

Getting the Hang of the Maze Procedure

Dr. Ovidio A García-Villarreal*

Consultant in Cardiac Surgery, Monterrey, Mexico

***Corresponding Author:** Dr. Ovidio A García-Villarreal, Consultant in Cardiac Surgery, Monterrey, Mexico.

Received: February 24, 2020; **Published:** February 29, 2020

Abstract

The maze procedure has been designed to eliminate any type of atrial fibrillation (AF) or flutter. However, a few extremely important considerations must be taken always into account before performing the maze procedure. A series of surgical incisions or burn lines are strategically placed in a maze-like fashion on both atria; therefore, all possible macro-reentrant circuits causing AF can be broken up. Besides the classic “cut-and-sew” standard fashion, only bipolar radiofrequency and cryothermia can be safely used in terms of getting complete transmural burn lines in the atrial myocardium. The other utmost important condition is the use of a full bi-atrial lesion pattern as part of a real and comprehensive standardization for the maze procedure. In an attempt to improve the quality of our daily practice, we explain in a little more detail herein each and every of the most important key points to correctly perform the maze procedure.

Keywords: *Arrhythmia; Atria; Atrial Fibrillation; Left Atrium; Cox-maze Procedure; Maze Procedure*

A lot of information has been released about the Maze procedure. However, they do not put so much stock in what is beyond all this. We are urged to make clear that there is a true lack of standardization in the Maze procedure. Briefly speaking, in daily practice, there is no a common agreement about “how complete” the procedure must always be nor about the “authorized” alternative energy sources in this regard. We must be more sensible in applying these principles.

As a general overview, as we shall more fully see later in this article, there are some basal considerations we have to keep in mind at all time before attempting any maze procedure. The maze procedure has been designed to eliminate any type of atrial fibrillation (AF) or flutter [1]. However, before entering on the subject in this regard, we must make a few preliminary remarks in order to get a much better understanding about how the Maze procedure works. Based on the framework that the atrial fibrillation is a re-entry arrhythmia, it always takes two main conditions in order to produce AF. The first one is the genesis of the AF. Triggers (ectopic foci) located into and around (in the antrum) the pulmonary veins (PV) generate some shootings or electrical impulses, whose are the true origin of the AF. Once the electric impulse reaches the whole atrial myocardium along both atria, from this point forward, two conditions can be developed, depending on how electrically remodeled the atrial myocardium is. If the atrial myocardium is normal or nearly normal, the electric impulse tends to fade away by itself within the next two days. Alternatively, some other medical or electrical actions can be taken to eliminate the AF before the seventh day after onset. Conversely, if atrial myocardium is enough remodeled, the electric impulse can persist making circles (also called macro-reentrant circuits) anywhere in both atria for longer even in an endless way. Triggers from the PV foci are not necessary anymore to generate AF. To put it in a nutshell, AF is now self-sustaining [2]. This condition above is better known as non-paroxysmal or persistent AF (more than 7 days in duration).

Citation: Dr. Ovidio A García-Villarreal. “Getting the Hang of the Maze Procedure”. EC Cardiology SI.02 (2020): 01-03.

The other concept of utmost importance to bear in mind is how the maze procedure works. This surgical procedure has been designed to eliminate any type of AF and flutter. Based on the assumption that the minimum size of the macro reentrant circuit to self-sustain AF in the human atria is 6 cm or larger [3]. When all anatomic aspects in human atria are considered, and two separate incisions or burn lines are placed in a parallel way less than 6 cm one from the other, there will not be enough space, enough tissue for the development of the macro-reentrant circuit. Thus, we can draw conclusions in a way that no more AF is seen after the procedure. At the same time, special and spatial orientation of all incisions or lines of the maze procedure makes possible to preserve the atrial transport function. Following the maze pattern, the electric impulse travels from the sinus node towards the atrioventricular node. All myocardial syncytium is electrically stimulated almost at the same time. Thus, the atrial transport function is preserved [4]. When properly performed, success rate freedom from AF can reach up to 90% at 5 years follow-up [5].

