Clinical electrophysiology relentlessly continues to tantalize us with innovative technology and new areas of research. The first half of 2015 has already seen much happen, with several late-breaking clinical trials in clinical electrophysiology from the Heart Rhythm Society (HRS) and European Heart Rhythm Association EUROPE-CARDIOSTIM 2015 conferences paving the way and setting the tone for the coming years. Beyond advanced technology for pacing and catheter ablation, several other themes, including remote monitoring, Botox therapy, and lifestyle modification, for treating heart rhythm disorders continue to evolve.

**ATRIAL FIBRILLATION**

Catheter ablation continued to remain center stage, with 2 important studies at the HRS meeting in Boston, Massachusetts, examining balloon-based technology with alternative energy sources. The FreezeAF study, a prospective, randomized, controlled, noninferiority study compared the safety and effectiveness of a cryoballoon (CB) ablation catheter (Arctic Front, Medtronic, Minneapolis, Minnesota) with radiofrequency (RF) ablation. In total, 322 patients with symptomatic paroxysmal atrial fibrillation (AF) were randomly assigned to either strategy for pulmonary vein isolation. Freedom from AF at the 12-month mark was comparable between the 2 arms (CB, 68% vs. RF, 65%), with a similar adverse event profile except for phrenic nerve injury, which was higher in the CB group. In another study, the HeartLight Trial demonstrated that, in terms of safety and efficacy, the laser balloon too was noninferior to RF ablation. This study examined the ability to perform pulmonary vein isolation using the HeartLight system (CardioFocus, Marlborough, Massachusetts), compared with a control arm using an irrigated RF ablation catheter (Thermocool catheter, Biosense Webster, Diamond Bar, California) for paroxysmal AF. A total of 353 patients were randomized in a 1:1 manner between the 2 arms. Notably, the overall procedure was longer in the laser arm (236 min) than in the ablation arm (193 min), with no significant difference in primary effectiveness and safety endpoints at 1-year follow-up. The different energy systems appear to be equivalent, and it seems that balloon-based technology is here to stay. The availability of these alternative approaches, along with RF, will eventually pave the way for developing more individualized ablation strategies in the future.

AF is also an annoying occurrence in approximately 40% of patients undergoing cardiac surgery. Besides prolonging the length of stay, AF also negatively affects long-term clinical outcomes. An interesting study from Russia, extending on earlier work (1), examined the effect of botulinum toxin in patients with a history of paroxysmal AF undergoing CABG. In a randomized controlled study (vs. placebo, n = 30), botulinum toxin, which interferes with neurotransmitter release, was injected into the 4 major epicardial fat pads visible to the surgeon. Postoperative data captured through an implantable loop recorder demonstrated that a significant reduction in long-term AF was noted. Notably, none of the patients in the study arm had clinically significant AF during a 12-month follow-up, whereas 20% of the placebo arm had recurrent AF needing additional drug therapy or catheter ablation. The mechanism for this long-term effect remains speculative at best, but it could point toward favorable atrial remodeling and the possibility of a permanent change to ganglionic plexii within the fat pad. This form of neuro modulation, if validated in larger studies, may prove to be a novel therapeutic intervention in post-cardiac surgery patients.
Recently the LEGACY study (2) showed us that long-term sustained weight loss (>10%) in obese patients was associated with a significant reduction of AF burden and a 6-fold greater probability of freedom from AF. The same group of investigators shared the results of the CARDIO-FIT study at the EP Meeting (3). In this study, 308 patients with body mass index ≥27 kg/m² were offered risk factor management and participation in a tailored exercise program. Patients underwent exercise stress testing to determine peak metabolic equivalents (METs). The effect of cardiorespiratory fitness gain was ascertained by the objective gain in fitness at final follow-up (≥2 METs vs. <2 METs). AF burden and symptom severity decreased significantly in the group with a cardiorespiratory fitness gain of ≥2 METs compared with the <2 METs group. A 2-fold increase in arrhythmia-free survival (with and without rhythm control strategies) was observed in those with a METs gain ≥2 compared with those with a METs gain <2 in cardiorespiratory fitness. These results emphasize the importance of exercise in obese individuals and remind us that maybe we should pay more attention to risk factor modification before even offering an ablation to this subset of patients. The evidence for treating sleep apnea, losing weight, and exercise seems to be mounting, and also underscores the importance of implementing population health strategies to treat the burden of AF in our society.

MAGNETIC RESONANCE IMAGING SAFE AND LEADLESS TECHNOLOGY

Two important studies (i.e., Evera MRI and ProMRI) presented at HRS found that appropriately designed implantable cardioverter-defibrillators (ICDs) were safe and effective during and after magnetic resonance imaging (MRI). The Evera MRI (Evera MRI ICD, Medtronic) study (4) examined 275 patients receiving a de novo single- or a dual-chamber device with prespecified leads. Patients were randomized on a 2:1 basis to either cardiac, thoracic, cervical, and head MRI at 1.5-T or a 1-h waiting period without CMR. The primary efficacy endpoints of no significant change in the ventricular pacing capture threshold and change in R-wave amplitude in the study group at 30 days post-MRI were observed. Importantly, in a subgroup of patients who went on to have ventricular tachycardia/ventricular fibrillation, there was no negative effect on sensing, detection, or treatment from the device. The ProMRI was a similar evaluation of single- and dual-chamber ICDs (Iforia ProMRI system, Biotronik, Berlin, Germany) in a single-arm, nonrandomized study of 170 patients. Again, no adverse events related to the ICD and MRI exposure were observed, without any change in pacing and sensing parameters. As patients continue to need MRIs for a variety of clinical conditions, the propensity to use MRI-safe ICDs will increase over the coming years.

