

Bi-atrial Electrocautry Maze- Amiodarone Protocol for the Treatment of Atrial Fibrillation

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The Cox maze III procedure (The cut and suture technique) is the standard benchmark for AF surgery. It has the highest reported conversion rate to sinus rhythm with re-establishment of atrial transport function. It is primarily a method to enforce a blockade of the electrical wave front. The major reason for its limited use is the extensive nature of the procedure and the multiple suture lines giving rise to possible troublesome bleeding apart from the increase in cross clamp time. Different sources of energy have been used instead; namely cryo-ablation, radiofrequency waves, laser, and electrocautry.

The electrocautry (EC) maze is a cost-efficient, easily reproducible and quick method. A method using the creation of lesions by an ordinary unipolar surgical diathermy unit for creating linear lesions akin to the Cox maze procedure to create a pathway.

The Operative Technique

All patients are placed on conventional CPB with bicaval venous cannulation (SVC cannula being passed through the right atrial appendage) and ascending aortic cannulation. On normo-thermic bypass with the non cross-clamped perfused beating heart, the right atrium is opened.

The initial cautery lesions are placed using the "spray mode" of an ordinary cautery pencil connected to a diathermy machine (Valley Lab Force 40 STM Valleylab, Inc., CO) set at 40 watts and using the coagulation – spray setting. The output waveforms are as follows: Valleylab Force 40 STM – 500 kHz damped sinusoidal bursts with a repetition frequency of 31.25 kHz, rated load of 300 ohms and power output being 40 watts. The theoretical energy delivery is approximately 40 Joules for every second of cauterization. Lesions are created by slow progression of the pencil such that the tissue blanched when the cautery arc is moved against the tissue. Since the spark mode arc is employed in an empty heart, alteration in conductivity (due to blood and charring) is typically avoided and the rate of progression of the cautery is primarily determined by blanching. This is approximately at the rate of around 1-2 seconds per centimeter. The cautery is never kept stationary as it has to be moved as soon as the tissue blanches. Inspection on the opposite side easily demonstrates the transmural nature of the burn visually.

The pencil diathermy probe is used the ordinary "knife" tip and not a ball electrode. The tip actually does not come in contact with the tissue after the spark

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arc-gap is established. For this a knife tip would be better than a ball tip. In early experience, I have used the elongated-tipped handle, then I have switched to the foot paddle use to act precisely on the atrial walls.

The right atrial lesions are as follows: Remember the # 5 on your fingertips

Step 1: From the posterior wall of the SVC – RA Junction (just caudal to the level of the SA node), down across the fossa ovalis to the IVC cannula veering towards the mouth of the coronary sinus and burning the inferior mouth of the coronary sinus including as much of the ostium as possible (Figure 1).

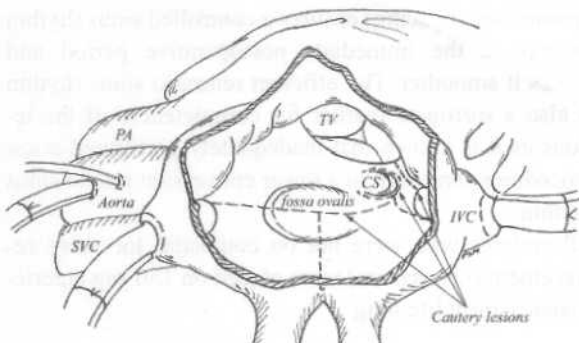


Fig (1): The right atrial electromaze. Modified and reproduced after Simha M P, The Electrocautery Maze – How I Do It. The Heart Surgery Forum #2001-98765 4 (4):340–345. (With permission).

Step 2: From the IVC burning the atrial isthmus and proceeding to the tricuspid valve orifice at 5 o'clock (Figure 1).

Step 3: From the middle of lesion 1 laterally towards the atrial wall, burning the atrial "Crista" and proceeding further laterally to meet the atriotomy (Figure 1). The right sided lesions are performed on the beating perfused heart primarily to see the effect of ablation on the right side. Nearly 60% of cases revert to sinus rhythm or develop a slowing of the heart rate and intermittent P wave formation. The lesion at the coronary ostium can be precisely placed and thus heart blocks can be avoided.

Step 4: From the superior end of the atriotomy to the right atrial appendage stopping at the cannulation orifice.

Step 5: Restarting at the diametrically opposite point and continuing the lesion towards the dome of the left atrium.

