The Cox-Maze Procedure for Lone Atrial Fibrillation: A Single-Center Experience Over 2 Decades

Summary: This study reviews our experience in the surgical treatment of atrial fibrillation (AF) during the past 2 decades in 212 consecutive patients with lone AF. Freedom from AF in the original Cox-Maze III procedure was 93%. However, the procedure was difficult to perform and had a 10% rate of major complications. By using radiofrequency bipolar clamp technology to replace surgical incisions with transmural lesions, we modified the procedure (Cox-Maze IV), essentially maintaining the original pattern of lesions. Our results demonstrate that the procedure is much easier to perform, the time to perform the procedure is reduced, and the major complication rate declined to 1%. The present study shows that freedom from AF is still 90% and even off antiarrhythmics it is 83%. Thus, we were able to maintain the efficacy of the original procedure and make it more accessible to a wider cohort of patients. The Cox-Maze IV represents a therapeutic option for lone AF in patients who have had clinical symptoms despite medical treatment or in whom a catheter ablation has failed, patients who have had a stroke despite anticoagulation therapy, and patients who are not candidates for other therapies. The procedure can be performed with minimal risk. The results of this study also serve as a benchmark for the future development of procedures to treat lone AF.

Conclusions: The Cox-Maze Procedure, although simplified and shortened by alternative energy sources, has excellent results, even with improved follow-up and stricter definition of failure.1

Implantable Cardioverter Defibrillator Therapy in Adults With Congenital Heart Disease: Who Is at Risk of Shocks?

Summary: Sudden cardiac death is a major cause of mortality in adults with congenital heart disease (CHD) and might be prevented by implantable cardioverter defibrillator (ICD) therapy. The number of patients with CHD who receive an ICD is steadily increasing. However, in this population, contrary to the patients with ischemic or nonischemic cardiomyopathy, the indication for ICD implantation is poorly defined and little is known about the efficacy of ICD therapy. Therefore, we conducted a multicenter study to determine the long-term outcome of ICD therapy in adults with CHD and developed a simple risk score model for appropriate ICD discharges. Overall, 136 adults with CHD and ICD (mean age ± SD, 41 ± 13 years; 67% male) were identified. The indication for ICD implantation was primary prevention in 50% of patients. Thirty-nine patients (29%) received effective appropriate ICD shocks during a median follow-up of 4.6 years. Patients with a secondary prevention indication, coronary artery disease (CAD), and symptomatic nonsustained ventricular tachycardias were at highest risk of receiving appropriate shocks. Based on these clinical features, a risk score was developed to evaluate the likelihood of appropriate ICD shocks. The 8-year Kaplan-Meier curve to first appropriate shock was 94%, 57%, and 26% for low-, intermediate-, and high-risk patients, respectively. More important, morbidity was considerable because of the relatively high rate of inappropriate shocks (30%) and implantation-related complications (29%). Therefore, the risk/benefit ratio of ICD therapy should be carefully assessed in individual patients. In patients with supraventricular tachycardias, ablation before ICD implantation should be considered because this reduced the risk of inappropriate shock by 25%. In addition, because the population of adults with CHD is growing and aging, assessment of CAD might be warranted.

Conclusions: Adults with CHD and ICDs receive high rates of appropriate and effective shocks. Patients with secondary prevention indication, coronary artery disease, and symptomatic nonsustained ventricular tachycardias are at highest risk of receiving appropriate ICD shocks. ICD implantation is accompanied by considerable morbidity, including inappropriate shocks and procedure-related complications.2

Endocardial Left Ventricular Pacing Improves Cardiac Resynchronization Therapy in Chronic Asynchronous Infarction and Heart Failure Models

