NEW PAGE-CAMPBELL MERGER:
On July 1, 2006, Vanderbilt Heart and Vascular Institute and Page-Campbell Cardiology Group officially joined forces to provide the most comprehensive cardiology services in Middle Tennessee. Please join us in welcoming:

» Andre L. Churchwell, MD
» Keith B. Churchwell, MD
» Walter K. Clair, MD
» Marshall H. Crenshaw, MD

» Rand T. Frederiksen, MD
» G. Christian Friesinger, MD
» Clifford L. Garrard, Jr., MD
» Mark D. Glazer, MD

» Rob R. Hood, MD
» Adam J. Prudoff, MD
» Thomas R. Richardson, MD
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from the editor:

Robert N. Piana, MD
Associate Professor of Medicine
Director, Vanderbilt Cardiovascular Network
Associate Chief, Division of Cardiovascular Medicine
Director, Interventional Cardiology Fellowship Training Program
Editor, Vanderbilt Heart

The second issue of Vanderbilt Heart marks several milestones for our program. In July 2006, clinical growth surged ahead with full integration of the Page-Campbell Cardiology practice into the Vanderbilt Heart Institute. This merger is the culmination of a close, 6-year affiliation, with potential to expand Vanderbilt Heart’s practice volume by 20,000 patients. In parallel, Dr. John Byrne has continued expansion of the cardiac surgical program’s scope and depth with the recruitment of Dr. Michael Petracek, a leading Nashville heart surgeon for more than 20 years. Dr. Petracek brings expertise in stentless aortic valve surgery and minimally invasive mitral valve surgery.

Vanderbilt Heart has carefully coupled clinical growth with a focus on quality. The June 2006 accreditation of Vanderbilt Heart as a Chest Pain Center by the Society of Chest Pain Centers recognizes this “quality first” approach. Dr. Waleed Irani of Vanderbilt Heart and Dr. Marc Mickiewicz of Emergency Medicine are Chest Pain Center joint medical directors; Cardiology Case Manager, Jeannie Byrd provides nursing guidance. This national recognition places Vanderbilt Heart among providers offering optimal diagnosis and management of acute coronary syndromes and heart failure.

Vanderbilt Heart also continues to garner national recognition through academic accomplishments. Chief of Cardiovascular Medicine, Dr. Doug Vaughan is a longtime leader in vascular biology and thrombosis research. In June 2006, the National Heart, Lung, and Blood Institute awarded Dr. Vaughan a 5-year, $16-million SCCOR (Specialized Center of Clinically Oriented Research) grant to study thrombosis. Dr. Vaughan’s multidisciplinary team will focus on increased thromboembolic risk leading to myocardial infarction and stroke found in patients with diabetes, insulin resistance, and obesity.

Read on for an in-depth look at our programs in aortic aneurysm repair, cardiac transplant, and atrial fibrillation management.
Aortic aneurysms occur when the aorta expands to a diameter 1.5 times the normal adjacent aorta. Aortic aneurysms account for 15,000 deaths annually and are the 15th leading cause of death in the United States. Of these, 9,000 deaths are due to abdominal aortic aneurysms (AAA), with the remainder located in the thoracic aorta. AAAs are found in 4% to 8% of men and 0.5% to 1.5% of women. Increasing age, smoking, gender, and family history represent the most significant risk factors for AAA.

The impetus to screen for AAA is motivated by its prevalence and natural history. Although AAAs may be asymptomatic for years, up to 40% will eventually rupture if undiagnosed or left untreated. When rupture occurs, prognosis is poor, with most deaths occurring out of the hospital. For patients who survive to hospital admission, emergent AAA repair is associated with high mortality; only 10% to 25% of individuals with ruptured AAAs survive until discharge.

AAA Screening Recommendations

Evidence supporting screening for AAAs has been slow to evolve. In 1996, the US Preventive Services Task Force (USPSTF) found insufficient evidence to recommend for or against routine AAA screening of asymptomatic adults, citing the need for more data from population-based screening trials. Since then, results from several population-based, randomized controlled trials of AAA screening have been published. On the basis of this new evidence, USPSTF recently updated its recommendation for AAA screening to include:

❤ One-time screening for AAA by ultrasonography in men aged 65 to 75 years who have ever smoked. (This is a Grade B recommendation - at least fair evidence the service improves important health outcomes, and benefits outweigh harms.)

