The annual congress of the Heart Rhythm Society (HRS) held earlier this year in San Francisco drew attendees from around the world, confirming the high value of the conference and the prominent role of the congress in the international cardiac electrophysiology community. Upon browsing the program, it appeared that there was a resurgent interest in gaining a better understanding of the different potential mechanisms underlying both paroxysmal and persistent atrial fibrillation (AF) and which ablation strategies should be chosen to achieve an effective outcome.

Besides this, an overwhelming amount of data were presented on the subject of novel ablative approaches for both AF and ventricular tachycardia (VT), thus heralding an expected future improvement also in the treatment of the most complex cardiac arrhythmias.

In this commentary, I would like to emphasize certain aspects related to the newest ablative techniques and address particular topics in the field of cardiac pacing and upcoming new modalities of remote cardiac rhythm monitoring as indicators of the rapid evolution ongoing in telemedicine.

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New concepts in the treatment of atrial fibrillation

Persistent AF is understood by far to be the most challenging atrial arrhythmia to be treated by ablation. In the electrophysiology community, there is a clear consensus that the achievement of pulmonary vein (PV) isolation (PVI) is not adequate enough to treat patients suffering from persistent AF. In this regard, the location of so-called “non-PV triggers” is considered of pivotal significance in order to improve the success rate of ablation. To this end, Dr. Francis Marchlinski offered a significant contribution to the understanding of the role of non-PV triggers with his presentation, which highlighted the concept that, if PVs are isolated and there is still AF, therefore must be non-PV triggers located elsewhere in the atria. He defined the protocols for initiating non-PV triggers, ranging from an infusion of incremental doses of isoproterenol up to 30 mcg/min to the use of burst pacing during isoproterenol infusion and adenosine administration.

Prior research suggests that non-PV triggers are more frequently induced in females and more often found in the left atrium (> 70% of cases) than in the right atrium, with site locations including the crista terminalis (CT), the coronary sinus, in the antra of PVs, and the left atrial appendage (LAA). One understood clue for unmasking triggers is to position multipolar catheters in different locations such as along the CT, LAA, and in the coronary sinus. Most important is the validation of the value of
non-PV trigger elimination by repeating the provocati
protocol. This approach, by ensuring the elimination of
non-PV triggers, can significantly improve the clinical
outcome as compared with in patients in whom non-PV
triggers are not eliminated during the redo procedure. Dr.
Marchlinski alluded to this in his presentation, stressing
that the occurrence of non-PV triggers at the repeat pro-
cedure identifies a poorer outcome.

Another extensively discussed topic was LAA electric-
cal isolation in patients with long-lasting persistent AF,
covered by Dr. Luigi Di Biase. This remains a hot topic
in electrophysiology, since it appears that secondary
foci can be identified in the LAA in about 20% to 25%
of patients with persistent AF, and prior clinical data
suggest that the procedural outcome is better when the
LAA is electrically isolated even during the index pro-
cedure. The rationale supporting LAA isolation relies
on the thought that the prevalence of non-PV triggers
(and therefore also the likelihood of the LAA being a
source of secondary triggers) is higher in patients with
long-lasting persistent AF. Furthermore, the LAA hosts
cells with automaticity, which can remain active even
after extensive atrial substrate ablation and PVI, lead-
ing to a greater chance for arrhythmia recurrence. Clin-
cal data from different groups have demonstrated the
reproducibility of LAA isolation, providing evidence
that this approach can play a role in improving the
clinical outcome of patients with persistent AF. In this
regard, a recent meta-analysis by Romero et al. corrob-
orated the suggestion that LAA isolation constitutes a
clinical benefit when included in the ablative strategy
for patients with persistent AF.

The safety of catheter ablation of AF remains of piv-
ontal importance and was discussed by Dr. David Haines,
who also pointed out the subtle risk of promoting micro-
emboli during radiofrequency (RF) delivery in the left
atrium. In his presentation, Dr. Haines explored the
subject in question, underlying the main biophysical
aspects of RF current and stressing that it is important
to pay full attention to anticoagulation, sheath manage-
ment, and the unique features of the ablation technol-
ogy being employed in each case. Probably the most
striking results that Dr. Haines presented were related
to the potential neuropsychological effects and the sub-
tle cognitive dysfunction that can be detected after AF
ablation. Specifically, reduced brain dysfunction, as
demonstrated with brain magnetic resonance imaging,
is more pronounced in the first six months after abla-
ton, but progressively lessens over time. Again, the
main cause of this finding was the promotion of micro-
emboli formation during RF delivery, which favors the
occurrence of asymptomatic cerebral lesions. In order
to minimize the occurrence of asymptomatic cerebral
emboli, Dr. Haines suggested that he supports the
exploration of a multifaceted protocol that includes a
proper transseptal technique, sheath flushing, optimal
anticoagulation, avoidance of overpowered ablation,
and possibly the use of improved ablation algorithms
and catheter designs.

News from the late-breaking clinical trials
As always, the late-breaking clinical trials sessions are
ripe with intriguing data. From among them, for this
commentary, I sought to focus on the potential role of
vagus nerve stimulation to suppress AF, which has been
extensively investigated in the last few decades and
which remains a controversial topic. During one session,
Dr. Stavros Stavarakis offered up the latest results of the
Transcutaneous Electrical Vagus Nerve Stimulation to
Suppress Atrial Fibrillation (TREAT-AF) randomized
clinical trial, where 53 patients with paroxysmal AF were
subdivided into two arms: an active group receiving
vagus nerve stimulation at the tragus and a sham group
receiving earlobe stimulation. The study in question
demonstrated that, after combining the results recorded
at the three- and six-month follow-up points, the median
AF burden was reduced by 75% in the active group as
compared with in the sham group. These impressive
clinical results support the validity of pursuing further
exploration of noninvasive neuromodulation to treat AF.

