

DOWNLOAD PDF MINIMALLY INVASIVE SURGICAL APPROACH TO TREAT ATRIAL FIBRILLATION

Chapter 1 : Convergence Procedure for Treatment of Atrial Fibrillation – Medical Tourism Journeys

A systematic review of minimally invasive surgical treatment for atrial fibrillation: a comparison of the Cox-Maze procedure, beating-heart epicardial ablation, and the hybrid procedure on safety and efficacy.

Perspective Treatment of lone atrial fibrillation: Since , my colleagues and I have diligently pursued a minimally invasive surgical, beating-heart, left atrial isolation technique that is offered to patients with lone atrial fibrillation AF. We began clinical cases in In , we reported our initial experience with video-assisted bilateral pulmonary vein PV isolation and left atrial appendage LAA exclusion for the minimally invasive treatment of AF Wolf technique. From our experience in over 1, cases there have been many lessons learned in the evaluation, selection and minimally invasive surgical treatment of patients with lone AF. In our experience we have had zero mortality and no conversions to sternotomy. Recently we reviewed patients who are now 1 to 9 years out from the Wolf technique. The follow-up included 7-day continuous monitoring. There were no deaths personal review. The Wolf technique is a safe and effective treatment for selected patients with lone AF. Minimally invasive surgical treatment of lone atrial fibrillation AF Submitted Oct 20, Accepted for publication Dec 30, Some electrophysiologists initiated catheter ablation for lone structurally normal heart AF 1. Figure 1 Explanted porcine heart after bipolar clamp application externally on the beating heart. On the endocardium, beautiful transmural lesions are seen. Since , my colleagues and I have diligently pursued a minimally invasive surgical, beating-heart, left atrial isolation technique that is offered to patients with lone AF. In , we reported our initial experience with video-assisted bilateral pulmonary vein PV isolation and left atrial appendage LAA exclusion for the minimally invasive treatment of AF Wolf technique 2. At average 3-month follow-up in 23 patients, 21 were free of AF by objective endpoints [Electrocardiograph ECG and 7-day home monitoring]. In , we then began two projects simultaneously: During the last eight years we have added pacing for block, testing entrance and exit block, ganglionic plexi testing and isolation 3 , and use of a bipolar pen for isolation. After demonstrating the technique to surgeons in the United States, Europe, South America, and Asia, there emerged more single-center reports using our technique, with similar good short-term results 4 - 6. This type of minimally invasive surgical technique to cure AF is becoming more common. More than 12, minimally invasive Wolf techniques with the Atricure system have been performed to date. Recently, the Atrial Fibrillation Catheter Ablation Versus Surgical Ablation Treatment FAST Trial – the first randomized, controlled study comparing minimally invasive surgical ablation consisting of bilateral left atrial antral isolation, partial cardiac denervation and excision of the LAA to catheter ablation – was reported with 1-year follow-up 7. In addition, all surgical patients had removal of the LAA, obviating the need for continued anticoagulation 8. It should be clearly understood that energy sources that seem to perform adequately during on-pump procedures with the heart empty may not provide transmural lesions in the beating heart 9. However, dry bipolar RF produces in complete transmural lesions and no histological damage to surrounding tissues on the beating heart Figure 1. These findings are explained by the fact that circulating blood in the beating heart acts as an infinite heat sink, making transmural lesions problematic. Using a bipolar clamp and dry RF, there is no heat sink as the blood is excluded from the treated area. In addition, in using a dry bipolar clamp there is minimal lateral thermal spread, so the energy application is limited to the treated area. We have been a strong proponent of LAA exclusion or excision. Some patients are referred because of inability to tolerate warfarin on the background of transient ischemic attacks TIAs or stroke. The main reason for surgical referral in this subgroup of patients is to exclude the LAA as a source of repeated cerebral embolic events. In the FAST trial, there were two cerebral vascular events in the catheter ablation group in the postoperative month period. These problems are absent in the postoperative minimally invasive surgical patients, as the LAA has been removed 8. Intraoperative electrophysiologic testing We believe intraoperative EP testing is of paramount importance. We were the first to test for ganglionated plexi GP activity about the left atrium and isolate these GPs during our minimally invasive AF procedure, with the assistance of Dr. Ben