❤ No recommendation for or against screening for AAA in men aged 65 to 75 who have never smoked. (This is a Grade C recommendation - at least fair evidence the service can improve health outcomes, but the balance of benefits and harms is too close to justify a general recommendation.)

❤ Recommends against routine screening for AAA in women. (This is a Grade D recommendation - at least fair evidence the service is ineffective or harm outweighs benefits.)

Although updated recommendations are a step in the right direction, they are not without controversy. USPSTF found evidence that screening and elective surgical repair of AAAs in men aged 65 to 75 years who are current or former smokers leads to decreased AAA-specific mortality. However, USPSTF deferred any recommendation for men in this age group who have never smoked as the lower prevalence of AAAs offsets any benefit of screening, deferring any recommendations in this group at this time. Also USPSTF recommended no screening in women, citing low AAA prevalence. According to these recommendations, women and nonsmoking men, even those with a family history of AAA, do not merit screening, despite well-documented high prevalence of AAAs in these subgroups. In addition, USPSTF concluded
that in women and nonsmoking men, “screening and early
treatment result in important harms,” but do not specifically
define “harms” precluding elective AAA repair. Because of these criticisms, the Society for Vascular
Surgery and the Society for Vascular Medicine and
Biology continue to recommend screening for AAA in all
men aged 60 to 85 years; women aged 60 to 85 years
with cardiovascular risk factors; and men and women
50 years and older with a family history of AAA. After
initial screening, USPSTF also recommends no further
testing if aortic diameter is <3 cm; ultrasonography
annually if aortic diameter is between 3 cm and 4 cm;
ultrasonography every six months if aortic diameter is
between 4 cm and 4.5 cm; and referral to a vascular
specialist if aortic diameter is >4.5 cm.

With the strength of USPSTF recommendations and
the work of the National Aneurysm Alliance, efforts
to provide a one-time AAA screening benefit under
Medicare Part B reached a milestone on February 8,
2006, with the signing of the Deficit Reduction Act of
2005, also known as the Budget Reconciliation Bill. It
includes the Screening Abdominal Aortic Aneurysms
Very Efficiently Act, a provision that will implement
AAA screening as a Medicare benefit for at-risk
beneficiaries 65 years and older. The legislation takes
effect January 1, 2007. Although there are limitations
to this benefit, it is an important step toward placing
AAAs at the forefront of public awareness.

**AAA TREATMENT RECOMMENDATIONS**

The goal of elective AAA repair is preventing rupture
and prolonging life, and should be performed when
rupture risk is high compared with operative risk and
in patients whose life expectancy is long enough to
realize benefit. Selection of patients for AAA repair
is determined by balancing estimates of aneurysm
rupture risk, elective operative mortality risk, life
expectancy, and patient preference.

The strongest risk factor for AAA rupture is maximal
aortic diameter. The natural history of clinically apparent
AAAs is difficult to determine, but by best estimates,
the 1-year risk of rupture when the AAA is <4 cm is
0%; 4 cm to 5 cm, 0.5% to 5%; 5 cm to 6 cm, 3%
to 15%; 6 cm to 7 cm, 10% to 20%; 7 cm to 8 cm,
20% to 40%; and >8 cm, 30% to 50%. Rupture risk
substantially increases as AAA diameter increases from
5 cm to 6 cm. Level I evidence for treatment of small
AAAs from two randomized prospective clinical trials
conducted in the United Kingdom and the United States
supports this notion. Both trials concluded surveillance
of AAA of 4 cm to 5.5 cm is safe, and surgery did not
result in any long-term survival advantage, thereby
reinforcing the 5.5 cm threshold. A rapid rate of
aneurysm expansion (>1.0 cm/y) also is used as an
indication for repair independent of absolute size;
however, the value of expansion as a predictor of
rupture risk is less clear.
As with rupture risk, reported operative mortality of conventional open AAA repair varies considerably in the literature. Many referral-based series from individual centers of excellence describe 30-day perioperative mortality of 1% to 5% following elective conventional open AAA repair. Conversely, many recent population-based series employing statewide or national databases indicate higher mortality, in the 4% to 8% range. Such variation supports the excellent results and low mortality rates often achieved by selected referral centers with very experienced surgeons.