While placing this lesion, care must be taken to specifically search for the sinus node artery and the interrupt

the cautery lesion for 3 mm on either side of the artery. The yellow fat pad indicating the area of the sinus node should be assiduously searched for and avoided during the placement of all lesions. The lesion near the sinus node artery is placed as it is found that this lesion usually caused a sudden conversion. While placing the right atrial lesions, I chose to keep this lesion as they had "visual comfort" when sinus rhythm was restored during the right sided lesions itself prior to arresting the heart. This lesion is extended as far as possible medially and is stopped short of the ascending aorta.

The retrograde cannula is placed back into the coronary sinus. Any tricuspid procedure that has been planned is performed. The atriotomy is closed and the heart is arrested with antegrade cold blood cardioplegia. During this period, if there is no left atrial thrombus, the left atrium is ligated externally with a silk/linen ligature. The left atriotomy is done after dissecting the interatrial (Sondergaard's) groove extensively (vertical left atriotomy). Any left atrial thrombus is evacuated and all lamellar thrombus in the atrial body is assiduously evacuated. The mitral valve procedure is performed.

The left atrial lesions are as follows: Remember the # 5 on your fingertips

Step1: If the left atrial appendage has not been ligated previously, it is now ligated externally.

Step2: The lesions are placed circumferentially at one centimeter from the pulmonary vein orifices. The cautery lesions are placed while controlled warm retrograde normokalemic reperfusion is being done.

Step3: A lesion touching each of the previous lesions and the mitral annulus at 5 o'clock connects all four lesions. (On a practical basis, if the gap between the left superior and inferior pulmonary vein is small, a common lesion can encircle both pulmonary veins). The peripulmonary lesion is made to touch the mitral annulus only at 5 o'clock to limit any chance of significant circumflex coronary artery injury.

Step4: A lesion is placed from this outer lesion to the ligated left atrial appendage.

Step5: In giant left atria with atrial diameter more than 7 cms, an optional cruciate lesion is placed within the circum-pulmonary vein lesion (Figure 2).

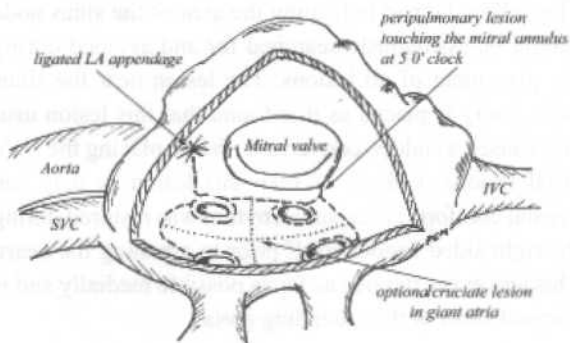


Fig (2): The left atrial electromaze. Modified and reproduced after Simha M P, The Electrocautery Maze – How I Do It. The Heart Surgery Forum #2001-98765 4 (4):340-345. (With permission).

The left atriotomy is then closed. The heart is de-aired and the patient is weaned off CPB in the routine manner.

Trans-esophageal echocardiography (TEE) is done. Atrial and ventricular wires are placed. Care is taken to place the atrial wires as high as possible to enable sinus node recovery time (SNRT) studies.

Postoperative Care

Patients who are in sinus rhythm were put on an infusion of amiodorone (10 mg/Kg/24 hours) and then an oral amiodorone 200 mg/day for three months, and then stopped. Patients who had nodal rhythm were given intravenous aminophylline (15 mg/Kg/24 hours) with an

initial 200-mg bolus on CPB, if there was nodal rhythm, and temporary atrioventricular pacing was instituted as and when required. (Notice that all the numbers can be divided on # 5)

Amiodorone was given primarily to ensure decreased atrial automaticity to offset the increased atrial tissue conduction speed that can cause transient AF despite adequate maze lesions. This is done to ensure maintenance of sinus rhythm postoperatively at all times to ease hemodynamic management in sick left ventricles. Since sinus rhythm begets sinus rhythm, addition of amiodorone, even though only three months, ensures maintenance of sinus rhythm and early return of atrial function. Multimodal attack of AF (maze + amiodorone + optional atrial pacing) ensures a controlled sinus rhythm throughout the immediate postoperative period and makes it smoother. The efficient return to sinus rhythm is also a surrogate marker for completeness of the lesions as it is known that inadequately performed maze procedures can result in a lower conversion rate to sinus rhythm.

All patients who were not on coumadin for valve replacement (i.e., repairs) were placed on 150-mg enteric-coated aspirin life long.

References

1. Simha M P, The Electrocautery Maze – How I Do It. The Heart Surgery Forum #2001-98765 4 (4):340-345, 2001 Online address: www.hsforum.com/vol4/issue4/2001-98765.html