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Scherlag, and using his techniques 11 - Figure 2 A The usual tested areas for ganglionic plexi activity on the right side of the left atrium; B This demonstrates usual testing areas for stimulation for ganglionic plexi on the left side of the left atrium. The GPs are isolated both with the bipolar clamp applied medial to Waterston groove fat pad and with a bipolar pen directly over any remaining positive GPs. We also test after isolation of the GPs. In addition to adding objectivity to the procedure, by learning these EP techniques, the surgeon will speak the same language as the electrophysiologist. In cases referred after failed catheter ablation for AF, the nonisolated PVs are identified at the time of testing during the minimally invasive surgical AF procedure. In addition to providing a map for the surgical ablation procedure, this provides helpful feedback to the electrophysiologist and helps ensure consistency when reporting results. The GP isolation also addresses one of the plausible mechanisms of AF. Patient selection and preoperative testing The ideal patient for minimally invasive surgical treatment is listed below: History of TIA or stroke; Inability to take anticoagulants; Patient desire to be rid of anticoagulants or antiarrhythmics; Documented AF; No significant obstructive coronary artery disease; Left atrium less than 6 cm; Failed catheter ablation. AF must be objectively documented preoperatively. If it has not been, 7-day continuous Holter monitoring is recommended. We have found other arrhythmias in patients labeled with AF, including recurrent non-sustained ventricular tachycardia. These patients must be referred for proper work-up and certainly would not benefit from a surgical AF procedure. Any history of obstructive CAD or valvular heart disease must be thoroughly evaluated preoperatively. Our routine preoperative workup is described in Table 1. Table 1 Different tests used during treatment of lone atrial fibrillation Full table Surgical approach Although catheter-based techniques are the least invasive approach to the heart, it can be argued that epicardial discrete surgical isolation of the antrum as opposed to current extensive endocardial ablative techniques is much less invasive to the heart itself. This difference in approach helps to account for the low pro-arrhythmia rate following minimally invasive antrum exclusion surgically with a clamp versus catheter ablation personal observation. Another advantage of the surgical approach is that it reliably treats the autonomic nerves, which are epicardial 3 , Preparation A double lumen endotracheal tube is used for selective lung ventilation and a central line is placed. External defibrillator pads are placed in the appropriate vector. Sequential compression stockings are placed on the lower extremities. A warmer is used to control body temperature during the procedure. Document the external anatomy. Place the first port in the sixth or seventh intercostal space ICS in the mid-axillary line. From the scope view, identify the fourth ICS. Make a cm working port in the auscultatory triangle in the fourth ICS and carry it anteriorly Figure 3. Figure 3 Right-sided VATS approach with an inferior port with scope in place and working port being created in the fourth intercostal space ICS anteriorly. Verify that a pediatric Yankauer suction freely falls into the oblique sinus through this opening. Use the scope to check the access angle for the dissector device. A sponge stick can be used to gently retract the heart medially as needed for access and visualization. This allows the dissector to be lined up for direct in-line access with the appropriate port. Bluntly retract the SVC medially with a sponge stick or grasper to help gain exposure and visualization of the superior aspect of the RPA. Feed the dissector tip into the oblique sinus just above the IVC, around the back of the heart, and then articulate the dissector to pass between the superior PV and the pulmonary artery. This provides for more medial isolation of the left antrum and usually treats all the GPs, except level 9 on the right Figure 4. Figure 4 Intraoperative photograph demonstrating the septal lesion with the bipolar clamp. This encompasses the right side of the left antrum as well as a Waterston groove fat pad and extends to the base of the superior vena cava superiorly and to the base of the inferior vena cava inferiorly. Also seen to the right is the placement of a bipolar pacing lead inside of the pericardium. Map and record the epicardial ECG. Prior to closing the pericardium, a temporary bipolar pacing lead is placed through the medial edge of the pericardium to lie on the right atrium. The leads are held in place by the pressure of the pericardium on the right atrium. Place a small drain through one of the inferior port sites and close the right-sided incisions. The dissection and ablation are performed similar to the right side, except that on the left side, the ligament of Marshall must be divided. Passing and placement of the Isolator clamp is similar to the right side Figure 5. Figure 5 Intraoperative

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photograph on the left side. Left superior and inferior pulmonary veins are visualized and the dry bipolar clamp is seen well up on the left antrum. The Echelon flex 60 powered stapler Ethicon Endosurgery is used with a thick tissue load green, staple height 4. The stapler should be introduced through the most posteriorly located inferior port site. The pericardium should be closed on the left side to avoid herniation of the heart Figure 6. Figure 6 The stapled left atrial appendage is being removed from the intrapericardial area. At the conclusion of the left side there are two inferior port sites, one of which is used for the drain tube. The working port incision in the 4th ICS measures about 6 cm Figure 7. Figure 7 Intraoperative photograph. Demonstrating the position of the camera port, which now has in place a chest tube and the working port in the fourth intercostal space ICS anteriorly. The working port measures six centimeters. Conclusions Recently we reviewed patients who are now 1 to 9 years out from the Wolf procedure. If it is difficult to discern thrombus in the distal LAA, start the minimally invasive surgical procedure on the left side and remove the LAA first. Although we occasionally do this to be conservative when there is some question of LAA opacification, we have yet to find thrombus in the LAA. If there is questionable opacification distal to the left circumflex, in our practice it has been safe to perform the procedure. Remove the LAA flush with the left atrium in all cases. Remember there are two reasons for LAA excision: Test and ablate the GPs in all cases.

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Chapter 2 : Heart Surgery for Atrial Fibrillation (MAZE) | Cleveland Clinic

Now patients with lone atrial fibrillation can choose between a catheter-based and a minimally invasive surgical approach. Minimally invasive surgery to treat lone atrial fibrillation also can benefit patients who have a contraindication to warfarin, heparin, or antiarrhythmics medications, or a history of cerebral events, Fig. 1.