Summary: Conventionally, cardiac resynchronization therapy (CRT) is applied using a left ventricular (LV) pacing electrode, positioned at the LV epicardium (either in an epicardial vein or surgically screwed into the myocardium). However, physiological electric activation originates in the endocardium and spreads toward the epicardium. In a previous study performed at our laboratory in a canine model of acute left bundle-branch block, we showed that pacing at the LV endocardium rather than the LV epicardium provides more pronounced electric resynchronization and hemodynamic benefit. However, more recent clinical studies have shown inconclusive evidence of superiority of endocardial over epicardial CRT. The present study investigated endocardial CRT in chronic dyssynchronous canine models with myocardial infarction or heart failure. This study demonstrates that, in animal models, endocardial CRT results in better resynchronization, which is explained by higher impulse conduction velocities along the endocardium and from endocardium to epicardium compared with velocities along epicardium and from epicardium to endocardium, respectively. Also, the shorter conduction path length along the endocardium compared with the epicardium contributes to more synchronous activation during endocardial CRT, although this factor contributes less in dilated failing hearts. The hemodynamic effects were congruent with the electric effects.

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Practical application of endocardial CRT will depend on the availability of reliable techniques and tools to implant the LV lead into the LV endocardium. Possible options are a transatrial-septal approach, a longer screw electrode using a surgical approach, and the novel technique of leadless pacing.

**Conclusions:** Endocardial CRT improves electric synchrony of activation and LV pump function compared with conventional epicardial CRT in compromised canine left bundle-branch block hearts. This benefit can be explained by a shorter path length along the endocardium and by faster circumferential and transmural impulse conduction during endocardial LV pacing.1

**Long-Term Mortality After Transvenous Lead Extraction**

**Summary:** Cardiovascular implantable electronic device (CIED) use continues to increase, with 4.5 million active devices and 1 million new leads implanted annually. With the increase in device therapy, observed complications have increased in parallel, leading to an increased need for transvenous lead extraction (TLE). Multiple reports of TLE procedural outcomes exist; however, data regarding postprocedural and long-term mortality are limited. Between January 2000 and December 2010, 985 patients underwent 1043 TLE procedures. A 0.48% major complication rate was observed, and there were no procedure-related deaths. The mean follow-up was 3.7 years (range, 0.1–11.3 years). Kaplan–Meier analysis demonstrated a cumulative mortality of 2.1% at 30 days, 4.2% at 3 months, 8.4% at 1 year, and 46.8% at 10 years. In multivariable analysis, systemic infection (HR, 3.52; 95% CI, 1.95–6.38; P<0.0001), local infection (HR, 2.70; 95% CI, 1.55–4.67; P=0.0004), device system upgrade (HR, 2.14; 95% CI, 1.07–4.25; P=0.03; indication compared with a reference group of extraction for lead malfunction), diabetes mellitus (HR, 1.71; 95% CI, 1.25–2.35; P=0.0009), increasing age (HR, 1.05; 95% CI, 1.04–1.07; P<0.0001), and serum creatinine (HR, 1.16; 95% CI, 1.01–1.35; P=0.04) were significant correlates of increased mortality risk. Thus, although TLE procedural mortality is exceedingly low at high-volume centers, postprocedural and long-term mortality remain high in certain patient populations, such as elderly patients and those undergoing TLE for infectious indications and device system upgrade. Knowledge of these risks may help guide CIED and lead management. Future studies aimed at identifying potential interventions that modify long-term mortality are warranted.

**Conclusions:** Although TLE procedural mortality is exceedingly low at high-volume centers, postprocedural and long-term mortality remain high in certain patient populations, such as elderly patients and those undergoing TLE for infectious indications and device system upgrade. Information regarding TLE long-term outcomes may help guide cardiovascular implantable electronic device and lead management.4

**Intramural Idiopathic Ventricular Arrhythmias Originating in the Intraventricular Septum: Mapping and Ablation**

**Summary:** Identification and management of idiopathic intramural ventricular arrhythmias (VA) can be challenging. In a consecutive group of 93 patients, we describe 7 patients (8%) with idiopathic, intramural VAs from the intraventricular septum. All VAs had a left bundle-branch block inferior axis morphology. The analyzed ECG features were not specific enough to differentiate intramural VA from VA originating from the aortic cusps. The intramural focus could be ablated in 5 of 7 patients via an endocardial approach from the left and right intraventricular septum or from within the myocardium via a perforator vein. Knowledge of this type of arrhythmia will help to further improve treatment of patients with idiopathic VAs.