Endovascular aneurysm repair (EVAR) emerged in the early 1990s as an alternative treatment for AAA and has had an expanding role in recent years. Many studies have demonstrated equivalent safety and efficacy of EVAR compared with conventional open repair. Short-term benefits of EVAR include reduced intensive care unit and hospital lengths of stay, reduced blood loss, fewer major complications, and more rapid recovery. However, studies with longer follow up are inconsistent with some reports suggesting equivalent outcomes, while others raised concerns about EVAR durability, including problems of endoleak, need for late reinterventions, conversion to open repair, or both, and a low incidence of delayed rupture. Only recently has published randomized data supported a perioperative survival advantage, but this was not sustained beyond the first postoperative year. Since continued risk for complications are recognized over the long term after EVAR, management strategies for endovascular repair of aneurysm must take into account the need for permanent long-term follow up. Events such as endovascular leak, migration, and aneurysm enlargement are well-described potential late events that can be easily monitored through specialty care. When complications following EVAR are identified, simple, minimally invasive procedures can result in satisfactory resolution and prevention of need for conversion to open operation or aneurysm rupture. Patients who are not available for careful long-term follow up have risks of unforeseen late EVAR-related complications and may be better served by conventional open repair. With uncertain long-term durability and effectiveness, as well as the need for ongoing surveillance, based on current evidence, EVAR is most appropriate for patients at increased risk for conventional open AAA repair. As more prospective randomized data become available, and as technology evolves, the role of EVAR may evolve to support a lower threshold for AAA repair and may shift the risk-benefit ratio of screening to justify more widespread screening than currently recommended by USPSTF.
An important component of our surgical treatment of end-stage heart failure is our bridge to the transplant assist device (VAD) program. We have reinvigorated this aspect of the program with the addition of the Thoratec VAD to our bridge program. Using a combination of the Novacor Left Ventricular Assist System (LVAS) and the Thoratec Percutaneous Assist Device (PVAD), we successfully bridged five patients to heart transplantation in 2005 and have one patient currently awaiting transplant on a Novacor device. This tremendous achievement was accomplished through the commitment of our VAD team and a dedicated VAD coordinator.

New developments in the program include a shift toward newer, smaller implantable devices and a shift toward out-of-hospital care for our VAD patients awaiting heart transplant. The addition of new and improved technologies will improve quality of life of VAD patients, while insuring the continued success of the program. We plan to incorporate the Thoratec IVAD (Implantable Ventricular Assist Device) for patients in need of single or biventricular support.

Our history of success with ventricular assist devices and our recent excellent results in our bridge to transplant patients have led to opportunities to participate in clinical trials. We will soon be participating in an exciting multicenter, pivotal trial of the Jarvik 2000 axillary flow ventricular assist device. This will bring cutting edge technology to our eligible bridge to transplant patients.

In summary, the Vanderbilt heart transplant team is devoted to providing world-class care to our end-stage heart failure patients. These exciting new developments in heart transplant and ventricular assist programs will help ensure our patients receive the best possible care through all phases, from initial evaluation to posttransplant management. We look forward to the future and hope you and your patients will be a part of it.

At Vanderbilt University Medical Center, 2005 was a year of milestones for heart transplantation. In 2004-2005, we transplanted our program’s 500th adult patient and our 100th pediatric patient. Last year we transplanted one of the youngest set of twins in the world. Fittingly, July 2005 marked the 20th year of our program, giving new hearts and new lives to our patients.

While we celebrate these past accomplishments, we continue to enhance the transplant program. We have added new leadership in both medical and surgical aspects of the program, hiring three transplant coordinators and a dedicated transplant pharmacist. We also have added a dedicated donor coordinator to improve donor availability and quality, in order to maximize successful transplant outcomes.

Under this new leadership, clinical outcomes have exceeded the national benchmark for 1-year survival. The actual survival for 2005 was 100%. These statistics demonstrate the best early survival outcomes in the 20-year history of a heart transplant program that has traditionally achieved excellent clinical outcomes.

