

Minimally invasive surgery for atrial fibrillation—Wolf Mini Maze procedure

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Introduction

The Cox-Maze III procedure has traditionally been considered the “gold-standard” in the surgical treatment of atrial fibrillation (AF). In an era of increasingly minimally invasive surgical techniques, proponents have highlighted advantages of reduced trauma, shortened hospitalization length and improved cosmesis. Developed by Dr. Randall Wolf, the Wolf Mini Maze procedure is a minimally invasive surgical approach, utilizing a video-assisted epicardial ablation.

In 1999, we made a bipolar device from a Semb clamp and modified it with gold electrodes on the tips. The idea was that by placing the clamp between the ribs to surround the pulmonary veins for pulmonary vein isolation, a minimally invasive surgical approach could be achieved. An acute porcine model was initially used, with a sternotomy performed and clamp placed on the beating heart around the pulmonary veins. There are several advantages of such a clamp technique, including the exclusion of all of the blood while the clamp is being fired. We demonstrated transmural isolation of the pulmonary veins in 100% of the animals tested, particularly acute transmural lesions in the excised and stained cardiac tissue. This can be observed via cross-sections near the antrum and transmural lesions from the inside of the heart. Lastly, we also performed trichrome stains to demonstrate the scar, the basis for isolating AF triggers about the antrum. The trichrome stain can be clearly observed in the transmural lesion of the cardiac muscle. In 2001 in Leiden, we utilized a disposable bipolar clamp during concomitant procedures. Our goal was still to proceed with a minimally invasive approach for a stand-alone procedure.

The Wolf Mini Maze procedure

The Wolf Mini Maze procedure was first performed in 2003, at the Department of Cardiothoracic Surgery, University of Cincinnati, Ohio, and demonstrated great success. The first surgical patient had AF for 12 years, and was in long-standing persistent AF prior to his procedure. Currently, the patient continues to be free from AF and antiarrhythmics such as amiodarone and Coumadin for over ten years. We have studied him at home on three different occasions continuously for one week and found no evidence of asymptomatic AF. There has been a significant evolution of the procedure and the devices over the last ten years. The present video-atlas demonstrates the current edition of the way the Wolf Mini Maze procedure is performed, detailing the following procedural steps: preparation, signal testing, right pulmonary vein isolation, stamping technique and left pulmonary isolation and left atrial appendage occlusion (*Video 1*).

Comments

For those surgeons who are truly interested in proceeding with this minimally invasive surgery for stand-alone AF, it is highly recommended that cadaver studies be performed to become familiarized with opening the pericardium laterally, surrounding the pulmonary veins and applying disposable isolator clamps between the ribs. Expertise should also be attained in using one of the isolator clamps. We demonstrated it could be placed easily through a port site below the working port, from which the clamp could be directed around the pulmonary veins. It was an imperative point to show that the clamp would fit around the veins

well up on the left atrial antrum, and that such a maneuver could be done without a malleable shaft on the device. In fact, a non-malleable device is advantageous as it ensures that the tips of the electrodes are in close approximation. The left atrial appendage can be isolated and excised using a stapler or a clip. In our initial cadaver studies as well as our initial clinical studies, we placed the clamp safely around the pulmonary veins using a red rubber guide. The procedure has evolved since then, however we use the same basic technique with a red rubber catheter guide on the bottom jaw of the clamp.

In 2003, the Wolf Mini Maze procedure was used on the first clinical cases, with no bipolar pen. In the early days, a 2-5-2 EP catheter was utilized for sensing and high frequency stimulation, with the atrium still beating and the ventricle stopping. Furthermore, initially, a neuro bayonet

bipolar device was used to isolate the ganglionic plexi (GPs) in the Waterston groove. A diastolic arrest results following high frequency stimulation of the GPs.

The instruments and techniques of the Wolf Mini Maze procedure continue to evolve. This procedure now represents an excellent approach to the surgical treatment of AF. We would like to acknowledge and thank all of the engineers and cardiothoracic surgeons who continually contribute to the ongoing evolution and success of this technique.

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