**Conclusions:** Idiopathic septal ventricular arrhythmias can originate from intramural foci. Activation mapping from within a perforator branch within the interventricular septum is helpful in identifying the site of origin of intramural septal arrhythmias. Ablation within the septum or from both sites of the septum may be required to eliminate the targeted arrhythmia.3

**Randomized Ablation Strategies for the Treatment of Persistent Atrial Fibrillation: RASTA Study**

**Summary:** The single-procedure efficacy of pulmonary vein isolation (PVI) for ablation of persistent atrial fibrillation (AF) is less than ideal, and the approach to additional ablation is controversial. The inability to achieve durable PV isolation and consistently target AF triggers and substrate outside the PVs contribute to failures. This trial assessed the benefit of additional ablation at complex fractionated electrogram (CFE) regions or common sites of non-PV triggers in patients with persistent AF undergoing PVI plus ablation of provokable AF triggers. We randomized patients to receive no additional ablation, additional ablation of left atrial CFE sites, or ablation at predefined common sites of non-PV triggers. Single-procedure efficacy was <50% in all groups, and CFE ablation beyond PVI did not significantly enhance the single-procedure efficacy. Moreover, in those patients with arrhythmia recurrence who underwent repeat ablation, all had reconnection of at least 1 PV; targeting these alone improved long-term AF control. These findings imply that PVs remain critical in the genesis of persistent AF for many patients.

**Conclusions:** These data suggest that additional substrate modification beyond PVI does not improve single-procedure efficacy in patients with persistent AF.6

**Acute Hemodynamic Effect of Left Ventricular Endocardial Pacing in Cardiac Resynchronization Therapy: Assessment by Pressure–Volume Loops**

**Summary:** Transvenous endocardial pacing via transeptal puncture has been proposed as an alternative method to position the left ventricular (LV) lead during cardiac resynchronization therapy device implantation. Initial experience in early studies with transvenous endocardial pacing has yielded promising results. In the present study, we evaluated the acute hemodynamic effects of resynchronization therapy through LV endocardial pacing in heart failure patients. Our results show that the optimal site of the pacing lead varies among patients. Nonetheless, pacing at the optimal individual LV endocardial site yields enhanced ventricular performance in comparison with the conventional coronary sinus site stimulation. Therefore, endocardial pacing might constitute an alternative approach to resynchronization therapy, when coronary sinus pacing is not viable. Our data suggest that LV lead position during resynchronization therapy affects cardiac performance, in part, by limiting electromechanical dysynchrony of the left ventricle. Thus, its optimization should be proposed as a therapeutic strategy to improve response to cardiac resynchronization therapy. For this purpose, LV endocardial pacing offers the additional advantage of providing access to a greater variety of LV pacing sites than conventional coronary sinus implantation or the thoracotomy approach.

**Conclusions:** Pacing at the optimal individual LV endocardial site yields enhanced LV performance in comparison with conventional CS site stimulation. Endocardial LV pacing might constitute an alternative approach to CRT, when coronary sinus pacing is not viable.7
Clinical Outcome of Catheter Ablation in Patients With Nonparoxysmal Atrial Fibrillation: Results of 3-Year Follow-Up

