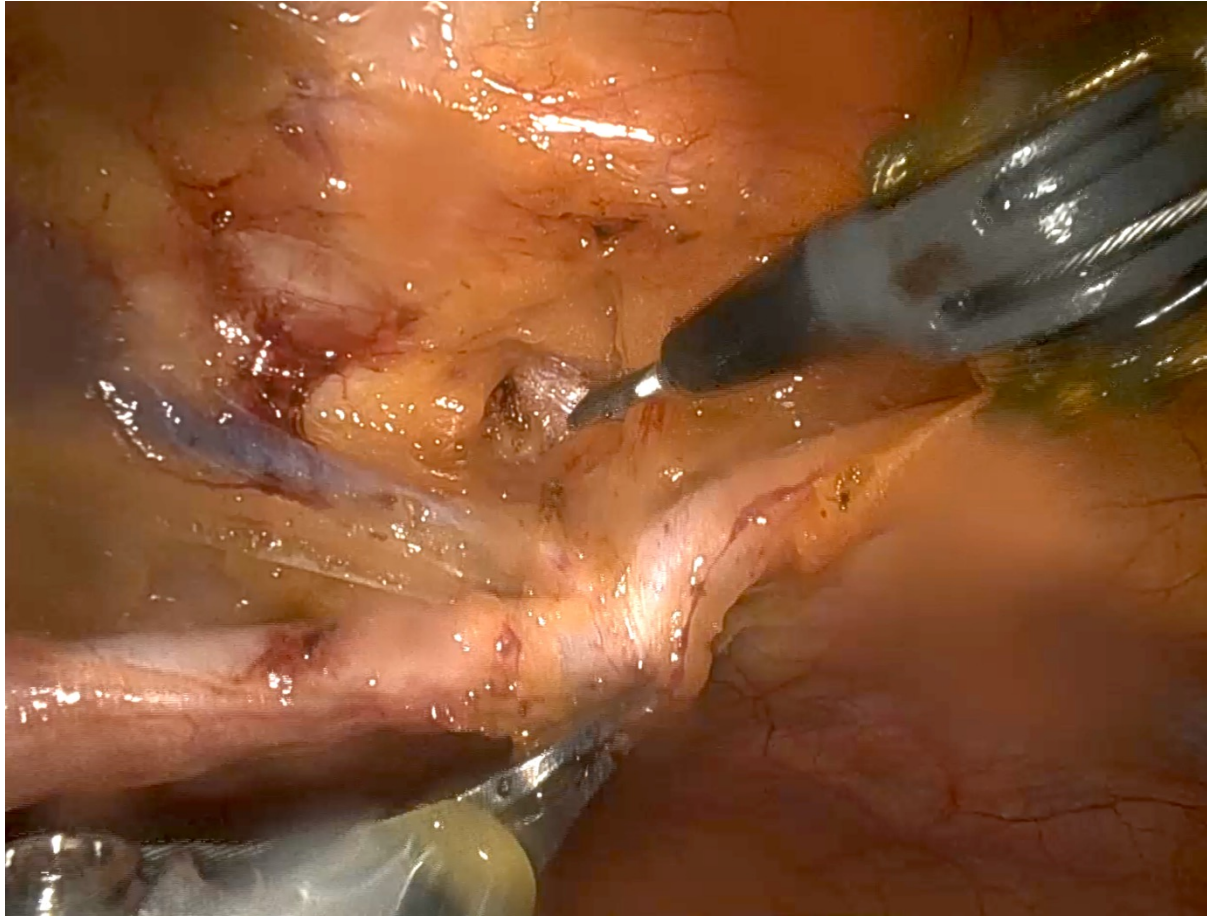


Fig. 1 IMA Preparation

Using monopolar scissors, the pericardium is incised and the target coronary vessels are identified. Heparin is given at this time. The LIMA is clipped distally and transected before being fixed to the pericardial fat with another clip. With the aid of a cannula manipulated by the assistant the ideal intercostal space for access is decided. This cannula is left in place and used as a guide for the site of lateral thoracotomy.