Clinical trials of new medications to improve long-term outcomes in our heart transplant patients will continue. We recently have been invited to participate in a posttransplant evaluation of sirolimus for maintenance immunosuppression. This newer medication may have fewer side effects and help decrease incidence of allograft vasculopathy.
Contemporary Approach to Ablation of Atrial Fibrillation

OVERVIEW

Atrial Fibrillation (AF) is the most common arrhythmia encountered in clinical practice, accounting for approximately one third of hospitalizations for cardiac rhythmic disturbance. An estimated 2.2 million Americans have paroxysmal or persistent AF; prevalence increases with age to more than 6% in octogenarians. Moreover, AF confers an average annual stroke risk of 5%, up to seven times the rate in the general population. Conventional AF management has focused on restoration and maintenance of sinus rhythm with electrical cardiovascular and antiarrhythmic agents, controlling the ventricular response to chronic AF with agents that slow heart rate and anticoagulation to reduce stroke risk. Nevertheless, the efficacy of these modalities is limited, and the morbidity and mortality attributable to AF remain significant.

Recent advances in our understanding of AF have led to development of catheter ablation techniques that could feasibly achieve a cure for AF. This review discusses new insights into mechanisms initiating and perpetuating AF and how they impact catheter ablation of AF. It also highlights the evolution of different strategies and techniques for AF ablation and presents Vanderbilt University’s AF Ablation Program results with the left atrial circumferential ablation approach.

Catheter ablation for AF was first reported more than a decade ago. During this relatively short time, our strategies and techniques have dramatically evolved in parallel with improved understanding of mechanisms initiating and maintaining AF.

MECHANISMS OF AF

Based on experimental and clinical studies using a variety of catheter and surgical ablation techniques, it is possible to postulate two mechanisms for AF initiation and perpetuation.

1. Primary drivers: Some types of AF, particularly paroxysmal AF, may be primarily dependent on tachycardias that initiate and drive AF. Although often located in the pulmonary veins (PVs), drivers also may originate from the superior vena cava, vein of Marshall (a small vein from the left atrium, opening into the coronary sinus in close proximity to the left superior PV), or coronary sinus, or within the left or right atrium. Furthermore, secondary tachycardias resulting from a primary driver also may function as AF drivers. Once the primary driver induces secondary drivers, AF perpetuation is more likely. This occurs even if the primary driver is extinguished, as other drivers continue to function. AF also is perpetuated by microreentrant circuits, or “rotors,” exhibiting high-frequency periodic activity from which spiral wave fronts of activation radiate into surrounding atrial tissue. These rotors activate atria at exceedingly high frequencies and result in fibrillatory conduction. Importantly, dominant rotors in AF are primarily localized in the junction between the left atrium (LA) and PVs. Based on this mechanism, successful ablation of AF should target elimination of primary and secondary drivers with strategies...
such as electrically “disconnecting” PVs from the LA by ablating around vein origins.

2. **Multiple wavelet reentry:** In 1959, Moe and Abildskov advanced the multiple wavelet hypothesis. In this concept, AF is maintained by multiple independent wavelets moving around functionally refractory tissue. AF maintenance depends on the probability that, at any point in time, a sufficient number of active wavelets can sustain electrical activity. Wavelength is an important determinant of wavelet number. Factors shortening refractoriness or slowing conduction will shorten wavelength and facilitate attainment of the critical number of wavelets. Based on this mechanism, AF ablation requires modification of the atrial substrate to prevent attainment of the critical number of circulating wavelets.

**CLINICAL RELEVANCE TO CATHETER ABLATION OF AF**

Based on these mechanistic insights, catheter ablation of AF could target either drivers originating from the PVs, LA, or elsewhere, or the LA substrate such that AF can no longer occur even in the presence of a driver. A hybrid approach also could be used. A careful literature review, however, reveals PV ablation remains experimental, and is most suitable for patients whose recurring symptomatic episodes of AF have not been suppressed by antiarrhythmic drugs or who do not wish to take long-term antiarrhythmic medications. Further, radiofrequency (RF) ablation seems most effective when applying ablation energy at the LA-PV junction. Discrete RF applications to rapidly firing PV arrhythmogenic foci have potential of curing paroxysmal AF. However, the technique has proven inadequate in many patients because of prolonged procedure times, frequent need for repeat interventions, and an unacceptable rate of PV stenosis. Understanding and overcoming limitations of the focal PV ablative approach have incited electrophysiologists to propose two alternative approaches, the so-called “segmental PV isolation” and “circumferential PV ablation.”