Summary: Catheter ablation targeting the pulmonary veins has been reported to be a potential method for treating atrial fibrillation (AF) since late 1990s. As techniques and technologies have improved, the indications of AF ablation have broadened to include nonparoxysmal AF patients. Therefore, the data about the long-term efficacy of catheter ablation for nonparoxysmal AF are important but seem to be lacking. In the present study, we investigated the ablation outcome in a total of 88 nonparoxysmal AF patients with a median follow-up period of 3 years. The recurrence-free rate (without antiarrhythmic drugs) was 28.4% after a single procedure and could increase to 47.7% after multiple procedures. For patients with a CHADS2 score of ≥2 and a left atrial dimension ≥44 mm, all of them had recurrences within 1 year after the procedure. Therefore, the decision to perform the ablation in nonparoxysmal AF patients should be made cautiously by the physicians in regard to the high recurrence rate, and patients should be informed about the high possibility and necessity of multiple procedures to achieve the freedom of the arrhythmia. Despite the high recurrence rate of atrial arrhythmias, sinus rhythm could be restored from persistent AF in 67 of 88 patients (76.1%) after multiple procedures.

Conclusions: The long-term recurrence-free rate of ablation in nonparoxysmal AF was only 28.4% after a single procedure, and multiple procedures were necessary to raise the recurrence-free rate. The CHADS2 score and LA dimension may help us to identify patients who will have recurrences after catheter ablations of nonparoxysmal AF.

Neural Control of Ventricular Rate in Ambulatory Dogs With Pacing-Induced Sustained Atrial Fibrillation

Summary: Ventricular rate (VR) control is important in managing patients with atrial fibrillation (AF). However, the mechanisms of VR control during AF remain unclear. We simultaneously and continuously recorded right vagal nerve activity, left vagal nerve activity, and inferior vena cava-inferior atrial ganglionated plexus nerve activity (IVC-IAGPNA) in ambulatory dogs with AF. We then compared the nerve discharges with the VR. Immunohistochemical staining of the cervical vagal nerves was performed. There are several unexpected findings. First of all, cervical vagal nerves contain sympathetic and parasympathetic nerve fibers. The cervical vagal nerves also contain sympathetic ganglion cells. Therefore, vagal nerves can be a source of sympathetic tone. A second unexpected finding is that IVC-IAGPNA is invariably associated with VR reduction during AF. In comparison, right vagal nerve activity or left vagal nerve activity is associated with VR reduction only when it coactivates with the IVC-IAGPNA. The vagal nerve that controls VR during AF may be different from that which controls sinus rhythm.

Acute Pulmonary Vein Isolation Is Achieved by a Combination of Reversible and Irreversible Atrial Injury After Catheter Ablation: Evidence From MRI

Summary: Single ablative therapy for paroxysmal atrial fibrillation has moderate success, and many patients present with recurrent arrhythmia. We proposed that the structure of the radiofrequency lesion applied during ablation is important in determining recurrences. The nature of the radiofrequency lesion was studied using MRI with gadolinium-enhanced imaging and high-signal T2-weighted imaging. Twenty-five patients underwent MRI scans for delayed enhancement (DE) and T2 at 3 time points: before ablation, within 24 hours, and 6 months after ablation. Patients were divided into those with (n=11) and without (n=14) recurrent arrhythmia. Levels of DE+T2 were low in preprocedural scans but rose dramatically immediately after the procedure. Acute DE was greater in patients without recurrences compared with those with recurrences. Conversely, T2 levels were lower in patients without recurrences and higher in those with recurrences. On the late scans, T2 reduced to baseline. DE, however, remained and was greater in patients without recurrences. We, therefore, propose that acute radiofrequency ablation injury is composed of 2 types of tissue damage. DE infers largely necrotic tissue injury, which lasts longer and causes persistent conduction block. T2 is a transitory phenomenon coexisting with DE, causing acute conduction block. We propose that resolution of the T2 signal is associated with recurrences of pulmonary vein connection and, therefore, arrhythmia recurrences. Modifications in our ablative techniques to achieve more DE at the acute ablation would potentially be important in conferring a better ablation outcome. These data potentially provide a mechanistic explanation as to why pulmonary veins reconnect after wide area circumferential ablation.

Conclusions: The higher T2 signal on acute scans and greater decline in DE on chronic imaging in patients with recurrences suggest that they have more reversible tissue injury, providing a potential mechanism for pulmonary vein reconnection, resulting in arrhythmia recurrence.

