

only 3 patients in Group III, and this finding needs to be confirmed in a larger study. FM

### Changes in Atrial Fibrillation Cycle Length and Inducibility During Catheter Ablation and Their Relation to Outcome

Haissaguerre M, Sanders P, Hocini M, et al. *Circulation* 2004; 109:3007-13.

**Study Question:** How does ablation affect the atrial fibrillation cycle length (AFCL), and is the inducibility of atrial fibrillation (AF) predictive of clinical outcome after pulmonary vein isolation (PVI)?

**Methods:** Seventy patients with paroxysmal AF underwent PVI with an irrigated-tip radiofrequency ablation catheter; 35 patients were randomly assigned to also undergo linear ablation of the mitral isthmus. The AFCL was measured in the coronary sinus during the course of the ablation procedure. Inducibility of AF was assessed by rapid atrial pacing. Sustained AF was defined as AF lasting  $\geq 10$  min.

**Results:** Baseline mean AFCL was 186 ms. The AF terminated after PVI in 75% of 56 patients in whom ablation was performed during AF. The AFCL progressively increased during PVI, more so when AF terminated than when it did not. Mitral isthmus ablation further prolonged the AFCL. Sustained AF was noninducible in 43% of patients after PVI, and in 77% of patients after mitral isthmus ablation. At a mean follow-up of 7 months, 74% of patients with PVI and 83% with mitral isthmus ablation were free of AF without antiarrhythmic drug therapy. Repeat ablation was performed in 28% of patients. Noninducibility of AF was associated with higher long-term efficacy (87% vs. 62%).

**Conclusions:** An increase in AFCL during PVI is associated with termination and noninducibility of AF. Clinical outcomes are improved when AF is no longer inducible after PVI.

**Perspective:** The pulmonary veins are widely recognized to be a source of triggers of AF. This study provides important confirmation of prior studies demonstrating that the pulmonary veins also are a major source of drivers that maintain an episode of AF. FM

### Electrophysiologic Properties of Pulmonary Veins Assessed Using a Multielectrode Basket Catheter

Kumagai K, Ogawa M, Noguchi H, Yasuda T, Nakashima H, Saku K. *J Am Coll Cardiol* 2004;43:281-9.

**Study Question:** Do the electrophysiologic properties of the pulmonary veins (PVs) provide any insight into the mechanism of atrial fibrillation (AF)?

**Methods:** In 48 patients with paroxysmal AF, 81 PVs were mapped with a 64-pole basket catheter, and the effective refractory period (ERP) and conduction within the PVs were measured.

**Results:** The mean distal PV ERP (177 ms) was significantly shorter than the ERP at the PV-left atrial (LA) junction (222 ms). The mean conduction time from the distal PV to the PV-LA junction (73 ms) was significantly longer than the conduction time in the opposite direction (32 ms). At the initiation of AF, there was reentry between the PVs and left atrium, with specific exit and entrance points at the PV-LA junction.

**Conclusions:** Heterogeneous refractory and conduction properties in the PVs may promote reentry within the PVs and at the PV-LA junction during AF.

**Perspective:** Bursts of rapid electrical activity within the PVs often play an important role in triggering and/or maintaining an episode of AF. Whether the mechanism of arrhythmias generated within the PVs is abnormal automaticity, triggered activity or reentry has been unclear. This study provides fairly strong evidence that reentry is at least one of the mechanisms. FM

### Atrio-Esophageal Fistula as a Complication of Percutaneous Transcatheter Ablation of Atrial Fibrillation

Pappone C, Oral H, Santinelli V, et al. *Circulation* 2004;109: 2724-6.

**Study Question:** What are the signs and symptoms of an atrio-esophageal fistula (AEF), and how can this complication of radiofrequency ablation (RFA) in the posterior left atrium (LA) be avoided?

**Methods:** Two men, ages 36 and 59 years (left atrial diameter 29 and 33 mm, respectively), underwent circumferential pulmonary vein ablation. RFA was performed with an 8-mm-tip catheter using a power output of 70-100 W and a target temperature of 55-60°C. The right- and left-sided pulmonary veins were encircled 1-2 cm from the ostia, and additional ablation lines were created in the posterior LA and mitral isthmus.

**Results:** Both patients developed symptoms consistent with bacterial endocarditis 3 to 5 days after the ablation procedure. Multiple thrombotic or air emboli to the brain and heart ensued. One patient survived after emergent surgical repair of the AEF. The other patient died of extensive cerebral infarction, and autopsy revealed an AEF with a vegetation at the fistula site. In both patients, the AEF occurred near the left superior pulmonary vein, at the junction of the posterior and circumferential ablation lines.

**Conclusions:** An AEF should be suspected whenever a patient who has undergone RFA in the posterior LA develops a clinical picture consistent with endocarditis. Survival is possible if surgical repair is performed emergently.