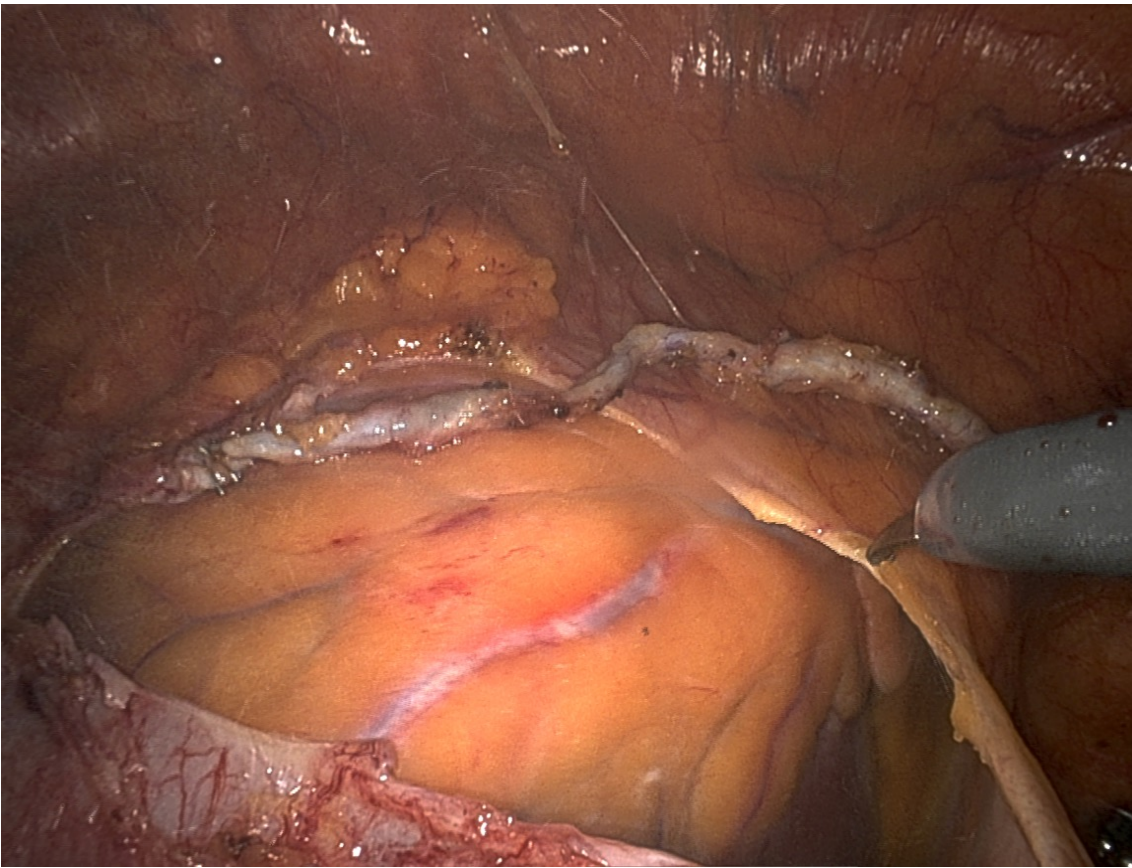


Fig 2 Incised Pericardium and IMA Graft

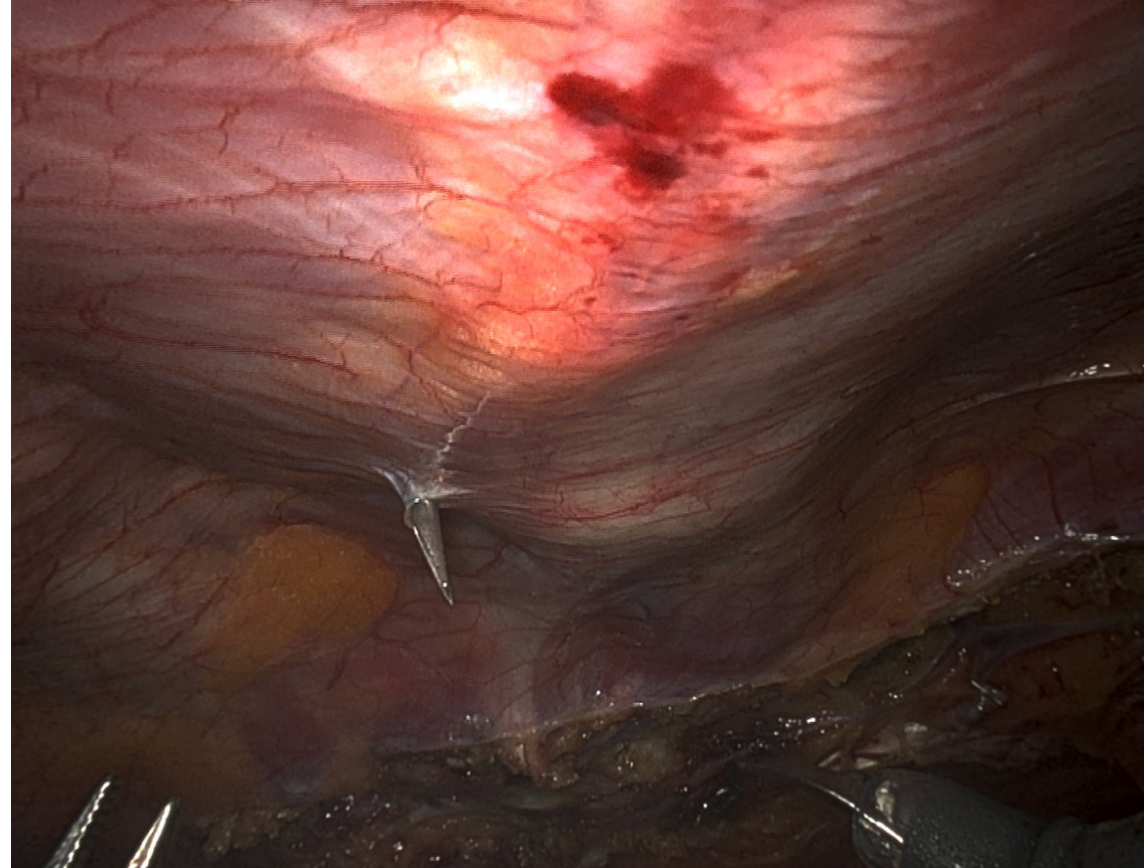


Fig. 3 Cannula for approximation of access

A left lateral thoracotomy is performed. The LIMA is inspected and filled with an eupaverin-blood solution to prevent vasospasm. The pericardium is opened laterally and cranially to expose the LAA adequately. Lateral suspension of the pericardium to the incision or laterally to the chest wall can facilitate a better exposition of the LAA. The stabilizer arm is placed at the base of the LAA and fixed into position while monitoring for hemodynamic changes.



Fig. 4 Stabilizer exposing the LAA

The Atriclip Flex V System (AtriCure Mason, Ohio) is used to occlude the LAA under direct vision and ultrasound guidance. Repositioning is performed as needed to ensure there is no residual pouch. Once the clip is positioned at the base of the LAA, the appendage is thoroughly examined using TEE from at least three different angles to confirm complete closure before deploying the clip. Focus is then shifted to the target coronary vessel.

