

Treatment of Atrial Fibrillation: Is It Really Going to Be a Surgical Market?

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Introduction

Surgery for atrial fibrillation (AF) has made considerable progress in the past several years. Various energy sources besides cryothermia, such as radiofrequency (RF) (Unipolar Cooled RF,¹⁾ Unipolar RF,²⁾ microwave,³⁾ ultrasound,⁴⁾ and laser,⁵⁾ have been introduced through modern technology to ablate the atrial wall of AF patients. It is of great benefit to have methods by which surgery can be facilitated. However, some new devices are still reported to be behind the conventional “cut and sew” method in the complete formation of transmural lesion.⁶⁾ From the viewpoint of cardiac physiology, most methods with new devices are less invasive or are an *incomplete* version of the Cox-Maze III procedure. This procedure yielded a high success rate of defibrillation in part by blocking the route around the mitral annulus in addition to P-V isolation. However, the recent modification of the Cox-Maze procedure handles mainly P-V isolation, which has been shown to be less effective in defibrillation than the complete Cox-Maze III procedure.⁷⁾

It is understandable that the current boom of AF surgery was partly facilitated by surgeons’ fears that they would face a catastrophic decrease of the volume of cases because of drug-eluting stents (DES). Are current efforts of the incomplete version of the Cox-Maze procedure really going to recover the surgical arena?

Generally speaking, when a new method aims at overcoming competitors in medical practice, the following patterns versus competitors’ methods should be considered:

Pattern 1. The method is less invasive and more effective

This is ideal, and it has a good chance of growing if its cost is reasonable. However, it is not easy for surgery to overcome catheter intervention in invasiveness. Endoscopic off-pump P-V isolation appears to be beneficial to patients in terms of no exposure to irradiation, but the catheter appears to be easier and safer. In fact, some cases of atrial laceration have been reported in endoscopic P-V isolation. The author fears that Pattern 1 surgery can seldom exist in the treatment of AF.

Pattern 2. The method is more invasive, but more effective

This may not be ideal, but the method may have a unique role when competitors fail to cure the disease in certain patients. Conventional coronary artery bypass grafting (CABG) and even off-pump CABG has so far belonged to this category. Currently, CABG is facing difficulties because the emergence of DES places CABG toward a “more invasive but equally effective” evaluation compared to DES. In the treatment of AF, Pattern 2 should be a choice for surgery to survive.

Pattern 3. The method is less invasive, but less effective

This may also have a role in some situations, such as when the patient cannot tolerate invasive procedures. However, surgical treatment seldom achieves this pattern because of its invasive nature.

Pattern 4. The method is more invasive, but less effective

This method is out of the question, and the method will sooner or later disappear.

Then where do new surgical treatments for AF, such as RF ablation, belong? The author unfortunately believes

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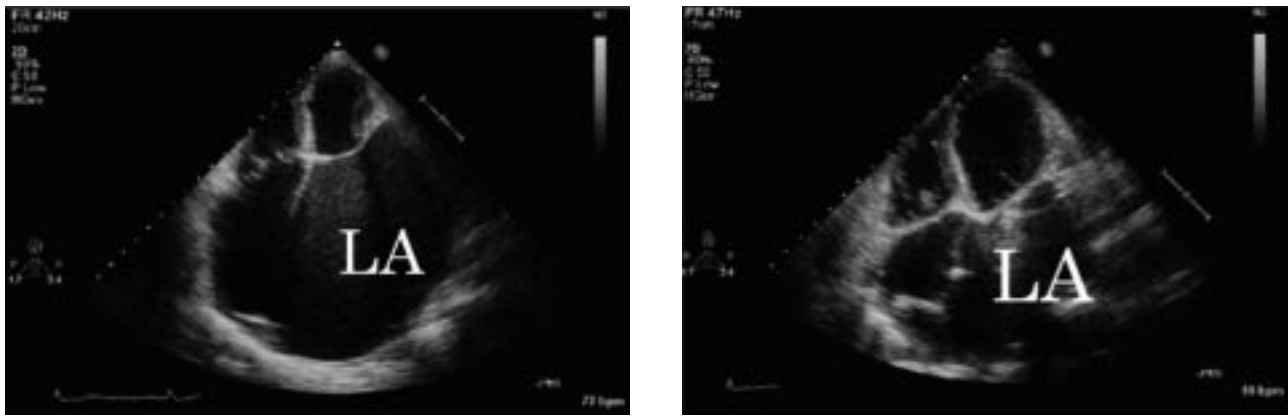


Fig. 1. Four-chamber view of echocardiography in a representative case (a 62-year-old female with mitral stenosis, tricuspid regurgitation, giant left atrium [LA] and right atrium [RA], permanent atrial fibrillation [AF] for years, and left ventricle [LV] dysfunction) before (left) and after (right) surgery, which consists of an atrial reduction of the Cox-Maze procedure and mitral valve replacement with tricuspid annuloplasty.