Heavy alcohol use Enlargement of the chambers on the left side of the heart Patients with Atrial Fibrillation Afib have heart rhythms that are at a significantly faster than a normal heartbeat. The clots put patients at high risk for stroke if left untreated. Facts about Atrial Fibrillation An estimated 2. With the aging of the U. African Americans are less likely than those of European descent to have AFib. Because AFib cases increase with age and women generally live longer than men, more women than men experience AFib. Our Approved Provider in Denver, Colorado offers a new, minimally invasive approach does not require an open-heart surgical procedure. This new procedure restores normal heart rhythm in even the most difficult-to-treat patients suffering from persistent and long-standing forms of Afib. The Convergence Procedure for Treatment of Atrial Fibrillation is performed by an Electrophysiologist EP paired with cardiothoracic surgeon to combine the best of both traditional catheter and surgical ablation treatments. This new clinical approach, available since , improves the early and mid-term outcomes for the most challenging patients and reduces procedure times when compared to single disciplinary approaches. In the past , therapeutic options for atrial fibrillation AF included lifelong medications i. Treatment decisions for Atrial Fibrillation were based on the type and duration of AF, the severity and type of symptoms, associated cardiovascular disease, patient age, associated medical conditions, short-term and long-term treatment goals, and pharmacological and nonpharmacological therapeutic options. The new multidisciplinary Convergence Procedure for Treatment of Atrial Fibrillation does not include the more traditional surgical ablation approaches that are significantly more invasive, requiring chest incisions or ports, and lung deflation. It is performed on a beating heart in the cardiac catheterization lab shown above. During the procedure, new scar tissue is created intentionally on the heart in order to block abnormal electrical signals. The EP then threads an ablation catheter through the femoral vein in the groin to reach the inside of the heart to perform complex electrical-anatomic mapping and to ablate abnormal signals that occur in predictable locations on the inside of the left atrium specifically in and around the pulmonary veins. The primary advantage for the Electrophysiologist is the ability to isolate the posterior wall of the left atrium safely and effectively through this complementary access and ablation tool. The doctors utilize best practices to standardize new procedures to ensure ablation completeness and predict substantially better outcomes than have ever been seen before for persistent forms of Afib. If your insurer will not cover the procedure, we will negotiate a cash discount with our Approved Providers that can be paid by cash, check or credit card at or before your arrival in Denver. Many medical tourism companies in the USA and abroad work as "patient brokers" - an illegal act in the USA and many other countries. We work for you. We provide valuable services, convenience and expertise to help our clients travel to their chosen destination and their chosen providers in our our Approved Provider Network for medical, dental and other services they want or need. We are paid a modest fee for the time we spend and to cover the costs of inspecting our Approved Providers and how we use decades of expertise arranging medical travel journeys for our clients and coordinating their aftercare and measuring outcomes upon their return back home. Can I use my insurance or Medicare for payment? If your insurance or Medicare will approve the procedure and provide pre-authorization or pre-certification, we are happy to coordinate that for you. Our careful three-point check ensures that: The procedure is an approved and covered procedure for a covered condition. Our Approved Provider is eligible to receive payment in accordance with the terms and conditions of your policy. That the insurance company intends to honor your claim if you decide to travel out of your home area to receive care. If we need to mount an appeal on your behalf to Medicare or to your insurer, employer or the Department of Insurance or other regulators IRS, Department of Labor, etc. Usually, we can get an answer within 3 working

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days once we begin our process. To start the process, we need a one-paragraph form letter signed by you that gives us permission to speak with your insurer on your behalf. Where can I travel for care? Medical Tourism Journeys coordinates health and wellness travel to more than countries on five continents.

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Chapter 3 : Minimally invasive surgery for atrial fibrillation

Heart Surgery for Atrial Fibrillation (MAZE) Menu Overview Before the Procedure During the Procedure After the Procedure Doctors Who Treat Resources & Patient Info Dr. Marc Gillinov discusses the results of a randomized controlled trial from the Cardiothoracic Surgical Trials Network and recommends surgical ablation or maze procedure for.