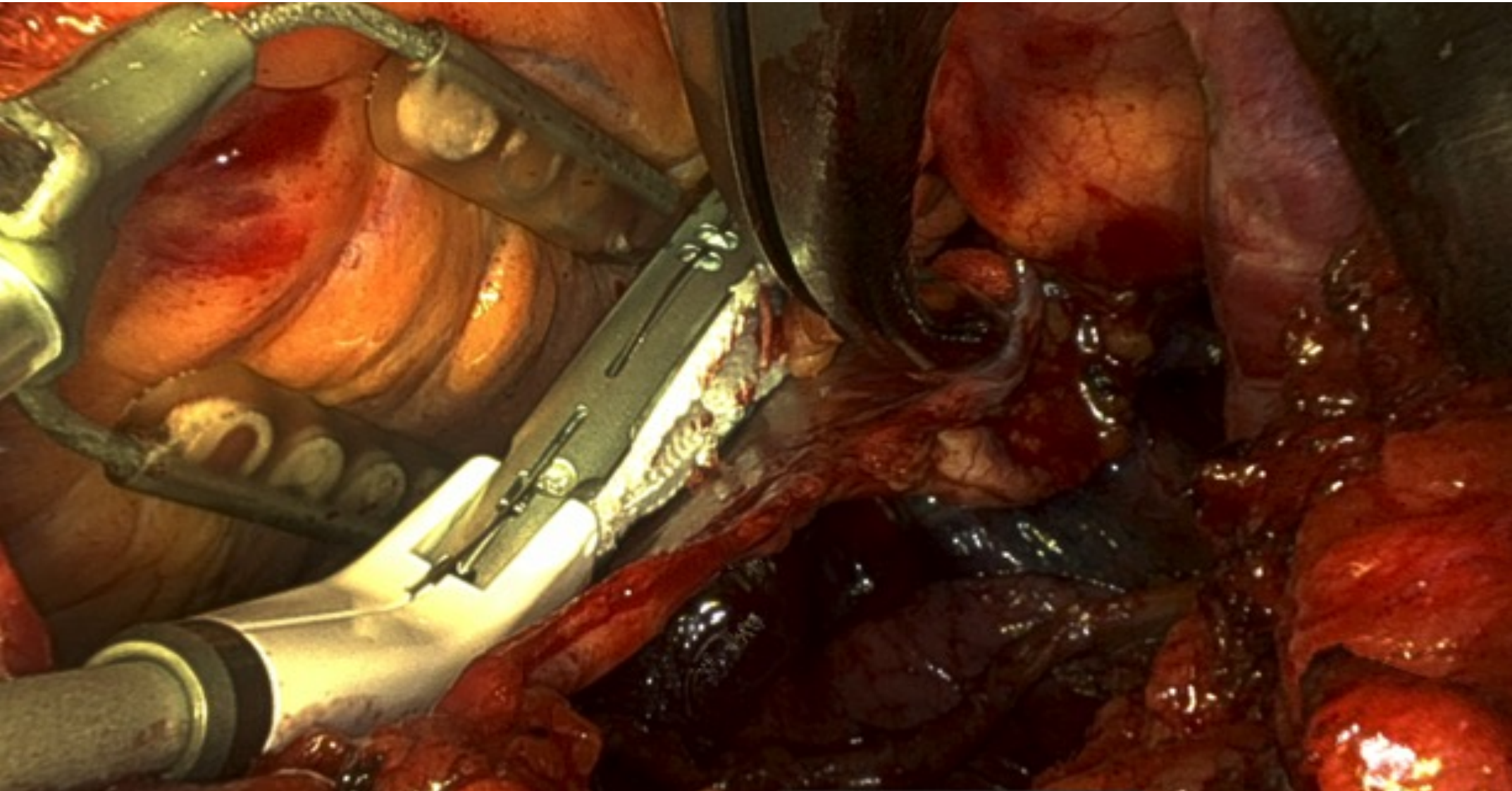


Fig. 5 Clip Application

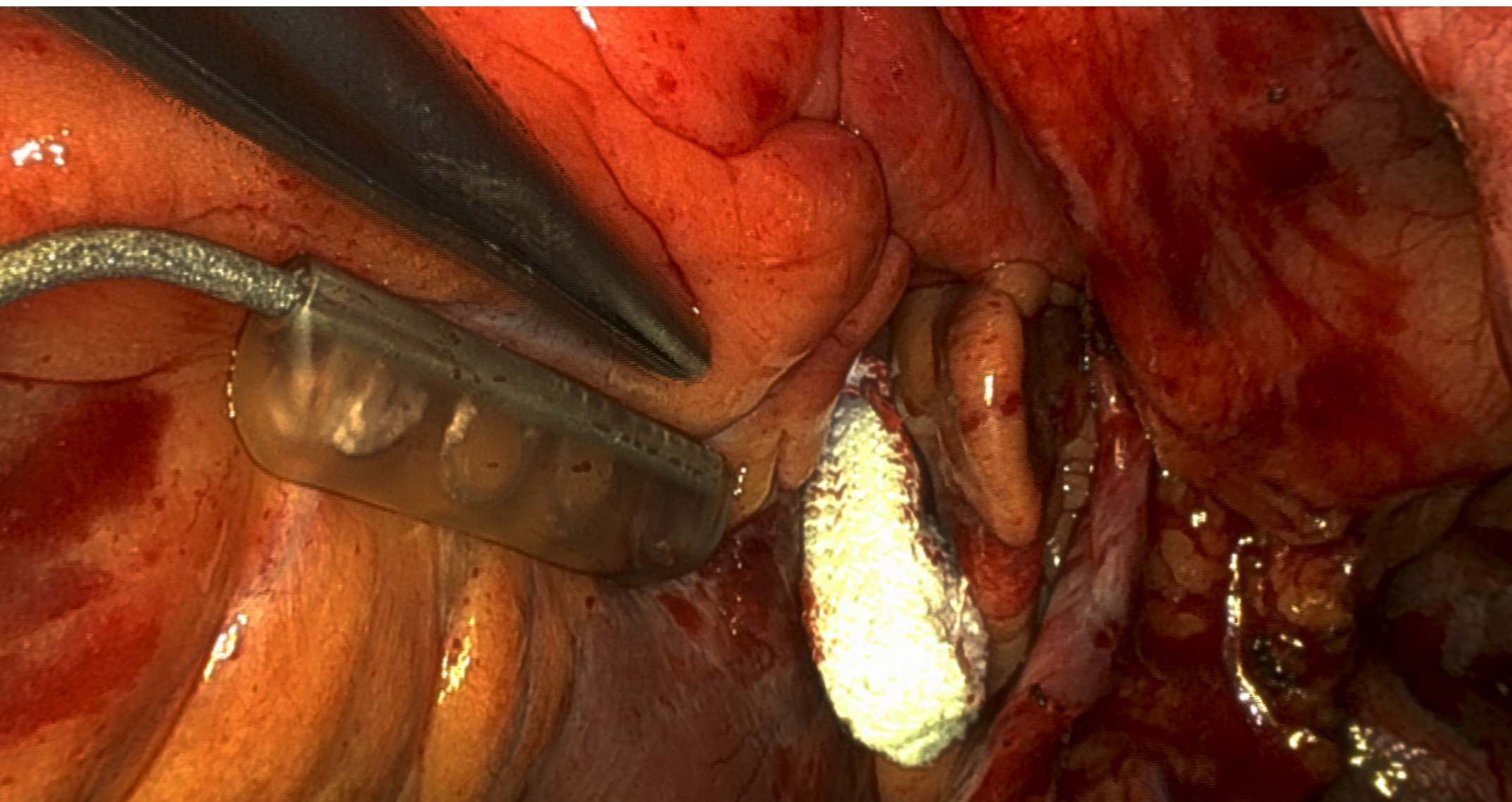


Fig. 6 Result

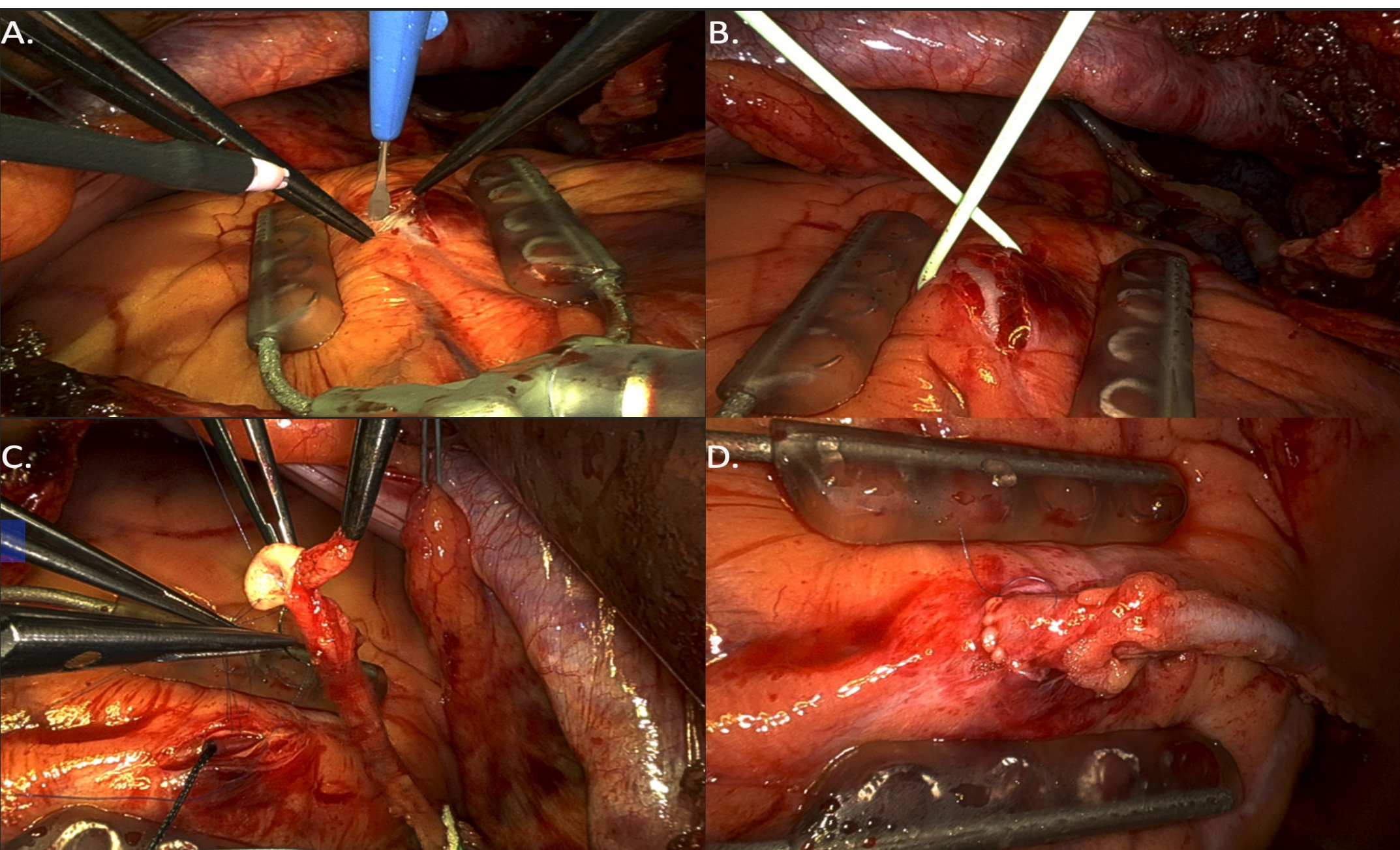


Fig. 7 Steps of Coronary Anastomosis – A. Exposing the LAD, B. Proximal occlusion with loop, C. Anastomosis, D. End result

Discussion

LAA closure in itself provides a significant reduction of stroke risk and consequently mortality in patients who undergo cardiac procedures.⁴ While it is possible to close the LAA as part of conventional MIDCAB surgery the limiting factor is access.⁵ The relatively medially placed incision in MIDCAB facilitates direct harvesting of the LIMA and performing the coronary anastomosis but rarely provides adequate safe exposition of the LAA. A second incision in the chest wall/pericardium and additional manipulation is often necessary for this purpose. There have been various such methods described in literature.