**Perspective:** An AEF can cause massive hematemesis, but a common presentation is symptoms and/or signs of endocarditis with stroke or transient ischemic events. An AEF has been known to be a possible complication of intraoperative RFA of AF, and this report demonstrates that AEFs

may also result from catheter RFA. Strategies to avoid this complication include use of low-power settings, avoidance of overlapping ablation lines in the posterior LA, and possibly temperature monitoring in the esophagus. FM

### **Gender Differences in Ventricular Arrhythmia Recurrence in Patients With Coronary Artery Disease and Implantable Cardioverter-Defibrillators**

Lampert R, McPherson CA, Clancy JF, Caulin-Glaser TL, Rosenfeld LE, Batsford WP. *J Am Coll Cardiol* 2004;43:2293-9.

**Study Question:** Is there any difference in the frequency of episodes of ventricular tachycardia/ventricular fibrillation (VT/VF) between men and women with an implantable cardioverter/defibrillator (ICD)?

**Methods:** This was a retrospective study of clinic records and stored ICD data in 340 men and 59 women with coronary artery disease (CAD) and an ICD.

**Results:** Sustained VT/VF was more prevalent in men (52%) than in women (34%). Men had a greater number of VT/VF episodes and electrical storms than did women. The gender differences were independent of multiple clinical, electrocardiographic and electrophysiologic variables and were greatest among patients with spontaneous or inducible sustained monomorphic VT. Monomorphic VT was inducible in 75% of patients of both genders. Among patients who presented with VF, no gender differences existed in the number of VT/VF episodes during follow-up.

**Conclusions:** Among patients with CAD and an ICD, VT/VF is more common in men than in women, particularly in patients with a stable anatomic substrate for VT.

**Perspective:** The findings of this study may explain why sudden cardiac death is more common in men than in women. Of note is that the prevalence of inducible VT was the same in men and women, indicating that the anatomic substrate for VT was present as often in the women as in the men. This suggests that the greater frequency of VT during follow-up in men may have been attributable to more prevalent triggering mechanisms. FM

### **Is Defibrillation Testing Required for Defibrillator Implantation?**

Strickberger SA, Klein GJ. *J Am Coll Cardiol* 2004;44:88-91.

**Study Question:** The investigators examined the issue of whether measurement of the defibrillation threshold (DFT) and/or assessment of defibrillation efficacy are necessary in patients receiving an implantable defibrillator (ICD).

**Reasons to Measure the DFT:** Instead of programming the shock strength at the maximal output of the ICD (usually 25-30 J), one may be able to safely use lower shock strengths if the DFT is measured. This may shorten the time to defibrillation and prolong the life of the generator.

**Reasons to Assess Defibrillation Efficacy:** Even if the DFT is not determined, one could make the case for one induction

of ventricular fibrillation (VF) to prove that the maximal output is effective in defibrillation. Approximately 5% of patients need either a subcutaneous electrode or a high-output generator because of failure to defibrillate. These patients could not be identified if defibrillation efficacy is not evaluated.

**Reasons to Abandon Testing:** 1) The probability of successful defibrillation is high (95%); 2) most ICD shocks are for ventricular tachycardia (VT), and less energy is required to terminate VT than VF; 3) even if the first shock fails to defibrillate, the second or third shock may be effective; 4) deeper anesthesia/sedation is needed for defibrillation testing; 5) patients with severe ventricular dysfunction may decompensate after even one induction of VF; 6) ICD implantation by non-electrophysiologists would be facilitated if defibrillation testing was not necessary.

**Conclusions:** Adequate data are lacking, and a clinical trial with a sample size of approximately 29,000 patients is needed to resolve this issue.

**Perspective:** An adequately powered clinical trial of defibrillation testing is not realistic. Given that defibrillation testing identifies the occasional patient who requires an additional lead or high-output generator, the arguments against testing do not seem strong enough to abandon this practice. FM

### **Patient Alert in Implantable Cardioverter Defibrillators: Toy or Tool?**

Becker R, Ruf-Richter J, Senges-Becker JC, et al. *J Am Coll Cardiol* 2004;44:95-8.

**Study Question:** How useful is an implantable cardioverter-defibrillator (ICD) that alerts the patient to problems such as low battery voltage?

**Methods:** An ICD that provides an audible alert for a lead impedance outside the normal range, low battery voltage, charge time >18 s, or for delivery of all therapies in a zone was implanted in 240 patients. A complete ICD evaluation was performed every 3 months during follow-up. A serious complication was defined as a generator or lead abnormality that prompted surgical revision or immediate reprogramming. Patients were instructed to go to the ICD clinic as soon as possible if they heard an alert signal.

**Results:** During a mean of 12 months of follow-up, a serious complication occurred in 9% of patients. The ICD provided an audible alert in 10% of patients. The sensitivity, specificity and positive predictive values of a patient alert for a serious complication were 64%, 96% and 58%, respectively. Eleven of 16 lead fractures (68%) were first detected as a result of a patient alert.

**Conclusions:** The use of a patient-alert ICD feature allows the early detection of a large proportion of serious complications in ICD recipients.

**Perspective:** The study demonstrates that the patient-alert feature is useful mainly because it allows the early detection