It increases in incidence as we age. Atrial fibrillation reduces the efficiency of the heart making patients feel fatigued, and causes swirling of the blood in the fibrillating heart chambers which can lead to blood clots and strokes. When stroke strikes, permanent damage, loss of function or death can occur. Statistically, if a person develops atrial fibrillation and is compared to their neighbor who never develops atrial fibrillation, the person with atrial fibrillation will be 2x more likely to die and have 5x the risk of suffering a stroke in their lifetime. Medications to treat atrial fibrillation have limited ability to durably convert and keep patients with atrial fibrillation in normal sinus rhythm. Hence most patients are placed on rate controlling drugs and lifelong blood thinners such as Coumadin to make them feel more comfortable and help reduce their risk of stroke. What causes atrial fibrillation? It turns out that many of the electrical impulses that initiate and propagate atrial fibrillation emanate from either the pulmonary veins or the back wall of the left atrium. Cardiologists specially trained in arrhythmias of the heart are called electrophysiologists. Knowing that the pulmonary veins and the back wall of the left atrium can initiate and propagate atrial fibrillation, physicians for years have been working to better understand and treat atrial fibrillation. One well known highly effective surgical procedure is called the Cox-Maze procedure. By this act of extensively cutting and sewing the heart back together again at these well-defined anatomical lines, the aberrant electrical currents that initiate and propagate atrial fibrillation are interrupted. Part of the Cox-Maze surgical procedure is ligation of the left atrial appendage. What relative role; ligating the left atrial appendage which is known to be the location of most of the thrombi that form in the heart vs. Catheter ablation of Atrial Fibrillation: Electrophysiologists have long attempted to recreate the clinical success of the Cox-Maze surgical procedure. To achieve the same results less invasively, they have tried snaking radiofrequency emitting catheters up the veins in the leg, across the interatrial septum of the heart, electrically mapping and then ablating the left atrium and pulmonary veins in a manner similar to the ablation lines described in the Cox-Maze surgical procedure. Ablating electrophysiologists have to be concerned at all times with damaging nearby surrounding tissues like the esophagus which can lead to a rare but usually lethal complication like an atrial-esophageal fistula. The hope of catheter ablation is that it can attain the block to conduction that the Cox-Maze surgical procedure affords the patient and high resumption of normal sinus rhythm, without the trauma of open heart surgery. Unfortunately, even if catheter ablation is successful in restoring a patient to normal sinus rhythm, the left atrial appendage is almost never ligated. This study describes the 5-year efficacy of catheter ablation for long-standing persistent atrial fibrillation LS-AF. Initial ablation strategy was circumferential pulmonary vein isolation PVI. After the first ablation procedure, sinus rhythm was documented in 41 of After multiple procedures, sinus rhythm was maintained in 91 of In patients, PVI was the sole ablative therapy, 49 Persistent AF duration hazard ratio: J Am Coll Cardiol ; You can click here to download this article. Is there a better way? Robotic Hybrid Atrial Fibrillation Ablation: Since the results of catheter based ablation alone can be so dismal and the Cox-Maze surgical procedures can be so invasive, might there be a better way? Why not learn from our success in robotic hybrid coronary revascularization and combine the best of both worlds of cardiac surgery and cardiology? There exists a robotic assisted method for wrapping a long radiofrequency emitting catheter around the beating heart in a closed chest setting that can provide linear ablation lines similar to the Cox-Maze surgical procedure with no sternotomy and no use of cardiopulmonary bypass. Since this personal series was performed, the technology has improved markedly and we now have available a 3rd generation radiofrequency catheter that promises even better rates of transmural ablation. Read the articles here. Article 2 Scientific Basis In addition, investigators

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have recently reported that a hybrid approach may be the best approach to treat long standing persistent chronic atrial fibrillation. In addition, they usually add some additional ablation lesions that are not accessible to a minimally invasive surgical approach. In this manner, by combining the best of both the worlds of cardiac surgery and cardiology, investigators are reporting impressive clinical success! Electrophysiologic and surgical procedures to treat stand-alone atrial fibrillation AF have recently evolved, but disappointing results in patients with long-standing persistent LSP AF have challenged the durability of these procedures. Mean left atrial dimension was A continuous rhythm monitoring device was implanted at the end of the operation. Thoracoscopic ablation was successfully completed without morbidity or mortality and without any intensive care unit stay. Additional transcatheter lesions were performed in At a mean follow-up of 30 months range, months , The combination of a surgical box lesion and transcatheter ablation in a hybrid approach provided excellent durable clinical outcomes in patients with LSP-AF. J Thorac Cardiovasc Surg :- In addition, for all our patients in this revolutionary and unique program, we perform left atrial appendage ligation. The left atrial appendage is known to be the primary site where blood clots form in atrial fibrillation. Active clinical programs utilizing these approaches are currently underway at major academic centers like the University of Chicago and the University of North Carolina. Picture of one of our robotic minimally invasive surgical ablation patients 2 weeks after surgery:

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Chapter 4 : Minimally invasive surgery for atrial fibrillation - Zembala - Journal of Thoracic Disease

Minimally invasive surgery to treat lone atrial fibrillation also can benefit patients who have a contraindication to warfarin, heparin, or antiarrhythmics medications, or a history of cerebral events, Fig. 1.