Use of Primary Prevention Implantable Cardioverter-Defibrillators in a Population-Based Cohort Is Associated With a Significant Survival Benefit

Summary: Primary prevention implantable cardioverter-defibrillators (ICDs) are well established to provide significant mortality reduction in patients with persistently low ejection fraction post-myocardial infarction and with heart failure. We sought to determine utilization rates in a primary prevention ICD-eligible population and mortality in this group compared with a group that had undergone ICD placement. Using 2 comprehensive provincial registries, a primary prevention ICD-eligible cohort was derived from patients who had hospital admission for acute coronary syndrome (including myocardial infarction) or congestive heart failure. The primary prevention ICD population was derived from a prospective, provincial ICD registry. The primary outcome was mortality, derived through linkage with vital statistics. Our study estimated a low rate of utilization for primary prevention ICDs in a contemporary population at risk for sudden death. We found that in a real-world cohort of patients, the use of a primary prevention ICD was associated with a significant
Repolarization Changes Underlying Long-Term Cardiac Memory Due to Right Ventricular Pacing: Noninvasive Mapping With Electrocardiographic Imaging

Summary: Recent studies have drawn attention to the potentially deleterious effects of long-term right ventricular (RV) pacing on cardiac mechanical function. In addition, RV pacing is known to result in electric changes (as manifested by an altered T-wave axis), a phenomenon described as cardiac memory, although a detailed understanding of the spatial pattern of repolarization changes resulting from RV pacing has remained lacking. Using noninvasive electrocardiographic imaging, the present study provides novel insights into the pattern of electric remodeling induced by RV pacing. Two new insights emerged from the present study. First, the region close to the site of pacing exhibits a local action potential prolongation, resulting in a potentially arrhythmogenic dispersion of repolarization. Second, this dispersion of repolarization is only partially evident during continuous RV pacing, raising the intriguing possibility that the potentially arrhythmogenic substrate induced by RV pacing is only partially present after cessation of pacing. The clinical implications of these findings require further study, but the results offer mechanistic insights into the potential clinical sequelae of RV pacing.

Conclusions: These results demonstrate that electric remodeling in response to ventricular pacing in human subjects results in action potential prolongation near the site of abnormal activation and a marked dispersion of repolarization. This dispersion of repolarization is potentially arrhythmogenic and, intriguingly, was less evident during continuous right ventricular pacing, suggesting the novel possibility that continuous right ventricular pacing at least partially suppresses pacemaker-induced cardiac memory.

Cardiac Dysfunction and Prolonged Hemodynamic Deterioration After Implantable Cardioverter-Defibrillator Shock in Patients With Systolic Heart Failure

Summary: The benefit of the implantable cardioverter-defibrillator (ICD) in sudden cardiac death has been demonstrated in several trials. Although ICD shocks themselves are related to short- and long-term serious complications, especially in patients with left ventricular (LV) systolic dysfunction, the effect of ICD shocks on cardiac function and their association with tissue damage and subsequent hemodynamic change in patients with systolic heart failure have not been well understood. In the present study, using echocardiography, we demonstrated that ICD shocks caused LV systolic dysfunction in patients with reduced LV ejection fraction (LVEF) and LV diastolic dysfunction and both in patients with reduced and preserved LVEF in the clinical setting. Impaired ventricular relaxation lasted at least 5 minutes after ICD shocks in both groups, as demonstrated by sustained reduction of global strain rate during the isovolumetric relaxation period from 2-dimensional speckle-tracking echocardiography, which provides more accurate assessment of LV relaxation than conventional parameters. However, serum cardiac markers were unaffected or did not exceed normal values at any time point in either group, suggesting that transient ventricular dysfunction was not a result of myocardial injury. Furthermore, time to recovery of central arterial pressure to the baseline level was significantly longer in patients with reduced LVEF than in patients with preserved LVEF. Therefore, even though the effects of ICD shocks on cardiac function and hemodynamics are transient, clinicians should select optimal medical therapy for avoiding ICD shocks. In addition, the necessity for defibrillation threshold testing should be reconsidered, especially in patients with reduced LVEF.