In the light of the foregoing, why then the maze procedure is not fully accepted all over the world in the daily practice? Broadly speaking, it seems to me that there are three main reasons to explain this fact. Hence the need to analyze this fact at greater length as it deserves. The first reason is that the maze procedure is time-consuming in the operating room. Nothing is more far from the truth, nowhere near! With the new technological breakthroughs, the maze procedure has evolved at a mind boggling rate. Surgical incisions of the standard cut-and-sew maze III procedure have been replaced by burn lines, giving rise to the so-called maze IV procedure. There is a considerable saving-time in favor of the maze IV procedure when comparing both procedures [6]. Full transmural burn lines are a matter of utmost priority on this subject. Nevertheless, only bipolar radiofrequency and cryothermia have demonstrated to be consistent for full transmural when applied in the atrial myocardium. Any alternative energy sources other than cryo or bipolar radiofrequency must be avoided when performing the maze IV procedure [7].

The second reason is that in an attempt to simplify the maze procedure, it turns into a disaster. I have already previously published that the more complete the procedure, the higher the chance for success [3]. A true standardization with no variations as much as possible in the way of performing the maze procedure, the correct selection of energy sources as well as in the way of using these energies are mandatory to get the best results. Now, we have the best evidence getting the most prominent results when using a “full bi-atrial lesion pattern” in the maze procedure [8,9]. Any variation from the original conception as maze procedure may be deleterious for the final outcome. No changes are allowed in the procedure, not even the slightest.

Thirdly, although it has been said that the results after maze procedure are not that good, here is where a fully more detailed analysis comes into play. Many times, a large number of articles selected as matching standards for a given meta-analysis they simply turned out to be not true mazes. As expected, the final outcomes in this kind of meta-analysis are not so good. Mini-mazes, left-sided mazes, and any variation whatever minimal are a few instances for this matter [10].

In short, as a conclusion, (i) there are only two possible alternative energy sources working well for transmural. Namely, Bipolar radiofrequency ablation (hot energy), and cryolesion (cold energy). Other than these should be avoided. (ii) There are just three possible ways to do the Cox-maze procedure in a suitable manner: a) Cut-and-sew plus application of cryothermia on critical areas; viz, on the coronary sinus (outside the heart), on the mitral and tricuspid annuli (inside the heart), b) Bipolar radiofrequency ablation in combination with cryolesion on critical areas (see above), and c) Cryolesion for the whole procedure. (iii) Any variation whatever minimal from the original concept of the Cox-maze procedure is not well tolerated in terms of freedom from AF. So, any effort should be always well appreciated to perform a full bi-atrial lesion pattern regardless the underlying pathology for the AF. Even though some troubles are facing when moving from the theory into the practice, a great deal of effort must be put into the following the foregoing indications. In so far as they are followed, outstanding results freedom from AF may be obtained after maze procedure.

Bibliography

1. Cox JL, *et al.* "The surgical treatment of atrial fibrillation". III. Development of a definitive surgical procedure 101 (1991): 569-583.
2. Cox JL. "Atrial fibrillation I: a new classification system". 126 (2003): 1686-1692.
3. García-Villarreal OA. "Why the maze procedure is so effective. Let's get straight down into business!" *Cirugia Cardiaca En Mexico* 5 (2020): 18-20.
4. Cox JL, *et al.* "Successful surgical treatment of atrial fibrillation. Review and clinical update". *JAMA* 266 (1991): 1976-1980.
5. Cox JL, *et al.* "An 8 1/2-year clinical experience with surgery for atrial fibrillation". *Annals of Surgery* 224 (1996): 267-273.
6. García-Villarreal OA. "Cox-maze III versus Cox-maze IV. Resultados a largo plazo". *Cirugia Cardiaca En Mexico* 1 (2016): 119-123.
7. Ad N., *et al.* "Expert consensus guidelines: Examining surgical ablation for atrial fibrillation". *The Journal of Thoracic and Cardiovascular Surgery* 153 (2017): 1330-1354.
8. García-Villarreal OA. "Standardization in maze procedure: a step towards a better future". *Journal of Thoracic Disease* 10 (2018): S3887-S3889.
9. Ad N. "The importance of standardization in surgical ablation for atrial fibrillation". *The Journal of Thoracic and Cardiovascular Surgery* 151 (2016): 399-401.
10. Cox JL, *et al.* "When Is a Maze Procedure a Maze Procedure?" 34 (2018): 1482-1491.

© All rights reserved by Dr. Ovidio A García-Villarreal.