Home Can Afib Be Cured? Mini Maze Procedure Surgical Ablation Not everyone with atrial fibrillation needs to have open heart surgery. Fortunately, if you have just atrial fibrillation and no heart valve issues, there is a minimally-invasive version of the maze procedure. It evolved from the Cox Maze III procedure, which is a "cut-and-sew" procedure, and is performed on a beating heart without opening the chest. This procedure is done by a cardiothoracic surgeon. Thus, recovery time is much shorter and easier, and most patients are afib-free afterwards. The mini maze procedure offers a way to stop the irregular heartbeats and heart palpitations without the long and difficult recovery for open-heart surgery. It is a potential atrial fibrillation cure. Mini Maze Procedure – Minimally-Invasive Surgical Ablation While patients with paroxysmal atrial fibrillation have been considered the best candidates for the mini maze procedure, recent enhancements have also yielded success with persistent and longstanding persistent atrial fibrillation, sometimes referred to as chronic or permanent atrial fibrillation. To get to the heart, the surgeon makes three or four small incisions on each side of the chest, and through these incisions places surgical instruments, an ablation device, and a thoracoscope. The thoracoscope endoscope is a camera and direct vision device that allows the surgeon to see the heart inside of the chest. A surgical ablation energy source is used to create a conduction block that isolates the pulmonary veins and stops the chaotic electrical signals from disrupting the heart. While in there, the surgeon treats the Ligament of Marshall and nerve bundles that are called the ganglionic plexi, and removes or clamps off the left atrial appendage to reduce the risk of blood clots and stroke. Recently, outcomes have improved for those with persistent and longstanding persistent atrial fibrillation through new lesions, including lesions in the roof and floor of the heart, a lesion connecting to the mitral annulus a fibrous ring around the mitral valve, and isolation of the coronary sinus and of the superior vena cava just above the right atrium. New tools and procedures have improved ablation effectiveness in these thicker and hard-to-access heart tissues. Finally, a "four box" verification technique has been added to confirm the electrical isolation of all sources of atrial fibrillation in order to increase the potential for staying in normal sinus rhythm. This newest version of the mini maze procedure is called the Total Thoracoscopic Maze. To learn more about this latest version of the mini maze procedure, read about the Total Thoracoscopic Maze or see Surgeon Discusses Evolution and Future of Atrial Fibrillation Maze Procedure to watch a video of an actual mini maze procedure. A recent minimally-invasive variation is the Paracardioscopic Ex-Maze, which involves placing a small circular incision in the abdomen and going through the diaphragm to access the back of the heart. One of the newest frontiers in afib treatment is a very encouraging trend that has evolved out of the collaborations between electrophysiologists and cardiothoracic surgeons, especially at integrated afib centers. Since there are advantages to both the mini maze procedure and catheter ablation, the newer convergent procedures combine the best of the mini maze procedure and catheter ablation in the same operation and offer a lot of promise. It is important to be aware that the US Food and Drug Administration FDA has not approved most surgical devices specifically for atrial fibrillation treatment, though clinical trials are underway to gain this approval. However, many of these tools have been FDA-approved for use on "cardiac tissue" and doctors are at liberty to use the tools that they deem appropriate and safe for the treatment of atrial fibrillation patients.

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Chapter 5 : Advantages of the Convergent Procedure by Andy C. Kiser, MD, Paul Mounsey, MD,

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Minimally invasive surgery for atrial fibrillation Michael O. Minimally invasive surgical ablation remains one of the most dynamically evolving fields of modern cardiac surgery. While there are more than a dozen issues driving this development, two seem to play the most important role: Paucity of this data offers surgical community unparalleled opportunity to challenge guidelines and change indications for surgical intervention. Large, multicenter prospective clinical studies are therefore of utmost importance, as well as honest, clear data reporting. Second, a collaborative methodology started a long-awaited debate on a Heart Team approach to AF, similar to the debate on coronary artery disease and transcatheter valves. Appropriate patient selection and tailored treatment options will most certainly result in better outcomes and patient satisfaction, coupled with appropriate use of always-limited institutional resources. The aim of this review, unlike other reviews of minimally invasive surgical ablation, is to present medical professionals with two distinctly different, approaches. The first one is purely surgical, Standalone surgical isolation of the pulmonary veins using bipolar energy source with concomitant amputation of the left atrial appendage—a method of choice in one of the most important clinical trials on AF—the Atrial Fibrillation Catheter Ablation Versus Surgical Ablation Treatment FAST Trial. The second one represents the most complex approach to this problem: The Convergent Procedure, which includes both endocardial and epicardial unipolar ablation bonds together minimally invasive endoscopic surgery with electroanatomical mapping, to deliver best of the two worlds. Accepted for publication Oct 26, Its prevalence increases sharply with age. A trend towards longevity, augmented by continuous advances in cardiovascular and cancer medicine will most certainly contribute to an even greater incidence of AF, especially in patients already suffering from structural heart disease. Current estimates suggest that the number of patients suffering from AF in Europe will double within the next 10 years and soar to 5 million by the year However, these numbers must be considered by taking into consideration the incidence of major adverse events associated with AF, namely stroke. It has been proven that AF is associated with an increased risk of cerebrovascular thromboembolic events, increased frequency of cardiac-related hospitalizations and a significantly reduced quality of life. The occurrence of these major adverse events raises mortality two-fold and notably increases the cost of care of patients either suffering from AF or from its non-fatal comorbidities 2 - 4. Sole antiarrhythmic therapy is rarely sufficient and limited by its toxicity, and yet recent years have brought only minor improvements in this field. The highly anticipated benefits of dronedarone have doubtful efficacy 5 , leaving amiodarone the drug of choice for most of the patients suffering from highly symptomatic AF. However, serious side effects such as hyperthyroidism and liver dysfunction limit its clinical potential 6. On the other hand considerable advances have been made in the field of anticoagulation, as novel oral anticoagulants NOACs have been widely accepted as an equally effective option to vitamin K antagonists VKA , namely warfarin 7. This however, may be perceived as an opportunity to compensate for the ineffective methods to achieve sinus rhythm restoration, either pharmacologically or by intervention. Elimination or a significant reduction of the AF burden remains however, the most important measure of stroke prevention. Introduction of percutaneous catheter ablation for AF in by Haissaguerre marks the foundations of modern electrophysiology. Current guidelines equate surgical and catheter based ablation in terms of therapeutic efficacy IIB indicating that catheter ablation may be considered an effective treatment option for patients with PSAF or LSPAF 9 - The evidence supporting this recommendation is, however, limited C. Repeated ablations are often required, exposing the patient to extended periods of radiation and an increased risk of peri-procedural complications, and a considerably increase in the healthcare costs. On the other hand surgical ablation offers higher success rate, but its widespread acceptance is slow, mainly due to its