**Segmental PV Isolation:** Haissaguerre et al described results of PV segmental isolation guided by circumferential mapping data obtained with a steerable circular catheter (Figure 1). Activation was never circumferentially synchronous within PV during sinus rhythm, indicating preferential breakthroughs into the vein from the atrium. The hypothesis was that, although PV muscle covers a large portion of the PV ostial perimeter, specific breakthrough sites of conductance with the LA allow ostial PV disconnection with minimal ablation. LA-PV breakthrough was determined by mapping the perimetric distribution and activation sequence of PV potentials, thus guiding ostial ablation to segments showing earliest

**Figure 1:**
Schematic representation of the ‘segmental PV isolation’ approach. A mapping catheter (Lasso) is positioned at the os of the left superior pulmonary vein (LSPV). As activation is never circumferentially synchronous within the PVs, specific breakthrough sites of conductance within the left atrium (LA) allow ostial PV disconnection. Since the breakthrough is at pole # 3, ablation (abl) at this site may electrically disconnect the vein from the rest of the atrium.
activation with the endpoint of PV disconnection (Figure 2). The extent of perimetric ablation was confined, minimizing risk of PV stenosis.

The main limitation of this approach is proper alignment of the mapping catheter with the notoriously irregular geometry of PVs, making interpretation of recorded electrograms challenging. Furthermore, catheter drift may mislead the operator regarding ostial position. Finally, this technique is not applicable to RF ablation outside PV ostia, which may require complete circumferential lesions to produce distal disconnection.

Clinical studies have demonstrated complete electrical isolation of PVs with a segmental approach prevents recurrent AF in about 70% of patients with paroxysmal AF and about 25% of patients with persistent AF. Less favorable results in patients with persistent AF likely reflect the minor role played by PVs in this patient population. In addition, isolation of PVs addresses only one possible mechanism for AF; many others are not targeted by this approach. Furthermore, even if the primary driver is eliminated by PV ablation, patients with persistent AF likely have secondary drivers that may perpetuate AF.

Figure 2:
Elimination of pulmonary vein (PV) potentials by segmental ostial ablation. Shown are leads I and V5, distal bipole of an ablation catheter (Abl), bipolar electrograms recorded with a decapolar ring catheter (Lasso) positioned at ostium of left superior PV (L1–2 and L9–10), and proximal and distal bipoles of a quadripolar catheter positioned within coronary sinus (CSp and CSd). Before ablation (A), several PV potentials were recorded at ostium (arrows). After segmental ostial ablation (B), PV potentials were no longer present. Reproduced from Oral et al, with permission.
Circumferential PV Ablation: To circumvent these limitations, Pappone proposed a purely anatomic approach: Circumferential RF lesions are created using three-dimensional electroanatomic guidance around ostia of each PV, with the aim of disconnecting these veins from the LA, while reducing risk of PV stenosis (Figure 3). An important distinction between these approaches is that an approach aimed at eliminating arrhythmogenic triggers or critical connections between substrate and trigger, irrespective of ongoing trigger activity, appears to yield greater success. An anatomically based procedure eliminates the need for mapping spontaneous or induced arrhythmias and would, therefore, effectively prevent recurrent AF caused by multiple foci, even if new foci eventually emerge.

An additional advantage is the lesion can be tailored to varying PV-LA junction features, unlike circumferential ablation catheters with a prefixed size and design, which are difficult to accommodate in ostia with larger diameters, eccentric shape, or a complex proximal PV branching pattern. This approach also appears more feasible than left atrial compartmentalization through a single long line encircling PVs and connecting to the mitral annulus. The overall success rate of circumferential PV ablation is about 85%. Interestingly, patients with paroxysmal (86%) or permanent AF (83%), had similar success rates, raising the question of reversibility of AF-induced electrophysiologic atrial changes. A recent randomized study demonstrated a modification of circumferential PV ablation (encircling left and right-sided PVs with an ablation line along the posterior LA) is about 20% more effective than segmental PV isolation in preventing paroxysmal AF recurrences.

VANDERBILT UNIVERSITY AF ABLATION PROGRAM

Vanderbilt University’s electrophysiology laboratory, established in 1984, offers comprehensive evaluation and treatment of all cardiac arrhythmias. Interest in AF ablation therapy at Vanderbilt University began in the mid-1990s, with the first AF ablation performed in 1998. The AF program has grown rapidly, and in 2004, we performed 60 AF ablations; 55 in 2005.

