



## Surgical Epicardial Left Atrial Appendage closure : A True Alternative

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### Abstract

Left atrial appendage closure has now become a mainstream alternative to oral anticoagulation in atrial fibrillation. Surgical options are available. herein we briefly describe these.

### Background

Left atrial appendage closure was originally described by Madden in 1949 who was the first to perform appendix amputation<sup>[1]</sup>. This was a very invasive procedure with poor outcome, but performed for stroke prevention. Much later, it was James Cox whom described the Cox-Maze procedure, which included multiple incisions to create a maze like pathway for the electrical impulse to go undisturbed from the sinus node down to the atrio-ventricular node<sup>[2]</sup>. Since then cardiac surgeons stopped focusing on the left atrial appendage and went on about seemingly more important things. Only with the advent of catheter based options for stand alone left atrial appendage closure did the interest in the field light up again. It is the very impressive clinical outcomes from the protect AF trial which has declared left atrial appendage closure as mainstream therapy in modern cardiovascular care<sup>[3]</sup>. Not only does the current data suggest that left atrial appendage closure with a Watchman when compared to oral anticoagulation is non inferior, but moreover a long term survival benefit has been demonstrated. Not only clinical adoption has led large-scale enthusiasm about left atrial appendage closure options but also pressure from the financial markets driving Industry into this direction has created a huge interest<sup>[4]</sup>. As predicted by certain financial institutions market growth for left atrial appendage closure is exponential and it's going to have a huge financial impact in the coming years, with great opportunities not only in the field of medicine. It appears that the main focus of development is on the endocardial space. The epicardial approach are seen by the financial visionaries, and also clinicians, remains a limited. It is this part of the vision which we herein see as problem. In many fields of medicine the interdisciplinary care has become the basis of any therapeutic decision. No cancer patient undergoes any form of therapy before being assessed by a interdisciplinary tumor board. And as such it is crucial that interdisciplinarity becomes the standard of care in the setting of left atrial appendage

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therapies. And more importantly an honest exchange without financial and power interest must take place in favor of obtaining the best clinical outcomes possible.

### The left atrial appendage – the surgeon's perspective

To mention the left atrial appendage is to acknowledge a highly variable anatomical structure, coming in many shapes and forms which can be described in many words<sup>[5]</sup>. Every different size and shape creates a true therapeutic challenge when addressing closure modalities especially when coming from the endocardial space but also epicardially. As basic consideration the fact that the ostium of the left atrial appendage is endocardial creates a problem in itself. Furthermore the ostium is an oval structure, a circle pulled in the length of the so-called Coumadin ridge. Therefore it becomes clear that catheter based device being round may present a certain challenge to accommodate this characteristic<sup>[6]</sup>. This will lead to the necessity of device over sizing with consequences on the surrounding structures.. In addition it appears that even though this area is supposed to be free of muscular trabeculations, which are hypothesized to be the source of the underlying thrombo-embolic problem. It is the neck which presents itself to the cardiac surgeons as the target for left atrial appendage therapies. The neck is not difficult to address – for surgeons.

It is very important to understand the difference of concomitant left atrial appendage closure and stand-alone. As part of any open-heart surgery the necessity to address the left atrial appendage must be taken into account in all patients. It is crucial to assess every patient in this regard and to choose the means by which the left atrial appendage will be addressed. As for stand-alone left atrial appendage closure, this is an invasive procedure which must be applied to a very select patient population. This is not a mainstream procedure as it involves thoracic surgery skills and interdisciplinary patient selection<sup>[7]</sup>. Two last issues remain to be investigated, one is the role of electrical isolation of the left atrial appendage. It appears that with the epicardial approach complete electrical isolation can be achieved<sup>[8]</sup> in addition we believe that this might even be an explanation for the excellent results seen in the FAST<sup>[9]</sup> trial when comparing catheter ablation to thoracoscopic

ablation with appendage amputation, i.e. silencing [7]. The precise neurohormonal implication of left atrial appendage clipping remain to be investigated.

### Open surgical left atrial appendage therapies

Open surgical left atrial appendage treatment can become necessary in several settings. It appears that all patients undergoing open heart surgery could benefit if a certain risk profile is necessary of a left atrial appendage therapy. As such it is included in the most recent guidelines<sup>[10]</sup>. The available surgical strategies are few, as a perfect results are necessary to obtain durable surgical closure. Suture or staple ligation should be abandoned as these lead to reperfusion over time with very poor clinical outcome<sup>[11]</sup>. In the open chest setting resection of the left atrial appendage can still be performed easily, but provide a technical challenge as the stump left behind may lead to some oozing and bleeding problems, adding a certain degree of complexity to any surgical case. Therefore we use the newly available open chest Atriclip as this provides safe, effective and very durable left atrial appendage closure<sup>[12],[13]</sup>.

### Minimally invasive stand alone left atrial appendage therapies

As for minimally invasive options for LAA closure, the bulk of data comes from the thoracoscopic ablation literature. Up to very recently these patients were undergoing a video assisted thoacoscopic procedure with epicardial pulmonary vein isolation and left atrial appendage amputation by stapler. Only recently has the new Atriclip Pro2 become available. With this new epicardial clip it is possible to occlude the left atrial appendage at its base under trans esophageal echocardiographic guidance and obtain perfect closure. The procedure – which can be part of a thoracoscopic ablation procedure or done in a stand alone setting is done through three ports. A 12mm is used for the Atriclip. As such a port is inserted in the 4 or 5th Intercostal space on the midaxillary line in the left chest with CO2 insufflation with a camera. Two additional ports for two instruments are inserted in the 3rd and 5th intercostal space more anteriorly. The phrenic nerve is identified and an incision 1 cm below exposes the left atrial appendage. A sizing device 35 to 50mm is used to assess the dimensions of the base of the left atrial appendage. Then the Atriclip is applied to the base of the left atrial appendage. In meantime on trans oesophageal echocardiography the closure is documented before final release. Only wen perfect closure is obtained is the clip deployed for good. It must however be noted that due to the epicardiac nature of the clip and the endocardial portion of the ostium a certain part of endocardial pouch can be observed. This varies in all patients and between 0.5cm to 1.5 cm.

### “Surgical” patient selection

As the surgical procedure is more invasive than a catheter based intervention. The pro and con needs to be weighed in a very precise manner. For this a functioning heart team setting is necessary. We suggest following criteria for patients to undergo a thoracoscopic stand-alone left atrial appendage closure:

- Failure to treat by endovascular devices due to size or morphological considerations..
- Necessity to discontinue all anticoagulants or antiplatelet agents in the setting of fresh stroke, other bleeding problems

### Contraindications:

- Presence of smoke and or chronic thrombi in the left atrial appendage
- Previous heart or left sided lung surgery .

### Summary

Left atrial appendage closure should be done in a dedicated manner. Open heart surgery is a great opportunity to use foresight in dealing with this important issue. Only device enabled left atrial appendage closure or surgical resection should be done to achieve perfect results. As for stand-alone epicardial left atrial appendage clip closure, in limited series to date only, offers safe, durable and effective results over time. Interdisciplinary heart team offering a tailored approach based on patient and procedure selection for all approaches (endovascular vs. epicardial) offers a great opportunity to achieve perfect outcomes in this patient population making LAA closure amenable to many more patients.

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