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invasive nature, having chest incisions and heart dissections. Moreover, regardless of previously published statements, European Society of Cardiology ESC limits surgical ablation to patients who have failed a previous catheter ablation. The key concepts Surgical ablation as proposed by J. Cox resulted in sinus rhythm restoration in a majority of treated patients His concept evolved around creation of a new pathway for the electric impulse which originates in the sinus node and ultimately ends at the atrioventricular node. Although extremely effective even in very large atria, the Cox-Maze procedure remains technically challenging and complex, limiting its adoption in everyday clinical practice. It requires a full sternotomy, cardiopulmonary bypass and aortic cross clamping with subsequent cardiac arrest. Bleeding and complete atrioventricular block were not rare in the postoperative course of these patients. The introduction of the off-pump procedures, raised questions regarding lesion transmuralty and efficiency of a beating heart ablation. Numerous new energy sources were introduced to facilitate this rapidly evolving field. Yet the aim remained the same, simple and unchanged from the basic concepts: The aim of this review, unlike other reviews of minimally invasive surgical ablation, is to present medical professionals with two distinctly different approaches: Standalone surgical isolation of the pulmonary veins using bipolar energy source with concomitant amputation of the LAA; The Convergent Procedure, a multidisciplinary approach that combines both endocardial and epicardial unipolar ablation. Standalone surgical ablation Isolation of the pulmonary veins as right and left pairs through bilateral mini-thoracotomies performed off-pump using a bipolar radiofrequency device was first introduced by Randal Wolf in Yet, it required multiple chest incisions and lung deflation. Since the construction of these devices was fairly simple and constituted of a single tube with heating element located on the inner side of the tube, its introduction into the pericardial sac, and around the LA remained quite humble and required minimal endoscopic skills 18 , However breaking through pericardial reflections, especially one separating superior vena cava from the right pulmonary artery, was cumbersome and not once resulted in both SVC and LA laceration and bleeding. Introduction of various type of add-ons facilitating probe delivery and retrieval magnets made this quick and widely accepted surgical procedure. However, it proved to be moderately successful in SR restoration. More importantly, it addressed the need for treatment options for patients with paroxysmal and persistent who at that time had been receiving treatment that was less invasive and at least as effective with percutaneous techniques. Other modifications followed such as additional three lesions were placed on the lateral wall of the right atrium, creating a triangular area of isolated myocardium. The procedure was then enhanced by percutaneous catheter based endocardial ablation, but only in patients who had recurrences after the initial treatment. Should it be considered as the true hybrid or bail out remains an open question. The FAST Trial was the first prospective randomized clinical trial was designed to compare catheter and surgical ablation in a well-described population of patients with AF It randomized one hundred twenty-four patients into two treatment arms. This rare comparison showed however, that surgical ablation was superior to catheter ablation in achieving freedom from left atrial arrhythmias after 12 months of follow-up, although the procedural adverse event rate was significantly higher for the surgical group. Most of these were minor and included pneumothorax 6 cases! Sadly, it was not the success rate, but the number of periprocedural complications that was most remembered by the general public. Therefore it is crucial for minimally invasive techniques to remain truly minimal in all the aspects of care. Unfortunately, the FAST trial remains the only randomized clinical trial directly comparing surgical versus percutaneous treatment options. The standalone surgical ablation procedure The totally thoracoscopic, off-pump, bilateral extended ablation with the ganglionated plexi GP ablation and the LAA amputation procedure is based on the bipolar radiofrequency technology, which has long-established data on excellent transmuralty. This line is similar in its purpose to the left mitral isthmus line in the classical MAZE concept Figure 1. Modified Left atrial lesion set. Patient is placed in the supine position under general anesthesia and intubated using double lumen intratracheal tube to facilitate single lung ventilation. Three thoracoscopic ports are placed on both sides of the chest through the 4th camera port and 6th working ports intercostal spaces in the midaxillary line. Once identified, GPs are then ablated using an unipolar pen-like device Figure 2. At least three overlapping ablation