AF Clinical Outcomes: Improved understanding of mechanisms initiating and maintaining AF has led to modification of our ablative approach. Currently, our approach is a modification of the left atrial circumferential approach, with encirclement of the left and right PVs and linear lesions at the roof of the posterior LA and between circumferential lesions.
Contemporary Approach to Ablation continued

and the mitral valve annulus. Ablation is guided by the Ensite NavX (Endocardial Solutions, St. Paul, MN) three-dimensional advanced mapping system, which is integrated with its novel three-dimensional CT/MRI (computed tomography/magnetic resonance imaging) image-importing function. This system permits three-dimensional modeling of the left atrium and PVs, with real-time visualization of any standard electrophysiology catheter to assist ablation. Figure 4 shows a view of left atrial three-dimensional anatomy constructed with the EnSite NavX system and an imported MRI image. It also shows the two circumferential lesions created by RF energy to encircle the ipsilateral PVs as a pair, and linear lesions between the two circumferential lesions at the roof of the LA and between the lesions and the mitral valve annulus.

The characteristics of 58 consecutive patients with paroxysmal/persistent AF who have undergone the left atrial circumferential approach at Vanderbilt University are shown in Table 1. Response to AF ablation is defined in terms of complete absence of AF by Holter monitoring (on no antiarrhythmic drugs); partial response if >75% reduction in frequency and duration of symptoms, with or without previously ineffective antiarrhythmic drugs; or recurrence if no change in frequency and duration of AF. During average follow up of 14 ± 3 months, 73% of patients with paroxysmal AF had no symptomatic recurrence of AF (Figure 5). The success rate was lower in patients with persistent AF. Table 2 delineates complications associated with these procedures.

Table 1:
Characteristics of patients who have undergone the left atrial circumferential ablation approach at Vanderbilt University.

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<tr>
<th>CHARACTERISTIC</th>
<th>NO. OF PATIENTS (N = 58)</th>
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<tbody>
<tr>
<td>Age</td>
<td>56 ± 10</td>
</tr>
<tr>
<td>Male/Female</td>
<td>44/14</td>
</tr>
<tr>
<td>Paroxysmal/Persistent AF</td>
<td>46/12</td>
</tr>
<tr>
<td>Duration of AF (yr)</td>
<td>5 ± 2</td>
</tr>
<tr>
<td>Frequency of symptoms (episodes/month)</td>
<td>20 ± 17</td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>0.56 ± 0.02</td>
</tr>
<tr>
<td>Left atrial diameter (cm)</td>
<td>42 ± 3.4</td>
</tr>
<tr>
<td>Structural heart disease</td>
<td>7 (12%)</td>
</tr>
<tr>
<td>No. of failed AADs</td>
<td>2.4 ± 1.3</td>
</tr>
<tr>
<td>Follow-up (months)</td>
<td>14 ± 3</td>
</tr>
</tbody>
</table>

AF, atrial fibrillation; AADs, antiarrhythmic drugs.
Table 2:
Complications associated with left atrial circumferential ablation approach.

<table>
<thead>
<tr>
<th>Complication</th>
<th>No. of patients (n = 58)</th>
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<tbody>
<tr>
<td>Pericardial tamponade</td>
<td>1/58 (1.7%)</td>
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<tr>
<td>Transient ischemic attack</td>
<td>1/58 (1.7%)</td>
</tr>
<tr>
<td>PV narrowing (&lt;50%)</td>
<td>2/58 (3.4%)</td>
</tr>
<tr>
<td>Symptomatic PV stenosis</td>
<td>0</td>
</tr>
<tr>
<td>Left atrial flutter</td>
<td>4 (6.9%)</td>
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PV, pulmonary vein

CONCLUSION

The last decade has seen remarkable advances in our understanding of AF and has led to catheter ablation techniques demonstrating the feasibility of achieving cure. However, given the mechanistic heterogeneity of AF, it seems unlikely that one minimum set of ablation lesions will ever be effective for all patients. Nonetheless, future advances in techniques and technology and demonstration of ablation outcomes in prospective randomized trials will likely expand use of ablation in broad AF populations.

Figure 5:
Outcomes in patients with paroxysmal and persistent atrial fibrillation (AF) who underwent the left atrial ablation approach at Vanderbilt University.

NEW STAFF MEMBER:
Kimberly Vernier, BSN, MSN, APRN-BC, Chest Pain and Stroke Coordinator, Emergency Services