Both atria, especially the left atrium, became much smaller and have better hemodynamics with sinus or atrial rhythm. This type of patient eventually never becomes a candidate for conventional catheter-based ablation.

that it is more invasive than catheter ablation, and in the future that it will not be more effective. Then just as with any coronary artery disease, cardiologists who are gatekeepers in the field of AF perform treatment by using catheter ablation more than they previously did, and therefore it is unlikely for them to give in the treatment of AF especially lone AF to surgeons' hands.

With a breakthrough in technology, there will be a possibility that the surgical treatment of AF will be popular even for lone AF. For that to happen, treatments such as RF ablation should be either entirely free from such complications as bleeding and should perhaps be as effective as the Cox-Maze III procedure. We must remember that such breakthrough technology may also facilitate the progress of catheter ablation technology, and it may not change the relative status of surgical treatment for AF.

Finding that the above Pattern-2 may be practical, the author developed the atrial volume-reduction Maze III procedure after studying excellent foregoing works.⁸⁾ The left atrial size is one of the major risk factors of AF, and the presence of a dilated or huge left atrium excludes catheter ablation, and perhaps also a the standard Cox-Maze III procedure. However, when combined with atrial volume reduction, the Cox-Maze III procedure may become more effective for this population of AF patients with large atriums.^{9,10)} After the left atrial reduction on average down to a third of the preoperative size, modified Cox-Maze patients are usually defibrillated. Even if they are not,

intra-atrial flow will be made better (i.e., increased), and will possibly be indicated to hybrid catheter ablation because the atrium does not exclude catheter treatment at that stage. A representative case is shown in Fig. 1.

In conclusion, for surgery to contribute more to patients and society, either another breakthrough in energy source/method or further-refined atrial reduction with the Cox-Maze III procedure will be useful and worthwhile to consider.

References

1. Deneke T, Khargi K, Grewe PH, Laczkovics A, von Dryander S, et al. Efficacy of an additional MAZE procedure using cooled-tip radiofrequency ablation in patients with chronic atrial fibrillation and mitral valve disease. A randomized, prospective trial. *Eur Heart J* 2002; **23**: 558–66.
2. Akpınar B, Guden M, Sagbas E, Sanisoglu I, Ozbek U, et al. Combined radiofrequency modified maze and mitral valve procedure through a port access approach: early and mid-term results. *Eur J Cardiothorac Surg* 2003; **24**: 223–30.
3. Schuetz A, Schulze CJ, Sarvanakis KK, Mair H, Plazer H, et al. Surgical treatment of permanent atrial fibrillation using microwave energy ablation: a prospective randomized clinical trial. *Eur J Cardiothorac Surg* 2003; **24**: 475–80.
4. Groh MA, Binns OA, Burton HG 3rd, Ely SW, Johnson AM. Ultrasonic cardiac ablation for atrial fibrillation during concomitant cardiac surgery: long-term clinical outcomes. *Ann Thorac Surg* 2007; **84**: 1978–83.

5. Williams MR, Casher JM, Russo MJ, Hong KN, Argenziano M, et al. Laser energy source in surgical atrial fibrillation ablation: preclinical experience. *Ann Thorac Surg* 2006; **82**: 2260–4.
6. Stulak JM, Dearani JA, Sundt TM 3rd, Daly RC, McGregor CG, et al. Superiority of cut-and-sew technique for the Cox maze procedure: comparison with radiofrequency ablation. *J Thorac Cardiovasc Surg* 2007; **133**: 1022–7.
7. Melby SJ, Zierer A, Bailey MS, Cox JL, Lawton JS, et al. A new era in the surgical treatment of atrial fibrillation: the impact of ablation technology and lesion set on procedural efficacy. *Ann Surg* 2006; **244**: 583–92.
8. Sankar NM, Farnsworth AE. Left atrial reduction for chronic atrial fibrillation associated with mitral valve disease. *Ann Thorac Surg* 1998; **66**: 254–6.
9. Marui A, Nishina T, Tambara K, Saji Y, Shimamoto T, et al. A novel atrial volume reduction technique to enhance the Cox maze procedure: initial results. *J Thorac Cardiovasc Surg* 2006; **132**: 1047–53.
10. Marui A, Tambara K, Tadamura E, Saji Y, Sasahashi N, et al. A novel approach to restore atrial function after the maze procedure in patients with an enlarged left atrium. *Eur J Cardiothorac Surg* 2007; **32**: 308–12.