In the scenario of catheter ablation, one of the main
challenges is by far the successful ablation of ventricu-
lar arrhythmias, including—in particular—so-called
intractable VT and premature ventricular contractions
(PVCs). In this regard, specific interest has grown regard-
ing the use of intramural infusion needle to ablate deep
localizations of ventricular rhythms. Dr. Tomofumi Naka-
mura presented preliminary data on the application of
this technique in 19 patients with PVCs/VTs with deep
origins in the septum or left ventricular summit. All of
these patients had undergone a previous failed ablation
attempt, and the infusion needle ultimately produced
acute arrhythmia elimination in 68% of patients, with the
arrhythmia burden reduced from 24.2% ± 8.5% to 2.7% ±
5.4% and the left ventricular ejection fraction improved
from 32.4% ± 11.4% to 42.4% ± 6.8%, respectively. These
preliminary clinical data suggest the technique presented
is a promising ablative therapy for the management of
intramural ventricular arrhythmias that have failed
standard catheter ablation.

The search for an effective energy source to achieve dura-
ble lesions in AF ablation has been an attractive goal for
several investigators in the last few decades, and the time
for the availability of an alternative energy option to RF
current has come. Pulsed electric-field ablation (PFA)
has been investigated for a number of years to date and
has been extensively explored in the last few decades, and
the time for the availability of an alternative energy option to RF
current has come. Pulsed electric-field ablation (PFA)
has been investigated for a number of years to date and
now finally seems ready to be employed in the clinical
setting. The technology promotes cell death through the
nonthermal mechanism of irreversible electroporation.
During a late-breaking clinical session at HRS 2019, Dr.
Jacob Koruth discussed the preliminary data for endocar-
dial mono- or biphasic PFA for PVI in a swine model. The
study demonstrated comparable chronic PVI rates
for the two PFA waveforms, but biphasic PFA did not
require neuromuscular paralysis as was necessary with
the monophasic approach, and this constitutes a basis
for possible clinical use of the biphasic PFA waveform
in humans. Furthermore, since myocardial cells are
particularly sensitive to PFA as opposed to other organs like the esophagus, larger vessels, and nerves, the use of this disruptive technology seems to be highly promising for specific deployment in humans, since potential complications are expected to be limited.

Cryoenergy has become an established effective alternative energy source for the ablation of AF, in part because it is less likely to adversely impact areas surrounding the target (i.e., cooling effect is more reversible) and may be less painful than RF ablation. To this end, data on the use of an ultra-low-temperature cryoablation system were presented by Dr. Felix Bourier, who discussed the safety, efficacy, and long-term durability results of using a preshaped catheter to deliver ultra-low cryoenergy in a porcine model. This technique reportedly led to effective lesion formation both in the atria and in the ventricles as demonstrated by extensive three-dimensional mapping and histopathology. More striking was the finding that the lesions were confirmed even at a 90-day reevaluation point in animals that underwent three-dimensional remapping and histopathology. No major complications occurred. The study authors concluded that this novel modality of cryoenergy application might be safely deployed in humans to attain a higher degree of lesion durability.

New avenues in cardiac pacing

His-bundle pacing has been a hot topic in the last few years and, during HRS 2019, there were several presentations on the subject. Of note, a poster by Zanon et al. suggested reducing the minimum value of the pacing threshold along with performing a simultaneous optimization of the sensing capability of the apical back-up lead. This approach ultimately led to an energy consumption savings of 24%, thus increasing the device longevity by 32%. To counteract potential skepticism about the role of His-bundle pacing, another poster discussed a long-term follow-up (more than five years) of more than 400 patients, finding effective, persistent His-bundle pacing was successful in 81% of them and a requirement for reintervention in the same time period only occurred in 5.5%.

Also in the field of pacing, the talk given by Dr. Petr Neuzil about the current status of leadless implantable cardioverter-defibrillator (ICD) and cardiac resynchronization therapy (CRT) technology was of great interest. With the advent of the leadless pacemaker, a future goal has evolved to actualize a full leadless ICD/CRT device: this is the focus of the Wireless Stimulation Endocardially for CRT (WiSE-CRT) study, which includes different components: a coimplanted leadless right ventricular pacemaker; a receiver electrode implanted in the left endocardium; a battery implanted subcutaneously in the left mid-axillary line, and a phased ultrasound transmitter implanted submuscularly using cardiac echocardiography. Briefly, the system, via the submuscular transmitter, provides synchronization with the right ventricular pacing pulse to transmit ultrasound energy to the left endocardial receiver to provide biventricular pacing. The aim with this device was to avoid the use of any intravascular components so as to reduce complications such as infections, lead malfunction, and issues with surgically created pockets that currently still constitute major confounding factors in the management of intravascular devices.

Remote arrhythmia detection: state-of-the-art and future opportunities

Last but not least, the subject of adopting novel wearable devices for detecting cardiac arrhythmia disorders including specifically AF was one of focus. This interest is related to the continued desire to address the overwhelming burden that cardiac disorders can produce through the introduction of newer and more innovative technologies. In this regard, providers must understand key concepts in electrophysiology science and management, including the effectiveness and complications of the diagnosis and how to manage patients appropriately. Therefore, the advent of new diagnostic tools such as wearable devices and watches are crucial to encourage an open discussion of guidelines, perceived challenges, and future directions in clinical practice to optimize patient care. The different symposia on this hot topic were well-designed for the physicians and allied health care providers alike who are in charge of managing arrhythmic patients who are also at risk of comorbidities. Remote diagnosis of cardiac arrhythmia disorders and better communication among patients, physicians, and other health care providers will become more crucial in the years to come and will be an important step in improving patient care.

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