Conclusions: Implantable cardioverter-defibrillator shock transiently impairs cardiac function and hemodynamics especially in patients with systolic dysfunction, although significant tissue injury is not observed.

Assessing the Risk of Bleeding in Patients With Atrial Fibrillation: The Loire Valley Atrial Fibrillation Project

Summary: Management decisions for thromboprophylaxis in atrial fibrillation need to balance the risk of stroke against serious hemorrhage. In this study, we assessed anticoagulation use in relation to calculated bleeding risk and compared the HAS-BLED score against other older bleeding risk scores (HEMORR2HAGES) and the new ATRIA score in an atrial fibrillation cohort. On multivariable analysis, independent predictors of bleeding were age ≥75 years and age 265 years, alcohol excess, anemia, and heart failure. We found that current oral anticoagulation prescribing patterns would suggest that bleeding risk estimation by clinicians is poor and that oral anticoagulation prescribing does not reflect bleeding risk per se. The HAS-BLED score performed well in relation to predicting bleeding events compared with other older bleeding scores and the new ATRIA score, with significantly improved reclassification using HAS-BLED compared with all other bleeding risk scores tested.

Conclusions: Current oral anticoagulation prescribing patterns would suggest that bleeding risk estimation by clinicians is poor and that oral anticoagulation prescribing does not reflect bleeding risk per se. The HAS-BLED score performs well in relation to predicting bleeding events compared with older bleeding scores and the Anticoagulation and Risk Factors in Atrial Fibrillation score, with significantly improved reclassification using HAS-BLED compared with all other bleeding risk scores tested.

Single-Ring Posterior Left Atrial (Box) Isolation Results in a Different Mode of Recurrence Compared With Wide Antral Pulmonary Vein Isolation on Long-Term Follow-Up: Longer Atrial Fibrillation—Free Survival Time but Similar Survival Time Free of Any Atrial Arrhythmia

Summary: Recent long-term studies have shown that recurrences are common after a single ablation procedure for atrial fibrillation
(AF) and that many patients require repeat procedures. To improve outcomes after one procedure, different lesion sets, sometimes including additional linear ablations, have been developed. In this randomized clinical trial of 220 patients with highly symptomatic paroxysmal or persistent AF, we compared single-ring isolation (SRI) of the posterior left atrium and pulmonary veins against the more commonly used wide antral pulmonary vein isolation technique. Patients were also randomly assigned to receive mitral isthmus line ablation because the efficacy of this in SRI is unclear. Although overall survival free of any atrial arrhythmia recurrences was similar, patients who had SRI had longer AF-free survival. Mitral isthmus line ablation, on the other hand, resulted in a reduction of organized atrial tachyarrhythmias, which was nearly significant. It also had differential effects on SRI and wide antral isolation. It significantly reduced organized atrial tachyarrhythmias in patients who had SRI, whereas it nearly significantly reduced AF recurrences in patients who had wide antral isolation. Although overall recurrence rates were similar, this study showed that changes to the basic lesion set can alter the mode of recurrences after AF ablation procedures. This may have implications for patients who undergo repeat procedures because it has been observed that patients who have AF recurrences have worse outcomes than those who have organized atrial tachyarrhythmia recurrences. Outcomes after multiple procedures using these lesion sets are under investigation.