⁶ Robotic harvesting of the LIMA allows for a more lateral thoracotomy that easily allows direct access to the LAA as well as an adequate angle for applying a clip. Once the LAA is sufficiently exposed its occlusion is possible with minimal manipulation and without prolonging the total duration of surgery. The lack of extra incisions lowers the risk of chest wall bleeding or phrenic nerve injury. The learning curve for this technique is basically limited to manipulation the clip applier. We chose the Atriclip Device because of its straightforward implementation procedure and intuitive design.³ Potential limiting factors, such as intrapericardial adhesions or inadequate atrial anatomy, pose challenges for LAA closure regardless of the approach method. We found this technique to be so easily reproducible and feasible that it has become the standard therapy for patients undergoing minimally invasive robotically assisted bypass surgery with known Afib. Further long-term follow up is needed but one can safely assume that these patients have a double benefit: firstly, effective occlusion of the LAA dramatically reduces stroke risk² and secondly, in the months following surgery oral anticoagulants can be stopped after confirmation of complete occlusion through ultrasound. These medications bring an added chronical bleeding risk which rises exponentially with the duration of treatment.

Conclusion

The concomitant closure of the left atrial appendage utilizing a clip device during left sided mini thoracotomy, performed for minimally invasive robotically assisted bypass surgery, represents a feasible, safe, and effective treatment option.

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