Risk Stratification Techniques for Sudden Death

Challenges in the identification of individuals at high risk for sudden cardiac death (SCD) persist. Nearly 1,000 deaths occur every day in the United States due to SCD. Data-based alternatives for SCD risk stratification dates back to the mid-1990s with the Cardiac Arrythmia Patient Outcomes Research Team (PORT) and several studies published in the *American Heart Journal* (September 2002, Volume 144). Although these were landmark studies, Mario Talajic, MD, Chief of Medicine, Montreal Heart Institute, Montreal, Canada, says "we still have limited clinical applications for what we've learned."

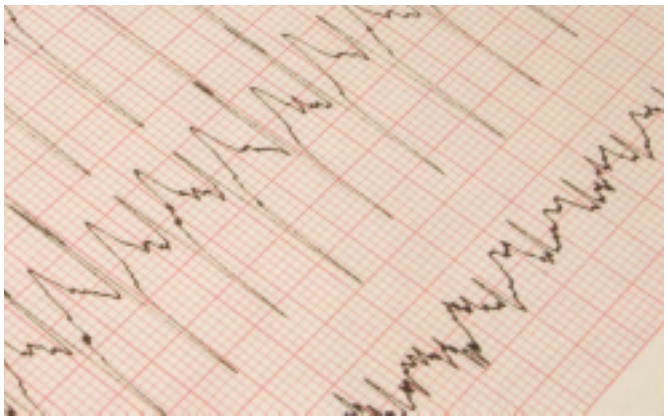
Otto Costantini, MD, Assistant Professor of Medicine, Case Western Reserve University, looked at the role of T-wave alternans (TWA) as a risk stratification tool. TWAs noted on ECG can predict the risk of life threatening arrythmia. "But they can also be hard to see, or are obscured by electrical interference," according to Dr. Constantini.

Dr. Constantini suggested that TWA has promise, but "many risk stratification techniques that were promising later hit the junkpile. At the moment, we can't beat a lowered ejection fraction (EF) as a reliable risk predictor. We look forward to data on combining EF with TWA to create a risk score." (TWA may soon be mandated by Centers for Medicare and Medicaid Services for patients being evaluated for ICD for primary prevention of SCD.)

Maria Teresa La Rovere, MD, of the Department of Cardiology, Scientific Institute of Montescano, Italy, discussed autonomic markers of SCD. Many studies confirm the role of the autonomic nervous system (ANS) as a SCD risk factor, particularly when vagal and sympathetic output collide to increase the risk of ventricular dysrythmia.

The key ANS markers are heart rate variability (HRV) and baroreflex sensitivity. Depressed HRV along with reduced (<40%) EF and reduced baro-sensitivity (<3 ms/ mm Hg) are strongly associated with increased SCD risk.

While multiple studies have demonstrated that autonomic markers can be used as risk stratification tools for SCD, some observers note a lack of consensus regarding autonomic markers while suggesting that the arm of mathematics known as nonlinear dynamics may offer more powerful risk prediction.



But does nonlinear dynamics have any role in forecasting arrythmias? "Not yet," according to Leon Glass, PhD, Department of Physiology, McGill University, Montreal, Canada.

Nonlinear dynamics developed out of chaos theory, and applies equations and computer projections to model ebb, flow, and aberrations in complex rhythmic environments—like the human heart. Largely the province of mathematicians and physicists, few physician researchers have yet delved deeply into nonlinear dynamics.

"To the casual observer the pacing dynamics of the heart can look like wild disorder," Dr. Glass said. "We chaos researchers search for inherent order in apparent disorder. Cardiac arrythmias are a perfect example." While the goal is to develop new tools with clinical applicability, Dr. Glass noted that mathematical studies have not yet yielded useful tools. "We're just beginning to lay the groundwork," he said.

"A summation of all the talks today—mine included—is that we don't yet have consistently reliable methods to stratify people at risk for SCD. A big part of this challenge is that people at SCD risk are very hetereogeneous."

With such a various patient population, Dr. Glass noted that "pulling all our findings to date into a coherent system is still beyond us. But we know that clinical applications often follow basic research by many years. I think we're looking at great opportunities in improving risk stratification for SCD, not just in nonlinear dynamics but with all the techniques discussed here today."