



How I do it: simplified Cox-Maze IV via right mini-thoracotomy

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Clinical vignette

A 59-year-old male suffered symptomatic long-standing persistent atrial fibrillation (AF). There were no relevant comorbidities except multiple failed transcatheter ablations. A moderate left atrium (LA) dilation and a right coronary dominance was detected pre-operatively. The patient underwent modified minimally invasive Cox-Maze IV surgical ablation.

Surgical technique

Preparation and exposition

Under general anesthesia, venous (right internal jugular and femoral veins) and arterial (femoral artery) cannulation for cardiopulmonary bypass (CPB) is achieved percutaneously. The right thorax is slightly lifted using an inflatable bag. A 4–5 cm anterolateral mini-thoracotomy is performed at the 3rd intercostal space (ICS). The camera port is positioned at the 2nd ICS at the anterior axillary line. The right pericardium is opened at least 2 cm above the phrenic pedicle to avoid nerve injury. Heparin is given and CPB commenced. The aorta is cross-clamped and cardioplegic solution delivered in antegrade fashion. The LA is widely opened towards the oblique sinus and extended towards the coronary sinus (CS). This reduces the length between the inferior part of the incision and the mitral annulus (MA).

Surgical ablation procedure

An articulated bipolar radiofrequency (BRF) clamp (EMT1, Isolator SynergyClamp, Atricure, West Chester, OH, USA) is inserted through the left atriotomy with the internal jaws

directed towards the MA crossing the CS epicardially. This line should be adapted to individual coronary anatomy. In left-dominancy, ablation should be directed towards the postero-medial commissure of the mitral valve (MV) while in right-dominancy this line is directed towards the P2–P3 junction (1). Alternatively, a cryoprobe is positioned epicardially at the level of the CS, overlapping the previous RF lesion line. A blue marker is used to highlight the endocardial end of the cryothermic lesion. This will help complete the MA ablation line endocardially afterward.

Then, BRF is used to perform the box-lesion: the inferior jaw is advanced at the level of LA posterior wall from the left atriotomy inferior edge while the superior jaw is advanced within the ostium of the left atrial appendage (LAA) thus performing the “floor” ablation line. Similarly, the inferior jaw is positioned at the level of the transverse sinus while the superior jaw is advanced from the left atriotomy superior edge inside the ostium of the LAA, automatically excluding the left pulmonary veins (PVs) and the posterior aspect of the LA.

Although the lesion set can be completed by introverting the LAA inside the LA and ablating it at its base, the LAA exclusion with an AtriClip device will reach the same goal by providing a complete electrical block (2).

LAA management

With the right atrium (RA) fully collapsed, the aorta is lifted and the LAA exposed through the transverse sinus. A 4/0 Prolene running suture at the level of the crest will help to traction the appendage within the exclusion device (AtriClip Pro 2, Atricure). Then, the LAA is gently engaged and accommodated until AtriClip reaches the LAA base.

Completion—right atrial ablation lines

The RA is opened 1 cm away and parallel to the right atrioventricular (AV) groove. This reduces the distance with the tricuspid annulus (TA), allowing completion of the isthmus ablation line with cryoenergy. In this setting, an additional stab wound should be performed close to the Waterston groove and a BRF ablation performed towards the superior vena cava (SVC). To avoid the sinus node at the level of the SVC, the jaws should be directed towards the SVC posterior wall. Then, the BRF clamp jaws are inverted and passed from the inferior edge of the right atriotomy towards the inferior vena cava, completing the “intercaval line”. The cryoprobe is then inserted at the level of the superior edge of the right atriotomy and advanced until the TA is reached at 1–2 o'clock (tricuspid isthmus). Finally, from the upper end of the right atriotomy, the BRF clamp is advanced towards the tip of the right atrial appendage, completing the right atrial lesion set.

Comments

In this latest technical modification, we illustrate how to easily perform a full Cox-Maze IV ablation via right mini-thoracotomy. The main novelty is the simplification of the isolation of the PVs and the posterior aspect of the LA (box lesion set). By directly sliding the inner jaw of the BRF clamp into the ostium of the LAA (either performing the superior and inferior lines), the left PVs are automatically included and isolated. It is of paramount importance to extend the left atriotomy down towards the CS to reduce the length between the inferior atriotomy edge and the LAA ostium. Furthermore, this also reduces distance with the MA thus allowing BRF and cryotherapy devices to complete the mitral isthmus line. Although the MA can be swiftly clamped with BRF, the AV groove is thicker and the adipose tissue lining on the epicardial surface below the MA could impede reaching the MA itself (3). For this reason, cryothermic energy should be used to complete this ablation line. We recommend protecting the surrounding tissues with a sponge anytime cryotherapy is used. Direct contact between important anatomical structures with the frozen epicardium may cause injury.

In our setting, we also performed the TA line by means of cryotherapy. Although beginners in arrhythmia surgery might be skeptical, cryotherapy has proven safe when performing the TA ablation line without damage to the right coronary artery (RCA) running superiorly (4).

Alternatively, the RCA can be lifted by surgically dissecting the AV groove: the outer jaw of the BRF clamp can be advanced below. However, this maneuver could be cumbersome in a minimally invasive setting.

We remind readers this procedure should always be completed by managing the LAA. To date, exclusion by means of an epicardial device such as AtriClip has shown to be largely effective in achieving a complete exclusion without gaps or residual stump (5). This independently allows risk reduction of stroke regardless of a stable sinus rhythm restoration in AF patients. Moreover, it should be considered that this epicardial device allows complete electrical isolation once released thus permanently tackling arrhythmic foci perpetuating AF (2).

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Footnote

Conflicts of Interest: S.B. discloses financial relationship with Atricure, Artivion, Allergan. The other authors have no conflicts of interest to declare.

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References

1. Benussi S, Nascimbene S, Calvi S, et al. A tailored anatomical approach to prevent complications during left atrial ablation. *Ann Thorac Surg* 2003;75:1979-81.
2. Rosati F, de Maat GE, Valente MAE, et al. Surgical clip closure of the left atrial appendage. *J Cardiovasc Electrophysiol* 2021;32:2865-72.
3. Castellá M, García-Valentín A, Pereda D, et al. Anatomic aspects of the atrioventricular junction influencing radiofrequency Cox maze IV procedures. *J Thorac Cardiovasc Surg* 2008;136:419-23.

4. Cheema FH, Pervez MB, Mehmood M, et al. Does cryomaze injure the circumflex artery?: a preliminary search for occult postprocedure stenoses. *Innovations (Phila)* 2013;8:56-66.

5. Whitlock RP, Belley-Cote EP, Paparella D, et al. Left Atrial Appendage Occlusion during Cardiac Surgery to Prevent Stroke. *N Engl J Med* 2021;384:2081-91.

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