Over the past few years, the failings of transvenous pacing systems have been repeatedly emphasized. The consequent attempt to eliminate the subcutaneous generator and the lead system with miniaturized leadless pacemakers seems to be becoming a reality. There were 2 important late-breaking clinical trials at HRS 2015 that are paving the path for leadless pacemakers for both right ventricular and left ventricular (LV) pacing. The Micra transcatheter pacing system (Medtronic) was evaluated for its safety and efficacy in the short- and intermediate-term for right ventricular pacing. This device was implanted in 140 patients, 60 of whom had completed their 3-month follow-up when the data were collected (5). The device was mostly implanted for bradycardia with persistent AF (65%), sinus node dysfunction (15.7%), or atrioventricular block (13.6%). The device (about 2.5 cm in length and 0.7 cm in diameter) was delivered via the right femoral vein utilizing a 27-F outer diameter introducer and fixed via 4 electrically inactive protractible nitinol tines. There was a 100% implant success, with the majority of implants (81%) successfully completed with 1 or 2 positioning attempts. There were no unforeseen events, that is, no device migration, dislodgements, device telemetry issues, infections, or re-operations or related deaths. All of the pacing and sensing parameters remained optimal throughout the follow-up. Of course, a longer follow-up will be of interest to assess the durability of these findings and the concern about the retrieval or subsequent additional device implantation when it is considered.

Another presentation explored the role of leadless pacing of the LV. The SELECT-LV trial is a prospective, nonrandomized study using a wireless and leadless endocardial LV pacing system (Wise LV, EBR Systems, Sunnyvale, California) to achieve cardiac resynchronization. This system uses a subcutaneous generator that transmits ultrasound energy to an LV pacing-pellet, which converts this into pacing output. Patients (n = 39) with a wide QRS who had failed conventional cardiac resynchronization therapy (CRT) were recruited. The procedure involves the implantation of a subcutaneous battery and transmitter followed by a transvascular procedure to place the endocardial pacing pellet. This device is then able to synchronize LV pacing to the right ventricular pacing impulse from other pacing devices. Although
previous data from the published WISE-CRT study had shown cardiac perforation to be a problem (6), this was not observed in the SELECT-LV study. Although this exciting technology may open the door for individualized LV pacing and treating non-responders, much work still needs to be done to refine the technology and procedure.

SYNCOPE AND REMOTE MONITORING

At EUROPACE, an interesting late-breaking clinical trial addressed the vexing topic of “syncope.” In this study from the Syncope Unit Project (SUP)-2, investigators assessed a systematic guideline-based algorithm in different forms of reflex syncope (7). This prospective, multicenter, observational study in 253 patients reinforced the need for a stepwise approach using carotid sinus massage, a tilt table test, and implantable loop recorder-guided therapy. Patients who were observed to have an asystolic response on 1 of these tests received a dual-chamber pacemaker and were then subsequently observed to have a low recurrence rate of syncope. The actuarial syncope recurrence rate was significantly reduced to 9% at 1 year and 15% at 2 years in the pacing group compared with 22% and 37%, respectively, in patients who remained nondiagnostic to the previously mentioned tests. Syncope continues to present a common clinical problem, and it seems that having a systematic approach, preferably a multidisciplinary one, can help reduce the morbidity from recurrent episodes.

Finally, an important presentation at HRS rekindled interest in the often-neglected area of remote monitoring, where the investigators evaluated 92,566 patients with implanted devices (ICDs, permanent pacemakers, and CRTs) over a 5-year period. Patients were categorized into 2 subgroups: 1 that had remote monitoring and clinical follow-up, and 1 with only clinical follow-up. The remote monitoring arm was associated with a shorter mean length of stay (5.3 days vs. 8.1 days; p < 0.001) and a 30% reduction in all-cause hospitalization costs, translating to $3,700 less per patient year. Notably, 30-day rehospitalization for heart failure (HF) was reduced in remote monitoring (8.8% vs. 11.3%), with an absolute difference of approximately 7% in CRT-defibrillator patients (11.2% vs. 17.8%). Noticeably, the benefit of remote monitoring extends across all devices, improving clinical outcomes and decreasing health care expenses. Most patients with HF have implanted devices, and it makes sense for electrophysiologists and HF specialists to work together to help reduce HF readmissions and, consequently, the burden on the health care system.

ADDRESS CORRESPONDENCE TO: Dr. Jagmeet P. Singh, Cardiology Division, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts 02114. E-mail: jsingh@mgh.harvard.edu.

REFERENCES