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lesions are performed at the antrum of the veins 8. Bidirectional acute conduction block is confirmed both by absence of sensed atrial potentials in the PVs and pacing of the PVs in patients in sinus rhythm. An additional ablation lesion is created if necessary. Subsequently additional lesions using the bipolar linear device are performed to close the box pattern lesion and so-called triangular line between the roof of the left atrium and the non-coronary aortic annulus. Then the left thoracic cavity is entered in a similar fashion. Left pericardium is opened posterior to the phrenic nerve and both upper and lower pulmonary veins are encircled with the bipolar clamp. Again, minimum of 3 overlapping applications are performed. Dissection of the ligament of Marshall using electrocautery and amputation of the LAA are performed last. LAA is usually addressed with a GI stapler and entirely removed. Extreme caution must be taken during this part of the procedure, as LAA may be torn easily. Moreover a stapler must be well positioned, not to leave any remnants, as these may be even stronger triggers that predispose thrombus formation. Recent modification of the abovementioned technique lead to multidisciplinary procedure, with electrophysiology specialists performing either right-sided lesions or completing left sided, trigonal or isthmus lines. Initial results of this combined approach are very encouraging, especially in patients with LSPAF 24 , Standalone surgical ablation of atrial fibrillation. Clearly visible lesion separating right pulmonary veins from the left atrium. Ablation of ganglionated plexi with unipolar device. The convergent approach The concept of the combined surgical epicardial ablation and electrophysiological endocardial ablation approach to treat AF was introduced in , and has evolved over time to what is now referred to as the Convergent Procedure-a collaborative effort of cardiac surgeons and electrophysiologists. Over time the Convergent Procedure has been adopted by increasing number of centers as the positive outcomes demonstrated by the early adopting centers were published 26 - The convergent procedure The Convergent Procedure is a collaborative effort of both the cardiac surgeon and the electrophysiologist. The patient is selected and scheduled for the Convergent Procedure after both the cardiac surgeon and the electrophysiologist has completed their exam and evaluation of the identified patient. Pre procedural procedures are followed per physician and facility standard of care. After the patient is anesthetized trans-diaphragmatic access is obtained using standard laparoscopic surgical techniques for creating a pericardial window, to access the posterior surface of the heart. A 3 cm incision is created below the xyphoid in the midline of the abdomen. Using CO2 insufflation an incision is created through the central tendon of the diaphragm, above the liver and medial to the falciform ligament. The cannula nContact Surgical Inc. By gentle manipulation of the endoscope, the surgeon is able to clearly visualize the posterior aspect of the left atrium and both right and left pulmonary veins irrespective of their anatomical variations Figure 4. The electrode is designed to fit within the narrow working channel created by the cannula, is then placed inside the pericardium, oriented towards the structures to be ablated. The coagulation device utilizes vacuum to create consistent contact between the 3 cm unipolar radiofrequency electrode and epicardial tissue. The vacuum additionally pulls saline through the device to cool the surface not intended for ablation thereby directing energy only into epicardial tissue pulled into engagement with the ablation electrode. The Radiofrequency Generator utilizes an algorithm based on impedance that regulates power to prevent tissue overheating and subsequent vaporization. Using a step-by-step approach, a comprehensive ablation pattern is then created. Posterior wall of the left atrium is ablated first, then posterior surfaces of right and left pulmonary veins. Then the cannula is moved towards the right to visualize and ablate anterior aspect of the left pulmonary veins. In some cases visualization and subsequent ablation of the ligament of Marshall is also completed. Lesion pattern set of the convergent procedure.

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Chapter 6 : Atrial Fibrillation Mini Maze Procedure - Minimally-Invasive Surgical Ablation

Abstract. Atrial fibrillation (AF) remains the most common cardiac arrhythmia, affecting nearly 2% of the general population worldwide. Minimally invasive surgical ablation remains one of the most dynamically evolving fields of modern cardiac surgery.

Electrocardiogram ECG Other tests as needed After the evaluation, the surgeon will discuss your treatment options and together, you will determine if you are a candidate for surgery. Who is a Candidate for Atrial Fibrillation Surgery? Marc Gillinov discusses the results of a randomized controlled trial from the Cardiothoracic Surgical Trials Network and recommends surgical ablation or maze procedure for patients who are having heart surgery and have pre-existing atrial fibrillation. Using the very latest technology, including advanced surgical robotics, Cleveland Clinic heart surgeons can now extend treatment to virtually all patients with atrial fibrillation. Surgical treatment for atrial fibrillation is termed a "Maze" procedure or ablation; other commonly used terms include "mini-Maze" or pulmonary vein isolation. While variations of these procedures are common, at Cleveland Clinic we believe that best results are obtained by using less invasive approaches to perform a procedure that closely resembles the classic Maze procedure. Patients considered for surgical ablation fall into two groups: Patients with isolated atrial fibrillation - may be candidates for minimally invasive treatment approaches. Patients with atrial fibrillation who require heart surgery for other reasons, most commonly to treat coronary artery disease or valvular heart disease. Minimally Invasive Surgery for Patients with Isolated Atrial Fibrillation Currently, most patients with atrial fibrillation are candidates for minimally invasive surgical ablation. The maze procedure is the surgical ablation approach with the greatest long-term success in treating atrial fibrillation. The maze procedure includes creation of lines of conduction block scar tissue that block the abnormal impulses that cause atrial fibrillation, enabling restoration of normal sinus rhythm. The lines of conduction block are created using cryotherapy freezing or radiofrequency energy. Surgical ablation also includes exclusion of the left atrial appendage, the primary source of strokes in patients with atrial fibrillation. The maze procedure is appropriate for patients with highly symptomatic atrial fibrillation, patients in whom catheter ablation has failed, and patients who have a history of stroke or other blood clots. Patients with Atrial Fibrillation Who Require Other Heart Surgery Atrial fibrillation is very common in patients who require heart surgery for other reasons such as mitral valve surgery, aortic valve surgery, coronary artery bypass grafting, and other surgical procedures. Recent data from Cleveland Clinic demonstrate that untreated atrial fibrillation in such patients increases mortality see graphs below. Therefore, in patients with a history of atrial fibrillation, Cleveland Clinic surgeons treat the atrial fibrillation during other types of cardiac surgery. Survival After Heart Surgery Atrial fibrillation surgery combined with mitral valve repair Patients with untreated preoperative AF blue lines have reduced survival. Now, all AF is ablated at the time of heart surgery. When patients with AF have valve or bypass surgery, surgeons create a classic Maze lesion set on the heart using either radiofrequency energy or cryotherapy. This generally adds 15 minutes to the operative procedure and does not increase operative risk. Selected patients with valvular heart disease and atrial fibrillation may be candidates for a minimally invasive approach that enables treatment of both conditions. This information is about procedures and may include instructions specific to Cleveland Clinic. Please consult your physician for information pertaining to your specific procedure.