Conclusions: Ring isolation resulted in fewer AF recurrences compared with wide antral pulmonary vein isolation on long-term follow-up but did not reduce the recurrence of all atrial arrhythmias. Mitral isthmus line ablation may reduce organized atrial tachyarrhythmia recurrences.15

Prevalence and Presentation of Externalized Conductors and Electrical Abnormalities in Riata Defibrillator Leads After Fluoroscopic Screening: Report From the Netherlands Heart Rhythm Association Device Advisory Committee

Summary: The Riata family of implantable cardioverter-defibrillator leads is prone to a specific insulation abrasion characterized by externalization of conductor cables, and the leads were placed under a class I recall by the Food and Drug Administration in December 2011. In this study, we determined the prevalence of externalized conductors and electric abnormalities using a national screening program consisting of fluoroscopic and electric assessment in all patients with an active Riata lead. As of March 1, 2012, data for 1029 active Riata leads were available. Conductor externalization was observed in 147 leads (14.3%), with estimated rates of externalized conductors of 6.9% and 36.6% at 5 and 8 years after implantation, respectively. Of the 147 leads with externalized conductors, 10.9% had abnormal electric parameters. A clinical decision model for leads under advisory is not available because of limited data on the best management strategy for leads under advisory. Whereas management of leads in the context of electric abnormality is clear, there is no consensus on the management of leads with conductor externalization without overt evidence of electric dysfunction. Considering the progressive failure rate of conductor externalization, and considering that the majority of externalized conductors are not detectable with standard implantable cardioverter-defibrillator interrogation, screening with fluoroscopy is reasonable.

Conclusions: The prevalence of externalized conductors in Riata leads is significantly high (14.3%) using fluoroscopic screening. The majority of externalized conductors are not detectable with standard ICD interrogation. Screening with fluoroscopy is reasonable.16

Clinical Implication of Adenosine Test at Repeat Atrial Fibrillation Ablation Procedure: The Importance of Detecting Dormant Thoracic Vein Conduction

Summary: The utility of adenosine test at repeat ablation procedure undertaken for recurrent atrial tachyarrhythmias has not been reported. The results of the present study demonstrate that adenosine test could reveal dormant thoracic vein conduction associated with late recurrence of atrial tachyarrhythmias after previous thoracic vein isolation procedure. Adenosine test thereby can elucidate the etiology of recurrent atrial arrhythmia attributable to dormant thoracic vein conduction in patients with paroxysmal atrial fibrillation. When any pulmonary vein—left atrium conduction is not observed during a repeat procedure, evaluation of dormancy using adenosine might reveal the etiology of recurrent atrial arrhythmia and might help cure it. The present study suggests that thoracic veins might be underestimated as the triggers of late recurrent paroxysmal atrial tachyarrhythmias.

Conclusions: Adenosine provokes dormant thoracic vein conduction associated with the late recurrence of atrial tachyarrhythmias after previous thoracic vein isolation. Thus, adenosine provocation test can specifically help identify and target the cause of recurrent atrial arrhythmia.17

Direct Comparison of Percutaneous Circulatory Support Systems in Specific Hemodynamic Conditions in a Porcine Model

Summary: Percutaneous circulatory support systems are increasingly used for the support of high-risk catheter ventricular tachycardia mapping and ablation, for treatment of cardiogenic shock or electrical storm, and for even restoring circulation in cardiac arrest. However, to date a direct comparison of the available systems has not been performed, and selection of the most appropriate system for the specific patient and hemodynamic status remains challenging. Therefore, we performed a head-to-head comparison of Impella 2.5, TandemHeart, and extracorporeal membrane oxygenation systems under specific hemodynamic conditions in a porcine model. Whereas no or only nonsignificant differences were found among the systems during simulation of ventricular tachycardia at 200 and 300 beats per minute, under ventricular fibrillation the extracorporeal membrane oxygenation system was significantly the most efficacious, followed by TandemHeart, and finally Impella 2.5. These data indicate that, of the currently available percutaneous systems, extracorporeal membrane oxygenation system provides the best support, particularly under the most severe hemodynamic conditions. Our results may influence the decision-making process when selecting the most appropriate circulatory support in specific patients.

Conclusions: Differences were seen in the hemodynamic efficacy of available percutaneous circulatory support systems, particularly under the most severe hemodynamic condition, ventricular fibrillation.14

References


