Interview with Professor Thor Edvardsen M.D., Ph.D., Department of Cardiology at Oslo University Hospital, Rikshospitalet, Norway.

Creating New Standards in Ultrasound Cardiology

New Guidelines Incorporating 2D Wall Motion Tracking to Assess Non-ST Elevation Acute Coronary Syndrome Could Save Lives

Coronary Artery Disease (CAD) presents in a variety of forms, some of which, pose particular diagnostic challenges for specialists. Non-ST Elevation Acute Coronary Syndrome (NSTE-ACS), for example, is not evident with Electrocardiogram (ECG) examination. However, early detection and appropriate treatment are essential for these high risk patients and many lives could be saved by faster diagnosis. Advanced echocardiographic technology provides promising new options in diagnosis.

Diagnosing the somewhat elusive, but potentially life-threatening condition of NSTE-ACS has until now, presented a clinical challenge for cardiologists worldwide. CAD can present as silent ischemia, stable angina pectoris, acute coronary syndrome (ACS) or death. ACS includes unstable angina (UA), non-ST segment elevation (NSTE) and ST segment elevation myocardial infarction (STEMI). These high risk manifestations of CAD are significant causes of emergency medical care and hospitalization globally. Diagnosis is not always straightforward. An ST-elevation found in ECG usually indicates that the patient has a coronary artery occlusion and requires acute revascularization therapy. Coronary artery occlusion and/or significant coronary artery stenosis may, or may not manifest in those with NSTE-ACS - there is a great deal of variation from patient to patient. ECG examination is not sensitive enough to reliably identify some of these manifestations. Despite this, revascularization therapy is required in as many as two thirds of NSTE-ACS cases and early diagnosis and treatment improves prognosis.

A SOPHISTICATED SOLUTION

Professor Thor Edvardsen M.D., Ph.D. is one of the world's leading cardiologists. He promotes the use of advanced echocardiography techniques as a reliable diagnostic tool in the assessment of suspected NSTE-ACS patients. Using Toshiba's 2D speckle tracking technology, he advocates Wall Motion Tracking (WMT) for analyzing strain in the myocardial layers and detecting myocardial deformation - an intrinsic mechanical property that measures myocardial systolic function more directly than cavity-based echocardiographic parameters. As its potential to save lives becomes evident, Toshiba has introduced 2D WMT into all its echocardiographic systems and has organized an international training initiative to enhance knowledge about the technique.

RESEARCH WITH LIFE SAVING POTENTIAL

"The high mortality of NSTE-ACS patients has always concerned me and has driven my research into new diagnostic procedures that could save lives," remarked Professor Edvardsen. "It is vital to discover and treat significant CAD quickly and effectively. Echocardiographic tools have progressed significantly in the last 10 years and advances in 2D image resolution enable analysis of layer-specific myocardial deformation and myocardial systolic function clearly, quickly and accurately. I would like to see these techniques incorporated into global best practice guidelines for the diagnostic and treatment strategy of suspected NSTE-ACS patients, as soon as possible."

ADVANCED TECHNOLOGY

Before Toshiba developed 2D WMT, imaging techniques enabled examination of the complete thickness of the myocardial wall, without distinction between the layers of the myocardium. The left ventricular wall of the myocardium comprises three myocardial layers with the endocardial layer the most susceptible to ischemic injury. Toshiba pioneered improvements in 2D echocardiographic image resolution that enable the analysis of the different layers and with careful evaluation, can increase the diagnostic accuracy in CAD. The 2D WMT technique is currently unique to Toshiba systems. It is not offered with any other commercially available system.

"2D WMT is a semi-automated quantitative technique for assessment of cardiac function based on gray-scale images," explained professor Edvardsen. "Strain in terms of relative tissue deformation, is evaluated on a frame-by-frame basis, by tracking acoustic markers (speckles) throughout the cardiac cycle. We measure it in each Left Ventricle section by calculating the average relative deformation in longitudinal circumferential, or radial directions. Analysis of this strain analysis enables global and regional myocardial deformation to be quantified, which can help to identify NSTE-ACS patients with coronary artery occlusion, so that appropriate treatment can be started immediately."

"What I like about 2D speckle tracking is its robustness."

PROMISING RESULTS

Professor Edvardsen, together with a dedicated cardiology research group at the Oslo University Hospital, Rikshospitalet, in Norway, assessed the endocardial function of patients with significant CAD compared to those with without. They measured layer-specific strain through 2D WMT, using 2D speckle-tracking echocardiography (STE) incorporated in Toshiba's Ultrasound systems such as the Artida, Aplio and Xario. Territorial longitudinal strain (TLS) was calculated on the basis of perfusion territories of the three major coronary arteries in a 16-segment Left Ventricular (LV) model and global circumferential strain (GCS) was averaged from six circumferential LV segments in all three layers.