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Chapter 7 : Robotic Atrial Fibrillation Ablation (Robotic Ablation)

This new minimally invasive approach for Treatment of Atrial Fibrillation available in Denver, Colorado, does not require a traditional open-heart surgical procedure No doubt you've been hearing the long television commercials about the blood thinning medications now available for Atrial Fibrillation.

What you do to help people through this [A-Fib] process is really incredible. I certainly recommend it for patients who want to know more about atrial fibrillation than what they will learn from doctors She loves it and finds it very useful to help her in dealing with atrial fibrillation. You managed to combine an encyclopedic compilation of information with the simplicity of presentation that enhances the delivery of the information to the reader. This is not an easy thing to do, but you have been very, very successful at it. Steve Ryan, PhD, provides a comprehensive guide for persons seeking to find a cure for their Atrial Fibrillation. Cardiac surgeons continually strive toward less invasive procedures which avoid approaches like full median sternotomies and thoracotomies. However, reports of minimally invasive cardiac surgical procedures may include hemi-sternotomies, mini-thoracotomies, or full median sternotomies without cardiopulmonary bypass. There are a variety of techniques and devices in use for the surgical treatment of atrial fibrillation AF. The current gold standard for the surgical treatment has been the Cox cut and sew maze procedure. There have been variations through the years leading to a host of other surgical AF procedures, such as the Wolf mini-maze 1 , practiced by many surgeons. Other techniques create myocardial lesions using some form of radiofrequency energy, laser, cryotherapy or high-frequency ultrasound. Some techniques require cardiopulmonary bypass and sometimes cardioplegia to stop the heart entirely. Pericardioscopy is a totally endoscopic technique that provides direct visualization of, and access to, the epicardial surface of the beating heart without the need for cardiopulmonary bypass or prolonged postoperative recovery. Unlike a subxyphoid approach, pericardioscopy provides access to the heart via the central tendon of the diaphragm. This allows direct vision of the posterior cardiac structures with minimal hemodynamic compromise. Such access and visualization of the epicardial cardiac surface has enabled epicardial ablation techniques, like the Convergent Procedure, as a treatment for atrial fibrillation. Electrophysiologists, in comparison, use endocardial catheters and electrodes to identify the triggers causing AF and direct their treatments towards these foci of abnormal electrical activity in the atria. A truly successful and adoptable AF treatment has always seemed to be just out of reach. The acclaimed gold standard cut and sew maze procedure reports exceptional outcomes but remains a complex procedure that is rarely performed. However, both the surgeons and the cardiologists have demonstrated that when treatment is limited to the left atrium, outcomes suffer as a consequence. The high rate of repeat procedures and less than desirable long-term outcomes have been disappointing. The Convergent Procedure has been developed by a multidisciplinary team of cardiologist and cardiac surgeons to address the procedural and communication barriers. This convergence of technologies and expertise provides or allows for: The creation of a complete, bi-atrial, endocardial and epicardial ablation pattern without a chest incision or cardiopulmonary bypass; 2. Intra-operative metrics to confirm procedural success; 3. Integrated patient care by cardiology and cardiac surgery; and 4. Decreased length of hospital stay and the number of repeat ablation procedures. Evaluation of each case by the multidisciplinary team of arrhythmia experts ensures an individualized, yet consensus, treatment plan. Without this integrated approach, the best treatment option may not be available or may require much longer wait times, more travel and more inconvenience and delay for the patient. Left atrial size, AF type and AF duration are significant contributory factors. We advocate a hour Holter monitor on all patients under evaluation to document the degree of AF burden. Additional evaluation includes a trans-thoracic echocardiogram and cardiac catheterization or stress test to exclude structural heart disease in the setting of AF. When the left atrium is larger than 6. It is difficult for the electrophysiologist to consistently and effectively complete pulmonary vein isolation when the left atrium is greater than 5. Therefore, when a patient has paroxysmal AF and the left atrium is under 4. Surgeons who have experience

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with minimally invasive approaches choose the ablation technology best suited for their technique. Whichever approach and device is used, a comprehensive lesion pattern of contiguous and transmural lesions are essential. Persistence and intra-operative verification of lesion and pattern integrity is crucial. The Convergent Procedure has established new criteria for lesion integrity by the verification of procedural completion by endocardial electrophysiologic metrics. The Convergent Procedure is not complete until pulmonary vein isolation and posterior left atrial exclusion is confirmed, the coronary sinus is ablated, and a cavo-tricuspid isthmus lesion is created. These metrics provide confidence of procedural success and set new standards for the hybrid treatment of persistent and long-standing persistent AF. By integrating electrophysiology and cardiac surgery in a hybrid AF treatment, new procedural and perioperative standards have been established at our institution. The initial outcomes utilizing this multidisciplinary approach are excellent and patient satisfaction is overwhelmingly positive.