EDITORIAL

Noninvasive Electrocardiology Has Come of Age

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The complex relationship between diagnostic testing and therapeutics is a fundamental bridge in the advancement of clinical medicine. Diagnostic accuracy almost always precedes the introduction of effective therapy, and this truism is especially apropos in common cardiac disorders such as coronary disease. But the avenue of diagnostic testing and therapeutics is an interdependent two-way street, for as new therapeutics are introduced there is a need for more effective identification of patients who will benefit from the therapy. In the arena of electrical therapeutics involving pacemakers, radiofrequency ablation, implantable defibrillators, and, more recently, cardiac resynchronization therapy (CRT), there is a need for better case selection to improve the percentage of patients who benefit from the therapy and to enhance cost-effectiveness. During May and June of this year, there were two major international electrocardiology meetings, the Heart Rhythm Society (previously known as NASPE) in San Francisco (May 19–24, 2004) and CARDIOSTIM in Nice, France (June 16–19, 2004), that have highlighted this tight linkage between noninvasive electrocardiology and electrical therapeutics.

To highlight this diagnostic-therapeutic linkage, let us look at MADIT-II as an example.¹ In the MADIT-II trial, the implanted defibrillator was associated with a 31% reduction in the risk of death during an average 20-month follow-up when compared with conventional therapy in patients with a documented prior myocardial infarction and an ejection fraction $\leq 30\%$ —an impressive finding with recent confirmation by the Sudden Cardiac Death—Heart Failure Trial (www.sicr.org/scdheft.index.html). In MADIT-II, 36% of the patients received appropriate ICD therapy for life-threatening ventricular

tachycardia or ventricular fibrillation during the 4-year course of the trial. In other words, 64% never utilized the ICD for antiarrhythmic therapy during this time frame. Clearly, the MADIT-II population includes a heterogeneous mix of high- and low-risk patients, and the question is how can we better identify the high-risk subset of patients who obtain the major benefit from ICD therapy. There are two ways of doing this with noninvasive electrophysiologic screening—we can either identify and eliminate low-risk patients, or we can selectively identify high-risk patients, and the methodological approaches to such risk stratification may be somewhat different. Similar noninvasive electrophysiologic risk stratification approaches can be used in the identification of subsets of patients who will achieve enhanced benefit from pacemaker, radiofrequency ablation, or CRT therapy.

As highlighted at the Heart Rhythm Society and CARDIOSTIM meetings, noninvasive electrocardiology occupied an important place in the scientific programs. In addition to many sessions on risk stratification for sudden cardiac death and heart failure, noninvasive electrocardiology was a central feature in the identification of patients with life-threatening arrhythmias; inheritable ventricular arrhythmias associated with Long QT Syndrome, hypertrophic cardiomyopathy, arrhythmogenic right ventricular dysplasia, Brugada Syndrome, and catecholaminergic polymorphic ventricular tachycardia; drug-induced QT prolongation; genotype-phenotype aspects of repolarization disorders; atrial fibrillation requiring improved rate control and/or ablation therapy; and arrhythmogenic syncopal episodes.

Noninvasive electrocardiology now involves a spectrum of techniques for the evaluation of the heart's electrical activity, and the field of

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noninvasive electrocardiology continues to evolve, mature, and expand. In addition to the traditional 12-lead ECG, ECG-monitored exercise testing, and 24-hour Holter monitoring, we have available improved methods to evaluate specific electrical characteristics of the heart. Such methods include time- and frequency-domain analysis of heart rate variability to evaluate autonomic nervous systems' influences on the heart, heart rate turbulence for improved stratification of patients at risk for sudden cardiac death, T-wave alternans and T-wave variability for new insights into repolarization instability as a fundamental arrhythmogenic mechanism, QT/RR dynamics, and late-potential as well as QRS duration in the signal-averaged ECG (SAECG). Since electrocardiographic digital data acquisition and digital signal processing are integral components of noninvasive electrocardiology, the science of our subspecialty has dramatically improved.

Electrocardiology is now subdivided into invasive and noninvasive components, and there is an enormous number of practicing cardiologists who are actively involved in the clinical application of noninvasive electrocardiology in everyday clinical practice. The International Society for Holter and Noninvasive Electrocardiology (ISHNE) is in an excellent position to

involve noninvasive electrocardiologists in ongoing professional education. In this regard, the recent internet-based, ISHNE-sponsored, virtual cardiac symposium on Long QT Syndrome served this purpose well (<http://www.qts-symposium.org>). During April 2004, there were 2716 registrants from 48 different countries who accessed the ISHNE LQTS Virtual Symposium. The average Symposium traffic involved 23,800 downloaded lectures. Over 8000 presentations were viewed on-line, and approximately 2500 physicians from around the world listened to these broadcasts. At the conclusion of the ISHNE-sponsored LQTS Virtual Symposium at the end of April 2004, the organizers received innumerable e-mail letters of grateful appreciation from the participating physicians and from the faculty regarding the important education they received from this internet-based virtual symposium. Noninvasive electrocardiology has advanced significantly during the past 4 years,² and it has now come of age!

REFERENCES

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