The eventual study, published in The Journal of the American College of Cardiology (JACC) Cardiovascular Imaging in May 2013 [1], showed that endocardial function was more affected in patients with significant CAD compared to epicardial function and ejection fraction (EF). Patients with significant CAD had worse function in all three myocardial layers assessed through TLS and GCS. Endocardial TLS was most affected. Differences in endocardial and epicardial TLS and GCS were lower in patients with significant CAD, reflecting a pronounced decrease in endocardial function.

"Since publication of this research paper, I have received significant positive interest from cardiologists from all over the world, who are eager to find out more about the results, techniques used and how to replicate them," said Professor Edvardsen. "Apart from the emerging scientific evidence of its potential to save lives, what I like

"The potential of 2D WMT to save lives is considerable."

about 2D speckle tracking is its robustness - the reproducibility is very good, the technique can be very easily trained to others and takes only minutes to incorporate into diagnostic procedures. We advise clinics to adopt the procedures and work together with hospitals and clinics across Norway to train people in the technique. "

The Cardiac Competence Team from Toshiba provides intensive support to the Cardiology Research Team of the Rikshospitalet Oslo. In addition engineers from Toshiba Medical Systems Japan also collaborate with the advanced cardiological research activities. The hospital received their Artida™ system three years ago for research purposes. Since the introduction of the speckle tracking technology Toshiba has incorporated 2D and 3D speckle tracking into its full range of echocardiographic systems.

POTENTIAL FOR POINT OF NEED DIAGNOSTICS

"A key aspect of improving prognosis is fast, effective diagnosis. Medical emergencies can arise at any time and any place and there might not always be a cardiologist available. Technology and techniques that are reliable, mobile, convenient and easy to use for other specialists can improve a patient's chances." emphasized Professor Edvardsen. "The compact size and mobility of the wide range of Toshiba systems that incorporate 2D WMT offers the potential for diagnosis in a variety of practical settings, including smaller clinics and health centers. The key to the future is in developing effective point of need devices and practices that can be used by a broader range of healthcare professionals."

GROWING INTEREST

There is an increasing interest in diagnosing the contractility of the different myocardial layers. Growing interest from cardiologists in the paper published by Professor Edvardsen and his team was confirmed with additional interest in presentation of the 2D WMT technique in NTSE-ACS by Dr. Sebastian Savari, Lead Cardiology Research Associate at Oslo University Hospital, Rikshostpitalet, Norway, at the European Cardiology Society 2013 Congress in Amsterdam, the Netherlands. Dr. Savari's presentation was delivered to a packed and appreciative audience of international cardiologists. [2]

In response to this growing interest, Toshiba has organized practical workshops in WMT for specialists. The first took place on November 2013 at Clinico San Carlos, Madrid, Spain, where leading cardiologist, Dr. Leopoldo Pérez de Isla, conducted a two-day training on the clinical impact of WMT.

Prof. Thor Edvardsen is one of the world's leading cardiologists. He received his Medical Degree (M.D.) from Haukeland University Hospital, University of Bergen, Norway and Ph.D. / Dr.Med. from the University of Oslo, Norway. Professor Edvardsen is a board-certified specialist in Internal Medicine and Cardiology and has been a senior staff member at Department of Cardiology at Oslo University Hospital, Rikshospitalet, since 2002. He became Acting Chief of the Department of Cardiology in 2012. In 2003-2004, he worked at John Hopkins Hospital, Baltimore, United States (US). Professor Edvardsen was reelected as a Board member of the European Association of Cardiovascular Imaging (EACVI) in 2012 and is now the Chair of the EACVI Scientific Documents Committee. He has more than 100 international scientific publications and 10 book chapters. He is active in clinical and experimental research in the area of myocardial function and has extensive knowledge of cardiac ultrasound, MRI, CT and hemodynamics.

GLOBAL BEST PRACTICE

Professor Edvardsen strongly believes 2D WMT should become an additional standard best practice globally.

"The evidence emerging from research is clear and positive and the potential of 2D WMT to save lives is considerable," he said. "The sooner it is incorporated into international guidelines on Assessing Non-ST Elevation Acute Coronary Syndrome the better, however, this will probably take some time to realize."

References:
1. Sarvari SI, Haugaa KH, Zahid W, Bendz B, Aaberge L, Aakhus S, Edvardsen T: The Diagnostic Value of Layer-Specific Quantification of Myocardial Deformation in the Assessment of Patients with Coronary Artery Disease. J Am Coll Cardiol Img 2013 6(5):535-44.
2. http://tinyurl.com/ptpenwx